



JAIPUR METRO

JAIPUR METRO RAIL CORPORATION LIMITED

Invitation for Bid

Date:	31.01.2017
Loan/Grant No. and Title:	3062-IND: Jaipur Metro Rail Line 1-Phase B Project
Contract No. and Title:	DC No. JP/JS02: DESIGN, MANUFACTURE, SUPPLY, INSTALLATION TESTING & COMMISSIONING OF SIGNALLING & TRAIN CONTROL SYSTEM FOR JMRC PHASE 1B
Deadline for Submission of Bids: up to 15.00 Hrs. on 06.03.2017	

1. INDIA has received financing from the Asian Development Bank (ADB) toward the cost of Jaipur Metro Rail Line 1-Phase B Project. Part of this financing will be used for payments under the Contract named above. Bidding on Direct Contract Mode of procurement is open only to the designated JMRC Line-1 Phase-A (Mansarovar to Chandpole Section) contract executing agency, i.e., M/s Alstom Consortium.
2. Jaipur Metro Rail Corporation Limited (JMRC) ("the Employer") invites sealed bids from M/s Alstom Consortium for the **"Manufacture, Supply, Installation Testing & Commissioning Of Signalling & Train Control System for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East-West corridor of Jaipur Metro Phase- 1B at Jaipur, Rajasthan, India – "DC No. JP/JS 02"**.
3. Bidding will be conducted in accordance with ADB's Single-Stage: Two-Envelope bidding procedure as applicable for Direct Contract Mode of procurement and in conformance with ADB Procurement Plan given in ADB Project Administration Manual for JMRTS (Project No. P46417 Loan Number L3062) from the designated JMRC Line-1 Phase-A (Mansarovar to Chandpole Section) contract executing agency, i.e., M/s Alstom Consortium.

IFB for DC No. JP/JS 02: Manufacture, Supply, Installation, Testing & Commissioning of Signalling & Train Control System for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East-West corridor of Jaipur Metro Phase- 1B at Jaipur, Rajasthan, India, on direct contract mode is published here for intimation purpose only. Parties/Vendors other than the designated vendor as at 1 above are requested not to participate in bidding process against above IFB.

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SANJAY MISHRA
GENERAL MANAGER (SIGNALLING & TRAIN CONTROL)
JAIPUR METRO RAIL CORPORATION
JAIPUR

4. Key details of the Bid are as under:-

Bid Security amount	:	NA
Availability of Bid Document commences from	:	31.01.2017
Pre Bid Session on	:	Will be notified later
Dead line for submission of Bid	:	Up to 1500 Hrs 06.03.2017

5. **Eligibility Criteria:** Reference to be made to clauses of Section 3 (Evaluation and Qualification Criteria) as applicable for direct mode of contract on designated contractor M/s Alstom Consortium.

6. To obtain further information following may be contacted:

**Mr. Ashwani Saxena, Director (Project),
Jaipur Metro Rail Corporation Limited
3rdFloor, RAJSICO Building, Udyog Bhawan,
Tilak Marg, C-Scheme, City: Jaipur (Rajasthan)
Postal Code: 302005
Country: India
Telephone: +91-141-5192452/+91-141-5192453
Facsimile number: 0141-5192451
Electronic mail address: jmrc.gmsnt@gmail.com;
dp.jmrc@gmail.com**

7. Availability of Bid Documents for JS 11 (Phase 1B) commences from 31.01.2017. Designated Contractor M/s Alstom Consortium or its representative may collect the Bid Documents for JS 02 (Phase 1B) from 31.01.2017 onward from address as above.

8. Delivery of Bid:

- To the address above.
- On or before the deadline: up to 15.00 Hrs on 06.03.2017.

Bids will be opened immediately after the deadline for bid submission in the presence of bidders' designated Contractor M/s Alstom Consortium or its representative(s) who choose to attend.

IFB for DC No. JP/JS 02: Manufacture, Supply, Installation, Testing & Commissioning of Signalling & Train Control System for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East-West corridor of Jaipur Metro Phase- 1B at Jaipur, Rajasthan, India, on direct contract mode is published here for intimation purpose only. Parties/Vendors other than the designated vendor as at 1 above are requested not to participate in bidding process against above IFB.

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Section 1 - Instructions to Bidders

A. General

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| 1. Scope of Bid | <p>1.1 In connection with the phase 1B,S&T system work around, the Employer, a, issues this Bidding Document for the procurement of plant and services as specified in Section 6 (Employer's Requirements). The name, identification, and number of lot/s (contract/s) of the international competitive bidding (ICB) are provided in the BDS.</p> <p>1.2 Unless otherwise stated, throughout this Bidding Document definitions and interpretations shall be as prescribed in Section 7 (General Conditions of Contract) and section 6 [Employer's Requirement].</p> |
| 2. Source of Funds | <p>2.1 The Borrower or Recipient (hereinafter called "Borrower JMRC") indicated in the BDS has applied for or received financing (hereinafter called "funds") from the Asian Development Bank (hereinafter called "ADB") toward the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.</p> <p>2.2 Payments by ADB will be made only at the request of the Borrower and upon approval by ADB in accordance with the terms and conditions of the Financing Agreement between the Borrower (JMRC) and ADB (hereinafter called "Financing Agreement"), and will be subject in all respects to the terms and conditions of that Financing Agreement. No party other than the Borrower shall derive any rights from the Financing Agreement or have any claim to the funds.</p> |
| 3. Fraud and Corruption | <p>3.1 ADB's Anticorruption Policy requires Borrowers (including beneficiaries of ADB-financed activity), as well as Bidders, Suppliers, and Contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB</p> <p>(a) defines, for the purposes of this provision, the terms set forth below as follows:</p> <ul style="list-style-type: none"> (i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party; (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation; (iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party; (iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party; (v) "obstructive practice" means (a) deliberately destroying, falsifying, |

altering, or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an Office of Anticorruption and Integrity (OAI) investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or (e) materially impeding ADB's contractual rights of audit or access to information; and

- (vi) "integrity violation" is any act which violates ADB's Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of ADB sanctions, retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standard.
- (b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;
- (c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;
- (d) will impose remedial actions on a firm or an individual, at any time, in accordance with ADB's Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate¹ in ADB-financed, administered, or supported activities or to benefit from an ADB-financed, administered, or supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices or other integrity violations; and
- (e) will have the right to require that a provision be included in the Bidding Documents and in contracts financed by ADB, requiring Bidders, suppliers and contractors to permit ADB or its representative to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

3.2 Furthermore, Bidders shall be aware of the provision stated in the General Conditions of Contract (GCC 9.6 and 42.2.1 (c)).

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, or government-owned enterprise subject to ITB 4.5 - or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture. In the case of a Joint Venture,

¹ Whether as a Contractor, Subcontractor, Consultant, Manufacturer or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document).

- (a) all partners shall be jointly and severally liable, and
 - (b) the Joint Venture shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the partners of the Joint Venture during the bidding work amount finalization process and, in the event the Joint Venture is awarded the Contract, during contract execution.
- 4.2 A Bidder, and all partners constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section 5 (Eligible Countries). A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.
- 4.3 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if any of, including but not limited to, the following apply:
- (a) they have controlling shareholders in common; or
 - (b) they receive or have received any direct or indirect subsidy from any of them; or
 - (c) they have the same legal representative for purposes of this bid; or
 - (d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
 - (e) a Bidder participates in more than one bid in this bidding process, either individually or as a partner in a joint venture, except for alternative offers permitted under ITB 13. This will result in the disqualification of all Bids in which it is involved. However, subject to any finding of a conflict of interest in terms of ITB 4.3 (a) - (d) above, this does not limit the participation of a Bidder as a subcontractor in another Bid or of a firm as a subcontractor in more than one Bid; or
 - (f) a Bidder or any affiliated entity, participated as a consultant in the preparation of the design or technical specifications of the plant and services that are the subject of the Bid; or
 - (g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer or Borrower as Project Manager for the Contract.
- 4.4 A firm shall not be eligible to participate in any procurement activities under an ADB-financed, administered, or supported project while under temporary suspension or debarment by ADB pursuant to its Anticorruption Policy (see ITB 3), whether such debarment was directly imposed by ADB, or enforced by ADB pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a temporary suspended or debarred firm will be rejected.

- 4.5 Government-owned enterprises in the Borrower's country shall be eligible only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and (iii) are not dependent agencies of the Employer.
- 4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.
- 4.7 Firms shall be excluded if by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country or any payments to persons or entities in that country.
- 4.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.
- 5. Eligible Plant and Services**
- 5.1 The plant and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 4.2 and all expenditures under the Contract will be limited to such plant and services.
- 5.2 For purposes of ITB 5.1 above, "origin" means the place where the plant, or component parts thereof are mined, grown, produced, or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

- 6. Sections of Bidding Document**
- 6.1 The Bidding Document consists of Parts I, II, and III, which include all the sections indicated below, and should be read in conjunction with any addenda issued in accordance with ITB 8.
- PART I Bidding Procedures**
 Section 1 - Instructions to Bidders (ITB)

 Section 3 - Evaluation and Qualification Criteria (EQC)
 Section 4 - Bidding Forms (BDF)
 Section 5 - Eligible Countries (ELC)
- PART II Requirements**
 Section 6 - Employer's Requirements (ERQ)
- PART III Conditions of Contract and Contract Forms**
 Section 7 - General Conditions of Contract (GCC)
 Section 8 - Special Conditions of Contract (SCC)
 Section 9 - Contract Forms (COF)
- 6.2 The Invitation for Bids (IFB) issued by the Employer is not part of the Bidding Document.
- 6.3 The Employer is not responsible for the completeness of the Bidding Document and its addenda, if they were not obtained directly from the source stated by the Employer in the IFB.

- 6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the Bid.
- 7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting**
- 7.1 A prospective Bidder requiring any clarification on the Bidding Document shall contact the Employer in writing at the Employer's address indicated in the BDS, or raise inquiries during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond to any request for clarification, provided that such request is received no later than 21 days prior to the deadline for submission of bids. The Employer's response shall be in writing with copies to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 24.2.
- 7.2 The Bidder is advised to visit and examine the site where the plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a contract for the provision of plant and services. The costs of visiting the site shall be at the Bidder's own expense.
- 7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents, will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
- 7.4 The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than 1 week before the pre-bid meeting.
- 7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.
- 7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.
- 8. Amendment of Bidding Document**
- 8.1 At any time prior to the deadline for submission of Bids, the Employer may amend the Bidding Document by issuing addenda.

- 8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.
- 8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 24.2

C. Preparation of Bids

- 9. Cost of Bidding** 9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
- 10. Language of Bid** 10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the English language. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the English language, in which case, for purposes of interpretation of the Bid, such translation shall govern.
- 11. Documents Comprising the Bid** 11.1 The Bid shall comprise two envelopes submitted simultaneously, one containing the Technical Bid and the other the Price Bid, both envelopes enclosed together in an outer single envelope.
- 11.2 The Technical Bid submitted by the Bidder shall comprise the following:
- (a) Letter of Technical Bid;
 - (b) Bid Security or Bid-Securing Declaration, in accordance with ITB 21;
 - (c) alternative Bids, if permissible, in accordance with ITB 13;
 - (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 22.2;
 - (e) documentary evidence in accordance with ITB 14.1, that the plant and services offered by the Bidder in its Bid or in any alternative Bid, if permitted, are eligible;
 - (f) documentary evidence in accordance with ITB 15, the Bidder's eligibility and qualifications to perform the contract if its Bid is accepted;
 - (g) Technical Proposal in accordance with ITB 17.
 - (h) documentary evidence in accordance with ITB 16, that the plant and services offered by the Bidder conform to the Bidding Document;
 - (i) in the case of a bid submitted by a Joint Venture, the Bid shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the Bid, together with a copy of the proposed agreement;

- (j) list of subcontractors, in accordance with ITB 17.2; and
- (k) any other document required in the BDS.

11.3 The Price Bid submitted by the Bidder shall comprise the following:

- (a) Letter of Price Bid;
- (b) completed schedules as required, including Price Schedules, in accordance with ITB 12 and ITB 18;
- (c) alternative price Bids, if permissible, in accordance with ITB 13; and
- (d) any other document required in the BDS.

12. Letter of Bid and Schedules

12.1 The Letters of Technical Bid and Price Bid, and the Schedules, and all documents listed under ITB 11, shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested and as required in the BDS.

13. Alternative Bids

13.1 The BDS indicates whether alternative Bids are allowed. If they are allowed, the BDS will also indicate whether they are permitted in accordance with ITB 13.3, or invited in accordance with ITB 13.2 and/or ITB 13.4.

13.2 When alternatives to the Time Schedule are explicitly invited, a statement to that effect will be included in the BDS, and the method of evaluating different time schedules will be described in Section 3 (Evaluation and Qualification Criteria).

13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the Employer's requirements as described in the Bidding Document must also provide: (i) a price at which they are prepared to offer a plant meeting the Employer's requirements; and (ii) all information necessary for a complete evaluation of the alternatives by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed installation methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.

13.4 When Bidders are invited in the BDS to submit alternative technical solutions for specified parts of the facilities, such parts shall be described in Section 6 (Employer's Requirements). Technical alternatives for the specific parts of the facilities that comply with the performance and technical criteria specified for the plant and services shall be considered by the Employer on their own merits, pursuant to ITB 32.

14. Documents Establishing the Eligibility of Plant and Services

14.1 To establish the eligibility of the plant and services in accordance with ITB 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms, included in Section 4 (Bidding Forms).

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| 15. Documents Establishing the Eligibility and Qualifications of the Bidder | <p>15.1 To establish its eligibility and qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria), the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).</p> <p>15.2 Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility as described in ITB 38. Refer BDS. (Not applicable)</p> |
| 16. Documents Establishing Conformity of the Plant and Services | <p>16.1 The documentary evidence of the conformity of the plant and services to the Bidding Document may be in the form of literature, drawings and data, and shall furnish:</p> <ul style="list-style-type: none"> (a) a detailed description of the essential technical and performance characteristics of the plant and services, including the functional guarantees of the proposed plant and services, in response to the Specification; (b) a list giving full particulars, including available sources, of all spare parts and special tools necessary for the proper and continuing functioning of the plant for the period named in the BDS, following completion of plant and services in accordance with provisions of the contract; and (c) |
| 17. Technical Proposal, Subcontractors | <p>17.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.</p> <p>17.2 For major items of plant and services as listed by the Employer in Criterion 2.5 of Section 3 (Evaluation and Qualification Criteria), which the Bidder intends to purchase or subcontract, the Bidder shall give details of the name and nationality of the proposed Subcontractors, including Manufacturers, for each of those items. In addition, the Bidder shall include in its Bid information establishing compliance with the requirements specified by the Employer for these items. Bidders are free to list more than one Subcontractor against each item of the plant and services. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.</p> <p>17.3 The Bidder shall be responsible for ensuring that any Subcontractor proposed complies with the requirements of ITB 4, and that any plant, or services to be provided by the Subcontractor comply with the requirements of ITB 5 and ITB 15.1</p> |
| 18. Bid Prices and Discounts | <p>18.1 Unless otherwise specified in the BDS and/or Section 6 (Employer's Requirements), bidders shall quote for the entire plant and services on a "single responsibility" basis such that the total Bid price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the Bidding Document in respect of the design, manufacture, including</p> |

procurement and subcontracting (if any), delivery, construction, installation, and completion of the plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the Bidding Document, the acquisition of all permits, approvals, and licenses, etc.; the operation, maintenance, and training services and such other items and services as may be specified in the Bidding Document, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items.

18.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the Bidding Document.

18.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 4 (Bidding Forms). Where no different Price Schedules are included in the Bidding Document, Bidders shall present their prices in the following manner: Separate numbered Schedules included in Section 4 (Bidding Forms) shall be used for each of the following elements. The total amount from each Schedule (Nos. 1 to 4) shall be summarized in a Grand Summary (Schedule No. 5) giving the total bid price(s) to be entered in the Letter of Price Bid. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the Bid.

Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad

Schedule No. 2: Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Schedule No. 3: **Design Services (12/PM/F/F)**

Schedule No. 4: Installation and Other Services

Schedule No. 5: Grand Summary (Schedule Nos. 1 to 4)

Schedule No. 6: Recommended Spare Parts

Bidders shall note that the plant and mandatory spare parts included in Schedule Nos. 1 and 2 above exclude materials used for civil, building, and other construction works. All such materials shall be included and priced under Schedule No. 4, Installation and Other Services.

18.4 In the Schedules, Bidders shall give the required details and a breakdown of their prices as follows:

(a) Plant to be Supplied from Abroad (Schedule No. 1):

- (i) the price of the plant shall be quoted carriage and insurance paid (CIP)-named place of destination basis specified in the BDS;
- (ii) all customs duties and other taxes paid or payable in the Employer's country on the plant if the contract is awarded to the Bidder; and
- (iii) the total price for the plant.

(b) Plant Supplied from Within the Employer's Country (Schedule No. 2):

- (i) the price of the plant shall be quoted on an EXW Incoterm basis

(ex works, ex factory, ex warehouse, ex showroom, as applicable), including all customs duties and sales and other taxes already paid or payable on the components and raw material used in the manufacture or assembly of plant quoted ex works or ex factory, or on the previously imported plant of foreign origin quoted ex warehouse, ex showroom;

(ii) sales tax and other taxes payable in the Employer's country on the plant if the contract is awarded to the Bidder, and

(iii) the total price for the plant.

(c) Design Services. (Schedule No. 3). Rates or prices shall include all taxes, duties, levies, and charges payable in the Employer's country as of 28 days prior to the deadline for submission of Bids.

(d) Installation and Other Services (Schedule No. 4) shall be quoted separately and shall include rates or prices for local transportation, insurance, and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables, and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Bidding Document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies, and charges payable in the Employer's country as of 28 days prior to the deadline for submission of bids.

(e) Recommended spare parts (Schedule No. 6) shall be quoted separately as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts.

18.5 The current edition of Incoterms, published by the International Chamber of Commerce shall govern.

18.6 The prices shall be either fixed or adjustable as specified in the BDS.

(a) In the case of Fixed Price, prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account. A Bid submitted with an adjustable price quotation will be treated as nonresponsive and rejected.

(b) In the case of Adjustable Price, prices quoted by the Bidder shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport, and contractor's equipment in accordance with the procedures specified in the corresponding appendix to the Contract Agreement. A Bid submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. Bidders are required to indicate the source of labor and material indexes in the corresponding Form in Section 4 (Bidding Forms).

18.7 If so indicated in BDS 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). Bidders wishing to offer any price reduction (discount) for the award of more than one contract shall specify in their Letter of Price Bid the price reductions applicable to each package, or alternatively, to individual contracts within the package, and the manner in which the price reductions will apply.

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| 19. Currencies of Bid and Payment | <p>19.1 The currency(ies) of the bid shall be, as specified in the BDS.</p> <p>19.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements.</p> |
| 20. Period of Validity of Bids | <p>20.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.</p> <p>20.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 21, it shall also be extended 28 days beyond the deadline of the extended bid validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid.</p> |
| 21. Bid Security/ Bid Securing Declaration | <p>21.1 Unless otherwise specified in the BDS, the Bidder shall furnish as part of its Bid, in original form, either a Bid-Securing Declaration or a bid security as specified in the BDS. In the case of a bid security, the amount and currency shall be as specified in the BDS.</p> <p>21.2 If a Bid-Securing Declaration is required pursuant to ITB 21.1, it shall use the form included in Section 4 (Bidding Forms). The Employer will declare a Bidder ineligible to be awarded a Contract for a specified period of time, as indicated in the BDS, if a Bid-Securing Declaration is executed.</p> <p>21.3 If a bid security is specified pursuant to ITB 21.1, the bid security shall be, at the Bidder's option, in any of the following forms:</p> <ul style="list-style-type: none"> (a) an unconditional bank guarantee, (b) an irrevocable letter of credit, or (c) a cashier's or certified check, <p>all from a reputable source from an eligible country as described in Section 5 (Eligible Countries). In the case of a bank guarantee, the bid security shall be submitted using either the Bid Security Form included in Section 4 (Bidding Forms) or another form acceptable to the Employer. The form must include the complete name of the Bidder. The bid security shall be valid for 28 days beyond the original validity period of the Bid, or beyond any period of extension if requested under ITB 20.2.</p> <p>21.4 Unless otherwise specified in the BDS, any Bid not accompanied by a substantially compliant bid security or Bid-Securing Declaration, if one is required in accordance with ITB 21.1, shall be rejected by the Employer as nonresponsive.</p> <p>21.5 If a bid security is specified pursuant to ITB 21.1, the bid security of the unsuccessful Bidder shall be returned as promptly as possible upon the successful Bidder's furnishing of the performance security pursuant to ITB 45.</p> |

- 21.6 If a bid security is specified pursuant to ITB 21.1, the bid security of successful Bidders shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.
- 21.7 The bid security may be forfeited or the Bid-Securing Declaration executed:
- (a) if a Bidder withdraws its Bid during the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, except as provided in ITB 20.2 or
 - (b) if the successful Bidder fails to:
 - (i) sign the Contract in accordance with ITB 44;
 - (ii) furnish a performance security in accordance with ITB 45; or
 - (iii) accept the arithmetical corrections of its Bid in accordance with ITB 36.
- 21.8 The bid security or the Bid-Securing Declaration of a Joint Venture shall be in the name of the Joint Venture that submits the Bid. If the Joint Venture has not been legally constituted at the time of bidding, the bid security or the Bid-Securing Declaration shall be in the names of all future partners as named in the letter of intent referred to in ITB 4.1.

22. Format and Signing of Bid

- 22.1 The Bidder shall prepare one original set of the Technical Bid and one original set of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL - TECHNICAL BID" and "ORIGINAL - PRICE BID". Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE". In addition, the Bidder shall submit copies of the Bid, in the number specified in the BDS and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.
- 22.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid, except for unamended printed literature, shall be signed or initialed by the person signing the Bid. If a Bidder submits a deficient authorization, the Bid shall not be rejected in the first instance. The Employer shall request the Bidder to submit an acceptable authorization within the number of days as specified in the BDS. Failure to provide an acceptable authorization within the prescribed period of receiving such a request shall cause the rejection of the Bid.
- 22.3 A Bid submitted by a Joint Venture shall be signed so as to be legally binding on all partners.
- 22.4 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

- 23. Submission, Sealing, and Marking of Bids**
- 23.1 Bidders may submit their Bids by mail or by hand. When so specified in the BDS, Bidders shall have the option of submitting their Bids electronically. Procedures for submission, sealing and marking are as follows:
- (a) Bidders submitting Bids by mail or by hand shall enclose the original and each copy of the Bid, including alternative Bids, if permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL," "ALTERNATIVE," and "COPY." These envelopes containing the original and the copies shall then be enclosed in one single envelope. The rest of the procedure shall be in accordance with ITB 23.2 to ITB 23.6.
 - (b) Bidders submitting Bids electronically shall follow the electronic bid submission procedures specified in the BDS.
- 23.2 The inner and outer envelopes shall
- (a) bear the name and address of the Bidder,
 - (b) be addressed to the Employer in accordance with ITB 24.1, and
 - (c) bear the specific identification of this bidding process indicated in the BDS 1.1.
- 23.3 The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB 27.1.
- 23.4 The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB 27.7.
- 23.5 Alternative Bids, if permissible in accordance with ITB 13, shall be prepared, sealed, marked, and delivered in accordance with the provisions of ITB 20 and ITB 21, with the inner envelopes marked in addition "ALTERNATIVE NO...." as appropriate.
- 23.6 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.
- 24. Deadline for Submission of Bids**
- 24.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.
- 24.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
- 25. Late Bids**
- 25.1 The Employer shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 24. Any Bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.
- 26. Withdrawal,**
- 26.1 A Bidder may withdraw, substitute, or modify its Bid after it has been submitted

**Substitution,
and
Modification of
Bids**

by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 22.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

- (a) prepared and submitted in accordance with ITB 22 and ITB 23 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "Withdrawal," "Substitution," "Modification;" and
- (b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 24.

26.2 Bids requested to be withdrawn in accordance with ITB 26.1 shall be returned unopened to the Bidders.

26.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Technical Bid or any extension thereof.

27. Bid Opening

27.1 The Employer shall open the Technical Bids in public at the address, on the date, and time specified in the BDS in the presence of Bidder's designated representatives and anyone who choose to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 23.1, shall be as specified in the BDS. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening. If the Technical Bid and the Price Bid are submitted together in one envelope, the Employer may reject the entire Bid. Alternatively, the Price Bid may be immediately resealed for later evaluation.

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27.4 Next, outer envelopes marked "MODIFICATION" shall be opened. No Technical Bid and/or Price Bid shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Bids, both Original as well as Modification, will remain unopened in accordance with ITB 27.1.

27.5 All other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:

- (a) the name of the Bidder;
- (b) whether there is a modification or substitution;
- (c) the presence of a bid security or a Bid-Securing Declaration, if required; and
- (d) any other details as the Employer may consider appropriate.

Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Technical Bid are to be

initialed by at least three representatives of the Employer attending the bid opening. No Bid shall be rejected at the opening of Technical Bids except for late Bids, in accordance with ITB 25.1.

- 27.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; and alternative Bids; and the presence or absence of a bid security or a Bid-Securing Declaration, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.
- 27.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice of the opening of Price Bids.
- 27.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially nonresponsive to the requirements of the Bidding Document and return their Price Bids unopened.
- 27.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders' representatives who choose to attend at the address, on the date, and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.
- 27.10 All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:
- (a) the name of the Bidder;
 - (b) whether there is a modification or substitution;
 - (c) the Bid Prices, including any discounts and alternative offers; and
 - (d) any other details as the Employer may consider appropriate.

Only Price Bids, discounts, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Price Bid and Price Schedules are to be initialed by at least three representatives of the Employer attending the opening. No Bid shall be rejected at the opening of Price Bids.

- 27.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.

E. Evaluation and Comparison of Bids

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| 28. Confidentiality | <p>28.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on the Contract award is communicated to all Bidders.</p> <p>28.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.</p> <p>28.3 Notwithstanding ITB 28.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it should do so in writing.</p> |
| 29. Clarification of Bids | <p>29.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids, in accordance with ITB 36.</p> <p>29.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its Bid may be rejected.</p> |
| 30. Deviations, Reservations, and Omissions | <p>30.1 During the evaluation of Bids, the following definitions apply:</p> <ul style="list-style-type: none"> (a) "Deviation" is a departure from the requirements specified in the Bidding Document; Annexure-14 Bidding form. (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document. |
| 31. Examination of Technical Bids | <p>31.1 The Employer shall examine the Technical Bid to confirm that all scheme documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, the Bid may be strictly rejected.</p> <p>31.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected.</p> <ul style="list-style-type: none"> (a) Letter of Technical Bid; (b) written confirmation of authorization to commit the Bidder; (c) Bid Security or Bid-Securing Declaration, if applicable; and (d) Technical Proposal in accordance with ITB 17. |

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| 32. Responsiveness of Technical Bid | <p>32.1 The Employer's determination of a bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB11.</p> <p>32.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,</p> <p style="padding-left: 40px;">(a) if accepted, would:</p> <p style="padding-left: 80px;">(i) affect in any substantial way the scope, quality, or performance of the plant and services specified in the Contract; or</p> <p style="padding-left: 80px;">(ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or</p> <p style="padding-left: 40px;">(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.</p> <p>32.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 17, Technical Proposal, in particular to confirm that all requirements of Section 6 (Employer's Requirements) have been met without any material deviation, reservation, or omission.</p> <p>32.4 If a Bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.</p> |
| 33. Nonmaterial Nonconformities | <p>33.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformities in the Bid that do not constitute a material deviation, reservation, or omission.</p> <p>33.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.</p> <p>33.3 Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in Section 3 (Evaluation and Qualification Criteria).</p> |
| 34. Detailed Evaluation of Technical Bids | <p>34.1 The Employer will carry out a detailed technical evaluation of the Bids not previously rejected as being substantially nonresponsive, to determine whether the technical aspects are in compliance with the Bidding Document. The Bid that does not meet minimum acceptable standards of completeness, consistency, and detail, and the specified minimum and/or maximum requirements for specified functional guarantees, will be treated</p> |

as nonresponsive and hence rejected. To reach such a determination, the Employer will examine and compare the technical aspects of the bids on the basis of the information supplied by the Bidders, taking into account the following:

- (a) overall completeness and compliance with the Employer's Requirements; deviations from the Employer's Requirements; conformity of the plant and services offered with specified performance criteria; suitability of the plant and services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the Bid. The Bid that does not meet minimum and/or maximum acceptable standards of completeness, consistency, and detail will be rejected for non-responsiveness;
- (b) type, quantity, and long-term availability of mandatory and recommended spare parts and maintenance services; and
- (c) other relevant factors, if any, listed in Section 3 (Evaluation and Qualification Criteria).

34.2 Where alternative technical solutions have been allowed in accordance with ITB 13, and offered by the Bidder, the Employer will make a similar evaluation of the alternatives. Where alternatives have not been allowed but have been offered, they shall be ignored.

35. Eligibility and Qualification of the Bidder

35.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether a Bidder meets the eligibility and qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).

35.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 15.

35.3 An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.

35.4 The capabilities of the manufacturers and subcontractors proposed in its Bid for the major items of plant and services to be used by the lowest evaluated Bidder will also be evaluated for acceptability in accordance with Section 3 (Evaluation and Qualification Criteria). Their participation should be confirmed with a letter of intent between the parties, as needed. Should a manufacturer or subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to propose, without changing its bid price, an acceptable substitute manufacturer or subcontractor meeting the minimum technical specifications stated in Section 6 (Employer's Requirements). If a Bidder does not provide an acceptable substitute manufacturer or subcontractor by the date and time set in the Employer's request for substitution of manufacturer or subcontractor, its Bid may be rejected.

35.5 Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved manufacturers or

subcontractors for each item concerned.

36. Correction of Arithmetical Errors

- 36.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:
- (a) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the amounts given under the column for the price breakdown shall prevail and the Total Price will be corrected accordingly;
 - (b) where there are errors between the total of the amounts of Schedule Nos. 1 to 4 and the amount given in Schedule No. 5 (Grand Summary), the total of the amounts of Schedule Nos. 1 to 4 shall prevail and the Schedule No. 5 (Grand Summary) will be corrected accordingly;
 - (c) if there is a discrepancy between the grand total price given in Schedule No. 5 (Grand Summary) and the bid amount in item (c) of the Letter of Price Bid, the grand total price given in Schedule No. 5 (Grand Summary) will prevail and the bid amount in item (c) of the Letter of Price Bid will be corrected; and
 - (d) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetical error, in which case the amount in figures shall prevail subject to (a), (b), and (c) above.
- 36.2 If the Bidder that submitted the lowest evaluated Bid does not accept the correction of errors, its Bid shall be disqualified and its bid security may be forfeited or its Bid-Securing Declaration executed.

37. Conversion to Single Currency

- 37.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified in the BDS .

38. Margin of Preference

- 38.1 Unless otherwise specified in the BDS, a margin of preference shall not apply.

39. Evaluation of Price Bids

- 39.1 The Employer shall use the criteria and methodologies listed in this clause. No other evaluation criteria or methodologies shall be permitted.
- 39.2 I. To evaluate a Price Bid, the Employer shall consider the following:
- (a) the bid price, excluding provisional sums and the provision, if any, for contingencies in the Price Schedules;
 - (b) price adjustment for correction of arithmetical errors in accordance with ITB 36.1;
 - (c) price adjustment due to discounts offered in accordance with ITB 18.7;
 - (d) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 33.3;
 - (e) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 37; and
 - (f) the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria).

II. The Employer's evaluation of a Bid will exclude and not take into account,

- (a) in the case of Plant and Mandatory Spare Parts (Schedule No. 1) supplied from abroad, all taxes and duties, applicable in the Employer's country and payable on the Plant and Mandatory Spare Parts if the Contract is awarded to the Bidder; and (SCC
- (b) in the case of Plant and Mandatory Spare Parts (Schedule No. 2) supplied from within the Employer's country, sales and other taxes, applicable in the Employer's country and payable on the Plant and Mandatory Spare Parts if the Contract is awarded to the Bidder.

39.3 If price adjustment is allowed in accordance with ITB 18.6, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

39.4 If this Bidding Document allows Bidders to quote separate prices for different lots (contracts), and the award to a single Bidder of multiple lots (contracts), the methodology to determine the lowest evaluated price of the lot (contract) combinations, including any discounts offered in the Letter of Price Bid, is specified in Section 3 (Evaluation and Qualification Criteria).

39.5 If the Bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Price Schedules, to demonstrate the internal consistency of those prices with the methods and time schedule proposed. After evaluation of the price analyses, taking into consideration the terms of payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

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| 40. Comparison of Bids | 40.1 | The Employer shall compare all substantially responsive Bids to determine the lowest evaluated Bid, in accordance with ITB 39.2. Refer BDS. |
| 41. Employer's Right to Accept Any Bid, and to Reject Any or All Bids | 41.1 | The Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, bid securities, shall be promptly returned to the Bidders. |

F. Award of Contract

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| 42. Award Criteria | 42.1 | The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated Bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be eligible and qualified to perform the Contract satisfactorily. Refer BDS. |
| 43. Notification of Award | 43.1 | Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. |
| | 43.2 | At the same time, the Employer shall also notify all other Bidders of the results of the bidding. The Employer will publish in an English language newspaper or well-known freely accessible website the results identifying the Bid and lot numbers, and the following information: (i) name of each |

Bidder who submitted a bid; (ii) bid prices as read out at bid opening; (iii) name and evaluated prices of each bid that was evaluated; (iv) name of Bidders whose Bids were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded. After publication of award, unsuccessful Bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their Bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after publication of contract award, request for a debriefing.

43.3 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

44. Signing of Contract

44.1 Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement.

44.2 Within 28 days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.

45. Performance Security

45.1 Within 28 days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the performance security in accordance with the conditions of contract, subject to ITB 39.5, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer.

45.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security or execution of the Bid-Securing Declaration. In that event, the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

Section 2 - Bid Data Sheet

This section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section 1 - Instructions to Bidders.

A. General

ITB 1.1	<p>The number of the Invitation for Bids (IFB) is : ONE (Single Bid)</p> <p>The Employer is: Jaipur Metro Rail Corporation</p> <p>3rd Floor , RAJSICO Building, Udhog Bhawan Premises , C-Scheme Jaipur, Rajasthan, India</p> <p>The name of the international competitive bidding (ICB) is : Not Applicable</p> <p>The identification number of the Bid is: JP/JS02-Phase-1B</p> <p>The number and identification of lots (contracts) comprising this Bid:- One (JP/JS02-Phase-1B).</p>
ITB 2.1	<p>The Borrower is : Jaipur Metro Rail Corporation.</p> <p>3rd Floor, RAJSICO Building, Udhog Bhawan Premises , C-Scheme Jaipur, Rajasthan, India.</p> <p>The Borrower has received financing (hereinafter called funds) from the Asian Development Bank (hereinafter called ADB) towards the cost of the Project : Design, Manufacture, Supply, Installation Testing and Commissioning of Train Control & Signalling System for Jaipur Metro Rail Project (Phase 1B)</p>
ITB 4.3 (e)	Not applicable as direct mode of contracting is adopted.
ITB 6.2 & 6.3	Not applicable

B. Contents of Bidding Documents

ITB 7.1	<p>For <u>clarification purposes</u> only, the Employer's address is:</p> <p>Attention: Director (Project), Jaipur Metro Rail Corporation.</p> <p>Street address: RAJSICO_Building, Udhog Bhawan Premises , C-Scheme</p>
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	<p>Floor/Room number: 3rd Floor,</p> <p>City: Jaipur</p> <p>ZIP code: 302005</p> <p>Country: INDIA</p> <p>Telephone: 0141- 5192450</p> <p>Fax: _____</p> <p>E-mail address: jmrc.project@gmail.com</p>
ITB 7.4	<p>A Pre-Bid meeting may take place if Prospective bidder/ contractor have some doubt or seek clarification. The date, time and place are as follows :</p> <p>Date : To be notified later</p> <p>Time: To be notified later</p> <p>Place: Jaipur Metro Rail Corporation. 3rd Floor, RAJSICO Building, Udhog Bhawan Premises , C-Scheme, Jaipur, Rajasthan, India.</p> <p>A site visit can be organized by the Employer, if required. The cost of same shall be borne by bidder/ contractor.</p>

C. Preparation of Bids

ITB 11.2 (b)	Bid Security or Bid-Securing Declaration is not to be submitted.
ITB 11.2 (c)	Alternative bids are not permissible.
ITB 11.2 (k)	<p>The Bidder shall submit with its Technical Bid the following additional documents:</p> <ol style="list-style-type: none"> 1. Certificate Of Compliance (Form COC to Section 4) 2. Endorsement of the requirement of SCC/GCC (Annexure-III of SCC, Section-8)
ITB 11.3 (b)	Quantity specified in Minimum BOQ, Section 4 is the total minimum quantities to be covered as part of scope of work .Any other item or enhancement to listed items required to complete the contract shall also be provided as part of this lump sum contract. The bidder shall fill the price schedules on Section 4 using the items listed in Minimum BOQ as a baseline document.
ITB 11.3 (d)	The Bidder shall, on or before the date and time notified in Bid Documents, submit along with his Bid:-Original with Two copies each of all the Bid document, including Bid Drawings and Addenda there to, with each page signed and stamped to confirm acceptance by the Bidder of the contents.

ITB 12.1	The units and rates in figures entered into the Price Schedules should be typewritten or if written by hand, must be in print form. Price Schedules not presented accordingly may be considered nonresponsive.
ITB 13.1	Alternative bids are not Acceptable .
ITB 13.2	Alternatives to the Time Schedule shall not be permitted .
ITB 13.4	Alternative technical solutions shall be permitted for any part or sub systems of the plant and service.
ITB 15.2	No provision of domestic preference is kept.
ITB 16.1(a)	Only applicable for equipment / sub system different from one supplied & installed in Phase 1-A of JMRTS [MSOR- CDPE section], but as per PS & GS.
ITB 16.1 (b)	The period following completion of plant and services in accordance with provisions of the contract shall be 10 years from the date of taking over of plant or start of Revenue Operation Date, whichever is later.
ITB 16.1 (c)	For same equipment as utilized in JMRC Phase 1-A, responsiveness shall constitute Certificate of Compliance, Form COC, Bidding Forms.
ITB 18.3	Prices quoted for Schedule 6 (a) & (b) shall not to be used for bid price evaluation.
ITB18.4(a)(i)	<p>The Inco term for quoting plant to be supplied from abroad is CIP.</p> <p>The place of destination for delivery of materials shall be Jaipur Metro Rail Corporation, Mansarovar Depot, Bhriugu Path, Mansarovar Jaipur, Rajasthan 302020 India.</p>
ITB18.4(a)(ii)	The price quoted shall be inclusive of all taxes, levies, duties, cess, freight, insurance and all other incidental charges required to fulfill the contract requirements including statutory deduction viz., TDS towards Income Tax T/Works Contract Tax etc., except, to the extent applicable and available, Concessional Custom Duty Project Import under chapter 98.01 of Custom Tariff Act, Excise Duty & Rajasthan VAT and Rajasthan Entry Tax. [Refer provisions of SCC Clause 7].
ITB 18.6	The prices quoted by the Bidder shall be fixed .

ITB 19.1	<p>The currencies of the Bid shall be as follows:</p> <ul style="list-style-type: none"> (a) The prices shall be quoted either in the currency of the Employer Country (Indian National Rupee), or in any fully convertible currency of up to three foreign currencies. (b) A Bidder expecting to incur a portion of its expenditures in the performance of the Contract in more than one currency, and wishing to be paid accordingly, shall so indicate in the Schedule of Prices and the Letter of Price Bid. (c) If some of the contract expenditures related to Design, Installation and Other Services are to be incurred in the Employer's country, such expenditures shall be quoted in either foreign and/or local currency, depending upon the currency in which the costs are to be incurred. (d) Bidders may be required by the Employer to clarify their local and foreign currency requirements, and to substantiate that the amounts included in the Price Schedules are reasonable and responsive to ITB 18.1 in which case a detailed breakdown of its foreign currency requirements shall be provided by the Bidder (e) During the performance of the contract, the foreign currency portions of the outstanding balance of the Contract Price may be adjusted by agreement between the Employer and the Contractor to reflect any changes in foreign currency requirements for the contract. Any such adjustment shall be effected by comparing the amounts quoted in the bid with the amounts already used in the Facilities and the Contractor's future needs for imported items.
ITB 20.1	The bid validity period shall be 180 days from the date of final submission.
ITB 21	Not applicable.
ITB 22.1	In addition to the original Bid, the numbers of copies to be submitted are two .
ITB 22.2	<p>The written confirmation of authorization to sign on behalf of the Bidder shall consist of nomination of one of the members of the partnership, consortium or joint venture to be in-charge; and this authorization shall be covered in the Power of Attorney signed by the legally authorized signatories of all members of consortium or joint venture.</p> <p>The bidder shall submit an acceptable authorization within reasonable period.</p>
ITB 22.3	<p>The bidder, to qualify for award of Contract, shall submit a written power of attorney authorizing the signatories of the bid to commit each member of the partnership, consortium or joint venture.</p> <p>The bidder shall submit the following information:-</p> <ul style="list-style-type: none"> i) A Copy of Memorandum of understanding (MOU) relating to the composition of bidder shall be submitted.

	<p>ii) Nomination of one of the members of the partnership, consortium or joint venture to be in-charge; and this authorisation shall be covered in the Power of Attorney signed by the legally authorised signatories of all members of consortium or joint venture;</p> <p>iii) Details of the intended participation by each member shall be reconfirmed and expanded with complete details of the proposed division of responsibilities and corporate relationships among the individual members.</p> <p>iv) The joint venture/consortium/partnership agreement must contain a clause stating "All the partners are jointly and severally liable to JMRC".</p> <p>In case the bidder being successful, joint venture/consortium/partnership agreement shall be registered in Jaipur so as to be legally valid and binding on partners/members of the joint venture/consortium/partnership.</p> <p>v) The lead partner in charge shall be authorized to incur liabilities, receive payments and receive instructions for and on behalf of any or all partners of the joint venture/consortium/partnership.</p>
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D. Submission and Opening of Bids

ITB 23.1	Bidders shall not have the option of submitting their bids electronically. Bidders must submit their bids by hand / post.
ITB 24.1	<p>For <u>bid submission purposes</u> only, the Employer's address is</p> <p>Attention: Director (Project), Jaipur Metro Rail Corporation. Street address: RAJSICO_Building, Udh yog Bhawan Premises , C-Scheme Floor/Room number: 3rd Floor City: Jaipur ZIP code: 302005 Country: INDIA</p> <p>The deadline for bid submission is Date: _____ Time: _____</p>
ITB 25.1	Not Applicable.
ITB 26	Not Applicable.
ITB 27	As applicable to the extent of Single Bid in Direct Contracting method.

E. Evaluation and Comparison of Bids

ITB 29.2	Not Applicable.
ITB 30.1	In addition, all deviations shall be recorded in Statement Of Deviations- Form SD to Bidding Forms
ITB 31.2 (c)	Not Applicable.
ITB 32.4	Not Applicable.
ITB 33.3	Not Applicable.
ITB 34.1	<p>The contractor/ prospective bidder is advised that the Employer's policy in respect to evaluation is that Technical & Financial Packages will be opened on same day and reviewed to determine their acceptability and responsiveness to Section 6.</p> <p>Also, the technical evaluation of bid will take into account submission of Certificate of Compliance, Form COC of Bidding form to confirm compliance to Employer's requirements of same equipments/ sub systems already supplied as existing equipment. If otherwise, Bidder shall furnish all the details as mentioned in referred item.</p>
ITB 35.3	Not Applicable.
ITB 36.2	Not Applicable.
ITB 37.1	<p>The currency that shall be used for bid evaluation and comparison purposes to convert bid prices expressed in various currencies into a single currency is Indian Rupee(INR).</p> <p>The source of the selling exchange rate shall be of Reserve Bank of India.</p> <p>The date for the selling exchange rate shall be 28 days before date of submission of bid.</p>
ITB 38.1	A margin of preference shall not be applied.
ITB 39.2.II	The evaluation of price bid shall take into account prices inclusive of all taxes as applicable in accordance with provisions of SCC Clause 7 or elsewhere in the bidding document.

ITB 39.3,39.4 & 39.5	Not Applicable.
ITB 40.1	Comparison of bids shall not be applicable, as Single bidding method is applied. However, Unacceptable & unresponsive bid will be rejected.

F. Award of Contract

ITB 42	The Employer shall award the Contract to the Bidder whose offer has been determined to be the reasonable & responsive to the Employer's requirement.
ITB 43.2	Not Applicable.

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1. Evaluation

1.1 Technical Evaluation

Technical Evaluation shall be as per the criteria listed in ITB 34.1 (a) – (b).

1.2 Alternative Technical Solutions **Not Applicable**

1.3.1 Quantifiable Deviations and Omissions Not Applicable

1.3.2 Time Schedule Not Applicable

1.3.3 Operating and Maintenance Costs Not Applicable

1.3.4 Functional Guarantees of the Facilities Not Applicable

1.3.5 Work, Services, Facilities, etc., to be provided by the Employer Not Application

1.3.6 Specific Additional Criteria Not Applicable

1.3.7 Domestic Preference Not Applicable

1.4 Multiple Contracts Not Applicable.

2. Qualification

It is the legal entity or entities comprising the Bidder, and not the Bidder's parent companies, subsidiaries, or affiliates, that must satisfy the qualification criteria described below.

2.1 Eligibility

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.1.1 Nationality

Nationality in accordance with ITB Subclause 4.2.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI - 1; ELI - 2 with attachments
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2.1.2 Conflict of Interest

No conflicts of interest in accordance with ITB Subclause 4.3.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.1.3 ADB Eligibility

Not having been declared ineligible by ADB, as described in ITB Subclause 4.4.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
--	-----------------------	-----------------------	-----------------------	----------------	-------------------------

2.1.4 Government-Owned Enterprise

Bidder required to meet conditions of ITB Subclause 4.5.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI - 1; ELI - 2 with attachments
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2.1.5 United Nations Eligibility

Not having been excluded by an act of compliance with a UN Security Council resolution in accordance with ITB Subclause 4.7.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.2 Pending Litigation and Arbitration

Pending litigation and arbitration criterion shall apply as below.

2.2.1 Pending Litigation and Arbitration

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
All pending litigation and arbitration, if any, shall be treated as resolved against the Bidder and so shall in total not represent more than 50% percent of the Bidder's net worth calculated as the difference between total assets and total liabilities.	must meet requirement by itself or as partner to past or existing Joint Venture	not applicable	must meet requirement by itself or as partner to past or existing Joint Venture	not applicable	Form LIT - 1

2.3 Financial Situation

2.3.1 Historical Financial Performance

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Submission of audited financial statements or, if not required by the law of the Bidder's country, other financial statements acceptable to the Employer, for the last 03 years to demonstrate the current soundness of the Bidder's financial position. As a minimum, the Bidder's net worth for the last year calculated as the difference between total assets and total liabilities should be positive.	must meet requirement	not applicable	must meet requirement	not applicable	Form FIN - 1 with attachments

2.3.2 Average Annual Turnover

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Minimum average annual turnover of (INR) 15.21 Crore* calculated as total certified payments received for contracts in progress or completed, within the last 3 years.	must meet requirement	must meet requirement	must meet 50% (##) of the requirement	must meet 75% (##) of the requirement	Form FIN - 2

**3% contingency accounted for and contract duration for 3.5 years assumed.*

Confirmation and acceptability on same has to be finalized by Employer.

2.3.3 Financial Resources

If the bid evaluation process and the decision for the award of the Contract takes more than one (1) year from the date of bid submission, Bidders shall be asked to resubmit their current contract commitments and latest information on financial resources supported by latest audited accounts / audited financial statements, or if not required by the law of the Bidder's country, other financial statements acceptable to the Employer, and the Bidders' financial capacity shall be reassessed on this basis.

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
The Bidder must demonstrate that it has the financial resources to meet:					
(a) its current contract commitments, as defined in FIN-4 (Total Financial Requirements for Current Contract Commitments), plus	must meet requirement	not applicable	must meet requirement for its own contractual commitments	not applicable	Form FIN - 4
(b) the requirements for the Subject Contract of INR 1.84 Crore*	must meet requirement	must meet requirement	50%(A) (##)	75%(B) (##)	Form FIN – 3 and Form FIN - 4

**3% contingency accounted for and contract duration for 3.5 years assumed.*

Confirmation and acceptability on same has to be finalized by Employer.

2.4 Bidder's Experience

Not Used.

2.5 Subcontractors

Subcontractors or Manufacturers for the following major items of plant and services must meet the following minimum criteria, herein listed for that item in case the Subcontractor/Manufacturer were not approved during Phase 1-A of JMRTS . Failure to comply with this requirement will result in rejection of the subcontractor but not the Contractor.

Item No.	Description of Item	Minimum Criteria to be met	Documents Submission Requirements
1		Subject to review by Employer's representative	Form EXP-3
2			
3			
4			
5			

Section 4 - Bidding Forms

This section contains the forms to be completed by the Bidder and submitted as part of its Bid.

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Letter of Technical Bid

-- Note --

The bidder must accomplish the Letter of Technical Bid on its letterhead clearly showing the bidder's complete name and address.

Date:

ICB No.:

Invitation for Bid No.:

To:.....

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.
- (b) We offer to Design, Manufacture, Supply, Installation, Testing & Commissioning of Train Control & Signalling System for Jaipur MRTS Project-Phase-1B
- (c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of 180 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (d) We, including any Subcontractors or Manufacturers for any part of the Contract, have or will have nationalities from eligible countries, in accordance with ITB 4.2.
- (e) We, including any Subcontractors or Suppliers for any part of the Contract, do not have any conflict of interest in accordance with ITB 4.3.
- (f) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by ADB, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council.
- (g) [We are not a government-owned enterprise] / [We are a government-owned enterprise but meet the requirements of ITB 4.5].¹

¹ Use one of the two options as appropriate.

- (h) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.
- (i) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section 6 (Employer's Requirements) and our technical proposal, or as otherwise agreed with the Employer.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

Letter of Price Bid

-- Note --

The bidder must accomplish the Letter of Price Bid on its letterhead clearly showing the bidder's complete name and address.

Date:

ICB No.:

Invitation for Bid No.:

To:.....

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.
- (b) We offer to Design, Manufacture, Supply, Installation, Testing & Commissioning of Train Control & Signalling System for Jaipur MRTS Project-Phase-1B
.....

- (c) The total bid price, excluding any discounts offered in item (d) below is the sum of

[amount of foreign currency in words], [amount in figures], and [amount of local currency in words], [amount in figures]

The total bid price from the Grand Summary (Schedule No. 5) should be entered by the Bidder inside this box. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the bid.

- (d) The discounts offered and the methodology for their application are as follows:
- (e) Our Bid shall be valid for a period of 180 days from the date fixed for the submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (f) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document.

- (g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: ¹

Name of Recipient	Address	Reason	Amount
.....
.....

- (h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.
- (i) We understand that you are not bound to accept the bid that you may receive.
- (j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

¹ If none has been paid or is to be paid, indicate "None."

Price Schedules

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows:
Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad
Schedule No. 2: Plant and Mandatory Spare Parts Supplied from within the Employer's Country
Schedule No. 3: Design Services
Schedule No. 4: Installation and Other Services
Schedule No. 5: Grand Summary
Schedule No. 6 (a) Recommended Spare Parts
Schedule No. 6(b) Comprehensive AMC beyond DLP for 2 years
2. The Schedules are to be filled by Bidder using Minimum BOQ (Table-I, Section 4) as a reference which specifies the minimum quantity to be supplied. The minimum BOQ does not generally give a full description of the plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Employer's Requirements and other sections of the Bidding Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.
3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

4. The units and rates in figures entered into the Price Schedules should be typewritten or if written by hand, must be in print form. Price Schedules not presented accordingly may be considered nonresponsive. Any alterations necessary due to errors, etc., shall be initialed by the Bidder.
As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract.
5. Bid prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Document.
For each item, Bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.
Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements) or elsewhere in the Bidding Document.
6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.
7. When requested by the Employer for the purposes of making payments or part payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Schedules of Rates and Prices

Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad

Item	Description	Country of Origin	Quantity ^b	Unit Price ^{a,c}		Total Price ^{a,c}	Taxes and Duties
				Foreign Currency	CIP	Foreign Currency	Local Currency
1	2	3	4	5	6	7= 4 x 6	8
TOTAL Column 7 to be carried forward to Schedule No. 5: Grand Summary							

Name of Bidder_____

Signature of Bidder_____

- ^a Specify currencies in accordance with ITB 19.1 of the BDS. Create additional columns for up to a maximum of three foreign currencies if so required.
- ^b Quantity specified in Schedule 1,2,3,4 should be the total minimum quantity to be covered as part of scope of work . The bidder should fill Schedule 1,2,3,4, of Section 4 using the minimum BOQ(Table-I, section 4) as a baseline schedule. Any other item or enhancement to listed items required to complete the contract shall also be provided as part of this lump sum contract.
- ^c Column 6 Price shall be inclusive of all taxes, levies, duties, cess, freight, insurance and all other incidental charges required to fulfill the contract requirements including statutory deduction viz., TDS towards Income Tax T/Works Contract Tax etc., except Custom Duty as applicable for Project Import under chapter 98.01 of Custom Tariff Act, Excise Duty & Rajasthan VAT and Rajasthan Entry Tax.

Country of Origin Declaration Form

Item	Description	Country

Schedule No. 2: Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Quantity ^c	Unit Price ^a		Total EXW Price ^{a,c}	Sales and other Taxes
			Local Currency	EXW ^b Price		
1	2	3	4	5	6 = 3 x 5	7
TOTAL Column 6 to be carried forward to Schedule No. 5: Grand Summary						

Name of Bidder_____

Signature of Bidder_____

^a Specify currency in accordance with ITB 19.1 of the BDS.

^b Column 6 Price shall be inclusive of all taxes, levies, duties, cess, freight, insurance and all other incidental charges required to fulfill the contract requirements including statutory deduction viz., TDS towards Income Tax T/Works Contract Tax etc., except Custom Duty as applicable for Project Import under chapter 98.01 of Custom Tariff Act, Excise Duty & Rajasthan VAT and Rajasthan Entry Tax.

^c Quantity specified in Schedule 1,2,3,4 should be the total minimum quantity to be covered as part of scope of work. The bidder should fill Schedule 1,2,3,4, of Section 4 using the minimum BOQ (Table-I, section 4) as a baseline schedule. Any other item or enhancement to listed items required to complete the contract shall also be provided as part of this lump sum contract. The bidder should specify the portion of total quantity to be supplied from abroad in Schedule 1 and portion of total quantity to be supplied from within Employer's country in schedule 2.

Schedule No. 3: Design and other Services

Item	Description	Quantity	Unit Price ^{a,b}		Total Price ^{a,b}		Service Tax (already included in 6)
			Local Currency Portion	Foreign Currency Portion	Local Currency Portion	Foreign Currency Portion	
1	2	3	4	5	6 = 3 x 4	7 = 3 x 5	8

TOTAL Columns 6 and 7 to be carried forward to Schedule No. 5: Grand Summary

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Name of Bidder _____

Signature of Bidder _____

^a Specify currency in accordance with ITB 19.1 of the BDS.

^b The bidder shall quote price as per bid conditions and show separately the amount of service tax included in the bid price. Refer SCC Clause 7 for further details.

Schedule No. 4 - Installation and Other Services

Item	Description	Quantity	Unit Price ^{a,b}		Total Price ^{a,b}		Service Tax (already included in 6)
			Local Currency Portion	Foreign Currency Portion	Local Currency Portion	Foreign Currency Portion	
1	2	3	4	5	6 = 3 x 4	7 = 3 x 5	8
TOTAL Column 6 & 7 to be carried forward to Schedule No. 5: Grand Summary							

Name of Bidder _____

Signature of Bidder _____

^a Specify currency in accordance with ITB 19.1 of the BDS.^b The bidder shall quote price as per bid conditions and show separately the amount of service tax included in the bid price. Refer SCC Clause 7 for further details.

Schedule No. 5: Grand Summary

Schedule No.	Title	Total Price ^a	
		Foreign	Local
1	Plant and Mandatory Spare Parts Supplied from Abroad ^b		
2	Plant and Mandatory Spare Parts Supplied from Within the Employer's Country ^b		
3	Design Services		
4	Installation and Other Services		
Grand Total to be carried forward to Letter of Price Bid			

Name of Bidder _____

Signature of Bidder _____

^a Specify currency in accordance with ITB 19.1 of the BDS. Create additional columns for up to a maximum of three foreign currencies if so required.

^b Prices are inclusive of all applicable taxes and duties as per SCC Clause 7 or elsewhere in Contract.

***Schedule No. 6 (a): Recommended Spare Parts**

Item	Description*	Part No.	Primary Source of Supply	Secondary Source of Supply	Lead Time (Month)	Shelf Life (Month)	Unit Cost Without Escalation	Number of units required for the system during expected life	Number of units required for the system during the first 10 years	Quantity	Unit Price ^a		Total Price ^a	
											EXW Local Parts Local Currency	CIP Imported Parts Foreign Currency	Local Currency Portion	Foreign Currency Portion
1									2	3	4	5	6 = 3 x 4	7 = 3 x 5
TOTAL														

* Description should include details like part number, lead time, shelf life etc as per SCC Clause no.3

Table –I: Minimum BOQ for Train Control & Signalling System for Jaipur Metro Phase-1B

Schedule-A Project Management & Interface Management			
S. No.	Item Description	Unit	Quantity
1.	Project management for Train Control & Signalling Part		
2.	Any other item necessary for meeting the contract requirements		
Schedule-B Design			
S. No.	Item Description	Unit	Quantity
1.	Primary, Final & Application Design		
2.	Any other item necessary for meeting the contract requirements		
Schedule-C: Manufacture, Supply, Delivery of Trackside and Station Equipment			
S. No.	Item Description	Unit	Quantity
1.	Track Circuits with accessories	No.	
a	with 3 receivers	No.	0
b	with 2 receivers	No.	2
c	with 1 receivers	No.	23
2.	Mainline Point Machine (MJ81) with External Mechanical Locks and other accessories	No.	4
3.	Signal with accessories	No.	
a	3 Aspect	No.	13
b	Buffer light	No.	4
c	Route Indicator	No.	3
4.	Power Distribution Cubicle with accessories for	No.	
a	Interlocking Stations (PDC & Txfmer)	No.	1
b	Secondary Stations (Transformer Cubicle)	No.	1
5.	CBI equipment with all Software and associated accessories	No.	1
6.	Cable termination rack, relay rack, Relays, Boxes, ESPs, EKTs with associated accessories for		
a	Interlocking Stations		
i	Cable termination rack	No.	2
ii	ESPs	No.	2
iii	EKTS	No.	2
iv	Relays and Relay Racks	No.	
b	Secondary Stations		
i	ESPs	No.	2
7.	Interlocking VDU Display and associated accessories	No.	1
8.	LATS server with all software and associated accessories	No.	1
9.	ATS workstation at station with accessories	No.	3

10.	Wayside ATC sector computer with all software and all other associated accessories	No.	1
11.	Sign & Marker Boards with associated accessories	No.	
i	Stopping Reverse Marker Board	No.	6
ii	Point number plate	No.	4
iii	signal number Plate	No.	17
iv	Normal stopping marker board (stopping Position)	No.	10
12.	Cables in KM		
a	Outdoor cable for signal & point of various cores (each type to be listed seperately)		
i	2P x 1 sqmm armoured ZHLS	km	6.0
ii	4P x 1 sqmm armoured ZHLS	km	6.0
iii	7P x 1 sqmm armoured ZHLS	km	8.0
iv	14P x 1 sqmm armoured FRLS	km	2.0
v	28P x 1 sqmm armoured FRLS	km	3.0
b	AFTC Quad Cable	km	
i	1 Quad x 1.4 mm core dia armoured ZHLS	km	12.0
ii	3 Quad x 1.4 mm core dia armoured ZHLS	km	12.0
c	Bonding Cables	km	
i	1C x 25 sqmm ZHLS	km	0.500
ii	1C x 70sqmm ZHLS	km	0.500
iii	1C x 185 sqmm ZHLS	km	0.500
d	OFC cable 24F Armoured	km	5.0
f	Data Cables	km	17
g	Power Cable	km	14.5
i	2C x 1.5 sqmm ZHLS	km	
ii	2C x 2.5 sqmm ZHLS (PDC-CBI& Txfer cubicle)	km	
iii	2C x 10 sqmm ZHLS (PDC-RC for 24V & 30V supply)	km	
iv	4C x 2.5 sqmm ZHLS	km	
v	4C x 25 sqmm ZHLS	km	
vi	6C x 2.5mm2 armoured ZHLS	km	
vii	Eurobalise Power Cable 3C x 1.5 mm2 armoured ZHLS	km	
viii	1C x 1.5 sqmm Copper ZHLS	km	
ix	1C x 6 sqmm Copper ZHLS	km	
x	1C x 10 sqmm Copper ZHLS	km	
xi	1C x 25 sqmm Copper ZHLS	km	

xii	1C x 25 sqmm Aluminium ZHLS	km	
xiii	cable 1C x 6 sqmm ZHLS (LIU)	km	
13.	Impedance Bond	No.	4
14.	Lineside Boxes	No.	40
15.	Eurobalise	No.	17
16.	Printer	No.	1
17.	Furniture	No.	2
17.	Any other item necessary for meeting the contract requirements		

Schedule-D: Installation, Trackside, Stations

S. No.	Item Description	Unit	Quantity
1.	Track circuit and associated accessories		
a	With 3 receivers	No.	
b	With 2 receivers	No.	2
c	With 1 receivers	No.	23
2.	Point Machine with associated accessories	No.	4
3.	Main Signals including buffer signals	No.	17
4.	All outdoor equipment and associated accessories (except items 7.1,7.2,7.3 above) for		
a	Interlocking station	No.	1
b	Secondary station	No.	1
5.	All indoor equipment and associated accessories for		
a	Interlocking station	No.	1
b	Secondary station	No.	1
6.	Cable for all type and core	Km	82
7.	OFC Cable including HDPE Pipe & all accessories	Km	5
9.	Any other item required to meet the scope of work		
a	Impedance Bonds Installation	No.	4
b	Power Supply Cabinets installation	No.	2

Schedule-E: Testing & Commissioning (Including Service Trials)

S. No.	Item Description	Unit	Quantity
1.	Testing & Commissioning of all indoor equipment at stations (For two stations of Ph-1B)	LS	1
2.	Testing & Commissioning of all outdoor equipment at stations (For two stations of Ph-1B)	LS	1
3.	Testing & Commissioning of all equipment at OCC (For two stations of Ph-1B)	LS	1
4.	Testing & Commissioning of all train borne ATP equipments including ATO equipments (For two stations of Ph-1B)	per cab	20

5.	Migration testing between Phase-1A & Phase-1B including any other testing required in existing Phase-1B system	LS	1
6.	Any other necessary testing & commissioning required for meeting the contract requirements	LS	1
Schedule-F: Integrated Testing and Commissioning (Including Service Trails)			
S. No.	Item Description	Unit	Quantity
1.	Integrated Testing & Commissioning of all trackside indoor and outdoor Train control & Signalling System Track, Traction Telecommunication and other designated contractors. (For Phase 1-B section)	LS	1
2.	Integrated Testing & Commissioning of on-board ATP including ATO system with rolling stock, Traction ,Track ,TVS, Telecommunication and other designated contractors. (For entire line Phase-1A+ Phase-1B sections)	Per Cab	20
3.	Any other necessary Integrated Testing & Commissioning required for meeting the contract requirements		
Schedule-G: Miscellaneous			
S. No.	Item Description	Unit	Quantity
1.	Supply of contract spares as per Appendix P of PS	LS	
2.	Supply of Special Tools as per Appendix Q of PS	LS	
3.	As built Drawings along with the drawings required for submission to RDSO/CMRC and other authorities*	LS	
4.	Supervised Maintenance	Man Month	4
5.	Defect Liability Period Support	Man Month	24
6.	Training Onshore	Man Month	1
7.	False Flooring of SER Room	Sqm	85
8.	Any other item necessary for meeting the contract requirements		
8.a	Operating manuals	LS	

Note: This is a minimum quantity of items to be supplied by contractor to complete the scope of Works as specified in contract. The contractor should fill quantities in Schedule 1,2,3,4 using this minimum BOQ as a baseline reference taking into account the scope of Works as per design. Installation costs should be filled in Schedule 4.

Technical Proposal

The Bidder shall submit a Certificate of Compliance (Form COC to Bidding Forms, Section 4) on all the clauses of the Employer's Requirements undertaking that the technical proposal amongst others for phase 1-B of JMRTS shall be same as that of Phase 1-A of JMRTS. The contractor shall describe here the proposed changes to technical proposal employed earlier and indicate in the Certificate of Compliance that the proposed changes are in full compliance of Employer's Requirements. Where the Bidder is not able to comply fully with certain clauses and proposes an alternative design it should be mentioned as deviations. All the deviations shall be consolidated and listed separately in the Statement of Deviations (Form SD to Bidding Forms, Section 4). Excepting the items listed in the statement of deviations, the contractor shall give a Certificate of Compliance in the form attached of all the items. The bidder shall also submit Form PER-1, PER-2, EQU and any other forms listed under this section.

Personnel

Form PER – 1: Proposed Personnel

Bidders should provide the details of proposed personnel to be stationed in Jaipur or at Contractor's Headquarters dealing with Key design, installation and commissioning activities and their experience record in the relevant Information Forms below for each of the candidate.

1.	Title of position*
	Name
2.	Title of position*
	Name
3.	Title of position*
	Name
4.	Title of position*
	Name
etc.	Title of position*
	Name

-- Note --

* As listed in Section 6 (Employer's Requirements).

Equipment

Form EQU: Equipment

The Bidder shall provide adequate information and details to demonstrate clearly that it has the capability to meet the equipment requirements indicated in Section 6 (Employer's Requirements), for all equipment proposed for use in phase 1-B, which is different from that utilized during Phase 1-A, JMRTS, if any, using the Forms below. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of Equipment		
Equipment Information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current Status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment	
	<input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental/lease/manufacture agreements specific to the project	

Proposed Subcontractors and/or Manufacturers for Major Items of Plant and Services

The following Subcontractors and/or Manufacturers are proposed for carrying out the item of the facilities indicated. Bidders are free to propose more than one for each item.

Major Items of Plant and Services	Proposed Subcontractors or Manufacturers	Nationality

CONTRACTOR'S LETTERHEAD**CERTIFICATE OF COMPLIANCE**

This Certificate is issued in the full knowledge that the Technical Proposals submitted are in, Clause by Clause, Compliance with the Instruction to Bidder, Employer's Requirements (General Specifications and Particular Specifications), General Conditions of Contract (GCC), Special Conditions of Contract (SCC) except as noted in FORM-SD to the Bidding Forms (Statement of Deviations) accompanying this Certificate.

Signed _____

Authorised Representative

FORM SD : Statement of Deviations**(A) STATEMENT OF DEVIATIONS FROM THE INSTRUCTION TO BIDDER**

Clause Number	Details of Deviations	Remarks explaining reasons for deviations and why it may be considered by the employer

(B) STATEMENT OF DEVIATIONS FROM THE GCC AND SCC

Clause Number	Details of Deviations	Remarks explaining reasons for deviations and why it may be considered by the employer

(C) STATEMENT OF DEVIATIONS FROM THE EMPLOYERS REQUIREMENT- GENERAL**SPECIFICATIONS AND TECHNICAL SPECIFICATION**

Clause Number	Details of Deviations	Remarks explaining reasons for deviations and why it may be considered by the employer

Note:

1. We hereby confirm that the pricing for unconditional withdrawal of the deviations from Instruction to Bidder, GCC & SCC and the Employers Requirements (General Specifications and Particulars Specifications) noted in this FORM-SD has been given in the financial bid.
2. We hereby confirm that all implicit and explicit deviations, comments and remarks mentioned elsewhere in our proposal shall be treated as NULL and VOID and stand withdrawn.
3. We hereby confirm that but for the deviations noted in this FORM-SD, our proposal is full and truly compliant.

SIGNATURE OF BIDDER

Bidder's Qualification

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI – 1 : Bidder's Information Sheet

Bidder's Information	
Bidder's legal name	
In case of Joint Venture, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
<p>Attached are copies of the following documents:.</p> <p><input type="checkbox"/> 1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2</p> <p><input type="checkbox"/> 2. Authorization to represent the firm or Joint Venture named above, in accordance with ITB 22.2</p> <p><input type="checkbox"/> 3. In case of Joint Venture, letter of intent to form Joint Venture or Joint Venture agreement, in accordance with ITB 4.1</p> <p><input type="checkbox"/> 4. In case of a government-owned enterprise, any additional documents not covered under 1 above required to comply with ITB 4.5</p>	

Form ELI – 2 : Joint Venture Information Sheet

Each member of the Joint Venture must fill out this form separately and Subcontractor also must fill out this form.

Joint Venture/Subcontractor Information	
Bidder's legal name	
Joint Venture Partner's or Subcontractor's legal name	
Joint Venture Partner's or Subcontractor's country of constitution	
Joint Venture Partner's or Subcontractor's year of constitution	
Joint Venture Partner's or Subcontractor's legal address in country of constitution	
Joint Venture Partner's or Subcontractor's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following documents: <ul style="list-style-type: none"> <input type="checkbox"/> 1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2 <input type="checkbox"/> 2. Authorization to represent the firm named above, in accordance with ITB 22.2 <input type="checkbox"/> 3. In the case of government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5 	

Subcontractors are those listed in Technical Proposal – Proposed Subcontractors and/or Manufacturers for Major Items of Plant and Services.

Form LIT – 1: Pending Litigation and Arbitration

Each Bidder must fill out this form if so required under Criterion 2.2 of Section 3 (Evaluation and Qualification Criteria) to describe any pending litigation or arbitration formally commenced against it.

In case of joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Pending Litigation and Arbitration			
<p>Choose one of the following:</p> <p><input type="checkbox"/> No pending litigation and arbitration.</p> <p><input type="checkbox"/> Below is a description of all pending litigation and arbitration against the Bidder (or each Joint Venture member if Bidder is a Joint Venture).</p>			
Year	Matter in Dispute	Value of Pending Claim in INR Equivalent	Value of Pending Claim as a Percentage of Net Worth

- Note -

This form shall only be included if Criterion 2.2 of Section 3 (Evaluation and Qualification Criteria) is applicable.

Form FIN - 1: Historical Financial Performance

Each Bidder must fill out this form.

In case of joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Financial Data for Previous Years [INR Equivalent]		
Year 1:	Year 2:	Year 3:

Information from Balance Sheet

Total Assets (TA)			
Total Liabilities (TL)			
Net Worth = TA-TL			
Current Assets (CA)			
Current Liabilities (CL)			
Working Capital = CA - CL			

Most Recent Working Capital		To be obtained for most recent year and carried forward to FIN-3 Line 1; in case of Joint Ventures, to the corresponding Joint Venture Partner's FIN-3
-----------------------------	--	--

Information from Income Statement

Total Revenues			
Profits Before Taxes			
Profits After Taxes			

- ☐ Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last _____ years, as indicated above, complying with the following conditions.
- Unless otherwise required by Section 3 of the Bidding Documents, all such documents reflect the financial situation of the legal entity or entities comprising the Bidder and not the Bidder's parent companies, subsidiaries or affiliates.
 - Historical financial statements must be audited by a certified accountant.
 - Historical financial statements must be complete, including all notes to the financial statements.
 - Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

Form FIN - 2: Average Annual Turnover

Each Bidder must fill out this form.

The information supplied should be the Annual Turnover of the Bidder or each member of a Joint Venture in terms of the amounts billed to clients for each year for work in progress or completed, converted to US dollars at the specified exchange rate.

In case of joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Annual Turnover Data for the Last 3 Years			
Year	Amount Currency	Exchange Rate	INR Equivalent
Average Annual Turnover			

Form FIN – 3: Availability of Financial Resources

Bidders must demonstrate sufficient financial resources, usually comprising of Working Capital supplemented by credit line statements or overdraft facilities and others to meet the Bidder's financial requirements for

- (a) its current contract commitments, and
- (b) the subject contract.

In case of joint ventures, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Financial Resources		
No.	Source of financing	Amount (INR equivalent)
1	Working Capital (to be taken from FIN-1)	
2	Credit Line ^a	
3	Other Financial Resources	
Total Available Financial Resources		

^a To be substantiated by a letter from the bank issuing the line of credit.

Form FIN- 4: Financial Requirements for Current Contract Commitments

Bidders (or each Joint Venture partner) should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

In case of joint ventures, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Current Contract Commitments						
No.	Name of Contract	Employer's Contact (Address, Tel, Fax)	Contract Completion Date	Outstanding Contract Value (X)	Remaining Contract Period in months (Y)	Monthly Financial Resources Requirement (X / Y)
1						
2						
3						
4						
Total Monthly Financial Requirement for Current Contract Commitments						INR

Form FIN - 5: Compliance Check of Financial Resources (Criterion 2.3.3 of Section 3)**Form FIN-5A: For Single Entities**

For Single Entities:	Total Available Financial Resources from FIN-3 (C)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN-4 (D)	Available Financial Resources net of CCC (C-D)	\geq	Requirement ^a
_____ (Name of Bidder)	_____	_____	_____	\geq	100% of Requirement from Section 3 - 2.3.3(b) _____

Form FIN-5B: For Joint Ventures

For Joint Ventures:	Total Available Financial Resources from FIN-3 (C)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN-4 (D)	Available Financial Resources net of CCC (C-D)	\geq	Requirement ^a
One Partner:					
_____ (Name of Partner)	_____	_____	_____	\geq	B(%) of Requirement _____
Each (Other) Partner:					
_____ (Name of Partner 1)	_____	_____	_____	\geq	A(%) of Requirement _____
_____ (Name of Partner 2)	_____	_____	_____	\geq	A(%) of Requirement _____
_____ (Name of Partner 3)	_____	_____	_____	\geq	A(%) of Requirement _____
All partners combined			$\Sigma (C-D)^b =$ _____	\geq	100% of Requirement from Section 3 - 2.3.3(b) _____

Form FIN – 5 is made available for use by the bidder as a self-assessment tool, and by the employer as evaluation work sheet, to determine compliance with financial resources.

^a Requirement for the subject contract is defined in Criterion 2.3.3(b) of Section 3. Value A is the required percentage of the subject contract, which each partner must meet; and value B is the required percentage of the subject contract, which one partner must meet. A and B values are defined in Criterion 2.3.3 of Section 3 (Evaluation and Qualification Criteria).

^b $\Sigma (C - D)$ = sum of available financial resources net of current contract commitments (CCC) for all partners.

Form EXP – 1: Contracts of Similar Size and Nature

Not Applicable

Form EXP - 2: Experience in Key Activities

Not Applicable.

Form EXP - 3: Subcontractors

Fill out one (1) form per contract.

Contract for the Major Items		
Contract No of	Contract Identification	
Award Date		Completion Date
Role in Contract	<input type="checkbox"/> Contractor <input type="checkbox"/> Management Contractor <input type="checkbox"/> Subcontractor	
Total Contract Amount	INR	
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Employer's name Address Telephone number Fax number E-mail		
Description of the major items in accordance with Criterion 2.5 of Section 3		

Section 5 - Eligible Countries

- | | |
|---------------------------------|-------------------------------------|
| 1. Afghanistan | 35. Micronesia, Federated States of |
| 2. Armenia | 36. Mongolia |
| 3. Australia | 37. Myanmar |
| 4. Austria | 38. Nauru |
| 5. Azerbaijan | 39. Nepal |
| 6. Bangladesh | 40. The Netherlands |
| 7. Belgium | 41. New Zealand |
| 8. Bhutan | 42. Norway |
| 9. Brunei Darussalam | 43. Pakistan |
| 10. Cambodia | 44. Palau |
| 11. Canada | 45. Papua New Guinea |
| 12. China, People's Republic of | 46. Philippines |
| 13. Cook Islands | 47. Portugal |
| 14. Denmark | 48. Samoa |
| 15. Fiji | 49. Singapore |
| 16. Finland | 50. Solomon Islands |
| 17. France | 51. Spain |
| 18. Georgia | 52. Sri Lanka |
| 19. Germany | 53. Sweden |
| 20. Hong Kong, China | 54. Switzerland |
| 21. India | 55. Taipei, China |
| 22. Indonesia | 56. Tajikistan |
| 23. Ireland | 57. Thailand |
| 24. Italy | 58. Timor-Leste |
| 25. Japan | 59. Tonga |
| 26. Kazakhstan | 60. Turkey |
| 27. Kiribati | 61. Turkmenistan |
| 28. Korea, Republic of | 62. Tuvalu |
| 29. Kyrgyz Republic | 63. United Kingdom |
| 30. Lao PDR | 64. United States of America |
| 31. Luxembourg | 65. Uzbekistan |
| 32. Malaysia | 66. Vanuatu |
| 33. Maldives | 67. Viet Nam |
| 34. Marshall Islands | |

CHAPTER 1

1. GENERAL

1.1 Application of the General Specification (GS)

1.1.1 The provisions contained in the Particular Specification (PS) and the Employer's Drawings shall prevail over the provisions contained in this GS.

1.1.2 The provisions contained in the GS shall prevail over the provisions contained in International Standards, European Standards, British Standards, Indian Standards, British Standard Codes of Practice and similar standard documents stated in the Contract.

1.1.3 This GS shall be read in conjunction with the other documents constituting the Contract.

1.1.4 Abbreviations

Common abbreviations used in the GS and in the PSs shall have the following meanings:

ACB	: Air Circuit Breaker
AMC	: Annual Maintenance Contract
BCC	: Backup Control Centre
BS	: British Standard
CADD	: Computer Aided Design and Drafting
CAR	: Corrective Action Request
CNP	: Construction Noise Permits
COTS	: Commercial Off the Shelf
CPM	: Critical Path Method
CV	: Curriculum Vitae
DLP	: Defects Liability Period
DMRC	: Delhi Metro Rail Corporation
DVT	: Design Verification Table
E&M	: Electrical & Mechanical
EMC	: Electromagnetic Compatibility
EMIP	: Environmental Mitigation Implementation Plan
EMP	: Environmental Management Plan
EMSD	: Electrical and Mechanical Services Department
EMU	: Electric Multiple Unit
EN	: Euro-Norm (Europea Standards)
EPD	: Environmental Protection Department

ETI	: Employer's Training Instructors
FAI	: First Article Inspection
FAT	: Factory Acceptance Test(s)
FMEACA	: Failure Mode Effect and Criticality Analysis
GCC	: General Conditions of Contract
GIF	: Graphic Information Format
GS	: General Specification (this document)
HV	: High Voltage
IEC	: International Electro-technical Commission
IEE	: The Institution of Electrical Engineers
IP	: Ingress Protection
IS	: Indian Standards
ISO	: International Standards Organisation
ITT	: Instructions To Tenderers
ITU	: International Telecommunications Union
LV	: Low Voltage
MC	: Metro Corridor
MCB	: Miniature Circuit Breaker
MMI	: Man-Machine Interface
MTR	: Mass Transit Railway
NSR	: Noise Sensitive Receivers
OCC	: Operations Control Centre
OCS	: Overhead Contact System (Rigid Conductor)
OSR	: Operational Safety Report
OSR(S)	: Operational Safety Report (Software)
OHE	: OverHead Equipment (Flexible Catenary)
P3	: Primavera Project Planner
PLC	: Programable Logic Controller
PPE	: Personal Protective Equipment
PS	: Particular Specification
PVC	: Polyvinyl Chloride
QA	: Quality Assurance
RAMS	: Reliability, Availability, Maintainability and Safety

RC	: Rail Corridor
RTU	: Remote Terminal Unit
SAR	: Special Administrative Region
SAT	: Systems Acceptance Test(s)
SCC	: Special Conditions of Contract
SIL	: Safety Integrity Level
SQAP	: Software Quality Assurance Plan
SRR	: Submission Review Request
SWA	: Steel Wire Armoured
T/C	: Time Chainage
TRIP	: Track Related Installation Programme

Table 1-1 General Abbreviations

- 1.1.5 Further abbreviations may be defined within the body of the GS or PS where there is only local applicability. Where such abbreviations exist the Contractor shall exercise great care that the abbreviation is not used out of context when communicating with the Employer, the Employer's Representative or any Third Party.
- 1.1.6 Abbreviations of units of measurement used in the GS shall have the meanings as defined under the SI system of units.

1.2 Definitions

Words and phrases defined in the GCC or SCC shall retain the same meaning within the GS and PS unless specifically redefined within this GS or under the provisions of clause 1.1.1 above for the purpose of a particular clause or group of clauses.

- (1) "Access Dates" are dates that are to be achieved by other than the Contractor and which are considered to be essential to the successful completion of the Contract to the original planned schedule. A list of the activities completion of which are considered to give rise to an Access Date are included in the PS.
- (2) "Commissioning" means the process of setting to work the complete transportation system through a series of integrated tests that demonstrate the installation and performance in accordance with the specified criteria.
- (3) "Day" means calendar day unless expressly stated otherwise.
- (4) "Defined Area" means an area within which Works Trains will be operated and the Employer's defined area working safety rules will apply.
- (5) "Factory Acceptance Tests" means the tests to be performed at the Contractor's factories prior to delivery to the Site to verify compliance with the Specification and quality standards
- (6) "Installation Tests" means the tests to be performed to verify the conformity of completion of an installation/assembly to the design documents previously reviewed without objection by the Employers Representative prior to the start of Commissioning. Installation Tests do not form part of the Tests on

Completion to be performed by the Contractor in order to achieve Employer's Taking Over of the Works or any Section however they must be successfully completed before the Tests on Completion can commence.

- (7) "Key Dates" are dates which are to be achieved by the Contractor and which are considered to be essential to the successful completion of the project to the original planned schedule. A list of the activities, completion of which gives rise to a Key Date, is included in the PS.
- (8) "Partial Acceptance Tests" means the functional tests to be performed on components and parts of systems to meet the specified criteria. Partial Acceptance Tests form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (9) "Service Trial" means the phase after completion of the System Acceptance Tests where the training and operating procedures are validated through the running of the trains to the published timetable. Service Trial form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (10) "Quality Control Point" means a point in time when a notice or other document is to be submitted to the Employer's Representative in accordance with the Contract before the Contractor can commence, proceed with or terminate an activity
- (11) "Quality Hold Point" means a point in time when a notice of no objection by the Employer's Representative is required.
- (12) " 'S' curve" means the graphical relationship between the planned (and actual where appropriate) quantity of completed work (or resources) and time. The curve produced is to be illustrated on an accumulative basis where the slope of the line indicates the rate of undertaking the work or rate of expenditure of the resources.
- (13) "Specification (the)" means the aggregate sum of the documents and any amendments thereto, issued to Tenderers by JMRC as part of the Tender process before the final date for submission of Tenders. This shall include but not be limited to; Design Criteria, Employer's Requirements, Employer's Tender Drawings, Preliminary Operating Plan and Clarification of Tender Documents issued in accordance with the ITT but shall not include the ITT itself nor any minutes of meetings.
- (14) "Specification (this)" means the particular document within which the reference is made.
- (15) "System Acceptance Tests" means those tests that demonstrate the performance of the installation/equipment to the specified requirements as detailed in the PS. SATs form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (16) "Integrated Testing and Commissioning" means those tests that demonstrate the integration of the complete transport system meeting the requirements of the Specification in an operating environment. Integrated

Testing and Commissioning form part of the Tests on Completion to be performed by the Contractor in order to achieve Employer's Taking Over of the Works or any Section.

- (17) "Validation" means the process of confirmation by examination and provision of objective evidence that the application produced achieves the particular requirements specified.
- (18) "Verification" means the process of confirmation by examination and provision of objective evidence that the specified requirements have been incorporated within design.

1.3 Glossary of Terms

- 1.3.1 Words and expressions to which meanings are assigned in any paragraph of the GS shall have the same meanings in other paragraphs of the GS except when the context otherwise requires.
- 1.3.2 Utilities are electricity, lighting, traffic control, telephone and other communication cables, gas, water, sewage and drainage pipes and ducts, including all associated protection, supports, ancillary structures, fittings and equipment.

1.4 Submission for Review

- 1.4.1 Reference in the GS and PS to any submission made by the Contractor to the Employer's Representative having been reviewed without objection by the Employer's Representative shall mean the issue of a notice of no objection by the Employer's Representative issued in response to a submission made by the Contractor. Documents, drawings, specifications, calculations, technical papers, material samples, methods of construction and any other matters which have been reviewed without objection by the Employer's Representative shall not be changed without further submission for review to the Employer's Representative of the proposed changes.
- 1.4.2 Clause 4.2, prescribes the process to be adopted for submissions of documents, material samples and any other items to the Employer's Representative. Schedules of items that are to be submitted to the Employer's Representative for review are contained within this GS and/or the PS.
- 1.4.3 Submissions for review shall be made in accordance with the dates (relative to the Works Programme) stated in the GS and/or the PS, or in accordance with Appendix 4 of this Specification. For items not specifically given a submission date in the Specification submissions shall be strictly in accordance with the agreed Submissions Programme or as directed by the Employer's Representative.

1.5 Standards, Codes of Practice

- 1.5.1 Unless otherwise stated in the Contract, reference in the GS to International Standards, European Standards, British Standards, British Standard Codes of Practice and similar standards shall be to that edition of the document stated in the PS, including all latest amendments issued by the relevant authority. In the event that no specific edition reference is given, the current edition as at the date of issue of the Letter of Acceptance shall apply.
- 1.5.2 Later editions of International Standards, European Standards, other national or international Standards or Codes of Practice and other similar standards, or standards which are considered to be equivalent, shall not apply unless reviewed without objection by the Employer's Representative. The Employer's Representative shall give or withhold his notice of no objection after the Contractor has provided him with a copy of the relevant

standard for information. If a notice of no objection is given, the Contractor shall provide two copies of the document for use by the Employer's Representative.

- 1.5.3 Permanent Works, Temporary Works, Contractor's Equipment, hardware, firmware, software, apparatus of all kinds, and, where appropriate, materials and workmanship shall be in accordance with the Standards quoted in the Specification and the requirements identified in the PS or, where no Standard is identified, the Contractor shall make a proposal which shall be subject to review by the Employer's Representative.

1.6 Employer's Drawings

- 1.6.1 The Employer's Drawings assist in describing the scope of the Works in general and clarify constraints, interface arrangements and the conceptual nature of the finished structures/system outline.
- 1.6.2 The Contractor shall carefully check all Employer's Drawings and advise the Employer's Representative of discrepancies, omissions, errors or ambiguities should any be found.
- 1.6.3 The Contractor shall note that any drawings included but marked "For information only" do not form part of the Contract.
- 1.6.4 Dimensions shall not be obtained by scaling from the Employer's Drawings. Dimensions that are not shown or are not calculable from dimensions shown on Employer's Drawings shall be obtained from the Employer's Representative.

1.7 Specifications in Metric and Imperial Units

- 1.7.1 Specifications in imperial units shall not be substituted for specifications in metric units stated in the Contract without the prior consent of the Employer's Representative.
- 1.7.2 Conversion of metric units to imperial units and of imperial units to metric units shall be in accordance with the Standard International Practice.

1.8 System Safety

1.8.1 Safety philosophy

- 1..8.1.1 Safety of passengers, staff and the general public is paramount for railway operation. Prime consideration shall be given to all design issues that can have an effect on safety.
- 1..8.1.2 During the construction phase the safety of all staff involved in the Works and any members of the general public affected by the Works shall be the prime feature of all working methods, including storage and transport to site as well as all temporary works not incorporated into the final construction.

1.8.2 Safety Management

The Contractor shall implement the Contract Systems Safety Management Requirements, as referenced in the Project Safety Manual and elsewhere in the Specification, in consultation with the Employer's Representative.

1.8.3 Prescriptive Safety Criteria

- 1..8.3.1 The Contractor shall identify and list all applicable statutory and regulatory requirements and codes of practice relevant to the design of the Works undertaken and to work within the constraints and limitations imposed by the requirements and codes.
- 1..8.3.2 The safety of the Contractor's supplied systems and equipment shall be developed by the Contractor in accordance with the requirements contained in clause 3.4.5 below and the PS.

1.9 Availability (Reliability and Maintainability)

- 1.9.1 The reliability and maintainability of the Permanent Works shall be developed by the Contractor in accordance with the requirements contained in clause 3.4 below and the PS.

1.10 Suitability for Purpose

Jaipur Metro Rail Corporation (JMRC) shall be operating high-density passenger trains with high volume of traffic in the proposed corridors commensurate with the stage opening of the sections.

1.10.1 Interference and Compatibility

The Contractor shall ensure that all Works and Contractor's Equipment operate in a satisfactory manner without causing interference to other equipment and services including parties external to the Employer. The Contractor shall also ensure that the Permanent Works are physically and technically compatible with associated plant and in particular with that of other Contractors.

1.10.2 Design for introduction to service

The Permanent Works shall be designed in such a manner that they can be installed, tested and commissioned without adversely affecting the operation or safety of the Project. The Permanent Works shall be designed so that, where appropriate, considering the operating procedures adopted by the Employer, they can be brought into operational use during non-traffic hours and if necessary during a single night following maintenance, repair or overhaul during the life of the Permanent Works, equipment and systems.

1.11 Climatic Condition / Operating Environment

1.11.1 General

- 1.11.1.1 The following information on climatic conditions in Jaipur shall be taken into account by the Contractor when designing any part of the Permanent Works. The Contractor shall ensure that due allowance is made for more severe local conditions when Permanent Works are required to operate, for example, with restricted ventilation that may lead to higher local ambient temperatures, and any other factors that may affect the operating environment in any way.

- (1) Unless specific figures are provided elsewhere, the Permanent Works will generally be required to function at its rated value with the values of ambient temperature and relative humidity appropriate to the location of the equipment within the classifications shown in Table 1-2. Certain parts of the Permanent Works may need to be rated for more or less onerous conditions as required by the PS.
- (2) Clause 1.11.2 below gives the different classifications of environment to be encountered. For any type of item, examples of which are installed in more than one environmental class, all examples of the type shall be suitable for installation in the most severe environmental class conditions encountered by any example of the type.
- (3) The Contractor's attention is drawn to the more severe environmental conditions that may exist during the construction period and shall take adequate measures to protect the Permanent Works against any deleterious effects of such conditions during the time between installation and final completion of the Project.

- (4) Air throughout the Project will contain considerable moisture content and the atmosphere will be corrosive. The Permanent Works shall be tropicalised and vermin proof.

1.11.2 Classification of Equipment Environment

The locations at which equipment may be installed have been divided into four environmental classes as shown in Table 1-2. The classes of environment are considered to become more extreme from A to D.

CLASS	LOCATION of EQUIPMENT
A	Air Conditioned Offices, Computer and Equipment Rooms
B	Ventilated Equipment Rooms in buildings at the surface or at the underground station or structures.
C	Train Tunnels
D	Outdoors

Table 1-2 Classes of Environment

The following are the minimum design requirements for equipment to be installed in each class of environment. Where any class does not have a value for a parameter the most extreme value quoted for the lesser class environments should be used.

1.11.3 Requirements for Class A

Minimum Temperature - 5°C
 Ambient Temperature - 25°C
 Maximum Temperature - 35°C
 Relative Humidity - Minimum 0%, Nominal 65%, Maximum 95% (Non Condensing)
 Electrical Noise - High Frequency to 1MHz, 1kV damped to 50% after 6 cycles.
 Radio Frequency field strength 10 V/m, UHF & VHF bands.

1.11.4 Requirements for Class B

Ambient Temperature - 30°C
 Maximum Temperature - 45°C
 Relative Humidity - Nominal 70%, Maximum 100% (Non Condensing)
 Air Quality - Polluted and dusty - SO₂: 80-120mg/m³
 Suspended Particulate Matter: 360-540mg/ m³
 Electrical Noise - Impulse 1kV, 1.2/50 rise/decay, 500Ω source impedance, 0.5 J source energy.
 Radio & High frequency as Class A.

1.11.5 Requirements for Class C

Ambient Temperature - 46°C
 Maximum Temperature - 60°C
 Electrical Noise - Impulse 5kv, otherwise as Class B.

1.11.6 Requirements for Class D

1..11.6.1 Temperature

All equipment shall be designed and tested in accordance with the given figure allowing a margin of at least 10% greater and 2°C less than the limits recorded. All designs for equipment shall work within the enclosures proposed with the specified environment outside the enclosure

1.11.7 Electromagnetic Compatibility (EMC)

Electronic equipment in a railway environment shall be immunised against the usual electromagnetic influences to be expected from the rail operations. For this, the following EMC classification in accordance to IEC 801 or similar, for the equipment rooms shall be achieved:

1..11.7.1 Electrostatic discharge

The electronic equipment rooms shall be designed in accordance to class 2 of IEC 801-2 or similar.

1..11.7.2 Electromagnetic fields

The electronic equipment rooms shall be designed in accordance to class 2 of IEC 801-3 or similar.

1..11.7.3 Fast transient interference (Burst)

The electronic equipment rooms shall be designed in accordance to class 2 of IEC 801-4 or similar.

1..11.7.4 High energy transient interference

The electronic equipment rooms shall be designed in accordance to class 2 of IEC 801-5 or similar.

1..11.7.5 Switching processes in high-voltage installations

The location of computer systems in the neighbourhood < 1m of high-voltage installations, such as medium voltage or transformer stations as well as direct parallel exposure of power and data cables should be avoided.

1..11.7.6 Magnetic fields

The following magnetic field strengths at the place of installation of cathode ray tube (CRT) based visual display units (VDU) should not be exceeded:

DC fields: 10 A/m or 12 µT

AC fields: 1 A/m or 1,2 µT

If the image quality is impaired by values exceeding the above the Contractor shall provide any necessary shielding or alternative corrective measures to restore the picture quality. Note flat screen VDU using LED technology or similar may be acceptable if a sufficiently high resolution and image size can be obtained.

1.12 Survey and Site Investigations

1.12.1 For reference to surveys external to the Contract, the Contractor shall refer all Levels to Mean Sea Level (MSL) Datum, which is that generally used throughout Jaipur.

1.12.2 The datum used for the Contract shall be Mean Sea Level Datum.

1.12.3 The Contractor shall carry out all further site investigations necessary for the design of the Permanent Works and to enable the determination of the methods of construction and the nature, extent and design of Temporary Works.

1.12.4 The Contractor shall investigate environmental factors also to determine suitable methods of manufacture and installation, both for Temporary and Permanent Works. In particular the Contractor shall ensure that the dusty environment of Jaipur has no detrimental effect to the functionality, reliability or long term maintainability of the Permanent Works.

* End of Chapter *

CHAPTER 2

2. PLANNING, PROGRAMME AND PROGRESS MONITORING

2.1 Planning

- 2.1.1 The Contractor shall develop in detail, a logical method of executing the Works taking into account their complex nature and different phases and shall provide programmes which reflect the detailed planning undertaken.
- 2.1.2 The programmes shall start with the Commencement Date of the Works as day one, are to be realistic, achievable and shall be accompanied by the detailed supporting Plans referred to in Chapter-3 below.

2.2 Programming General Requirements

- 2.2.1 Programme activities shall be discrete items of work, which when combined, produce definable elements, components, Milestones, Stages and Sections of the Works and clearly identify the completion obligations of the Contractor. Design programmes shall be organised by Design Stages and Plans as described in clause 3.5.1 below.
- 2.2.2 Key Dates and Milestones shall be an integral part of all programmes and all activities, and sequencing and interrelationships required to achieve each completion obligation shall be shown. Milestones shall not impose constraints that in any way affect the programme logic and float or limit the achievement of Key Dates. Milestones shall not be introduced into any programme as constrained dates.
- 2.2.3 The critical path shall be clearly identified in the programme and fully described in the accompanying programme narrative.
- 2.2.4 Activity descriptions shall clearly convey the nature and scope of the Works. Programmes shall take into account the activities of precursor, concurrent, adjacent and follow on Project Contractors as well as utility service diversions, new utilities and connections and any other activity that may affect the progress of the Works.
- 2.2.5 The Contractor shall also incorporate the Employer's Representative's requirements for additional activities, to further explain or subdivide complex or long duration tasks, without affecting completion dates.

2.3 Progress Monitoring

The Contractor shall monitor its and its subcontractors' performance and against programmes to ensure its compliance with its obligations under the Contract. Monitoring of the Works shall include direct, daily monitoring of the progress of the Works and the preparation of written and computerised reports to be submitted to the Employer's Representative. The reports shall include all necessary supporting data to apprise the Employer's Representative of the status of the completion of the Works as described in clause 2.17 below.

2.4 Works Programme

The Works Programme to be submitted under the Contract shall be developed from the Outline Works Programme submitted and developed during the Tender period. Similarly the Design Submission Programme shall be developed from the Outline Design Submission Programme submitted and developed during the Tender period.

2.4.1 Submission Dates

- 2.4.1.1 Within 15 days of the Commencement Date of the Works, the Contractor shall submit for review by the Employer's Representative, his proposed initial version of the Works Programme which shall provide full programme details for the first six months of the Contract and shall provide outline details for the remaining period of the Contract.
- 2.4.1.2 Within 30 days of the Commencement Date of the Works, the Contractor shall submit for review by the Employer's Representative the proposed full version of the Works Programme.
- 2.4.1.3 Should the Contractor fail to submit the initial and full versions of the Works Programme within the timescales nominated above the Employer may nominate the Outline Works Programme as the first issue of the Works Programme required under the Contract.
- 2.4.1.4 In the event that the Employer does nominate the Outline Works Programme as the first issue of the Works Programme under the Contract the Employer's Representative may include any amendments that he sees fit to change external constraining dates, duration of activities by parties other than the Contractor and subdivide the Contractors own activities to provide additional detail and links to other activities but without altering the duration or sequencing of the activities shown on the Outline Works Programme.
- 2.4.1.5 Any either initial or final Works Programme resulting from a nomination by the Employer of the Outline Works Programme as amended shall be taken by the Contractor as his own work and any responsibility for further maintenance of the Works Programme as nominated shall remain the Contractor's.

2.4.2 Content

- 2.4.2.1 The Works Programme shall demonstrate by reference to its Sub-Programmes, Supplementary Programmes and associated Management Plans, the sequence and duration of activities and any restraints thereto, that the Contractor shall adopt to achieve Key Dates and to fulfil all Contract obligations. The Works Programme shall become the Employer's Representative's basis of administration of the time-related aspects of the Contract.
- 2.4.2.2 The Contractor shall provide the Employer's Representative with substantiation for each constraint whether target start, target finish or mandatory constraint entered by the Contractor into the Works Programme. The number of constraints shall be kept to an absolute minimum .
- 2.4.2.3 The Works Programme shall include activities for all the phases and stages of the Works, clearly showing all logical interdependencies and stages in the development of the Contractor's design, procurement, installation, commissioning and setting to work. As a minimum, it shall include:
- (1) all work comprising the Permanent Works;
 - (2) preparation, submission and review of Design Documents showing all items where review by the Employer's Representative is required;
 - (3) not used
 - (4) procurement of all major materials and items of Contractor's Equipment for the Works, including the dates orders are to be placed, manufacture period and the expected delivery date to the Site for each item;
 - (5) any software development requirements and Validation time frames;
 - (6) all manufacture or prefabrication of materials or components;

- (7) all design and installation of major Temporary Works;
- (8) all activities associated with the securing of necessary permits and other statutory approvals for the Works;
- (9) access and availability dates for all Project Contractors;
- (10) all interfaces related to the Project that may affect the progress of the Works;
- (11) testing and commissioning activities which demonstrate an understanding of the interfaces and requirements of Chapter 9 below and
- (12) Training.

2..4.2.4 The Works Programme shall be divided into Sub-Programmes of manageable sizes addressing in more specific detail, the content of the Management Plans as stated in Chapter 3 below. The Sub-Programmes shall be as follows:

- (1) Design Submission Programme;
- (2) Design, Procurement and Manufacturing Programme;
- (3) Installation Programme;
- (4) Testing and Commissioning Programme; and
- (5) Training Programme

2..4.2.5 The submission of the full version of the Works Programme shall include the Design, Procurement and Manufacturing Programme and a preliminary version of the Installation Programme and the Testing and Commissioning Programme identifying all major installation, testing activities and associated interfaces.

2..4.2.6 The Sub-Programmes shall be further substantiated by the supplementary programmes ,as required by the Employer's Representative.

2..4.2.7 The Contractor's Works Programme shall comply with the following:

- (1) all programmes submitted in both hard copy and electronic data format;
- (2) all programmes, shall be prepared using the latest version of CPM scheduling software Primavera Project Planner or similar;
- (3) Not Used;
- (4) a standard Gregorian calendar shall be used for planning and execution of the Works. All programme submissions shall include details of the Contractor's allowance for Public Holidays and non-work periods. If a Key Date or Milestone falls on a Public Holiday or non-work day, it shall be effective the next working day;

- (5) the planning unit for the duration of all programme activities shall be the day. Any activity having a duration of more than thirty (30) days shall be divided into sub-activities that shall not exceed (30) days;
- (6) CPM programmes shall reflect status using remaining duration and percent complete;
- (7) all programmes shall be fully resource loaded as appropriate or required by the Employer's Representative covering all stages and aspects of the Contract and shall include, but not be limited to:
 - (a) major manpower for both design and installation ;
 - (b) number of items of Contractor's Equipment ;
 - (c) number of drawings and other design deliverables ;
 - (d) principle quantities of components or parts ;
 - (e) principle quantities of bulk materials inclusive of cabling, pipe, ductwork and equipment items, etc.

2.4.3 All programmes constituting the Works Programme shall be organised in a logical work breakdown structure including work stages or phases. Each activity shall be coded to indicate, as a minimum, the work group or entity responsible for the activity, the area, facility or location and the Cost Centre in which the activity is included, from information provided in the Pricing Document. Key Dates and Milestones shall be coded so as to be separately identifiable. The Contractor may be required to assign additional activity codes as required by the Employer's Representative.

2.5 Design Submission Programme

2.5.1 The Contractor shall, within 30 days of the Commencement Date of the Works, submit a Design Submission Programme covering all proposed submissions to the Employer's Representative. The Design Submission Programme shall be broken down into a submission programme for each of the Management Plans defined in clause 3.1.2 below each of which shall define the dates for individual submissions and these shall conform to the baseline dates shown in the Works Programme.

2.5.2 The Submissions Programme shall include the requirements of the Design Submissions as described in clause 3.5.1 below including the procurement activities of all sub-contractors and suppliers.

2.5.3 The Submissions Programme shall include each submission for every item listed in the Specification as being required to be submitted.

2.5.4 The Submissions Programme shall ensure that all submissions are properly co-ordinated with the Contractor's overall Works Programme, particularly in respect of the following:-

- (i) progress of design, manufacture, installation and testing work;
- (ii) co-ordination with other Contractors; and
- (iii) including due allowance for the Employer's Representative's review process to be undertaken, including the time needed for any re-submissions.

2.5.5 The Design Submission Programme shall specifically include a milestone for the submission by the Contractor of the Final Design on completion of the Preliminary Design stage referred to in clause 3.5.1.1 below. The Final Design shall include at least

but not limited to; details showing all of the proposed equipment, interconnections, physical layout, installation locations and interfaces to other suppliers.

2.6 Design, Procurement and Manufacturing Programme

- 2.6.1 Within 60 days of the Commencement Date of the Works, the Contractor shall submit for review by the Employer's Representative a Design, Procurement and Manufacturing Programme that shall be an integrated part of the overall Works Programme.
- 2.6.2 The Design, Procurement and Manufacturing Programme shall show the interdependencies between engineering disciplines as well as between the Contractor and its sub-contractors and suppliers. This programme shall demonstrate compliance with the requirements of the Submissions Programme in clause 2.5 above.
- 2.6.3 The Contractor shall submit a weighted bar chart of the Contractor's design, procurement and manufacturing activities. Each activity weight shall normally not be more than 5% of the total man-hour content or value of the respective work.
- 2.6.4 The Design, Procurement and Manufacturing Programme shall include a separate breakdown, supported by the Material Control Schedule, which shall be a complete amplification of the Contractor's programme and equipment list, including those items which are subject to long lead time or component parts which are manufactured from countries outside the country of assembly and testing.
- 2.6.5 The Material Control Schedule shall be automated, and shall detail the following information for each permanent major and minor material and significant component. The format of such a schedule shall include:
- (1) name, description, supplier/sub-supplier details;
 - (2) drawing information (where appropriate), title, drawing status, submission dates, shop drawings/ fabrication drawing preparation, etc.;
 - (3) the manufacturing process, manufacturing of test pieces, trial production, Employer's Representative's inspection, monthly production of components and monthly supply of components;
 - (4) the assembly process, erection and assembly sequences (particularly for the first pieces) prior to shipment, test assemblies, monthly assembly requirement, Employer's Representative's inspection, testing of assemblies; and
 - (5) transportation process, quality release from factory, factory storage, transport to dock, shipment.
- 2.6.6 The Contractor shall continuously maintain this schedule and report upon the status of each item as part of the Contractor's regular progress reporting.
- 2.6.7 From this base data, the Contractor shall prepare an exception report detailing all components that are in delay. This report shall be annotated with the reason for the delay and indicate what action the Contractor is taking to recover the lost time.
- 2.6.8 The Contractor shall submit, as part of the Design, Procurement and Manufacturing Programme, a Factory Testing Programme that shall support all aspects of the Factory Testing Plan. This Programme shall clearly demonstrate the logic and include the topics listed in clause 3.5.3 below.

- 2.6.9 The Factory Testing Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.
- 2.6.10 The Factory Testing Programme shall demonstrate the logical dependencies between the individual tests of the Works, and shall also show the interfaces and dependencies with the Contractor's delivery programme.
- 2.6.11 The Factory Testing Programme shall include details of inspection, testing and witnessing of the Contractor's and subcontractor's procurement and manufacturing activities. As a minimum, it shall include:
- (1) First Article Inspection;
 - (2) Quality Hold Points;
 - (3) Quality Control Points;
 - (4) Type Tests; and
 - (5) Routine tests.

2.7 Installation Programme

- 2.7.1 The Installation Programme shall be submitted as stated in the PS or as directed by the Employer's Representative. The Installation Programme shall comply with the requirements of clause 2.4.2.7 above.
- 2.7.2 The Installation Programme shall include detailed activities describing all aspects of the installation of the Works, to meet all Milestones and Key Dates given in the Contract. It shall be clearly linked to the Design, Procurement and Manufacturing Programme and Testing and Commissioning Programme to form an integrated part of the Works Programme.
- 2.7.3 The Installation Programme shall be fully supported by the Construction and Installation Management Plan as specified in clause 3.6 below.
- 2.7.4 The Installation Programme shall indicate the physical areas to which the Contractor requires access, access date, duration required and the required degree of completion for civil or architectural finishes prior to the access date.
- 2.7.5 The Installation Programme shall take into account the requirements for arrival at port, delivery, storage, preservation and positioning of large items of Contractor's Equipment and Permanent Works and shall set out the Contractor's proposed delivery route for such items to the Site.
- 2.7.6 Installation Tests shall be clearly shown in the Installation Programme and shall include those interface tests required to be carried out by others to establish a timetable for these tests.
- 2.7.7 Activities that may be expedited by the use of overtime, additional shifts or by any other means shall be identified and explained.
- 2.7.8 In preparing the Installation Programme, the Contractor should note that the following conditions shall apply:
- (1) the Contractor shall not have exclusive access to any part of the Site except by the specific consent of the Employer's Representative;
 - (2) the Contractor shall take note that concurrent time allocations for certain areas may be given to more than one contractor. The Contractor shall co-ordinate the

Contractor's work in such areas with that of Project Contractors through the Employer's Representative;

- (3) the absence of a programme date or installation period for the Contractor in a specific area shall not prejudice the right of the Employer's Representative to establish a reasonable programme date or installation period for that area;
- (4) the Contractor shall comply with the identified Key Dates. The Contractor shall also comply with the Milestone dates identified in the Schedule of Milestones; and
- (5) the Contractor shall deliver all Contractor's Equipment and Permanent Works for stations and ventilation shafts by road and via temporary access openings unless otherwise reviewed by the Employer's Representative.

2.8 Testing and Commissioning Programme

- 2.8.1 The Testing and Commissioning Programme shall be submitted as stated in the PS or as directed by the Employer's Representative and shall comply with the requirements of clause 2.4.2.7 above.
- 2.8.2 The Contractor shall submit the Testing and Commissioning Programme that shall fulfil all the on-Site testing and commissioning requirements of clause 9.3.2.2 below. The Testing and Commissioning Programme shall clearly demonstrate the logic and highlight the topics listed in the On-Site Testing and Commissioning Plan in clause 9.3.2.2 below.
- 2.8.3 The Testing and Commissioning Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.
- 2.8.4 The Testing and Commissioning Programme shall demonstrate the logical dependencies between the individual tests of the Works, and shall also show the interfaces and dependencies with all of the Project Contractors' tests required to commission the Works and support the Commissioning Plan.

2.9 Training Programme

- 2.9.1 The Contractor shall, within 280 days of the Commencement Date of the Works, submit for review by the Employer's Representative, a Training Programme covering all proposed formal training courses, delivery of training equipment and accesses by the Employer's personnel.
- 2.9.2 The Training Programme shall be developed to the Training Plan as required under clause 3.7.4 below.-
- 2.9.3 The Training Programme shall be sufficiently detailed that the Employer can ensure the availability of staff for all the courses required under clause 10.1.6 below.
- 2.9.4 The Training Programme shall include the requirements of Chapter 10, including the Training activities of all sub-contractors and suppliers.

2.10 Not Used

2.11 Not Used

2.12 Not Used.

2.13 Not Used.

2.14 Programme Submissions

- 2.14.1 The Contractor shall submit all programmes described in this Chapter in conjunction with the Management Plans described in Chapter 3 below to the Employer's Representative for review.

2.15 Programme Review

- 2.15.1 The Employer's Representative shall, within 28 days of receipt of the initial submission of any programme for review, either give a notice of no objection or provide specific details as to why a notice of no objection is not given. If the Contractor is advised that the programme is not given a notice of no objection, the Contractor shall amend the programme taking into account the Employer's Representative's comments and/or requirements and resubmit the programme within 14 days.
- 2.15.2 In the case of further re-submittals, the resubmission time shall also be 14 days.

2.16 Works Programme Revisions

- 2.16.1 The Contractor shall immediately notify the Employer's Representative in writing of the need for any change in the Works Programme, whether due to a change of intention or circumstances or for any other reason. Where such a proposed change affects the timely completion of the Works or any Section or Stage; the Contractor shall within 14 days of the date of notifying the Employer's Representative submit for the Employer's Representative's review his proposed revised Works Programme and accompanying Programme Analysis Report. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions on the Works and Project Contractors and their works.
- 2.16.2 If at any time the Employer's Representative considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Works Programme. Upon receipt of such a request the Contractor shall submit within 14 days a revised Works Programme, together with an accompanying Programme Analysis Report and Narrative Statement, that shall demonstrate the means by which the Contractor intends to eliminate the deviation.

2.17 Monthly Progress Report

- 2.17.1 The Contractor shall prepare Monthly Progress Reports covering all aspects of the execution of the Works. Such Monthly Progress Reports shall be in writing and shall be delivered to the Employer's Representative by the 5th day of the month following the month of the Monthly Progress Report. The Monthly Progress Report shall take account of work performed up to and including the last day of the month to which the Monthly Progress Report relates.
- 2.17.2 The Monthly Progress Report shall include an executive summary and contain clear and concise statements in respect of every significant aspect of the Works including, without limitation, the requirements specified in this Specification.

2.17.3 The Monthly Progress Report shall contain evidence that documents and supports the progress of the Works, as stated in the Interim Payment Certificates, to the satisfaction of the Employer's Representative.

2.17.4 The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work to be accomplished and shall provide the Employer's Representative with a sound basis for identifying problems and deviations from planned work and for making decisions.

2.18 Programme Analysis Report

2.18.1 The Contractor shall submit a Programme Analysis Report that shall, in narrative format, describe the basis and assumptions used to develop all programme submissions. The Programme Analysis Report shall be prepared in a format having been reviewed without objection by the Employer's Representative and contain as a minimum the following:

- (1) cycle times and work sequences;
- (2) the deployment of Contractor's Equipment and labour;
- (3) the production rates used in determining duration;
- (4) the shifts assumed in determining duration;
- (5) the breakdown of labour requirements by trades;
- (6) the schedules of quantities used in developing the programme, to the extent that such information is not provided elsewhere;
- (7) interfaces with the Employer's Representative and Project Contractors and other constraints; and
- (8) any assumptions used in the programme.

2.18.2 The Programme Analysis Report shall be in sufficient detail to enable the duration, leads and lags in the logic diagram to be reconciled and substantiated, and to enable the projected levels of labour (by trade) and staff and flows of goods, materials and equipment to be substantiated.

2.19 Key Date and Milestone Report

2.19.1 The Key Date and Milestone Report shall be prepared in a format reviewed by the Employer's Representative and identify and state the status of :-

- (1) all Key Dates and Milestones that were planned to be achieved in the reporting period or earlier but have not been achieved;
- (2) all Key Dates and Milestones that have been achieved in the reporting period;
- (3) all Key Dates and Milestones that are planned to be achieved in the next reporting period; and
- (4) any future Key Dates and Milestones that appear unlikely to be achieved on time.

2.19.2 The Key Date and Milestone Report shall identify, for all relevant Key Dates and Milestones, the planned dates, the actual dates achieved, and where the original

planned dates are forecast to be unachieved, the revised dates identified in the Contract, as the same may be revised from time to time in accordance with the Contract.

- 2.19.3 The Key Date and Milestone Report shall also provide an explanation for any deviation from the planned dates. Measures taken or required to recover programme delays shall also be identified.

2..19.3.1 Not Used.

2.20 Progress Meetings

- 2.20.1 The Employer will chair progress meetings every month with the Contractor. These meetings will be held at dates and times to be advised by the Employer's Representative. Progress meetings shall not be later than 10 days after the issue of the Contractor's Monthly Progress Report.

2.20.2 The Employer's Representative may convene at his discretion, at any time upon reasonable notice to the Contractor, any meeting, either on or off the Site, to discuss and address any aspect of the Works or the Contract. The Contractor shall attend any such meetings convened by the Employer's Representative.

2.20.3 All meetings shall be convened in Jaipur unless directed otherwise by the Employer's Representative. Meetings shall be attended by senior personnel from the Contractor who shall arrive properly briefed for all aspects of the meeting and shall be empowered to make executive decisions in respect of the execution of the Works.

2.21 Quarterly Review Meetings

- 2.21.1 The Employer's Representative may convene Quarterly Review Meetings in Jaipur at approximately three monthly intervals. The Employer's Representative will notify the Contractor the date of such Quarterly Review Meetings not less than 28 days before they are to be held.

2.21.2 Quarterly Review Meetings shall be held over a period of up to 3 days in order to review the overall progress of the Works in the context of the Project as a whole and to address and resolve any issues relevant to the execution and progress of the Works. Such Quarterly Review Meetings will be chaired by the Senior Director, Capital Projects of the Employer or his delegate. The Contractor shall have in attendance one senior representative of Director level from each of the companies comprising the Contractor (together with the Managing Director of the company acting as leader or sponsor of the Contractor if it is a joint venture, consortium or partnership whenever necessary and required by the Employer's Representative).

2.21.3 The Contractor shall submit names of the persons whom the Contractor proposes to attend each Quarterly Review Meeting to the Employer's Representative for review not less than 7 days prior to each Quarterly Review Meeting.

- End of Chapter *

CHAPTER 3

3. MANAGEMENT PLANS AND SUBMISSIONS

3.1 General

3.1.1 In order to organise the various submissions required by the Employer's Representative, and to ensure the Contractor understands and compliance with the requirements of the Contract, a series of Management Plans shall be developed. These Management Plans will serve to structure the submittals in a manner that the Contractor can develop and prepare the submittals and the Employer's Representative can review and comment on a prescribed programme.

3.1.2 The Management Plans shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below.

The plans and documents shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

Unless otherwise stated in the PS, all plans and documents shall be submitted in preliminary form within 60 days of the Commencement Date of the Works followed by detailed plans within 45 days of the preliminary submission. Further submissions shall be made:

- (1) when required in accordance with the Works Programme;
- (2) whenever the development of the Contractor's designs or planning allows the plan to be developed further;
- (3) in response to comments made by the Employer's Representative in accordance with clause 4.3.6 below.
- (4) whenever any change occurs that invalidates the information contained in the previously submitted and reviewed document, within 14 days of the occurrence of such change; and
- (5) when requested by the Employer's Representative from time to time.

3.2 General Organisation

3.2.1 The Plans listed below shall be developed and submitted by the Contractor for the Employer's Representative's review:

Project Management Plan

- **Contractor's Project Plan**
- **Interface Management Plan**

Systems Assurance Plans

- **Quality Plans**

- **Safety Plans**
- **Electromagnetic Compatibility Management Plan**
- **Software Quality Assurance Plan**

Design, Procurement and Manufacturing Plan

- **Design Plan**
- **Design Verification and Validation Plan**
- **Factory Testing Plan**
- **Procurement, Manufacturing and Delivery Plan**

Construction and Installation Management Plan

- **Construction and Installation Plan**
- **Health and Safety Documentation**
- **Environmental Qualities Management Plan**
- **Environmental Mitigation Implementation Schedule**
- **Traffic Management Submissions** (if required)

Completion Management Plan

- **Commissioning Plan**
- **Operation and Maintenance Manuals Plan**
- **Training Plan**
- **Spares Management Plan**
- **Defects Liability Management Plan**

3.3 Project Management Plan

The overall management of the Works shall be the Contractor's responsibility. The organisation of the resources for the design, procurement, manufacture, delivery, installation, testing and commissioning, and setting to work is to be developed into a Project Management Plan. Each section of this plan shall fully describe the Contractor's understanding of the Works and management skills and structure required to achieve the same.

3.3.1 Contractor's Project Plan

- 3..3.1.1 The Contractor's Project Plan shall provide a clear overview of the Contractor's organisation, management systems and methods to be used for the complete execution of the Works.
- 3..3.1.2 The Contractor's Project Plan shall include a summary description of each and every stage of implementation of the Works, clearly showing the principal organisational interfaces both within the Contractor's own organisation (including sub-contractors of every tier) and with Other Contractors and Relevant Authorities, defining how each of these interfaces is to be managed and controlled. An organisation chart shall be produced to illustrate the subdivision of the work into elements for effective technical and managerial control, the reporting structure and the interface relationship among all parties involved. Names, addresses, telephone and fax numbers of all principal contacts shall be listed.
- 3..3.1.3 The Contractor's Project Plan shall contain structured organisation charts showing the hierarchical relationship of the Contractor's organisation (including sub-contractors of every tier). The organisation charts shall be produced as a "family" such that the basic chart shows the overall organisation structure supported by subsidiary charts detailing the internal structure of the various departments or sections of the overall organisation.
- 3..3.1.4 The Contractor's Project Plan shall include full details of the qualifications, experience, authority and responsibility of the personnel assigned to all key positions of the Contractor's organisation (including sub-contractors of every tier). As a minimum, this shall include all levels down to senior managers and shall include the personnel responsible for each individual department and functional group. A clear reference shall be given as to the location of staff (e.g. Site resident or factory based, etc.). Names, addresses, telephone and fax numbers of all principal contacts shall be listed.
- 3..3.1.5 The Contractor's Project Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall, without limitation, identify and set out:
- (1) the procedure for audit;
 - (2) the procedures for the control of receipt and issue of all Works related correspondence so as to ensure traceability;
 - (3) the procedures for filing system to be implemented to maintain the Contractor's records during the course of the work. The filing systems used by the Contractor and sub-contractors of any tier shall be compatible as far as is necessary;
 - (4) the procedures for the identification, production, verification, internal approval, review (when required) by the Employer's Representative, distribution, implementation and recording of changes to all drawings, reports and specifications;
 - (5) the procedures for the evaluation, selection, engagement and monitoring of sub-contractors / suppliers together with the means of application of quality assurance to their work including audit and acceptance;
 - (6) the procedure for the regular review and revision of each type of quality plan and its supplemental individual specific quality plans to ensure their continuing suitability and effectiveness, in addition to the method to be used for revision and issue of revised documentation;
 - (7) the procedures for the control, calibration and maintenance of inspection, testing and measuring equipment;

- (8) the procedures for the selection, indexing, disposition and maintenance of project records for storage in the archives. A list of items to be archived including their periods of retention shall be submitted for review by the Employer's Representative;
- (9) the procedures for identifying training needs and for the provision of training of all personnel performing activities affecting quality; and
- (10) the procedures for the control of non-conformity.

3..3.1.6 Particulars of Contractor's Manager/Agent

- (1) The Contractor shall give and provide all necessary supervision during the execution of the Works as long as the Employer's Representative considers necessary for the proper fulfilment of the Contractor's obligations under the Contract.
- (2) The Contractor shall ensure that he is at all times represented on the Site by a competent and authorised English/Hindi speaking agent who shall be deemed to have been reviewed without objection by the Employer's Representative provided such agent is not expressly objected to by the Employer's Representative in writing within 14 days from the service of a notice upon the Employer's Representative by the Contractor of the appointment of such agent. Such agent shall be constantly on the Site and shall give his full time to the superintendence of the Works.
- (3) The Employer's Representative shall have the authority to withdraw his notice of no objection to the agent at any time. If such notice of no objection is withdrawn the Contractor shall remove the agent from the Site forthwith and shall not thereafter employ him again on the Site in any capacity and shall forthwith replace him by another competent English/Hindi speaking agent reviewed without objection by the Employer's Representative.
- (4) Such authorised agent shall receive on behalf of the Contractor directions and instructions from the Employer's Representative.
- (5) The following particulars of the proposed agent shall be submitted to the Employer's Representative for review:-
 - (i) name;
 - (ii) copy of Identity Card;
 - (iii) details of qualifications, including copies of certificates; and
 - (iv) details of previous experience.
- (6) The particulars of the agent shall be submitted 30 days before the agreed scheduled start of that part of the Works. Except in the case of a replacement agent (as provided for in clause 3.3.1.6.(3) above), in which case the said particulars shall be submitted forthwith.
- (4) The agent shall possess relevant academic or professional qualification and have at least 10 years experience in relevant engineering works. The Employer's Representative reserves the right to call upon the Contractor to prove such qualifications/experience to the satisfaction of the Employer's Representative.

3.3.2 Interface Management Plan

- a) The Contractor shall interface and liaise with other Contractors in accordance with the requirements of clause 16.3 below.
- b) Within 60 days of notification from the Employer's Representative of the identity of each Other Contractor, the Contractor shall develop and submit to the Employer's Representative an Interface Management Plan that is mutually acceptable to both the Contractor and the other Contractors. The Interface Management Plan shall:
 - (1) identify the sub-systems as well as the civil works and facilities with interfacing requirements;
 - (2) define the authority and responsibility of the Contractor's and other Contractors' (and any relevant sub-contractors') staff involved in interface management and development;
 - (3) identify the information to be exchanged, together with the management and technical skills required for the associated development work, at each phase of the Contractor's and other Contractors' (and any relevant sub-contractors') project life-cycles;
 - (4) include considerations of the Interface Hazard Analysis;
 - (5) specify the configuration and version control procedures in accordance with the Contractor's and other Contractors' (and any relevant sub-contractors') quality management system; and
 - (6) address the design, supply, installation, testing and commissioning programme of the contracts to meet the key dates of each contract, and highlight any programme risks requiring management attention.
- c) Once the Interface Management Plan has been reviewed without objection by the Employer's Representative, the Contractor shall execute the Works in accordance with the Interface Management Plan. The Contractor shall advise the Employer's Representative immediately of any difficulty in developing a mutually acceptable Interface Management Plan.
- d) Within 90 days of notification from the Employer's Representative of the identity of each Other Contractor, the Contractor shall develop and submit to the Employer's Representative for review a Detailed Interface Document for each Other Contractor that is mutually acceptable to both contractors. The Detailed Interface Document shall address in detail how the dates identified in the Interface Management Plan shall be achieved and shall identify the data required by the interfacing other Contractors to meet the requirements of the PS.
- e) The Detailed Interface Document shall specify the proposed method and schedule for verifying the interface integrity, the individual equipment/system performance and the combined system performance. The Detailed Interface Document shall include a programme of tests to demonstrate the performance and integrity of the integrated systems. The Interface Specification appended to the PS shall form the basis of the Detailed Interface Document, but does not relieve the Contractor's obligation to identify any new interface to meet the Contract requirements. Any revision to the Detailed Interface Document shall be mutually acceptable by contractors and submitted to the Employer's Representative for review.

3.4 Systems Assurance Plans

3.4.1 The Systems Assurance Plans shall submitted for review to the Employer's Representative in Preliminary and Final forms.

3.4.2 The various plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

3.4.3 Not Used.

3.4.4 Quality Plans

The Contractor shall submit for review by the Employer's Representative quality plans in accordance with the requirements of clause 5.2 below.

3.4.5 Safety Plans

3..4.5.1 Site Safety Plan

3..4.5.1.1 The Contractor shall prepare a Site Safety Plan incorporating the requirements of the Project Safety Manual and designed specifically for the various sites (including storage and overseas sites) on which work under the Contract is carried out.

3..4.5.1.2 The Site Safety Plan shall form a part of the Health and Safety Documentation referred to in Chapter 18 below.

3..4.5.2 RAMS Plan

3..4.5.2.1 The Contractor shall implement a formal Reliability Plan and a formal Maintainability Plan in accordance with the PS .

3..4.5.2.2 The Contractor's Reliability Plan and Maintainability Plan shall include Failure Modes, Effects and Criticality *Analysis and the production of a Reliability Critical Items List*.

a) The Contractor shall submit for review by the Employer's Representative the Contractor's Systems Safety Plan. The System Safety plan shall address all the factors referenced in Appendix-2 of this Specification and as required by the PS.

b) The Contractor shall submit for review by the Employer's Representative the Contractor's Reliability Plan and Maintainability Plan in accordance with the requirements of clause 1.9 above.

3.4.6 Electromagnetic Compatibility Management Plan

a. The Contractor shall prepare and submit for review by the Employer's Representative an EMC Management Plan which shall, based upon a top-down approach, define the EMC philosophy, activities, means of control for the design processes and EMC submissions to be supplied to demonstrate compliance with the PS and GS.

b. The EMC Management Plan shall identify a comprehensive list of specifications, standards, method statements and procedures to be submitted to the Employer's Representative for review. The EMC Management Plan shall also include a programme that shall identify the dates for EMC submissions.

- c. The EMC Management Plan shall include an initial list of design documentation, test specifications and test reports with a single paragraph description of each document to indicate compliance with the Specification.
- d. The EMC Management Plan shall include a definition and description of the process and methods used for Verification and Validation that the Works will achieve the required EMC parameters in all respects.
- e. The Contractor shall co-ordinate the levels of interference emissions and susceptibility of all equipment which are to be designed, manufactured, supplied and installed by the Contractor and its sub-contractors and suppliers. The Contractor shall designate a person as point of contact to deal with EMC matters. Details of the nominated person and any subsequent change of the nominated person shall be subject to review by the Employer's Representative.
- f. The Contractor shall liaise and co-ordinate with all Other Contractors in the exchange of EMC data and related equipment performance characteristics and advises the Employer's Representative when any such information is requested from any Other Contractor. A copy of all EMC related information exchange shall be sent to the Employer's Representative for review.
- g. The Contractor shall comply with the following EMC requirements:
 - (i) The Contractor shall ensure that all electrical and electronic apparatus is designed and constructed to operate without degradation of quality, performance or loss of function in the electromagnetic environment of the Project.
 - (ii) EMC considerations shall be incorporated in the Contractor's procedures for product safety and design Verification.
 - (iii) Detailed requirements in respect of electromagnetic compatibility characteristics are contained in the PS.
 - (iv) The design shall ensure that any electromagnetic interference emissions introduced into the environment do not exceed those detailed in the PS and GS. The Contractor shall ensure that the specified electromagnetic compatibility (EMC) requirements are adequate. Any shortcomings shall be made known to the Employer's Representative immediately and recommendations for corrective action formulated.
 - (v) In respect of the design documentation, the Contractor shall demonstrate by theoretical analysis that the design of the electrical and electronic systems is fully compliant with the EMC requirements identified. The Contractor shall state clearly in the documentation all the assumptions made and parameters used in the analysis.
 - (vi) The Contractor shall detail the methodology, verify and validate any simulation models used in support of the analysis. The Contractor shall prepare and submit to the Employer's Representative for review reports of the Verification and Validation of the models.
 - (vii) Not Used
 - (viii) Not Used

- (ix) The Contractor shall supply documentation showing how system safety and reliability is ensured. It shall include Failure Modes, system failures, the effect of human intervention and how equipment thresholds have been set in order to keep them above worst case interference levels, and how equipment tolerances and other characteristics in the Specification have been allowed for in designing the system.
- (x) The Employer's Representative may conduct an independent EMC audit for both the system and its component parts and shall therefore require access to all the relevant design and production information. The Contractor shall supply sufficient documentation and analysis in a form reviewed by the Employer's Representative.
- (xi) Not Used
- (xii) The Employer's Representative may request at his discretion, attendance at the manufacturing factory prior to delivery to assist in providing confidence that the EMC requirements will be met. However, this will not give design acceptance that can only be given after successful completion of the System Acceptance Tests.
- (xiii) Not Used
- (xiv) The Contractor shall implement corrective actions to rectify any EMC problems identified during design, on-Site testing and when the whole system is in operational service.
- (xv) The Contractor must be fully aware of the EMC requirements and any modifications to systems and equipment carried out by the Contractor during the Defects Liability Period and during DLP period shall not cause the immunity or emission levels of the installed system and equipment to exceed such values. Detailed EMC documentation on all modifications carried out shall be submitted to the Employer's Representative for review. Modification work shall not commence until the respective submission has been reviewed without objection by the Employer's Representative.

3.4.7 Software Quality Assurance Plan

Where software is a design deliverable, the Contractor shall submit a Software Quality Assurance Plan in accordance with the requirements of clause 6.1 below. The Software Quality Assurance Plan shall address all elements of the design and development of software required as part of the Works.

3.5 Design, Procurement and Manufacturing Plan

The Design, Procurement and Manufacturing Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below. The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works fully meet the requirements of the Specification in respect of the subjects listed.

3.5.1 Design Plan

3..5.1.1 Design shall be undertaken to ensure a smooth flow of information for review by the Employer's Representative. Submissions shall be strictly in accordance with the Design Submissions Programme prepared in accordance with clause 2.5 above.

3..5.1.2 The Contractor shall perform his designs for the Works and prepare a design plan for his design work in accordance with the following design stages. The Contractor shall submit to the Employer's Representative for his review, relevant design information as identified under each stage:

- (1) Not used.
- (2) Preliminary Design Stage

The Contractor shall prepare and submit to the Employer's Representative for his review a System Requirement Specification (SRS) which includes, as a minimum, operational, functional, performance and design requirements of the proposed system.

- a. The System Requirement Specification, serving as a means of system requirement management and the Contractor's top level design document, shall state all the requirements completely and unambiguously and how each requirement can be verified and validated.
- b. The System Requirement Specification shall include a compliance matrix that includes cross-references to the requirements stated in the PS, the System Requirement Specification and the Design Verification Table (DVT).
- c. The preliminary design stage, as a minimum, shall identify the function of each system, sub-system, equipment or other element within the overall SRS and specify the relationships and interfaces between each element of the system, including the systems of the interfacing elements of other Contractors.

Further the preliminary design stage shall address each element of the SRS as developed in the Preliminary Design. Equipment and interconnection specifications, with supporting calculation, shall be developed at this stage. .-Design of the overall system and elaborating on the proposed system configuration with emphasis on how the interface requirements are to be achieved shall be included in the preliminary design. Manufacturing of production units will only be allowed to commence after receiving a notice of no objection for the relevant design elements

- d. Preliminary electrical and control schematics shall be developed to illustrate how the various operational and functional requirements can be achieved. Software design and development shall also be carried out during this stage.
- e. The submission shall clarify and confirm as necessary all technical aspects of all interfaces with other elements of the Contractor's overall design and of any interfaces with works being supplied by other Contractors.
- f. Ergonomic design, shall be developed as part of the preliminary design.
- g. If at any time in the development of the preliminary design, the Contractor wishes to modify the conceptual design by dividing any system or sub-system into a number of smaller systems or by reconfiguring the interfaces or for any other reason, the Contractor shall resubmit the SRS and/or the Preliminary Design for the Employer's Representative's review.

≡ A detailed submission list for the preliminary design shall be submitted to the Employer's Representative for review prior to the start of the preliminary design. The submission shall be in sufficient detail to evaluate the progress and technical adequacy of the selected design approach.

- (3) A series of Design Reviews shall be arranged prior to the conclusion of the preliminary Design Stage.

Upon completion of the Preliminary Design Stage the Contractor shall submit for review by the Employer's Representative a homogenous Final Design.

- (4) Site Design Stage

Installation detail and method statements for various areas and sections shall be released progressively during this stage. Installation works on Site will only be allowed to commence following the Employer's Representative's review of the relevant design information with no objection raised.

3..5.1.3 Separate parts of the design plan shall be prepared for Contractor and subcontractor design activities. The design plans shall define the Contractor's policy for the design of the Works and shall, without limitation, define:

- (1) the organisation of the Contractor's design staff with particular reference to the design interfaces;
- (2) the specific allocations of responsibility and authority given to identified design staff with particular reference to the review and Verification of design specification, drawings and calculations by the Contractor;
- (3) the specific methods of design necessary to identify any relevant method statements and develop those method statements to a sufficient degree of detail reviewed by the Employer's Representative; and
- (4) the list of procedures and work instructions to be applied to manage and control the quality of the design work, including without limitation:
 - a) the design and performance requirements which shall be defined in terms of basic data and design assumptions made; relevant codes, standards and regulatory requirements; safety, reliability, security and environmental requirements; and commissioning requirements;
 - b) the design methods. Software applications to be used in the design, both proprietary and public domain, including any requirements for physical and mathematical model testing;
 - c) the preparation, checking, issue, distribution, indexing and filing of reports, calculations, drawings and specifications together with the means for their revisions;
 - d) the formal design review, authorisation and approval of design documentation; and
 - e) the independent design Verification and Validation.

3.5.2 Design Verification and Validation Plan

- 3..5.2.1 The Design Verification and Validation Plan, supplementary to the Design Plan, shall be prepared by the Contractor in order that design Verification and Validation activities are properly directed. The plan shall address, but not be limited to, the following:-
- (1) the objectives of each Verification phase and each Validation phase;
 - (2) defined input and output criteria for each development phase;
 - (3) identification of types and detailed methods of test, Verification and Validation activities to be carried out;
 - (4) detailed planning of Verification and Validation activities to be carried out, including schedules, resources and approval authorities;
 - (5) selection and utilisation of the test equipment, and their test environmental conditions; and
 - (6) criteria on which the Verification or Validation is judged to be acceptable. These criteria shall be traceable to the design and performance requirements as referred to in Clause 3..5.1.3.(4).a) above.
- 3..5.2.2 The Contractor shall, by means of a design Verification and Validation process, demonstrate that all requirements within the Specification have been met. The Contractor shall prepare a Design Verification Table (DVT) that identifies the Contractor's proposed methodology for demonstrating compliance.
- 3..5.2.3 The DVT shall be supplied to the Employer's Representative for his review and shall be monitored throughout the design and construction of the Works. Any changes to the DVT must be submitted to the Employer's Representative for review before implementation.
- 3..5.2.4 The DVT shall identify the proposed Verification and Validation process (es) for each specification requirement and the acceptance criteria for achieving the requirement. The DVT does not relieve the Contractor of any other requirements of the Specification in relation to design review, Verification, Validation, conformance or planning.
- 3..5.2.5 For each item in the DVT, the Verification and Validation methods to be used shall be listed by the Contractor. The methods used shall be reviewed by the Employer's Representative. At least one stage of Verification and Validation shall be performed prior to production of an item.
- 3..5.2.6 Subject to review without objection by the Employer's Representative for each application, the Verification and Validation methods listed below are acceptable if implemented (whether singly or in combination):
- (1) Similarity - equipment and requirement are identical to those successfully applied on other projects.
 - (2) Historical - requirement has been met by numerous previous design.
 - (3) Calculations and Drawings - for review.
 - (4) Design Review - either scheduled or specifically targeted.
 - (5) Development Test - performance testing on equipment or material under development.
 - (6) Type Test - performance testing of the as-built component, assembly or system.

- (7) Routine Test - test every component, assembly or system.
- (8) First Article Inspection (FAI) - acceptances of the exact look and fit of equipment.
- (9) Inspection - formal inspection of the finished item.
- (10) In Service - for service demonstration requirements only.

3..5.2.7 After each Verification or Validation activity, a Verification Report shall be produced including, as a minimum, the following:

- (1) the Verification or Validation results stating whether the objectives and criteria of the Design Verification and Validation Plan have been met; and
- (2) the reasons for failure if there is a failure, and proposal for remedial actions.

3.5.3 Factory Testing Plan

3..5.3.1 The Contractor shall prepare and submit for review by the Employer's Representative the Contractor's Factory Testing Plan detailing and explaining how the Contractor will plan, perform, and document all inspections and tests that will be conducted to verify and validate the Works prior to delivery to the Site. The plan shall consist of a narrative description supported by graphics, diagrams and tabulations as required.

The plan shall contain but not be limited to the following topics:

- (1) the Contractor's strategy for inspection and Factory Acceptance Tests of all constituent parts of the Works and how this relates to the sequence of delivery;
- (2) the sequencing and interrelationships of the inspections and tests including:
 - (a) all Quality Hold Points; and
 - (b) all Quality Control Points;
- (3) the type and extent of inspection and Factory Acceptance Tests to be undertaken and the parts of the Works to be proven by that testing;
- (4) the objective of each inspection or test, what particular design and operating criteria the test or inspection will prove and how the success of the test or inspection will be demonstrated or measured;
- (5) organisation chart and CV of key personnel in inspection and test team;
- (6) the plan for the production and submission of the inspection and test procedures to the Employer's Representative for review including the submission of the inspection and test reports and records; and
- (7) Type Tests, Routine Tests, First Article Inspections and any other tests constituting the Factory Acceptance Tests.

3..5.3.2 The Contractor shall arrange for all equipment and systems manufactured for incorporation into the Permanent Works to undergo a Factory Acceptance Test (FAT) before shipment from the place of manufacture. Any particular requirements for inspection and testing at the place of manufacture are prescribed in the PS.

3..5.3.3 The Contractor shall be responsible for re-inspecting and re-testing any failed inspection and Factory Acceptance Test including regression testing on previously passed items.

3..5.3.4 Inspections and tests that are to be witnessed by the Employer or the Employer's Representative shall be sensibly grouped and scheduled so that as many inspections and tests as possible may be witnessed during a single visit.

- 3..5.3.5 If required, Type Tests as detailed in clause 9.2.6 below shall be performed on all items of equipment to be installed as part of the Permanent Works under the Contract.. The Type testing shall be based on the environmental class of the sites into which the equipment will be installed. Refer to clause 1.11.2 above for the different environmental classifications or otherwise as required in the PS.
- 3..5.3.6 For all production items a First Article Inspection shall be undertaken as detailed in clause 9.2.6.8 below. Routine production testing methods shall be detailed for review by the Employer's Representative. Routine testing shall ensure that all samples of a production item are within the tolerances required for complete interchangeability.
- 3..5.3.7 The Contractor shall prepare two copies of an inspection or test report immediately after the completion of each inspection or test whether or not witnessed by the Employer or the Employer's Representative. If the Employer or the Employer's Representative has witnessed the inspection or test, he will countersign the inspection or test report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) contained therein. If the Employer or the Employer's Representative has not witnessed the inspection or test (i.e. if a waiver has been granted, or the Employer or the Employer's Representative has not witnessed the inspection or test for some other reason in accordance with the Contract), the Contractor shall forward two copies of the inspection or test report without delay to the Employer's Representative. The Employer's Representative will countersign the report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) and return one copy to the Contractor. Where the results of the inspection or test do not meet the requirements of the Specification, the Employer or the Employer's Representative may call for a re-inspection or re-test.
- 3..5.3.8 For standard equipment which is serial or bulk manufactured, manufacturer's type test certificates (or equivalent) may, subject to review by the Employer's Representative, be accepted.
- 3..5.3.9 Test equipment and instrumentation shall be subject to approved calibration tests within a properly controlled calibration scheme, and signed calibration certificates shall be supplied to the Employer's Representative in duplicate. Such calibration checks shall be undertaken prior to testing and, if required by the Employer's Representative, shall be repeated afterwards.
- 3..5.3.10 Materials and equipment shall not be released for shipment until all applicable inspections and tests including Factory Acceptance Tests have been satisfactorily completed.

3.5.4 Procurement, Manufacturing and Delivery Plan

- 3..5.4.1 The Contractor shall prepare procurement, manufacturing and delivery plans in respect of all items and goods. Separate parts of the plan shall be prepared for Contractor or sub-contractor off-Site activities. Each plan shall identify the scope of work to be applied. In relation to such scope of work, it shall, without limitation, define:
- (1) the organisation of the Contractor's staff directly responsible for the day-to-day management of the manufacturing activity on or off the Site;
 - (2) the specific allocations of responsibility and authority given to identified personnel for the day-to-day management of the work with particular reference to the supervision, inspection and testing of the work;
 - (3) the interfacing or co-ordination required with the Contractor's other related plans;

- (4) the specific methods of manufacture to identify any relevant method statements and develop those method statements to a degree of sufficient detail reviewed by the Employer's Representative; and
- (5) the list of procedures and work instructions to manage and control the quality of work during purchasing, manufacturing and delivery, including without limitation:
 - a) the purchasing of items and goods and ensuring they comply with the requirements of the Specification, including (without limit) purchasing documentation and specific Verification arrangements for Contractor/Employer's Representative inspection of material or manufactured product prior to release for use;
 - b) the manufacturing process so as to ensure compliance with the design;
 - c) the manufacturing process so as to ensure clear identification and traceability of material and manufactured parts;
 - d) the inspection and testing of incoming materials, in process and final product so as to ensure specified requirements for the material and/or manufactured product are met;
 - e) the identification of the inspection and test status of all material and manufactured products during all stages of the manufacturing process to ensure that only products that have passed the required inspections and tests are dispatched for use and/or installation;
 - f) review and disposal of non-conforming material or product so as to avoid unintended use;
 - g) the assessment and disposal of non-conforming material and manufactured product and approval for reworking or rejection as scrap;
 - h) the identification of preventive action so as to prevent recurrence of similar non-conformance; and
 - i) the handling, storage, packaging, preservation and delivery of manufactured product.

- 3..5.4.2 The Contractor shall prepare and submit the inspection and testing plans to manage and control any test and inspection activities in accordance with clause 3.5.3 above;
- 3..5.4.3 The Contractor shall propose a structured set of inspection hold points. The hold points shall be structured such that a formal hold point is allowed for each significant element of the manufacturing process. At each hold point, the Employer's Representative shall hold a formal inspection or advise that the inspection has been waived.
- 3..5.4.4 Once the inspection and any required remedial actions are completed to the satisfaction of the Employer's Representative, the Employer's Representative shall give a notice of no objection for unit shipment. The Employer's Representative will not withhold his notice of no objection for shipping unreasonably, provided all pre-delivery assembly and testing has been successfully completed.

- 3..5.4.5 Any unit delivered without the Employer's Representative's notice of no objection shall be rejected at the Site and all expenses thereby incurred shall be borne by the Contractor.

3.6 Construction and Installation Management Plan

The Construction and Installation Management Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below.

The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

3.6.1 Construction and Installation Plan

- 3..6.1.1 The Contractor shall prepare plans for the construction and installation activities on and off the site, as referenced in clause 14.1.1 below, and shall ensure that these are properly related to the subsequent testing and commissioning activity.
- 3..6.1.2 Separate parts of the plan shall be prepared for other contractor(s) or sub-contractor(s) off-site activities.
- 3..6.1.3 Each construction plan shall identify the scope of activity to be controlled. In relation to such scope of activity, it shall, without limitation, define:
- (1) the organisation of the Contractor's staff directly responsible for the day-to-day management of the activity on or off the Site;
 - (2) the specific allocations of responsibility and authority given to identified personnel for the day-to-day management of the Works with particular reference to the supervision, inspection and testing of the Works;
 - (3) the interfacing or co-ordination required with the Contractor's other related plans;
 - (4) the specific methods of construction and installation to identify any relevant method statements and develop those method statements to a sufficient degree of detail reviewed by the Employer's Representative;
 - (5) a detailed method statement which shall include but not be limited to:
 - a) description of main operations and sub-operations;
 - b) sequence of sub-operations;
 - c) quantities of the work and production rates to be achieved;
 - d) resources to be employed; and
 - e) quality checks to be carried out, supervision being exercised and safety precautions to be employed;
 - (6) the list of procedures and work instructions to manage and control the quality of construction and installation works, including without limitation:
 - a) the inspection and testing activities of incoming materials, in process and final product so as to ensure specified requirements for the material and/or product are met;
 - b) the purchasing of materials and ensuring they comply with the requirements of the Specification, including purchasing documentation and specific Verification arrangements for Contractor/Employer's Representative

inspection of material or manufactured product prior to release for use/installation;

- c) the construction processes including Temporary Works so as to ensure compliance with drawings and Specification. In addition, any software to be used in the construction, installation and commissioning process shall be identified and details of the Verification and Validation processes for the software application shall be given;
 - d) the construction and installation process so as to ensure clear identification and traceability of material and manufactured product;
 - e) the identification of the inspection and test status of all material and manufactured products during all stages of the construction and installation process to ensure that only products that have passed the required inspections and tests are despatched for use and/or installation;
 - f) review and disposition of non-conforming material or product so as to avoid unintended use/installation;
 - g) the assessment and disposition of non-conforming material and product and approval for reworking or rejection as scrap;
 - h) the identification of preventive action so as to prevent recurrence of similar non-conformance; and
 - i) the handling, storage, packaging, preservation and delivery of product; and
- (7) the security control of the Site and the works area for Contractor's accommodation, storage, car park and other works facilities, etc. in accordance with clause 15.10 below.

3..6.1.4 The Contractor shall prepare and submit the inspection and test plans to manage and control any test and inspection activities in accordance with clause 5.7.1 below.

3..6.1.5 Where all or part of the Works is within the JMRC Protection Zone, the Contractor shall follow the guidelines issued by the Employer's appropriate authority. The Contractor shall submit to the Employer's Representative for review his construction method statement and detailed design of any Temporary Works proposed to be erected within this zone adjacent to DMRC properties.

3..6.1.6 The following particulars shall be submitted to the Employer's Representative for review within 14 days of the Commencement Date of the Works:

- (i) drawings showing the layout within the Site of the Employer's Representative's and Contractor's accommodation, Project signboards, access roads and major facilities required early in the Contract;
- (ii) drawings showing the layout and the construction details of the Employer's Representative's accommodation; and
- (iii) drawings showing the details to be included on Project signboards.

3..6.1.7 Drawings showing the location of stores, storage areas, work areas and other major facilities shall be submitted to the Employer's Representative for review as early as possible, but in any case not later than 28 days before construction of the facilities.

3.6.2 Health and Safety Documentation

3..6.2.1 The Contractor shall submit Health and Safety Documentation to fully comply with the requirements of the Project conditions and proposed work activities in accordance with Chapter 18 below.

3..6.2.2 The Contractor shall submit to the Employer's Representative the Health and Safety Documentation for review within 30 days of the Commencement Date of the Works.

3.6.3 Environmental Qualities Management Plan

3..6.3.1 The Contractor shall within 112 days of the Notice to Proceed submit an Environmental Plan based the Outline Environmental Plan submitted and adapted during the Tender period. The Environmental Plan shall comprise a set of Environmental Plans as detailed below:

- **Environmental Management Plan;**
- **Environmental Mitigation Implementation Schedule** (if required); and
- **Traffic Management Submissions.**(If applicable)

3..6.3.2 Environmental Plans shall include the Contractor's proposed means of complying with his obligations detailed and in the PS in regard to:

- a) The Site Environment as found; and
- b) System Environment as described in the Specification.

The Environmental Plan shall include as required detailed policies, procedures and applicable regulations.

3..6.3.3 Environmental Management Plan

3..6.3.3.1 The Contractor shall submit for review by the Employer's Representative, an Environmental Management Plan (EMP) which will set out in detail the approach for dealing with each of the potential environmental impacts arising from the various different construction activities.

3..6.3.3.2 The EMP shall address all the potential impacts outlined in the Employer's Final Assessment Report and shall follow the EMP Outline contained in Chapter 20 below.

3..6.3.3.3 The Contractor shall submit the final EMP, for review by the Employer's Representative, 30 days prior to the commencement of construction activities.

3..6.3.4 Environmental Mitigation Implementation Schedule

3..6.3.4.1 The Contractor shall submit for review an Environmental Mitigation Implementation Schedule (EMIS) which is a plan for the provision of the mitigation measures identified in the EMP.

3..6.3.4.2 The Contractor shall submit the EMIS, for review by the Employer's Representative in conjunction

3..6.3.5 Traffic Management Submissions (If applicable)

Where the Contractor is required to become involved with traffic or footpath management activities, submissions shall be made by the Contractor for the Employer's Representative's review 60 days before implementation proving all relevant details and implications.

3.7 Completion Management Plan

3.7.1 The Contractor shall organise the services required under the Contract to bring the Works into service under one plan. This co-ordinated approach shall allow the Employer's

Representative the ability to review all aspects of the Works and services in an integrated manner.

The Completion Management Plan shall be configured as a family of “stand-alone” plans and associated documents each covering one of the subjects listed below.

The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor’s proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

3.7.2 Commissioning Plan

3.7.2.1 The Contractor shall ensure the timely preparation of the Commissioning Plan in a format and to a level of detail in accordance with clause 9.3 below. The Contractor shall submit the first draft of the Commissioning Plan to the Employer’s Representative within 120 days of the Commencement Date of the Works.

3.7.2.2 The Commissioning Plan shall consist of the following:

a. Factory Testing Plan (see clause 3.5.3 above)

b. On-Site Testing and Commissioning Plan

(i) Installation Test Schedule

The Contractor shall submit to the Employer’s Representative a comprehensive schedule of Installation Tests as required by clause 9.4.3 below and the PS and in accordance with the Installation Programme as stated in clause 2.7 above. The schedule shall be submitted within the period of time laid down in the PS, or, if none is given, not later than two months in advance of the date for the commencement of the Installation Tests.

(ii) Partial Acceptance Tests Plan

The Contractor shall submit to the Employer’s Representative a comprehensive Partial Acceptance Tests Plan including all requirements detailed in clause 9.4.4 below and the PS. The plan shall be submitted within the period of time laid down in the PS, or, if none is given, not later than four months in advance of the date for the commencement of the Partial Acceptance Tests.

(iii) System Acceptance Tests Plan

The Contractor shall submit to the Employer’s Representative a comprehensive System Acceptance Tests Plan including all requirements detailed in clause 9.4.5 below and the PS. The plan shall be submitted within the period of time laid down in the PS, or, if none is given, not later than four months in advance of the date for the commencement of the System Acceptance Tests.

(iv) Integrated Testing & Commissioning Plan

The Contractor shall submit to the Employer’s Representative a comprehensive Integrated Testing & Commissioning Plan including all requirements detailed in clause 9.4.6 and the PS. The plan shall be submitted within the period of time laid down in the PS, or, if none is given, not later than four months in advance of the date for the commencement of the Integrated Testing & Commissioning.

3.7.3 Operation and Maintenance Manuals Plan

3..7.3.1 The Contractor shall develop an Operation and Maintenance Manuals Plan to suit staged commissioning of the system and to ensure the timely preparation of the Contractor's Operation and Maintenance Manuals and the 'As-Built' drawings in a format and to a level of detail reviewed without objection by the Employer's Representative and in accordance with Chapter 11 below.

3..7.3.2 The Contractor shall submit the Operation and Maintenance Manuals Plan by the date stated in the PS, or, if none is given, not later than nine (9) months prior to the issue of the Taking Over Certificate for the Works and according to staged commissioning of the proposed systems.

3.7.4 Training Plan

3..7.4.1 The Contractor shall ensure the timely preparation of the Contractor's Training Plan in a format and to a level of detail reviewed without objection by the Employer's Representative and fulfilling the requirements of clause 10.1 below.

3..7.4.2 The Contractor shall submit the Training Plan by the date stated in the PS, or, if none is given, not less than three (3) months prior to the issue of the Taking Over Certificate for the Works and also to suit the staged commissioning of the relevant systems.

3.7.5 Spares Management Plan

3..7.5.1 The Contractor shall submit for review by the Employer's Representative a Spares Management Plan to furnish a priced, manufacturer-recommended list of spare parts necessary to support continuous operation of all such equipment for a minimum period of 12 months after the DLP, in accordance with Chapter 13 below.

3..7.5.2 The Contractor shall submit the Spares Management Plan by the date stated in the PS, or, if none is given, not less than three (3) months prior to the issue of the Taking Over Certificate for the Works.

3.7.6 Defects Liability Management Plan

The Contractor shall submit for review by the Employer's Representative a Defects Liability Management Plan to repair, replace and perform any remedial item upon the Works identified by the Employer's Representative during the Defects Liability Period (DLP). The first submission of this plan is at least 2 months before ROD. The Contractor shall:

- (a) endeavour to complete all necessary work in a timely responsible manner;
- (b) not proceed with any remedial work without the consent of the Employer's Representative;
- (c) submit a plan that details the methods and timing of any proposed work; and
- (d) update the plan monthly, showing progress of the work and the time to completion.

3.7.7 Supervision of Maintenance Plan

The Contractor shall prepare outline plans for the management of the maintenance function in accordance with the requirements of clause 12.2.1 below and submit them for review by the Employer's Representative at least 3 months prior to the ROD.

3.7.8 AMC Management Plan

The Contractor shall submit for review by the Employer's Representative an Annual Maintenance Contract Management Plan to repair, replace and perform any item upon the Works identified by the Employer's Representative during the Annual Maintenance

Contract (AMC). The first submission of this plan is required before the expiry of the DLP and 6 months before commencement of the AMC period for each section.

* End of Chapter *

Appendix 1

1. MONTHLY PROGRESS REPORT

1.1 Topics

1.1.1 The Monthly Progress Report required under clause 2.17 of the GS shall include as a minimum the following sections and topics:

- (1) Executive Summary, highlighting any matters of concern and explaining corrective action to be taken
- (2) Safety and Quality issues (including any necessary corrective action taken or proposed to prevent the re-occurrence of the non-conformities)
- (3) Programme and overall progress
- (4) Physical progress report (see Paragraph 2.19 of the General Specification)
- (5) Achievement of Key Dates and Milestone Dates
- (6) Design status
- (7) Design and design co-ordination progress
- (8) Design submission and Employer's Representative's response status (list of all design submissions showing current status to be appended)
- (9) Manufacturing status
- (10) Materials ordered / in process
- (11) Equipment manufactured / procured
- (12) Factory acceptance test status report
- (13) Delivery status
- (14) Shipping / transportation activity
- (15) Deliveries to DMRC (including release certificate reference)
- (16) Free issue items (where applicable)
- (17) Installation / erection on Site
- (18) Site surveys (where applicable)
- (19) Equipment installation and erection
- (20) Completion of remedial works / Site acceptance
- (21) Safety audit and safety report
- (22) Test and Commissioning
- (23) Commissioning activity
- (24) Planned vs. Actual Table
- (25) Remedial works
- (26) System integration tests
- (27) Documentation
- (28) Functional design

- (29) Operation manuals
- (30) Maintenance manuals
- (31) Training manuals
- (32) As-built drawings
- (33) Spares / special tools / test equipment
- (34) Training
- (35) Employer's Taking Over of Works (part or whole of Works)
- (36) Taking Over Certificate
- (37) Maintenance issues
- (38) Defects Liability
- (39) Contractual / Commercial
- (40) Payments / invoices
- (41) Employer's Representative's instructions and variation orders
- (42) Claims / potential claims
- (43) Contractor's resources (details of all staff and sub-contractors engaged on the Works)
- (44) Progress photographs
- (45) Labour Law Compliance Status.

1.2 Progress Reports

- 1.2.1 The programmes shall show current status to provide a comparison between the Works Programme and reported progress.
- 1.2.2 Actual progress shall be reported for each activity in the Works Programme in the following terms:
 - (1) the percentage of the work which is complete;
 - (2) the remaining duration of the work;
 - (3) the actual start date; and
 - (4) the actual completion date.

1.3 Copies

- 1.3.1 The Contractor shall submit 1 unbound original and 1 bound hard copies of all Monthly Progress Reports and of the accompanying documents plus one copy in electronic format on PC compatible.

* End of Appendix 1 *

Appendix 2

2. CONTRACT SYSTEMS SAFETY MANAGEMENT

- 2.1** The Contractor shall with Safety Assurance Programme
- 2.1.1 In 60 days of Notice to Proceed, submit his proposed Safety Assurance Programme Plan for review and acceptance by the Employer's representative.
- 2.1.2 The Safety Assurance Programme Plan shall cover design, manufacture, testing, integrated testing, and commissioning to ensure safe routing, spacing, movement and control of trains and meet the requirements as stipulated in the PS.
- 2.1.3 The Safety Assurance Programme Plan shall also address reliability, maintainability and availability of the system. This shall ensure the system has a high degree of reliability and minimise down time during routine and failure repair.
- 2.1.4 The Safety Assurance Programme Plan shall include an EMC/EMI Control Plan that shall evaluate the requirements for electro-magnetic compatibility and interference, in this specification for all appropriate elements of the system, and ensure they are met.
- 2.1.5 The Safety Assurance Programme Plan shall include a Fire Control Plan which shall evaluate and ensure *inter-alia* that the fire loading of the materials proposed to be used, and potential sources of combustion in case of failure are compatible with currently accepted international practice.
- 2.1.6 The Safety Assurance Programme Plan shall describe procedures required to perform the specific tasks necessary to achieve safety, reliability and maintainability requirements. These procedures shall be incorporated within the Contractor's Quality Assurance System, and shall be subject to review by the Employer's Representative
- 2.2 Hazard Analysis**
- 2.2.1 The Contractor shall take the lead role in the interface Hazard Analysis for trackside equipment, to which the system is interfaced, provided by other contractors.
- 2.2.2 The Contractor shall produce the Hazard Analysis Schedule for his complete system including all interfacing systems and shall interface principally with the Rolling Stock, Signalling, Communication, Power Supply, Civil and Depot Contractor as well as any other Designated Contractors to obtain the information necessary, from their hazard analyses, to complete the analysis.
- 2.2.3 The Contractor shall, as part of the safety analysis, prepare analyses to identify Hazards and ensure their satisfactory resolution. The analyses shall be prepared and submitted by the Contractor for the Employer's representative acceptance.
- 2.2.4 . Not Used.
- 2.2.5 The Contractor shall compile a list of critical and catastrophic items identified as a result of hazard analysis.
- 2.2.6 All hazard resolution by procedural control shall be cross-referenced from the Critical and Catastrophic Items List to the appropriate manuals.
- 2.2.7 The qualitative measures of hazard severity are defined as follows:
- (i) Hazard Category I – Catastrophic: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or

procedural deficiencies may cause death or system loss. The safety target shall be based on internationally accepted standards.

- (ii) Hazard Category II – Critical: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural deficiencies may cause severe injury to personnel, severe occupational illness or major system damage.

The safety target for the occurrence of all Category II hazards summed together shall again be based on internationally accepted standards.

- (iii) Hazard Category III – Marginal: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural deficiencies, may cause minor injury to personnel, minor occupational illness or minor system damage.
- (iv) Hazard Category IV – Negligible: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural deficiencies will not result in injury to personnel occupational illness or damage to the system.

- 2.2.8 The Contractor shall prepare a Fire Safety Design Report for review and acceptance by the Employer's representative. This shall be submitted within 2 months after Notice to Proceed and revised and updated for the completion of the preliminary, pre-final and final design stages. Materials used in the Permanent Works of the system shall conform to fire safety requirements of international standards, subject to the acceptance of the Employer's Representative.

2.3 Results

- 2.3.1 Source of all failure rates employed shall be indicated in the Hazard Analyses .
- 2.3.2 All hazard analyses submitted to the Employer are to be standardised by the Contractor such that format and forms employed by all sub-contractors are the same.
- 2.3.3 The following targets shall be employed for the Fault Tree Analysis
 - (i) No single point failure shall lead to death.
 - (ii) No combination of undetected failure and double point failures shall result in death.
 - (iii) No combination of undetected failure and single point failure shall result in major injury.
- 2.3.4 The procedures for Operation, Maintenance, Training and the Contractor's Quality Assurance manuals shall incorporate resolution of hazards identified from this hazard analysis.

* End of Appendix 2 *

Appendix 3

3. SUBMISSION FOR REVIEW REQUEST FORM

SUBMISSION FOR REVIEW REQUEST

Reference No. _____ (see Paragraph 4.3.2) Date _____

Programme reference and scheduled date: _____

Submission Stage _____ (see Paragraph 3.5.1.1)

Title _____

We hereby submit for review by the Employer's Representative the documents or articles listed below:

(Introduction and list of items submitted – see Paragraph 4.3.5.2 – continue on separate sheet if necessary)

I confirm that the material submitted is in full compliance with the Contract.

Signed _____ (Contractor's responsible engineer)

Employer's Representative's Response _____ Dated _____

The material submitted has been reviewed and the following decision is given:

"No Objection" / "No Objection Subject To" (see below) / "Rejected" (see below)

The following comments are made and a re-submission is to be made by the Contractor within 10 working days demonstrating fully how all of these are taken into account:

(Employer's Representative's comments)

Signed _____ (Employer's Representative)

* End of Appendix 3 *

Appendix 4

4. SCHEDULE OF ITEMS TO BE SUBMITTED BY CONTRACTOR

This Appendix lists the principal items to be submitted by the Contractor for review by the Employer's Representative. This list is not exhaustive and the Contractor is reminded to satisfy itself of the requirements for all submissions whether or not they are included within this Appendix.

Article	Reference Paragraph(s)	To be submitted
Availability, Reliability and Maintainability deliverables	1.9	In accordance with RAM deliverables described.
Initial version of the Works Programme	2.4.1.1	Within 15 days of the Commencement Date of the Works
Works Programme	2.4.1.2	Within 30 days of the Commencement Date of the Works
Design Submissions Programme	2.5.1	Within 30 days of the Commencement Date of the Works
Design, Procurement and Manufacturing Programme	2.6.1	Within 60 days of the Commencement Date of the Works
Material Control Schedule	2.6.5	As stated in the PS
Factory Testing Programme	2.6.8	Factory Testing Programme shall support all aspects of the Factory Testing Plan.
Installation Programme	2.7.1	As stated in the PS or as directed by the Employer's Representative
Testing & Commissioning Programme	2.81	As stated in the PS or as directed by the Employer's Representative
Monthly Progress Report and supporting documentation	2.17.1	The 5 th day of each month.
Physical Progress Report (baseline)	1.1.1.1	Within 30 days of the Commencement Date of the Works
Contractor's Project Plan	3.1.2	As stated in the PS, or if none is given, within 60 days of the Commencement Date of the Works
Particulars of agent/Contractors Manager	3.3.1.6 (6)	30 days before the Commencement Date of the Works
Interface Management Plan	3.3.2.(b)	Within 60 days of notification from the Employer's Representative of the identity of each Project Contractor
Detailed Interface Document	3.3.2.(d)	Within 90 days of notification from the Employer's Representative of the identity of each Project Contractor
EMC Management Plan	3.4.6	As stated in the PS

Article	Reference Paragraph(s)	To be submitted
Software Quality Assurance Plan	3.4.7	As stated in the PS
Design Plan	3.5.1	As stated in the PS
Design Verification and Validation Plan	3.5.2	As stated in the PS
Contractor's Factory Testing Plan	3.5.3	As stated in the PS
Test Reports	3.5.3.7	Immediately after the completion of Factory Testing
Procurement, Manufacturing and Delivery Plan	3.5.4	As stated in the PS
Contractor's Health and Safety Documentation	3.6.2.2	Within 30 days of the Commencement Date of the Works
Environmental Management Plan	3.6.3.3.3	30 days prior to the commencement of construction activities
Environmental Mitigation Implementation Schedule (EMIS)	3.6.3.4.2	The Contractor shall submit the EMIS, for review by the Employer's Representative in conjunction
Traffic Management Submissions	3.6.3.5	60 days before implementation proving all relevant details and implications
Commissioning Plan	3.7.2.1	First draft within 120 days of the Commencement Date of the Works
Installation Test Schedule	3.7.2.2 b. (i)	As stated in the PS or if not given, not later than two months in advance of the Date scheduled for commencement of respective tests
Partial Acceptance Tests Plan	3.7.2.2 b. (ii)	As stated in the PS or if not given, not later than four months in advance of the Date scheduled for commencement of Partial Acceptance Tests
System Acceptance Tests Plan	3.7.2.2 b. (iii)	As stated in the PS or if not given, not later than four months in advance of the Date scheduled for commencement of System Acceptance Tests
Integration Tests & Commissioning Plan	3.7.2.2 b. (iv)	As stated in the PS or if not given, not later than four months in advance of the Date scheduled for commencement of Tests on Completion
Operation & Maintenance Manuals Plan	3.7.3.2	As stated in the PS or if not given, not later than nine months prior to the issue of the Taking Over Certificate for the Works
Training Plan	3.7.4.2	As stated in the PS or if not given, not later than three months prior to the issue of the Taking Over Certificate for the Works
Spare Management Plan	3.7.5.2	As stated in the PS or if not given, not later than three months prior to the issue of the Taking Over Certificate for the Works

Article	Reference Paragraph(s)	To be submitted
Defects Liability Management Plans	3.7.6	atleast 2 months before ROD
Project Document Control Procedure	4.3.2	Within 45 days of the Commencement Date of the Works
Quality Manual	5.2.3	Within 30 days of the Commencement Date of the Works
Quality System Procedures	5.2.3	Within 30 days of the Commencement Date of the Works
Details of Quality Manager	5.2.6	Quality Manager(s), who shall be directly responsible to senior management level
Proposed Corrective & Preventive Action Plan	5.2.7	Within 14 days of issue of CAR
Management Quality Plan	5.3	The Management Quality Plan shall define the Contractor's management structure for the execution of the Works
Design Quality Plan	5.4	The Contractor shall prepare a Design Quality Plan for its design works
Manufacturing Quality Plan	5.5	The Contractor shall prepare a Manufacturing Quality Plan for his manufacturing works
Site Quality Plan	5.6	The Contractor shall prepare a Site Quality Plan for its construction and installation works
Reports of Quarterly Quality Audits	5.8.2	Every Three months
Quality Control Register	5.9	7 th working day of every month
Software Deliverable	6.1	As stated in the PS
Operational Safety Report (Software)	6.6	Software acceptance shall be based upon the supply of software functioning in a manner reviewed without objection by the Employer's Representative
Packaging Materials & Procedures	8.4.1	As stated in the PS
Latest drawings, test procedures, specifications and quality documentation for inspection of equipment	9.2.7.4	At least 15 days prior to each First Article Inspections (FAI)
Installation Tests Reports	9.4.3.3	Immediately after the completion of each test
Partial Acceptance Tests Records	9.4.4.9	Immediately following the successful Partial Acceptance Tests
System Acceptance Tests Records	9.4.5.8	Immediately following the successful System Acceptance Tests

Article	Reference Paragraph(s)	To be submitted
Integration Tests & Commissioning Records	9.4.6.8	Immediately following the successful Tests on Completion of the system
Service Trial Records	9.4.7.8	Immediately following the successful Service Trial of the system
Summaries of Inspection and/or Test	9.6.11	7 th day of the following month
Operation & Maintenance documentation (Draft Version)	11.4.1	As stated in the PS or if not given, not later than 2 months prior to the issue of the Taking Over Certificate for the Works
Operation & Maintenance documentation (Final Version)	11.4.3	As stated in the PS or if not given, not later than 2 month prior to the issue of the Taking Over Certificate for the Works
Operating & Maintenance instructions and illustrated parts list (Final Submission)	11.4.3	At a date set by the Employer's Representative
Spare Parts List	13.1.3	As stated in the PS
Construction & Installation Plan	14.1.1	As stated in the PS
Particular Uses of Site	17.2.1	Within 60 days of the Commencement Date of the Works
Method Statements Programme	18.5.5.3	Within 30 days of the Commencement Date of the Works or at a date reviewed by the Employer's Representative
Detailed written report of accidents, incidents and dangerous occurrence	18.6.4.1	Within 7 days of occurrence/accident
Name and qualification of safety representative for temporary site electricity	22.3.1	Not later than 4 weeks before appointment

* End of Appendix 4 *

Appendix 5

5. TYPICAL TYPE TEST REQUIREMENTS

5.1 Electronic and Electrical Equipment

The initial visual inspection shall be carried out to ensure that the equipment is of sound construction and, so far as can be ascertained, meets the requirements of the Specification.

5.1.1 Initial Performance Test

- i. The initial performance tests shall consist of a comprehensive series of measurements of the characteristics of the equipment to demonstrate that its performance is in accordance with its functional requirements, including detailed requirements of the Specification.
- ii. This test shall normally be performed at an ambient temperature of 40°C +5°C while supplied at its normal voltage and frequency, if relevant.
- iii. This test shall extend to demonstrating compliance with any limitation on self-generated vibration or interference as stated in the Specification.

5.2 Mechanical Tests

5.2.1 Drop Test

- i. The drop test is intended to be carried out on units and sub-assemblies that are portable. It is not intended that it be carried out on complete racks of equipment.
- ii. Casings or dust covers, which have to be removed for servicing, shall be removed after subjecting equipment to this test to inspect for damage. The test is designed to reveal any weakness of assembly and to ensure that the component mountings are of adequate strength. It is not designed to check whether doors or windows made of glass will fracture and to this end meters, glass windows, etc., may be removed.
- iii. The equipment shall not be deemed to have failed the drop test if externally accessible components such as control knobs or connectors are damaged. The Employer's Representative however reserves the right to ask for some form of guard, to prevent such damage, to be fitted at the Contractor's cost.

5.2.2 Vibration Test

The vibration test is designed to reveal any parts or components of the equipment that may be prone to any resonance severe enough to cause possible damage or malfunctioning.

5.3 Environmental Tests

5.3.1 Dry Heat Test

- i. The dry heat test shall be carried out on each complete piece of equipment or assembly, with all doors and covers being in place and closed as in normal operation.

5.3.2 Low Temperature Test (in case applicable for Jaipur ambient temperature range)

The low temperature test shall be carried out on each complete piece of equipment or assembly, with all doors and covers being in place and closed as in normal operation.

5.4 Electrical Tests

5.4.1 Supply Variations

Measurements of equipment performance and maximum VA consumption shall be made, for supply voltage and frequency variations in all possible combinations of upper limit, normal and lower limit as detailed in the Specification. Throughout these tests, the equipment shall function in accordance with the Specification.

5.4.2 Supply Interruptions

- i. The supply input to the equipment under test shall be interrupted for periods of 10ms.
- ii. The tests shall be performed ten times at random for ac supplies and three times at random for dc supplies.
- iii. The equipment shall be capable of withstanding these interruptions of supply input without damage, interruption or resetting by the operator and shall continue to function and operate correctly in accordance with the Specification.

* End of Appendix 5 *

Signed

**Filled in by
Inspector**

The above work was inspected and permission was given / not given to proceed with next operation.

* The following remedial works were required

* Contractor informed verbally (to MR

by Mr _____ on _____ at _____ hrs)

* Remedial works inspected and permission given to proceed with next operation on _____ at _____ hrs)
_____ as supervised _____

by

Signed

Date

Time

Verbal or written permission by the Employer's Representative or his staff shall in no way relieve the Contractor of his responsibilities under the Contract.

* To be completed if applicable.

* End of Appendix 6 *

Appendix 7

7. NOT USED

* End of Appendix 7 *

Appendix 8

8. FIRST AID REQUIREMENTS

8.1 Not Used

8.2 Provisions by the Contractor

8.2.1 The Contractor shall supply portable first aid boxes maintained fully equipped at each local site offices and any work locations where 20 or more persons work at a time.

8.2.2 In each site office and work location at least one of the Contractor's employees shall be trained in first aid and should be available at all working hours for purpose of attending to emergencies.

8.2.3 The Contractor shall be responsible for making his employees aware of the location and access route to the nearest first aid base and if necessary shall provide facilities for evacuating a workman by stretcher from the worksite.

8.2.4 The Contractor shall keep the first aid base personnel informed of the number and identity of staff working within the area of responsibility of each first aid base.

* End of Appendix 8 *

Appendix 9

9. NOT USED

* End of Appendix 9 *

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LIST OF DEFINITIONS

In this Particular Specification, the following defined terms shall have the meanings ascribed to them below:

Abnormal Operation	The situation where the Train Control and Signalling System operates in a manner not intended by the design.
Availability	The probability that an item will be in a state to perform a required function under given conditions, at a given instant in time or over a time interval, assuming that the given external resources are provided.
Cab Signalling	Signalling in the train cab which governs the movement of the train by conveying the limit of movement authority (LOMA) and the authorised speed, target distance/speed as deduced from the most restricting ATP condition, signalling mode etc.
Call-On	A signal move to allow a train in rear to pass its LOMA.
Civil Speed Limit	The permanent maximum speed limit for all trains upon a section of line. This speed limit shall not be exceeded at any time.
Coasting	An increase of inter-station run time over the maximum train performance time, usually by a specified constant percentage value.
Command	The facility to perform or modify a function of the System.
Consist	Any service operable collection of cars with a cab car at each end.
Controller	Any of the Employer's staff authorised by the Employer to control the System.
Corrective Maintenance	Maintenance performed to correct the occurrence of an equipment or system fault.
Dark Fibre	An available, un-switched optical fibre.
Delay	Delay is caused when a train is unable to move or its speed is reduced due to failure of the Train Control and Signalling System. The delay is measured by the time lost by the first affected train due to a failure of the Train Control and Signalling System.
Distance to Target Speed	The distance the train has to run before the target speed must be achieved.
Dwell	The period of time taken from the instant that a train's wheels stop at a station until the point in time when the wheels start in motion again.
Engineer's Train	A specially run non-passenger train used for engineering purposes.

Equipment	A part of the Permanent Works.
Equipped Train	A train with fully operational Train Control and Signalling System equipment installed onboard.
Failure	A failure is an event, which causes loss of function or performance within any part of the Train Control and Signalling System and requires a maintenance intervention to restore full functionality and performance.
First Line Maintenance	This is the routine inspection and minor associated work such as greasing, replacing minor worn parts, checking and resetting tolerances, and reporting on condition after measuring certain parameters.
Fleet Mode	The automatic mode of a semi-automatic signal.
Fouling Point	The position at the convergence of two tracks where the kinematic envelopes, one on each line, would come into contact.
Gauge	The space between the rails of one track.
Graceful Degradation	The transfer in quality or performance from the initial level to a lower operable level.
Headway	Minimum time interval between successive trains at any point on the line such that the speed of a following trains is not reduced by the presence of any other service train ahead.
Independence	The isolation between the investigating technician undertaking the work and a second person for example, responsible for checking or approving the work.
Jerk	Rate of change of acceleration.
Latched Alarms	Alarms arising from faults in equipment. These alarms remain active until the equipment fault has been remedied.
Leaky Feeder	A cable that radiates radio waves of a desired frequency along its length. Often used for track to train communications.
Limit Of Movement Authority (LOMA)	LOMA is the point beyond which the train may not safely proceed.
Line Replaceable Unit (LRU)	Equipment that can be replaced as a single complete unit and can be handled by a single person.
Main Line	Lines other than those the depot.
Maintenance Block	Taking a section of the line out of service for engineering purposes.
Maintenance Track	Maintenance tracks are those tracks within the depot on which first, second and third line maintenance will be carried out.

Man Machine Interface (MMI)	The visual interface between the Controller and the control system. The MMI consists of the computer screens, displayed objects, icons, and equipment as well as the facilities by which the Controller executes control.
Maximum Safe Speed (MSS)	The maximum safe speed shall be the lowest of: the Civil Speed Limit, the safe speed required to ensure that the LOMA is not passed, any Temporary Speed Restrictions in force, maximum permissible train speed, maximum speed set by the current operating mode and train parameters.
Mean Time Between Maintenance Action (MTBMA)	The average time between maintenance being required on a piece of equipment, system or subsystem.
Mean Time Between Service Affecting Failures (MTBSAF)	The average time between failures causing service delays for a piece of equipment, a system or a subsystem.
Mean Time between failure (MTBF)	The average time between failures for a piece of equipment, a system or a subsystem.
Mean Time To Restore (MTTR)	The average time to restore equipment, subsystems, systems to full functionality.
Mimic	A graphical representation of the railway and its global operating status.
Non Equipped Train	A train with either no Train Control and Signalling System equipment onboard, or with a failed System onboard.
Non-Passenger Train	A special train run without passengers, such as engineer's trains or trains operating to or from depot to enter or leave service.
Operating hours	Operating hours shall be 05:00 to 24:00, 7 days per week.
Preventive Maintenance	Periodic or regular maintenance performed in order to pre-empt the occurrence of equipment faults in the future. This shall include First, Second and Third Line Maintenance.
Push-Out	A mode of operation which allows the LOMA to be moved up to the rear of a failed train in front in order to remove a failed train from the line.
Rake	An empty train without passengers.
Recoverability	The measure of ability of a system to recover from a system failure.
Reliability	The measure of ability to rely upon equipment and systems to perform their intended function. The measure of reliability is MTBMA.
Right Side Failure	A failure that is not a Wrong Side Failure.

RM (Restricted Manual) mode	That mode of the ATP system that is the default mode within the depot or in certain cases in the main line. It allows for a maximum speed of 25 km/hr with no cab signal energy being received.
Run on Sight Mode	In this mode the only control is concerning the train speed which cannot exceed a maximum speed ROS – speed limit (Emergency breaking triggered by ATP system). The running monitoring is the same as for RM. The ATP will give Cab Signal indications as soon as the train reaches a track position where normal running can be resumed. The ATP authorizes the ROS request.
Route	A part of the line originating at a signal through which the points have been set and secured to enable the safe passage of a train.
Safety-Critical	Failure of the system, sub-system or equipment will directly lead to a situation with the potential to cause harm, injury, damage to property, plant or equipment, damage to the environment, or economic loss.
Second Line Maintenance	Maintenance that covers the overhaul of equipment and also includes the replacement of modules, major parts and assemblies, with the used ones being returned to a central workshop or the supplier for repair and/or overhaul.
Service	When the railway is available for the use of fare paying passengers.
Service Affecting Failure	A failure which causes a Delay.
Signalled Headway	The minimum time interval that the Train Control and Signalling System will permit between two following trains.
Stopping Position	The specified point within a station at which the train is to stop.
Sub-system	A part of the Train Control and Signalling Permanent Works as defined in this Contract.
System	The Permanent Works.
Target Speed	The speed the train must achieve at the required target distance.
Technician	Qualified person competent to lead work party for installation/investigation of the System.
Third Line Maintenance	The workshop maintenance and where the major components and assemblies removed during second line maintenance are maintained and overhauled.
Trip Time	The time for a train to travel from one terminal to the opposite terminal on the same line, with 30-second dwell times at each intermediate station. This time does not include any layover time at the termini.
Turnout	A track assembly comprising a point and a crossing enabling a train to be switched from one track to another.

Train Description	An alphanumeric sequence uniquely identifying a running train.
Train operator	The person on the train responsible for its operation.
Type Test	Functional test of the as-built component, assembly or system under environmental conditions similar to those to be encountered in the Permanent Works.
Unequipped Train	A train without operable ATP equipment. This may be a train whose on-board ATP equipment has failed and is operating in Cut-Out Mode or a piece of work rolling stock that is not equipped with ATP.
Unauthorised Roll-back	An unintentional reversal of the train's direction
Workstation	The collection of processors, screens and input devices necessary to provide one Controller with the necessary System displays and Commands.
Wrong-Side Failure	A failure of a safety-critical system or subsystem which directly leads to a situation with the potential to cause harm, injury, damage to property, plant or equipment, damage to the environment, or economic loss.

LIST OF ABBREVIATIONS

ABA	Alarm Browser Application
ACR	Area of Control Region
AFTC	Audio Frequency Track Circuit
ALARP	As Low As Reasonably Possible
AOA	Area of Authority
APC	Auxiliary Power Control
ARS	Automatic Route Setting
ATO	Automatic Train Operation
ATP	Automatic Train Protection
ATR	Automatic Train Regulation
ATS	Automatic Train Supervision
BER	Bit Error Rate
BIS	Bureau of Indian Standards
CATC	Continuous Automatic Train Control
CC	Communications Co-ordinator
CBI	Computer Based Interlocking
CCIR	Consultative Committee on International Radio
CCITT	Consultative Committee on International Telephone and Telegraphy
CENELEC	European Committee for Electrotechnical Standards (Comité Européen de Normalisation Electrotechnique)
CER	Central Equipment Room
CSS	Communications System supervisor
CTC	Central Train Control
CWR	Continuously Welded Rail
DCC	Depot Control Centre
DCCLAN	Depot Control Centre Local Area Network
DMRC	Delhi Metro Rail Corporation
DTC	Depot Traffic Controller
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
EMU	Electric Multiple Unit

ETCS	European Train Control System
FAT	Factory Acceptance Test
FOTS	Fibre Optic Transmission System
FRB	Failure Review Board
FRS	Functional Requirement Specification
GCC	General Conditions of Contract
GR	General Rules of the Indian Railways
GS	General Specification
IMR	Incident Management Room
I/O	Input / Output
IR	Indian Railways
IRS	Indian Railway Standards
IRSTE	Institution of Railway Signal & Telecommunication Engineers (India)
ISO	International Standards Organisation
JTC	Jointless Track Circuit
JMRC	Jaipur Metro Rail Corporation
LAN	Local Area Network
LOMA	Limit of Movement Authority
LRU	Line Replaceable Unit
MAN	Metropolitan Area Network
MCB	Miniature Circuit Breaker
MCS	Main Control System
MCSC	Main Control System Controller
MIS	Management Information Service
MMI	Man-Machine Interface
MMS	Maintenance Management System
MSS	Maximum Safe Speed
MTBF	Mean Time Between Failures
MTBMA	Mean Time Between Maintenance Action
MTBSAF	Mean Time Between Service Affecting Failures
MTTR	Mean Time to Restore
OCC	Operations Control Centre

OCCLAN	Operations Control Centre Local Area Network
PA	Public Address
PAP	Passenger Assistance Phones
PAS	Public Address System
PALA	Passenger Alarm
PIDS	Passenger Information Display System
PPE	Personal Protective Equipment
PSB	Platform Supervisor's Booth
RAMS	Reliability, Availability, Maintainability, Safety
RBD	Reliability Block Diagram
RDSO	Research, Design, and Standards Organisation (IR)
RIN	Radio Identity Number
SAP	System Assurance Plan
SCC	Special Conditions of Contract
SCR	Station Control Room
SEM	Signal Engineering Manual (IR)
SER	Signalling Equipment Room
SLAN	Station Local Area Network
SSI	Solid State Interlocking
TCP/IP	Transmission Control Protocol/Internet Protocol
TC	Traffic Controller
TCN	Train Consist Number
TCS	Train Control System
TER	Telecommunication Equipment Room
TIMS	Train Information Management System
TRN	Train Running Numbers
UIC	International Union of Railways (Union Internationale des Chemins de Fer)
VDU	Visual Display Unit
WAN	Wide Area Network

LIST OF STANDARDS

This list is provided solely for the convenience of the Contractor/tenderer. Standards referenced within this document that are not identified in this list must still be complied with. The reference to any specifications shall be taken as the reference to the latest version of that specification.

Subject	Organization	Standard
Electro-magnetic compatibility	EEC	89/336/EEC
Electro-magnetic compatibility	CENELEC	EN 50081-2 EN50121-1, EN50121-2 EN50121-3 EN 50121-4. EN50123 IEC 61000-1 IEC 61000-2 IEC 61000-3 IEC 61000-4 IEC 61000-5
Conducted immunity level	CENELEC	EN 50082-2
Electrostatic discharge (ESD)	IEC	IEC 61000-4-2
Fast transient burst	IEC	IEC 61000-4-4
Point machines	IR	IRS: S24
Computer Based Interlocking	IR	RDSO/SPN/192/2005
Relay Interlocking	IR	IRS: S36
Electric Signalling & Interlocking Equipment	IR	IRS: S23
Power surge	IEC	IEC 61000-4-5
Safety and Reliability Requirement of Electronic Signalling Equipment	IR CENELEC	RDSO/SPN/144 EN 50126, EN50128, EN50129
Software	CENELEC	EN 50128/ EN50129 EN50159-1 &2
Train Control and Signalling System	IEC	IEC 60529 Ed. 2.0 b
Functional Requirement specification for ETCS (European Train Control System)	ETCS	A200 FRS
Environmental Requirement specification for ETCS (European Train Control System)	ETCSenv	A200/FRSenv
Electronic equipment on used on Railway Vehicles.	IEC CENELEC	IEC 571 EN50155
Prevention of inadvertent ignition of flammable atmospheres by radio frequency radiation	BS	6656
Trainborne equipment	IS	IS 9000

Subject	Organization	Standard
Trackside equipment	IS	IS 9000
Installation work and lineside assets	Railtrack	GS/IH0001 or an equivalent
Standard CD ROM format	ISO	ISO 9660
Network time protocol	Network Working Group	RFC 1305
Cable standard and cable installation standard	BS IEC IEC	BS 6360 IEC 287 IEC 364-5-523
Cable standard	IRS IRS IRS	S-35/93 S63/89 Amendment-5; or latest TC30/05

CHAPTER 1

1 INTRODUCTION

1.1 Scope and Purpose

1.1.1 This Technical Specification specifies the particular requirements of the Train Control and Signalling System of Jaipur Metro Rail Corporation (JMRC) Phase 1B work.

1.1.2 The Works to be executed under the Contract include the design, manufacture, verification, delivery, installation, testing, commissioning and technical support for a complete, integrated Train Control and Signalling System, including all control centres, trackside, and train borne equipment, necessary to deliver the requirements of this Specification.

1.2 Relevant Documents

1.2.1 These Technical Specifications should be read in conjunction with the General Conditions of Contract (GCC), the Special Conditions of Contract (SCC), the General Specification (GS), the Employer's Drawings and any other document forming part of the Contract.

1.2.2 In the event of a conflict between the GS and this Specification, this Specification shall prevail.

1.2.3 In the event of a conflict between this Specification and any other standards or specifications quoted herein, the requirement of this Specification shall prevail.

1.2.4 Notwithstanding the precedence specified in Paragraphs 1.2.2, 1.2.3, and 1.2.5 the Contractor shall always immediately seek advice from the Employer's Engineer in the event of conflicts between Specifications.

1.2.5 The order of preference, with 1.2.5.1 having the highest priority, is:

1.2.5.1 Particular Specification and its Appendices

1.2.5.2 General Specification

1.2.5.3 Jaipur Metro General Rules

1.2.5.4 Jaipur Metro Signal Engineering Manual

1.2.5.5 Indian Railway Standards

1.2.5.6 International Standards referenced herein

1.2.5.7 Other International Standards

CHAPTER 2

2 OVERVIEW OF THE PROJECT

2.1 General

2.1.1 This Chapter gives an overview of the Project. Information provided in this Chapter is for reference purposes only.

2.2 Line 2 Phase 1B

2.2.1 Line 2 Phase 1B (Stage 2) consists of approx 2.34 km Underground section from Chandpole (Excluding Chandpole Station) to Badi Chauper .There are two underground stations on this line Choti Chaupur and Badi Chaupur .

2.2.2 Phase 1B (Stage 2) will be opened for revenue services as per the schedule given in Appendix V of this specification.

2.3 Salient Features

2.3.1 System will utilise 25 kV 50 Hz overhead for traction power.

2.3.2 Trains will be electric multiple unit (EMU).

2.4 Key Challenges

2.4.1 There are four overriding considerations which are of the highest importance in the development of the Train Control and Signalling System:

- (1) The Train Control and Signalling System shall be designed by the Contractor to smoothly support a close headway operation in different operating modes, as required in Phase 1A, while accommodating and recovering from various perturbations;
- (2) The attainment of the reliability, availability, maintainability and safety requirements of the System will be verified by analysis, simulation, testing and commissioning, and system demonstrations as required in this Specification;
- (3) The attainment of the operating performance requirements, e.g. signalled headway and throughput; and
- (4) The minimization of the amount of trackside equipment.

CHAPTER 3

3 SCOPE OF THE WORKS

3.1 General Requirements

3.1.1 Performance

3.1.1.1 The Train Control and Signalling System shall be designed, manufactured, supplied, installed, tested and commissioned by the Contractor under the Contract and shall meet all performance and functional requirements as defined in the Specification.

3.1.1.2 Unless otherwise specified herein, the requirements of the Jaipur Metro Signal Engineering Manual shall apply to this Contract, a copy of which will be given by JMRC for reference and comments.

3.2 Scope of Supply

3.2.1 Systems and Equipment

3.2.1.1 The scope of supply shall cover the requirements of Signalling & Train Control system completely.

3.2.1.2 The Contractor shall supply all equipment and facilities necessary to meet the requirements of this PS, including, but not limited to:

- (1) Control equipment, including:
 - Servers and computers including LAN at OCC, stations, and other locations and optical fibre links; Workstations; Mimic panel etc.
- (2) Trackside equipment;
- (3) Concrete or metallic bases/ fixtures/ supports for Indoor and trackside equipment;
- (4) Enclosures and supporting brackets for housing and fixing equipment;
- (5) All cables including optical fibre cables, cable terminations and cabling support/ protection pipes/ accessories necessary for the Works;
- (6) Power supply distribution panel, circuit breakers, and isolators and earth leakage detectors for both ac and dc;
- (7) Any equipment necessary for integration with existing 1A Signalling & Train Control Systems to allow the introduction of 1B future services without disruption to existing Phase 1A services.
- (8) Station equipment, including:
 - Station Control Room equipment;
 - Signalling Equipment Room and Signalling Maintenance Room equipment;
 - Emergency Stop Plungers
- (9) All equipment associated with any interfaces required to ensure operation within the performance requirements;
- (10) All equipment necessary to allow the installation, testing and introduction of services on this section. ;

- (11) All special test equipment and tools including Maintenance, Special tools and Tool Rack;
- (12) Pipes for Cables protection.
- (13) All equipment necessary to carry out on site testing and commissioning;
- (14) Spare parts including those for the Defect Liabilities Period (DLP);
- (15) All software & hardware, appropriately safety validated, verified and certified, to meet the requirements of the Specification;
- (16) All software and hardware required for data logging;
- (17) Updating existing Testing Platforms, if any.
- (18) Second Drive shall be provided by Track Contractor. However locking arrangement, if any, for the same shall be provided by Signalling Contractor.
- (19) False Flooring of Signal Equipment Rooms and supply of necessary furniture, Tool Box & documentation rack etc. in MSS's SER / Signal Maintainer Room.
- (20) Prototypes, mock-ups, emulation and simulation as required (There are no mockups, prototypes or samples to be provided by the Contractor within the scope of 1B contract except in the case of equipment, which differs in design from that supplied under Phase 1A).
- (21) Any other apparatus needed to provide a complete Signalling & Train Control system.

3.2.2 Services

3.2.2.1 The Services to be performed by the Contractor shall include, but not be limited to, the following:

- (1) Design, manufacture, supply, system assurance, installation, testing and commissioning of the Train Control and Signalling System in line with existing Phase 1A section, along with migration activity & necessary commissioning & testing;
- (2) Presentations, reviews and audit support as specified in the Specification;
- (3) Assist and provide all information, documents required by Independent safety assessor, if appointed by JMRC;
- (4) Interface management as specified in the Specification;
- (5) System operations and maintenance support services;
- (6) Training for operations and maintenance staff.
- (7) Updating existing Operation, Maintenance, Installation and Training Manuals;
- (8) Decommissioning, removal and/ or disposal of non required existing equipments and Temporary Works ;
- (9) Design, manufacture, delivery and installation of foundations/ fixtures for Indoor and Outdoor equipment;
- (10) Warranty period and defect liability support after commissioning of Phase-1B section;
- (11) Providing necessary support and documents including drawings, compliances etc. required for getting safety worthiness of the Train Control and Signalling System certified from Indian authorities viz. Railway Board, RDSO, and Commissioner of Railway Safety;

- (12) Supervised maintenance;
 - (13) All software & hardware, appropriately safety validated, verified and certified, to meet the requirements of the Specification.
 - (14) All equipment necessary to allow the installation, testing and introduction of services on 1B phase ;
 - (15) Any other service needed to provide a complete Signalling & Train Control system
- 3.2.3 Documentation
- 3.2.3.1 The documentation to be supplied by the Contractor under the Contract shall be in accordance with the GS and PS.
- 3.3 **Key Dates**
- 3.3.1 The key dates applicable to this Particular Specification are given in the Instruction to Tenderer and Appendix V to the Particular Specifications.
- 3.4 **Work Excluded from this Contract**
- 3.4.1 Refer to the relevant Interface Specifications in Appendix A for the specific demarcation of responsibility and supply with other Project Contractors.
- 3.4.2 Services Provided by Project Contractors
- 3.4.2.1 The services detailed in Paragraphs 3.4.2.3 to 3.4.2.8 will be provided by Project Contractors and the Contractor will use these services where appropriate.
- 3.4.2.2 The Contractor shall identify and submit to the Employer's Engineer for review within 60 days (As per GS) from the Commencement Date of the Works if and how they intend to use any of these services.
- 3.4.2.3 Equipment Rooms: All equipment rooms will be provided by the Civil Works Project Contractors. The details of the provision are provided in the Appendix A2 of this PS.
- 3.4.2.4 UPS and Battery Backup: UPS supply will be provided to JS02-Phase-1B contractor at a shared location in UPS room at stations.
- 3.4.2.5 Earthing Pits: Earth Termination Bar in UPS room will be available for shared use by JS02-Phase-1B contractor. However, JS02-Phase-1B contractor have to set up earth bus bar in Signalling Room from the Earth Termination bar in UPS room.
- 3.4.2.6 Rolling Stock Equipment: See Appendix A1 for details.
- 3.4.2.7 Cable Routes: Hangers/ Ducts for main cable routes in tunnels will be provided by E&M Project Contractors as shown in the Interface Specifications in Appendix A2 and will be available for shared use by JS02-Phase-1B contractor.
- 3.4.2.8 Furniture for Station Control Room, Training School and OCC Theatre is excluded from the scope of supply of JS02-Phase-1B contract.
- 3.5 **The Site**
- 3.5.1 The Site for the Permanent Works shall include –

- ❑ Territory between existing Chandpole and Badi Chauper, a distance of approximately 2.34 Km. Phase 1B section includes 2 underground stations;
- ❑ Operational Control Centre for Phase 1B will be located in OCC Building, at Mansoravar Depot.

3.5.2 The access dates to the Site are referenced in Appendix V to the Particular Specifications.

3.6 **Employer's Facilities Provided**

3.6.1 The facilities shown in the Bid Drawings will be provided by the JMRC /Employer to the Contractor for the on-site work on the dates set out in the Special Conditions of Contract and Appendix V. In the event that the Contractor wishes to use such facilities he shall take into account the dates of availability of such facilities as set out below in his programming and planning of the Works.

3.6.2 The Contractor shall submit to the Employer's Engineer details and notice of his intention to use any of the Employer's facilities and the period of usage. This shall be submitted within 30 days from the Commencement Date of the Works.

3.6.3 Space for contractor's office and storage

3.6.3.1 The contractor is entitled to use existing constructed site office at MSVD for JS02-Phase-1B project . The office will be available to the Contractor till completion of his works under JS02-Phase-1B Contract i.e. completion of DLP. All facilities that were installed by the Contractor shall be removed, and the land returned to the grade and condition in which it was received on completion to JMRC.

3.6.3.2 The Contractor shall arrange for the utilities and any facilities and resources necessary to operate his site offices, such as electrical, telephone, water, and sewage as well as security.

3.6.3.3 The Contractor shall be responsible for all costs of running his site offices, including but not limited to: utilities, consumables, office supplies, cleaning and maintenance etc.

3.6.3.4 The Contractor shall vacate and restore the location of the temporary site offices to its original condition at the end of the JS02-Phase-1B Contract.

3.6.4 The Employer will not provide the Contractor with any general works trains for the execution of this Contract.

3.6.5 JMRC/O&S shall arrange and provide necessary work permits and any other necessary arrangements to enable TC&S System contractor to upgrade Phase 1-A systems and to fulfill his obligations under this contract. While any modification/up gradation work is carried out on existing equipment under possession of JMRC/O&S, the contractor shall ensure that the due procedure laid down by JMRC/O&S is followed in accessing equipment at areas under JMRC's possession while the overall security of the equipment shall lie with JMRC/O&S.

3.7 **Outdoor Cables**

3.7.1 Outdoor cables for AFTC and Signals, Optical fibre cables and suitable pipes will be part of the supply of JS02-Phase-1B.

- 3.7.2 The Contractor shall supply all types of outdoor cables, and all types of indoor cables & onboard cables (if required).
- 3.7.3 False Floor and all Cable Trays in Signalling Equipment Rooms. Necessary trays/ conduits at Signalling Maintenance Room, Crew Control Room shall be provided by JS02-Phase-1B Contractor. Site office and transport facilities for the Employer are excluded from the scope of supply.
- 3.7.4 Site office and transport facilities for the Employer are excluded from the scope of supply.
- 3.8 JS02-Phase-1B contractor shall supply furniture for its equipment at Signalling Equipment Room, Signalling Maintenance Room , Crew Control Room and any other location wherein his own equipment is installed other than those already stated. No wooden or inflammable furniture is allowed inside equipment rooms.

CHAPTER 4

4 PERFORMANCE REQUIREMENTS

4.1 General

- 4.1.1 The Train Control and Signalling System shall achieve all performance requirements specified in this PS for this line extension including existing 1A equipments.
- 4.1.2 All the sub systems, equipments to be used for Train control & Signalling system shall be same as those used in JS02 Phase 1A contract, or their upgrade of proven design and in use in some passenger carrying Railway or metro system. The Employer's decision on this shall be final.
- 4.1.3 Built-in diagnostics and remote monitoring functions for each microprocessor-based equipment module of the Train Control and Signalling System shall be provided by the Contractor.
- 4.1.4 The reliability and maintainability processes and procedures shall be planned, integrated and developed in conjunction with the operating environment, and the design, development and production functions to permit the most effective and economical achievements of the systems and equipment design objective.
- 4.1.5 The system shall meet or exceed the requirements of CENELEC Standards EN50126, EN50128 and EN50129 for Reliability, Availability, Maintainability and Safety of electronic signalling equipment.

4.2 Reliability Requirements

- 4.2.1 The Reliability requirements of this PS shall be subsidiary to the Availability and Maintainability requirements of this PS. If higher figures are required to achieve the Availability requirements and Maintainability requirements then these higher figures shall become the Reliability requirements for the Train Control and Signalling System.
- 4.2.2 The Reliability measure for the Train Control and Signalling System shall be Mean Time Between Maintenance Action (MTBMA).
- 4.2.3 The Train Control and Signalling System shall achieve a MTBMA of no less than 7 days for each Line.
- 4.2.4 Maintenance actions shall include investigations where no fault or failure is identified.
- 4.2.5 The Reliability of the Train Control and Signalling System shall be demonstrated by the Contractor in accordance with the processes defined in the Specification.

4.3 Availability Requirements

- 4.3.1 The Contractor shall be responsible for providing a System design, maintenance procedures, and defining the recommended spares holdings to ensure that the Availability requirements of the Train Control and Signalling System shall be achieved.
- 4.3.2 The measures for Availability shall be Mean Time Between Service-Affecting Failures (MTBSAF).
- 4.3.3 The availability figures shown in Table 4-1 shall be met by the Train Control and Signalling System for the Line.

Description	MTBSAF
Delay to train service exceeding 2 minutes, or fault preventing a train from entering service at its scheduled time.	240 hours
Delay to train service exceeding 5 minutes, or requiring temporary closure of one or more stations.	1200 hours
Delay to train service exceeding 20 minutes, or closure of a station more than 2 hours, or implementation of single line working for a period of 1 hour or more.	7008 hours
Severe service disruption resulting in trains being stranded on track for more than one hour or closure of a station for more than one day.	26280 hours

Table 4-1 Availability Performance Figures

- 4.3.4 For the purposes of availability calculations, the Contractor shall assume that the service operating hours are 19 hours per day (05:00 to 24:00) for 365 days a year.
- 4.3.5 In all availability calculations the following access times shall be assumed:
- (1) 30 minutes for train-borne equipment;
 - (2) 60 minutes for equipment located in equipment rooms that are accessible during traffic hours; and
 - (3) 10 hours for trackside equipment or equipment located such that it is only accessible during non-traffic hours.
- 4.3.6 The availability of the Train Control and Signalling System for entire main line including existing Phase 1A shall be demonstrated by the Contractor in accordance with the processes defined in the Specification.
- 4.3.6.1 Detrainment of passengers, during DLP period, caused due to a failure of Signalling & Train Control system may call for imposition of penalty on the Contractor, not exceeding Rs.Two Lakhs per such event.
- 4.3.7 Perturbation Analysis
- 4.3.7.1 A detailed System perturbation analysis shall be performed stating the types of failures that could cause service interruptions and the failure management actions required to mitigate the effect of these failures.
- 4.3.7.2 The service interruption analysis shall document all failure modes capable of causing revenue service disruptions.
- 4.3.7.3 Operational actions, System design features or maintenance strategies that can reduce the impact of potential service interruptions shall be submitted to the Employer's Engineer for review.
- 4.4 Maintainability Requirements**
- 4.4.1 Systems and Equipment Design

- 4.4.1.1 The System shall be designed to maximise Availability during traffic hours, to minimise the amount of maintenance required to maintain the System and to ensure that any maintenance can be carried out with the minimum amount of time, the minimum amount of skill and at a minimum cost.
- 4.4.2 Mean Time To Restore
 - 4.4.2.1 The maintainability measure for the Train Control and Signalling System shall be Mean Time To Restore (MTTR).
 - 4.4.2.2 The required MTTR shall be achieved for failures of the whole System or any part of the System, whether service affecting or not.
 - 4.4.2.3 The following MTTR shall be achieved:
 - (1) 15 minutes for train-borne equipment;
 - (2) 15 minutes for train detection equipment;
 - (3) 30 minutes for other trackside equipment (excluding Point Machine); and 45 minutes for Point Machines;
 - (4) 15 minutes for equipment located in equipment rooms or control rooms.
 - 4.4.2.4 The MTTR time measurement shall include on site diagnostics and rectification of the failure (including software re-boot) up to the point that the System is restored to full functionality. In the event that the failure cannot be rectified, this time measurement shall include the time necessary to remove the failed piece of equipment from the System and replace it with a functioning one.
 - 4.4.2.5 The MTTR does not include the time taken for designated personnel to arrive on site (access time) to begin local diagnostic activities nor the time taken for the replacement parts to be delivered to site.
 - 4.4.2.6 The maintainability requirements of the Train Control and Signalling System for Phase 1B shall be demonstrated by the Contractor in accordance with the processes defined in the Specification.
- 4.4.3 Line Replaceable Unit Replacement
 - 4.4.3.1 All line replaceable units shall follow maximum weight restrictions such that these can be easily handled manually by a single person (exceptions: point machines and impedance bonds).
- 4.4.4 Service Life
 - 4.4.4.1 All components, materials, software and other support required to repair and service all Train Control and Signalling System shall be available for at least 20 years from the Employer's Taking over of the Works or Section. The exception to this shall be the central control equipment, which shall be available for at least 10 years from the Employer's Taking over of the Works or Section.
 - 4.4.4.2 All updated components shall be fully backward compatible with the originally installed component.

- 4.4.4.3 The Contractor shall notify the Employer in writing prior to deleting any component of the System from general availability, and submit written assurances that it can provide functionally identical replacement units. The notification period for the deletion of the component and written assurances shall not be less than the lead-time for ordering or manufacturing the component plus six months.

4.5 Safety Requirements

- 4.5.1 The Train Control and Signalling System shall provide for the safe routing, spacing, movement and control of trains.
- 4.5.2 The Contractor shall establish and maintain complete responsibility of the system safety through the application of engineering and management principles, criteria and techniques to optimise all aspects of safety throughout all phases of the system life cycle. This shall apply to all systems supplied under this contract.
- 4.5.3 Not used.
- 4.5.4 The Train Control and Signalling System shall not lead to an unsafe condition when the plug in module/ card/ equipment is taken out.
- 4.5.5 The probability of Wrong Side Failure shall be less than 10^{-9} per train operating hour for the complete train control & signalling system supplied, installed and commissioned under this contract.
- 4.5.6 The safety performance requirement shall be achieved with a calibration/ inspection interval of not less than 1 year.
- 4.5.7 The safety of the Train Control and Signalling System shall be demonstrated by the Contractor in accordance with the process defined in GS.
- 4.5.8 The safety level of each function of the Train Control and Signalling System in Chapter 5 shall be defined and demonstrated by the Contractor in accordance with the process defined in GS.

4.6 Service Capacity

- 4.6.1 Service Capacity Requirements
- 4.6.1.1 The Train Control and Signalling System shall make provision for the sustained operation of EMU consists in both directions per hour with no cumulative delay between the terminal stations, and including turnback operation at the terminal stations.
- 4.6.2 Service Capacity Conditions
- 4.6.2.1 Per hour per direction service capacity requirement shall be achieved given the following conditions:
- (1) EMU station stops with 30-second dwells;
 - (2) Minimum two-minute train layover at all terminals;
 - (3) All merges, diverges, and conflicting moves;
 - (4) Train characteristics and performance as specified in Appendix A1 of this PS.
 - (5) Tender drawings and Systems being provided by other Project Contractors.

4.6.3 Train Types

4.6.3.1 The Train Control and Signalling System shall provide for the safe operation of the all train types including,

- (1) EMU consist
- (2) Empty rakes
- (3) Engineer's trains, Tower Wagons and Light locomotives
- (4) Accident Relief Train

4.7 Signalled Headway

4.7.1 Notwithstanding the service capacity requirement above, the Train Control and Signalling System shall provide a minimum theoretical signalled headway of 120 seconds on entire Line 2 signalled routes between -

Mansarovar and Badi Chauper terminals, including turn back operation at the two terminal stations

This headway shall be measured on the line using the respective EMU performance for 6-car trains with 30-second dwells at intermediate stations and a minimum 2-minute layover at the terminal stations. (minimum 30-second layover at Mansarovar and Chandpole when front crossover is used).

4.7.2 The Signalled Headway requirement of the Train Control and Signalling System shall be demonstrated by the Contractor for all the scenarios detailed in paragraph 4.7.1 above. The Contractor shall furnish the Employer with Design Data, formulas, calculations, and computer simulation logic, results and printouts for demonstrating that both safe braking and the specified theoretical headways have been provided by the design & obtain the approval of the Employer's Engineer.

4.7.3 In ATO mode, the Train Control and Signalling System should provide a minimum theoretical signalled headway of 115 seconds on entire Line 2 (Phase-1A & 1B) signalled routes detailed above.

4.8 Equipment Response Time

4.8.1 The response time for all equipment, except for point machines, irrespective of the location shall not generally be greater than 500 ms.

4.8.2 Equipment response times for all OCC, SCR, CER and SER equipment shall be inclusive of all processing time, display time and overheads.

4.8.3 Response time in this context is time taken for the equipment to process the commands (or input) and generate a signal at the output (or user display).

4.8.4 The response time of the Train Control and Signalling System shall be demonstrated by the Contractor as defined in Chapter 8 of this PS.

4.9 Station Stopping

4.9.1 Stopping Position

4.9.1.1 Stopping Positions shall be provided for each direction of travel, designed for end stopping of the EMU consist on the platform or optimised for platform entry/ exit locations.

4.9.1.2 The System shall provide for Stopping Positions for two lengths of trains operating on the system.

- 4.9.1.3 The requirement of paragraph 4.9.1.2 above shall be achieved with requiring any change in system software and/ or application software.
- 4.9.2 Stopping Accuracy
- 4.9.2.1 All trains in ATO mode shall stop within ± 500 mm for 99.98% of station stops.
- 4.9.2.2 When a train is stopped within ± 500 mm of the Stopping Position and proved to be stationary, it is said to be “docked”.
- 4.9.2.3 These stopping accuracy requirements shall be achieved with a 1% soap solution sprayed on the surface of the rails throughout the braking distance.
- 4.9.3 Door opening authorisation in ATP mode
- 4.9.3.1 If the Train stops within safety conditions for door opening authorisation (generally, -0.7m, +1m from the train stopping position), the train control & signalling system will provide the door enable signal to the train operator to open the doors manually on the correct side of the platform. If the train does not stop within the door opening authorisation window defined above, the Train Control and signalling system shall not provide the door enable signal to the train operator to open the doors manually on the correct side of the platform.
- 4.9.3.2 If the train has stopped outside the door opening authorisation window, the System shall provide the Train operator with the following three alternatives:
- (1) To attempt, in ATP mode, to reposition the train in case the train stops short of stopping position subject to a maximum creeping speed of 10 Km/h.
 - (2) To attempt, in ATP mode, to reposition the train in case the train overrun the stopping position subject to a maximum total reversing distance of 10 m (or as already implemented in JMRC); and
 - (3) To proceed to the next station in ATP Mode in case the train overrun the stopping position more than 10m. In this case, an alarm shall be activated by ATC system to indicate this condition. In addition ATC shall initiate a passenger announcement to this effect.
- 4.10 Recoverability**
- 4.10.1 In the event of failure of one operating mode, there shall be graceful degradation to another mode, which shall optimise service capacity while maintaining safety.
- 4.10.2 The Contractor shall demonstrate, during the on-site test and commissioning period, that the Automatic Train Supervision (ATS) shall recover a delay to service by utilising all available margin obtained from the difference between 5% and maximum performance for all inter-station runs and the difference between the nominal and minimum values for all station dwells.
- 4.10.3 The Contractor shall demonstrate that the Train Control and Signalling System can recover delays to scheduled train service.

- 4.10.4 The Contractor shall demonstrate that the Train Control and Signalling System can recover train service to constant service headway. For the purposes of this demonstration, a delay to a single train at any station of 2 minutes, with full train service of constant required headway (180 seconds), shall be recovered within 30 minutes. Recovery, in this context, shall be defined as all trains operating to a constant required headway (180 seconds), within the configurable tolerance, subject to review by the Employer's Engineer.
- 4.10.5 Bi-Directional Running
- 4.10.5.1 The Train Control and Signalling System shall provide for bi-directional running under all operating modes throughout the entire infrastructure of the Project. The Train Control and Signalling System shall provide full protection of ATP in ATP mode of the train running in both direction.
- 4.10.5.2 The bi-directional running requirement in ATP Mode shall be demonstrated by the Contractor.
- 4.10.6 Degraded Operation Modes
- 4.10.6.1 The normal mode of operation for trains equipped for ATP Mode shall be ATP Mode
- 4.10.6.2 In the event of failure, ATP Mode degrades to ROS Mode after stopping of train and a conscious action of the train operator of pressing the ROS button.
- 4.10.6.3 An alarm indication shall be provided within the train operator cab to indicate degraded mode of operation.
- 4.10.6.4 The degraded operation performance requirements shall be demonstrated as specified in Chapter 5 of this PS.
- 4.11 Ride Quality**
- 4.11.1 The Train Control and Signalling System shall control the movement of following trains to avoid frequent occurrences of acceleration and braking. This function shall not compromise the headway and capacity requirements.
- 4.11.2 The Train Control and Signalling System shall ensure that the jerk limit specified for the EMU consist is not exceeded. Detail were provided in JS02/ Rolling Stock Interface Specification and attached in Appendix A1.
- 4.12 Electro-magnetic Compatibility**
- 4.12.1 This Paragraph defines the minimum Electro-magnetic compatibility (EMC) requirements for all electronic and electrical equipment supplied under this Contract. For 25 KV ac traction area, the contractor shall follow EN50121 (Part 1 to 5) and Indian Railway RE practices or better. Refer to Paragraph 3.4.6 of GS for requirements of EMC management plan.
- 4.12.2 EMC control plan of JS02 contract shall be reused for this extension. Fresh EMC tests on JP/JS02 equipment used on this section without any hardware modification need not to be done.

4.12.3 If contractor envisage any updation/ modification in EMC plan than it shall include measures to reduce conducted, induced and radiated emissions to acceptable levels as specified by the relevant international standards. The plan shall specify measures to increase immunity of the Train control and signalling system. Particular attention should also be paid to additional requirements in grounding, bonding, shielding, filtering and cabling arrangements.

4.12.4 Not used.

4.12.5 Not used.

4.12.6 The Contractor shall co-ordinate with Project Contractors and ensures that the frequencies and bandwidths employed in the Train Control and Signalling System will not fall into the frequencies known to be major sources of interference.

4.12.7 The Contractor shall ensure that the fundamental frequencies, harmonics and cross products produced by the Train Control and Signalling System will not interfere with those of other systems in the Project.

4.13 EMC Tests

4.13.1 The contractor is required to conduct full EMC tests and the tests to be conducted shall include but not limited to satisfying standards as follows:

Overall Compliance:

EN50121-1

EN50121-2

EN50121-4

4.13.2 Specific Standards:

(1)	Electrostatic Discharge	IEC 61000-4-2
(2)	Radio Frequency field	IEC 61000-4-3
(3)	Electrical fast transient/burst	IEC 61000-4-4.
(4)	Surge	IEC 61000-4-5
(5)	Conducted RF	IEC 61000-4-6
(6)	Power Frequency magnetic field	IEC 61000-4-8
(7)	Pulse magnetic field	IEC 61000-4-9
(8)	Damped oscillatory magnetic field	IEC 61000-4-10
(9)	Voltage dips, short interruptions	IEC 61000-4-11
(10)	Oscillatory waves	IEC 61000-2-12
(11)	Harmonics and Inter Harmonics	IEC 61000-4-13
(12)	Voltage fluctuation	IEC 61000-4-14
(13)	Conducted disturbance	IEC 61000-4-16
(14)	Ripple of DC power supply	IEC 61000-4-17
(15)	Variation of power frequency	IEC 61000-4-28
(16)	Digital Radio phone	IEC (Latest draft)

- 4.13.2.1 The following specific EMC requirements shall be met by the design of the Train Control and Signalling System:
- (i) Radiated Emissions
As a minimum requirement, the maximum levels of radiated electro-magnetic interference (EMI) of the installation shall not exceed the levels specified in EN50081-2;
 - (ii) Conducted EMI
The maximum levels of conducted EMI of the installation shall not exceed the levels specified in EN50081-2; and
 - (iii) Induced EMI
The Contractor shall ensure that any cables supplied under this Contract other than power cables used by the System are properly screened, earthed and terminated to prevent noise and/or electric shock from exceeding the levels defined by the International Telegraph and Telephone Consultative (CCITT).
- 4.13.3 The maximum levels of induced voltages shall be as follows:
- (1) Longitude voltage to earth (continuous) 60V; and
 - (2) Longitude voltage to earth (Fault Conditions) 430V
- 4.13.4 The Contractor shall demonstrate with evidence that the induced longitude voltage on the cables does not exceed the levels specified in Paragraph 4.13.3.
- 4.13.5 Radiated Immunity Levels
- (1) Any sensitive electronic equipment supplied will operate in an environment with a substantial amount of radiated interference present. The equipment may be subject to radiated energy from hand-held transceivers and other communications systems.
 - (2) As a minimum requirement, the equipment must be immune to a field strength of 20V/m in the frequency range of 27 to 2000 MHz.
- 4.13.6 Conducted Immunity Levels
- The equipment supplied shall continue to operate correctly with no degradation in performance, when subject to the levels of conducted interference set out in the European Standard EN50082-2 in the frequency range of 150 kHz to 30 MHz
- 4.13.7 Electrostatic Discharge (ESD)
- Any equipment, which contains sensitive electronic components and is likely to be handled or touched by personnel or customers shall be protected against electrostatic discharge and shall be tested to 6 kV with contact discharge or 8 kV with air discharge as defined in IEC61000-4-2.
- 4.13.8 Fast Transient Burst
- In regard of fast transient burst, equipment supplied shall be tested to 2 kV peak in accordance with IEC61000-4-4.
- 4.13.9 Power Surge
- In regard of power surge, equipment supplied shall be tested to 2 kV (common mode) and 1 kV (differential mode) in accordance with IEC61000-4-5.

4.13.10 **Magnetic Field**

The Contractor shall ensure that any static or alternating magnetic fields generated in the environment shall not interfere with correct operation of any equipment to be supplied.

4.13.11 CRT Monitor: CRT monitors shall not be used, and all monitors supplied as a part of this contract shall be LCD-TFT type.

4.13.12 The Contractor shall conduct a preliminary EMI Hazard analysis at the conceptual design stage to identify sources of EMI likely to affect other system equipment and equipment sensitive to EMI; likely consequence in the event of failure and the proposed EMC measures.

4.14 Off-the-shelf Products

4.14.1 EMC test certificates shall be submitted to the Employer's Engineer for review for any standard off-the-shelf products.

4.15 Inter System EMC

4.15.1 The contractor shall ensure that all the Train control & Signalling equipment for phase 1B are designed and constructed in accordance with the latest issues or versions of internationally recognised EMC standards, including but not limited to EN50081, EN50082, EN50121, EN50123, IEC571, EN50155, IEC 61000 to ensure proper functioning.

4.16 Intra System EMC

4.16.1 The Contractor shall ensure that all intra system EMI are taken care of through proper design and other special measures. All major subsystems shall be tested for emissions and immunities in accordance with the appropriate international standards for equipment operating in Railway of similar industrial environment. Examples of these international standards are given in , but not limited to in the list of standards.

4.16.2 Where testing is not applicable due to factors such as size of subsystem or availability of test facilities, written approval shall first be obtained from the Authority for waiver of such tests. In this circumstance, an appropriate technical construction file shall be developed in accordance with EC EMC Directives and be certified by an appropriate Competence Body for the compliance of the EMC Directives.

4.17 Safety-related systems interference

4.17.1 Special attention shall be given to the immunity of the signalling systems to inter-system EMI due to its safety-related operations. Special tests shall be designed to ensure that the emissions from other apparatus, whether conducted, induced, or radiated conform with the specific requirements of the signalling system. Adequate safety margins between the immunity levels of these safety-related systems and the emission levels of other electrical and electronic equipment shall be adopted. Measures shall be taken to improve the immunity of the signalling system. These measures shall include, but not limited, to the following actions:

- (1) Proper grounding to reduce ground-loop coupling.
- (2) Proper cable shielding to reduce common-mode coupling.

- (3) Proper use of twisted-pair cable to reduce differential mode coupling.
- (4) All cable pairs in multi-pair cables shall be twisted.
- (5) Proper magnetic shield to reduce low-frequency magnetic field interference from the traction system.
- (6) Use steel cable supports (trunkings, trays, etc.).
- (7) All cable supports shall be grounded.
- (8) Correct choice of operating frequency.
- (9) Use of filter to reject out-of-band noise.
- (10) Proper use of surge arrestor.
- (11) Use of high-level modulation technique to improve the immunity of the system.
- (12) Use of redundancy codes/check sum, etc. to improve the immunity of the system.
- (13) Use of parallel-check technique to improve the immunity of the signalling system.
- (14) The probabilities of various conditions, which could lead to an unsafe operation shall be determined. An appropriate technical construction file suitable for safety audit shall be developed to demonstrate EMC compliance.

4.18 Environmental EMC

- (1) The train borne electronic and electrical equipment shall not produce significant interference with radio, television, tape recorders/players, heart pace makers, radar, computer systems, magnetic media, portable and cellular telephones, pagers etc. in the passenger saloon or externally. This includes action by static electricity, magnetic field and electric field.
- (2) Effect of emission on explosive or volatile / flammable material must be considered. BS6656 (Prevention of inadvertent ignition of flammable atmospheres by radio frequency radiation) and other related standards must be adhered to.
- (3) Effect of the low frequency magnetic field produced by traction on Jaipur MRTS grounding system as well as electrolytic weakening of underground structures should be considered wherever applicable.

4.19 Installation and Mitigation Guidelines for Cabling

4.19.1 The cables used in the signalling system shall be adequately protected against external interference. Additional protective measures, including but not limited to the use of metallic conduit, armour, ferrite choke, EMI filters shall be used to reduce such external interference wherever required. Covered conduit is preferred.

The cables shall also be installed at a safe separation from potential interfering sources, including power cables, LCX, etc. A cable routing plan shall be designed so that there are least likelihood of coupling between the signalling cables and the potential sources. The Contractor should refer to guidelines recommended by IEC61000-5-2 wherever possible.

4.19.2 Signal trunking

For protection against electrostatic capacitance coupling, direct electrical connection between ducts of power cables and signal cables shall be avoided.

For protection against electromagnetic induction, the latest versions of IEC61000-5 and/or other relevant standards shall be referred to wherever practical.

CHAPTER 5

5 FUNCTIONAL REQUIREMENTS

The functional requirements shall be in accordance with these specifications, design criteria (in Appendix D), specification of CBI (Appendix N), specification of ATC (Appendix O), and other requirements of this Particular Specification. In case of conflict between any of them the contractor shall seek the advice of Employer's Engineer.

Contractor shall upgrade all the system/subsystem so as to achieve same functionality and performance on Phase-1B as per the approved design of existing line and to make the system interoperable.

5.1 Operating Modes

5.1.1 The Train Control and Signalling System shall provide the following modes of train operation.

- (1) ATO Mode
- (2) ATP Mode
- (3) Restricted Manual Mode
- (4) Running on Sight Mode and
- (5) Cut-Out Mode

These modes shall be same as those on JMRC Phase 1A. The system on existing Line 2 [Phase 1A] and the respective extension of this line[Phase 1B] shall be interoperable.

5.1.2 ATO Mode

5.1.2.1 In ATO mode, the train shall operate without intervention by the train operator except when starting from a station stop. ATO mode shall operate under the supervision & controls of ATP functions.

5.1.2.2 ATO mode shall be the normal mode of operation on Phase 1B, same as in existing Phase 1A.

5.1.2.3 Trains capable of automatic operation shall be entered into service in ATO Mode.

5.1.2.4 In ATO mode, the ATO function controls the train braking and traction systems under the supervision of ATP.

5.1.2.5 In ATO Mode, the Train Control and Signalling System shall:

- (1) Accelerate and decelerate the train by applying traction power, coasting, and applying and removing brakes;
- (2) Automatically control speed, acceleration, preventing unnecessary braking, stopping and starting;
- (3) Stop the train at stations;
- (4) Provide all indications necessary to operate the train;
- (5) Determine continuously the Maximum Safe Speed (MSS) and Limit of Movement Authority (LOMA);

- (6) Prevent movement of the train in excess of the Maximum Safe Speed (MSS) and Limit of Movement Authority (LOMA);
 - (7) Open train doors on the correct side when the train is docked if permitted by the ATP door release; and
 - (8) Prevent the train from starting if train doors are not detected closed.
- 5.1.2.6 Train re-starting from a signal stop other to at station shall be automatic.
- 5.1.2.7 Train starting or re-starting from a station stop shall be initiated by the train operator.
- 5.1.2.8 The train operator shall have the capability of taking over control of the train any time while degrading the mode appropriately.
- 5.1.3 ATP Mode
 - 5.1.3.1 In ATP Mode the train will be driven by the train operator, obeying cab signals.
 - 5.1.3.2 ATP Mode shall be the normal mode of operation in the event of failure of ATO and shall be same as those on JMRC Phase 1A and interoperable.
 - 5.1.3.3 In ATP Mode, the Train Control and Signalling System shall:
 - (1) Provide Cab Signals and all other indications necessary to operate the train including current speed;
 - (2) Determine continuously the MSS and LOMA;
 - (3) Prevent train operation in excess of the MSS or LOMA;
 - (4) Provide audible and visual warning if the train speed exceeds the MSS;
 - (5) Enable train doors when the train is docked, enabling only the doors on the platform side of the train; and
 - (6) Prevent the train from starting if train doors are not detected closed.
 - 5.1.3.4 ATP Mode shall be available on all trains.
 - 5.1.3.5 Not Used
- 5.1.4 Restricted Manual Mode
 - 5.1.4.1 It is the default mode of operation in Depot; it remains in operation until sufficient conditions have been met to allow for a transfer to the Automatic train Protection (ATP) Mode.
 - 5.1.4.2 Restricted Manual Mode will be used to operate trains in depot.
 - 5.1.4.3 In Restricted Manual Mode the train speed shall be limited to 25Kmph. The train operator shall be given a warning, both audio and visual when the speed is above RM threshold but below 25 Kmph. This speed shall be enforced by On-Board ATP equipment.
- 5.1.5 Running on Sight Mode (ROS mode)

- 5.1.5.1 In ROS mode of operation, the mode Selector is in ATP position and ROS mode is selected by a ROS button/ Key and the train operator Runs On Sight. The only control is concerning the train speed which cannot exceed a maximum speed ROS – speed limit (25 Kmph) (Emergency breaking triggered by ATP system). The running monitoring is the same as for RM. The ATP will give Cab Signal indications as soon as the train reaches a track position where normal running can be resumed. The ATP authorizes the ROS request.
- 5.1.5.2 This mode remains in operation until sufficient conditions have been met to allow for a transfer to the Automatic train Protection (ATP) Mode. However, the train operator will select the ROS signalling mode in certain cases (e.g. following an emergency brake application).
- 5.1.6 Cut-Out Mode
 - 5.1.6.1 In Cut-Out Mode, the train will be operated by the train operator in accordance with line side signals and verbal instructions from the Controller.
 - 5.1.6.2 Cut-Out Mode is intended for use in case of complete trainborne Train Control and Signalling System failure preventing release of the emergency brake. The emergency brake will be held off by the train. The train-borne equipment supplied by the Rolling Stock Contractor will limit speed the speed at 25 kmph (Refer Signalling/ Rolling Stock Interface Specification in Appendix A1).
 - 5.1.6.3 The ATP By-pass Mode shall be initiated by the train operator operating a Safety Cut-out Switch (SCS). The operation shall be recorded by the On-board digital counter and TIMS. The SCS shall be provided by Rolling Stock Contractor. The On-board digital counter shall be provided by the JS02-Phase-1B. In this mode the train doors shall only be enabled and controlled manually.
 - 5.1.6.4 Cut-out Mode shall be available at all times, on all trains and on any line.
- 5.1.7 Call-On and Push-Out
 - 5.1.7.1 The Train Control and Signalling System shall allow for call-on or push-outs to be safely performed in the event of operational need to rescue a failed train using a functional train.
 - 5.1.7.2 Coupling of trains for call-on or push-out shall normally be performed in Restricted Manual Mode.
- 5.2 **Transition Between Modes**
 - 5.2.1 The Train Control and Signalling System shall allow the train to transfer from ROS to ATP automatically without stopping the train while it should be possible to select the ROS mode only at standstill. The Train Control and Signalling System shall allow the train operator to transfer from ATO to ATP modes at standstill. Transfer from ATP to ATO shall only be possible at standstill at a station stopping point.

- 5.2.2 In case of failure of ATP, the degradation to Cut-out Mode shall not be automatic. The train will automatically come to stop and the train operator shall change over to Cut-out mode by a manual switch. All such change over shall be recorded by an on board counter.
- 5.2.3 In the event that the train is above the MSS of the requested mode of operation, the Train Control and Signalling System shall adopt the requested mode of operation but shall brake the train to within the new MSS.
- 5.2.4 Effects of equipment failure
- 5.2.4.1 Minimising the effects of failure so that the train service may continue during times of equipment failure is of paramount importance. Consequently, the area of railway affected by the failure of an item of Wayside ATC equipment, which causes the use of RM/ ROS mode of operation, shall not be greater than the area between two adjacent stations or between the halfway points on either side of the station. In any case this RM/ ROS operation area shall not be longer than 900 m in the normal direction of travel.
- 5.3 **Safe Train Movement**
- 5.3.1 Operating Envelope
- 5.3.1.1 The Train Control and Signalling System shall ensure safe movement of all trains under all operating conditions by continuously generating a safe operating envelope defined by the LOMA and the MSS.
- 5.3.1.2 The LOMA shall be the furthest point to which the train may safely proceed taking into account margins for error in speed and distance measurement, calculating braking distances and equipment reaction times.
- 5.3.1.3 Not Used
- 5.3.1.4 The MSS shall be the maximum speed at which the train is permitted to travel without intervention by the Train Control and Signalling System. It shall be continuously calculated such that:
- (1) Civil Speed Limits are never exceeded;
 - (2) The speed limits for the type of train are never exceeded;
 - (3) Temporary Speed Restrictions are never exceeded; and
 - (4) The train can always stop without passing the LOMA.
- 5.3.1.5 A Target Speed shall be calculated for display to the train operator to provide advance warning of changes in MSS in ATP Operation.
- 5.3.1.6 Where the new MSS is lower than the current MSS, the Target Speed shall be calculated and displayed to the train operator in advance, such that the train may be braked to the new MSS with a normal service brake application.

5.3.1.7 Where the new MSS is higher than the current MSS, the Target Speed shall reflect this change immediately. The Train Control and Signalling System shall ensure a minimum train separation of 50 m. The Contractor shall submit this information to the Employer's Engineer for review.

5.3.2 Prevention of Movement Outside Safe Operating Envelope

5.3.2.1 The Train Control and Signalling System shall prevent train movement outside of the safe operating envelope by application of the service brake.

5.3.2.2 If the actual speed exceeds the permitted speed, a warning must be given to the train operator to enable him to react and avoid intervention from train borne ATC equipment at least 2 sec. before the intervention of the full service brake until the actual speed does not exceed permitted speed, then the train operator must be capable of selecting release of full service braking. The warning must continue until actual speed does not exceed permitted speed. The full service brake intervention and emergency brake intervention must be recorded. If the full service brake fails or is not adequate to stop the train at the target point, the trainborne equipment must apply the emergency brake.

5.3.2.3 **Station stopping Monitoring and Supervision**

5.3.2.3.1 The ATC system should provide advisory indications on the Driver's MMI to help the train operator to stop correctly the train in station. If necessary, the ATC triggers the Full Service Brake (FSB) in case the train operator has not correctly followed these indications.

Advisory indications: The ATC calculates a normal station stopping braking curve from the Station Stopping Point (SSP). When approaching the station, the train hits the curve and the ATC triggers an audible indication named Station Braking Announcement. From this point, the train operator must brake the train following this curve. He will be helped by two speed indications on the Driver's MMI: the advice speed and the warning speed. The advice speed is represented by a Yellow triangle which decreases following the normal braking curve. The warning speed is represented by an orange triangle located a few km/h above the advice speed triangle. The train operator will brake the train according to the advice speed. The train speed can stay below the advice speed or between the advice speed and the warning speed. In case the speed goes above the warning speed, an audible warning is triggered. Then, the train operator has a few seconds to react and go back below the warning speed. If not, the intervention is triggered.

Intervention: The ATC gives a few seconds to the train operator to react after warning. If not, the ATC triggers the FSB.

5.3.3 **Unauthorised Roll-Back**

5.3.3.1 The Train Control and Signalling System shall prevent an unauthorised reverse movement of the train by applying the emergency brake after a pre-determined distance.

5.3.4 Traction Supply Neutral Zone or Air gap

5.3.4.1 The Train Control and Signalling System shall ensure that no train or part of the train stops within the neutral zones (or Air gap). The Lineside signals shall also be located suitably.

5.3.4.2 The Train Control and Signalling System shall ensure that the train does not apply traction through neutral zones (Air gap) when in ATO Mode.

5.3.4.3 Locations of neutral zones, if planned, will be supplied by the Traction Power Contractor, as described in the Interface Specification in Appendix A5.

5.3.5 Emergency Stop Switches

5.3.5.1 Emergency switches shall be provided at each platform and in the SCR, one for each platform. The functionality of these switches shall be same as that on Phase 1A.

5.3.5.2 The switches shall be designed such that accidental misuse is prevented.

5.3.5.3 Operation of a switch shall have the following effects:

- (1) If an approaching train is more than its service braking distance from the platform, it shall stop with a service brake application;
- (2) If an approaching train is less than its service braking distance from the platform, or any part of a train is in the platform area, it shall stop with an emergency brake application;
- (3) If a train is stopped at the platform. It shall not be able to leave station until the switch is restored to normal position; and
- (4) Any departing train, where no part of it occupies the platform area, shall proceed as normal.
- (5) If the train has started from the Platform and part of it occupies the platform area, shall stop with the application of emergency brake.

5.3.5.4 Indications of which switch has been activated shall be provided at the site and on Workstations, and an audible alarm shall be raised at the OCC and SCR.

5.3.5.5 Platform Screen Doors

5.3.5.5.1 The signalling & train control system shall not preclude the future installation of platform screen doors, but neither hardware nor software for platform screen doors needs to be provided in this tender.

5.3.6 Points and Crossings

5.3.6.1 Point mechanism on this extension shall be MJ81 with VCC Clamp locks and Detectors operating on 380V AC in similar configuration and functionality as in Phase 1A.

5.3.6.2 Main line points shall be non-trailable. Main line point machine shall be used in conjunction with external mechanical lock. Main Line Point Machine shall be electric, operating on 3 ϕ -380V AC only..

- 5.3.6.3 Point machines shall be capable of operating points with Curved/thick web section with UIC 60 (60 kg/m) stock rail and 73 kg/m or 90 kg/m thick web section. Generally, 1:12/1:8.5 turnouts (1:9/1:7 turnouts for Standard Gauge) will be used. Nominal switch opening at toe will be 160mm.
- 5.3.6.4 Locking detection shall be provided to detect that the point lock is in the respective locked position before authorising a train movement over the points.
- 5.3.6.5 It shall be possible to operate trains through all points and crossings in all directions of travel. Loss of electrical power shall not cause a change of physical point status and the points and lock shall remain in the last operated position.
- 5.3.6.6 The Contractor shall provide point machine and all mechanical rail connections except those fittings explicitly stated in the interface specifications to be under the responsibility of track contractor. Detection shall be provided by Signaling Contractor as required by the length of the point.
- 5.3.6.7 Point detection shall be provided to detect that each switch is positioned with sufficient accuracy to ensure safe travel through the point before authorising a train movement over the points. The limits of Go and No-Go test shall be 2mm and 5mm respectively at 150mm from toe of the switch.
- 5.3.6.8 Where the points form a crossover, independent detection shall be provided for the points at each end of the crossover. The relative position between the point machines and the stock rail shall be fixed such that independent movement is prevented.
- 5.3.6.9 Provision shall be made for individual manual operation of each point. Electrical power shall get disconnected from the point drive under manual (crank handle) operation. Crank handles used for manual operation of point shall be interlocked with the interlocking such that removal of a crank handle shall prevent setting of relevant routes. The number of crank handles shall be minimised by suitable grouping such that the operational impact is minimal when a key has been taken out.
- 5.3.6.10 Not Used.
- 5.3.7 **Train Detection**
- 5.3.7.1 The Train detection equipment on main line shall be Audio Frequency Track Circuit, SDTC same as that on Phase 1A. All trains and vehicles shall be positively detected, whether moving or stationary, under all Modes of operation. The train detection device shall provide for detection of the broken rail, as much as possible.
- 5.3.7.3 Train detection shall be provided on the Main Line, sidings, reception lines. The back-up signalling shall use the same track circuit layout as designed for the ATP working for meeting the headway requirements.
- 5.3.7.4 Impedance bonds shall be provided wherever required. The Signalling & Train Control Contractor shall provide the impedance bonds. The Signal & Train Control Contractor shall work with the traction power contractor to assure that the impedance bonds provided meet the requirements for traction power return without compromising train detection or cab signal reception.

5.3.8 Interlocking

- 5.3.8.1 The Train Control and Signalling System shall meet the requirements of the CBI specifications as given in the Appendix-N of this PS and System shall meet or exceed the requirements of the CBI functional specifications of Phase 1A section.
- 5.3.8.2 Interlocking shall provide for an overlap for all the routes, which shall be proven in the Green aspect of corresponding signal. In the normal running direction, one-track circuit free of any points shall be used for the overlap. This shall also be achieved in reverse running direction, where simultaneous movements are possible. In other situations, or where such track circuit free of points is not feasible due to the track layout, points in the overlap shall be set and locked with the route.
- 5.3.8.3 Maintenance workstation shall be provided with each CBI, which shall have the capability of displaying any fault, error or log. The maintenance workstation shall log the change of status of all elements viz. track circuits, points, signals, route indicators, route etc. The centralised maintenance workstation at OCC shall get the information of all the interlocking units.
- 5.3.8.4 Separate Interlocking units shall be provided at all the stations with points and crossings (see Appendix R). The area of jurisdiction of the interlocking units shall be so configured as to cover the entire section. The plan for the same shall be submitted for approval of the Engineer. The contractor shall ensure that the effect of induced voltage is taken into account while designing the location and number of CBI units on the line. Wherever the induced voltage is likely to be more than as defined in clause 4.13.3, object controllers or separate interlocking unit at stations without points and crossings should be provided to cover the entire Line.
- 5.3.8.5 Each CBI shall be provided with a VDU workstation at SCR of interlocking station, which shall be used as a backup in case of failure of ATS.
- 5.3.8.6 The Contractor shall develop and submit the system configuration drawing, train movement specification, signalling plan and route table to the Engineer for approval. All Turnbacks permitted by the track layout shall be provided and shall be fully ATP protected. Turnbacks shall also be provided at each platform in both directions at all CBI stations (with or without points). Sequence Mode/ Cycles shall be provided at terminals, at intermediate terminals and at stations with points; see Design Criterion, Appendix D. All such possible sequences/ cycles shall be allowed for trains arriving in the normal running direction.
- 5.3.8.7 The system shall be provided in a dust-protected cabinet. If force cooling is required, the cooling fans shall operate on system power supply with over current protection arrangement. The equipment shall have door-locking arrangement.
- 5.3.8.8 The Interlocking shall provide Approach Locking, Route Locking, Route Releasing, Fouling Protection etc., in accordance with the Design Criterion, Appendix D.
- 5.3.8.9 **Route Control Modes**

5.3.8.9.1 The Interlocking System shall make available the following three operating modes for route control:

- (1) Manual Mode (Automatic release mode) - the route will be set on command from the Controller and will be automatically released after the passage of the first train or at reception of a route cancellation request, and a new request has to be sent for another train passage.
- (2) Fleet Mode - the route once set in fleet mode remains set, unless cancelled, irrespective of the passage of train.
- (3) Sequence Mode at termini - trains shall enter and leave platforms in a predetermined sequence with routes being set automatically.

5.3.9 Relays

5.3.9.1 The various types of relays used in interlocking systems shall comply with IRS specification no. S34 and the requirements of IRS, BS or BRS specifications or any other specifications as approved by JMRC.

5.3.9.2 Time element relays electronic type conforming to IRS/BS/BRS or of the specification approved by the JMRC shall be used. When electronic time element relays are used these shall be two in number and their contacts should be in series with each other.

5.3.9.3 The relays shall be preferably of the plug-in type and shall be same as utilised in phase 1A. The contractor shall seek the advice of Employer in case other than plug-in-type relays are proposed to be used.

5.3.9.4 All plug-in Relays and relay groups shall be fitted with non-interchangeable interlocking device to prevent the wrong relays/relay group being accidentally plugged in during replacements.

5.3.9.5 Removal or replacement of plug-in relays/relay groups from the relay racks during operation shall not cause any unsafe conditions in the circuits.

5.3.9.6 Contractor shall provide auto-contact jam detection and contact bounce elimination function for all relays to ensure proper operation of the system.

5.3.9.7 All relays shall be housed in the SER to achieve maximum centralization.

5.3.9.8 All relays shall have 10% of working contacts as spare subject to a minimum of one front and one back contact.

5.3.10 Tunnel Ventilation Shaft Section – Underground portion

5.3.10.1 This shall be a non-vital function.

5.3.10.2 A logic shall be build in ATS system of The Train Control and Signalling System, which shall prevent any train from leaving a station until the front of the train ahead has arrived at the ventilation shaft ahead & is continuing its journey. In case the distance between two underground stations is long, there may be additional ventilation shafts in between two stations. If this presents a problem in achieving required headway, the Contractor shall immediately notify the same to the Engineer.

5.3.10.3 It shall be possible for the controller from OCC to remove and restore the above restriction section by section.

5.3.10.4 The Train control & Signalling System shall provide an alarm to the SCADA system controlling the tunnel ventilation system.

5.3.11 Cables

5.3.11.1 The Contractor shall work out the requirement of cable, size wise. The cables shall be supplied & installed as per Chapter 3, Appendix I & J of this PS. The Installation and mitigation guidelines with reference to EMC requirements are as given in Chapter 4 of this PS.

5.3.12 Power Supply

5.3.12.1 UPS Equipment

There will be common UPS for Signalling & Train control, Telecommunication and Automatic Fare Collection Systems. The UPS supply will be made available to JS02-Phase-1B contractor at a shared location in the UPS room; and further distribution, protection arrangements, DC supply etc. shall be the responsibility of JS02-Phase-1B contractor.

5.4 Temporary Speed Restrictions

5.4.1 The Train Control and Signalling System shall provide for temporary speed restrictions to be applied from the ATS workstation, and from interlocking VDU at station depending on the existing level of control. These shall be applied in the logic, in the same manner as implemented on existing line.

5.4.2 No Train Control and Signalling equipment failure shall cause the loss of an imposed temporary speed restriction.

5.4.3 No loss of power supply shall cause the loss of an imposed temporary speed restriction.

5.4.4 It should be possible to apply temporary speed restrictions in steps of 5 Kmph .

5.4.5 Temporary speed restrictions shall be capable of being imposed over any track segment that includes one or more track circuits.

5.4.6 Temporary speed restriction shall be in effect for the entire train. A train or train length is to be taken into account when the train leaves the speed restriction section. The train must observe the permitted speed within the speed restriction section until the tail end of the train has passed the speed restriction section.

5.4.7 Temporary speed restrictions shall only be lifted in a safe manner.

5.4.8 The Train Control and Signalling System shall ensure that no one can inadvertently remove or modify a temporary speed restriction.

5.5 Maintenance Blocks, Route Blocks, Signal Blocks and Point Blocks

5.5.1 The Train Control and Signalling System shall provide for means to restrict movements or physical state of a point equipment to facilitate safety during maintenance activities. These shall be applied in the interlocking logic, in the same manner as implemented on existing Line.

5.5.2 It shall be possible to impose and lift Maintenance block (movement not possible towards the blocked area from either direction), Route block (particular route is blocked), Signal block (particular signal blocked) and Point block (throwing of point blocked) from the ATS Workstations and from interlocking VDU at station depending on the existing level of control. The logic shall be implemented in the interlocking and the logic shall be in same manner as implemented on existing line.

5.5.3 Commands for lifting blocking restrictions shall require a second confirmation from the operator.

5.5.4 Loss of power shall not release any blocking restrictions.

5.6 Not Used

5.7 Train Stopping

5.7.1 Station Stopping

5.7.1.1 In ATO Mode, the Train Control and Signalling System shall ensure that trains stop with the accuracy specified in Chapter 4. This shall be implemented in the same manner as done on existing line.

5.7.1.2 Docking shall be achieved if the train is stopped within the limits defined in chapter 4 of this PS and proved to be stationary (or moving at less than 1 km/h).

5.7.1.3 A visual indication shall be provided to the train operator when the train has docked.

5.7.1.4 If docking is not achieved due to the train overrunning the Stopping Point, the Train Control and Signalling System shall permit a single reverse movement of no more than 10 m.

5.7.1.5 When reversing following failure to dock, train speed shall be limited by the Train Control and Signalling System to maximum 10 km/h.

5.7.1.6 Audible and visual alarms shall be provided to the train operator if this reversing speed limit is approached.

5.7.2 Train Doors

5.7.2.1 An enable doors signal shall be provided for train doors, indicating left-side, right-side or both-side, as appropriate for the station, when both the following conditions are met:

5.7.2.2 (1) The train is stopped within the performance limits; and

5.7.2.3 (2) Train speed is lower than 1 km/h.

5.7.2.4 This signal shall be available to the train within 0.5 s of these conditions being achieved.

- 5.7.2.5 In ATO Mode, the Train Control and Signalling System shall initiate door opening when the enable doors signal is sent. In ATP Mode, the doors will be opened by the train operator.
- 5.7.2.6 Provision shall be made for the train operator to prevent door opening in ATO Mode.
- 5.7.3 Cab Side Door Interlock
- 5.7.3.1 In ATO Mode only, the train shall be prevented from departing unless all cab doors are closed.
- 5.8 **Not Used**
- 5.9 **Equipment Reset**
- 5.9.1 All Train Control and Signalling System equipment shall be provided with a reset function to allow the equipment to be restarted following failure without powering it down.
- 5.9.2 Use of the reset shall not cause any logged data to be lost.
- 5.10 **Train Identification**
- 5.10.1 The Train Control and Signalling System shall uniquely and positively identify every train. The train description shall consist of 4 numeric characters. The train Id consists of first two digits to identify the current destination and last two digits to identify the service. The Service identification remains constant during the service, the Destination identification changes at each trip or turn back. The Undetermined trains should be numbered outside the above normal range. When the train is situated in the depot or on the mainline (Not in revenue service), the follow-up carries out from the "Rake Id" of this train (Range 0000 to 0999). Such a train identity is attributed manually from the Depot ATS or Central ATS in according to location of this train respectively depot or main line. The attribution is automatic when the train terminates the current service.
- 5.11 **Signals and Signs**
- 5.11.1 Line side signals
- 5.11.1.1 Line side signals shall be installed on the Main Lines at the entry to all routes (interlocking) for bi-directional working. The line side signals shall be placed, on the left hand side of the track to which it refers, unless authorized otherwise under special instruction or any space constraint.
- 5.11.1.2 Contractor shall submit the design of line side signals including the route indicators and shall obtain the approval of Engineer. The line side signals and route indicator shall be rugged, reliable, aesthetic, of proven design and shall be based on International Railway standards. The Contractor shall submit a copy of standards and specifications and obtain approval of the Employer.
- 5.11.1.3 Mainline Signals shall be three-aspect colour light signal. The sizes of the signal unit shall be so designed so that it does not infringe the requirements of structure gauge without affecting the visibility of the signals. Each unit shall be equipped with a hood & background.

- 5.11.1.4 Route indicators shall be provided on main line to indicate each route wherever a signal can lead to more than one route and shall be mounted on the signal in such a way that it does not infringe the requirements of structure gauge.
- 5.11.1.5 Bi-directional operation shall be considered in sighting of the line side signals. Signals shall be sited to avoid confusion to the train operators and where they are necessary on adjacent tracks shall be located parallel with one another.
- 5.11.1.6 Line side signal on Main Line shall be provide adequate sighting distance. The sighting distance should not cause any constraint on the speed of train operation. Contractor shall submit the calculations along with proposed design for the approval of Engineer. The sighting distance at 25 kmph shall be considered not less than 150 m.
- 5.11.1.7 All signals including main, buffer stop and route indicators shall be rugged, reliable, of reputed make, aesthetic, matching best industrial quality, of proven design and high performance LED type in accordance with International Standards. The Contractor shall submit a copy of standards and specifications and obtain approval of the Employer. Route indicator shall be LED matrix type capable of displaying -
- M for Main Line
- D for first diversion
- S for second diversion and
- T for third diversion, as the case may be
- 5.11.2 Line Side Signal Aspects
- 5.11.2.1 The mainline line side signal aspects shall be as under:
- Red:** Stop: Route not set and locked, or the first track circuit after the signal is occupied (or one of the two track circuits for a cross over)
- Violet:** Conditional proceed: Route set and locked, and the first track circuit after the signal is clear (or two track circuits of the cross over) or the green aspect is failed or the route indicator is failed
- Green:** Proceed: Route set, locked and the track circuits to the next route signal are clear and the overlap locked. Signals and track circuits shall be planned in such a way that one-track circuit free of points is provided, to be used as overlap in all cases. A signal shall not show Green aspect unless the overlap is set and locked.
- 5.11.2.2 Cascading of Signal aspects
- (1) Green aspect → Violet aspect: On failure of Green aspect
- (2) Green aspect → Violet aspect: On failure of Route Indicator
- (3) Violet aspect → Red aspect: In such case, Target speed on the Cab signal shall reduce to zero, not to create any conflict between the Cab signals and Line side signals

- 5.11.2.3 In 'ATP mode' Violet shall be interpreted by the train operator in accordance with the target speed/ distance displayed. In RM or ROS or Cut-out modes, Violet aspect shall be interpreted by the train operator as Stop. In RM or ROS or Cut-out modes, train operators should never pass a signal showing
- A Red or Violet aspect, until the train operator obtains a formal authorization from the controller under the rules laid down in the JMRC General Rules.
 - An extinguished signal, until the train operator obtains a formal authorization from the controller under the rules laid down in the JMRC General Rules
- 5.11.2.4 Route indicators mounted on the main signal shall be used to display the route as the case may be with both Green aspect as well as Violet aspects to indicate the movement through the interlocking.
- 5.11.2.5 Aspects shall be designed to be clearly visible at the required sighting distance under all weather conditions including rain and direct sunlight.
- 5.11.2.6 Buffer Stop Signals: The Train Control and Signalling System shall provide stop signals at each buffer stop incorporating a fixed red lamp/LED.
- 5.11.2.7 Lamp/LED proving shall be provided for all line side signals, 7 route indicators, buffer stop signals. The failure shall be logged and indicated on ATS Workstations and on CBI control workstation.
- 5.11.3 Line side Signs
- 5.11.3.1 Line side signs shall be provided as required by the System. These signs shall include but not be limited to:
- (1) ATC Begins Marker
 - (2) Restricted Manual Mode marker
 - (3) Stopping Reverse Marker Board
 - (4) Speed restriction signs for speed less than 25 kmph
 - (5) Change operating mode;
 - (6) Depot Connecting Track stopping point
 - (7) Point number plates;
 - (8) Normal stopping marker board (Stopping Position); and
 - (9) Signal number.
- The contractor shall develop a numbering scheme for signal gears & obtain Engineer's approval. The design of marker boards shall be consistent with the design on already working lines of Jaipur Metro/.
- 5.11.3.2 The provision or non-provision of any sign or signal shall be submitted for review by the Engineer, as shall the form of any sign or signal provided.

5.12 Automatic Train Supervision System

5.12.1 The ATS system of 1B section shall be integrated with the ATS system of existing line. The ATS system shall have all functionalities and data processing facilities as per approved ATS design for existing Line [Phase 1A]. Please note that Central redundant servers located at Mansarovar OCC. OCC's ATS servers and other equipments shall be upgraded and be able to achieve same functionality and performance on Phase-1B as per the approved design on existing Line . ATS system shall have data processing facilities & achieve the minimum following main functions but not limited to:

- Monitor CATC equipment (Interlocking, ATP and ATS equipment)
- Signalling equipment management
- Perform automatic route setting, automatic train regulation etc.
- Train Descriptor, Monitor & regulate train movement continuously
- Display information on PIDS and PA system
- Generation of the schedules
- Training facilities for operators
- Operation assistance including Generating alarms & store system-operating data

5.12.2 The ATS sub-system is divided into three categories:

- Category 1: Communication with external systems & Local signalling operation. Automatic signalling operation from Local ATS server at station.
- Category 2: Central Operation: Automatic signalling operation from central ATS server at OCC.
- Category 3: Off-line operation (Upgradation of ATS software is required to cater the requirement of phase-1A & 1B, without disturbing the operation of existing ATS system).

5.12.2.1 The ATS sub-system component of Category 1 shall be composed of Local Redundant LAN, Redundant server(s), Field Interfaces and Operator workstations.

Interface between software components of Category 1 and external sub-systems shall include Local Server to CBI, Local server to ATC, Local server to Radio System and Local server to PA/PIDS.

5.12.2.2 The ATS sub-system component of Category 2 shall be composed of WAN, Local Redundant LAN at OCC, Redundant server and Operator workstations. For WAN, redundant point-to-point 2 Mbps channel will be made available to JS02-Phase-1B Contractor between OCC and each interlocking station by the Telecom contractor. See Appendix A3 for details.

Interface between software components of Category 2 and external sub-systems shall include Central server to Radio System, Central server to PA/PIDS, Central server to Mimic Panel, Central server to Master clock system.

The central server shall also have redundant link to Local server(s).

5.12.2.3 The ATS sub-system component of Category 3 shall be composed of:

- Off-line Redundant LAN
- Off-line redundant servers
- Off-line workstations
- Playback system
- Training Simulator

5.12.2.4 The ATS system shall provide as a minimum the following functions:

- Monitoring of signalling equipment
- Control of signalling equipment
- Train detection and train follow-up
- Track-Circuit management
- Train identifier
- PTI management
- Inter-station stop detection management
- Automatic route setting
- Delays and departure/arrival times of scheduled trains management
- Dwell and inter-station running times management
- ATS train hold management
- Skip stop station management, keep doors closed
- On line timetable management
- Delay distribution management
- Manual shifting management
- Passenger information management
- TSR management
- Rolling stock management
- Crew management
- Change of ends request
- ATS sub-system supervision
- Alarms & Events management
- Time management
- Operating System Administration
- Off-line timetable management
- Quality of service

- Playback management
- Training Simulator and Trainee positions
- All functions (operating modes)
- Man Machine Interface (MMI)

5.13 ATS Hardware and Architecture

5.13.1 ATS hardware for the extensions shall be compatible with the hardware of existing 1A. Also note Redundant LAN, including optical fibre cables, shall be provided at stations and shall be connected through redundant optical switches to form a redundant network. The bandwidth shall meet all the functional, performance and redundancy requirements. Redundant optical switches shall be provided at all stations.

5.13.2 Communication redundancy meaning at least two physically distinct communication media shall be available between sender and receiver throughout the entire communication path, no matter how many intermediate nodes the message must go through. The redundancy shall be in LAN, Ethernet switches, FEPs etc. There shall be dual redundant communication medium between any two-computer units of OCC, between the CATS/ LATS servers, between the CATS/ LATS servers and the operator & maintenance workstations.

5.13.3 The hardware of the system shall be based on the proven design philosophy and shall be fault tolerant and modular. The redundancy shall be built in the hardware both in the external equipment interface and also in the OCC network equipment interfaces/ link such that no single failure will lead to shut down of the ATS functioning. Route diversity for cable entry points from field shall be provided in order to provide better reliability & availability of the circuits. The software shall be based on open system concept and shall have portability and inter operability across multi vendor environments.

5.13.4 The contractor shall submit the hardware specification of the servers to meet the functional and performance requirements as specified in chapter 4 and chapter 5 of PS. The specification of the server shall be based on latest configuration available at the time of supply. There shall be external redundant links to CBI, ATC and redundant link to LAN. A screen, keyboard and mouse shall be available for server administration purpose only and it shall be integrated inside the cubicle.

The cubicle for the ATS shall integrate:

- The redundant local server
- The redundant LAN
- The field interface equipment
- All cables between integrated equipment
- Appropriate connectors for external links: power supply, links to CBI/ ATP, links to operator workstations, links to network

5.13.5 The contractor shall submit the hardware specification of the Operator Workstation to meet the functional and performance requirements as specified in chapter 4 and chapter 5 of PS. There shall be redundant link to Ethernet LAN (2 single Ethernet port boards in the PC, with a software able to manage these boards).

5.13.6 Ethernet network shall be based on a 10/100/1000 Mbits standard.

5.13.7 Sizing Performances: The ATS system shall support the following or better:

Definition	Central ATS	Local ATS	Depot ATS
Number of I/O values	100,000	10,000	10,000
Number of Field events per second	100	20	20
Number of operator position	64	8	20
Number of monitor per operator	4	4	4
Number Local ATS per ATS central	64		
Number of CBI per ATS	128	8	8

5.13.8 Timing performances

Definition	Time		
Time interval from the arrival of one information in the Server and its screen display	1 second		
Duration to display and update a mimic including 500 visible graphic symbols. The number of graphic symbols must be virtually unlimited (> 10 000).	2 s without cache 1 s with cache		
Duration to display and update a mimic including 2000 visible graphic symbols .The number of graphic symbols must be virtually unlimited (> 10 000).	4 s without cache 1 s with cache		
Time interval from operator action(mouse click, keystroke,...) to its screen display	0.5 s		
Response time between operator command and field acknowledgement (Without WAN/LAN time, nor Field Interface Unit Latency)	3 s		
Retrieving data from a set of 24 hours archive.	10 s		
Switching time of server	6 s		
Start up of one operator position	30s		
	CATS	LATS	DATS
Start up of one server (not including OS start up time)	10min	4min	4min

5.13.9 The ATS functions shall be available in OCC, SCR(s). Train Describer facility of Depot will be available in OCC.

5.13.10 The ATS user profiles shall have the following area of operations:

ATS user profile	Entire Line(Phase 1A & 1B)	Local ATS	CBI sector	Depot ATS
OCC chief controller	Yes	Yes		Monitoring
OCC assistant chief controller	Yes	Yes		Monitoring
OCC traffic controller	Yes	Yes		Monitoring
OCC rolling stock controller	Yes			Monitoring
Fault management controller	Yes			Monitoring
OPC				
CATC system development				
DCC crew controller				Yes
DCC depot controller		Monitoring adjacent to depot		Yes
Crew controller Terminal station	Monitoring	Monitoring		Monitoring adjacent to LATS
SCR station controller	Monitoring	Yes	Yes	Monitoring adjacent to LATS
SER technician	Monitoring	Monitoring	Monitoring	No
System administrator at OCC	Yes	Yes		Yes

5.13.11 The ATS system shall ensure central control from Operation Control Centre, local control from each main line Station Control Room, and depot control from Depot Control Centres. The ATS networking shall guarantee the fault tolerance, transfer of controls between control levels, hot redundancy ensuring transparent switchover, ATS scalability and without loss of data.

5.13.12 The ATS system shall have redundant link with other systems: CBI system, ATP system, Tunnel Ventilation System, Radio system, PAS/ PIDS.

5.14 **Control Locations**

5.14.1 Workstations for control are provided in the following locations:

- (1) Operations Control Centre (OCC);
- (2) Depot Control Centre (DCC);
- (3) Station Control Room (SCR);

5.14.2 All Workstation functionality shall be independent of the Workstation's location. The available functionality for a particular Workstation shall remain subject to the Controller's assigned area of authority (AOA) and area of control region (ACR).

5.14.3 The workstation at the Operations Planning Centre shall be capable of displaying any of the screens available at the OCC but shall not be able to send any controls.

5.14.4 The workstation at the Software Development Facilities Centre shall be used for software development. These changes shall only be performed off line.

5.14.5 All operational workstations of existing line [Phase 1A] and OCC/ DCC shall be upgraded to include this extension [1B] as per requirement.

5.15 **Levels of Control**

5.15.1 There shall be two levels of control:

- (1) Central Control from the OCC and
- (2) Local Control from the SCR.

5.15.2 Workstations provided in the OCC for Central Control to be updated to include 1B section.

5.15.3 Up gradation / updation in ATS workstations shall be provided as per the list given in Appendix C.

5.15.4 Not Used.

5.15.5 The network shall support installation of additional workstations of the line at a remote Backup Control Centre in future.

5.16 **Local control from Station**

5.16.1 An ATS Workstation shall be provided in each SCR.

5.16.2 Station Control shall provide all the functions under authorization of OCC, and verbally under OCC authorization upon failure of OCC if it is not in operation.

5.16.3 In addition to ATS workstation in each SCR, the SCR's of the stations having CBI or CBI field interface unit shall be provided with an interlocking VDU display as a backup. The SCR controller shall be able to operate the interlocking from the interlocking VDU.

5.17 **Technician's workstation**

5.17.1 SMR of each station provided with CBI shall be provided with ATS workstation. Secondary station SER shall have facility to plug the maintenance laptop.

5.17.2 The Technician's work station shall have following:

- (1) Indication of position of all trains in the area and approaching the area of control;
- (2) Indication of all local equipment and route states;
- (3) Alarm conditions and status;
- (4) Not Used. ;
- (5) Acknowledge alarms; and
- (6) Analysis of fault logs and data log

5.18 Transfer of Control

- 5.18.1 The Train Control and Signalling System shall provide a mechanism to transfer train control from the OCC to a specified station and vice versa. This mechanism shall be co-operative; the OCC and SCR must both agree to the change in control. Stations under station control shall be clearly displayed as such upon the line overview display and the mimic panel.
- 5.18.2 The system shall also provide a cooperative mechanism to transfer train control from ATS to interlocking VDU and vice versa.
- 5.18.3 It shall be possible to take Emergency control of any CBI from interlocking VDU at SCR without any cooperative mechanism. All such events shall be logged with time stamp and an inbuilt increment counter. The interlocking VDU shall log all safety critical commands with time stamp and an inbuilt increment counter.
- 5.18.4 Simultaneous operation from ATS works station and interlocking VDU shall not be possible.

5.19 Degraded Operation

- 5.19.1 Scheduled regulation, Constant Headway regulation, manual regulation shall be available to regulate the train in the event that a failure causes the loss of Central Control functionality.
- 5.19.2 The Central ATS server will hold the timetable for the trains to run as per schedule. The central ATS shall send the actual schedule type for the day to the Local ATS server at each location every morning when the system is started. In this way the trains can run normally, receive dwell, coasting and departure information in the event of failure of central control. If the station is in local operation mode the information handled by the Local ATS shall be sent to the central ATS on restoration of Central Control functionality to keep track of trains.
- 5.19.3 All the ATS functions of central control shall be available for first level of degradation to automatic operation from Local ATS. The local control from the station will in the first level of degradation work with schedule regulation, in the second level of degradation in the constant headway mode, in third level of degradation in manual mode from the ATS workstation.
- 5.19.4 The system will be operated with the interlocking VDU from each station having interlocking unit or field equipment interface in the event of failure of Local ATS.

5.20 Control Equipment Status

- 5.20.1 The status of all control equipment shall be monitored and displayed on all Workstations. Controller Log-On, Area of Authorisation and Area of Control Region
- 5.20.2 The Train Control and Signalling System shall require Controllers to execute a log-on sequence before any commands are available on a Workstation.
- 5.20.3 The log-on sequence shall, as a minimum, require the Controller to enter both a unique user name and password.
- 5.20.4 The System shall enable immediate access to all authorised indications and commands following log on and allocation of AOA and ACR.
- 5.20.5 The AOA granted to a Controller shall define the functions and commands that are authorised and accessible by the Controller on the Workstation.
- 5.20.6 The ACR granted to a Controller shall define the geographical region(s) over which the Controller is authorised to exercise control from the Workstation.
- 5.20.7 The Contractor shall define the initial AOAs and ACRs for each of the Controllers.
- 5.20.8 The System shall provide the facility to modify, add, regroup, and remove AOAs and ACRs by the Chief Controller.
- 5.20.9 The Chief Controller shall have the capability of logging in to any workstation. Upon logging in to that workstation it shall become the Chief Controller's position.
- 5.20.10 Only one Chief Controller's position shall be operative at any one time.
- 5.20.11 The ACR of the Traffic controller shall allow control of a discontinuous area.

5.21 Workstation Display

- 5.21.1 The System shall provide, as a minimum, the following displays on all Workstations:
- (1) Line overview diagram;
 - (2) Available and assigned AOA/ACR;
 - (3) System alarms history and alarm management;
 - (4) Available and assigned timetables;
 - (5) System equipment connection status;
 - (6) ATR tools - performance graphs;
 - (7) ATR related screens/pages;
 - (8) Data logging viewing and management; and
 - (9) Correspondence between Train ID & Rolling Stock, Train Radio, Crew number.
 - (10) All alarms/ display functions available on SCR CBI control workstation shall also be available in OCC workstations.
 - (11) Status of station control mode (Local/ Central/ VDU)

5.22 Line Overview Diagram

- 5.22.1 The existing line overview diagram shall be updated to include 1B section and shall provide a concise, uncluttered and logical view of the track layout for complete

Corridor including train movement and equipment status by employing different colours. The colour scheme shall be same as approved in Phase 1A. All modification shall be done onsite without disturbing the existing revenue operation.

5.22.2 The line overview diagram shall consist of, but not be limited to, permanent, detailed and dynamic indications.

5.22.3 Line Overview Diagram - Permanent Display

The line overview diagram shall permanently display, as a minimum, on all magnification levels, the following:

- (1) All tracks and turnouts;
- (2) Block boundaries;
- (3) Stations, station names, platforms and platform identities;
- (4) All points;
- (5) Signals;
- (6) Neutral zones;
- (7) Tunnels; and
- (8) Bridges.

5.22.4 Line Overview Diagram - Detailed Display

The magnification feature shall not only magnify the line overview, it shall add additional information and details at a higher magnifications levels as follows:

- (1) Point identities;
- (2) Block identities;
- (3) Signal identities; and
- (4) Maintenance blocks and temporary speed restriction zones.

5.22.5 Line Overview Diagram - Dynamic Indications

The line overview diagram shall display, on all magnification levels, at least the following dynamic indications:

- (1) Train position and identity;
- (2) Operating mode of each train;
- (3) Route status;
- (4) Point detection status;
- (5) Point lock status;
- (6) Train door status;
- (7) Signal status;
- (8) Direction of train travel;
- (9) Platform hold status;

- (10) Train hold status;
- (11) Central/ station control status;
- (12) Fleet mode status;
- (13) Sequence mode status;
- (14) Dwell countdown clock;
- (15) Point block status
- (16) Signal Block status
- (17) Maintenance Block, Route Block, Point Block, Signal Block status and information;
- (18) Platform Emergency Plunger status.
- (19) Train Delay
- (20) Headway Value,
- (21) Non-Descriptive train status for a train without a run number.
- (22) Alarms;
- (23) Train ready
- (24) Cycles in the terminal stations and intermediate turn back station; and
- (25) Any other indication required by the Specification.

5.22.6 The line overview diagram shall comprise of three different type of views:

- (1) Overview of the complete line on one screen: All tracks and turnouts, block boundaries, station names, platforms and platform identities, dynamic track position, train position and identity, train delay information;
- (2) Detailed display in continuous span to display any portion of line, sidings and stations with possibility of different magnification levels
- (3) Individual discrete detailed displays of each interlocking areas (or more than one interlocking area per display) configured in most optimised manner

5.23 **Man Machine Interface**

5.23.1 The Contractor shall provide same type of MMI in 1B section as developed and approved during phase 1A with necessary modification and submit to the Employer's Engineer for review prior to their implementation.

5.23.2 Colours chosen for distinguishing between different functions and alarms displayed on each of the Workstations and mimic panel shall be of good contrast, easily distinguished by the average person.

5.23.3 As a minimum the controls shown in Appendix G had been provided from the functional OCCat Mansarovar to the field. Appropriate controls shall be provided from the SCR of 1B section to the field.

- 5.23.4 As a minimum the indications shown in Appendix F were provided from the field to the OCC. Appropriate indications shall also be provided from the field to the SCR of Phase-1B section.
- 5.23.5 The MMI shall be user friendly, menu driven and same as approved in Phase 1A. Whenever information is required, it shall prompt the operator and shall guide him to give the correct input/information. In case of safety critical commands like that of remote control or removal of blocking restrictions, double checking facility shall be available for doubly ensuring the correctness of command that has been input by the operator. Various help levels shall be available for helping the operator. It should be possible to select the required option with minimum number of operations.
- 5.23.6 The system shall be designed so as to achieve the overall objective of providing instant information for having meaningful action. The vital response times of time between a change of state at a remote station and its display at OCC, the time taken between initiating of a command and its display on the OCC etc. shall be considered in design to cater to overall equipment response time as laid down in Chapter-4 and 5.13.8 of this particular specifications.
- 5.24 **Workstations**
- 5.24.1 The Workstation shall consist of all equipment necessary to provide the specified display and command functions for one Controller and shall be in line with approved Phase 1A system. Work Stations MMIs shall be provided as per the list given in Appendix C.
- 5.24.2 Workstations for traffic controllers' desk having three monitors each, with a facility to run them concurrently independent of each other, is to be updated to include 1B section.
- 5.24.3 Each Workstation shall be equipped with only one keyboard, and one pointing device regardless of the number of screens or processors used.
- 5.24.4 All Workstation displays shall support high-resolution (1280x1024) colour graphics. All the workstations (in stations, ~~depot~~, maintenance room, crew room etc.) shall be with 20" LCD screens.
- 5.24.5 A4 size colour laser printer shall be provided in the SCR or SMR of interlocking stations. At all other SCRs, port for printer shall be provided.
- 5.25 **Mimic Overview System**
- 5.25.1 The Contractor shall modify the existing video wall / mimic overview system to incorporate whole line from Mansarovar to Badi Chauper at OCC & at other controller MMI positions. All modification shall be done onsite without disturbing the existing revenue operation
- 5.25.2 The Video Wall/mimic panel shall display minimum following:
1. Real time train movement using track circuits' status
 2. Display train ID of moving train
 3. Position of points (locking & detection) & status of routes

4. Track circuit failure or track circuit “put out of service” shall allow the progression of train movement to be followed on the mimic panel without the loss of train description using train trekking algorithm.
5. In addition following alarms shall be displayed on the mimic panel:
 - Trouble (Station equipment failure – CBI and ATP)
 - Power failure (No power supply to SER equipment's)
 - UPS failure (for UPS1 & UPS2).
 - Train Ready
 - Train door status
 - Blocking/ unblocking of points, route, signals and maintenance blocks.
 - Cycles in the terminal stations and intermediate turn back station.

5.25.3 Not Used.

5.25.4 On the mimic display, train progression will be displayed by Train ID in the Train ID box. Train ID box will be provided at all platform lines, sidings and in section between any two stations for each line. In case of more than one train in a section on the same line, an additional LED indication shall be displayed on the mimic display and also on the VDU.

5.25.5 Not Used.

5.25.6 The mimic display shall be clearly readable in lighting of 550 lux.

5.25.7 Not Used.

5.25.8 Not Used

5.26 **System Alarms and Alarms Management**

5.26.1 Controllers shall have the ability to view and take action upon alarm conditions incoming to the System. The alarms shown in Appendix E shall be provided by the signalling and train control system.

5.26.2 All incoming alarms shall be time and date stamped. The ATS system clock shall be synchronised with the Central Master Clock system at OCC respectively. In case of failure of Master clock the ATS system shall work on its internal clock.

5.26.3 Each incoming alarm shall be classified within an alarm priority level, depending upon the severity of the alarm condition and the urgency of Controller response required.

5.26.4 Priority levels shall be allocated by the Contractor and submitted to the Employer's Engineer for review.

5.26.5 All alarms shall remain on the alarm display list for each Workstation until they have been acknowledged by the intended Workstation.

5.26.6 Alarms resulting from equipment faults shall be Latched Alarms. The alarm list shall be updated on real time basis with the occurrence. Un-acknowledged alarms shall flash.

5.26.7 All alarms removed from the alarm display list shall automatically be inserted into the alarm history list upon acknowledgement by the Controller.

5.26.8 Alarm Displays

5.26.8.1 Alarms shall be directed to Workstations dependent upon the AOA and ACR granted to the Controller logged onto the Workstation. Alarms within the AOA and ACR of a station shall also be displayed on the Station Control Console and shall be acknowledged on that Console.

5.26.8.2 Alarms shall be displayed upon the Workstation in two ways:

- (1) Via a consistently placed alarm bar, displayed at all times. It will include higher priority alarms, which will be decided in consultation with Employer's Engineer; and
- (2) Via a detailed full screen Alarm Browser Application (ABA). The ABA shall be one of the System display screens and shall provide a form in which multiple alarms and alarm history can be managed.

5.26.8.3 The overriding principle of the ABA display shall be to allow a concise, uncluttered view of alarm information to the Controller, with a clear emphasis upon higher priority alarm information.

5.26.8.4 The Contractor shall provide as a minimum the following general capabilities and characteristics for the ABA for alarm display list and alarm history:

- (1) The ability to quickly filter the alarm display to view alarms generated from a particular subsystem (Train related, interlocking related/ trackside related, ATR related) or by geographic region;
- (2) A colour-coding scheme indicating the alarm severity according to the alarm priority levels;
- (3) The display of the alarms in chronological order along with their associated time stamps;
- (4) A scrollable interface, to allow the Controller to view more alarms than directly fit upon the display;
- (5) The facility to acknowledge alarms; and
- (6) The facility to clear alarms from the display.

5.26.9 Audible Alarms

5.26.9.1 In conjunction with the alarm display upon the consoles, incoming alarms of the higher priority levels shall each be accompanied by an audible tone.

5.26.9.2 Highest priority alarms shall be accompanied by a periodic sound that will not stop until the Controller has taken positive action to address the alarm.

5.26.9.3 The volume of all audible alarms shall be sufficient to alert the Controller within the control centre environment.

5.26.9.4 A command shall be provided to disable the audible alarm.

5.27 System Administration

5.27.1 A supervisor administration function to be exercised by a single nominated person shall be available to control, as a minimum, the following:

- (1) Allocation of passwords;
- (2) Creation and deletion of users;
- (3) Administration and housekeeping functions; and
- (4) Creation, deletion and modification of AOAs and ACRs.

5.27.2 The functions of supervisor administration shall rest with Chief Controller.

5.28 Timetable Compilation and Proving

5.28.1 A timetable compilation and proving system shall be provided such that timetables can be compiled and tested off-line and loaded directly to the System when ready.

5.28.2 The timetable compilation and proving system shall enable the creation and modification of timetables through an MMI.

5.28.3 Editor

5.28.3.1 The timetable compilation and proving system shall provide an editor for editing inter-station running times, platform dwell times, terminus turnaround times and train description for each of the timetable blocks (timetable periods) defined.

5.28.4 Block Generation & Connection

5.28.4.1 The timetable compilation and proving system shall provide for the automatic generation of a timetable block, given only the headway, number of trains, duration of the block, set(s) of running and dwell times used.

5.28.4.2 The timetable compilation and proving system shall provide the ability to connect timetable blocks to generate a complete timetable.

5.28.4.3 When connecting timetable blocks, the timetable compilation and proving system shall:

- Match trains in the different blocks;
- Recommend the introduction/removal of trains during service build up and run down; and
- Check and highlight any conflicts with suggested corrections.

5.28.5 Types of Trains in Timetable

5.28.5.1 The timetable compilation and proving system shall provide the facility for scheduling train paths for the following train types:

- EMU consists;
- Empty rakes;
- Engineer's trains.

5.28.5.2 Provision shall be made for an additional 10 train types to be defined in the future. Necessary software licences shall be provided.

5.28.6 Timetable Adjustment

5.28.6.1 The timetable compilation and proving system shall adjust the timetables automatically under the following circumstances:

- Global adjustment made to one timetable block;
- Adjustments made to only a particular train through the day; and
- Local adjustments to a particular train trip.

5.28.6.2 Provision shall be made for manual adjustment of the timetable by manipulation of the time-distance graph.

5.28.7 Compare Timetables

5.28.7.1 The timetable compilation and proving system shall compare timetables to ensure the matching of trains at interchange stations. Conflicts shall be highlighted automatically with proposed solutions provided.

5.28.7.2 A facility shall be provided for the setting of arrival time difference for interchange stations, duration of interchange matching required and the matching of interchange stations for a particular period.

5.28.8 Generation of Timetable

5.28.8.1 The timetable compilation and proving system shall generate the following different parts of the timetables:

- Working timetable;
- Distances between stations and different sets of run time and dwell times; and
- Summary of train frequencies.

5.28.9 Crew Roster Facility

5.28.9.1 The timetable compilation and proving system shall provide a facility for the Controller to enter the crew roster information attached to the timetable.

5.28.10 Plot Train Movements

5.28.10.1 The timetable compilation and proving system shall plot train movements in the form of a time distance graph utilising a suitable colour scheme on A0 size graph as approved by the Employer. Contractor shall supply high-resolution graphic plotter.

5.28.11 Timetable Verification

5.28.11.1 The timetable compilation and proving system shall simulate the running of a timetable to verify the viability of the timetable, including, but not limited to:

- Non-conflicting movements; and
- Interchange matching.

5.28.11.2 The timetable compilation and proving system shall simulate the effect of perturbations to test the robustness of the timetable.

5.28.12 Generate Summary Information

- 5.28.12.1 The timetable compilation and proving system shall calculate and generate number of train trips and train kilometres for all timetable trains.
- 5.28.13 Online timetable system shall have redundant communication links with Offline timetable and ATS system.
- 5.28.14 Timetable system shall be customised in accordance with the as built system design.
- 5.28.15 Timetable system shall have capability to define new projects, line characteristics of the project, additional type of trains or the configuration of vehicle types. At least 4 user licences shall be provided.
- 5.29 **Train Movement Control**
- 5.29.1 Automatic Route Setting
 - 5.29.1.1 The Train Control and Signalling System shall provide Automatic Route Setting. The ARS with PTI function shall be provided for use in constant headway regulation mode. When the Train ID received from PTI and the Train ID in the Central ATS do not match, an alarm shall be raised to the operator.
 - 5.29.1.2 Automatic Route Setting shall ensure that trains are routed according to timetable and train ID.
 - 5.29.1.3 The Automatic Route Setting shall provide the following ARS modes:
 - (1) ARS Train mode
 - (2) ARS Train acknowledgement mode.
 - (3) ARS Platform mode
 - (4) ARS Hold Train mode
 - (5) ARS Platform preference mode
 - (6) ARS Terminal mode
 - (7) ARS Junction mode
 - 5.29.1.4 Automatic Route Setting shall be the normal mode of operation.
 - 5.29.1.5 The Train Control and Signalling System shall provide commands to disable automatic route setting on specific routes and manually set routes in various modes. The following modes shall be available for route setting:
 - (1) Fleet and manual modes (including shunt route setting); and
 - (2) Sequence mode for turnarounds.
- 5.29.2 Daily/ Weekly Timetable Selection
 - 5.29.2.1 The Train Control and Signalling System shall automatically select the correct timetable for application at the start of each traffic day based upon a pre-defined weekly schedule. The Controller shall be able to override the automatic selection at any time and select a different timetable for the day.
- 5.29.3 Online Timetable Modification

5.29.3.1 After a timetable has been loaded, the following online timetable modification commands shall be available:

- (1) Cancel a train trip;
- (2) Insert additional train trip;
- (3) Turn a train short at a specified track section or station platform;
- (4) Reschedule a trip (i.e. modify timetable departure times); and
- (5) Modify dwell time at a platform.

The timetable modifications shall be taken into account by the ATS function but the reference timetable shall not be affected by them.

5.29.4 Train Dispatch

5.29.4.1 Trains shall be dispatched from reception tracks, sidings and stations automatically, as determined by the Train Control and Signalling System or by Controller command.

5.29.4.2 The Train Control and Signalling System shall provide a train-ready signal, initiated by the train operator which shall place a train into service from any track section on the running lines, including, but not limited to:

- (1) Reception lines;
- (2) Turnback platform; and
- (3) Turnback track.

5.29.4.3 The train shall be dispatched automatically or by manual intervention upon receipt of the train ready signal.

5.29.4.4 The System shall distinguish between a train ready signal in ATP and a train ready signal in ATO Mode.

5.29.5 Inter-Station Stop Detection

5.29.5.1 The Train Control and Signalling System shall detect trains that have remained stationary between stations for more than a time interval, which shall be user configurable. This condition shall be treated as an alarm and shall be shown on the workstation & mimic panel by flashing the ID.

5.29.5.2 In addition, if the inter-station stop occurs in the tunnel, the Train Control and Signalling System shall automatically hold trains at stations preventing them from entering into the tunnel unless manually overridden.

5.29.6 Train Hold and Release

5.29.6.1 A command shall be provided on Workstations to hold a specific train at a designated platform, preventing departure of the train until a release command is issued. The hold command shall be capable of being issued at any time before the train arrives at the platform or subsequent to its arrival at the platform.

5.29.6.2 An indication shall be provided to the train operator when this command is operational on his train.

5.29.7 Platform Hold and Release

5.29.7.1 A platform hold/release command shall be provided on Workstations to hold or release all trains arriving at the specified platform.

5.29.7.2 An indication shall be provided to the train operator when this command is operational on his train.

5.29.8 System Hold and Release

5.29.8.1 The Train Control and Signalling System shall provide a command on Workstations to hold or release all trains at their nearest platform along the whole line by the chief controller or within ACRs by respective traffic controllers.

5.29.8.2 An indication shall be provided to the train operator when this command is operational on his train.

5.29.9 Dwell Time

5.29.9.1 A command shall be provided on Workstations to allow the Controller to modify the dwell time at a particular station for all trains.

5.29.9.2 The dwell time at each station shall also be modified by the ATR function.

5.29.9.3 At each station, the System shall generate an indication (the dwell countdown clock) to the train operator and Controller of the dwell time remaining, in units of one second.

5.29.9.4 The System shall generate an audible alarm to the train operator when the dwell count down has reached zero.

5.29.9.5 The nominal dwell time shall be 30 s.

5.29.10 Skip-Stop

5.29.10.1 The Train Control and Signalling System shall provide a command on Workstations to cause specified trains to run through specified stations without stopping.

5.29.10.2 The train operator shall be provided with an indication that this command is in force. The same shall also be transmitted to PIDS and automatic announcement system.

5.29.10.3 When a train has been commanded to skip a station it shall not enter that station until it is cleared to proceed past the station. The fact that the next train shall pass the station shall be shown on the PIDS.

5.29.10.4 The command to skip stop shall be disabled once the train has braked to below 5 km/h upon arrival to the station.

5.29.11 Automatic Train Regulation

5.29.11.1 The Train Control and Signalling System shall provide Automatic Train Regulation (ATR).

5.29.11.2 The major function of ATR should be as below;

- a) Monitor Trip Adherence Monitor
- b) Regulate Schedule
- c) Regulate Headway
- d) Regulate Constant Headway

e) Manage Offset

5.29.11.3 ATR shall regulate train movements in order to optimise the regularity of service and to recover from disruptions.

5.29.11.4 The ATR shall be designed to dynamically regulate train services to ensure that delay is distributed in a linear fashion over trains in the immediate vicinity of the delay. This shall be put into effect whenever a delay is outside of a configurable range defined by the Contractor, and reviewed by the Employer's Engineer.

5.29.11.5 The ATR shall have the capability to manage a major train delay (a configurable time delay) by performing a best-fit schedule re-determination or timetable reformation. The ATR shall allow the Controller to confirm the new schedule prior to actually carrying out the reformation by the ATR.

5.29.11.6 Regulation Modes:

5.29.11.6.1 The ATR shall offer the following regulation modes:

- a) **Full:** Schedule (Timetable) and Headway Adherence simultaneously active. This is the standard default mode.
- b) **Schedule (timetable) Adherence Only:** Only Schedule Regulation is active:
 - In timetable regulation mode, the ATR algorithm shall regulate trains to schedule to minimise overall delay with respect to the timetable.
 - The ATR shall maintain the timetable sequence of trains.
 - When ATR timetable mode is selected, a train is considered early/late if it is operating outside of a time window which shall be user configurable. If a train is early or late then the ATR shall regulate the train to timetable using the following two ATR functions:
 - (1) Train performance regime adjustment to meet the scheduled arrival time at the next station; and
 - (2) Station dwell optimization.
 - The Schedule regulation strategy should include accelerate, slowdown, dwell time calculation and optimization, use of minimum dwell time and speed.
- c) **Constant Headway Regulation:** Schedule time pattern from trips are disregarded.
 - In headway regulation mode, the ATR algorithm shall regulate trains to a selected headway, aiming to produce a balanced headway throughout the line.
 - The headway regulation mode shall utilise the following ATR functions:
 - (1) Train performance regime adjustment; and
 - (2) Station dwell optimization.

- In case of service disruption, the trains shall turn short at intermediate stations, creating one or more short loop operations. The ATR shall be capable of operating trains in headway regulation mode within these loops.
- The headway regulation strategy should include the following:
 - (1) Normal: Hold Train Ahead and Behind the Disturbing Train
 - (2) Ahead Only: Hold Train Only Ahead the Disturbing Train
- d) **Manual Regulation mode:** In manual regulation mode, each train shall be dispatched from each platform by a manual action of the Controller
- e) **Monitoring Only:** ATR only monitors the trains, computes delays, raise alarms, update the expected trip plan, but doesn't actuate on trains circulation.
- f) **ATR OFF:** ATR component is disabled.

5.29.12 Station Dwell Optimisation

- 5.29.12.1 For each platform, the dwell countdown clock for each train shall be automatically calculated and displayed on the appropriate Workstations and to the train operator.
- 5.29.12.2 The dwell countdown clock time shall also be adjusted to include 2 seconds for the train operator to react to close the train door and 3 seconds for the train door to physically close.
- 5.29.12.3 The minimum value for the dwell shall be configurable by the Controller.

5.29.13 Junction/ Reverse running Management

- 5.29.13.1 The ATS shall provide junction management for all merging and diverging junctions.
- 5.29.13.2 The ATS shall provide for the following junction management modes:
 - (1) First come first serve;
 - (2) Priority for late trains;
 - (3) Priority for selected train types or individual trains; and
 - (4) Priority for selected routes.
- 5.29.13.3 The junction management mode and associated parameters shall be selectable by the Controller for individual or sets of junctions.
- 5.29.13.4 During reverse running the Train Describer facility shall be available and the movement of train running in reverse direction shall be followed by ATS without automatic route setting.
- 5.29.14 Regulation Strategies
- 5.29.14.1 The ATR shall first perform the station dwell optimisation on a train that is either early or late.
- 5.29.14.2 If the station dwell optimisation for the train is not sufficient to regulate it to the operator-defined service headway, the ATR shall adjust the performance regime of the train based on the regulation strategies as outlined in Table 0-2 to achieve the on-time arrival at the next station.

	Train is Early	Train is Late
Service Recovery	Increase the % coasting of the performance regime	Reduce the % coasting of the performance regime
Energy Optimization	Increase the % coasting of the performance regime	No change in the % coasting of the performance regime

Table 0-2 Regulation Strategies

- 5.29.14.3 The ATR shall further adjust the current station dwell if the new arrival time at the next station does not match with the timetable resulting from the adjustment of the coasting level of the performance regime.
- 5.29.14.4 The Train Control and Signalling System shall provide facilities for the Controller to select through the Workstations the regulation strategy and the time window within the current Operating hours that the selected regulation strategy will be enabled. Only one regulation strategy shall be enabled at any one time.
- 5.29.15 Crew Management and Rolling stock Management
- 5.29.15.1 The ATR shall provide a Workstation facility for the Controller to enter or modify the crew roster information attached to the running timetable.
- 5.29.15.2 In the event of train reformation, the ATR shall notify the train staff supervisor (Crew Controller) of the impact on crew roster.
- 5.29.15.3 The Crew Management function should include the following:
- Crew Plan Management component
 - Crew Follow Up component
 - Crew Constraints Management component
 - TDS interface component
 - MMI interface component
- 5.29.15.4 The Rolling Stock Management function should include the following:
- Rolling Stock Plan Management component including adjustment of rolling stock assignment
 - Rolling Stock Follow Up component including management of localisation of Rolling stock i.e. Yard, On line and Stabling lines
 - Rolling Stock Constraints Management component
 - Maintenance Management component including a) Follow incident b) Follow Rolling stock failure.
 - TDS interface component
 - MMI interface component

5.30 ATR Support Tools

- 5.30.1 An ATR performance monitoring tool shall be provided for online and off line analysis of the ATR performance. This tool shall be used for factory acceptance test (FAT), onsite test and commissioning, and ATR configuration.
- 5.30.2 The performance-monitoring tool shall be capable of producing statistical reports as well as colour graphical representations of ATR performance. The form of the graphical outputs shall be submitted to the Employer's Engineer for review.
- 5.30.3 The system shall generate, as a minimum, the following reports:
- Punctuality Analysis on daily weekly, monthly & yearly basis.
 - Analytical reports of various unusual occurrences, i.e. signal failures, OHE breakdown, rake failure, etc, on a daily, weekly, monthly & yearly basis.
 - Analytical report of crew link and rake utilization.
 - Total Traffic Blocks granted/refused along with locations, time blocked, time cleared.
 - Sectional running times by trains of any ID.
 - Delay report of trains along with train numbers, delayed time, etc.
 - Department wise booking of delays of trains.
 - Difference between actual and scheduled running times in tabulated as well as graphical form.
 - It shall be possible to add remarks that should get tagged along with the display on the workstations.
- 5.30.4 The performance-monitoring tool shall make use of logged data allowing for online and offline performance analysis as well as for incident investigation.
- 5.30.5 The ATR performance monitoring tool shall be capable of producing the following:
- Train performance line graph - actual performance versus timetabled performance taking the form of station platforms versus deviation in seconds;
 - On-time train performance graph – comparison of actual trains departure times compared with the timetable at each station;
 - Headway interval graph – headway interval in seconds versus time in minutes;
 - Inter-station stopping chart – a plot of the number of stops in between stations; and
 - The capability to produce online and offline graphical analysis with hard copies of the outputs from the performance monitoring tools.
 - The capability to produce the train graph for a particular train along with the ATP commands/signals it has encountered;
 - The capability to give complete information about a selected train viz. Train number, crew information, rake details, etc.;
 - The capability to produce interactive train graphs/time table in off line mode where it will be possible to alter the running times of any train interactively to see the effect

instantly, simulate and observe the effect graphically of various parameters like speed restrictions, dwell time, coasting etc on headway.

5.30.6 Time Distance Graph (TDG): The graphical representation of the line traffic shall provide for the screen consultation on a specific workstation and for the plotter printing.

The Time Distance Graph shall represent:

- The scheduled traffic - the data on the scheduled traffic come from the daily Timetable
- The actual traffic - the data on the actual traffic define the current train movements in line.
- Traffic forecasted - the data on traffic forecasted are the result of assumption on future traffic. Leaning on the scheduled and actual traffics, for each trip a time translation shall be computed defining an estimated range of advance or delay
- Potential inconsistencies in the traffic forecasted - the future traffic estimated shall be verified as the scheduled traffic after trip modifications to detect the potential inconsistencies in the traffic forecasted. The online TDG edition shall be accessible on specific workstation at the OCC for the operator having the profile of traffic controller. The graphical representations shall concern the line traffic of the corridor. No other functions shall be accessible from this on-line TDG workstation

5.30.7 The performance of the System shall not be degraded by the use of the on- line ATR performance monitoring tool.

5.30.8 Arrival and Departure Time Prediction

5.30.8.1 The ATR shall continuously update the estimated arrival/departure time for all trains to all platforms.

5.30.8.2 The arrival and departure time predictions shall be shown on Workstations.

5.30.8.3 The arrival and departure times , along with the Train Composition information ,shall be transmitted to Telecommunications System for the PIDS / PAS interface.

5.30.9 ATR Indications

5.30.9.1 The ATR shall provide the following indications on all Workstations:

- (1) Line overview: train punctuality status, dwell counter at each individual station; and
- (2) Terminus departure showing the latest train departing from each terminus, the actual time of departure, timetable time and deviation;

5.30.10 Performance Regimes

5.30.10.1 The Train Control and Signalling System shall provide different performance regimes for each train, selected from Workstations and by the ATR.

5.30.10.2 Each performance regime shall select different levels of acceleration, braking and coasting.

5.30.10.3 The minimum performance regimes to be provided by the Train control & Signalling system shall be as follows:

- (1) A maximum train performance regime;
- (2) Full coasting regime
- (3) Energy Saving Regime
- (4) 5% coasting performance regime; and
- (5) 8% coasting performance regime.

5.30.10.4 The Contractor should propose any other performance regime apart from the above.

5.30.10.5 ATR shall provide following operator commands:

- (1) Select Regulation Mode;
- (2) Select Schedule Regulation Strategies
- (3) Select Headway Regulation Strategies.
- (4) Hold/Release Train
- (5) Run Through
- (6) Set station in service, out of service
- (7) Set train in service, out of service
- (8) Anticipation of delay
- (9) Control compensation step for delay distribution

5.31 Event and Fault Logging

5.31.1 Data Logging

5.31.1.1 System shall log and retain all train movement, all events, all System commands, all actions, alarms (both when they occur and when the condition is corrected), alarm acknowledgements, and failures of the System.

5.31.1.2 Each item recorded shall be date and time stamped.

5.31.1.3 Equipment shall be provided to download and analyse this log.

5.31.1.4 The System shall have sufficient data storage capacity to maintain one month's data logs online at the OCC.

5.31.1.5 The Contractor shall supply permanent offline storage for data logs.

5.31.1.6 The Contractor shall provide a facility similar to that of the ABA so that the data log can be retrieved, filtered, viewed and managed for on- and offline analysis and for incident investigation at both OCC as well as local station. The System performance shall not be degraded by the use of this facility on-line.

5.31.1.7 Power down reset shall not cause any log data to be lost.

5.31.1.8 The system shall provide for logging of ATC, CBI, Power supply and other system alarms including health status at local stations, which shall be transmitted to the ATS system at OCC.

- 5.31.1.9 The system shall provide for automatic retrieval of data logged at the local station in the event of re establishment of link between the OCC and local station after such failure.
- 5.31.1.10 The System shall provide facilities to replay the captured data log on all Workstations.
- 5.31.2 Trainborne Log
- 5.31.2.1 The Rolling Stock Project Contractor will provide a data log to record all trainborne Train Control and Signalling System faults. All trainborne System faults shall be transmitted to the train for recording in this log.
- 5.31.2.2 The trainborne Train Control and Signalling System shall continuously record, under all modes of operations, except Cut-out mode, as defined in JS02-Phase-1B/Rolling Stock Interface Specification in Appendix A1
- 5.31.2.3 Notebook computers along with all hardware and software shall be provided to download and analyse trainborne logs.
- 5.32 **Training Simulator**
- 5.32.1 General
- 5.32.1.1 The existing training simulator shall be modified to include 1B section.if required.
- 5.32.2 Train Movement Model
- 5.32.2.1 It shall be possible for the Employer & Employer's Engineer to modify the simulation software.
- 5.32.3 The training facility shall provide for both Employer's Training Instructor run training sessions and Controller tutorial sessions where the trainee undertakes pre-programmed exercises with results stored for review by the Employer's Training Instructor later.
- 5.32.3.1 The training facility shall permit as a minimum, the Employer's Training Instructor to:
- (1) Set up, load and save initial conditions
 - (2) Run the training sessions
 - (3) Freeze training sessions
 - (4) Replay
 - (5) Generate, modify and select pre-defined exercise scenarios for training exercises
 - (6) Introduce service perturbations and System malfunctions and
 - (7) Record and playback trainee actions
- 5.33 **Depot Signalling and Control (Not Used)**

CHAPTER 6

6 DESIGN REQUIREMENTS

6.1 General

6.1.1 The design shall be in accordance with the approved design of Phase 1A line except otherwise stated and shall be in accordance with the Design Criteria (in Appendix D), specification of CBI (Appendix N), specification of ATC (Appendix O), and other requirements of this Particular Specification. In case of conflict between any of them the contractor shall seek the advice of Employer's Engineer.

6.1.2 The following design requirements shall be adopted by the Contractor and are in addition to those specified in the GS.

6.1.3 The Contractor shall submit a list of all design review documents for the review of the Employer's Engineer, as per the submission schedule given in GS.

6.1.4 No Single point failure shall cause the failure of an equipment or sub system of the Train Control & Signalling system.

6.2 Design Process

6.2.1 The Contractor shall adopt a structured design process, including, but not limited to, the following:

- (1) Conceptual, preliminary and final design reviews with the Employer's Engineer, including, but not limited to, requirements capture and decomposition, system architecture, logic flow diagrams, RAMS allocations, Standards to be followed, Safety integrity levels, operation and maintenance philosophy, and verification and test approach; and
- (2) Conceptual, preliminary, and final software design reviews with the Employer's Engineer, for the software design, including but not limited to: the software requirements specification, software architecture, requirements decomposition, logic flow diagrams, Standards to be followed, Safety integrity levels, MMI prototypes, and verification and test approach.

6.3 Software Requirements

6.3.1 General

6.3.1.1 All software shall be designed, developed, tested, verified and be validated in accordance with the CENELEC standards EN50126, EN 50128, EN 50129, and EN 50159. If any equivalent recognised International standard other than CENELEC has been used, the requirements specified in paragraph 6.3.3.2 (8) below shall be fulfilled.

6.3.1.2 The Contractor shall demonstrate to the Employer's Engineer the correct application of the standards specifically detailing the allocation of software integrity levels for all software. The Employer reserves the right to review the software validation and verification at the Contractor's facility and also to employ a third party for this purpose.

- 6.3.1.3 The Contractor shall submit with the Design Plan for the review of the Employer's Engineer a list identifying all software, which will be maintainable and re-configurable by the Employer.
- 6.3.1.4 The contractor to ensure that all relevant Licenses related to software/applications are valid till full life cycle. Detail to be provided 1 month before ROD.
- 6.3.2 Security
- 6.3.2.1 The Contractor shall define the procedures to maintain the security of the software. Aspects to be considered include:
- (1) Sabotage

The Contractor shall describe what measures are to be taken to protect the software against sabotage during the development phase. This description shall define the physical restrictions as well as procedural measures and specific tests to be carried out on the software.
 - (2) Unauthorised Access

The Contractor shall describe what measures are to be taken to protect the software against unauthorized access and subsequent modification. The description shall define both physical and procedural methods.
 - (3) Virus

The Contractor shall ensure software, which is susceptible to viruses, is developed in environment certified free from computer viruses. To achieve this, the Contractor shall use propriety virus detection software and suppression tools.
- 6.3.2.2 All software delivered to site shall be accompanied by evidence that demonstrates the media is free of viruses.
- 6.3.3 Software & System Design, Verification & Validation Standards with Complete Verification and validation Documents
- 6.3.3.1 The Contractor shall submit the complete documents of Software & System Verification & Validation plan and report along with a copy of the standard to which the all the sub-systems of Train Control & Signalling system have been designed, developed, manufactured, tested, verified and validated.
- 6.3.3.2 The Contractor shall supply the following documents:
- (1) Proof of safety report containing detailed analysis of software and hardware in accordance with CENELEC standards (Generic product safety case and Generic Application safety case)
 - (2) Type test results performed on equipment before its use for regular production
 - (3) Acceptance tests results performed before despatch
 - (4) Environmental test results performed on the equipment by manufacturer/ independent testing agency.

- (5) Full documentation of verification and validation procedure, quality assurance program along with report and certificate from Quality Assurance (QA) Group
- (6) The assessment report of Independent Safety Assessor of the Generic product safety case and Generic Application safety case as required by the relevant CENELEC standards for both Hardware and Software
- (7) In case of equipment that has been tested and approved for unconditional and unrestricted use on any passenger railway by any railway administration, the manufacturer should submit complete details of test carried out, test results and approval certificate issued by concerned railway administration.
- (8) If any equivalent recognised International standard other than CENELEC is used:
 - A copy of standards followed shall be submitted, in English language
 - A certificate from an independent recognised body shall be submitted stating that the proposed standards are equivalent to CENELEC standards
 - Credentials of the independent recognised body issuing such certificate shall be submitted for verification by the Employer
 - The certificate of validator certifying that the system is equivalent to SIL-4 / SIL-2 compliant shall also be submitted
- (9) Any other information, considered necessary by the Employer

6.4 System Safety Design Requirements

6.4.1 System Safety Objectives

6.4.1.1 The Contractor shall define a systematic approach to ensure that:

- (1) Safety consistent with sub-system, functional requirements are designed into the system in a timely, cost-effective manner.
- (2) Hazards associated with each system/sub-system are identified and evaluated, and eliminated throughout the entire life cycle of the system/sub-system.
- (3) Historical safety data generated by associated systems are considered and used, where appropriate.
- (4) No risk is involved in accepting and using designs, materials and production and testing techniques.
- (5) Retrofit actions required to improve safety are eliminated through the timely inclusion of safety features during development and acquisition of a system.
- (6) Modifications do not degrade the inherent safety of the system

6.4.2 System Safety design

The system safety design requirements shall be in accordance with the approved design of Phase 1A section and shall include, but not limited to, the following items:

- (1) Eliminate identified hazards or associated risk through design, including material selection or substitution

- (2) Isolate hazardous substances, components, and operations from other activities, areas, personnel and incompatible materials.
- (3) Locate equipment so that access during operations, servicing, maintenance, repair, or adjustment minimizes personnel exposure to hazards (e.g. hazardous chemicals, high voltage, electromagnetic radiation, cutting edges, or sharp points).
- (4) Minimize risk resulting from excessive environmental conditions (e.g. temperature, pressure, noise, toxicity, acceleration and vibration).
- (5) Design to eliminate risk created by human errors in the operation and support of the systems.
- (6) Protect the power sources, controls and critical components of redundant subsystems by physical separation or shielding.

6.4.3 System Safety Engineering

- 6.4.3.1 Safety shall be the primary consideration in the design and performance requirement for the system. To meet these requirements, all safety critical equipment shall be designed to fail-safe and check redundancy principles. Structured and systematic approach shall be employed to identify, analyse and resolve potential system hazards.
- 6.4.3.2 The system shall conform to CENELEC standard EN50126 for Reliability, Availability, Maintainability and Safety. The system shall in addition conform to CENELEC standard EN50129 for safety related electronics system for Signalling and CENELEC standard EN50128 for software for railway control and protection system.
- 6.4.3.3 All safety critical equipment shall be designed, manufactured and validated to Safety Integrity Level 4 as defined in the CENELEC standard EN50126, EN50128, and EN 50129.
- 6.4.3.4 Development process of ATS and ATO systems shall follow Safety Integrity Level 2 as defined in the CENELEC standard EN50126, EN50128 and EN50129. All potentially unsafe effects of safety-related functions performed by ATS and ATO shall be mitigated by mandatory interaction with SIL4 subsystems (ATP and CBI).
- 6.4.3.5 Critical commands such as unblocking a blocked signal/ route/ maintenance area, emergency operation of a point or releasing a temporary speed restriction shall be implemented in a safe manner.
- 6.4.3.6 Signalling system shall enable the Traffic Controller to take train movement decision based on the indications available with him (i.e. ATS MMI/ Mimic Panel/ Interlocking VDU) in the event of failure of a signal or track due to any reason when a train operator is to be authorized to pass a signal at red/ blank.

6.5 Deliverables

A list of project deliverables shall be submitted as part of the System Safety Management Requirements. The deliverables shall include but not limited to the following:

- (1) Safety Assurance Programme Plan as defined in GS.
- (2) Hazard Analysis conducted for the various phases of the system life cycle as defined in GS.
- (3) Identification of the Employer's requirements and supporting rules and procedures required to ensure safe operation and maintenance of the Train Control & Signalling system.

- (4) All documents as per paragraph 6.3.3.2 above, for all the subsystems including but not limited to Trackside ATP, On board ATP, CBI, Track circuits and ATO, ATS.
- (5) Proof of final safety report containing detailed analysis of software and hardware; and the assessment report of ISA for the same as required by the relevant CENELEC standards for both Hardware and Software for -
 - All the subsystems including but not limited to Trackside ATP, On board ATP, CBI, Track circuits and ATO, ATS.
 - Signalling & Train Control system as a whole
 - If any equivalent recognised International standard other than CENELEC has been used, the requirements specified in paragraph clause 6.3.3.2 (8) shall be fulfilled.
- (6) All the data of the CBI, ATP and ATS shall be provided to DMRC for reference in the required format.

6.6 Trackside Equipment

6.6.1 General

6.6.1.1 All trackside equipment shall be verified against the structure gauge and submitted for the Employer's Engineer review. Jaipur Metro's Schedule of Dimensions shall be followed for the structure gauge.

6.6.1.2 A set of typical Employer's trackside services drawings is provided in Appendix B of this PS. The Contractor shall use this set of drawings as a guideline for the design of trackside equipment. The outdoor junction boxes shall be made of stainless steel for rust protection. The Contractor shall submit the specifications of junction boxes for review by the Employer's Engineer.

6.6.2 Rail Connections

6.6.2.1 All connections to the rail shall be suitably welded to give resistance & corrosion free smooth contact. The rail welding material shall conform to IRS: S103-2004 or the latest.

6.6.2.2 Prior to the selection of the connection, the Contractor shall demonstrate the reliability and maintainability of its chosen method. In meeting the criteria, the Contractor shall provide evidence typically in the form of:

- (1) Mechanical and electrical test results;
- (2) Evidence of their reliable service on other railways;
- (3) Environmental test results; and
- (4) Maintainability in terms of removal, refitting and testing.

6.7 Environmental

6.7.1 All Train Control & Signalling equipment shall be suitable for the environmental conditions of Jaipur.

- 6.7.2 All Train Control and Signalling System equipment shall operate correctly to the environmental conditions broadly as per IS: 9000 & other specifications herein.
- 6.7.3 The Train Control and Signalling System shall conform to IEC 60529 Ed. 2.0 b to the following levels:
- (1) Trackside equipment: IP code 54;
 - (2) Internal trainborne equipment: IP code 52; and
 - (3) External trainborne equipment: IP code 67.
- 6.7.4 The Train Control and Signalling System shall be able to withstand following the environmental conditions stipulated below:
- 6.7.4.1 Temperature
- (1) Trainborne equipment: 0°C to 70°C;
 - (2) Trackside equipment: 0°C to 70°C;
 - (3) CER and SER equipment: Shall be capable of working in a non - air conditioned environment up to 40°C without any degradation in RAMS and MTBSAF requirements of the Contract
 - (4) Control room equipment:
- 6.7.4.2 Humidity
- (1) Trainborne equipment: 0 to 99 % relative (condensing);
 - (2) Trackside equipment: 0 to 99% relative (condensing);
 - (3) CER and SER equipment: 0 to 95% relative (condensing); and
 - (4) Control room equipment: 0 to 95% relative (condensing).
- 6.8 **Shock and Vibration**
- 6.8.1 All Train Control and Signalling equipment shall be protected from damage or reliability degradation due to shock or vibration.
- 6.8.2 Vibration and Shock (sinusoidal and random): The vibration and shock requirements will conform to the ranges and classification contained in IEC721.
- 6.9 **Applicable Standards**
- 6.9.1 The standards to be followed during the design, construction, and installation of the Train Control and Signalling System shall be as stipulated in the Specification. The Contractor may propose additional standards for review by the Employer's Engineer at least 60 days before application. Such standards shall include, but are not limited to, the following:
- (1) Isolation of safety-critical logic;
 - (2) Tests of individual components;
 - (3) Power supply standards;
 - (4) System performance and reaction time requirements;
 - (5) Electro-magnetic compatibility/ interference (EMC/EMI);
 - (6) Earthing & bonding (refer to Earthing Policy in Appendix M);
 - (7) Terminations;

- (8) Fire/smoke proofing of cabling;
- (9) Electrical isolation;
- (10) Lightning protection;
- (11) Structural requirements;
- (12) Cabling standard; and
- (13) Earth leak detection.

6.10 **Design Documentation**

6.10.1 Contractor shall submit the list of documents which are not modified , same as provided in phase-1A and not require any updating. The list shall be submitted within 60 days from LOA for review by the Employer's Engineer.

- (1) The Contractor shall, in addition to the documentation requirements specified in the GS, supply, as a minimum, the following hardware and software design documentations:-
- (2) Conceptual design specifications, details and drawings, if different to those provided during Phase 1A;
- (3) Preliminary design specifications, Software and system verification and validation standards, Signalling plans of entire main line including 1A with final location of signals etc., Earthing and lightening protection plan for UG section, Specifications of proposed Indoor and line side equipments. The Preliminary design includes but is not limited to:
 - System and Sub-system Overview,
 - System requirement specification, System traceability specification,
 - System safety plan,
 - System Verification & Validation Plan
 - System Assurance Plans consisting of EMC Management Plan, RAMS Plans, Software Quality Assurance Plan and Quality Plan
 - ATC interface with Rolling stock, including the design of driver's MMI for ATP etc., if different from one submitted in Phase 1A
 - Migration Plan, Migration Safety Studies
- (4) Final design specifications, details and drawings of Phase 1B including details of any up gradation or modification in OCC or Main Line system's hardware and software, Complete Specifications for various sub-systems e.g. CBI, ATP, ATO, ATS, Point Machines, Track Circuits, Train to Wayside communication devices, Communication network, Line side signals etc. and their configuration for required headway, which shall include as minimum the following:
 - Design reviews, Design Verification Table;
 - Failure mode effect and criticality analysis (FMECA);
 - Project risk management plan, Hazard Analysis and Operability studies ;
 - Hardware adaptation report;

- Result from simulation studies including Design Data, formulas, calculations, and computer simulation logic, results and printouts for demonstrating that both safe braking and the specified theoretical headways have been provided by the design & obtain the approval of the Employer's Engineer.
- Approved Signalling layout of entire line and numbering plan;
- Control tables;
- Data preparation validation report;
- Signalling principles;
- Overall signalling principle report;
- Installation design;
- Systems Engineering Plan;
- Final System Assurance Plan; and

6.10.2 The submission of the above documentation shall be included in the Submission Programme specified in GS.

6.10.3 Contractor shall resubmit all the documents not limited to system/sub-system, hardware & software design and specifications, As-builts of all mainline IXL sections, configuration plan including of Phase 1A, if any up gradation /reconfiguration/modification have been made at any level.

6.10.4 Contractor shall submit the migration plan and migration safety studies to cover train operation in Chandpole station during day & same section used for commissioning, updation /modification of MRSN/OCC systems and testing during night etc. Contractor is to realize the migration safety studies, Hazard and Operability studies. These documents shall also be submitted to designated ISA for review and audit the station minimum three months before the Installation testing.

6.11 **Equipment Cabinet and Equipment Enclosure**

6.11.1 All indoor equipment cabinets and equipment enclosures used for housing the Train Control and Signalling equipment shall be provided with lock and key. Padlocks shall not be used. The system shall meet or exceed the requirements achieved in Phase 1A.

6.11.2 The Contractor shall provide to the Employer, as a minimum, 3 keys per cabinet or equipment enclosure.

6.11.3 Sufficient ventilation shall be provided for the indoor equipment cabinets and enclosures in which active equipment are housed.

6.11.4 All outdoor equipment cabinets and equipment enclosures used for housing the Train Control and Signalling equipment shall be provided with suitable locking or protection arrangement. The key or opening arrangement for identical equipment shall be same. The key or opening arrangement for different equipment should be same as far as

possible. The system shall meet or exceed the requirements achieved in Phase 1A contract.

6.11.5 All metallic cabinets/ parts shall be properly earthed.

CHAPTER 7

7 INTERFACES

7.1 General

- 7.1.1 The purpose of the Interface Specifications is to provide Project Contractors involved in the interface with a clear overview of the purpose and functionality of each interface. It provides a framework such that Project Contractors can set to work in a co-operative way to produce the interfacing standard. Details of the interfaces with the Train Control and Signalling System are found in the Interface Specifications in Appendix A.
- 7.1.2 The Interface Specifications detailed below are used as the key documents for the interface definition and also to define the scope of each Project Contractor.
- 7.1.3 Interfaces required between the individual sub-systems of JS02-Phase-1B shall be worked out by the various sub contractors/ project partners of JS02-Phase-1B contract so as to meet the functional requirements of Signalling & Train Control systems.
- 7.1.4 The Interface Specifications shall be read as an integral part of the Particular Specification and contain the functional requirements for the interfaces.
- 7.1.5 The following Paragraphs provide a brief overview of each Interface Specification along with key details provided within the documents.

7.2 Interface with Other Designated Contractors

- 7.2.1 The contractor shall interface and liaise with other designated Contractors in accordance with the requirements given in Appendix A of this PS and GS.

7.3 JS02-Phase-1B/ RS8 Interface Specification (A1)

- 7.3.1 The JS02-Phase-1B/ RS8 Interface Specification describe the various interface requirements done between Contract Train Control and Signalling System and Rolling Stock Contracts in Phase 1A. The primary interface was with the onboard Train Control and Signalling System. It also covers the material and equipment to be supplied for the installation of the Train Control and Signalling System on the rolling stock.

7.4 JS02-Phase-1B/ Civil/ E&M/ Architectural Detail Design Consultant (DDC) and Construction Contracts Interface Specification (A2)

- 7.4.1 JS02-Phase-1B/ Civil/ E&M/ Architectural Detail Design Consultant (DDC) and Construction Contracts Interface describes the interface requirements between Contract JS02-Phase-1B and DDC, Construction contracts for Civil, Architectural and E&M works.

7.5 JS02-Phase-1B/ Telecommunication Contracts Interface Specification (A3)

- 7.5.1 The JS02-Phase-1B/ Telecommunication Contract Interface Specification describes the interface requirements between Contract JS02-Phase-1B Train Control and Signalling System and Telecommunications Contracts.

7.6 JS02-Phase-1B/ Track Contractors Interface Specification (A4):

7.6.1 The JS02-Phase-1B/ Track contract Interface Specification describes the interface requirements between Contract JS02-Phase-1B Train Control and Signalling System and Track Design and construction contracts.

7.7 JS02-Phase-1B / Traction Supply Interface Specification (A5):

7.7.1 The JS02-Phase-1B/ Traction Supply Interface Specification describes the interface requirements between Contract JS02-Phase-1B Train Control and Signalling System and Traction Power & OHE contract.

7.8 Not Used

7.8.1 Not Used

7.9 JS-02-Phase-1B /Tunnel Ventilation system Contract interface specification

7.9.1 The JS02-Phase-1B/TVS interface specification describes the interface requirement between Contract JS02-Phase-1B Train Control & Signalling System and Tunnel Ventilation System Contract.

CHAPTER 8

8 VERIFICATION, TESTING AND COMMISSIONING

8.1 General Requirements

- 8.1.1 The Contractor shall put in place a full testing regime to demonstrate that all the requirements of the Specification are met.
- 8.1.2 Dynamic tests shall be carried out by the Contractor as an essential part of the Train Control and Signalling System Completion Tests. The Contractor shall devise Integrated Testing & Commissioning plan to verify the system in all modes of operation and with all interfacing system. Test programmes, methods and results shall be documented and submitted to the Employer 's Engineer.
- 8.1.3 The contractor shall supply documentation showing how system safety and reliability are ensured. It shall include as a minimum, failure modes, system failures and how equipment thresholds have been set in order to keep them above worst case interference levels and what equipment tolerances have been allowed for in designing the system. It shall include all interface equipment in system whether indoor, track side or train borne. This information shall be presented in one coherent document.
- 8.1.4 Possession requirements for installation, testing & commissioning of new sections and their integration with commissioned section(s) will be reviewed by the Employer's Engineer.
- 8.1.5 The contractor shall include in Integrated Testing & Commissioning plan, methodology of ensuring safety during integrated testing and commissioning, and service trials.
- 8.1.6 The Employer' Engineer may conduct independent safety audit and will therefore require access to all the relevant design and product information. The contractor shall provide all necessary assistance for this to the Employer's Engineer.
- 8.1.7 All the tests shall be carried out by the Contractor and will be witnessed by the Employer Engineer or its representatives. The Employer's Engineer reserves the right to carry out any additional tests he considers necessary to satisfy himself that the System meets the requirements of the Specification.
- 8.1.8 The Contractor shall support the Employer's Engineer's additional tests as necessary. The Contractor's support shall include, but not be limited to:
- (a) Provision of test equipment;
 - (b) Attendance of competent staff; and
 - (c) Provision of test procedures.
- 8.1.9 The Employer's Engineer may request that repeat tests be carried out to simulate the failure mode of any critical hardware/ software component that is deemed to have a significant effect on the safety or reliability of the system.

- 8.1.10 The Contractor shall provide any simulation equipment, required for testing or commissioning.
- 8.1.11 The Contractor shall submit a Testing and Commissioning programme for the Employer's Engineer's review as given in GS. It includes systems or equipments of existing Phase 1A which are being modified or require any updating for integrating with 1B systems. The list shall be submitted within 60 days from LOA for review by the Employer's Engineer.
- 8.1.12 The Contractor shall provide details of the testing activities as specified in the Specification in the Testing and Commissioning programme.
- 8.1.13 All alterations to equipment, systems and designs shall be carried out within the scheduled time prior to installation & commissioning.
- 8.1.14 Access shall be granted to the Employer to any facilities where installation, cut- over work or tests are in progress and to all inspection and test and commissioning records.
- 8.1.15 The Contractor shall support any testing required by the Commissioner of Railway Safety in order to obtain approval for Revenue operation.
- 8.1.16 The Employer's Engineer reserves the right to access at any time the records of all pre and post installation inspection and testing of equipment. In the absence of good recording system, the Employer's Engineer shall have the right to request the Contractor to re-do these tests to avoid problems being accumulated at the subsequent phases. Testing and commissioning will not be allowed to start until the Post Installation Inspection and Testing phases are completed.

8.2 Sequence of Tests

- 8.2.1 The sequence of tests shall be as follows:
- (1) Type Tests;
 - (2) Factory Acceptance Tests (FAT);
 - (3) Pre-Installation Tests and Inspection
 - (4) Post-Installation tests and Inspection
 - (5) Partial Acceptance Tests (PAT):
 - (6) System Acceptance Tests (SAT);
 - (7) Integrated Testing And Commissioning;
 - (8) Service Trials

8.3 Type Tests

- 8.3.1 Type Tests shall be performed prior to full production and before FAT. Type Tests shall only be required if the equipment being provided is different from that already approved and in use in DMRC's operational system & Phase-1A of JMRC System, while also meeting the current Tender requirements.

- 8.3.2 Type Tests shall be used to confirm that the proposed equipment is fit for purpose in the environmental conditions specified and meets the requirements of the Specification including the EMC.
- ~~8.3.3~~ The Contractor shall provide a schedule of type tests required for the various components such as ATP/ ATO equipments, CBI equipment, Point machines, Cables, Track circuits, Signals etc. All Sub-systems, components, modules etc. requiring type testing shall be listed and submitted to the Employer's Engineer for acceptance-
- 8.3.4 The Contractor shall provide detailed Type test specifications in respect of tests to be performed for individual sub-systems, components, modules etc., as listed out by the contractor in the above clause.
- 8.3.5 Equipment that has been tested and approved for unconditional and unrestricted use on any passenger-carrying railway by any Railway administration may be exempted from fresh type approval test by Employer. However, for this exemption, complete details of tests carried out including environmental and EMC tests, test results and approval certificate issued by the concerned Railway administration or Independent Agency must be submitted to the Employer for verification and acceptance. Employer's decision on this will be final.
- 8.4 **Factory Acceptance Tests**
- 8.4.1 The Factory Test Plan shall be submitted for the Employer's Engineer's review as per GS. The plan shall adopt a top down approach and describe the FAT strategy as regards to methodology, procedures to be followed and records to be submitted. Contractor shall submit the comprehensive list of specifications to be followed.
- 8.4.2 The FAT plan/ submission shall include the appropriate testing and inspection items for approval.
- 8.4.3 The FAT shall demonstrate that each subsystem meets its functional specification.
- 8.4.4 No equipment or software should be delivered to the Site until the Contractor has demonstrated to the satisfaction of the Employer that the equipment or software conforms to the Specification by carrying out the FAT.
- 8.4.5 The FAT shall combine all subsystems to demonstrate that the requirements of the Specification are met.
- 8.4.6 FAT shall demonstrate the correct operation of the Train Control and Signalling System working together with all other systems with which it interfaces, as specified in the Specification. Interface protocol tests shall be completed prior to the commencement of the FAT for each interfacing system with the respective designated contractor. Any failed test shall be repeated after rectification. The JS02-Phase-1B contractor shall develop and agree with the designated contractor for the test procedures and submit for the approval of the Employer's Engineer.

- 8.4.7 The simulation shall as a minimum cover a complete weekday service operating at the minimum service headway on each Corridor.
- 8.4.8 The simulation shall include failures and disruption to service to fully demonstrate correct operation of the System under these circumstances.
- 8.4.9 The FAT shall demonstrate that 72 hours continuous service has been achieved with no fault occurring that would prevent the equipment from operating as per the Specification.
- 8.4.10 The Employer will / may witness the FAT.
- 8.5 **Pre-Installation Tests and Inspection**
- 8.5.1 Prerequisites for Installation and Inspection
- 8.5.1.1 Prior to installation, the Contractor shall ensure that equipment delivered to Site has not been damaged in transit. Inspection and testing shall be conducted by the Contractor to determine that the equipment has not been damaged or the performance impaired in any manner subsequent to shipment.
- 8.5.1.2 Designs for the Sections under test shall be completed and submitted to the Employer's Engineer for review prior to Installation.
- 8.5.2 Testing and commissioning requirements before Installation
- 8.5.2.1 The requirements of this Clause apply to commissioning of equipment installed in any new equipment room, existing equipment room, changes to any existing equipment, or changes to any equipment furnished by the Contractor and placed into service during a previous stage of the work.
- 8.5.2.2 Test procedures shall be carefully planned to ensure that the work can be completed in the time available. If the time available is restricted, this planning shall include contingency plan to be implemented if testing proceeds slower than anticipated or defects are identified, which cannot be corrected.
- 8.5.2.3 The Contractor's test personnel shall be knowledgeable in the existing/ new signalling principles and equipment to the extent that they fully understand the implications and effects of all interface connections.
- 8.5.3 Site Preparations
- 8.5.3.1 The Contractor shall submit to the Employer's Engineer a site preparation plan before installation.
- 8.5.3.2 The Contractor shall prepare the site in all respects required for installation of Train control & Signalling equipments.
- 8.5.4 Post-Installation Tests and Inspections
- 8.5.4.1 Pre-Power up checking, power up, customisation and configuration of equipment: The contractor shall submit a plan for Pre-Power up checking, power up, customisation and configuration of equipment for review and approval to the Employer's Engineer. The necessary test shall be carried out by the contractor based on the approved plan and shall be witnessed by the Employer.

- 8.5.4.2 Post Installation tests shall be carried out by the Contractor for each subsystem following Installation but before Functional Tests to demonstrate that the installation has been carried out correctly.
- 8.5.4.3 The Contractor shall submit a Post Installation Inspection and Testing Plan prior to the commencement of the post installation inspection and testing.
- 8.5.4.4 The inspection shall verify that equipment has been installed to the procedures and design that have been reviewed without objection by the Employer's Engineer and that equipment is correctly located and labelled.
- 8.5.4.5 The inspection shall verify that any false feed, temporary wiring and redundant items have been removed and that equipment is correctly protected against interference, damage and deterioration.
- 8.5.4.6 The Contractor shall maintain inspection records to demonstrate that each item of equipment has been inspected and found to be satisfactory, and attach to this record a detailed list of any discrepancies found and remedial work carried out. Inspection records shall be kept for all installed equipment and a detailed list attached of any discrepancies.
- 8.5.4.7 As the discrepancies are rectified, the record sheets shall be amended to record the corrections.
- 8.5.4.8 The Contractor shall provide detailed Post-Installation test specifications for each category of tests and these are listed, but not limited to the following for acceptance by the Employer's Engineer:

A) INDOOR Equipment

- (1) Equipment Check
- (2) Layout and equipment profile check.
- (3) Voltage measurements
- (4) Continuity test as per the wiring diagrams;
- (5) Cable insulation tests
- (6) Power Cubicle function tests
- (7) Wire continuity tests
- (8) Earthing system tests
- (9) "Null Count" to visually inspect and ensure that there are no circuits on contacts or terminals **not** in use;
- (10) "Wire Count and Null Count" on adjacent terminals and relay plug boards to ensure that no spurious wiring is present subsequent to stage works or modifications;
- (11) Software is correctly installed with the correct version and checksum;
- (12) Circuit board is of correct version and is correctly installed.
- (13) Control tables test
- (14) Strap & Function tests

- (15) Through circuit function tests of the equipment
- (16) Interfaces tests with other equipments.

(B) Track side Equipment –

- (1) Equipment Check
- (2) Cable Insulation test
- (3) Wire continuity test
- (4) Earth test
- (5) Signals, Point Machines and Track circuit tests
- (6) Insulation of point machine equipment from traction rail;
- (7) Structure gauge checks; Ensure the installations are within the Schedule of Dimensions;
- (8) Signal sighting checks;
- (9) Local Test of ATP/ATO/CBI etc.
- (10) Through circuit test of equipment.

(C) Train Borne equipment, if required or in scope of contract.

- (1) Equipment Check
- (2) Cable Insulation test
- (3) Wire continuity test
- (4) Static tests of ATP/ ATO equipment

(D) Computer Based Interlocking Equipment

- (1) Cable Insulation and continuity tests
- (2) Data Links tests
- (3) Complete control table tests shall be carried out on Simulator system with trackside equipment installed.
- (4) Central interlocking tests.
- (5) Through testing – Internal data links and external functions.

Before commissioning tests at site, all the interlocking and controls shall be functionally tested at the Contractor's factory. The contractor shall provide test certificates on the functional tests performed at the Contractor's factory for the Employer's Engineer's acceptance. The Contractor shall, prior to final functional /simulation test, have carried out all preliminary testing of the system, including a full functional test to control tables, track plans and other design requirements. The Employer's Engineer shall witness the final functional/simulation tests that shall be carried out by the Contractor at site.

8.6 Post Installation Test Team

- 8.6.1 Site tests shall be carried out by a separate test team independent from the installation & the design team in order to verify that the installation is correct and that when the system as a whole are connected together they function safely as an integrated system.
- 8.6.2 The tests to be performed shall cause each system and sub-system to be sequenced through all required operations and shall include simulated conditions to prove that the installation is in compliance with control logic tables and Vital safety requirements.
- 8.6.3 Testing shall progress in a systematic, sequential and logical manner from an established starting point to predetermined completion points of whole systems, sub-systems or stated segments.
- 8.6.4 All tests shall be documented, tests results recorded and signed by the testing engineer.
- 8.6.5 Test certificates with completed test records, which demonstrate equipment and components meet the performance requirement of the specifications, shall be submitted for information.
- 8.7 **Partial Acceptance Tests**
- 8.7.1 General
- 8.7.1.1 Installation work shall be completed and inspection records submitted to the Employer's Engineer for review before the commencement of each PAT.
- 8.7.1.2 The PAT Plan shall be submitted for the Employer's Engineer's review at least 120 days before the commencement of each PAT.
- 8.7.2 Functional Tests
- 8.7.2.1 The functional tests of the PAT shall be carried out on installed equipment before System Acceptance Tests (SAT) to demonstrate that the Section of the Works operates correctly in accordance with the Specification.
- 8.7.2.2 The functional tests shall sequence through all required operations to prove that the System performs in accordance with the Specification and that the local configuration data (for example, control tables) is correct.
- 8.7.2.3 Where necessary, input conditions shall be simulated.
- 8.7.2.4 The Contractor shall provide detailed Functional test specifications for review and acceptance by the Employer's Engineer and shall be carried out by Contractor's personnel independent of design and installation.
- 8.7.2.5 The functional test specifications for all the sub-systems, including the following categories but not limited to, shall be provided for acceptance by Employer's Engineer:
- (1) Indoor Equipment including CBI, ATP and ATS
 - (2) Trackside equipments including Signals, Point machines and Track circuits
 - (3) Train Borne ATC equipments
- 8.7.2.6 The Functional testing of CBI Equipment shall contain as a minimum, the following, but not limited to:

- (1) Input & Output Telegram tests
- (2) Technicians control tests
- (3) Testing of various functions of the CBI
- (4) Fault reporting tests
- (5) All controls in the CBI area.
- (6) Cross boundary tests to adjacent Interlocking
- (7) Simulation of all vital & Non vital Inputs and Outputs
- (8) Total System monitoring of commands and controls implemented by the system.
- (9) Interlinked design workstation simulation systems.

8.8 System Acceptance Tests

8.8.1 General

- 8.8.1.1 System Acceptance Tests shall comprise comprehensive testing of the completely assembled installation to ensure that every item has been installed and adjusted, and that all systems operate in every respect in accordance with the requirements of the Specification and are ready for Integrated testing & commissioning.
- 8.8.1.2 Prior to System Acceptance Testing, the Contractor shall submit a System Acceptance Plan to the Employer's Engineer for Approval. The plan shall adopt a top down approach and describe the System Acceptance strategies and processes.
- 8.8.1.3 The System Acceptance Plan shall identify a comprehensive list of specifications, standards, method statements, procedures, drawings ,records & locations viz. OCC/MSS/SSS etc. to be submitted to the Employer's Engineer for Approval. The Plan shall also include a programme, which identifies the dates for system acceptance submission and tests.
- 8.8.1.4 Any tests carried out which are deemed as System Acceptance Tests shall be identified. If these tests have been carried out earlier or form the part of earlier carried tests, the same need not be repeated unless desired by the Employer's Engineer. However, these tests should be identified and included in the System Acceptance Test Plan.
- 8.8.1.5 These tests shall be conducted in the presence of the Employer.
- 8.8.1.6 Any defects which become apparent in the course of these tests shall be made good and modifications as approved shall be implemented and recorded. All affected equipment shall be retested and certified before the system is accepted.
- 8.8.2 Prerequisites for SAT
- 8.8.2.1 The requirements, in general, in Paragraphs 8.8.2.2. to 8.8.2.5 shall be satisfied before the commencement of the System Acceptance Tests (SAT).
- 8.8.2.2 All documentation for the Safety Report shall be submitted to the Employer's Engineer for review.

- 8.8.2.3 All PAT shall be completed and test records submitted to the Employer's Engineer for review.
- 8.8.2.4 Facilities for the maintenance of the System shall be in place.
- 8.8.2.5 The SAT Plan shall be submitted to the Employer's Engineer for review at least 120 days before the commencement of the SAT.
- 8.8.3 System Acceptance Test Requirements
 - 8.8.3.1 It shall be the Contractor's responsibility to conduct all tests and record data, and restore the Train Control and Signalling System to full operational use following SAT.
 - 8.8.3.2 During SAT, all interfaces with external systems other than those pertaining to the designated contractors to the Train Control and Signalling System shall be tested.
 - 8.8.3.3 A SAT of the trainborne equipment on each and every train shall be carried out on the Main Line test track facility.
- 8.8.4 System Acceptance Tests shall include but not be limited to the following:
 - 8.8.4.1 Functional test of all Points and route/signal operations
 - 8.8.4.2 Train detection device shunting characteristics and ballast impedance
 - 8.8.4.3 Test of acceptance signal level under worst-case conditions for ATC transmission
 - 8.8.4.4 Functional test of each remote control link and system in respect of both controls and indications
 - 8.8.4.5 Check of system voltages and loads and a system check under low voltage conditions. Test of system response to the loss of one incoming power feed and to the transfer from normal to standby supply. Additional system tests shall be conducted for all equipment, including changeover and redundant equipment under high voltage conditions to ensure that no function, sub-system, system remains in a unsafe state due to the high voltage settings of the power supply equipment.
 - 8.8.4.6 Demonstrate that the system shall automatically re-initialise upon restoration of power following a complete power failure or reboot of any sub-system or system.
 - 8.8.4.7 EMC and Environmental testing of all the sub-systems, equipments.
 - 8.8.4.8 The SAT tests for ATC System shall be carried out to test all ATP/ ATO functions in entire main line and shall include the following but not be limited to:
 - (1) Verification of the safe braking distances
 - (2) Testing of Control lines to verify that trains receive only the correct speed information according to the locations of other trains, the setting of routes ahead, the imposition of temporary speed restrictions, the operation of emergency stop plungers, and inputs from the control system.
 - (3) Transmission of the correct side train door enable door closed information at each station by the Vital ATP link.

- (4) Testing of emergency stop devices for stopping trains in emergency by the station staff.
- (5) All hardware non-availability and loss of signals from the equipment does force the sub-system, system to respond to a safe state. i.e. (loss of ATP antenna, tachogenerator signals).
- (6) Fault monitoring facilities and also check that loss of supply and restoration does not generate erroneous data.
- (7) Verification of the signalled headway.

8.8.5 ATS System Acceptance test shall include but not be limited to:

- (1) Verification of correct implementation of operational commands and indications.
- (2) Demonstration of alarm responses and display format.
- (3) Verification of response to each input status change.
- (4) Correct implementation of various train hold functions.
- (5) Performance statistic report and failure report
- (6) Compilation of timetables of various headway and operational requirements with normal service and special service.
- (7) Changeover of Control under failure conditions and manual operation.
- (8) Train despatching under timetable and train description operation.
- (9) Dissemination of system information to sub-systems.
- (10) Control operation with station and depot.
- (11) Train regulation under normal and traffic disturbance conditions.

8.8.5.1 CBI System acceptance tests shall include but not limited to;

- (1) Interface with ATP,
- (2) Interface with ATS,
- (3) Interface with adjacent CBIs.

8.8.5.2 Checking of System operation under partial fault condition e.g. computer changeover to hot standby or alternative routing capability of remote control system.

8.8.5.3 Check that equipment response time complies with specified requirements

8.9 **Integrated testing & Commissioning**

8.9.1 General

8.9.1.1 On completion of testing and commissioning of the Contractor's own system to the satisfaction of the Employer's Engineer, the Contractor shall carry out all tests necessary to integrate the Train Control and Signalling System with all other systems of MRTS such as Rolling Stock, Track, Telecommunication etc. and demonstrate correct operation of all internal and external interfaces for complete line (MSOR – Badi Chaupar) including existing section.

- 8.9.1.2 Integrated testing & commissioning plan containing the schedule of integrated tests in coordination with the other designated contractors and test procedures shall be submitted to the Employer's Engineer for review and acceptance in accordance with GS. The tests shall be carried out in coordination with the relevant Designated Contractors.
- 8.9.1.3 The Contractor shall be required to lead in certain Integrated Testing and Commissioning where such tests are required to prove the performance of system provided by the Contractor.
- 8.9.1.4 All the defects and shortfalls in the contractor's system discovered in the course of Integrated Testing and Commissioning shall be made good and retested to the satisfaction of the Employer's Engineer before the dates fixed for service trials.
- 8.9.1.5 Integrated testing and commissioning shall include the integration of the section under integrated testing and commissioning with all earlier commissioned sections including OCC/ and depot(s) without disturbing the safety & revenue operation of the earlier sections.
- 8.9.2 Tests with Rolling Stock contractor shall include the following, but not limited to:
The Contractor shall be responsible for Integrated testing & Commissioning of the trainborne ATC equipment in co-operation with the Rolling Stock Project Contractor.
- 8.9.2.1 Static Tests
- (1) Other tests necessary for the safe and proper operations of the train before the Dynamic test.
- 8.9.2.2 Dynamic Tests
- 8.9.2.3 Dynamic tests shall be performed on a Section-by-Section basis.
Dynamic tests shall, as a minimum, demonstrate the following:
- (1) ATP/ ATO data transmission and track to train transmission link & vice-versa & Interface between On Board ATC and trackside equipment.
- (2) Correct interface between track and train equipment up to the Civil Speed Limit;
- (3) Ability of the Train Control and Signalling System to stop the train within the allowed safety distances from Civil Speed Limit
- (4) Correct operation of the Train Control and Signalling System in all modes.
- (5) Verify the speed profile attained against the speed profile received.
- (6) Verify that the train stops within the designated braking distance for various speeds.
- (7) Verify that the audiovisual warnings are activated and brakes are applied, if required when the maximum safe speed is exceeded.
- (8) Verify the activation of EBR and ZVR under required conditions.
- (9) Verify the train stopping accuracy with respect to station stops.

- (10) Verify that the train doors open at the correct side of the train when stopped at station.
 - (11) Verification of the signalled headway.
- 8.9.2.4 Low speed dynamic tests shall be carried out on the depot test tracks and the Main Line where available and as appropriate.
- 8.9.2.5 High-speed dynamic tests shall be carried out in Maintenance Block.
- 8.9.2.6 The Contractor shall submit the test specification and procedures for integration of all subsystems of Train Control & Signalling System with Telecommunication system for review and acceptance by the Employer's Engineer such as:
 - (1) Fibre Optic Transmission System
 - (2) Passenger Information Display System (PIDS)
 - (3) Public Address System (PA System)
 - (4) Train Radio Communication System
- 8.9.2.7 Tests with Other designated Contractors shall include the following, but not limited to:

The necessary tests shall be carried out for meeting the interface requirements with other systems of MRTS such as Track, Traction systems etc. for the purpose of integrated testing & commissioning.
- 8.9.3 Service Trials
- 8.9.3.1 On completion of the Integrated testing and Commissioning to the satisfaction of Employer's Engineer and System Acceptance test, the Contractor shall confirm in writing to the Employer's Engineer that the works provided by him under the contract is suitable and ready for the purpose of Service Trials for entire section (MSOR to Badi Choupar). During service trials, the relevant system wide contractors will run Electric trains and simulate the operating condition of the Railway system.
- 8.9.3.2 The Object of Service Trials is to ensure that the functions and operations of the various systems are satisfactorily integrated. The Employer's Engineer may issue instructions to the contractor for particular works or actions required of him during this period. In addition, the contractor shall make good all defects and complete all outstanding works within the Service Trials period so as to permit the commencement of Revenue operations.
- 8.9.3.3 The contractor shall make all arrangements including temporary provisions in his system to ensure safety during Service Trials. Service Trial shall include testing for whole line including of Phase-1A.
- 8.9.3.4 Certification shall be provided by the Contractor that the system is safe for Service trials prior to the commencement of the service trials.

- 8.9.3.5 A Service Trial plan for necessary performance and functional tests and demonstrations to be performed during service trials shall be submitted to the Employer's Engineer for review at least 120 days prior to the commencement of Service trials. The Service Trial plan shall be developed as defined in GS.
- 8.9.3.6 During Service trial on main line, JMRC/O&S shall provide services & support viz. arranging & providing work permits, power blocks, provide system access for components/ equipment located in areas under phase 1A, house keeping, safety, watch & ward, insurance, trains, Operators & Staffs for trials etc.
- 8.9.4 Service trials demonstration tests, conducted after all tests have been successfully completed, shall simulate revenue service and be designed to demonstrate that the signalling system is fully operational in conjunction with the control system under normal and abnormal conditions.
- 8.9.5 It shall cover the entire signalling interlocking, ATC and ATS systems and shall include the demonstration of the performance specified in PS are achieved.
- 8.9.6 These Tests shall be performed to demonstrate compliance with the stated electromagnetic compatibility criteria and repeat tests shall be conducted if modifications are required to conform to EMC requirements.
- 8.9.7 Maintainability Demonstration
- 8.9.7.1 The maintainability demonstration shall consist of simulated failures and repair activities, the duration of which shall be measured to determine the MTTR.
- 8.9.7.2 As an alternative, data from actual maintenance actions for relevant independent failures occurring during the testing period may be used in lieu of simulation.
- 8.9.7.3 A minimum of 50 maintenance actions shall be included for this demonstration.
- 8.9.7.4 The maintenance actions shall be distributed among the equipment of each test group in proportion to their expected failure occurrence and in accordance with the MTBF.
- 8.9.7.5 Maintenance personnel shall receive no prior information on the simulated failures.
- 8.9.8 Reliability Demonstration
- 8.9.8.1 A reliability demonstration shall form part of the pre-revenue operation. The demonstration shall cover the duration of the pre-revenue operation.
- 8.9.8.2 All failures and service interruptions shall be logged during the tests on completion and the MTBMA and MTBSAF shall be calculated.
- 8.9.9 Capacity Demonstration
- 8.9.9.1 The demonstration period shall be 7 days, covering weekday and weekend timetables.
- 8.9.9.2 The demonstration shall be performed by analysis of the control centre logs of train movements to show that the capacity requirements have been met.
- 8.9.10 Recovery Demonstration
- 8.9.10.1 The recovery demonstration shall take place in parallel with the capacity demonstration.

8.9.10.2 The demonstration shall be performed by analysis of the control centre logs of train movements.

8.10 **Reporting**

8.10.1 Failure Report Forms

8.10.1.1 All failures shall be recorded on a failure report form which shall contain as a minimum the following information:

- (1) Identification of the equipment, including nomenclature, serial number, manufacturer's part number and location;
- (2) Operating time of each system including each shut-down and its cause;
- (3) Date and time of each incident;
- (4) Failure indication, mode, cause and effect;
- (5) Classification of the incident (relevant independent failure or dependent failure);
- (6) Corrective maintenance or operational procedures required to restore the System to operation;
- (7) Time to restore System to operation and active repair time; and
- (8) Environmental conditions and supply voltages.

8.10.2 Failure Investigation Reports

8.10.2.1 Failure Investigation Reports shall be required for all failures.

8.10.3 Failure Database

8.10.3.1 The Contractor shall maintain a failure database throughout the execution of the Works. This database shall be handed over to the Employer at the expiry of the Defects Liability Period.

8.10.4 Failure Review Board

8.10.4.1 A failure review board (FRB) shall be established consisting of the Employer's Engineer and the Contractor.

8.10.4.2 The FRB shall review failures and assign responsibility.

8.11 **Performance Demonstration**

8.11.1 The performance demonstration shall take place over the Defects Liability Period.

8.11.2 The Contractor shall demonstrate that all performance requirements in Chapter 4 of the PS are met for 1B section including .

8.11.3 A performance demonstration plan shall be submitted for review by the Employer's Engineer at least 120 days prior to commencement of the DLP.

8.12 **Detailed Safety Case**

8.12.1 The Contractor shall submit a Safety Case conforming to EN50129 for each section and certify for Revenue operation which shall include as a minimum the safety features and safety standards of the Train control & Signalling System after System Acceptance Tests. The Contractor may be required to issue updated Safety Case conforming to EN50129 after Service Trials.

8.13 **Safety Certificate**

8.13.1 The Contractor shall submit the safety certificate for each section in the approved format after Completion of System Acceptance Tests, certifying that the Train Control & Signalling System is safe for opening for Revenue Operation.

8.14 **Equipment Field Trial**

8.14.1 The Contractor shall make all arrangements for field trial of Train control and signalling equipment and provide all necessary assistance and equipment for monitoring and logging the performance with a view to demonstrate RAMS data of all Train control and signalling equipment to the Employer's Engineer for at least 3 months either concurrently with Integrated testing & commissioning and Service trails or independently.

8.14.2 The Employer's Engineer shall monitor the performance of all Train Control & Signalling Equipment for each section for a period of at least three months after the successful completion of System acceptance tests. The train Control & Signalling System equipment's functional suitability, reliability as well as its maintainability and fail safe features shall be monitored, verified and validated during the field trials.

8.14.3 After the completion of the equipment field trials, a copy of the logged data shall be given by the Employer's Engineer to the Contractor.

8.14.4 The Contractor shall submit a detail report regarding the performance of Train Control and Signalling System along with detail analysis of RAMS data.

8.14.5 The Employer's Engineer shall analyse the above report and data logged for verifying RAMS of the Train Control and signalling System.

8.14.6 The Contractor shall make good all defects so noted during the field trial for the commencement of revenue operations.

8.14.7 After successful field trial ensuring that the system meets the Employer's requirement, the Train control & signalling system shall be used for revenue operation.

CHAPTER 9

9 PACKAGING, SHIPPING AND DELIVERY

9.1 General

- 9.1.1 The Train Control and Signalling System shall be packaged and shipped in accordance with the requirements of the GS.

CHAPTER 10

10 INSTALLATION

10.1 Construction & Installation Plan

- 10.1.1 The Contractor shall attend a weekly planning meeting with the Employer's Engineer to finalise the work detail, commencing 4-weeks prior to the start of Installation on Site.
- 10.1.2 The Contractor shall submit a Construction and Installation Plan for the review of the Employer's Engineer 90 days prior to the start of Installation on Site.
- 10.1.3 The contractor shall provide their installation Specification, which shall ensure that installation work and quality conform to the best-accepted railway signalling practices. This installation Specification shall be submitted to the Employer's Engineer for his review and acceptance.
- 10.1.4 Special attention shall also be paid to all equipment whose correct functioning is essential to the safe and efficient operation of the railway. In particular, the contractor shall comply with the following requirements:
- (1) Tail cables running to the trackside equipment shall not have any jointing.
 - (2) All trackside equipment shall be installed sufficiently clear of the high voltage and heavy current equipment so that maintenance risk is reduced to a minimum.
 - (3) All trackside equipment shall be installed clear of any stair or door access.
 - (4) All trackside equipment shall be installed not to cause any infringement to the schedule of fixed and moving dimensions.
 - (5) Trackside equipment such as disconnection boxes, tuning units etc. shall be installed at appropriate locations for ease of maintenance.
 - (6) Appropriate fixed means of access shall be provided for easy and safe maintenance of Trackside equipment such as signals, route indicators.
 - (7) All Signal Cables on the tracks shall cross the rails at right angle.
 - (8) Where Signal cables are required to cross the power cable or traction return cable, this shall cross the power cables at right angle and where possible at a minimum separation of 600 mm.
- 10.1.5 Design and Installation specifications of trackside equipments shall comply with the requirements of Schedule of Dimensions.

10.2 Method Statement

- 10.2.1 The Method Statements, as described in the GS, shall be submitted to the Employer's Engineer for review at least 30 days prior to the installation activity commencing On-Site.

10.3 Temporary Works

- 10.3.1 The design of the Temporary Works shall be submitted to the Employer's Engineer for review.

10.3.2 All Temporary Works shall be removed prior to Employer's taking over of the works or section, or as directed by the Employer's Engineer.

10.3.3 All Temporary Works shall be clearly distinguishable from the Permanent Works.

10.4 Work on Safety Critical Subsystems

10.4.1 The Contractor shall ensure that all safety critical activities are identified prior to the commencement of the Installation.

10.4.2 Procedures for safety critical activities shall be submitted to the Employer's Engineer for review.

10.5 Health and Safety

10.5.1 All Site personnel shall be required to undertake an induction safety-training course as detailed in the GS and in the Employer's Requirements on Safety, Health & Environment.

10.5.2 Staff Safety

10.5.2.1 The Contractor shall ensure that all areas of work are sufficiently illuminated for the Works to be undertaken safely and that a safe system of work is employed for all activities.

10.5.3 Identification of Staff

10.5.3.1 The Contractor shall operate a robust system for the control of persons entering or working upon the site. The system shall include as a minimum:

1. Register of all employees;
2. Personal identification, with photograph;
3. Levels of competency;
4. Date of expire;
5. Date of issue;
6. Signature; and
7. Register of all visitors.

10.5.4 Access and Egress Arrangements

10.5.4.1 The Contractor shall co-operate, at all times, with the Employer's Engineer and Project Contractors to ensure that the Site is protected from unauthorised admission, either wilfully or otherwise.

10.5.4.2 The Contractor shall make due provision for the safe access and egress to the Site of Works for its staff and subcontractors. This access shall be maintained such that it is free of all hazards and is in a safe condition throughout the duration of the Works.

10.6 Installation Work

10.6.1 The Contractor shall undertake installation work in stages as shown in the Special Conditions of Contract. Installation, testing, and commissioning of later stages shall not impact revenue operation of earlier stages.

10.6.2 Site Supervision

10.6.2.1 In accordance with the safety aspects of the Specification, the Contractor shall ensure that the Works are adequately supervised by properly trained and competent supervisory staff.

10.6.2.2 Resident Engineer

10.6.2.2.1 The Contractor shall ensure that a Resident Engineer is available on-Site for the duration of the On-Site Works during normal working hours and on-call to arrive on Site within 30 minutes at all other times.

10.6.2.2.2 The Resident Engineer shall have sufficient authority to progress the Contractor's work on Site.

10.6.2.2.3 The Resident Engineer shall be competent and qualified to act on behalf of the Contractor, and provide upon request information which may include:

- (1) Current progress of the Works;
- (2) Planned work for the next 5 weeks;
- (3) Audit and inspection reports;
- (4) Health and safety information; and
- (5) Documents and records pertaining to the Works.

10.6.3 Transportation of Equipment and Materials

10.6.3.1 The transportation of materials, plant or equipment by the Contractor along the railway shall be undertaken in accordance with the requirements of the GS.

10.6.4 Competence of Personnel

10.6.4.1 The Contractor shall propose for review by the Employer's Engineer, 4 weeks prior to the start of work on Site, a proposed Site organisation chart and manpower plan.

10.6.4.1 The Site organisation chart and manpower plan shall detail the staff competency and levels of authority.

10.6.4.2 The Contractor shall ensure that all its staff and subcontractors are trained and competent in the tasks that they are required to undertake. Such persons shall have their generic competence established and recognised through the holding of an appropriate licence, and must demonstrate their specific competence and knowledge in the particular systems, environment and procedures.

10.6.4.3 In addition to the generic form of licence, the Contractor shall provide evidence of specific competence and knowledge, which shall include:

- (1) Assessment and certified training in particular systems;
- (2) Recording of competence and work in the licence holder's logbook; and
- (3) Receiving or in receipt of sufficient and current exposure to the area of work that the holder is licensed for.

- 10.6.4.4 On no account shall the Contractor's staff undertake work for which they are not competent for and for which a current valid licence is not held.
- 10.6.4.5 The Employer's Engineer reserves the right to undertake, at any time, checks on the proficiency of the Contractor's staff, licensing and all associated documentation.
- 10.6.4.6 Should any of the Contractors staff be found incompetent or unlicensed, he will be removed from the Site until their competency has been established.
- 10.6.5 Equipment Locations
 - 10.6.5.1 All equipment shall be located and positioned such that the environmental, maintenance and operational requirements are met. These shall include as a minimum:
 - (1) Safety;
 - (2) Impact on Project Contractors; and
 - (3) Access and egress.
 - 10.6.5.2 The Contractor shall not place any materials, plant, tools or equipment, whether permanent or temporary, within 2.5 metres of the nearest running rail or the platform edge unless permitted to do so by the Employer's Engineer.
- 10.6.6 Point Equipment
 - 10.6.6.1 Point machines shall be installed on sleepers or track bed adjacent to the switch tongues mechanically linked to the switchblades with connecting rods.
- 10.6.7 Cable Installation
 - 10.6.7.1 General
 - 10.6.7.1.1 All cables shall be installed as per the ducting plans shown in the Employer's drawings wherever such ducts are not provided the cables shall be laid & installed in accordance with the standards contained in Appendix J of this PS.
 - 10.6.7.1.2 Cables shall be installed such that they are accessible for maintenance purposes.
 - 10.6.7.1.3 The Contractor shall ensure that the cabling design minimises the number of cables running adjacent to or across the running rails.
 - 10.6.7.1.4 Each cable and the circuits therein shall be identified.
 - 10.6.7.1.5 All Cables shall have 20% or 2 cores, whichever is the greater, as spares after completion of the Works.
 - 10.6.7.1.6 No jointing of cables will be allowed, except with the prior approval of the Employer's Engineer.
 - 10.6.7.2 Cable Protection and Immunisation
 - 10.6.7.2.1 Cables shall be used in accordance with the requirements of appendix I of PS.
 - 10.6.7.2.2 All cables outside equipment rooms shall be armoured.
 - 10.6.7.2.3 All cables shall be protected from extraneous voltage and interference sources, the cables shall be protected at least from the following:

- (1) Lightning;
- (2) EMI; and
- (3) Transient voltages.

10.6.7.2.4 The Contractor shall submit to the Employer's Engineer for review the earthing and bonding schemes of all the self-screened and separate screened cables.

10.6.7.3 Track Crossing

10.6.7.3.1 All cables that cross the running rail must be protected in suitable protection pipe that must not affect the track formation.

10.6.7.3.2 The pipe must be of sufficient strength to resist accidental damage to the cable from track maintenance.

10.7 Drawings and Records

10.7.1 General

10.7.1.1 The Contractor shall provide 6 copies of all as built drawings in A3 size in which 3 copies shall be colored, bound into circuit books. All drawings for use in trackside environment shall be durable and weatherproof.

10.7.1.2 The Contractor shall ensure that, at each equipment location, an as-built copy of the Site documentation is provided. This documentation shall include as a minimum:

- (1) Selection tables;
- (2) Circuit diagrams
- (3) Signalling plan and track plan
- (4) Installation Drawings; and
- (5) Operation and maintenance manuals.

10.7.2 Circuit Diagrams

10.7.2.1 The circuit wiring books containing the circuit diagrams shall include as a minimum the following information:

- (1) Signal circuits;
- (2) Point circuits;
- (3) Track circuits;
- (4) Interlocking circuits;
- (5) Cubicle and rack profiles;
- (6) Room layout;
- (7) Interface and boundary schedules with Project Contractors;
- (8) Through circuits;
- (9) Power supply arrangement;
- (10) Earthing & bonding arrangement;

(11) Cable circuit information.

(12) Circuits of interface of ATC with Rolling stock, if any.

10.7.3 Cable Records

10.7.3.1 The Contractor shall ensure that the as-built cabling infrastructure is fully documented and accurate at the time of Employer's taking over of the works or section. The documentation shall include:

- (1) Schematic of the cable routes;
- (2) Location of cable joints;
- (3) Cable types;
- (4) Installed dates;
- (5) Test data; and
- (6) Core plan indicating the circuit and function of each core.

10.7.3.2 The Contractor shall be responsible for adding to all of the Combined Services Drawings with the cable installation details and the timely supply of these marked up drawings to the Employer's Engineer for overall co-ordination.

10.7.4 Earthing

10.7.4.1 The Contractor shall provide at each signalling equipment room earth bars that shall be connected to the earthing system.

10.8 Asset Identification

10.8.1 The Contractor shall submit an asset database for review by the Employer's Engineer. The database shall contain the complete asset listing for the Train Control and Signalling System.

10.8.2 The database shall be designed with a minimum of the following information:

- (1) Asset details;
- (2) Failure history;
- (3) Date installed; and
- (4) Date (s) tested.

10.8.3 All equipment and software, down to the line replaceable unit, shall have a unique identification number that is capable of being identified electronically and manually.

10.8.4 All line side assets such as signals; point machines, track circuits, and all other field equipment shall be identified.

CHAPTER 11

11 OPERATION AND MAINTENANCE SUPPORT

11.1 General

11.1.1 The Contractor shall ensure that the design of the software and hardware of the Train Control and Signalling System is supportable throughout the service life of the System to address, as a minimum, the following:

- (1) Design errors in the System;
- (2) Operational changes;
- (3) Environmental changes; and
- (4) Changes in infrastructure.

11.1.2 The Contractor shall immediately inform the Employer upon it becoming apparent that the quality or supply of materials and components is or is likely to be affected, and without delay submit to the Employer for review its proposals for alternative sources of supply.

11.2 Maintenance during Defect Liability Period (DLP)

11.2.1 Competency of Personnel

11.2.1.1 During the DLP the Contractor shall support the Employer with sufficient trained and competent personnel.

11.2.1.2 Such persons shall have their generic competence established and must demonstrate their specific competence and knowledge in the particular systems, environment and procedures.

11.2.1.3 The Contractor shall provide evidence of specific competence and knowledge, which shall include:

- (1) Assessment and certified training in particular software applications and operations;
- (2) Recording of competence and work in the license holders logbook; and
- (3) Receiving or in receipt of sufficient and current exposure to the area of work that the holder is licensed for.

11.2.1.4 Routine spot checks on licensing may be carried out from time to time by the Employer's Engineer on the proficiency of the Contractor staff.

11.2.2 Wrong Side Failure

11.2.2.1 In the event of a Wrong Side Failure, the Contractor shall undertake the management and investigation necessary to identify and rectify the cause.

11.2.2.2 Should the Employer, during the DLP require further investigations at other sites throughout the railway, the Employer will formally request the Contractor to undertake such investigations, and the Contractor shall undertake the same.

11.2.3 Defects Liability Management Plan

- 11.2.3.1 As part of the Defects Liability Management Plan, the Contractor shall detail the management and organisation to be provided during the DLP.
- 11.2.3.2 If any modification or up gradation required in hardware of existing phase-1A TC&S system, to integrate with Phase-1B System, then liability of that equipment/hardware shall be covered under DLP of Phase-1B.
- 11.2.3.3 If any modification or up gradation required in software of existing Phase-1A TC&S system, to integrate with Phase-1B System, then liability of software part shall be covered in DLP of Phase-1B
- 11.2.4 Testing and Re-commissioning of Train Control and Signalling Equipment
 - 11.2.4.1 In the event of a failure requiring modifications to the System, the Contractor shall undertake any testing and re-commissioning required.
 - 11.2.4.2 Any such modification shall be submitted for review by the Employer's Engineer.
- 11.2.5 Temporary Alterations to Restore Service
 - 11.2.5.1 The Contractor shall undertake any temporary modifications necessary to maintain service.
 - 11.2.5.2 Any such modification shall be submitted for review by the Employer's Engineer.
- 11.2.6 Discrepancies between Installation and Design Records
 - 11.2.6.1 Should the Contractor discover inconsistencies between the maintenance drawings and documentation and the installed equipment, the Contractor shall correct all such errors within two weeks.
- 11.2.7 Communications
 - 11.2.7.1 The Contractor shall ensure that adequate communications facilities are provided to its staff during the DLP.
- 11.2.8 Location of Staff
 - 11.2.8.1 The Contractor shall be responsible for locating staff such that the Contractor meets its obligations.
- 11.2.9 Storage of Equipment and Materials During the Maintenance Period
 - 11.2.9.1 The Contractor shall ensure that no equipment is to be stored along the trackside.
 - 11.2.9.2 The Employer will provide defined storage locations for the support of First, Second and Third Line Maintenance.
 - 11.2.9.3 The Contractor shall satisfy itself and the Employer's Engineer that the storage locations for equipment and materials will meet the performance requirements of this PS.
- 11.2.10 Failure Investigations
 - 11.2.10.1 Failure investigations shall be conducted by the Contractor.
 - 11.2.10.2 The Employer will determine priorities in the event of a conflict between the Contractor and other Project Contractors during failure investigation.

- 11.2.10.3 Disputes between the Contractor and other Project Contractors will be resolved by the FRB (as described in Chapter-8 of this PS).
- 11.2.10.4 Contractor shall make available to the Employer all test and failure data as required.
- 11.2.10.5 If the Contractor fails to remedy any defect or damage within time specified in PS or as the Employer may deem to be reasonable, it shall be liable for levy of penalties as specified below:

S.No.	Description	Penalty
1.	For attending and rectification of failures(time to be taken from time of information given through email, SMS, Phone etc)	
a)	Beyond MTTR(Mean Time to Restore) upto 1 day	No financial penalty, however excess time taken will be cumulatively added to cater extension, if any, of DLP as given at Sr no. 3 below.
b)	Within 1 day to 5 days	Rs. 500/- per day
c)	After 5 days	Rs. 1000/- per day
2.	If any required manpower is not available	Rs. 500/- per person per day
3.	Extension of DLP period	50% of excess time taken in attending and restoration calculated by adding time in 1(a),(b),(c) & 2 above
4.	Maximum Penalty	5% of Contract Value

Penalty rates for non-compliances during DLP including non availabilityof necessary spares may be suggested by JMRC, for incorporation in above.

11.3 Software Support

11.3.1 General

- 11.3.1.1 The Contractor shall submit to the Employer's Engineer for review, the software support plan at least 90 days before commencement of software installation.
- 11.3.1.2 All changes, bug fixes, updates, modifications, amendments, new versions shall not result in any non-conformance with the Specification.
- 11.3.1.3 The Contractor shall submit all new versions to the Employer's Engineer for review at least 2 weeks prior to their installation.
- 11.3.1.4 The new versions of software shall not degrade the operation of the System.

- 11.3.1.5 The Contractor shall provide all tools, equipment, Configuration & Customisation data, manuals and training necessary for the Employer to maintain and re-configure all the software identified in the list as per Chapter-6 of this PS.
- 11.3.2 Security Obligations
- 11.3.2.1 Within 14 days of the installation of any software into the Permanent Works by the Contractor, the Contractor shall submit to the Employer's Engineer for retention by the Employer two back up copies of the software, which shall include, without limitation:
- (1) All executable code;
 - (2) All design documentation relating to the software; and
 - (3) Any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.
- 11.3.2.2 Any software item delivered by the Contractor to the Employer's Engineer pursuant to Paragraph 11.3.2.1 shall not be translated or modified by the Employer without the prior consent of the Contractor unless:
- (1) The owner of the software becomes insolvent or has a receiving order made against it or makes an arrangement or assignment or composition with or in favour of its creditors (including the appointment of a committee of inspection) or goes into liquidation or commences to be wound up or has a receiver, liquidator, trustee or similar officer appointed over all or any part of its undertaking or assets or if distress, execution or attachment is levied on, or if an encumberancer takes possession of, any of its assets or any proceeding or step is taken which has an effect comparable to the foregoing in any relevant jurisdiction; or
 - (2) The owner of the software ceases to trade; or
 - (3) The owner of the software assigns copyright in the software and the Contractor fails within 60 days of such assignment to procure in favour of the Employer, a licence from the new owner in the same terms as that required by the Contract; or
 - (4) The Contractor is in breach of any of his obligations under the Contract.
- 11.3.3 Error Correction
- 11.3.2.3 The Contractor shall inform the Employer's Engineer immediately when a fault is discovered within delivered software or documentation.
- 11.3.2.4 On receipt of a request from the Employer's Engineer for identification or further diagnosis of a failure or fault, the Contractor shall provide appropriate resources.
- 11.3.2.5 The Contractor shall provide written details as to the nature of the proposed correction to the Employer's Engineer and undertake the correction.
- 11.3.2.6 After the correction of the detected errors, the software shall be validated and tested.
- 11.3.4 Training

- 11.3.4.1 The Contractor shall provide training for Employer's staff to enable the Employer to make proper use of any new versions.
- 11.3.5 Fixes or Patches
- 11.3.2.7 The Contractor shall notify the Employer promptly of any fixes or patches that are available to correct or patch faults.
- 11.3.2.8 The Contractor shall detail any effect such fixes or patches are expected to have, upon the Train Control and Signalling System.
- 11.3.6 New Versions
- 11.3.6.1 The Contractor shall ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.
- 11.3.6.2 The Contractor shall ensure that all new versions are fully tested and commissioned once installed on the Site.
- 11.3.6.3 The Contractor shall deliver to the Employer any new version, together with the updated Operation and Maintenance Manuals.
- 11.3.6.4 The Employer shall not be obliged to use any new version and that shall not relieve the Contractor of any of its obligations.
- 11.3.6.5 Any effect upon the performance or operation of the Train Control and Signalling System that may be caused by a new version shall be brought to the Employer's attention.
- 11.3.7 Debugging and Trace Software
- 11.3.7.1 The Contractor shall provide debugging or trace logging software along with Laptop for Trackside or wayside ATC equipment, On board ATC equipment, CBI, SDTC etc.
- 11.3.7.2 The Contractor shall not install debugging or trace logging software that affects the performance or functionality of the Train Control and Signalling System.
- 11.4 Support Documentation**
- 11.4.1 Routine and Corrective Maintenance Procedures
- 11.4.1.1 Routine and corrective maintenance procedures shall be supplied for all equipment. The format shall be as follows:
 - (1) Uniform format and layout irrespective of equipment supplier;
 - (2) Colour coding for each activity;
 - (3) Cross referenced to the Operation and Maintenance Manuals; and
 - (4) Document control information.
- 11.4.1.2 The procedures shall be submitted for review by the Employer's Engineer; the following shall be included as a minimum:
 - (1) Frequency of maintenance;
 - (2) Type of maintenance;
 - (3) The equipment identification;

- (4) Safety precautions to be observed;
- (5) Step by step guide to the maintenance required; and
- (6) Explanatory diagrams.

11.4.1.3 The Contractor shall supply the Configuration and Customisation data, Parameters and Settings in both Hard copy and Electronic format.

11.5 Manuals

11.5.1 General

Manuals shall be submitted by the contractor in case the equipment and systems are different than those provided in phase 1A or for any update. Four weeks before the commencement date of Service trials, the Contractor shall deliver to the Employer these updated Operation and Maintenance manuals. The Final updated manuals shall be delivered to the Employer four weeks before the Commencement of revenue operation. These manuals shall have been submitted to and reviewed with No Objection by the Employer's Engineer prior to delivery to the Employer.

Each and every manual shall be divided into indexed sections explaining the subject matter in logical steps. The manuals shall consist of A4-size printed sheets bound in stiff-cover wear-resistant binders clearly and uniformly marked with the subject matter and reference number. The binding shall allow for all subsequent changes and additions to be readily effected.

11.5.1.1 Information shall be provided in pictorial form whenever possible and shall include step-by-step instructions and views of the particular equipment including exploded views. Programmable equipment shall be supplied with sufficient flow charts and fully documented programmes to enable faults to be quickly identified and system modifications to be undertaken at any time.

11.5.1.2 The Contractor shall provide clarifications and amendments to the Operation and Maintenance manuals as necessary during the Defects Liability Period. Updates shall be provided for the originals and all copies.

11.5.1.3 Contractor shall submit the manual for software installation which must have the details of each step of installation along with the pictorial & graphical representation.

11.5.2 Not Used

11.5.3 Not Used

11.5.4 Training Manuals

The Contractor shall provide Training Manuals suitable for use by the Employer in conducting in-house training. The manuals shall provide in details of all aspect of training covered in chapter 13.

11.5.5 Electronic Manuals

- 11.5.5.1 The Tenderer shall also deliver documents/manuals in electronic format. This is in addition to the submission of documents/manuals in hardcopies. The format of Electronic copies of Manuals shall be as per the ISO standards and shall be reviewed and approved by the Employer's Engineer.

CHAPTER 12

12 SPARE PARTS

12.1 General

- 12.1.1 The Contractor shall provide spare parts for the DLP in accordance with the requirements of GS. All spare parts in which the Contractor has been authorised to provide through a written instruction by the Employer's Engineer shall be provided 6 weeks before commencement of revenue service.

12.2 Spares List

- 12.2.1 The Contractor shall submit to the Employer's Engineer a list of spares required as per GS. The list of spares shall include the Employer's list including the quantity mentioned for each item as given in Appendix P of this PS.
- 12.2.2 For items not included in Appendix P, the Contractor shall submit to the Employer's Engineer for review the calculations and spares list.
- 12.2.3 The list shall be grouped by subsystem, test equipment and special tools as applicable for stocking identification.
- 12.2.4 The list shall have detailed description with drawing references and correlation with the maintenance manuals.

12.3 Second Sourcing

- 12.3.1 The Contractor shall identify principal and second-source suppliers that can supply the systems and sub-system spares listed.
- 12.3.2 The Contractor shall ensure that second-source supplier information is maintained up to date throughout the service life of the System.
- 12.3.3 The Contractor shall make the second-source supplier information available to the Employer's Engineer at the time of submission of the final design.

12.4 Long Lead Times

- 12.4.1 The Contractor shall identify the lead times for all spare parts. Parts with long lead times shall be identified as such to the Employer's Engineer in the spares list.

12.5 Routine Change

- 12.5.1 In the event that any item of the supply requires to be routinely changed or calibrated, regardless of whether it appears in the spares list or not, it shall be identified to the Employer's Engineer together with the routine change interval.

12.6 Shelf Life

- 12.6.1 In the event that any of the spares identified have a particular shelf life or storage requirement, this shall be made known to the Employer's Engineer with the submission of the spares list, including the necessary action for disposal or storage.

12.7 Testing of Spares

12.7.1 The Contractor shall ensure that all spares are correctly calibrated, tested and labelled prior to their delivery. Test certificates for each equipment shall be submitted to the Employer's Engineer.

12.8 Not Used

CHAPTER 13

13 TRAINING

13.1 Training

13.1.1 Training shall be provided for Employer's staff such that the Train Control and Signalling System can be operated and maintained in accordance with the Specification.

13.1.2 The Contractor shall submit a training plan to the Employer's Engineer for review and approval.

13.2 Scope of Training

13.2.1 The contractor shall provide the training to the Employer's personnel in design, testing, system architecture, maintenance and installation practices.

13.2.2 Onshore Training

- (i) The contractor shall provide 1 man months of his training instructors for this purpose.

13.2.3 The Contractor shall train the Employer's staff in the normal day-to-day operation of the Train Control and Signalling System. The Employer's staff shall also be trained to address efficiently and effectively failures of equipment, software and operation of the Train Control and Signalling System in these abnormal conditions. The Contractor shall, as a minimum, provide the following:

- (1) Recovery to normal operations after a System failure and other incidents;
- (2) Selection and de-selection of backup control functions;
- (3) Data logging, retrieval and preservation;
- (4) Contingency arrangements; and
- (5) Training scenarios for all operational aspects.

13.2.4 Maintenance Training shall include:

- (1) Principles of operation;
- (2) Preventative and corrective maintenance tasks and procedures;
- (3) Fault repair to the lowest level replaceable unit;
- (4) Use of test equipment, diagnostic and maintenance aids; and
- (5) Analysis of logs usually collected on faults.

13.3 Training Format

13.3.1 The training shall be structured in modular format, each module shall be capable of being delivered independently or together with other modules of a similar theme.

13.3.2 The Contractor shall make full and appropriate use of multi-media and computer techniques in the design and delivery of training packages.

13.3.3 The Contractor shall provide a training plan which shall include as a minimum:-

- (1) Schedule of training course;
- (2) Objectives;
- (3) Syllabus;
- (4) Format of course;
- (5) Training facilities required or to be provided;
- (6) List of training materials and documentation;
- (7) Examination procedures;
- (8) Employer's Training Instructors' qualifications; and
- (9) Course evaluation methods.

13.3.4 The Contractor shall provide all training material required to deliver the requirements of this Chapter. The material shall include as a minimum:-

- (1) Course agenda;
- (2) Objectives;
- (3) Lesson plans;
- (4) Outline presentations;
- (5) Training aids; and
- (6) Computer based training requirements.

CHAPTER 14

14 DOCUMENTATION

14.1 General Requirements

- 14.1.1 This section defines how submissions, including Design Documents and other material submitted for review by the Employer's Engineer, shall be presented and controlled.

14.2 Submission Control and Progress Monitoring

- 14.2.1 The Contractor shall submit a Submissions Programme in accordance with the GS. In addition, the Submissions Programme shall:
- (1) Identify all design, manufacturing, testing, operations and maintenance contract deliverables, required by the Specification; and
 - (2) Assign reference numbers to all submissions.

14.3 Meetings and Format

- 14.3.1 If the Contractor believes that a discussion or presentation will aid the Employer's Engineer understanding and/ or review of the design, then a request for a meeting may be made in not less than 15 days in advance of the proposed date. Such request shall include a time, location and agenda.
- 14.3.2 If the meeting is to review or present design information or other material, this material shall be forwarded to the Employer's Engineer not less than 10 days prior to the meeting.
- 14.3.3 Meetings shall not be arranged to gain formal or informal oral review of designs. The Employer's Engineer shall give full or conditional Notice of No Objection only through the submission process.
- 14.3.4 The Contractor shall, within 5 days after the date of the meeting, submit meeting minutes of each such meeting with the Employer's Engineer.
- 14.3.5 All documentation shall be submitted to the format contained in the General Specification.
- 14.3.6 Textual submittals, including reports, specifications, and calculations, shall also be submitted in electronic form, wherever feasible.
- 14.3.7 All 'As built' final documentation, including drawings and support documentation, shall be electronically stored on CD ROM media. The Contractor shall, not less than 90 days prior to the Employer's taking over of the works or section of each Corridor, submit a first draft of the documentation CD in addition to the hard copies to the Employer's Engineer. A final version shall be submitted at the time when the Contractor applies to the Employer's Engineer for Employer's taking over Completion Certificate. Any updates due to design changes during testing or revenue service shall be at the Contractor's expense.
- 14.3.8 The Standard CD ROM format shall be as defined in ISO 9660. The Contractor shall demonstrate that drawings reproduced from the CD ROM are legible. Legibility will be determined by being able to distinguish all dimensions, dimension lines, outlines and dash lines without use of supplementary viewing aids.

- 14.3.9 The CD ROM format shall be consistent with the CAD system specified by the Employer at the time of delivery.

14.4 Test Documents

14.4.1 On Site Records

- (1) Test copies of all site test documentation, control logic tables, track plans, track insulation plans and circuit diagrams shall be fully marked up for each stage of testing and certified by signature at three stages, as follows:
 - (a) Installation Copy - coloured green
 - (b) Post Installation Inspection & Testing Copy - coloured pink
 - (c) Testing & Commissioning Copy - coloured yellow
- (2) Equipment checks, tests and documentation shall be provided to prove that all labelling, codes and hardwired identity links for the Interlocking or plug-in units, are correct.
- (3) Documentation shall be provided to support the testing process from the development of test plans to finally hand over of equipment or system for operational service. Documents include test plan, test specification, test procedure, method statement, test record and test report.

14.5 Contractor Responsibilities

- 14.5.1 In addition to the requirements of the GS, the Contractor shall ensure that the requirements contained herein are carried out.
- 14.5.2 All submissions shall be complete with all relevant data required for review by the Employer's Engineer. Lack of data will be a cause for rejection of the submission and restart of the submission cycle.
- 14.5.3 The Contractor shall maintain a complete up-to-date, organised file of all past and current submissions including an index and locating system, which identifies the status of each submission.
- 14.5.4 The index shall be available for the Employer's Engineer review, and shall be used to:
- (1) Assign sequential numbers to each contract deliverable; and
 - (2) Assign new deliverable numbers to all resubmissions and cross-reference to previous submissions.
- 14.5.5 The Contractor shall provide supplemental information with each submission, in sufficient detail to explain completely the equipment described and their intended manner of use.
- 14.5.6 The Contractor shall transmit submittals prepaid.

14.6 Material Contract Deliverables

- 14.6.1 Materials deliverables shall be identified by a clear and durable identification plate, which shall include the following information:
- (1) Issue and revision status and date;

- (2) Contract title and number;
- (3) The names of the Contractor, subcontractor, supplier or manufacturer;
- (4) Identification of product by either description, model number, type number or serial number; and
- (5) Subject identification by Contract Drawing, Design Drawing or Specification reference.

14.7 Supplemental Modification Deliverables

- 14.7.1 Changes in submissions reviewed without objection will not be permitted unless those changes are resubmitted in the same manner as the original deliverable and reviewed by the Employer's Engineer.

APPENDIX A1 – JS02-PHASE-1B/ RS8 CONTRACTOR INTERFACES

Interface between JS02-Phase-1B and Phase 1A Rolling Stock Contractor to be dealt in Phase-1B section are :-

1. Next Station Information for Choti Chauper & Badi Chauper
2. Logging of On board information from ATP/ATO for 1B section, additionally
3. EMC/EMI interface between Rolling Stock & Train Control & Signalling System, if required.
4. Hardware/Software modification for announcement for correct side door opening (for phase-1B section)
5. Arrival & Departure announcement & indication on PA/PIS & TIMS (for bit updating)
6. Destination ID message for Badi Chauper Station.
7. Skip Station.
8. Announcement for short loop.
9. Choti Chauper & Badi Chauper Station codes for TIMS & PA/PIS

The requirements specified above are by no means exhaustive and it remains the responsibility of both RS8 and JS02 Phase 1B Contractors to develop and execute an interface plan during execution of Phase 1B work to ensure that:

- (i) All interface issues between the two contracts are satisfactorily resolved
- (ii) Supply, installation and testing of equipment and software are fully coordinated
- (iii) All equipments supplied in the contracts are fully compatible with each other

Please note that JS02 Phase 1B shall submit the jointly agreed & signed Interface plan to Employer as a part of detail design document.

The given below requirement were the interface between JS02 and RS8 Contractor for Phase-1A section (Mansarovar to Chandpole Section)

1 INTRODUCTION

1.1 Definitions and Scope

- 1.1.1 This Appendix describes the interface requirements between Contract JS02, Signalling & Train Control and Rolling Stock contract RS8.
- 1.1.2 Both the JS02 and the RS8 Contractors shall ensure that all requirements of the Specification pertaining to interfaces are properly satisfied.
- 1.1.3 The requirements specified herein are by no means exhaustive and it remains the responsibility of both the RS8 and JS02 Contractors to develop and execute an interface plan during execution of the work to ensure that:
 - (i) All interface issues between the two contracts are satisfactorily resolved

- (ii) Supply, installation and testing of equipment and software are fully coordinated
- (iii) All equipments supplied in the contracts are fully compatible with each other
- 1.1.4 The Automatic train Protection (ATP) system shall issue the braking commands to the Rolling Stock when safety limits are exceeded or when over-speed is detected. The removal of traction power and the correct application of brakes shall be the responsibility of Rolling Stock Contractor. The ATP system shall be responsible for monitoring of speed and the issuing of braking commands when safety limits are exceeded.
- 1.1.5 Parking brakes shall be provided by the RS8 Contractor. The parking brakes shall be capable of holding a fully loaded stationary train on a 4% gradient under all track conditions, indefinitely.

2 TRAIN OPERATING MODES

2.1 General System Description

- 2.1.1 The train-borne Automatic Train Control (ATC) system will consist of an Automatic Train Operation (ATO), if required as per the tender, and Automatic Train Protection (ATP) system.
- 2.1.2 The Rolling Stock shall be fitted with ATP/ ATO system.
- 2.1.3 The Automatic Train Control (ATC) System shall be supplied by the JS02 Contractor, who shall be required to liaise closely with the RS8 Contractor, in regard to the installation, testing and commissioning of the Signalling and Train Control Equipment.

2.2 ATO (or Auto) Mode

- 2.2.1 In this mode, the train's speed, motoring, coasting and braking within the parameters dictated by the ATP system will be performed by the on-board equipment without the train operator's intervention. This operation shall include:
 - (i) Automatic operation of trains between stations.
 - (ii) Receipt of coasting request and passing of request to traction power equipment and also provide for acceleration and deceleration of the train.
 - (iii) Automatic stopping of trains at platforms within a tolerance of ± 500 mm for 99.98% of station stops.
 - (iv) Automatic opening of doors on the appropriate platform side(s) when the train is berthed.
 - (v) Prevent the train from starting if train doors are detected "not closed".
 - (vi) Receipt and implementation of control to skip one or more stations.

The trains under ATO operation shall always remain under ATP protection. It shall be possible for the train operator to transfer from ATO to ATP mode at any time at standstill. Transfer from ATP to ATO shall only be possible at standstill at a station stopping point.

2.3 ATP (or Coded Manual) Mode

2.3.1 The onboard equipment shall provide Automatic Train Protection (ATP). In this mode, the control of the train speed and braking within the parameters dictated by the ATP system shall be performed by the train operator.

2.3.2 The ATP mode shall include:

- (i) Identification and enforcement of maximum safe speed at which the train may operate, as deduced from the most restricting ATP condition.
- (ii) Identification and display of actual speed, target speed, target distance, and the maximum safe speed.
- (iii) Identification and audible and visual warning when train is operating at a speed higher than the maximum safe speed. The equipment to provide audible and visible warnings shall be provided by JS02 Contractor.
- (iv) Provision of an audible and visual warning to the train operator, when the system identifies that the train is operating at a speed in excess of the maximum safe speed; recognition of a delay of 2s for the train operator to react, and a service brake application should the train operator fail to reduce the speed below the maximum safe speed in a specified time. In the event of the service-braking rate being inadequate, an irrevocable Emergency Brake application shall be made, automatically.
- (v) Identifying the platform side of the train with the train berthed at a station. The system shall then enable the doors to be opened on that side.
- (vi) Receipt of a door closed signal indicating that all doors are closed and locked before the train may start. Loss of this signal shall cause the ATP system to initiate a brake application.

2.4 Restricted Manual (or Yard) Mode (RM)

2.4.1 In this mode, principally for use in depot, the maximum train speed shall be controlled by the on-board ATP, to a limit not exceeding 25 km/h. This mode shall be available only when the on-board ATP equipment is operational.

2.4.2 Run on Sight Mode (ROS Mode)

In ROS mode of operation, the mode Selector is in ATP position and ROS mode shall be selectable by a ROS button/ key. In this mode, the maximum train speed shall be controlled by the on-board ATP, to a limit not exceeding 25 km/h. This mode shall be available only when the on-board ATP equipment is operational. The running monitoring shall be the same as for RM. The ATP shall give Cab Signal indications as soon as the train reaches a track position where normal running can be resumed. The ATP authorizes the ROS request.

2.5 Cut-out (or By-pass) Mode

2.5.1 By-pass Mode shall be provided for use in the event of failure of the ATP system. In this mode, the train speed shall be controlled entirely by the train operator, to a limit adjustable

between 15 km/h and 25 km/h. The RS8 Contractor shall provide equipment that limits speed to the above limit when the Cut-out Mode is in effect.

The ATP By-pass Mode shall be initiated by the train operator operating a Safety Cut-out Switch (SCS). The operation shall be recorded by the on-board digital counter and TIMS. The SCS shall be provided by RS8 Contractor. The on-board digital counter shall be provided by the JS02 Contractor. In this mode the train doors shall only be enabled and controlled manually.

2.6 Identification: Train Operating Mode, Train Description and Next Station Information

2.6.1 The Signalling and Train Control Contractor shall provide a four digit Train Identification Number (Train ID) to the RS8 Contractor. The first two digits shall identify a destination while the second two digits shall be a service identifier. The destination codes shall signify unique routes. RS8 Contractor shall accordingly use the relevant information such as names of intermediate stations, stopping pattern, station stop, door opening side information etc. for operation of on-train systems.

2.6.2 Train ID shall be allocated to train when it enters the service and shall be maintained until it finishes its service. It should be possible by the Employer to amend and / or modify the Train ID, subsequently, to suit the operational requirements. The Signalling and Train Control, and Rolling Stock Contractors should provide necessary equipment and means for the same.

2.6.3 The RS8 Contractor and the Signalling and Train Control Contractor shall exchange information identifying the effective mode, the active or non-active status of each cab, the door status etc. The inputs shall be categorised as vital and non-vital. The levels and form of these inputs shall be co-ordinated between the two Contractors.

2.6.4 Not used

2.6.5 The RS8 Contractor shall log each time the mode is changed using the onboard TIMS equipment.

2.6.6 In By-pass or Cut-out Mode, the external indication light shall flash or occult.

2.6.7 The JS02 Contractor shall provide the necessary input signals (next station information code, platform side information, triggering signal, etc.) to Rolling Stock for displaying and making next station announcements to passengers on-board. RS8 Contractor shall provide the necessary hardware. Levels and protocols shall be agreed between the two Contractors.

2.6.8 For ATO operation, the necessary train command inputs include that for PWM signal shall be provided by the JS02 Contractor. For all ATP/ ATO initiated PWM signal demands, redundancy shall be provided using TIMS. The level and form of these inputs shall be coordinated between the two contractors.

3 INTERFACE REQUIREMENTS

3.1 General

3.1.1 The JS02 Contractor shall provide the RS8 Contractor with the final list of equipments to be provided on the Rolling Stock. The sizes and weights of the ATP/ ATO and antennae etc., to

be mounted on the rolling stock shall also be provided as applicable. Notwithstanding the requirements given in the following clauses, It is to be clearly understood by JS02 that the space , routing of the On-Board Cables , On-Board mounting arrangements, TIMS interface, the DID , EMC results, etc are fixed in the Rolling Stock as per the present Line 5 & 6 design of DMRC. It is required for the JS02 Contractor to work within these constraints only, with no change. The Signalling Contractor will have to undertake all interfacing expenses and comply Detailed Interface Document (DID) based on inputs available as part of existing Rolling Stock RS3 Contract. The Tenderer is to coordinate with the Rolling Stock Manufacturer and take these into consideration. The results of EMC tests results already conducted as part of RS3 in Line 5 & 6 of DMRC, will be made available to Signalling Contractor during the Contract design stage. In case of any change required by Signaling Contractor from Rolling Stock end , then the Signalling Contractor JS02 shall be fully responsible for direct coordination with Rolling Stock Contractor for meetings , changes, testing, etc with all costs therein, without adversely affecting the Rolling Stock Schedule and the overall planned schedule.

- 3.1.2 The JS02 Contractor shall deliver to the RS8 Contractor's factories, all trainborne ATC equipment, as applicable, and data to enable fitting and testing.
- 3.1.3 The JS02 Contractor shall supply at RS8 Contractor's factory pre-wired equipment racks with appropriate connectors for all wiring terminating inside ATC enclosures, including wiring between ATC racks. JS02 Contractor, with the details provided by the RS8 contractor, shall ensure that the exterior finish and colours of the respective equipment suitably harmonise with that of the cab and the vicinity.
- 3.1.4 Interfacing wiring for each module provided by the JS02 Contractor shall terminate in a quick disconnect robust plug connector suitable for traction applications, with direct cable connection as far as possible. All cable connectors shall be identified within the cubicle using robust cable markers with distinctive colours for identification of e.g. safety function cables.
- 3.1.5 For all relay contact interfaces, the JS02 Contractor shall provide auto-contact jam detection and contact bounce elimination function to ensure proper operation of the system. Relays for safety functions shall comply with the appropriate internationally accepted standard specification.
- 3.1.6 The JS02 Contractor shall provide the RS8 Contractor with the number of train lines required between cars of a married pair and between married pairs to transmit signals from one end of the rake to the other end through an automatic electrical coupler. The number of such lines should be less than 31.
- 3.1.7 For compatibility, the rolling stock and the train detection system (track circuits), shall conform to EN 50238.
- 3.1.8 Vehicle control circuits shall be developed by the RS8 Contractor. All the vehicle control circuits incorporating the identified interfaces shall be provided to the JS02 Contractor, as

applicable. The JS02 Contractor shall provide specific observations, if any, to the RS8 Contractor. The RS8 Contractor shall suitably incorporate these observations in the design.

3.2 Rolling Stock Characteristics to be used by JS02 Contractor

3.2.1 The size and location of track circuits for determining the ATP blocks shall be designed to meet the headway requirements of trains of two different consists, based on the characteristics of the vehicles to be furnished (Annexure 1) and the track geometry. The back-up (line-side) signalling (in cut out mode) shall use the same track circuits as designed for the ATP working. The signal designer must co-ordinate with the rolling stock supplier to fine-tune the block design based on the traction and braking characteristics of the actual vehicles furnished. Acceptance tests of the signal system will use the actual vehicles supplied.

3.2.2 When operating in ATP Mode, a delay of 2s (programmable) shall be provided for the train operator to acknowledge a reduction in speed and begin to apply the brakes.

3.2.3 The model for calculating the safe braking distance (SBD) shall identify and take into account various systems' response times and train operators' reaction times. The design of ATP blocks shall also take into account the effect of track geometry on the traction and braking characteristics. The RS8 Contractor shall furnish the assured braking rate at the normal braking efficiency, and at the lowest braking efficiency permitted in service, including brake deterioration, to the JS02 Contractor. RS8 Contractor shall provide the speed/acceleration and speed/ tractive effort curves, for all loading conditions.

3.2.4 The RS8 Contractor shall furnish as a minimum the rolling stock parameters to be used by the JS02 Contractor for designing the target distance based ATP system, as set out in the attached Table refer Annex. 1.

3.2.5 For any other information required by the JS02 Contractor, he shall co-ordinate with the RS8 Contractor.

3.3 Signalling and Train Control Details to be used by RS8 Contractor

3.3.1 The following data shall be provided:

- (i) The maximum power consumed by the JS02 Contractor's equipment from the 110V DC supply under all specified operating conditions.
- (ii) The number of train wires required, and the function of each.
- (iii) All control logic outputs.
- (iv) Electrical characteristics of the interconnection cabling and wiring.
- (v) Sensitivity levels, and frequencies, which must be avoided.
- (vi) The specific heat load for air conditioning purposes.

3.4 ATC Equipment Cubicles

3.4.1 The RS8 Contractor shall supply the ATC equipment cubicle enclosure(s). All supports, braces, mounting holes, cabling apertures, etc. required for mounting the cubicle and its equipment shall be properly co-ordinated between the JS02 and RS8 Contractors to ensure secure mounting, and access. The cubicle(s) shall be resiliently mounted.

- 3.4.2 To achieve the ATC control functions, the JS02 Contractor shall identify any interfacing circuits specifically required for ATC operation and liaise with the RS8 Contractor. These include but not limited to start, door control, motoring, coasting, braking and emergency brake commands. Door control circuit design shall allow opening of doors in Standby position of mode selector under manual responsibility in case of non-availability of door opening authorisation from the ATP, without losing the ATP mode.
- 3.4.3 For train control circuits the JS02 Contractors shall identify the voltage free contacts to be provided by the RS8 Contractor, including the number and type of electrical signals required between the ATP equipment and the equipment provided by the RS8 Contractor. The two Contractors shall co-ordinate to agree on levels and protocols for each such signal.
- 3.4.4 As a minimum, all electronic equipment to be mounted on rolling stock, including those provided by the JS02 Contractor shall comply with IEC 60571: Electronic Equipment used on Rail Vehicles, for design, manufacture and testing, and shall use components purchased against an internationally recognized quality assurance and reliability certification procedure.
- 3.5 **Antennae**
- 3.5.1 The JS02 Contractor shall identify roof, bogie and underframe-mounted antennae, and associated disconnection box mounting brackets and location requirements to identify cable and conduit routes required to antennae.
- 3.5.2 The JS02 Contractor shall supply the necessary disconnection boxes, terminal blocks, cables and adaptation mounting brackets, flexible conduit assemblies complete with connectors and cables from antennae to the junction boxes.
- 3.5.3 The RS8 Contractor will provide the antenna mounting brackets, conduits, support or clamping arrangements to ensure security and reliability.
- 3.5.4 The antenna system shall not contravene the kinematic envelope and fully meet the radio coverage requirements both for normal and reverse directions of train working.
- 3.6 **Speed Measurement Devices**
- 3.6.1 For each ATC equipment set (per driving cab), the JS02 Contractor shall supply to the RS8 Contractor for installation, axle mounting speed measurement devices and couplings, to be configured, and the data from them processed in such a way as to achieve the objectives of 3.6.2 below.
- 3.6.2 The JS02 Contractor shall ensure that the speed measurement devices produce a signal which reflects the true speed of the train (within $\pm 1.0\text{km/hr}$) under any operational, weather and track conditions including gradient, curvature, wheel spin/slide and error in the speed measurement due to wear in wheel diameter.
- 3.6.3 The JS02 Contractor shall supply the necessary disconnection and terminal blocks, device mounting brackets and plates, flexible conduit assemblies complete with connectors and cables from speed measurement devices to the junction boxes. The JS02 contractor will supply all the mechanical fixing items like odometer, Antenna, Pick up coil and cables required

for ATC like cables for odometer, Antenna, Pick up coil etc within 3 months from award of contract.

3.6.4 The RS8 Contractor shall provide for each speed measurement device mounting brackets, support or clamping arrangements to ensure security and reliability.

3.6.5 The JS02 Contractor shall furnish the zero velocity detection apparatus (ZVR relay).

3.6.6 The JS02 Contractor shall provide speedometer indicating the actual speed, and with maximum safe speed. The design shall be acceptable to the Employer's Engineer.

3.6.7 The JS02 Contractor shall furnish the RS8 Contractor with full mounting details, apertures, fixing holes, etc.

3.7 Train Operator's Display

3.7.1 Indications to the train operator shall be displayed on the ATC Cab Display supplied by the JS02 Contractor. The train operator's display will be composed of an integrated LCD scree. It shall incorporate as a minimum, but need not be limited to the following information:

- (i) Train description, (ID) including crew identification
- (ii) Target Distance
- (iii) Target Speed
- (iv) Service and Emergency Brake Initiation
- (v) Train docked
- (vi) Train hold status
- (vii) Station dwell time available
- (viii) Departure order
- (ix) In ATP zone or not
- (x) ATP/ ATO failure indications
- (xi) Skip Stop indication
- (xii) Door Open Indication
- (xiii) Maximum Permissible Safe Speed (MSS) in ATP Mode
- (xiv) Train stopped outside of expected stopping window
- (xv) Depot indication, when the train is identified as being in a depot
- (xvi) Axle locked indication, for axles on which ATC speed sensors
- (xvii) Door release available; indicating on which side(s) of the train the doors may be opened.
- (xviii) Operating Mode

3.8 Interface Between TIMS and Train

3.8.1 The RS8 Contractor shall provide an on-board Train Information Management System (TIMS), to log the information from the ATP equipments supplied by JS02 Contractor, in addition to the information shown in the Rolling Stock specification.

- 3.8.2 Data stored in the TIMS shall be password protected. Levels and protocols shall be agreed between the two Contractors. The list of all such commands and responses shall be submitted to the Employer's Engineer for review and approval. JS02 shall provide Windows compatible software for maintenance terminals for viewing the data logged in TIMS.
- 3.8.3 All the vital commands by the on-board ATP system, to Rolling Stock equipment and the responses of the rolling stock equipment to these commands, shall be recorded in TIMS.
- 3.8.4 The signals to be supplied from the TIMS to the equipment of JS02 shall be tested jointly between the two Contractors.
- 3.8.5 The TIMS shall be able to communicate data to the wayside, the OCC. The data shall contain identified train alarms. The JS02 Contractor and Telecommunication Contractor shall interface to make the data available to its destination in OCC.
- 3.8.6 The interface shall ensure that TIMS receives necessary inputs from the on-board ATP system to enable TIMS to synchronize its clock with the system master clock. All the microprocessor/micro-controller based on-train systems shall synchronize respective clocks with TIMS clock.
- 3.9 **Power Supply and Earthing Arrangements**
- 3.9.1 Power supply circuits, including positive and negative poles, for ATC will be provided by the RS8 Contractor. Both Contractors shall co-ordinate for the power supply voltages.
- 3.9.2 The RS8 Contractor shall provide dedicated earthing arrangements for the train borne ATC equipment. The JS02 Contractor shall specify the earth impedance required.
- 3.9.3 The power supply cable between the train power supply and the ATC train borne equipment power equipment shall be as short as possible and directly connected to the supply without any intermediate connection.
- 3.10 **Not Used**
- 3.11 **Factory Installation and Testing**
- 3.11.1 All the special equipment associated with the train borne ATC shall be designed and supplied by the JS02 Contractor to the RS8 Contractor's factory. Each contractor shall be aware of the locations of manufacturing plants, which could concurrently be manufacturing cars.
- 3.11.2 The JS02 Contractor shall be responsible for providing all data and training of RS8 Contractor's staff in all aspects of ATC installation and testing where applicable. The ATC equipment shall be installed by the RS8 Contractor, under the supervision of the JS02 Contractor's Engineer, including the wiring for the interface of the ATC equipment with Rolling stock.
- 3.11.3 The RS08 Contractor will be responsible for installing wiring and equipment, and its testing on each car to the functioning standard.
- 3.11.4 Testing of each car shall comply with the accepted international standards agreed between the two Contractors as agreed with the Employer's Engineer. Initial Integration tests (static and dynamic) shall be done at the rolling stock factory and carried out by the test personnel of both Contractors jointly. Further main line integration tests will required to be carried out to ensure

all train control functions between OCC and Train which will be required to be done jointly by the two Contractors RS8 & JS02 at site in Jaipur. The test certificate for the on board equipment will be issued jointly by both RS8 and JS02 contractors.

3.11.5 The RS8 Contractor shall provide facilities including test track for comprehensive static, dynamic, and interface tests between the Rolling Stock and Signalling & Train Control systems at his premises. The JS02 Contractor shall be responsible for the provision of special test equipment and instrumentation.

3.11.6 In case of ATO, the integration test between RS8 and JS02 Contractors shall include tests on main line to confirm the realisation of demanded acceleration and deceleration rate by ATO under various conditions.

3.11.7 Should the need arise for modifications in the configurations of respective equipment or systems as a result of the integration test or otherwise, the scope of work and division of responsibility shall be jointly agreed amongst the two contractors and detailed procedure shall be developed.

3.12 **EMC/EMI Interface**

3.12.1 Regarding electromagnetic interference, the JS02 Contractor shall provide a list of frequencies and other sensitive requirements to the RS8 Contractor, to enable him to avoid such frequency bands in his design, and to provide devices to isolate the source of emission wherever required.

3.12.2 The RS8 and JS02 Contractor shall ensure that the emission and immunity level of their respective equipment meet the requirements of EN50121-3-1.

3.12.3 RS8 Contractor shall ensure that the return current in the track at the specified frequencies does not exceed the values specified by JS02 Contractor.

3.12.4 The two Contractors shall also jointly develop a test plan detailing how the electromagnetic compatibility of Traction and Signalling & Train Control systems will be verified. The two Contractors shall work together to assure that all electronic and electrical equipment on the rolling stock works properly without interfering with Signalling & Train Control systems.

3.12.5 The cable layout of the Signalling & Train Control systems in the cable ducts provided by the RS8 Contractor shall be jointly agreed. The separation between Signalling & Train Control cables and power cables of 25kV, 415V three phase AC, 230V AC single phase, 110V DC rating shall be in accordance with the international practice and jointly agreed.

3.12.6 The cable ducts should be earthed at notionally at every 2 m and also at the ends and should be in accordance with accepted international practices.

4 SCOPE OF INTERFACE

4.1 Division of Responsibility

- 4.1.1 The JS02 and RS8 Contractors shall co-ordinate interactively in order to achieve the functional and operational requirements of the system. The roles and activities of the two Contractors shall include minimum following but not limited to:

	JS02	RS8
1. On board ATP equipment. 2. On board ATO - Option 3. Antennae for ATP, ATS and TWC 4. Speed measuring sensors and Speedometer for RM/ ROS/ ATP mode. 5. ATC Cab Displays (Train Operators MMI) including special cables	To supply the equipment to the RS8 Contractor's Works	To provide space in the vehicle design for fixing and installation at the manufacturers facility by the RS8 contractor under the supervision of JS02 Contractor. The speedometer to be supplied by JS02 Contractor.
6. Not used 7. Not used		
8. Power supply and earthing for onboard ATP/ATO equipments	Furnish required voltage values and earthing requirements to RS8 Contractor.	To provide the required voltages and earthing
9. Logging of on-board information from ATP/ATO	JS02 to co-ordinate with RS8 for signal levels and protocols.	Provide the on board data logger TIMS.
10. Interface between ATP/ATO with train braking and propulsion systems for automatic braking, acceleration and deceleration.	ZVR & redundant EBR relays to be supplied by the JS02.	RS8 shall co-ordinate with the JS02 on levels and protocols for interface signals.
11. System master clock	JS02 Contractor to provide necessary inputs.	RS8 Contractor to synchronize its clock with the system master clock.
12. On board next station information to the passengers 13. Not used	Shall provide necessary signals on-board to RS8.	Shall provide for necessary hardware interface, display for on-board P.A. system inside the cars.
14. Climatic requirements for on board ATP/ATO equipments. 15. Not used	JS02 to specify at an early date, the total heat load wattage, and maximum permitted temperature	RS8 Contractor to provide Cab Air Conditioning installation to maintain a nominal temperature of 25°C. Suitable ventilation shall be provided by the Contractor for the backside area of the console.
16. EMI/EMC interface between the RS8 and JS02.	JS02 Contractor shall advise compliance to existing EMI/EMC plan for ATP equipment to RS8 Contractor at early date.	RS8 Contractor shall ensure the compliance of the requirements of JS02 Contractor for on board ATP equipment.

Annex 1 to Appendix A1

Rolling Stock Characteristics

Train composition DTC - Driving Trailer Car, TC - Trailer Car, MC - Motor Car	DTC-MC-MC-DTC DTC-MC-TC-MC-MC-DTC
Initial Acceleration on Tangent Track at Peak Load	0.80 m/s ² +/- 5%
Deceleration with full service brake	1.0 m/s ²
Minimum Average Emergency braking rate	1.3 m/s ²
Jerk Limiting Range	0.65 m/s ³ to 0.75 m/s ³
*Service Brake Response Time	2.0 s
*Emergency Brake Response Time	1.5 s max
*Service and Emergency Brake Release Time	2.5 s
Resistance to motion (formula, curve, starting resistance)	TR=21.96 +0.4222V + 0.00876 V ² N/t for underground. TR=14.01 +0.264V+0.00191V ² N/t for elevated/at grade. (V in kmph)
Maximum Vehicle Overhang	3625 +/- 125 mm
Maximum wheel diameter	860mm
Minimum wheel diameter	780mm
Maximum train design speed	95km/h
Maximum train service speed	85km/h
Door opening and closing times	Open 2.5 s (Max.) Close 3.5 s (Max.)
Tare weight Cars	41 Tonne
No of axles per Car	4
Presence of non service brake and non powered axles	All MC axles are powered while axles of DTC and TC cars are non-powered All axles are friction braked. However there shall be one axle for each driving cab which shall be : (i) Non powered, (ii) Not used for service brake application and ; (iii) used for emergency brake application, whenever required.
Axle Load	16 tonne
Train length – 4 Car Train	89m approximately
Train length – 6 Car Train	136 m approximately

Note : 1. All of the data in the above table are notional, and should be confirmed between the Contractors. The above data is not exhaustive, and full co-operation between Contractors is required.

2. For the four items marked *, the timings are for a brake application from full release to 90% of full brake cylinder pressure, and for brake release from full brake cylinder pressure to 10%.

APPENDIX A2 – JS02-PHASE-1B/ CIVIL, E&M, DETAIL DESIGN CONSULTANTS AND CONSTRUCTION CONTRACTORS INTERFACES

1 INTRODUCTION

1.1 Definitions and Scope

- 1.1.1 This specification describes the interface requirements between Contract JS02-Phase-1B for Signalling & Train Control and Detail Design Consultants and construction contractors.
- 1.1.2 In this Specification, unless otherwise stated, the term “Contracts” refers to all the relevant Contracts and the term “Contractors” refers to all the relevant Contractors.
- 1.1.3 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and PS pertaining to the contracts are fully resolved and implemented.
- 1.1.4 In the event of a conflict between the Particular Specification and this specification, the requirements of the Particular Specification shall prevail.

2 CONTRACTORS’ RESPONSIBILITIES

2.1 Coordination and Interfacing

- 2.1.1 This specification outlines the Contractors’ interface requirements, which are based on the Technical Studies carried out during the early stages of the Project. However, the requirements herein specified are by no means exhaustive and it remains the Contractors’ responsibilities to develop, update and execute jointly Interface Management details during design & throughout the execution of Works, to ensure that:
 - (i) All interface issues between the two contracts are satisfactorily resolved
 - (ii) Supply, installation and testing of equipment and software are fully coordinated
 - (iii) All equipment supplied in the contracts are fully compatible with each other

3 SCOPE OF WORK

Item No.	Subject	Station Detail Design and Design Contractor Viaduct Contractor	Civil/E&M/ Construction Contractors	JS02-Phase-1B responsibilities
1	Layout of rooms at the station – Signalling, UPS and Station control rooms.	Prepare and furnish station drawings; Incorporate room requirements and routing of Cable ducts/ cable trays.	Rooms complete with structures, , false ceiling if necessary, finishes, fire protection, doors, lighting fixtures, Air-conditioning & ventilation and power sockets. Provide Cable ducts /Hangers / cable trays up to the rooms.	Design: Mark cable trays on the station drawings in close coordination with the detailed design contractor. Review design with the design contractor. Co-ordinate closely with construction contractor to ensure the requirements at site are met. Construction: Construct all cable trays within the rooms required for Signalling & Train Control System. Provide False Floor, equipment foundations/ pedestals. Install all Signalling & Train Control equipment, cables etc. Seal the gaps after cable installation work.
2.	Track side equipment & Cabling infrastructure for Signalling	Design cable hangers/ cable ducts, cross track cast in cable ducts for main Signalling cables throughout the guideways. Fibre optic cables throughout the guideways shall have route diversity. Provision of space for line side equipments. Design details to be worked out in interface with JS02-Phase-1B design requirements.	Cable ducts for main Signalling cables throughout the guideways. Cross track cast in cable ducts for main cables. Fibre optic cables throughout the guideways shall have route diversity	Design: Furnish and confirm sizes and bending radius of trays, hangers, main cable duct and cross track cable ducts for main cables in close coordination with the civil design and/ or construction contractor. Furnish locations of line side equipments. Furnish and review requirements of EMC separation for cabling. Review the design from detailed design Contractors. Construction: Construct all secondary ducts including track crossings and partitioning/ providing cable trays/ channels in main cable ducts as required. Install cables for all

				<p>Signalling systems including provision of all cable supports.</p> <p>Install all line side equipments including equipment foundations etc.</p>
3.	Cabling infrastructure for Signalling at stations	<p>Incorporate routing of Cable ducts/ hangers/ trays for Signalling cables throughout the station.</p> <p>Fibre optic cables throughout the station shall have route diversity</p> <p>Design details to be worked out in interface with JS02-Phase-1B design requirements.</p>	<p>Cable ducts/ cable trays/ Hangers for routing Signalling cables from tunnel/ viaduct.</p>	<p>Design:</p> <p>Mark cable duct/ tray requirement on the GAD/ CSD in close coordination with the civil design and/ or construction contractor.</p> <p>Furnish and review requirements of EMC for cabling.</p> <p>Review and confirm design with the design contractor and closely co-ordinate with construction contractor to ensure that the requirements at site are met.</p> <p>Construction:</p> <p>Install cables for all Signalling systems.</p>
4.	Station Control Room	<p>Space for work stations/ ESP and other Signalling equipments.</p>		<p>Design:</p> <p>Furnish layout of Signalling equipment within Station Control Room for JS02-Phase-1B equipment in close coordination with the civil design and/ or construction contractor.</p> <p>Construction:</p> <p>Install Signalling equipment within Station Control Room.</p>
5.	Provision of Earthing at stations equipment rooms.	<p>Design of earth and earth bus bar < 2Ω including space for earth pits.</p>	<p>Earth bus bar < 2Ω inside UPS (S&T) Room.</p>	<p>Set up the earth bus inside Signalling equipment room from the earth bus bar provided in UPS (S&T) room.</p>

* End of Appendices A2 *

APPENDIX A3 – JS02-PHASE-1B/ TELECOMMUNICATION CONTRACTORS INTERFACES

1 INTRODUCTION

1.1 Definitions and Scope

1.1.1 This specification describes the interface requirements between Contract JS02-Phase-1B for Signalling & Train Control and Telecommunication Contracts.

1.1.2 In this Specification, unless otherwise stated, the term “Contracts” refers to all the relevant Contracts and the term “Contractors” refers to all the relevant Contractors.

1.1.3 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and PS pertaining to the contracts are fully resolved and implemented.

1.1.4 In the event of a conflict between the Particular Specification and this specification, the requirements of the Particular Specification shall prevail.

2 CONTRACTORS’ RESPONSIBILITIES

2.1 Coordination and Interfacing

2.1.1 This specification outlines the Contractors’ interface requirements, which are based on the Technical Studies carried out during the early stages of the Project. However, the requirements herein specified are by no means exhaustive and it remains the Contractors’ responsibilities to develop, update and execute jointly Interface Management details during design & throughout the execution of Works, to ensure that:

- (i) All interface issues between the two contracts are satisfactorily resolved
- (ii) Supply, installation and testing of equipment and software are fully coordinated
- (iii) All equipment supplied in the contracts are fully compatible with each other

3 SCOPE OF WORK

3.1 Interface of Signalling with Public Information Display System (PIDS)

3.1.1 The Contractors shall interface for automatic display of train related information including train arrivals/ departures on pre-designated display boards.

3.1.2 For each line, The Central ATS and Local ATS for a specific sector of the TC&S System shall send data to the PIDS to display train related information including train arrivals and departures on pre-designated display boards throughout the platforms and the concourse of all stations.

3.1.3 Based on the information received from the TC&S System, PIDS system will initiate and co-ordinate Train arrival/ departure related PIDS message with the Public Announcement System.

- 3.1.4 The PIDS will carry out time count down based on the estimated time data sent by the TC&S System and display the estimated train arrival and /or departure particulars. The estimated time to arrive and/ or depart of the train(s) as shown on any display board will be updated automatically and will be corrected if necessary following a data update from the TC&S System.
- 3.1.5 The pre-defined message displays will be triggered by the data sent by the TC&S system including message displays of non-stopping trains passing through the stations, train not in service and user defined message displays.
- 3.1.6 The TC&S equipment at each station shall invoke the station PIDS control equipment to clear the designated row of the train arrival/ departure information on the corresponding PIDS display boards subsequent to a train departure.
- 3.1.7 The Detailed Interface Document will be as per the existing Interface document already in operation in DMRC Line 5 & 6. The two contractors shall jointly review the detailed interface document covering the hardware interface, list of messages, type and format of message to be displayed and the protocols to be followed for exchange of data between the two systems. The detailed interface document shall be submitted for review of the Employer.
- 3.2 **Interface of Signalling System with Passenger Announcement System (PAS)**
- 3.2.1 The Contractors shall interface for automatic announcement of train related information including train arrivals/ departures on the designated station platforms.
- 3.2.2 Data shall be sent by the TC&S to the PAS System in a coordinated manner to broadcast predefined train information including train arrivals and departures on pre-designated display boards throughout the platforms of all stations.
- 3.2.3 PAS announcements will be made to alert passengers of all non-stopping trains based on the information received from the TC&S System.
- 3.2.4 The PAS will carry out the time countdown based on the estimated time data sent by the TC&S System. The estimated time to arrive and/or depart of the train(s) will be stepped down automatically every minute and will be corrected, if necessary following a data update from the TC&S System.
- 3.2.5 The time countdown will be frozen when a train stops proceeding to the next stopping station, due to circumstance detectable by the TC&S System and relayed to the PAS.
- 3.2.6 The pre-defined announcements will be triggered by the time countdown functions of the PAS or data sent by the TC&S System including announcement of non-stopping trains passing through the station.

3.2.7 The Detailed Interface Document will be as per the existing Interface document already in operation in DMRC Line 5 & 6. The two contractors shall jointly review the detailed interface document covering the hardware interface, list of messages, type and format of message to be displayed and the protocols to be followed for exchange of data between the two systems. The detailed interface document shall be submitted for review of the Employer.

3.3 **Interface of Signalling System with Radio System**

3.3.1 The Contractors shall interface to achieve reporting of the alarm and status of the Trainborne Signalling & Train Control Equipment by Radio to OCC through a Communication Port.

3.3.2 TC&S system shall interface with Train Radio for Dynamic Registration of Train identity numbers (TID) using the information provided by the ATS system.

3.3.3 Onboard ATP system shall interface with the Train radio to enable the Train radio automatically transmit alarm message to OCC whenever the mainline revenue Train has switched to Restricted Mode (RM) operation. This detection shall, however, be disabled for Trains operating in the depot.

3.3.4 As a minimum the RM operation indication shall appear on the Traffic controller's Radio Dispatcher Console and shall contain the Train Identity Number (TID), Rake ID, location from which it is originated (in terms of which Radio Base Station the alarm message was originally routed). The alarm message shall be time and date stamped. Radio Dispatcher Console shall be able to send an acknowledgement and initiate a call, both voice and short data message to the Train. This service shall operate regardless of whether the Train operator or the target user is engaged in a voice or data call.

3.3.5 Failure of the radio equipment shall not interrupt the normal operation of the Trainborne Signalling equipment.

3.3.6 The two contractors shall jointly develop detailed interface document covering the hardware interface, list of messages, type and format of message to be displayed and the protocols to be followed for exchange of data between the two systems. The detailed interface document shall be submitted for review of the Employer.

3.4 **FOTS Channels for Signalling Use**

3.4.1 Telecommunication Contractor will provide redundant point-to-point 2 Mbps channel to JS02-Phase-1B Contractor between OCC and each interlocking station (see list in Appendix R). Telecommunication Contractor will provide redundant point-to-point 2 Mbps channel to JS02-Phase-1B Contractor between OCC and DCC.

3.4.2 The point of interface for these channels will be TER at stations and CER at OCC. All cable from the Termination point of 2 Mbps of the Telecomm Contractor shall be laid by JS02-Phase-1B to his own equipment.

- End of Appendices A3 *

APPENDIX A4 – JS02-PHASE-1B/ TRACK CONTRACTS INTERFACES

1 INTRODUCTION

1.1 Definitions and Scope

- 1.1.1 This specification describes the interface requirements between Contract JS02-Phase-1B, Signalling & Train Control and Track Contract(s).
- 1.1.2 In this Specification, unless otherwise stated, the term “Contracts” refers to all the relevant Contracts and the term “Contractors” refers to all the relevant Contractors. The individual Contractors are referred to by the corresponding Contract number.
- 1.1.3 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and Particular Specification pertaining to the contracts are fully resolved and implemented.
- 1.1.4 In the event of a conflict between the Particular Specification and this specification, the requirements of the Particular Specification shall prevail.

2 CONTRACTORS’ RESPONSIBILITIES

2.1 Coordination and Interfacing

- 2.1.1 This specification outlines the Contractors’ interface requirements, which are based on the Technical Studies carried out during the early stages of the Project. However, the requirements herein specified are by no means exhaustive and it remains the Contractors’ responsibilities to develop, update and execute jointly Interface Management details during design & throughout the execution of Works, to ensure that:
 - (i) All interface issues between the two contracts are satisfactorily resolved
 - (ii) Supply, installation and testing of equipment and software are fully coordinated
 - (iii) All equipment supplied in the contracts are fully compatible with each other
- 2.1.2 The interface between JS02-Phase-1B/ Track Contractor(s) will be for both ballasted and ballastless tracks.

3 SCOPE OF WORK

S.N.	Subject	Track Contractor(s)	JS02-PHASE-1B
1.	Electrical properties of track assemblies.	Shall provide the same so as to meet electrical requirements of JS02-Phase-1B.	Shall furnish the electrical requirements for track circuits.
2	As built track alignment & profile plans	Shall provide the same giving the details of curves & gradients and also civil speed restrictions.	Shall incorporate the same in Train Control & Signalling design.
3.	Turn out assemblies and their mounting & driving arrangements.	Shall supply and install the Turnout assemblies (including the second drive) and provide for the mounting arrangements for point machines including second drive arrangements.	Shall co-ordinate with Track Contractor(s) on design and mounting of the Turn out assemblies including point machines. Supply and install the point machines including the locking arrangement , if any, for the second drive, suitable to drive the turnouts. Co-ordinate with Track Contractor(s) for design & installation of second drive arrangements.
4.	Insulated glued joints/ Insulated fish Plated joint.	Shall supply and install the insulated glued joints/ Insulated fish plated joint at the designated locations as per requirements of JS02-Phase-1B.	Shall furnish the requirement and locations of all insulated glued joints/ insulated fish plated joints to Track Contractor(s).
5.	Insulated Nylon joints (In case the provision of glued joints is not feasible)	Shall cut the rail and install the Insulated Nylon joints at the designated locations as per requirements of JS02-Phase-1B.	Shall supply and identify the locations of Insulated Nylon joints to Track Contractor(s).
6.	Scope of Supplies	Shall supply & install all track assemblies & Track fasteners, turnouts, all stretcher bars (except leading stretcher bar) and helper mechanism, second drive, wherever required, for second pull. The design of second drive arrangement shall be co-ordinated and interfaced with JS02-Phase-1B to ensure full compatibility.	JS02-Phase-1B contractor shall supply & install the point machines, leading (1 st) stretcher bar & co-ordinate with Track Contractor(s) for design and installation of second drive arrangement. Shall supply locking arrangement, if required, for second drive.
7.	Testing of rail-to-rail, rail to sleeper and insulated joints.	Shall arrange the testing of individual components before installation, preferably at the supply stage. The track form/ structure (including the rail surface) as installed shall be thoroughly cleaned to an acceptable standard as approved by the Employer's Engineer immediately after installation and as required thereafter to maintain the standard until the commencement of "Service Trials",	Shall arrange testing after installation. Shall co-ordinate closely with Track Contractor(s) during installation.

		so as to provide adequate levels of electric insulation and rail surface quality for the correct performance of Train Control & Signalling equipment's under the prevailing climatic & environmental conditions.	
8.	Track X-ings of Cables.	Shall provide cut-outs in the track plinth on ballastless track, at regular intervals.	Shall provide all track crossings including pipes and support and/or drilling of holes in the plinth.
9.	Installation of trackside equipments, signal posts.	Shall co-ordinate with JS02-Phase-1B to ensure the compliance of schedule of dimensions.	Shall furnish the final sizes of trackside equipment's and co-ordinate with Track Contractor(s) to ensure the compliance of schedule of dimensions.
10.	Track connections.	Shall co-ordinate with JS02-Phase-1B for track circuit bonding cables and point machine connections with track.	Shall supply and install track circuit bonding cables and point machine connections with track in co-ordination with Track Contractor(s). Shall fix bonding cables on sleepers on the ballasted track to prevent damage during tamping.
11.	Installation of points operation mechanism	Shall provide proper gauge, housing of points and opening of switches and carry out all other works as required to make the point suitable for installation of point machine by JS02-Phase-1B contractor.	Shall check the proper gauge, housing of points and operating of switches and all other items necessary from signalling point of view, JS02-Phase-1B contractor shall make necessary adjustment to points operating mechanism as required by track contractor(s) at the time of track parameters correction and tamping of ballasted turnouts.
12.	Testing of points and crossings	Jointly test with JS02-Phase-1B contractor during installation and while commissioning of point machines and during integrated testing & commissioning and rectify all defects pertaining to track, if any, identified during testing and commissioning of points.	Jointly test with track contractor(s) during installation and while commissioning of point machines and during integrated testing & commissioning.

- End of Appendix A4 *

APPENDIX A5 – JS02-PHASE-1B/ TRACTION SUPPLY INTERFACES

1 INTRODUCTION

1.1 Definitions and Scope

- 1.1.1 This specification covers the interface requirements between Train Control & Signalling Contract JS02-Phase-1B and Traction Power Distribution and Overhead Line Contract(s).
- 1.1.2 In this Specification, unless otherwise stated, the term “Contracts” refers to the JS02-Phase-1B, Traction Supply Contract(s) and the term “Contractors” refers to JS02-Phase-1B, Traction Contractors. The individual Contractor is referred to by the corresponding Contract number.
- 1.1.3 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and PS pertaining to interfaces are fully resolved and implemented.
- 1.1.4 In the event of a conflict between any Particular Specification and this specification, the requirements of the Particular Specification shall prevail.

2 CONTRACTORS’ RESPONSIBILITIES

2.1 Coordination and Interfacing

- 2.1.1 This specification outlines the Contractors’ interface requirements, which are based on the Technical Studies carried out during the early stages of the Project. However, the requirements herein specified are by no means exhaustive and it remains the Contractors’ responsibilities to develop, update and execute jointly Interface Management details during design & throughout the execution of Works, to ensure that:
 - (i) All interface issues between the two contracts are satisfactorily resolved
 - (ii) Supply, installation and testing of equipment and software are fully coordinated
 - (iii) All equipment supplied in the contracts are fully compatible with each other

3 PHYSICAL INTERFACE

3.1 Signal and Mast Locations

- 3.1.1 JS02-Phase-1B Contractor shall provide chainages of signal posts to Traction contractor(s). The Traction Contractor(s) shall provide the JS02-Phase-1B Contractor with the location of all OHE masts & their staggering arrangement in Main line.
- 3.1.2 The JS02-Phase-1B Contractor shall receive the information of OHE mast location from the Traction contractor(s) and shall ensure that signals are mounted in locations where these are not hidden by OHE masts or other hardware.
- 3.1.3 The contractors shall co-ordinate for ensuring the minimum safe distance between any signalling field installation and the live OHE contact point for the purpose of human safety apart from EMI/ EMC considerations.

4 ELECTRICAL INTERFACE

4.1 Traction Return

- 1) The Traction contractor(s) shall advise the JS02-Phase-1B Contractor of the normal and worst short circuit current levels.
- 2) The JS02-Phase-1B Contractor shall advise the Traction contractor(s) of the locations of the track circuits. The Contractors shall agree on the final location of cross bonds/ impedance bonds and other rail connections related to traction return current.
- 3) JS02-Phase-1B shall supply, install and terminate all impedance bonds, bonding cables and continuity bonds, including all bonding in the turnouts, required for proper functioning of track circuits. The Traction contractor(s) shall supply, install and terminate traction bonding cables, if required additionally, at appropriate intervals, which shall be co-ordinated with the JS02-Phase-1B, contractor to ensure the balanced & unobstructed flow of traction return current.
- 4) For connecting the traction transformer earthed neutral terminal to the running rails, Traction contractor(s) shall co-ordinate with JS02-Phase-1B.
- 5) The two Contractor shall interface regarding use of Buried Earth Conductor, if provided along the line, for earthing of outdoor signalling equipment.
- 6) The two Contractors shall interface to achieve an integrated Earthing & Bonding plan for the line.

4.2 Insulated Rail Joint

- 4.2.1 For track circuits, the JS02-Phase-1B Contractor shall provide the Traction contractor(s) with the location of required insulated rail joints on mainline.
- 4.2.2 Traction contractor(s) shall design the traction return system considering the locations of insulated joints.

4.3 Neutral Sections

- 4.3.1 The Traction contractor(s) shall provide the JS02-Phase-1B Contractor with the length & location of all traction neutral sections.
- 4.3.2 The JS02-Phase-1B Contractor shall design the Signal Locations such that no train or a part of a train stops within the neutral sections during normal operations.

5 FUNCTIONAL INTERFACE

5.1 Protection Characteristics

- 5.1.1 The Traction contractor(s) shall provide the JS02-Phase-1B Contractor with the overhead line feeder circuit rating, the protection tripping setting, the overhead line conductor current carrying capacity, Transient & surge protection and the protection relay setting.

- 5.1.2 The JS02-Phase-1B Contractor shall ensure that the Train Control and Signalling System makes allowance for the settings as described in Paragraph 5.2 when planning for simultaneous start up of several trains. The Contractors shall ensure that there is no degradation with respect to the performance requirement as specified in the respective Specifications.

6 ELECTROMAGNETIC COMPATIBILITY

6.1 Joint EMC Management Plans and Testing Regime

- 6.1.1 The Traction and JS02-Phase-1B Contractors shall perform a joint study and develop the Electromagnetic Compatibility Management Plans using such data as the emission characteristics, susceptibility levels, filter characteristics, physical layout and construction of their equipment, taking into consideration variation in component characteristics with frequencies. The study shall demonstrate compatibility or highlight areas of potential problems with a view to implement remedial measures in time to achieve compatibility.
- 6.1.2 Traction and JS02-Phase-1B Contractors shall co-ordinate for any information concerning EMI/ EMC in the overhead line & other structures.
- 6.1.3 The Contractors shall jointly develop a test plan detailing how the electromagnetic compatibility of the OHE traction System and the Signalling & Train control System will be verified, taking into consideration the study conducted.

- End of Appendix A5 *

APPENDIX A6 – NOT USED

Appendix A7 - JS02-PHASE-1B/ TUNNEL VENTILATION SYSTEM CONTRACTORS INTERFACES

1 DEFINITIONS AND INTRODUCTION

1.1 Definitions and Scope

- 1.1.1 This specification covers the interface requirements between Train Control & Signalling Contract JS02-Phase-1B and Tunnel Ventilation System Contracts.
- 1.1.2 In this Specification, unless otherwise stated, the term “Contracts” refers to all the relevant Contracts and the term “Contractors” refers to all the relevant Contractors.
- 1.1.3 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and PS pertaining to interfaces are fully resolved and implemented.
- 1.1.4 In the event of a conflict between any Particular Specification and this specification, the requirements of the Particular Specification shall prevail.
- 1.1.5 The requirements specified herein are by no means exhaustive and it remains the responsibility of the contractors to develop and execute an interface plan during execution of the work to ensure that:
 - (i) All interface issues between the two contracts are satisfactorily resolved
 - (ii) Supply, installation and testing of equipment and software are fully coordinated
 - (iii) All equipment supplied in the contracts are fully compatible with each other

2 SCOPE OF WORK

2.1 Interface of Train Control & Signalling System with Tunnel Ventilation (TVS) System – Underground Portion Only

- 2.1.1 The Train Control and Signalling System shall prevent any train from leaving a station until the front of the train ahead has arrived at the ventilation shaft ahead & is continuing its journey. In case the distance between two underground stations is long, there may be additional ventilation shafts in between two stations.
- 2.1.2 It shall be possible for the controller from OCC to remove and restore the above restriction section by section.
- 2.1.3 The Train Control & Signalling System shall provide an alarm to the SCADA system controlling the Tunnel Ventilation System.
- 2.1.4 The two contractors shall jointly develop detailed interface document covering the hardware interface, list of messages, type and format of message to be displayed and the protocols to be followed for exchange of data between the two systems. The detailed interface document shall be submitted for review of the Employer.

- End of Appendices A7 *

APPENDIX A8 – NOT USED

- End of Appendices A8 *

APPENDIX B – SCHEDULE OF EMPLOYER’S DRAWINGS

<u>S.NO.</u>	<u>REFERENCE DRGS</u>
---------------------	------------------------------

- | | |
|----|--|
| 1. | Tentative Conceptual Signalling plan of entire Main Line . |
| 2. | Not Used. |
| 3. | Typical Station Layout |

APPENDIX C – LIST OF EXISTING ATS WORK STATIONS

Location	Position	Number		Number of monitors	Remark
		Line 2			
OCC Theatre	Traffic Controller	2		3 per position	Contractor shall upgrade the ATS system software to include phase-1B stations on all controllers HMIs without disturbing the Phase-1A system.
	Chief Controller	1		1 per position	
	Assistant Chief Controller	1		1 per position	
	Auxillary system Controller	1		1 per position	
	Traction Power Controller	2		1 per position	
	Fault Management Controller	1		1 per position	
	Rolling Stock Controller	1		1 per position	
	Time Table Management Offline	1		1 per position	
	Time Table Management Online	1		1 per position	
	Offline Playback Management	1		1 per position	
Operation Planning Centre at OCC	Operation Planning Centre	1		1 per position	
CER at OCC	Maintenance MMI	1		1 per position	
	CATC system development	1		1 per position	
SCR of stations controlled by MRSN interlocking)	Train Control Work Station	1 each		1 per position	Contractor shall upgrade the ATS software of MRSN IXL to include the boundary of Phase-1B section
Crew Controller's Room (At terminal stations)	Crew Controller	1 each		1 per position	1 per position
SMR of interlocking stations	Maintenance MMI	1 each		1 per position	1 per position

ATS WORKSTATION TO BE SUPPLIED UNDER PHASE-1B CONTRACT

Location	Position	Number for Phase-1B section	Number of monitors
SCR of stations (Choti Chauper & Badi Chauper)	Train Control Work Station	1 each	1 per position
Crew Controller's Room (At terminal stations)	Crew Controller	1 each	1 per position
SMR of interlocking station	Maintenance MMI	1 each	1 per position

APPENDIX D – DESIGN CRITERIA

1 GENERAL

This design criteria document describes the functional and design requirements for the signalling and train control systems of the Jaipur Metro Rail Corporation (JMRC). The design of the Train Control & Signalling System for phase-1B is in same line with the proved TC&S System of Phase-1A. It is to be used in connection with the Particular Specification (PS) for Contract JS02-Phase-1B. In the event of conflicts between this document and the PS, the PS shall govern.

The Signalling & Train Control system shall use ATP system which will be target distance based. The transmission from track to train will be continuous through coded audio frequency track circuit with onboard displays for Maximum Safe Speed (MSS), current speed, target distance/speed as deduced from the most restricting ATP condition, signalling mode etc.

An Automatic Train Supervision (ATS) system shall be provided. The Operational Control Centre will be located at Mansarovar.

An Automatic Train Operation shall be provided as required as per the Tender.

For Initial Mode of operations by the Revenue Operations Date, as a minimum, the Line Side Signaling with suitable safety protection to be proposed by JS02-Phase-1B, shall be implemented by JS02-Phase-1B.

2 PRINCIPLE OF TRAIN OPERATION

2.1 Function

The Continuous Automatic Train Control (CATC) system shall consist of the following components:

- 2.1.1 Automatic Train Protection (ATP): All the functions under ATP shall be vital functions and shall govern the overall functioning of CATC system. This vital system maintains the safety of train operation including separation of trains, enforcement of speed restriction, and safe operations through interlocking.
- 2.1.2 The system shall utilize cab signals with lineside signals only at interlocking. Lineside signals shall be provided at all entrances to interlocking, including both the normal and the reverse direction.
- 2.1.3 Automatic Train Supervision (ATS): This system directs train operations to provide scheduled service under normal conditions and the best service [possible under adverse conditions. It exchanges messages with external subsystems such as CBI, ATC, Master Clock, PIDS, Train Radio etc.
- 2.1.4 Automatic Train Operation

2.2 Operational Modes

ATO Mode

ATP Mode

RM Mode

Run on Sight Mode (ROS Mode)

Cut-Out Mode

3 OPERATING CRITERIA

3.1 Headway

The design shall be based on a theoretical headway of 2 minutes in order to permit trains to operate on a sustained headway of 3 minutes under normal operations as described in the Particular Specification.

3.2 Speed Limits

3.2.1 Normal Operation

Allowed running speed of trains will be 85 km/hr. ATP/ ATO shall enforce civil speed restrictions and diverging speed restrictions over turnouts and crossovers. While the Track design is under finalisation, the anticipated permissible speed over 1:12 turnouts (and 1:9 turnouts for Standard Gauge) will be 40 km/hr and 1:8.5 turnouts (and 1:7 turnouts for Standard Gauge) will be 25 km/hr. Speed restrictions shall be in effect for the entire train. If ATO fails but ATP is still operating, the train shall operate at the same speed as it would under normal operation with enforcement of all normal and temporary speed restrictions.

3.2.2 Temporary Speed Restrictions

It shall be possible to add, modify or remove a Temporary speed restriction in a safe manner from both Operation control centre and local control depending on the existing level of control. The temporary speed restriction application, modification and removal shall be done in a safe manner.

A temporary speed restriction shall be limited to a sub-section that includes one or more track circuits. Temporary speed restriction shall be in effect for the entire train.

3.2.3 Cut-Out Mode

When a train is operating in Cut-Out Mode due to failure of the on-board ATP equipment, the speed shall be limited to 25 km/h. The on board Rolling stock equipment will enforce this limit.

3.2.4 RM Mode, ROS Mode

When a train is operating in RM Mode, the speed shall be limited to 25 km/h. The on-board ATP equipment shall enforce this limit.

3.3 Reverse Running

It shall be possible to operate trains in the reverse direction at the same speed as in normal direction running. Full protection shall be provided for reverse running on all main tracks. Following moves shall be permitted. Civil speed restrictions shall be enforced when trains operate in the reverse direction. Headways for the reverse direction shall be based on the block boundaries established for normal direction operation without any additional optimisation. ATO need not be provided in the reverse direction but full ATP shall be provided.

3.4 **Station Stopping**

If the Train stops within safety conditions for door opening i.e. door opening authorisation window, the Signalling & Train Control system will provide the door enable signal to the train operator to open the doors manually on the correct side of the platform. If the train does not stop within door opening authorisation window, the Train Control and signalling system shall not provide the door enable signal to the train operator. If the train is not berthed properly and it is desired to open the train doors, then a special door control signal must be sent to the door operating apparatus. The door controls will be supplied and installed by the Rolling Stock manufacturer. Specific criteria for accuracy of stopping and for door control are given in the Particular Specification.

Doors will be closed by the train operator when a starting signal is received from the ATS. In the event of failure of the ATS, the train operator shall be able to close the doors and start the train without a signal from ATS.

3.5 **Station Dwell Time**

The ATS shall optimise headways as described in the Particular Specification. The normal dwell time shall be 30 seconds at each station. The minimum dwell time shall be configurable.

3.6 **Train Consist**

Trains consist will be of two different type. Control and monitor equipment should preferably be located at the outer ends of the rakes.

3.7 **Design of ATP Blocks**

The size and location track circuits for determining the ATP blocks shall be designed for meeting the headway requirements based on the characteristics of the vehicles to be furnished & the track geometry. The back-up signalling shall use the same track circuits as designed for the ATP working. The specification for Rolling stock is as given in Appendix A1 of PS. A preliminary block layout shall be prepared based on the specifications in Appendix A1 of PS. The signal designer must co-ordinate with the rolling stock supplier to fine-tune the block design based on the braking characteristics and tractive effort of the actual vehicles furnished. Acceptance tests of the signal system will use the actual vehicles supplied.

The safety factor to be used for the safe braking model shall have suitable margin over the calculated braking distance. When operating in ATP Mode, a delay of 2 seconds (programmable) shall be provided for the train operator to acknowledge a reduction in speed and begin to apply the brakes.

The safe braking model for calculating the SBD (Safe braking distance) shall identify & take into account various systems' response time and train operator's reaction time. The design of ATP blocks shall also take into account the effect of track geometry on the braking characteristics and the tractive effort.

Rolling stock contractor will furnish the parameters as given in Appendix A1 of PS for use of JS02-Phase-1B Contractor for designing the Target distance based ATP system.

Civil track contractor will furnish the following parameters for use of JS02-Phase-1B Contractor:

- (1) Chainage wise details of curves
- (2) Chainage wise details of gradients.
- (3) Maximum civil speed.

For any other information required by the JS02-Phase-1B contractor, he shall co-ordinate with the Rolling Stock Contractor & other Civil Track Contractors.

The signal designer shall furnish the DMRC with the Design Data, formulas, calculations, and computer simulation logic, results and printouts for demonstrating that both safe braking and the specified theoretical headways have been provide by the design a obtain the approval of the Employer's Engineer.

3.8 **Interlocking**

Locking shall be provided in accordance with the requirements of the Delhi Metro Signal Engineering Manual (SEM). Interlocking system shall be based on Entrance-Exit Principle.

Signals shall be located on all tracks at the limits of all interlocking units and shall control entry to all interlocked routes including reverse running routes. Signal control circuits shall prevent conflicting train movements within the local interlocking plant and between adjacent track interlocking units.

The conditions to permit a signal to display proceed aspect for a particular route are described in the following:

- (a) The route must be set, and the route locking must be effected (all the subroutes/ elements locked);
- (b) All the points in protection must be set, locked and detected in the protection position (flank and trap protection);
- (c) Opposing route signals display a red aspect;
- (d) The timing release of the route is not in process;
- (e) The track circuit(s) between the origin signal and the destination signal is (are) clear (For Green aspect);
- (f) Overlap is set and locked (For Green aspect);

Origin of route signal shall be replaced to danger and disengaged as a precondition to route release. The automatic replacement shall not apply when the route has been set to operate in fleet mode. An automatic replacement shall be applied by occupying the berth track circuit and the first track circuit beyond the signal.

Nothing in the paragraph shall be construed as relieving the Contractor from providing the locking required in the SEM.

A route is defined by its origin and its destination.

Routes could be set by route control if all the following applicable conditions are met:

- (a) All conflicting routes are not set;

- (b) The route locking section/ route elements must not be locked in the opposite direction of the considered route;
- (c) All points required for the route, flank protection and trapping protection are set in the correct position or are free to be moved;
- (d) The opposite overlap (downstream a signal origin of an opposite route) must be free, if it is in the same section of track of the last switch of the considered route;

Route locking section (subroute/ elements): When the route is set, all the subroutes/ elements of the considered route are locked if points have been set in the correct position. It is a condition for locking a route.

Route locking: A route is locked only if the route is controlled and all subroutes/ elements are locked and all overlaps are eventually locked.

Application of Train Operated Route Release (TORR): Train operated route release (TORR) is the release of a route after the passage of a train without further action from the Controller. TORR must be inhibited if a route is set to work in fleet-mode.

Route locking release by manual control: When the Controller has decided to release a route, he engages the “route cancellation”. There is such a control for each route. When this process is engaged, the interlocking realizes the following actions:

- (i) The origin of route signal is replaced to danger;
- (ii) If the approach locking is free, the route is immediately released;
- (iii) Or if the approach locking is locked, the route is released after time delay.

Approach locking shall be provided for all routes governed by main signals and shall be continuously effective from the approach track, which shall commence from an adequate distance in rear of the signal. Approach locking shall lock all switches within a route governed by a clear signal and will not allow a set route to be released for a period not less than 90 seconds on the mainline and not less than 45 seconds in depot, when a cleared signal is put to stop.

Route shall ordinarily be released by the passage of trains over the route in a sequential manner. Sectional release of route (elements) shall be provided as necessary.

Overlap is the distance between the Point to Protect (junction of TC or point) and the Operating Stopping Point (signal). Overlap shall always be ensured by the Signalling & Train Control system for the safe braking distance.

Fouling protection shall be provided to prevent a train from approaching an interlocking where an overrun could corner a train. Once a route has been set, the infringement of the Fouling Point of any point or crossing in the route by any train shall cause an emergency stop command to be sent to any train approaching or within the set route.

Fleeting controls to make signals in the normal running direction operate in the automatic model shall be provided at each interlocking. These controls shall allow an interlocking signal to be automatically recleared behind a train.

3.9 **Terminals**

Automatic turnback (Cycle mode or Sequence mode) shall be provided in the interlocking logic at terminal stations including interim turn back stations, to automatically operate more than one route one after the other in a sequential manner. All such possible modes shall be provided for the trains arriving in the normal running direction.

4 **CONTINUOUS AUTOMATIC TRAIN CONTROL**

The Continuous Automatic Train Control (CATC) system shall consist of Automatic Train Control (ATP), Automatic Train Supervision (ATS), and optional provision of Automatic Train Operation (ATO).

The ATC Function shall be responsible for implementing train movements in accordance with the requirements established by the ATS Function, within the constraints established by the Interlocking Function. Complete system shall work in a fail-safe manner.

4.1 **Automatic Train Protection**

4.1.1 The ATP system shall work on the principle of target speed and target distance. Train detection and cab signal transmission to trains shall be continuous through coded audio frequency track circuits. The coded Audio frequency track circuits will be remote fed with minimum equipment on the trackside. Cross bonding between tracks shall be co-ordinated with the traction power designer to assure that broken rail detection is operative to the extent feasible, potential crosstalk problems between tracks are eliminated, and the requirements for the traction return current are met. Insulated joints and impedance bonds shall be provided wherever required. Shunting sensitivity of the track circuits shall be at least 0.5 ohms with ballast resistance of 2 ohms/km of track.

Special care shall be taken within interlocking to avoid crosstalk between track circuits. If loops are provided within interlocking for delivery of cab signals to the trains, the length of the loops shall not exceed the length of a four-car train. When the front end of the train leaves a track circuit or a loop, the cab signal energy shall be removed from that track circuit or loop.

Cab signals shall be provided for the train operator's use in determining the maximum safe speed, the current speed, the target speed, the distance to go to the target location, and the Limit of Movement Authority. Any change in allowable speed shall produce an audible indication. If the train is travelling above the allowable speed, the audible indication will need to be acknowledged by the train operator. The ATP system shall give the train operator 2 seconds (which can be programmable) to begin to reduce the speed of the train to the allowable speed. If the brake assurance logic does not indicate that the speed is being reduced in accordance with the predetermined speed reduction profile and the actual speed exceeds the permitted speed, a warning must be given to the train operator to enable him to react and avoid intervention from train borne ATC equipment at least 2 sec before the intervention of the full service brake until the actual speed does not exceed permitted speed, then the train operator must be capable of selecting release of full service braking. The warning must continue until actual speed does not exceed permitted speed. The full service brake intervention and emergency brake intervention

must be recorded. If the full service brake fails or is not adequate to stop the train at the target point, the trainborne equipment must apply the emergency brake. Once applied by the ATP system, the emergency brakes shall not be able to be released until the train reaches a complete stop. Each such operation will be recorded on the train-borne data log.

4.2 Automatic Train Supervision

The ATS system shall provide non-vital functions that oversee and optimise the train movements. It shall initiate route requests at interlocking, but the ATP and interlocking logic shall provide for the safe movement of trains through the interlocking. The ATS system shall assign train identification (TID) numbers; monitor the operation of each train; modify dwell times at each station; provide regulation information i.e. coasting commands as necessary to optimise headways, power consumption, or run times as determined by the traffic controller in OCC; provide outputs to the Passenger Information Display System (PIDS) units at each station, monitor alarms at stations and display them to the traffic controller and maintenance controller, and retain train performance information to allow future schedule adjustments based on actual train performance.

Trains at the terminal shall automatically receive a route and a leaving signal to leave the terminal when the time arrives for them to leave by a stored timetable. There shall be timetables for weekdays, Saturdays, Sundays, and holidays. It shall be possible to modify these timetables by input at the terminal station. It shall be possible to override the routing and leaving signals from the terminal station control room and from OCC.

The station controller shall have the capability of requesting routes locally, if communications with OCC is lost.

4.3 Automatic Train Operation

The automatic train operation system is responsible for train operation. Its functions include automatic running of train while remaining within the safety envelope calculated by ATP, train speed control, train target braking and automatic opening of doors (door control) once the train reaches the next station. The ATO system shall execute programmed stops and control, in conjunction with the ATS/ ATP equipment, of dwell times in accordance with the timetable/ headway. The ATS system shall be able to send a control to the train to leave the doors closed upon arriving at the station or to bypass any station.

When the train operator receives a command from the ATS system to leave the station, he will close the doors. When the doors are closed, the train operator will start the train. The ATO system shall then operate the train to the next station.

The ATO system shall accept coasting commands from the ATS system. The ATO system shall operate the train within the parameters set by the ATP system. As a train approaches a station, the ATO system shall reduce speed and control the stop to within ± 500 mm. When the train is properly berthed, the ATO system shall initiate a command to open the train doors.

The train operator shall have the capability to place the train into manual ATP operation. In this operation he will operate the train manually with ATP enforcement of speed restrictions. The ATP system shall also prevent the train operator from opening doors unless the train is properly berthed and there is a platform on the side he wants to open. In case of emergencies, the train operator will be able to open the doors at other than the platform.

4.4 **Transmission from Train to Track**

The system shall be capable of transmitting from train to track such data like but not limited to operating data such as train run number, destination and crew number etc., control information for automatic train routing such as current track circuit identification, etc, registration data and fault indications of the train data recording facility for the purpose of positive train identification and other requirements. The data from train to track shall be transmitted to Wayside ATC equipment/ OCC. The transmission points for train to track communications shall be as a minimum be located at Depot Cut-in/ Cut-out track, ATC Inter-sector boundary, all station platforms, and other points necessary from operating point of view. This shall be submitted to Employer's Engineer for review.

5 **DEPOT**

One depot is located at Mansarovar. Separate Interlocking shall be provided in the depot. Locking shall be provided in accordance with the requirements of the Metro Signal Engineering Manual (SEM). Interlocking system shall be based on Entry-Exit Principle. Each depot will be under the control of a Depot controller. He will determine all movements within the depot and track assignments for rakes and will operate from the ATS/ CBI control terminal and set the required route for the movement of rakes within the depot. These

movements will be guided by shunt signals provided for every route leaving the stabling lines. Signals will also be provided for movement of rakes for various maintenance facilities within the depot and also between non-interlocked area to interlocked area.

The points will be operated by electrically operated point machines. The track circuits shall prevent the point machines from being operated whenever a vehicle is detected to be on the turnout or within fouling distance of it. Remote fed audio frequency track circuits shall be provided in the depot. For any stabling track that can hold more than one 6-car rake, the track circuits shall be provided in such a way so as detect the presence of rakes individually. The signalling contractor will co-ordinate with the track design contractor for proper design of track circuits in the point zone and stabling lines.

When a train is to be taken out of service, the traffic controller at OCC will communicate with the Depot controller to advise that he wants to clear a route into the depot. Upon receiving permission from the Depot controller, the traffic controller will clear a route into the depot-connecting track. Suitable fail-safe interface with minimum manual intervention shall be provided between the depot CBI and concerned main line station CBI. The relevant track circuit, signal and point indications of concerned main line station CBI should be available at depot CBI and the relevant track circuit, signal and point indications of depot CBI should be available at concerned main line station CBI. The interlocking at concerned main line station shall not allow any signal to display proceed aspect into the Depot unless the train is expected to clear the main line fully. On getting a proceed signal at Concerned main line station, the train operator will enter the depot following the signals of the depot interlocking to the route set for that particular movement. Suitable arrangement will be made for changing from ATP/ ATO mode to RM mode without stopping the train and enter the depot at a restricted speed not exceeding 25 km/h to his destination point in the depot over the route.

When a rake is to leave the stabling track to enter the main line, the train operator will receive instructions from the Depot controller. Before proceeding to the main line the train operator is required to perform various functional tests viz. brake test, on-board ATP/ ATO equipment test & insertion and validation of train ID number. Suitable arrangement for pre-departure test i.e. ATP/ ATO test and brake test etc. shall be made.

ATP/ ATO tests shall be performed on the stabling line, the train operator will inform the Depot controller after completion of these tests. Trains in the depot will be identified by a 3 digit Rake ID. The ATS computer will validate the rake ID received from the train through the radio. The train operator will proceed towards the main line on receipt of the shunt signal from the DCC. The train shall receive the Train ID on the transfer track in the depot and the Train ID shall be positively verified before entry to the mainline. Suitable alternative method of assignment of train run number shall be provided in the event of failure of the radio communication link. The train shall start in the RM/ ROS mode & automatically change over to ATP/ ATO mode before entry to the main line.

The depot signalling design shall provide for transition (cut-in & cut-out tracks) for switching into and out of RM/ ROS mode from normal operation modes, while entering or leaving the depot. It shall be the responsibility of the Signalling and Train Control Contractor to provide all of the design, manufacture, installation, testing, and commission of the signalling apparatus to be installed in the depot.

6 POWER SUPPLY

Primary power will be supplied from a 33 kV supply at the station. This supply will be fed from a ring cable between traction power substations. Two separate cables will be provided from the station power room to the signal UPS room.

6.1 Uninterruptible Power Supply (UPS)

UPS supply will be provided to JS02-Phase-1B contractor at a shared location in UPS room at stations . JS02-Phase-1B contractor shall provide all further distribution, protection and any other equipment required for his use..

APPENDIX E – LIST OF ALARMS

As a minimum, the following alarms shall be sent in to the OCC to the ATS:

1. For each station:

- (1) Normal primary power supply failed.
- (2) Standby primary power supply failed.
- (3) Normal UPS failed.
- (4) Standby UPS failed.
- (5) Earthing connection detected on signal power.

2. Out side station:

- (1) Lamp filament/LEDs in signal unit or marker unit has failed.
- (2) Point failure.
- (3) Track circuit failure.
- (4) Stoppage of train in between the stations for more than a time interval.
- (5) Train passing a signal at danger

3. Onboard ATC alarms.

4. Any other alarm as required in the specification

APPENDIX F – LIST OF INDICATIONS

As a minimum, the following indications shall be sent from field in to the OCC to the ATS:

1. Status of Points & X-avers
 - (1) Points are in normal position and in correspondence with control request
 - (2) Points are in reverse position and in correspondence with control request
 - (3) Points are locked because of route locking, approach locking, back locking etc.
 - (4) Points Blocked /Unblocked
2. Status of lineside signals:
 - (1) Signal has been displayed for movement of equipped train
 - (2) Signal has been displayed for movement of non-equipped train
 - (3) Signal is at stop, but time or approach locking time is running
 - (4) Signal Blocked/unblocked
3. Track circuits:
 - (1) Track circuit is occupied
 - (2) Train position & ID
 - (3) Operating mode of each train
 - (4) Train door status
4. Platform Emergency Plunger status
5. Alarms and any other indication required by the Specification
6. Route Block/ unblock
7. Maintenance Block/ unblock

APPENDIX G – LIST OF CONTROLS

As a minimum, the following controls shall be sent by the OCC via the ATS:

1. For each interlocked turnout or crossover:
 - (1) Set and cancel routes
 - (2) Operate each point individually (normal position/ reverse position)
 - (3) Point block/ unblock
 - (4) Route Block/ unblock
 - (5) Cycle set/ unset
2. For each lineside signal:
 - (1) Place signal in automatic (fleeting)
 - (2) Take signal out of automatic (fleeting)
 - (3) Put signal on
 - (4) Emergency Signal stop
3. PIDS information:
 - (1) Train is scheduled to arrive
 - (2) The destination of the train
 - (3) Train type skip/stop
 - (4) Platform number
 - (5) Dwell time for each train at each platform
4. Train operation:
 - (1) Set & remove temporary speed restrictions
 - (2) Hold trains at the platform
 - (3) Set and remove Maintenance Blocks
 - (4) Train identity
 - (5) Operating mode of each train

APPENDIX H – VIDEO SCREEN

1. The existing video wall shall be used for phase-1B, the contractor shall make necessary modification in software/hardware to make it compatible for running application of phase-1A and phase-1B.
2. Contractor shall done all modifications at site without disturbing the running revenue operation activity of phase-1A.

APPENDIX I – CABLES

1 GENERAL

This specification covers the broad guidelines for design and construction requirements for cables for this tender. The Contractor shall be responsible for ensuring adherence to relevant specifications wherever applicable, sizing, procurement, installation, wiring and testing of all single and multi-core cables and wires required for the Train Control and Signalling system.

2 MANUFACTURING, PHYSICAL AND GENERAL PERFORMANCE REQUIREMENTS

2.1 GENERAL

2.1.1 All signalling cables shall have continuous operating life of at least 30 years.

2.1.2 Cables shall be to latest IRS specifications or other international standard for railway signalling cables. The contractor shall submit the standards and specifications to which the proposed cables comply.

- ❑ IRS specifications for signalling cables: IRS-S63/89 Amendment-5; or latest
- ❑ IRS specifications for track circuit cables: IRS-TC30/05 or latest
- ❑ Optical fibre cables shall be to latest IRS/ RDSO specifications and shall be laid in HDPE pipe.

2.1.3 HDPE pipe for protection of optical fibre cables shall be solid, rugged, minimum 40mm diameter, permanently lubricated and suitable for air blowing of optical fibre cable. HDPE pipe shall be to latest TEC specifications.

2.1.4 All outdoor cables shall be armoured type and shall be able to withstand rain and ultraviolet ray exposure. The cable insulation shall be moisture & heat resistant and be able to withstand temperature up to 70°C.

2.1.5 The cables shall be resistant to any kind of corrosion due to soil & environmental conditions and shall be suitable for use and also be immune from degradation under the following atmospheric impurities and environmental conditions:

- (a) Total immersion in water, acidic solutions with low concentration, salty media, etc.
- (b) Exposure to toxic materials, dirt, dust, grease, oil hazardous gases, etc.
- (c) Exposed to atmospheric conditions including indirect sunlight

2.1.6 Cables used for audio frequency track circuits shall be either in quad configuration or twisted pair configuration, to minimise the interference with other track circuits. Transmitter and receiver circuits of a track circuit shall not be in the same cable.

2.1.7 The outdoor single mode optical fibre cable shall have minimum fibre count of 24 fibres.

2.2 SPECIFIC REQUIREMENTS FOR CABLES FOR UNDERGROUND SECTION

2.2.1 For underground environment, the Contractor shall generally comply with the pertinent requirements of NFPA 130 or any other similar international standard to which the cables are in use in any passenger carrying railway or metro system.

2.2.2 Cables (including optical fibre cables) for underground environment shall be manufactured from fire retardant/ resistant, low smoke, zero halogen materials

2.2.3 Fire and Smoke Performance Requirements

2.2.3.1 Flammability

2.2.3.1.1 The bedding and over sheath of the cable shall have a minimum oxygen index of 29 when tested in accordance with ASTM D2863/BS 2782: Part 1: Method 141.

- 2.2.3.1.2 The temperature index of the bedding and over sheath of the cable shall not be less than 235°C when tested in accordance with ASTM D2863/ BS 2782: Pat 1: Method 143.
- 2.2.3.2 Fire Resistance
 - 2.2.3.2.1 All cables shall be flame retardant and shall comply with the requirements of IEC 331 and for bunched cables of IEC 332: Part 1 & 3 and for flame propagating criteria of US IEEE-383 with a minimum test short circuit time of five minutes.
 - 2.2.3.3 Smoke Emission
 - 2.2.3.3.1 The value of the smoke generated (Ao) of the low voltage power cables shall meet the requirements of IEC 1034.
 - 2.2.3.3.2 All cable materials shall meet requirements of the US National Bureau of Standard Smoke Chamber Test, used to evaluate plaque materials of constant thickness. (NFPA 258 Smoke Generation of Solid Materials 1982)
- 2.2.4 Corrosive and Acid Gas Emission
 - 2.2.4.1 The level of hydrochloric acid of the fire retardant low smoke, zero halogen compound (filter bedding, oversheath etc.) and the insulation of the cable shall not be greater than 0.5% when tested in accordance with BS 6425/IEC 754: Part 1.

2.3 MANUFACTURING

- 2.3.1 The Employer or his Engineer shall have free access to the works of the manufacturer and shall be given facilities by the manufacturer to inspect the manufacturing of the cables during any stage of manufacture. He shall have right to reject the manufacture in whole or part of any work or material that does not conform to the terms of this specification or and may order the same to be removed/ replaced or altered at the expense of the manufacturer.
- 2.3.2 In case of no relevant test certificates being available, tests shall be carried out by the manufacturer as those laid down with relevant specification but this shall not preclude any test desired by the Employer's Engineer to determine the quality of the cable. The Contractor shall satisfy the Employer's Engineer regarding the quality of cable supplied by him by production of a certificate from a recognized testing laboratory or otherwise that the materials used and the cable itself meets with the required standards and meet with all the testing requirements of relevant specifications. No new Type Tests shall be needed for the cables being provided which are exactly same and of same model & make as that previously approved and provided in already Operational system of DMRC and Phase-1A of JMRC System.

3 TESTS

- 3.1.1 Following tests shall be included in the FAT/ Type tests, as a minimum
 - (i) Propagation
 - (ii) Tensile strength
 - (iii) Conductor diameter/ area, resistance, capacitance
 - (iv) Screening Factor
 - (v) Armour thickness
 - (vi) Corrosive and Acid Gas Emission (for underground section)
 - (vii) Fire resistance/ Flammability (for underground section)
 - (viii) Smoke Emission (for underground section)
- 3.1.2 Cables to IRS specifications shall be supplied with RDSO inspection.

- 3.1.3 Test results and certificates shall be submitted for review to the Employer's Engineer.

4 MAIN AND SUBSIDIARY (TAIL) SIGNALLING CABLES

- 4.1.1 Main and Tail cables for vital signalling and train control trackside functions shall be of Individually insulated solid copper conductor. Protective armouring and sheathing suitable for direct burial or laying at ground level in the open, viaduct or in tunnel under the ambient conditions prevailing in Jaipur shall be provided
- 4.1.2 All tail cables from trackside location boxes and junction boxes to equipment installed on the track shall have a fully flexible core and sheathed to absorb track vibration. Approved type of crimping and termination shall be used. The location boxes and junction boxes shall have removable links to facilitate testing and isolation during faultfinding. The links shall be of a design, which prevents the cable in one pole short-circuiting to that of other pole.

5 SER AND LOCATION BOX WIRINGS

- 5.1.1 Wiring of circuits inside SER and location boxes shall be in fire retardant/resistant cable.
- 5.1.2 Non-vital and vital wiring and cabling shall be kept physically apart and, in signalling equipment rooms and location cases, in separate wire trees and runs. Full details shall be supplied by the Contractor. Specifications shall be accepted by the Employer's Engineer before being incorporated into system designs.

6 TRAINBORNE ATC EQUIPMENT CABLES

- 6.1.1 All Trainborne ATC equipment cables used by the Contractors shall be flame retardant, halogen free and low smoke emission type. Cables shall be subjected to large-scale flammability test specified in IEC 332 Part 3.

7 CABLE AND WIRE TERMINATIONS

- 7.1.1 Use of soldering in cable connections shall be minimized and it shall be used only for terminating conductors. Cables and wires shall be terminated by more flexible means such as WAGO terminals or similar.
- 7.1.2 The Terminal Blocks for Signalling cable terminations shall conform to international specifications and shall be submitted to the Employer's Engineer for acceptance.
- 7.1.3 All wire and cable conductors used in the Contract shall be identified at each end, using durable shrink-on or tag type labels firmly fixed to the wire ends, with descriptive nomenclature clearly and permanently marked. Labels shall be tied at both ends, at entry and exit points of cable trays, ducts and trenches and at appropriate locations where necessary. A record shall be provided to indicate clearly the type of cables, the sizes of cable, the use of each core or pair, and termination as well
- 7.1.4 All wire and cable terminals used in the Contract shall also be numbered, identified in the nearest vicinity, using appropriate type labels firmly fixed and clearly described with their functional purposes.

APPENDIX J – LAYING OF CABLES

1 GENERAL

- 1.1.1 Primary cable containment around station areas and along track-side will be provided by Civil Works Project Contractors (Refer to Interface Specifications).
- 1.1.2 The Contractor shall provide all necessary secondary cable containment and supports in addition to the primary cable containment provided, if necessary, to complete the connection to the Contractor's equipment.
- 1.1.3 The Contractor shall submit the working drawings with the following details to the Employer's Engineer for review:
- (1) Cable routes
 - (2) Details of the cables to be laid along the proposed cable routes including cable types, number of cables, cable diameter, core count and estimated cable Section length
- 1.1.4 All cables shall be neatly run and fitted in ducts or conduits, laid in trunkings, formed trenches or troughs, or supported by trays, hangers or cleats as appropriate.
- 1.1.5 The Contractor shall make any wall and slab openings, including the temporary removal of architectural finishes that shall be required for his cabling. After cabling is completed, the Contractor shall seal these openings with fire resistant materials and restore the architectural finishes and fire resistance to their original state.
- 1.1.6 Before commencing work on any part of the Site, the Contractor shall ascertain that the Employer's Engineer and also, where applicable, the local and statutory authorities or other bodies/persons concerned have reviewed each cable route without objection. The Contractor shall further ensure that all necessary permits in such cases have been obtained and notices served.
- 1.1.7 Conduits and ducts shall be thoroughly cleaned by a mandrel of diameter slightly less than the conduit or duct being drawn through. After the mandrel has been drawn through the conduits, a draw wire of galvanised steel shall be left in each conduit or duct, if required by the Employer's Engineer, to facilitate the drawing in of cables. The duct ends shall be sealed temporarily to prevent the entry of foreign matter. The conduits and ducts shall be cleaned again immediately before the cables are drawn in.
- 1.1.8 The Contractor shall provide his own brackets and clips to secure all the cables at an interval reviewed by the Employer's Engineer. Where cables are to be laid in troughs, the Contractor shall remove and re-instate trough lids prior to and after cable installation.
- 1.1.9 The contractor shall use suitable protection pipes for track crossing of cables and at locations where other means of protection are not available.
- 1.1.10 In case of direct burial of cables in earth, the cable shall be buried at a depth of 1.0 meter or otherwise suitable protection pipes shall be used. The area shall be properly restored after laying of cables.

- 1.1.11 A labelling scheme shall be applied for all cables installed. Each cable shall be uniquely identified. Labels shall be tied at both ends, at entry and exit points of cable trays, ducts and trenches and at appropriate locations where necessary. A record shall be provided to indicate clearly the type of cables, the sizes of cable, the use of each core or pair, and termination as well.
- 1.1.12 The installation and handling of cables shall be undertaken at all times by adequate staff suitably trained and supplied with all necessary plant, equipment and tools. The arrangement of the cables and all methods of laying shall be submitted to the Employer's Engineer for review and shall be planned to provide an orderly formation, free from unnecessary bends and crossings.
- 1.1.13 No cable joints shall be allowed along trackside without the prior approval of Employer's Engineer.
- 1.1.14 At no location shall the cable be bent with a radius lower than the minimum radius recommended by the manufacturers. Sharp edges shall be avoided.
- 1.1.15 Every precaution shall be taken to ensure that cables and equipment are not installed in a manner or under conditions likely to cause electrolytic or other corrosive action or damage to, or be detrimental to, the performance of the cables and equipment during operation.
- 1.1.16 All cables and wires inside cabinets shall be housed in appropriate cable conduits or tied neatly along the side of the cabinet. They shall not cause any obstruction to the access of equipment within.
- 1.1.17 All cables shall be adequately rated for their duties. All power cables shall be able to withstand full load current for peak operation when the equipment is at its ultimate capacity. The Contractor shall comply with the latest edition of IEEE Wiring Regulations.
- 1.1.18 Cable ties shall be made only from corrosion-resistant materials. They shall be further resistant to ultra-violet radiation if they are to be used at locations exposed to sunlight. In areas of significant vibration, cable ties shall be of metallic construction and coated further with a corrosion-resistant material.
- 1.1.19 Wherever possible, standard multi-pin plug/socket shall be used to terminate multi-core cables for connecting to equipment. Locking mechanism shall be integrated in the connector to secure the connection.
- 1.1.20 Use of soldering in cable connections shall be minimized and it shall be used only for terminating conductors. Cables and wires shall be terminated by more flexible means such as WAGO terminals or similar.
- 1.1.21 Heat-shrinkable sleeves shall enclose all exposed and terminated contacts inside multi-pin connectors.
- 1.1.22 Any unconnected socket shall be covered up and properly labelled to avoid exposure for short-circuit and making wrong connection by mistake.

- 1.1.23 Unused cable cores of multi-core cables shall be neatly tied and wrapped up inside the connectors.
- 1.1.24 Connectors shall be suitably configured to avoid the possibility of wrong mating.
- 1.1.25 Connectors at cable ends carrying high voltages or current sources shall invariably use female contacts.
- 1.1.26 Cables entering enclosures shall utilise suitable cable glands or grommets for protection of these cables over the service life of the System.

2 OPTICAL FIBRE CABLE

- 2.1.1 The optical fibre cable backbone network shall be formed by two outdoor single mode optical fibre cables, one laying along the up-track and the other along the down-track both. The normal and protected routes shall be routed through different fibre cables with path diversity.
- 2.1.2 The optical fibre cables within station shall be laid along different routes with maximum route diversity. In elevated/ at grade environment, the optical fibre cable shall be laid inside HDPE pipes.
- 2.1.3 Optical distribution frame shall be installed in Signalling equipment rooms. Optical fibre cables terminated at the optical distribution frame shall be either spliced through or spliced with optical pigtails or terminated at the optical patch panels including the spare fibres.
- 2.1.4 At least 5 metres cable slack shall be reserved at all equipment rooms for future network modification and expansion.
- 2.1.5 No cable joints shall be allowed along trackside. The contractor shall conduct survey of the cable route and ensure that cable lengths supplied are such as to avoid possible wastage of cable on account of residual pieces of cable.

3 TERMINATION

- 3.1.1 The termination and distribution practice shall adopt a consistent approach for easy circuit identification and is subject to the review of the Employer's Engineer.
- 3.1.2 The circuit terminations shall be secure enough to withstand vibration level, which is likely to be experienced in the railway environment.
- 3.1.3 The outgoing circuits connecting to external lines and all circuits liable for lightning or high-induced voltage, lightning arrestors and surge protection devices shall be provided with the required earth connections.
- 3.1.4 The termination shall make use of different colours or markers to aid circuit pairs identification.
- 3.1.5 The Contractor shall maintain records of all the circuit terminations.

4 IDENTIFICATION

- 4.1.1 Descriptive labels shall be provided for all cabinets, enclosures, panels, assemblies and sub-assemblies.
- 4.1.2 Labels shall be of engraved type, with durable markings and shall have character size not less than 6mm high.
- 4.1.3 The details of the labels including the material and size of the characters and sample of the labels shall be submitted to the Employer's Engineer for review.
- 4.1.4 Labels and notices on equipment shall be fixed with roundhead brass screws or self-tapping screws. Stick-on labels or fixing by adhesive shall not be accepted.
- 4.1.5 All enclosures containing terminals or exposed live parts where a voltage exceeds 120 volts shall have a label with lettering indicating the maximum voltage present in the enclosure. Warning signs shall be provided with graphical symbols and wordings in red for hazardous electrical equipment.

APPENDIX K, L – NOT USED

APPENDIX M – EARTHING POLICY & TRANSIENT PROTECTION

1 OBJECTIVES

Earthing shall be provided for all indoor & outdoor Signalling & Train Control installations to achieve the following objectives:

- (1) To provide the safety to the operating & maintenance personnel against the electric shock on account of any potential (voltage) appearing on exposed parts with respect to earth or due to electromagnetic or due to electrostatic induction.
- (2) To ensure safe & reliable operation of the equipment by limiting or eliminating the induced voltages and transients in the Signalling & Train Control equipments.
- (3) To protect the equipment against build up of unduly high voltages which can cause dielectric (Insulation) breakdown or damage to the equipment or their parts.
- (4) To serve as common voltage reference point wherever required.

2 POLICY

- (1) The Earthing system shall meet or exceed the requirements of IEEE 1100, NFPA 780 and IEC 1024 or relevant International standards.
- (2) Earthing and other protection devices shall be designed to accomplish the following minimum requirements but not limited to:
 - (a) Protect personnel and equipment from electrical hazards, including lightning.
 - (b) Reduce potential to system neutrals.
 - (c) Reduce or eliminate the effects of electrostatic and electromagnetic interference arising from within the DMRTS on account of Traction voltages, Traction return current, Rolling stock characteristics and other extraneous sources.
 - (d) Provide a proper earthing method for all equipment enclosures, cabinets, drawers, assemblies and sub-assemblies.
 - (e) Provide a clean zero-volt reference point where required.
- (3) The earthing system shall be so designed so as to give earth resistance within the stipulated limits (as given below) at all locations and under all climatic conditions.
- (4) Any electrical joints in the earthing system shall be protected from moisture ingress by using proper wrapping, sealing with waterproof tapes, or such other measures.
- (5) For the purpose of measurement of earth resistance, a small interconnecting copper strip of appropriate cross-section shall be provided in the ring earth in a small manhole chamber so that the ring earth can be broken from the loop.
- (6) The earthing methods, design and details shall be submitted to the Employer's Engineer for review.

2.1 Stations area (Indoor Equipments)

- 2.1.1 Main Earth:** Shared main earth bus bar ($< 2\Omega$) will be provided to JS02-Phase-1B contractor in the UPS (S&T) Room by the E&M works contractors. JS02-Phase-1B Contractor shall extend main earth from this location and install an earth bus bar in the SER. JS02-Phase-1B contractor shall be responsible for any other activity required for earthing of his equipment in accordance with the specifications contained in the PS and this appendix.

3 OUT DOOR INSTALLATIONS

- 3.1.1** Following out door installations are required to be earthed:

- (1) Metallic sheath & armouring of all main cables at regular intervals.
- (2) Location Boxes.
- (3) Signal posts and screens.
- (4) AFTC tuning units.
- (5) Point Machines
- (6) Any other installation as may be necessary to cover complete scope of works

- 3.1.2** The JS02-Phase-1B contractor shall design earthing requirements for his own use and implement them to suit requirements of various sub systems of JS02-Phase-1B. The contractor may make use of Buried Earth Conductor along the main line, if provided by the traction contractor as per interface specifications. Contractor shall also use suitable safety methods such as screen of wire mesh (earthed) for safety of maintenance staff wherever there is infringement of signal installation in the signal clearance zone as per IR, RE practices.

4 GUIDELINES FOR TRANSIENT PROTECTION & LIGHTNING PROTECTION

4.1 General

- (1) Despite the provision of earthing as specified above, some times failures of Solid state electronic equipments do occur on account of finite earth resistance, particularly high voltage transients and also due to lightning.
- (2) Typically, a transient & lightning are temporary, usually short duration, surge voltage of limited energy. Electronic equipment with a high input impedance is inherently more susceptible to transients.

- 4.1.1** Requirements for effective transient and surge protection:

Physical distance from the transient source does not necessarily guarantee immunity from transients. An effective transient protection system must protect the communication equipment from transients of the following specifications as a minimum (MIL-STD-704A):

- (1) Peak transients of up to 700 Volts on the DC Power Supply line for several microseconds.

(2) Average transient duration of 2 microseconds with a repetition frequency of 15kHz to 100kHz

(3) For short duration transients (< 5ms) the variation approaches a sine wave

(4) For longer duration transients (> 5ms) the variation approaches rectangular pulses with an initial rate of rise up to 5x10⁴ Volts per second

Suitable electronic devices (such as silicon avalanche suppressor devices – also called Transzorb) having high surge handling capability, fast response time, low clamping voltage, etc., shall be incorporated in the

CATC equipments and subsystems offered, to ensure that the latter withstands the conditions mentioned in (4.1.1) above without any damage or permanent degradation in performance throughout the system lifetime. The selection criteria for such devices shall include, but not be limited to, the following:

(1) *Reverse Standoff Voltage*: At least twice the maximum operating voltage and allowing operation over the temperature range –65°C to +175°C

(2) *Pulse Power Rating*: This shall have a value to handle the peak pulse power of the transients and ensure their decay in less than 10% of the rise time for the worst pulse likely to be encountered from all possible sources including lightning and transients from overhead traction power system.

(3) *Device Lifetime*: This shall not be less than that of the system for which it affords protection.

4.1.2 **Lightning Protection**: While the station buildings will be provided with the lightning protection arrangements, the protection against lightning surges travelling through conductors into equipment's side shall be done by the JS02-Phase-1B contractor using appropriate devices.

Earthing and other protective measures in preceding paragraphs are given only as indicative guidelines. JS02-Phase-1B contractor shall design, manufacture, install and be responsible for safe and correct working of all equipment/subsystems under the scope of JS02-Phase-1B. To achieve this objective, JS02-Phase-1B contractor shall submit his proposals requiring any changes/modifications in above. JS02-Phase-1B contractor shall also submit his proposal for protection devices at power lines, data communication lines and equipment parts and else where for review.

APPENDIX N – SPECIFICATIONS OF COMPUTER BASED INTERLOCKING

REFERENCES

IRS: S36	Relay interlocking systems
IRS: S23*	Electric signalling and interlocking equipment
RDSO/SPN/144	Safety and reliability requirement of electronic signalling equipment
IS: 9000*	Basic environmental testing procedures for electronic and electrical items.
IS 2147-62*	Degrees of protection provided by enclosure for low voltage switch gear and control gear
ISO 9001	Quality systems – Model for Quality Assurance in design, development, production, installation and serving
EN 50126	The specification and demonstration of dependability-reliability, Availability, Maintainability & Safety (RAMS).
EN 50128	Software for railway control and protection systems.
EN 50129	Safety Related Electronics Systems for Signalling.
EN 50159-1&2	Railway Applications: Signalling and Communications Safety related communication in closed & open transmission systems.
IEC 529/ EN60529	Specifications for degree of protection provided by enclosures (IP code)
EN 61000.4.2	Electromagnetic compatibility (EMC)- testing and measurement techniques – electrostatic discharge immunity test and basic EMC.
EN 61000.4.4	Electromagnetic compatibility (EMC)- testing and measurement techniques – electrostatic fast transient/ burst immunity test and basic EMC publication.
EN 61000.4.5	Electromagnetic compatibility (EMC)- testing and measurement techniques – surge and immunity test.
IRS-S99	Data logger system
RDSO/SPN/186	Domino type control panel for Railway Signalling

*(1) Or equivalent Recognized International Standard. The supplier shall submit a copy of the same for verification & seek the approval of DMRC.

In the event of conflict between the any two or more specifications or/and the requirements of this specification, the contractor shall seek the advice of DMRC with complete details.

Whenever, reference to any specification appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

1 SCOPE

- 1.1 This specification covers the technical requirements of computer Based Interlocking system.
- 1.2 The Computer Based Interlocking system covered in this specification shall be a microprocessor based equipment used for the operation of points, signals, releasing of crank handle for manual operation of points and other controls like slots etc. through a control-cum-indication panel or VDU based control panel. It shall interface with ATP and ATS systems.

2 TERMINOLOGY

- 2.1 For the purpose of this specification, the terminology given in IRS: S23 and RDSO/SPN/144 shall apply.

3 GENERAL REQUIRMENTS

- 3.1 The system shall provide all the interlocking, control and indication functions as per approved Signalling plan, selection table (i.e. control/ route table) and panel diagram/ MMI layout of the station.
- 3.2 The CBI shall be an Entry-Exit system.
- 3.3 The system shall be suitable for working on sections having 25 kV AC/1500 V DC traction and where cars will be hauled by GTO/ IGBT VVVF controlled three phase Induction motors.
- 3.4 The system shall work in conjunction with the control-cum-indication panel or a CBI Control terminal, field signalling equipment, signalling cables and outdoor power supply arrangements as laid down in specification IRS: S36.
- 3.5 The system shall interface with CATC systems.
- 3.6 The system shall be capable for working in non air-conditioned environment and ambient temperature range between -10° C to 70 ° C and Relative Humidity up to 95% at 40° C.
- 3.7 The system shall be provided in a dust protected cabinet. If force cooling is required, the cooling fans shall operate on system power supply with over current protection arrangement. The failure of any one of the fans shall given an alarm to the operator or an appropriate fan redundancy arrangement shall be provided.
- 3.8 The equipment shall be so constructed as to prevent unauthorized access to the system.

- 3.9 Necessary provision shall be made in the hardware and software for modular expansion of the system. For large stations, which cannot be covered by one CBI equipment, it shall be possible to connect more than one CBI equipment preferably through a serial channel.
- 3.10 Computer Based Interlocking system shall have user-friendly graphic based design tool to generate station specific application software to carry out future yard modifications.
- 3.11 For all vital inputs/ outputs, double cutting arrangement shall be provided.
- 3.12 Either OFC or twisted pair cable shall be used for all vital connections.
- 3.13 CBI shall have the provision of inbuilt block working.
- 3.14 Both hardware & software of CBI must meet SIL-4 as defined in CENELEC Standards. If any equivalent recognized International standard other than CENELEC has been used, the requirements specified in paragraph 6.3.3.2 (8) of Particular specifications shall be fulfilled.
- 3.15 The CBI system software as well as hot standby changeover software shall have been independently verified and validated including its offered configuration by an independent third party.
- 3.16 The Contractor shall give details of all modifications carried out in the system after initial validation/ approval. Date of each modification with brief reasons for undertaking modifications shall be given. All modifications must have got approval of original validating agency/ approving agency.
- 3.17 The audio-visual alarm shall be available for Approach locking, Button stuck etc., in CBI.
- 3.18 CBI shall log of all safety related commands with counters provided viz. Emergency Route cancellation, Emergency Point operation, Overlap release operation, Emergency Take Control, Unblocking operations etc. so that in case, operation commands are given through VDU in place of Control-cum-indication panel, then proper working of counters shall be possible and readings of all counters can be read as and when required.

4 INTERLOCKING REQUIREMENTS

- 4.1 The system shall meet the interlocking requirements as specified in JaipurMetro Signal Engineering Manual.

5 SYSTEM COMPOSITION

- 5.1 The CBI system shall consist of the following:
 - 5.1.1 Microprocessor based interlocking equipment to read the yard and panel inputs, process them in a fail-safe manner as per the selection table and generate required outputs.
 - 5.1.2 Cycle time and response time to read and process the input shall be fast enough to ensure safety and avoid any apparent delay. Cycle time and response time of the system shall be clearly indicated.
 - 5.1.3 Control-cum-indication panel or VDU terminal workstation to set routes and to perform other signalling control and monitoring functions.

- 5.1.4 Maintenance terminal (MT) with display, keyboard, and event logging facility for minimum 10,00,000 events.
- 5.1.5 Electronic Actuators/ Object Controllers or Relay rack along with required number of approved type of relays.
- 5.1.6 The system shall communicate with Operation control Centre. Dual serial link in hot stand by mode shall be used for this purpose.
- 5.1.7 The object controllers shall be such that it can operate/ receive status information from outdoor signalling equipment without any modification/ change in the design of out door signalling equipment. The object controllers will be centralized in the Station equipment rooms.
- 5.2 VDU shall be provided with selection of control switches for individual operation of points, clearing of signals, releasing of crank handle, cancellation of routes and other functions. Arrangements for route setting shall be provided.
- 5.3 CONTROL TERMINAL WITH VDU DISPLAY
- 5.3.1 The control terminal with VDU displays (Workstation) shall consist of:
 - (1) Colour VDU monitor of 20 inches LCD/TFT, and a suitable equipment to drive the VDU.
 - (2) A keyboard & mouse or digitiser
 - (3) Suitable interface to continuously display the current position/ status of various field equipment and track circuit
- 5.3.2 A flashing indication shall be provided on the VDU to indicate healthy condition of the main system, communication channel and panel processor.
- 5.3.3 Three dot markers in Red, Blue & Green colours respectively should also be displayed prominently at conspicuous location on the VDU terminal to indicate that the colour monitor is healthy and all the three colours (Red, Blue & Green) are present in right proportion.
- 5.3.4 The current position/ status of various field equipments and track circuits shall be displayed on the VDU using different colours/ symbols. The MMI design shall be submitted for review by the Employer's Engineer.
- 5.3.5 The system shall have suitable interface to receive and process the information for displaying the status of field equipment on the control terminal. This interface shall be of standard type like RS 232 or any other approved type.
- 5.3.6 Availability of communication channel shall be indicated by a constantly flashing indication. Whenever the serial channel goes faulty, a suitable error message shall be displayed on the terminal.

6 HARDWARE AND FAIL-SAFETY

6.1 Requirements of SEM as laid down in relevant clause of latest version of RDSO/SPN/144 shall be complied.

6.2 **COMPONENTS**

Components used shall comply with relevant clause of latest version of RDSO/SPN/144 and should be commercially available.

6.3 **PROTECTION AGAINST ELECTROMAGNETIC AND ELECTROSTATIC INTERFERENCE:**

The requirements laid down in relevant clause of latest version of RDSO/SPN/144 shall be complied. The equipment chassis shall be connected to suitable earth.

6.4 **PRINTED CIRCUIT BOARD**

6.4.1 The requirements laid down in relevant clause of latest version of RDSO/SPN/144 shall be complied.

6.4.2 Each card shall be marked with running serial number for identification of individual cards.

6.5 **FAIL-SAFETY**

6.5.1 The requirements laid down in relevant clause of latest version of RDSO/SPN/144 shall be complied.

6.5.2 Either or both of hardware and software redundancy shall be provided to ensure that any single fault does not lead to unsafe failure.

6.5.3 Mean Time Between Wrong Side Failures shall be minimum 10^9 hours.

6.6 The system shall have provision for accommodating additional 25% of I/O cards.

7 SYSTEM ARCHITECHTURE

7.1 Any of the following architecture shall be employed in the system:

Two out of three hardware architecture with identical or diverse hardware and common or diverse software

Or

Two sets of two out of two hardware with identical or diverse hardware and common or diverse software. Failure of a hardware will facilitate automatic changeover in a fail-safe manner without affecting train operation.

Or

Single Electronic Structure based on reactive fail – safety with diverse software. The system shall be duplicated with online and hotstandby configuration with facility of automatic changeover in case of fault of working system without affecting train operation.

7.2 **MAINTENANCE AND DIAGNOSTIC AIDS**

7.2.1 Maintenance terminal consisting of a reliable PC from a reputed manufacturer, a VDU terminal, printer, floppy drive and dedicated keyboard shall be used for following:

- Display of the current status of the yard;
- Storage of minimum one month data or 10,00,000 events
- Display of recorded events and
- Data transfer to floppy/ CD/ Memory or any other storage media

7.2.2 Control operation of yard functions shall not be possible from the maintenance terminal.

7.2.3 Facility of annunciation and display of faulty card/module for easy fault diagnostic shall be provided on the system. Suitable alarms shall be displayed for this.

7.2.4 A trouble-shooting chart shall also be provided to indicate the step-by-step actions to be taken in case of failure of the equipment. It shall be possible to rectify the fault by replacement of PCB card by the maintainer at site.

7.2.5 The system shall log all events, commands, functions etc, which should be date and time stamped, for enabling complete analysis of safe and proper functioning of the system.

8 SOFTWARE REQUIREMENTS:

8.1 The software of system should have two layers:

(a) Executive Software or System Software

This Executive Software shall define what the system can do and how the various parts of the system operate together. It shall include all start up and operational safety tests (including checking the Executive Software itself) that are the parts of the processor for continual assurance of safety operation.

(b) Application Software

It shall be containing the logic that defines how the inputs and outputs for a particular station are related. This shall be station specific.

The Executive Software and Application Software shall be programmed into Read Only Memories (ROM) by the Contractor. Both the ROMs shall be separated & isolated from each other. It shall not be possible to modify Executive Software. However, Application engineers should have the facility to modify application software as and when required.

8.2 Software used in CBI should have been developed in conformity with CENELEC software engineering standards with special relevance to safety critical applications. If any equivalent recognized International standard other than CENELEC has been used, the requirements specified in paragraph 6.3.3.2 (8) of Particular Specifications shall be fulfilled.

8.3 The selected CBI Software shall have been independently verified and validated. As specified in the software Engineering Standards, full documentation on Quality Assurance Program specially the Verification and Validation (V&V) procedures carried out in-house or by any independent agency, shall be made available to the Employer's Engineer to check their conformity to the standards. If the procedure and documentation for V&V is considered inadequate, the Employer reserves the right to get the verification and validation of software and hardware done by an independent agency at the cost of the Contractor.

8.4 The system shall conform to software requirements and self-check procedures as laid down in relevant clause of latest version of RDSO/SPN/144.

8.5 **SELF CHECK PROCEDURES:**

8.5.1 Self-check of the associated functional hardware as required by the hardware design should be performed periodically as laid down in relevant clause of latest version of RDSO/SPN/144. Sufficient self-check should be built into the system to detect possible hardware faults.

8.5.2 Integrity of the final vital output of the system for control of the field equipment should be continuously checked by reading both front & back contacts of relays to guard against inadvertent operation of the equipment.

9 POWER SUPPLY REQUIREMENTS:

9.1 The system shall work on 230 volts, 50 Hz AC commercially available power supply. The contractor shall make his own arrangement for any other supply such as 110V/60V/24V/12V DC.

9.2 A surge suppresser and proper earthing arrangement shall be provided in the power supply system to protect against transient voltages, lightening & spikes etc.

9.1 Two different voltages shall be used, one to drive CBI equipment and the other for receiving the inputs from the field gears.

9.2 Short circuit protection shall be provided.

9.3 The required protection shall be provided to protect from any malfunctioning due to false/spurious feed.

9.4 Suitable surge protection and proper earthing arrangement shall be provided in the power supply system to protect against transient voltages, lightning & spikes etc.

9.5 If Control-cum-indication panel and CBI are in separate building, then lightning and surge protection shall be provided for each core of copper cable connecting Control-cum-indication panel and CBI or else OFC cable shall be used to connect Control-cum-indication panel & CBI.

9.6 A detailed Power supply arrangement diagram/ circuit shall be provided.

9.7 Power supply arrangement for individual processor should be such that, in case of fault in power supply of one processor, all processors should not cease to function

simultaneously. It should be possible to switch off and take out faulty processor for repairing/replacement without affecting working of the balance system.

10 INFORMATION TO BE FURNISHED BY THE CONTRACTOR

The Contractor shall supply the following information:

- a) Design approach for the system.
- b) Functions achieved in hardware & software.
- c) Mode of interaction between hardware & software.
- d) Salient feature through which fail safety has been achieved e.g. use of a watchdog timer, automatic shut down etc.
- e) Proof of safety in the form of process adopted for safety analysis and result thereof.
- f) Full documentation of Software Engineering followed during development.
- g) Full documentation of verification and validation procedure, Quality Assurance Program along with report and certificate from in-house Quality Assurance (QA) Group or an Independent Safety Auditor (ISA).
- h) If the Employer considers further software validation necessary, the Contractor shall supply all the documents etc. to the validator nominated by the Employer.

10.1 The Contractor shall supply the following documentation/ manuals:

- i) Installation & Maintenance Manual with pre-commissioning check list.
- ii) Diagnostic aids including troubleshooting charts: A trouble-shooting chart shall also be provided to indicate the step-by-step actions to be taken in case of failure of the equipment. It shall be possible to rectify the fault by replacement of defective PCB card by the maintainer at site.
- iii) Details of Hardware e.g. schematic diagrams of the system circuits/components, details for each type of assembled PCB.
- iv) Details of software algorithm flow chart along with test/ validation procedure used and the results thereof.
- v) Version number of software and system.
- vi) Software checksum of EPROM(s) shall be provided.

10.2 The Contractor shall provide the following certifications from approved validation agency:

- i) Correctness and safety of the software.
- ii) Reliability and fail-safety of the interlocking system.
- iii) Details of modifications carried out in the system and its subsequent validation.
- iv) Expected MTBF.
- v) Expected MTBWSF.
- vi) Expected MTTR.

11 TESTS AND REQUIREMENTS

11.1 CONDITIONS OF TESTS

11.1.1 Unless otherwise specified all tests shall be carried out at ambient atmospheric conditions.

11.1.2 For inspection of material, relevant clauses of GS and PS shall apply.

11.2 TEST EQUIPMENT

11.2.1 The Contractor should have all essential Testing Equipments.

11.3 TYPE TESTS

11.3.1 The following tests shall constitute type tests:

- a) Visual inspection as per Clause 12.1
- b) Insulation Resistance tests as per Clause 12.2
- c) Card-level functional tests on all the cards and fail-safety tests on one card of each type.
- d) System level functional and fail-safety tests.
- e) Computerized testing for minimum two hundred thousand permutations and combinations as per Clause 12.3.
- f) Environmental/ climatic tests as per GS and PS (Indoor Equipment).
- g) System Diagnostics test as per Clause 12.4.
- h) System Software tests as per Clause 12.5.

11.3.2 Any other tests shall be carried out as considered necessary by the Employer's Engineer.

11.3.3 Only one CBI shall be tested for this purpose. The equipment shall successfully pass all the type tests for proving conformity with this specification. If the equipment fails in any of the type tests, the purchaser or his nominee at his discretion, may call for another equipment/card(s) of the same type and subject it to all tests or to the test(s) in which failure occurred. No failure shall be permitted in the repeat test(s).

11.4 ACCEPTANCE TEST

11.4.1 The following shall comprise acceptance tests:

- a) Visual inspection (Clause 12.1)
- b) Insulation Resistance tests (Clause 12.2)
- c) Card level functional test on all the cards.
- d) System level functional tests.
- e) System Diagnostics test (Clause 12.4)
- f) Verification of application software vis-à-vis selection table.

11.4.2 Any other tests shall be carried out as considered necessary by the Employer's Engineer.

11.5 ROUTINE TEST

11.5.1 The following shall comprise the routine tests and shall be conducted by Contractor on every CBI and the test results will be submitted to the inspection authority before inspection. The application software in proper format shall also be submitted to the inspection authority in advance.

- a) Visual inspection (Clause 12.1)
- b) Insulation Resistance tests (Clause 12.2)
- c) Card level functional test on all the cards.
- d) System level functional test.
- e) Computerized testing for 1,00,000 permutations and combinations (Clause 12.3)
- f) System diagnostics test as per Cl. 12.4.

11.5.2 Any other tests shall be carried out as considered necessary by the Employer's Engineer.

12 TEST PROCEDURE

The test procedure shall be based on the system design. The methodologies to be adopted for various tests shall be decided taking into account the system design/ configuration and shall be submitted for review by the Employer's Engineer.

12.1 VISUAL INSPECTION

The equipment shall be visually inspected to ensure compliance with the requirement of Clauses 3 to 7 of this specification. The visual inspection will broadly include –

- i) System level checking:
 - Constructional details
 - Dimensional check
 - General workmanship
 - Configuration
- ii) Card level checking:
 - PCB laminate thickness
 - General track layout
 - Quality of soldering and component mounting
 - Conformal coating
 - Legend printing
 - Green masking
- iii) Module level checking:
 - Mechanical polarization
 - General shielding arrangement of individual cards
 - Indications and displays

Mounting and clamping of connectors

Proper housing of cards

12.2 **INSULATION RESISTANCE TEST**

This test shall be conducted between the equipment power supply line terminals and the earth. If there is a possibility of the meggering voltage reaching the cards, these will be taken out before starting the IR test.

This test shall also be carried out after the climatic tests. The measurement shall be made at a potential of not less than 500 V DC.

The IR value shall not be less than 10 Mega ohms. After the climatic tests, this value shall not be less than 10 mega ohms.

12.3 **COMPUTERIZED TESTING**

The Contractor shall provide a computer-based test set up with the required software for automatic testing. The following tests shall be conducted with the help of this set up.

12.3.1 **FUNCTIONAL TESTING**

The system shall be tested functionally for all the signals with all routes, point operation, emergency point operation, route cancellation, emergency route cancellation, operation of and crank handle as per the selection table of the yard approved by the Employer's Engineer.

12.3.2 **OPERATIONAL FAIL SAFETY TEST**

These tests are conducted as per procedure given below:

- i) After setting of points in main route & desired overlap, signal is cleared. Back locking of the route and overlap should be verified. It should also be checked that other yard functions are free.

The track circuit of the route should be dropped one by one and it should be verified that it is not possible to clear the signal. All the routes are checked one by one.

- ii) Conditions required for route setting should be disturbed in various permutations and combinations and it should be verified that it is not possible to set the route with the disturbed conditions. Similarly, conditions required only for signal clearance (such as track circuits) should also be disturbed and it should be verified that the route is set but the signal is not cleared.

12.4 **SYSTEM DIAGNOSTICS TEST**

These tests shall be conducted by automatic test procedure through a PC. The diagnostic tests on the system shall be performed to test the integrity of the system software by verifying the checksum. It shall be possible to verify the application program vis-à-vis the selection table by the Employer's Engineer, preferably through regeneration of the locking table from yard data.

The PC at the end of the test shall print out summary of the tests conducted.

12.5 SYSTEM SOFTWARE TEST

Checksum of system software and format of the application software shall be verified. In case of any change in the system software/ format of application software, the same shall be validated.

12.6 The Contractor shall submit following documents to ensure that the system meets all requirements as mentioned in paragraph 11:

- i) Certificates of Type tests done.
- ii) List of Routine tests done and sample copy.
- iii) Acceptance tests to be done at the time of inspection of equipment to be supplied.
- iv) Performance feed back reports from user Railways.

For the verification of same, Employer's Engineer may visit the manufacturing facility of manufacturer in its respective Country(s). Sample tests shall be carried out, if found necessary.

13 QUALITY ASSURANCE

13.1 All materials & workmanship shall be of good quality.

13.2 Since the quality of the equipment bears a direct relationship to the manufacturing process and the environment under which it is manufactured, the manufacturer shall ensure QAP of adequate standard.

13.3 Validation and system of monitoring of QA procedure shall form a part of type approval. The necessary Plant, Machinery and Test instruments as given below shall be available with the manufacturer.

APPENDIX O – SPECIFICATIONS OF ATP/ ATO

1 REFERENCES

RDSO/SPN/144	Safety and reliability requirement of electronic signalling equipment.
IRS: S23*	Electrical signalling and interlocking equipment.
IS: 9000*	Basic environmental testing procedures for electronic and electrical items.
IS 2147-62*	Degrees of protection provided by enclosure for low voltage switchgear and control gear.
EN 50126	The specification and demonstration of dependability- reliability, Availability, Maintainability & Safety (RAMS).
EN 50128	Software for railway control and protection systems.
EN 50129	Safety Related Electronics Systems for Signalling.
EN50159-1&2	Railway Applications: Signalling and Communications Safety related communication in closed & open transmission systems.
EN 50121-2	Electromagnetic compatibility (EMC)-interaction of the of the whole railway system with the out side world.
EN 50121-4	Electromagnetic compatibility (EMC)-Signalling & Communication.
EN 50081-2	Generic Emission standards–Part 2: Industrial Environment.
EN 50082-2	Conducted Immunity Standards.
EN 50155	Railway Applications: Electronic equipment used on Rail vehicles.
IEC 571-1	Standard for Electronic equipments on railway vehicles.
IEC 721	Classification of environmental conditions – environmental parameters and their severities.
A200 FRS	Functional Requirements Specification for ETCS (European Train Control System)
A200/FRSenv.02 ver 00.03	Environmental Specifications for ETCS (European Train Control System)
IEC 61000-4-2	Electrostatic Discharge (ESD)
IEC 61000-4-4	Fast Transient Burst
IEC 61000-4-5	Power Surge

*(1) Or equivalent Recognized International Standard. The supplier shall submit a copy of the same for verification & seek the approval of DMRC.

(2) In the event of conflict between the any two or more specifications or/ and the requirements of this specification, the contractor shall seek the advice of DMRC with complete details.

Whenever, reference to any specification appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

2 SCOPE

This specification covers the technical requirements of Automatic Control System consisting of Automatic Train protection System (ATP) and Automatic Train Operation system (ATO).

3 TERMINOLOGY

For the purpose of this specification, the terminology given in IRS: S 23, A200 FRS ver 3.0 and RDSO/SPN/144/94 shall apply.

4 FUNCTIONAL REQUIREMENT

4.1.1 The system shall conform to A200 FRS, Functional Requirements Specification for ETCS (European Train Control System) in general.

4.2 Automatic Train Control (ATC) Function

4.2.1 The ATC Function shall be responsible for implementing train movements in accordance with the requirements established by the ATS Function, within the constraints established by the Interlocking Function.

4.2.2 Complete system shall work in a fail-safe manner. Train control system shall work on the principle of target speed and target distance with cab signalling and shall continuously supervise the safe running of train and, in case of danger warn the train operator and also apply brakes, if necessary, after a predetermined interval of time.

4.2.3 The system shall read back the brake system reaction after the generation of ATP commands, which shall be logged in the on board Data logger.

4.3 ATC Wayside Function

4.3.1 The ATC wayside equipment shall acquire and communicate in a vital way, information about the track, which is needed on board to calculate the safe speed-distance curves. The information to be transmitted to the train as a minimum, but not limited to are:

- (1) Track profile (Curves, gradient etc.), speed restrictions, switch/ Point locations and signal locations and any other necessary information.
- (2) Signalling status: track circuit status, point position, signal status, overlap status etc.
- (3) Train regulation Commands.

4.4 ATC Trainborne Function

The ATC Trainborne Function comprises as a minimum the following sub-functions, but not limited to:

- (1) The ATP Function, which is responsible for the safe operation of the train;
- (2) ATP Mode;
- (3) The Train operator Man Machine Interface (Train operator MMI) Function, which provides and interface between the signalling system and the train operator.
- (4) The Positive Train Identification function
- (5) The Train to Track communication function

4.4.1 ATC Bypass switch: A fault switch shall be provided in the cab to deliberately switch off the ATP onboard equipment. The actuation of this fault switch will disconnect the ATP and bridge the emergency brake activation circuitry.

4.5 Signalling Modes

The facilities provided by the ATC Trainborne Function will vary according to the signalling mode, which is operative on any given train. Trains may operate, in general, in one of three signalling modes but only one single signalling mode shall be active at any one instant of time. These three signalling modes are:

- 4.5.1 Restricted Manual (RM) Mode is the default mode of operation in Depot; it remains in operation until sufficient conditions have been met to allow for a transfer to the Automatic train Protection (ATP) Mode. However, the train operator will select the RM signalling mode in certain cases (e.g. following an emergency brake application or on entry to the depot etc.). The RM mode will be the default mode in the depot and the speed will be 25 km/ph by the on board equipment.
- 4.5.2 Automatic train Protection (ATP) Mode in which the traction and braking systems of the train are controlled by the train operator in accordance with indications provided in the cab by the Train operator MMI Function. This signalling mode shall provide greater degree of supervision of the train operator's actions than is available in the RM mode.
- 4.5.3 Automatic Train Operation (ATO) Mode, which is used to run the train to the next station without further involvement of the train operator. In achieving this, the ATO Function controls the train braking and traction systems under the supervision of ATP. Upon bringing the train to a stop at the station, the doors are opened automatically, if permitted by the ATP door release. The train shall depart from the station after the train doors are detected 'closed' and the train operator has pressed the Start button. The train operator shall have the facility of taking over control of the train any time.

4.5.4 Run on Sight Mode (ROS mode): The contractor may propose the ROS mode of operation with the mode Selector on ATP position and ROS mode being then selected by a ROS button/Key and the train operator Runs On Sight. The only control is concerning the train speed which cannot exceed a maximum speed ROS–speed limit –25 Kmph (Emergency breaking triggered by ATP system). The running monitoring is the same as for RM. The ATP will give Cab Signal indications as soon as the train reaches a track position where normal running can be resumed. The ATP authorizes the ROS request

4.6 **Degradation of Modes**

4.6.1 In case of failure of ATP, the degradation to Rolling stock mode (Cut out Mode) shall not be automatic. The train will automatically come to stop and the train operator shall change over to Cutout mode by a manual switch, to be provided with a lock. To deter incorrect use, the manual switch should be protected .The isolation of on board equipment must be recorded by a counter.

4.6.2 Effects of equipment failure:

Minimizing the effects of failure so that the train service may continue during times of equipment failure is of paramount importance. Consequently, the area of railway affected by the failure of an item of Wayside ATC equipment which causes the use of RM/ ROS operation shall not be greater than the area between two adjacent stations or between the halfway point on either side of the station. In any case this RM/ROS operation area shall not be longer than 900 m in the normal direction of travel.

4.7 **Functions of ATP System**

4.7.1 The ATP system shall work on the principle of target distance and target speed with cab signalling. The transmission from track to train will be continuous through coded audio frequency track circuits. All the functions under ATP shall be vital functions and shall govern the overall functioning of the ATC system. The ATP system is to permit supervised runs in the forward direction with respect to the occupied cab only. The ATP component of ATC system shall ensure safe movement of trains and shall have as minimum the following functions, but not limited to:

- (i) Reception of signal and line information.
- (ii) Track-related Speed Profile Generation: The ATP system shall compute the track-related speed profile from the line data and train data continuously along the track. The permitted speed shall be computed separately for each of the monitoring functions. The maximum safe speed shall be the minimum of these speeds.
- (iii) Outputting basic data for the cab display
- (iv) Monitoring and enforcing the change in Target Distance/Speed
- (v) Maintaining the safety distance between trains: Train separation shall be maintained by ATP system. The movement authority to a train must only be given

when relevant track section and a safe distance beyond it is free. The movement authority of two trains must not cover the same track section and should include the safety margin.

- (vi) Continuous supervision of maximum permitted speed on the line
- (vii) Monitoring of maximum permissible train speed
- (viii) Monitoring for constant speed
- (ix) Monitoring of maximum speed set by the current operating state of the on-board unit (e.g. permissive speed)
- (x) Continuous monitoring of a braking curve with respect to a defined target point. Monitoring of braking curves shall be provided for a target point with respect to a stopping point or a speed restriction section etc. The braking curve is to be computed continuously along the line, so as to enable a minimum safety distance to be maintained. This computation shall be based on line characteristics as well as the parameters of the train.
- (xi) Stopping point monitoring: The ATP system is to regard the stopping point as a fail-safe stopping point with the target speed of Zero (0) km/h. The stopping point monitoring function must ensure that a train does not run into the hazard point located beyond.
- (xii) Monitoring of speed restriction sections: A train or train length is to be taken into account when the train leaves speed restriction section. The train must observe the permitted speed within the speed restriction section until the tail end of the train has passed the speed restriction section.
- (xiii) Monitoring of train stop in the target area of a station, to ensure that scheduled trains stop at stations. The train must be supervised to stop within the stopping window
- (xiv) Entering and cancelling speed restriction sections: It shall be possible to add temporary speed restriction in a safe manner from both Operation control centre and local control depending on the existing level of control. The temporary speed restriction removal shall be done in a safe manner from local control at Station control room. A temporary speed restriction shall be limited to a sub-section that includes one or more track circuits. Temporary speed restriction shall be in effect for the entire train.
- (xv) Monitoring direction of travel and backward rolling. The unauthorised reverse movement of train shall be prevented by the application of emergency brakes after a pre-determined distance.
- (xvi) Initiating emergency braking when safety limits are exceeded.
- (xvii) Automatic braking of the train shall be initiated in the event of missing or incorrect information from the wayside equipment or a fault in on-board equipment.

- (xviii) Releasing doors on the correct side at stations when the train has come to a stop within the door opening authorisation window
- (xix) Releasing doors on the both sides at stations having double discharge platforms when the train has come to a stop within the door opening authorisation window
- (xx) To ensure that no movement of train is possible until all train doors are closed.
- (xxi) Entry to and Exit from ATP Area
- (xxii) Starting trains in ATP mode after Turnback operation

4.8 Functions of ATP Wayside equipment

4.8.1 The wayside equipment comprises ATP wayside units and jointless coded Audio frequency track circuits and other necessary equipments. It will have as a minimum the following functions but not limited to:

- (i) Extracting driving instructions
- (ii) Long-term storage of line parameters (line gradient, curve, track section length, civil speed restriction sections, temporary speed restriction sections, Station stopping points etc.)
- (iii) Interface to ATS system
- (iv) Interface to the interlocking (operating states of routes and route elements)
- (v) Communication with adjacent wayside units (fail-safe communication)
- (vi) Interface to the coded Audio frequency track circuits
- (vii) Interface to peripherals (service and diagnostic computer, contact inputs, emergency stop inputs etc.)
- (viii) Generation and transmission of necessary data in fail safe manner for safe train movement.

4.9 Man Machine Interface

4.9.1 The train operator's Man machine interface should be based on the ERTMS Drivers Machine interface (DMI) and should be in accordance with Draft EN 50XX6-1 Part 1 Ergonomic arrangements of ERTMS/ETCS information, Draft EN 50XX6-4 Part 4 Symbols, Draft EN 50XX6-5 Part 5 Audible information. The Driver's MMI should be similar to the DMI used on Lines of Delhi Metro. It is required that the DMI should fit in the space and mounting being provided by the Rolling Stock Contractor, without any change at the Rolling Stock side.

4.9.2 The Driver's MMI Function shall provide the train operator with the following information as a minimum but not limited to:

- (i) Signalling mode (provided only when operating in the signalling modes) namely: RM, ROS, ATP or ATO Operating mode
- (ii) Available mode: RM, ROS, MCS, and AUTO available modes shall be provided
- (iii) Actual speed
- (iv) Speed order

- (v) Target speed
- (vi) Target distance; If monitoring mode is MCS/AUTO, the target point indications are displayed when in brake curve: next target speed and next target distance.
- (vii) Advisory speed
- (viii) Advisory warning speed
- (ix) Over-speed alarm
- (x) Speed modification announcement
- (xi) Warning for over-speed – Full service brake will be triggered if speed not reduced to Permitted speed.
- (xii) Emergency Braking triggered
- (xiii) Full Service Brake triggered
- (xiv) Station braking announcement
- (xv) Advisory warning speed alarm
- (xvi) Not docked, manual adjusting
- (xvii) Door Opening Right or Left
- (xviii) Door closed
- (xix) Train hold
- (xx) Departure requested
- (xxi) Immediate departure requested
- (xxii) Dwell time countdown
- (xxiii) Keep doors closed
- (xxiv) Skip station
- (xxv) Advice speed for inter station regulation
- (xxvi) Locked axle
- (xxvii) Alarm and status indication

4.10 **Automatic Train Operation**

The automatic train operation system shall be responsible for train operation between stations. The train speed, acceleration, braking shall be automatically controlled, preventing unnecessary braking, stopping and starting. The ATO system should have the following functions as minimum, but not limited to:

- Automatic control of train running from station to station while remaining within the safety envelope calculated by ATP
- Opening of train doors in the stations

- Execute programmed stops and control, in conjunction with the ATS/ ATP equipment, of dwell times in accordance with the timetable/ headway

4.11 **Operational Requirement**

4.11.1 Speed Supervision

A number of different monitoring curves are to be provided within the ATP System. The audible warning tone for all the different cases below shall be different.

The warning curve	Issuing of an audible warning
The service brake curve	Issuing of an audible warning Activation of the visual display And application of the service brake
The emergency brake curve	Issuing of an audible warning (continuous) Activation of the visual display Application of the emergency brake

The ATC System shall prevent train movement outside of the safe operating envelope by application of the service brake. If the actual speed exceeds the permitted speed, a warning must be given to the train operator to enable him to react and avoid intervention from train borne ATC equipment at least 2 seconds before the intervention of the full service brake until the actual speed does not exceed permitted speed, then the train operator must be capable of selecting release of full service braking. The warning must continue until actual speed does not exceed permitted speed. The full service brake intervention and emergency brake intervention must be recorded. If the full service brake fails or is not adequate to stop the train at the target point, the trainborne equipment must apply the emergency brake.

4.11.2 Station stopping Monitoring and Supervision

4.11.2.1 The ATC system should provide advisory indications on the Train operator's MMI to help the train operator to stop correctly the train in station. If necessary, the ATC triggers the Full Service Brake (FSB) in case the train operator has not correctly followed these indications.

4.11.2.2 Advisory indications:

The ATC calculates a normal station stopping braking curve from the Station Stopping Point (SSP). When approaching the station, the train hits the curve and the ATC triggers an audible indication named Station Braking Announcement.

From this point, the train operator must brake the train following this curve. He will be helped by two speed indications on the Driver's MMI: the advice speed and the warning speed.

The advice speed is represented by a Yellow triangle which decreases following the normal braking curve. The warning speed is represented by an orange triangle located a few km/h above the advice speed triangle. The train operator will brake the train according to the advice speed. The train speed can stay below the advice speed or between the advice speed and the warning speed. In case the speed goes above the warning speed, an audible warning is triggered. Then, the train operator has a few seconds to react and go back below the warning speed. If not, the intervention is triggered.

Intervention:

The ATC gives a few seconds to the train operator to react after warning. If not, the ATC triggers the FSB.

At low speed, a trip function overrides the warning process and the FSB is triggered as soon as the train has overrun the SSP.

4.11.3 Setting of Train Data

Train-specific data are to be set by means of a fail-safe input procedure; Examples of such data are

- (1) Train type/number
- (2) Maximum permissible train speed
- (3) "Train / train length"
- (4) Wheel diameter
- (5) Service braking rate
- (6) Emergency braking rate
- (7) Brake application time
- (8) Full-scale speedometer deflection
- (9) Any other information.

4.11.4 Self-test: There shall be a provision of self-test of the on board ATP equipment when powered on.

4.11.5 Testing of ATP equipment: the system shall have the facility of testing the ATP equipment to verify proper operation and functioning of ATC inputs and outputs including the testing of adequacy of the braking system so as to complete pre-departure tests from depot to main line.

4.12 **Transmission from Train to Track**

The system shall transmit as a minimum, but not limited to, from train to track to, such data like operating data such as train number, destination and crew number etc., control information for automatic train routing such as current track circuit identification, odometer readings etc, registration data and fault indications of the train data recording facility for the purpose of positive train identification and other requirements.

5 COMPATIBILITY WITH TRACTION

The system shall be suitable for working on sections having 25 kV AC /1500 V DC traction and where Cars will be hauled by GTO/IGBT based VVVF controlled three phase Induction motors.

6 SAFETY AND RELIABILITY REQUIREMENTS

The System shall conform to the reliability & safety standards of CENELEC Standards EN50126, EN50128 & EN50129. The system shall conform to Safety Integrity Level - 4 of the relevant CENELEC standards. If any equivalent recognized International standard other than CENELEC has been used, the requirements specified in paragraph 6.3.3.2 (8) of Particular Specifications shall be fulfilled.

6.1 Software requirements

6.1.1 Software used in ATP system should have been developed in conformity with a software engineering standard EN50126, EN50128, EN50159-1&2, & EN50129 issued by European Committee for Electro technical Standardization (CENELEC) with special relevance to safety critical applications. If any equivalent recognized International standard other than CENELEC has been used, the requirements specified in paragraph 6.3.3.2 (8) of Particular Specifications shall be fulfilled.

6.1.2 The communication provided between various ATC equipments and between ATC equipment and interlocking system shall comply with the requirements for transmission of vital safety information conforming to CENELEC standards EN 50159-1 & 2.

6.1.3 The onboard ATP equipment shall conform to IEC 571-1, and CENELEC standard EN 50155.

6.2 Verification and Validation

6.2.1 The System shall be based on proven and reliable design.

6.2.2 The System shall be validated to Safety integrity level - 4 of the relevant CENELEC standards or other mentioned standards.

6.2.3 The contractor shall submit the certificate of validation to the relevant standards. For this the full documentation of verification and validation for both hardware and Software should be given to DMRC.

6.2.4 DMRC reserves the right to further assess the documentation of Verification & Validation to the relevant standards. In this case, the Assessor role will be played by DMRC or any other agency nominated by DMRC. The safety assessor may require specific tests to be carried out. The cost of such specific by the safety assessor shall be borne by the contractor.

6.2.5 If DMRC considers further validation or revalidation necessary, the contractor will supply all the documents to the validation agency nominated by DMRC.

6.3 Distance and Speed Measurement

The ATP system shall measure train speed in a fail-safe manner. This shall be derived from at least two independent sensors. Any fault in the speed measurement system shall either be

detected as a fault or result in a higher than actual speed indication. The speed measurement system shall be able to measure the true speed of the trains and there should be no measurement errors due to wheel slip or slide. The distance measurement, which may be falsified by sliding and skidding, shall be synchronized regularly. The speed measurement system shall be self-calibrating as the wheel diameter change with wheel wear or fitting of new wheel.

6.4 Locked axle detection

6.4.1 Locked axle detection should be provided.

7 SYSTEM ARCHITECTURE

7.1 No single failure of any component/ board/ module in the Trackside ATP and Onboard ATP/ ATO subsystem shall cause complete failure of the respective subsystem.

7.2 The ATP wayside equipment and on board ATP equipment shall be based on fail-safe microcomputer system.

7.3 The Wayside ATP equipment and Onboard ATP equipment shall have a fault tolerant equipment design using redundancies or other design features to ensure that a high level of train service is maintained in the presence of single point failure and also ensure achievement of availability as specified.

7.4 The wayside ATP equipment and on board ATP equipment shall be configured in a fail-safe arrangement with suitable redundancies conforming to safety integrity level 4 as defined in CENELEC EN50129:

a. Wayside ATP equipment

(1) Single Electronic Structure based on reactive fail-safety with diverse software. The system shall work with online and hotstandby configuration with facility of automatic changeover in case of fault of working system without affecting train operation

Or

(2) Dual Electronic structure based on composite fail safety with fail-safe comparison (2 x 2 out of 2, or 2 out of 3) and common software or diverse software. The system shall work with online and hotstandby configuration with facility of automatic changeover in case of fault of working system without affecting train operation

b. On board ATP/ ATO equipment

(1) Two out of three hardware architecture with identical hardware and identical or diverse software

Or

(2) Two out of two hardware with identical or diverse hardware and common or diverse software or Single Electronic Structure based on reactive fail safety with diverse software. Redundancy shall be provided, either in the same cab or

between front and rear cab, so that failure of one onboard ATP/ ATO equipment does not prevent the train from being operated in ATP mode.

The changeover in the event of failure of one unit shall be automatic, without train operator's intervention, with an indication in the cab. The train shall start in ATP mode and shall not degrade to ROS/ RM mode.

8 POWER SUPPLY REQUIREMENTS

- 8.1 The Wayside ATP system shall work on 230 volts, 50 Hz AC commercially available power supply.
- 8.2 The power supply for the on board ATC system shall be derived from the Rolling stock power supply system. For this the supplier shall interface with Rolling stock Contractor.
- 8.3 A surge suppresser or other suitable means and proper earthing arrangement shall be provided where necessary to protect against transient voltages, lightning & spikes etc.

9 ENVIRONMENTAL REQUIREMENTS

9.1 General

All the equipments shall be suitable for the environmental conditions of Jaipur. The ATC equipment shall conform to A200 FRSenv.02 version 00.03 and the environmental tests shall be carried out as per the methodology described in it. The equipment shall conform to the standards specifically, if any, mentioned for each item. The environmental conditions to be followed shall be for the weather protected enclosure without temperature or humidity control wherever applicable. The following conditions, identified as having a direct effect on the equipment shall consist of the following:

9.2 Climatic

- 9.2.1 Ambient temperature: The equipment shall be designed and manufactured for working in the ambient temperature range as specified in Range –1, operation as defined in table 6.1.1 for train, table 6.1.2 for track and trackside of A200 FRSenv.02 version 00.03. The Indoor system shall be designed and manufactured for working in a non air-conditioned environment and ambient temperature range between 0°C to 70°C.
- 9.2.2 Relative atmospheric humidity: The equipment shall be designed and manufactured to meet the external humidity over the complete range of ambient temperature values as defined in table 6.3.2 of A200 FRSenv.02 version 00.03.
- 9.2.3 For solar radiation, wind, atmospheric pressure, precipitation (i.e. rain, snow and hail), altitude and condensation, the equipment shall conform to A200 FRSenv.02 version 00.03.

9.3 Mechanical

- 9.3.1 Vibration and shock (sinusoidal and random): The vibration and shock requirements will conform to A200 FRSenv.02 version 00.03 and where ever the requirements are not entirely applicable, the ranges and classification contained in IEC721 shall be observed.

9.4 Electrical

The equipment shall conform to a200 frsenv.02 version 00.03 and the tests shall be carried out as described in it wherever applicable.

9.4.1 Electromagnetic environment (EMI and EMC): All equipments should work safely, reliably under electromagnetic & electrostatic interference conditions existing in the mass rapid transit system, which will have the traction voltages as 25 KV AC/1500V DC and 3 phase 33KV Electrical power cables running along the track. System shall be designed to work under worst fault conditions.

9.4.1.1 The wayside ATP equipment shall conform to CENELEC standards EN50121-2 & 4 and EN50082-2. For radiated Emissions & conducted EMI the system shall meet the requirements of CENELEC standards EN 50081-2.

9.4.1.2 ATP onboard equipment shall conform to IEC 571-1, CENELEC standards EN 50155, EN50121-2 & 4, EN50121-3 and EN50082-2. For radiated Emissions & conducted EMI the system shall meet the requirements of CENELEC standards EN 50081-2.

9.4.1.3 Transients (spikes and surges): The equipment shall conform to A200 FRSEnv.02 version 00.03. It shall also conform to the following:

9.4.1.4 All equipment shall be protected against electrostatic discharge as defined in IEC 61000-4-2.

9.4.1.5 All equipments shall conform to IEC 61000-4-4 for protection against Transient Burst.

9.4.1.6 All equipments shall conform to IEC 61000-4-5 for protection against Power Surge.

9.4.1.7 For power supply, susceptibility and generation, Earthing/ bonding, the equipment shall conform to A200 FRSEnv.02 version 00.03.

9.5 Chemical

9.5.1 For pollution, dangerous substances, resistance to solvents, the equipment shall conform to A200 FRSEnv.02 version 00.03.

9.6 Biological

9.6.1 For Animals, humans (vandalism), vegetation, the equipment shall conform to A200 FRSEnv.02 version 00.03.

9.7 General

9.7.1 For ionic radiation (exo and endo), fire resistance, earthquake, noise and illumination (for MMI), the equipment shall conform to A200 FRSEnv.02 version 00.03.

9.7.2 Train generated influences: For temperature, precipitation (e.g. water spray), pressure changes (e.g. tunnels), air movement, dust, the equipment shall conform to A200 FRSEnv.02 version 00.03.

10 DIAGNOSTICS

10.1 The system shall perform internal diagnostics. Internal self-test should be performed every system cycle and should verify the proper operation of CPU hardware and software as well as the health of other system PCB's. The failure shall be logged.

10.2 The system shall have the facility of interfacing with a portable test unit to retrieve data logs and system status information. The contractor shall provide the portable test unit with the associated software to DMRC.

10.3 **On Line data logging facility**

10.3.1 The system shall log all events, commands, functions etc which should be date and time stamped, for enabling complete analysis of safe and proper functioning of the system. The duration of logging will be minimum 24 hours.

10.3.2 The system shall interface with the on board Train management system of the Rolling stock for on line data logging of all events, commands and functions including on board Train control and signalling system failures, operating modes, current track circuit identification, etc. The duration of logging will be 24 hours.

10.3.3 Event logging facility for minimum 100000 events shall be provided for the Wayside ATC equipments.

10.3.4 The contractor shall provide Laptop with debugging software for both Onboard and Wayside ATC equipment to DMRC.

11 **GENERAL REQUIREMENTS**

11.1 The system shall be capable of interface with Interlocking systems. Supplier shall submit interface details. Interface with interlocking system shall not be Model/ Manufacturer specific.

11.2 The equipment shall be so constructed as to prevent unauthorized access to the system.

11.3 Necessary provision shall be made in the hardware and software for modular expansion of the system.

11.4 **Documents To Be Furnished By The Contractor**

11.4.1 The Contractor shall supply the following documents:

- (a) Proof of safety report containing detailed analysis of software and hardware. (Generic product safety case and Generic Application safety case.)
- (b) Type test results performed on equipment before its use for regular production
- (c) Acceptance tests results performed by Contractor before dispatch.
- (d) Environmental test results performed on the equipment by Contractor/ independent testing agency.
- (e) Full documentation of verification and validation procedure, quality assurance program along with report and certificate from Quality Assurance (QA) Group.
- (f) The ISA report of the Generic product safety case and Generic Application safety case shall be submitted by the contractor required by the relevant CENELEC standards or other mentioned standards for both Hardware and Software.
- (g) If DMRC considers further validation or revalidation necessary, the Contractor will supply all the documents to the validation agency nominated by DMRC.

- (h) In case of equipment that has been tested and approved for unconditional and unrestricted use on any passenger railway by any railway administration, the Contractor should submit complete details of test carried out, test results and approval certificate issued by concerned railway administration.
- (i) Any other information, considered necessary by DMRC.

11.4.2 The Contractor shall supply the following documentation/manuals

- (a) Manual of installation & Maintenance
- (b) Diagnostics aids including trouble shooting charts.
- (c) Details of Hardware e.g. schematic diagrams of the system circuits/ components, details for each type of assembled PCB.

11.4.3 The Contractor shall provide the following certifications from approved validation agency.

- (a) Correctness and safety of the software;
- (b) Reliability and fail-safety of the ATP system & Calculation details of MTBF & availability of the system
- (c) Any other information defined in CENELEC standards

12 TESTS AND REQUIREMENTS

As a minimum, type test, acceptance test and routine tests will be conducted.

12.1 Conditions of Tests

12.1.1 Unless otherwise specified all tests shall be carried out at ambient atmospheric conditions.

12.1.2 The Contractor shall have all the necessary software/ simulation programmes & test and measuring equipment for carrying out the test.

12.2 Type Test

The Type Test shall as a minimum include the following:

- (ii) Visual inspection
- (iii) Insulation Resistance tests
- (iv) Card-level functional tests on all the cards and fail-safety tests on one card of each type
- (v) System level functional and fail- safety tests
- (vi) Computerized testing for all possible permutations and combinations
- (vii) Environmental/ climatic tests
- (viii) System Diagnostics test
- (ix) System Software tests
- (x) Any other tests shall be carried out as considered necessary by the purchaser.

Only one ATP equipment shall be tested for this purpose. The equipment shall successfully pass all the type tests for proving conformity with this specification. If the equipment fails in any of the type tests, the purchaser or his nominee at his discretion, may call for another

equipment/card(s) of the same type and subject it to all tests or to the test(s) in which failure occurred. No failure shall be permitted in the repeat test(s).

12.3 Acceptance Tests

The following shall comprise acceptance test

- (i) Visual inspection
- (ii) Insulation Resistance tests
- (iii) Card-level functional tests on all the cards
- (iv) System level functional tests
- (v) System Diagnostics test
- (vi) Verification of application software
- (vii) Any other test considered necessary by the purchaser

12.4 Routine tests

The following shall comprise the routine tests and shall be conducted by Contractor on every ATP equipment and the test results will be submitted to the inspection authority before inspection. The application software in proper format shall also be submitted to the inspection authority in advance.

- (i) Visual inspection
- (ii) Insulation Resistance tests
- (iii) Card-level functional tests on all the cards
- (iv) System level functional tests
- (v) System Diagnostics test
- (vi) Any other test considered necessary by the purchaser

APPENDIX P – LIST OF SPARES FOR TRAIN CONTROL & SIGNALLING SYSTEM

S.No.	Item	Unit	Quantity
A	Interlocking		
A.1	<i>All type of cards used in Interlocking cubical</i>	No.	
A.1.a	ECPU3	No.	1
A.1.b	ECPU2	No.	1
A.1.c	ECPU1	No.	1
A.1.d	AOVD5	No.	1
A.1.e	EOVCM	No.	1
A.1.f	ALIM VP 12V	No.	1
A.1.g	VP 12VOLT _3	No.	1
A.1.h	ULE POWER SUPPLY MODULE(ALIM 5V/30 AMP)	No.	1
A.1.i	ALIM 5v	No.	1
A.1.j	AL 15	No.	1
A.1.k	AL 5	No.	1
A.1.l	AFM	No.	1
A.1.m	ELH	No.	1
A.1.n	EIOBUF	No.	1
A.1.o	EDBO16	No.	2
A.1.p	EIONT MAIN	No.	1
A.1.q	EIOINT RCHK	No.	1
A.1.r	EVPD	No.	1
A.1.s	EVIN16	No.	2
A.1.t	EHICOM DMS-528F	No.	1
A.1.u	EHICOM ATC- 527E	No.	1
A.1.v	EHICOM NR- 524B	No.	1
A.1.w	EHICOM FSFB-527E	No.	1
A.1.x	E32IN	No.	1
A.1.y	E32OUT	No.	1
A.2	<i>Interlocking cubical</i>		NIL
A.3	<i>All types of connectors used in Interlocking cabinets including all other sub-system interconnections with cables of sufficient length to enable replacement at any location</i>	No.	1 each type of used items
A.3.a	Link 15 (ASCV to Relay Frame)	No.	1
A.3.b	Link 14.1 (ASCV to Relay Frame)	No.	1
A.3.c	Link 13 (ASCV to Adaptation Cubical for SDTC)	No.	1
A.3.d	Link 5 (ASCV to Adaptation Cubical for SDTC)	No.	1
A.3.e	Link 6 (ASCV to Adaptation Cubical For SDTC)	No.	1

A.3.f	ASCV - ATS Link	No.	1
A.3.g	ASCV - ATC (Via Adaptation Cubical)	No.	1
A.4	<i>All type of frames (racks) with motherboard and without boards e.g. base frame, power supply frame, Extension frame, Fan assembly frame, and terminals</i>		NIL
A.5	<i>All type of Communication connections cords (copper/optical fiber) used for interconnections of used sub-systems</i>	No.	1 each type of used items
A.5.a	Optical Fiber Patch Cord - 5 mtrs	No.	1
A.5.b	Belden 8105 Cable 24WAG 5TWI Indoor- 5 Mtr..	No.	1
A.5.c	Belden 8107 Cable 24WAG 5TWI Indoor- 5 Mtr..	No.	1
A.5.d	Belden 8110 Cable 10P 100 OHM Indoor- 5 Mtr..	No.	1
A.5.e	Belden 8135 Cable 28WAG 5TWI Indoor- 5 Mtr..	No.	1
A.5.f	Belden 9431 Cable 20CIN X 0.35 Indoor - 5 Mtr	No.	1
A.5.g	Belden 9502 Cable 24AWG 2TWI Indoor – 5 Mtr.	No.	1
A.5.h	Flamex Cable 4 X 0.6 Indoor - 5 Mtr	No.	1
A.5.i	Flamex Cable 2 X 1.5 Indoor - 5 Mtr	No.	1
A.5.j	Flamex Cable 2 X 0.6 Indoor - 5 Mtr.	No.	1
A.5.k	ZUG Cable 6 Pair X 1 Sq.mm. - 5 Mtr	No.	1
A.7	<i>CRSA2 Modems used for Interlocking</i>	%	10 % of used items of each type
A.7.a	CRSA2 modem	No.	1
A.7.b	CRSA2 modem power supply	No.	2
A.8	<i>Over voltage protection devices used in interlocking cubical</i>	No.	NIL
A.9	<i>Filter mat door</i>	No.	10
A.9.a	Filter mat door	No.	10
A.10	<i>Fan assembly</i>	%	10 % of used items of each type
A.10.a	<i>Fan assembly 6"</i>	No.	4
A.10.b	<i>Fan assembly 4"</i>	No.	4
A.11	<i>All types Relay with base & clip used in Relay cubicles</i>	No.	2 each type of used items
A.11.a	QNA1 Relay with base & clip	No.	2
A.11.b	UN1K Relay with base & clip	No.	2
A.11.c	QBCA1 Relay with base & clip	No.	2
A.11.d	QEC61 Relay with base & clip	No.	2
A.11.e	3TF31 Relay (MJ81 Power supply Relay) with base & clip	No.	2
A.12	Relay Frame	No.	1
B	SDTC		
B.1	<i>All type of PCB cards used for all type of track circuits used including mother board and power supply units</i>	%	10 % of used items of each type
B.1.a	<i>Mother Board</i>	No.	

B.1.b	Power conversion Unit - 250VA	No.	
B.1.c	Modem Board	No.	
B.1.d	RT Board	No.	
B.1.e	Tx/Rx module F7	No.	
B.1.f	Tx/Rx module F8	No.	
B.1.g	Tx/Rx module F9	No.	
B.1.h	Tx/Rx module F10	No.	
B.1.i	Tx/Rx module F11	No.	
B.1.j	Tx/Rx module F12	No.	
B.1.k	Tx/Rx module F14	No.	
B.1.l	Hybrid Tx/Rx module F7L/F11	No.	
B.1.m	Hybrid Tx/Rx module F7L/F12	No.	
B.1.n	Hybrid Tx/Rx module F14L/F7	No.	
B.1.o	Hybrid Tx/Rx module F14L/F10	No.	
B.1.p	Hybrid Tx/Rx module F14L/F12	No.	
B.1.q	Switch Rx F7	No.	
B.1.r	Switch Rx F8	No.	
B.1.s	Switch Rx F10	No.	
B.1.t	Switch Rx F11	No.	
B.1.u	Switch Rx F12	No.	
B.2	SRB cabinet with Relays (fully loaded)	No.	1
B.4	Air filter	No.	10
B.5	Fan Assembly	No.	1
B.6	Trackside connection box (TU box)	No.	10 % of used items of each type
B.6.a	SS TU Connection box with base	No.	
B.7	TU board of each frequency used	No.	
B.7.a	Tuning Unit Board F7/F9	No.	
B.7.b	Tuning Unit Board F9/F11	No.	
B.7.c	Tuning Unit Board F11/F7	No.	
B.7.d	Tuning Unit Board F7/F10	No.	
B.7.e	Tuning Unit Board F8/F11	No.	
B.7.f	Tuning Unit Board F8/F10	No.	
B.7.g	Tuning Unit Board F8/F14	No.	
B.7.h	Tuning Unit Board F10/F12	No.	
B.7.i	Tuning Unit Board F10/F14	No.	
B.7.j	Tuning Unit Board F12/F14	No.	
B.7.k	Tuning Unit Board F8/F12	No.	
B.8	All types of connectors used in AFTC cabinet with cables of suitable length to enable replacement at any location	set	1 each type of used items
B.8.a	Cable with Matrimate 6 Pin connector	No.	1

B.8.b	Cable with Matrimate 4 Pin Connector	No.	1
B.8.c	Cable with Matrimate 9 Pin Connector	No.	1
B.9	Impedance bond CI-300	No.	1
C	Point Machine		
C.1	Non Trailable Point Machine used on Main Line	No.	
C.1.a	Non Trailable Main Line Point Machine MJ81	No.	1
C.2	<i>All replaceable part of Main line Point Machine used including Motor, Friction clutch, detector, point locks etc.</i>	No.	
C.2.a	Point Motor for MJ81 PM	No.	1
C.2.b	Detector Assembly LH and RH complete for 1 point for MJ 81 PM	No.	1LH & 1RH
C.2.c	VCC lamp lock assembly LH and RH for MJ81 PM	No.	1LH & 1RH
C.2.d	Magnetic Clutch Assembly	No.	1
C.3	Disconnection switch an keys used in section for manual operation	set	10 % of used items of each type
C.3.a	Trauv Lock with key	set	1 of each type
C.3.b	EKT with Keys	set	1 of each type
C.4	<i>Roding for point fitting complete with drive rod, pins, bushes etc for 1:7 & 1:9 for SG points used for point machine.</i>	set	1 set used for 1 Point Machine
C.4.a	VCC connecting rod 2 TER 1385 C	set	1
C.4.b	Adjustable drive bar L= 1760mm	set	1
C.4.c	VCC Plastic Slive	set	1
C.4.d	"Belleville" spring washers 25x50x3,5	set	1
C.4.e	Plate washers 25x55x4	set	1
C.4.f	Concentric insulating bush	set	1
C.4.g	Screw HM18x60 Inox A2/70 (for MJ)	set	1
C.4.h	Nut HUM18 Inox (for MJ)	set	1
C.4.i	Washer W18 Inox (for MJ)	set	1
C.4.j	Plastirail bolt 22-130 (insert)	set	1
C.4.k	Plastirail screw Spike 130-11 22x130	set	1
C.4.l	Plate screw RDSO/T 3911 L=140mm (MJ support)	set	1
C.5	Crank Handle	No.	1
C.6	<i>Set off accessories for changing of point machine</i>	set	1
C.6.a	Taparia Kit for changing the PM	set	1
C.7	Universal Lock & Key for PM	set	2
C.8	11 pin connector for Point Machine Power supply connection	set	2
D	Signals		
D.1	<i>Buffer Stop Light used in underground section</i>		10 % of used items of each type
D.1.a	Red Signal LED with PCB	No.	1
D.2	<i>Fixing bracket/ post and base compete with fixing bolts used for underground section</i>	No.	1
D.2.a	CLS Signal Base with fixing Bolts (UG)	No.	1
D.2.b	CLS Post 3.6 mtr (UG)	No.	1
D.2.c	CLS Signal Unit - 1 Aspect (UG)	No.	1

D.2.d	CLS Signal Unit - 3 Aspect(UG)	No.	1
D.3	<i>Signal LED unit with PCB (red/violet/green) for underground section</i>	No.	1 each type of used items
D.3.a	Green LED units with PCB (UG)	No.	1
D.3.b	Red LED units with PCB (UG)	No.	1
D.3.c	Violet LED units with PCB (UG)	No.	1
D.4	<i>Route Indicators (LED) used in underground section</i>	No.	1 each type of used items
D.4.a	Route Indicator M, D & S LED with PCB (UG)	No.	1 of each type
D.5	<i>All replaceable parts of Signal units used including lens, hood, socket etc used in underground section.</i>	No.	1 each type of used items
D.5.a	Hoods	No.	1
D.5.b	Brackets for mounting RI on signals	No.	1
D.5.c	CLS Signal Elbow with 'U' clamp	No.	1
D.5.d	CLS Signal Number Plate set	No.	1
D.5.e	Pinacale for Post	No.	1
D.5.f	CLS Mounting socket	No.	1
E	Cables		
E.1	S Bond Cable		
E.1.a	185 sqmm cable ZHLS	Meter	500
E.2	Bonding Cables		
E.2.a	25 sqmm Cable ZHLS	Meter	500
E.2.b	70 sqmm cable ZHLS	Meter	500
E.3	All types PVC indoor cables		
E.3.j	Ethernet Cable(Indoor) ZHLS	Meter	500
E.3.k	ZUG Cable 6 Pair X 1 Sq.mm ZHLS	Meter	500
E.4	All types of out door cables		
E.4.a	2P x 1 sqmm armoured ZHLS	Meter	500
E.4.b	4P x 1 sqmm armoured ZHLS	Meter	500
E.4.c	7P x 1 sqmm armoured ZHLS	Meter	500
E.4.d	1C x 2.5 sqmm VCC to Point Machine ZHLS	Meter	50
E.4.e	Fibre optique 24F/O MONOMODE upstairs	Meter	500
E.4.f	6C x 2.5 sqmm armoured ZHLS	Meter	500
E.4.g	LIU Cable 1C x 6 sqmm ZHLS	Meter	500
E.4.h	Eurobalise Data Cable 2C x 0.85 sqmm armoured ZHLS	Meter	500
E.4.i	Eurobalise Power Cable 3C x 1.5 sqmm armoured ZHLS	Meter	500
E.4.j	3 Quad x 1.4 mm Cable ZHLS	Meter	500
E.4.k	1 Quad x 1.4 mm Cable ZHLS	Meter	500
E.5	Power & Earthing Cables		
E.5.a	2C x 1.5 sqmm ZHLS	Meter	500
E.5.b	2C x 2.5 sqmm ZHLS (PDC-CBI & Txfer cubicle)	Meter	500
E.5.c	2C x 10 sqmm ZHLS (PDC-RC for 24V & 30V supply)	Meter	500
E.5.d	4C x 2.5 sqmm ZHLS	Meter	500
E.5.e	4C x 25 sqmm ZHLS	Meter	500
E.5.f	1C x 1.5 sqmm Copper ZHLS	Meter	500
E.5.g	1C x 6 sqmm Copper ZHLS	Meter	500
E.5.h	1C x 10 sqmm Copper ZHLS	Meter	500
E.5.i	1C x 25 sqmm Copper ZHLS	Meter	500
E.5.j	1C x 25 sqmm Aluminum ZHLS	Meter	500
E.6	Any other cables (FRLS/ZHLS) used	Meter	500m of each type

F	On Board ATC		NIL
G	Track Side ATC		
G.1	<i>Trackside ATC cubicle complete (redundant) with cards including all communication interfaces; connectors, Maintenance Terminal etc.,</i>	No.	NIL
G.2	<i>All types of connectors and sockets used in trackside ATC with cables of suitable length to enable replacement</i>	No.	1 each type of used items
G.2.a	ATC - ATS Link	No.	1
G.2.b	ATC- ASCV Link	No.	1
G.2.c	ATC - ATC Link	No.	1
G.3	<i>All type of cards used in trackside ATP Cubical including power supply boards and modems</i>	No.	10% of used items of each type
G.3.a	CPU PSU BOARD	No.	1
G.3.b	HSCU BOARD	No.	1
G.3.c	IO PSU BOARD	No.	1
G.3.d	MAIN PSU BOARD	No.	1
G.3.e	MPU BOARD	No.	1
G.3.f	REDMAN BOARD	No.	1
G.3.g	SAU BOARD	No.	1
G.3.h	TWC boards: CCE board	No.	1
G.3.i	TWC boards: CUC012 board	No.	1
G.3.j	TWC boards: CCO board	No.	1
G.3.k	TWC boards: CTD board	No.	1
G.4	<i>All other trackside equipments with complete fittings e.g. beacon, loops etc</i>	%	10% of used items of each type
G.4.a	Relocation Beacons	No.	10% of used
G.4.b	Installation Accessories viz. fasteners etc for RB	set	10% of used
G.4.c	STIB/DLR	No.	1
G.4.d	Installation Accessories viz. fasteners etc for STIB/DLR	set	2
G.4.e	LIU board	No.	1
G.5	<i>TWC frames (racks) with motherboard and without boards e.g. base frame and terminals</i>	No.	1
G.5.a	TWC assembled rack with motherboard (without boards)	No.	1
G.6	<i>All type of Communication connections cords (copper/optical fiber) used for interconnections of used sub-systems</i>	No.	1 each type of used items
G.6.a	Flamex Cable 4 X 0,6 Indoor – 5 mtrs	No.	1
G.6.b	Flamex Cable 2 pair X 1,34 Indoor – 5 mtrs	No.	1
G.6.c	Flamex Cable 2 X 0,6 Indoor – 5 mtrs	No.	1
G.6.d	Optical Fiber Patch Cord – 5 mtrs	No.	1
G.7	<i>Fuses of each type used in Interlocking cabinet including boards</i>	No.	10 each type of used items
G.7.a	Poliswitch Fuse REDMAN	No.	10
G.7.b	Micro Fuse REDMAN	No.	10

G.8	<i>LDOM Modems, CRSA2s And Its power supply used for Trackside ATC</i>	%	10 % of used items of each type
G.8.a	Long Distance Optical Modem (LDOM)	No.	1
G.8.b	CRSA2 Board	No.	1
G.8.c	CRSA2 Board power supply	No.	1
G.9	<i>Filter mat door</i>	No.	50
G.10	<i>T-ATC Fan assembly</i>	No.	1
H	ATS		
H.1	<i>LATS Server and VDU server</i>	No.	10 % of used items of each type
H.1.a	VDU workstation	No.	1
H.2	<i>All items FEP, KVM, Mini ATS, Switching unit, switch, Modems, router etc used in LATS cubicle</i>	No.	1 each type of used items
H.2.a	KVM	No.	1
H.2.b	Mini ATS	No.	1
H.2.c	Optical Switch	No.	1
H.2.d	Optical Switch Power Supply	No.	1
H.2.e	Switching unit	No.	1
H.2.f	Network switch 24 port	No.	1
H.2.g	Network switch 48 port	No.	1
H.2.h	Router Cubicle (Empty)	No.	1
H.2.i	Router cubicle with E1 card	No.	1
H.2.j	FEP	No.	1
H.2.k	Fan assembly for ATS	No.	1
H.3	ATS workstations	No.	1
H.4	<i>All types of connectors and sockets used in ATS with cables of suitable length to enable replacement</i>		
H.4.a	LAN Cable (CAT 6) 100mtr	No.	1
H.5	<i>Any other items used</i>	%	10 % of used items of each type
I	PDC		
I.1	All type of transformer used in transformer cubicle	No	1 each type of used items
I.1.a	Signal power supply step-down Transformer (1 Phase, 0.5KVA)	No	1
I.1.b	Point m/c power supply Delta to Delta Transformer (3 Phase, 10KVA)	No	1
I.1.c	Interlocking power supply Delta to Star Transformer (3 Phase, 10KVA)	No	1
I.2	PDC cubicle (fully loaded)	No	1
I.3	All type DC power Supply, MCB, IMD & ELD etc. use in PDC cubicle	No	1 each type of used items
I.3.a	All type used MCB in PDC and Transformer cubicle	No	1 each type
I.3.b	ELD	No	2
I.3.c	IMD	No	2
I.3.d	DC power supply 24V	No	1

I.3.e	DC power supply 30V	No	1
I.3.f	Transformer Cubicle	No.	1
I.4	<i>Any other items used</i>	%	10 % of used items of each type
J	Miscellaneous		
J.1	<i>Fuses of All types including those used on the cards/ modules of each sub-system, AFTC, Point Machine, Signal, ATC, ATS & Signalling gears.</i>	No	50 of each type
J.2	<i>Terminals used of all types</i>	No	NIL
J.3	<i>Lightning protection devices</i>	No	10 each type of used items
J.3.a	Surge Arresters (L.D.)	No	10
J.4	<i>Dominos, PCBs including mother board and other items.</i>	%	10% of each type used item
J.5	ESP complete box	No.	1
J.6	ODF	No.	1
J.7	Cable Frame	No.	1
J.8	Tool Rack	No.	1

Note: 1. In case the supplies are made out in terms of percentage, the fractions shall lead to the next integer value, separately for each line.

2. Quantities of items not covered in the above list shall be determined in accordance with GS

APPENDIX Q – LIST OF SPECIAL TOOLS

S.No.	Item	Unit	Quantity
1.	Well equipped tool kit	Nos.	3
2.	TORQUE wrench	Nos.	2
3.	OTDR	No.	1
4.	Meggaring Tool	Nos.	2
5.	LAN tester	Nos.	2
6.	Earthing measurement Tool	Nos.	1
7.	Clamp Meter	Nos.	4
8.	Crimping Tool	Nos.	3

APPENDIX R – SECTIONS

1 Line 2: – Mansarovar - Chandpole - Badi Chaupur

1.1 Stations with Interlocking (Three):

- 1) Mansarovar (Terminal Station of Phase 1A)
- 2) Railway Station (Presently Chandpole is Terminal Station in Phase 1-A)
- 3) Badi Chaupur (Terminal Station in Phase1-B)

1.2 Stations without Interlocking (Eight)

1. New Atish Market (Existing)
2. Vivek Vihar (Existing)
3. Shyam Nagar (Existing)
4. Ram Nagar (Existing)
5. Civil Lines (Existing)
6. Chandpole (Existing)
7. Sindhi Camp (Existing)
8. Choti Chaupur (Non IXL station of phase-1B)

1.3 Operation Control Centre

Operation Control Centre at Mansarovar

1.4 Onboard equipment

Contractor shall refer to the requirement of PS and TC&S/ RS8 interface document to work out modification in system hardware or software..

- End of Appendix R *

APPENDIX S, T, U – NOT USED

APPENDIX V – KEY & ACCESS DATES

1 KEY DATES

The work includes a number of stages. These stages, which are inter-related with, and essential to, the completion of the Signalling & Train Control systems, are to be achieved by the Key Dates indicated in the Schedule of Key Dates.

If the identified stage is not achieved by the stated Key Date, liquidated damages may become applicable as set out in the Contract.

1.1 STAGE 1 – Key Date 1 (KD1): Preliminary Design Submission

Achievement: Submission to the Employer's Engineer of the Preliminary Design as specified in paragraph 6.10.1 (2) of Particular Specifications.

1.2 STAGE 2 – Key Date 2 (KD2): Final Design Submission

Achievement: Submission to the Employer's Engineer of the Final Design as specified in paragraph 6.10.1 (3) of Particular Specifications.

1.3 STAGE 3 – Key Date 3 (KD3): Obtain “No Objection”/ “No Objection Subject to Comments” from Employer's Engineer on Final Design Submission

Achievement: Obtain “No Objection”/ “No Objection Subject to Comments” from Employer's Engineer on Final Design Submission as detailed above.

1.4 STAGE 4 – Key Date 4 (KD4): Delivery of Train Control & Signalling System/equipments at Contractor's premises in Jaipur.

Achievement: Delivery of Interlocking, Trackside ATP, Track Circuit, Point Machines, Cables, Signals etc. at Jaipur.

1.5 STAGE 5 – Key Date 5 (KD5): Completion of SAT & ITC including ATO

Achievement: This Key Date relates to the following:

Completion of System Acceptance Test (SAT) and Integrated Testing & Commissioning (ITC) including ATO.

1.6 STAGE 6 - Key Date 6 (KD6): Submission of Safety Certificate

Submission of safety case along with ISA Assessment Report for revenue service

1.7 STAGE 7 - Key Date 7 (KD7): Revenue Operation

Taking Over of the section by the Employer for running Revenue Services.

Delivery of As-Built Drawings & Documents.

1.8 STAGE 8 – Key Date 8 (KD8): Completion of Contract

Achievement: This Key Date relates to the following:

Completion of all Contract responsibilities including:

Satisfaction of the Defects Liability period requirements;

Issue of a Performance Certificate in accordance with SCC, and

Completion of the period of Supervision of Maintenance

2 ACCESS DATES

The JS02-Phase-1B Contractor shall require access to information as well as to various locations at stations/ guide-ways, etc., in stages, in order to plan his activities for time-bound completion of his obligations under the Contract. The dates on which such access becomes available are indicated in the schedule of Access Dates.

The Contractor shall develop his Work Plan based on these Access Dates. If, in the course of construction, the achievement of these access points must be shifted in time, to be either earlier or later, such adjustments shall be notified to the Contractor for modification of the Work Plan. If such readjustment cannot be accommodated without changes to the Key Dates and/or the level of effort, then the Contractor shall notify the Employer's Engineer of such conditions for resolution under the terms of the Contract.

JS02-Phase-1B contractor shall give all inputs required for meeting the Access Dates defined hereunder to other Designated Contractors in a timely manner to match the programme schedule of the designated contractor. In any case, all these inputs must have been given by JS02-Phase-1B contractor and agreed jointly between the designated contractors at least 16 weeks before the stated access date.

The Access Dates are defined as hereunder, which are for planning purposes only:

2.1 **STAGE 1 – Access Date 1 (AD1): Access to Equipment rooms at stations**

2.1.1 By this date, the JS02-Phase-1B Contractor will have access to the Signalling Equipment Rooms for JS02-Phase-1B use. Prior to such access, civil and electrical works specified below will have been completed:

Wall finishes, false floor and doors/ windows

Cable support structures from main cable guide-ways along the track to the above room for optical fibre cables/ power cables

Concealed conduits within the equipment room.

Installation (not commissioning) of electrical lighting fixtures and smoke detectors

2.2 **STAGE 2 – Access Date 2 (AD2): Access to Cable Ducts/ Hangers/ Trays along the Tunnel**

2.2.1 By this date, the JS02-Phase-1B Contractor will have general access to cable ducts/ hangers along the tunnel for JS02-Phase-1B use pertaining to laying of optical fibre cables/ main cables along the tunnel.

2.3 **STAGE 3 –Access Date 3 (AD3): Shared Access to Track**

2.3.1 By this date, the JS02-Phase-1B Contractor will have general shared access to track for JS02-Phase-1B use pertaining to installation of train control equipment on rails and along the guide-way.

2.4 **STAGE 4 – Access Date 4 (AD4): Access to Permanent Power & OHE**

2.4.1 By this date, the provision of permanent power and OHE will have been completed.

3 SCHEDULE OF KEY DATES

Key Date	Description	Choti Chaupar- Badi Chaupar Section
KD1	Submission of Preliminary Design Document	Within 10 weeks from LOA
KD2	Submission of Final Design Document	Within 20 weeks from LOA
KD3	Obtain Consent of Employer's Engineer on Final Design submission	40 weeks prior to KD7
KD4	Delivery of Train Control & Signalling system / equipments at Contractor's premises in Jaipur	34 weeks prior to KD7
KD5	Completion of System Acceptance Test (SAT) & Integrating System Testing including ATO.	8 weeks prior to KD7
KD6	Submission of Safety Certificate	4 weeks prior to KD7
KD7	Revenue operation	31/03/2018
KD8	Completion of Contract	31/03/2020

4 SCHEDULE OF ACCESS DATES

AD No.	Access Date	Line (Phase-1B)
AD1	Access to Equipment Rooms.	
AD2	Access to Cable Ducts/ Hangers/ Trays along the Viaduct	
AD3	Shared Access to Track	
AD4	Access to Permanent Power & OHE	

*End of Appendix V

APPENDIX W – ANNUAL MAINTENANCE CONTRACT (AMC) FOR TRAIN CONTROL & SIGNALLING SYSTEM

1. Terms & Conditions of AMC work

- 1.1 Contractor shall quote the price for comprehensive Annual Maintenance Contract for two years beyond the Defect Liability Period in Schedule 6(b), Section 4 of Bidding Documents, which shall not be considered for the evaluation of the bid. However, the Employer reserves the right to enter into AMC for any or all subsystems.
- 1.2 During AMC, contractor shall store sufficient number of spares to meet with any failure for which no extra payment will be made. In addition to AMC plan, the contractor has to also submit the comprehensive list of spares, consumables, tools, schedules etc required for maintaining the systems during AMC period to Employer for review and approval. This activity shall be completed three months prior to completion of DLP period.
- 1.3 List of the staff proposed to be deployed for the AMC shall be submitted along with their CVs to the Employer's Representative for review and approval. The approved list of the staff responsible for attending the failure shall be displayed at OCC and these two underground stations of Phase 1B with their address and contact numbers.
- 1.4 The scope of maintenance activities shall include supervision of scheduled and unscheduled maintenance, as and when required by employer, including all routine inspections and service overhauls as may be required for the Train Control & Signalling System. Providing breakdown services & to attend complaints as and when they occur in the systems.
- 1.5 Contractor shall maintain a round the clock centralized location where all the failures shall be reported including on Holidays/ Sundays. A complaint number shall be given as soon as the failure is reported.
- 1.6 The Contractor shall attend all the failures reported by the Employer or his representative. In case a failure cannot be attended at site, the Contractor shall arrange to remove the equipment from site and restore later upon rectification of the failure. In the meanwhile, the Contractor shall arrange, free of cost, temporary replacement before removing the defective equipment

- 1.7 The Contractor shall replace, free of cost, the components which may be necessary as a result of removal of the wear and tear during the period of contract. This will be responsibility of the contractor to ensure that all the required spares, consumables are available every time.
- 1.8 The Contractor's Engineer shall check all the system once a month for its perfect working and record the observations in the log book maintained by the Employer with his signature in addition to day to day attending of faults when reported by Employer's Representative.
- 1.9 Penalties shall be levied in case failures are not attended in stipulated time as specified below. Penalty shall be deducted from AMC Charges.

S.No.	Description	Penalty
1.	For attending and rectification of failures (time to be taken from time of information given through email, SMS, Phone etc)	
a)	Beyond MTTR (Mean Time to Restore) upto 1 day	No financial penalty, however excess time taken will be cumulatively added to cater extension, if any, of AMC as given at Sr no. 3 below.
b)	Within 1 day to 5 days	Rs. 500/- per day
c)	After 5 days	Rs. 1000/- per day
2.	If any required manpower is not available	Rs. 500/- per person per day
3.	Extension of AMC period	50% of excess time taken in attending and restoration calculated by adding time in 1(a),(b),(c) & 2 above
4.	Maximum Penalty	5% of AMC Value

Penalty rates for non-compliances during AMC including non availability of necessary spares may be suggested by JMRC.

- 1.10 Any failures/defects observed in the system during the currency of the AMC shall have to be rectified by the contractor before the completion certificate for AMC is issued

2. Hardware Failure Reports

- 2.1 For hardware failure that occurs, the Contractor shall investigate the failure and prepare a report on its cause(s).The report shall clearly show:

- (1) The observed symptoms;
- (2) The most likely cause of the failure;

- 2.2 All such reports will be retained as part of the permanent quality assurance record for the system, which shall be subject to inspection by the Employer's Representative.

3. Software Failure Reports

- 3.1 For each software failure that occurs, the Contractor shall generate a software failure report.
- 3.2 All such reports will be retained as part of the permanent quality assurance record for the system, which shall be subject to inspection by the Employer's Representative.
- 3.3 The report shall clearly show:
- (1) The observed symptoms;
 - (2) The likely cause;
 - (3) The operator input.
- 3.4 The report shall also clearly show the following information which shall be entered when the failure has been investigated:
- (1) The actual cause of the failure;
 - (2) The corrective action taken; and
 - (3) All software modules affected.
4. Man Power need to be deployed as per the requirement of work fronts as made available. Key managers need to be mobilized within one month from the date of issue of LOA.
5. The work of AMC beyond DLP shall be awarded by JMRC if so desires through a supplementary contract, however the contractor shall be bound to execute the same.
6. The prices for AMC shall be inclusive of service tax and other duties, transportation charges, Insurance etc. Bidders need to submit the performance guarantee for an amount of 10% of supplementary contract value at the time of signing of supplementary agreement.
7. JMRC/O&S shall provide following services to contractor during AMC:-
- a. Arranging & providing work permits, power blocks etc. if any needed for restricted zones. Provision of system access for components/ equipment located in restricted area etc.
 - b. Provision of Photo Gate Passes to Contractor's staff.
 - c. Any type of work pertaining to civil, electrical, RS,false ceiling, house keeping, safety, watch & ward, insurance etc.
 - d. Provision of lockable space inside station for contractor's service staff & storage space for spares, consumables & equipment.
 - e. Operation of the system
 - f. Any other requirement for proper execution of AMC.



JAIPUR METRO RAIL CORPORATION LIMITED

SAFETY, HEALTH AND ENVIRONMENT (SHE) MANUAL

CONDITIONS OF CONTRACT ON
SAFETY, HEALTH AND ENVIRONMENT
(NOVEMBER 2013)





Safety, Health and Environment (SHE) Manual

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PART – I : SHE MANAGEMENT



1.0 General

1.1 Scope

- 1.1.1 This document defines the principal requirements of the Employer on Safety, Health and Environment (SHE) associated with the contractor / sub-contractor and any other agency to be practiced at construction worksites at all time.

1.2 Definition / languages

1.2.1 In this document

- i) The use of 'shall' indicates a mandatory requirement.
- ii) The use of 'should' indicates a guideline that is strongly recommended.
- iii) The use of 'may' indicates a guideline that is to be considered.
- iv) 'SHE' means Safety, Health and Environment.
- v) **"Employer"** means JAIPUR METRO RAIL CORPORATION LIMITED (JMRC), its legal successors and assignees
- vi) **"Designer"** means the Contractor, or part of the group forming the contractor, person, firm or company or group of companies, or any replacement, carrying out the Design of Works or part thereof.
- vii) Chief Safety Officer means an officer nominated by JMRC who is overall responsible for monitoring all SHE functions prescribed in this document.
- viii) BOCWA means Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996
- ix) BOCWR means Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998
- x) RBOCWR means Rajasthan Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2009
- xi) CIIBC means Chief Inspector of Inspection of Building and Other Construction as appointed by Govt. of Rajasthan.

1.3 Application of this document

- 1.3.1 This document applies to all aspects of the contractor's scope of work, including all aspects conducted by sub-contractors and all other agencies. There shall be no activity associated to the contract, which is exempted from the purview of this document.

1.4 Purpose of this document

- 1.4.1 The objective of these guidelines is to ensure that adequate precautions are taken to avoid accidents, occupational illness and harmful effects on the environment during construction.

1.4.2 This document:

- i) Describes the SHE interfaces between Employer and the Contractor.
- ii) Details the processes by which the contractor shall manage SHE issues while carrying out the work under the contract.
- iii) Describes by reference, the practices and procedures as given in the JMRC Project Safety, Health & Environment manual for best SHE performance.



- 1.4.3 These requirements shall be read together with JMRC Project SHE Manual, OHSAS 18001-1999, Occupational Health and Safety Management System and ISO 14001: 2004 Environmental Management Systems. Definition of key terms used in these requirements related to OHSAS 18001 and ISO 14001 standard are found in JMRC's Project SHE Manual.

2.0 'SHE' Targets and Goals

- 2.1 The SHE targets, goals and aim for the Works are to achieve:
- i) Zero total recordable injuries.
 - ii) Zero reportable environmental incidents
 - iii) All personnel inducted in accordance with the approved contractor SHE plan
 - iv) Total compliance of conducting inspections and audits as per approved SHE plan
 - v) 100% incident recording and reporting
 - vi) 100% adherence of usage of appropriate PPEs at work.
 - vii) Executing construction work with least disturbance to the environment, adjoining road users and traffic.

3.0 Compliance

3.1 Memorandum of Understanding (MOU)

- 3.1.1 A Memorandum of Understanding placed at **Appendix No.: 1** shall be executed before the award of contract by the contractor with regard to various provisions on Safety, Health and Environment to be practiced during the construction work.

3.2 JMRC's SHE Policy and Management Systems

- 3.2.1 The construction works shall be undertaken in accordance with JMRC's SHE Policy and Management Systems as amended from time to time provided in Project SHE Manual.

3.3 Indian statutory requirements

3.3.1 Primary statutory regulations

- 3.3.1.1 **Contractor shall develop thorough understanding about Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996, Central Rules 1998, Rajasthan BOCW Rules 2009, Building and Other Construction Workers' Welfare Cess Act, 1996 and Central Rules, 1998 and Rajasthan Building Construction Workers' Welfare Board Rules, not only to satisfy the Inspectors' perspective but the use of legislation as the strong tool for effective SHE management at construction worksites. Contractor is strongly advised to practice the principle of voluntary compliance.**

- 3.3.1.2 In order to facilitate the contractor for better understanding on the various provisions of the above Act and Rajasthan Govt. Rules, a tabulated information highlighting the Sections/Rules referring to the corresponding registration of contractors, maintenance of registers and records, hours of work and wages, welfare, medical facilities and safety requirements are given in **Appendix No.: 2**. It is an indicative one and not a limiting list.



3.3.2 In addition, the construction works shall be undertaken in accordance with all applicable legislation including amendment made hereunder and Indian statutory requirements listed below but not limiting to:

- i) The Metro Railways (Construction of Works) Act 1978 and rules made thereunder
- ii) The Metro Railways (Operation and Maintenance) Act 2002 and rules made thereunder
- iii) The Electricity Act 2003 and The Indian Electricity Rules 1956
- iv) National Building Code, 2005
- v) The Factories Act, 1948, Rajasthan Factories Rules 1951.
- vi) Motor Vehicles Act as amended in 1994 and The Central Motor Vehicles Rules, 1989.
- vii) Indian Road Congress Code IRC: SP: 55-2001 'Guidelines on Safety In Road Construction Zones.
- viii) The Petroleum Act, 1934 and Rules 2002
- ix) Gas Cylinder Rules, 2004
- x) Indian Explosives Act. 1884, along with the Explosives substance Act 1908 and the Explosives Rules 1983
- xi) The (Indian) Boilers Act, 1923, Rajasthan Boiler Rules, 1954
- xii) The Public Liability Insurance Act 1991 and Rules 1991
- xiii) Minimum Wages Act, 1948 and Rules 1950
- xiv) Contract Labour Act, 1970 and Rules 1971
- xv) Child Labour (Prohibitions & Regulations) Act, 1986 and Rules 1988
- xvi) Environment Protection Act, 1986 and Rules 1986
- xvii) Air (Prevention and control of Pollution) Act, 1981 and Rules 1982
- xviii) Water (Prevention and Control of Pollution) Act, 1974 and Rules 1975
- xix) The Noise Pollution (Regulation & Control) Rules, 2000
- xx) Notification on Control of Noise from Diesel Generator (DG) sets, 2002
- xxi) Recycled Plastic Usage Rules, 1998
- xxii) Notification, Central Ground Water Board, Act January 1997
- xxiii) Manufacture, Storage & Import of Hazardous Chemicals Rules, 1989
- xxiv) The Hazardous Waste (Management & Handling) Rules, 1989
- xxv) Hazardous Waste Management Rules 1989 (amended 1999)
- xxvi) The Bonded Labour System (Abolition) Act, 1976 and Rules 1976
- xxvii) Batteries (Management and Handling) Rules, 2012
- xxviii) Fly ash utilization notification, Sept 1999 as amended in August 2003

3.3.3 The Employee's Compensation Act, 1923 along with allied Rules

3.3.3.1 The contractor shall ensure that all his employees / workmen are covered under 'Employee Compensation Act' and shall pay compensation to his workmen as and when the eventuality for the same arises.

3.3.4 Notwithstanding the above Act/Rules, there is nothing in those to exempt the contractor from the purview of any other Act or Rule in Republic of India for the safety of men and materials.

3.3.5 If the requirements stated in this document are less stringent than or in conflict with the country's applicable legislation, the latter shall apply.



- 3.4 International Standards, Guidelines & ISO Certifications
- 3.4.1 The works should be undertaken in accordance with the applicable international guidelines, standards and specifications on SHE and every contract shall aim to achieve ISO certifications listed below during the currency of the contract:
- OHSAS 18001-1999 : Occupational Health and Safety Management System.
ISO 14001-2004 : Environmental Management Systems.
- 3.4.2 The process of certification shall start immediately after the award of the work and complete within reasonable time. Towards this, the contractor shall undertake the required steps including appointment of ISO consultant for obtaining the certification on Occupational Health and Safety Management System and Environment Management System.
- 3.4.3 **In case of failure on the part of the contractor, the Employer at the cost of the contractor shall do the same.**
- 4.0 Contractor SHE Policy and Plan**
- 4.1 The contractor as per Section 39 of the BOCW Act shall formulate a SHE policy and get it approved by DG/CIIBC respectively and display it at conspicuous places at work sites in Hindi and a local language understood by the majority of construction workers.
- 4.2 Within 4 weeks of the notification of acceptance of the tender, the Contractor shall submit a detailed and comprehensive Contract specific SHE Plan. The SHE Plan shall include detailed policies, procedures and regulations which, when implemented, will ensure compliance of the contract provisions. The SHE Plan shall include the following but not be restricted to:
- i) A statement of the Contractor's policy, organisation and arrangements for SHE
 - ii) The name(s) and experience of person(s) within the Contractor's proposed management who shall be responsible for co-ordinating and monitoring the Contractor's SHE performance;
 - iii) The number of SHE staff who shall be employed on the Works, their responsibilities, authority and line of communication with the proposed Contractor's agent;
 - iv) A statement of the Contractor's policy and procedures for identifying and estimating hazards, and the measures for addressing the same;
 - v) A list of SHE hazards anticipated for this Contract and sufficient information to demonstrate the Contractor's proposals for achieving effective and efficient health and safety procedures;
 - vi) A description of the SHE training courses and emergency drills which shall be provided by the Contractor, with an outline of the syllabus to be followed;
 - vii) Details of the safety equipment which shall be provided by the Contractor, including personal protective equipment;
 - viii) A statement of the Contractor's policy and procedures for ensuring that Contractor's Equipment used on the Project Site are maintained in a safe condition and are operated in a safe manner;
 - ix) A statement of the Contractor's policy and procedures for ensuring that sub-contractors comply with the Contractor's safety plan;
 - x) A statement of the Contractor's disciplinary procedures with respect to SHE related matters, and



- xi) A statement of the Contractor's procedure for reporting and investigating accidents, dangerous occurrences or occupational illnesses
- 4.3 The Contractor shall, from time to time and as necessary are required by the Employer to produce supplements to the SHE Plan such that it is at all times a detailed, comprehensive and contemporaneous statement by the Contractor of his site safety, industrial health and environment obligations, responsibilities, policies and procedures relating to work on Site. Any and all submissions of supplements to the SHE Plan shall be made to the Employer in accordance with the agreed procedures.
- 4.4 If at any time the SHE plan is, in the Employer's opinion, insufficient or requires revision or modification to ensure the security of the Works and the safety of all workmen upon and visitors to the Site, the Employer may instruct the Contractor to revise the SHE plan and the Contractor shall within 7 days submit the revised plan to the Employer for review.
- 4.5 Any omissions, inconsistencies and errors in the SHE Plan or the Employer's acceptance or rejection of the SHE Plan and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to site safety, industrial health and environment and shall not excuse any failure by the contractor to adopt proper and recognised safety practices throughout the execution of the Work.
- 4.6 The Contractor shall adhere to the SHE Plan and shall ensure, as far as practically possible, that all sub-contractors of all tiers require that contracting parties each have a copy of the Site SHE Plan and comply with its provisions.
- 4.7 The details of contents to be covered in the site SHE plan are given in **Appendix No.: 3**

5.0 Designer's role

5.0 Designer's role in Safety, Health and Environment

- 5.1 Designer's primary role includes to minimise the risk to health and safety of those who are going to construct, maintain, clean, repair, dismantle or demolish the structures and any one else like adjoining road users/general public, who might be affected by the work.
- 5.2 General philosophy
 - 5.2.1 When considering health and safety in designer's work, they shall be expected to do what is reasonable at the time the design is prepared. It may be possible for hazards, which cannot be addressed at the feasibility stage to be looked at during detailed design. In deciding what is reasonably practicable, the risk to health and safety produced by a feature of the design has to be weighed against the cost of excluding the feature. The overall design process does not need to be dominated by a concern to avoid all risks during the construction phase and maintenance. However, a judgement has to be made by weighing up one consideration against another so the cost is counted not just in financial terms, but also those of fitness for purpose, aesthetics, buildability or environmental impact. By applying these principles, it may be possible to make decisions at the design stage, which will avoid or reduce risks during construction work. In many cases, the large number of design considerations will allow a number of equally valid design solutions. What is important is the approach to the solutions of design problems. This should involve a proper exercise of judgement, which takes account of health and safety issues.
- 5.3 Hierarchy of Risk Control



- 5.3.1 Designers shall need, so far as reasonably practicable, to avoid or reduce risks by applying a series of steps known as the hierarchy of risk control or principles of prevention and protection. The steps to be adopted shall include the following:
- i) consider if the hazard can be prevented from arising so that the risk can be avoided (eg, alter the design to avoid the risk);
 - ii) if this cannot be achieved, the risk should be combated at source (eg, ensure the design details of items to be lifted include attachment points for lifting);
 - iii) failing this, priority should be given to measures to control the risk that will protect all people;
 - iv) only as a last resort should measures to control risk by means of personal protection be assumed (eg, use of safety harnesses).

5.4 Duty to provide health and safety risks in the drawing itself

- 5.4.1 In case of situations where the designers have carried out the design work and concluded that there are risks, which was not reasonably practicable to avoid, detailed information shall be given about the health and safety risks, which remain. This information needs to be included with the design to alert others to the risks, which they cannot reasonably be expected to know. This is essential for the parties who have to use the design information.

- 5.4.2 If the designers' basic design assumptions affect health or safety, or health and safety risks are not obvious from the standard design document, the designer shall provide additional information. The information shall include a broad indication of the assumptions about the precautions for dealing with the risks. The information will need to be conveyed in a clear manner; it shall be included on drawings, in written specifications or outline method statements. The level of detail to be recorded will be determined by the nature of the hazards involved and the associated level of risk.

5.5 Employer's approval

- 5.5.1 Every structure like scaffold, false work, launching girder, earth retaining structures etc. shall have its design calculations included in the method statements in addition to health and safety risks. Employers' designer or his approved proof check consultants as applicable as per the contract conditions shall approve all these designs.

- 5.6 Any non-standard structures like trestles made up of re-bars or structures which are very old, corroded, repaired for many times etc. for which no design calculations can be made accurately from any national standards, shall not be allowed to be used at sites even for short duration.

- 5.7 If any of the above mentioned clauses are not adhered to, penalty shall be imposed depending upon the gravity of the unsafe act and/or condition.

6.0 Contractor SHE Organisation

6.1 Education and Experience

- 6.1.1 The contractor shall appoint the required SHE personnel as prescribed in General Instruction **JMRC/SHE/GI/001** (enclosed at the end) based upon the statutory requirement and establish the safety organisation based upon the contract value. The minimum educational qualification and the work experience are given in General Instruction **JMRC/SHE/GI/002**.



- 6.1.2 **In order to effectively interact on labour welfare matters with the Employer and the statutory authorities enforcing the labour welfare legislations every contractor shall employ a full time Labour Welfare Officer duly qualified and experienced as per Clause 6.1.1.**
- 6.2 Conduct and competency
 - 6.2.1 The conduct and functioning of the contractor SHE personnel shall be monitored by the Employer. Any default or deficiency shall attract penalty as per details given under penalty clause 56.0 of this document.
 - 6.2.2 The Contractor shall ensure that all personnel are competent to perform the job assigned to them. In the event that the Contractor is unable to demonstrate the competency of any person whose activities can directly impact on the Works' SHE performance, the Employer shall remove that person from the site without any procedural formalities.
- 6.3 Approval from Employer
 - 6.3.1 The name, address, educational qualification, work experience and health condition of each personnel deployed for SHE jobs shall be submitted to the Employer in the format prescribed for the purpose for comments and approval well before the start of the work. Only on approval by the Employer these personnel are authorised to work. In case any of the SHE personnel leaves the contractor the same shall be intimated to the Employer. The contractor shall recruit new personnel and fill up the vacancy.
- 6.4 **Responsibility of SHE personnel**
 - 6.4.1 **For all works carried out by the contractor and his sub-contractors, the responsibility of ensuring the required SHE manpower lies with the main contractor only. The minimum required manpower indicated by the Employer includes the sub-contractors' work also. It shall be the responsibility of the main contractor to provide required SHE manpower for all the works executed by all contractors. Necessary conditions shall be included in all sub-contract documents executed by the main contractor.**
- 6.5 Employment status of SHE personnel
 - 6.5.1 No contractor shall engage SHE manpower from any outsourcing agencies in which case the effectiveness would be lost. All SHE manpower shall be on the payroll of the main contractor only and not on the payroll of any subcontractor or outsourcing manpower agencies etc. This condition does not apply to positions like traffic marshals who are engaged almost on a daily requirement basis.
- 6.6 Reporting of SHE personnel
 - 6.6.1 All SHE personnel are to report to the Chief SHE Manager who shall report directly to the Chief Project Manager. The Employer shall monitor adherence to this procedure at all times. In case of non-adherence penalty shall be levied as indicated in the penalty clause.
- 6.7 **Inadequate SHE personnel**



- 6.7.1 In case if the contractor fail to provide the minimum required manpower as illustrated in General Instruction JMRC/SHE/GI/001, or fail to fill up vacancies created within 14 days, the same shall be provided by the Employer at contractor's cost. Any administrative expenses involved to provide the same like paper advertisement or manpower consultant charges, etc shall also be at the cost of contractor.
- 6.8 Prohibition of performance of other duties
- 6.8.1 As per Schedule VI of RBOCWR no SHE personnel shall be required or permitted to do any work which is unconnected to, inconsistent with or detrimental to the performance of the SHE duties for respective category mentioned in General Information JMRC/SHE/GI/001
- 6.9 Facilities to be provided to SHE personnel
- 6.9.1 As per schedule VIII of BOCWR, the contractor shall provide all SHE personnel with such facilities, equipment and information that are necessary to enable him to dispatch his duties effectively.
- 6.9.2 The minimum Employer's requirements of such facilities / equipments to be provided for SHE personnel are given in the General Instruction JMRC/SHE/GI/003.
- 7.0 Contractor SHE Committee**
- 7.1 All employees should be able to participate in the making and monitoring of arrangements for safety, industrial health and environment at their place of work. The establishment of site SHE committees in which employees and Contractor and sub-contractor management are represented can increase the involvement and commitment of employees. The contractor shall ensure the formation and monitor the functioning of contractor SHE committees.
- 7.2 Terms of Reference
- 7.2.1 The Terms of Reference for the committee shall be as follows;
- i) To establish company safety policies and practices
 - ii) To monitor the adequacy of the contractor's site SHE plan and ensure its implementation
 - iii) To review SHE training
 - iv) To review the contractor's monthly SHE report.
 - v) To identify probable causes of accident and unsafe practices in building or other construction work and to suggest remedial measures.
 - vi) To stimulate interest of Employer and building workers in safety by organizing safety week, safety competition, talks and film-shows on safety, preparing posters or taking similar other measures as and when required or as necessary.
 - vii) To go round the construction site with a view to check unsafe practices and detect unsafe conditions and to recommend remedial measures for their rectifications including first-aid medical and welfare facilities.
 - viii) Committee team members should perform a site inspection before every committee meetings and to monitor SHE inspection reports.
 - ix) To bring to the notice of the Employer the hazards associated with use, handling and maintenance of the equipment used during the course of building and other construction work



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- x) To suggest measures for improving welfare amenities in the construction site and other miscellaneous aspect of safety, health and welfare in building or other construction work.
- xi) To look into the health hazards associated with handling different types of explosives, chemicals and other construction materials and to suggest remedial measures including personal protective equipment.
- xii) To review the last safety committee meeting minutes and to take action against persons/sub-contractors for non-compliance if any.

7.3 Within 14 days of award of contract, the SHE committee shall be constituted and notification regarding the same shall be communicated to the members and employees as per the format provided in **Form No.: SF 001**

7.4 Site SHE Committee meeting shall be conducted at least once in a **month** with the minimum members listed below:

Chairman	Project Manager
Secretary	SHE Manager (In-charge)
Members	<ul style="list-style-type: none">i) Labour Welfare Officerii) In charge of plant and machineryiii) In charge of site electricsiv) In charge of stores.v) Senior Managers/ Engineers heading different sub functions.vi) Sub – contractor's representativevii) Labour Contractor's representativeviii) Workers' representativeix) Co-contractor representative.x) SHE staffs
Employer's Representatives	JMRC SHE in charge and other representatives

7.5 Construction SHE Committee meeting shall be conducted at least once in a **week** with the minimum members listed below:

Chairman	Project Manager
Secretary	SHE Manager (In-charge)
Members	<ul style="list-style-type: none">i) Labour Welfare Officerii) In charge of plant and machineryiii) In-charge of site electricsiv) Senior Managers / Engineers heading different sub functionsv) Sub- Contractor's representativevi) Labour contractor's representativevii) Workers' representativesviii) All SHE Staffs



- 7.6 Co-contractors' participation
- 7.6.1 In case of depot, station and other contiguous areas where more than one main contractors are working together, the Employer shall instruct the other contractors to join for the monthly SHE committee meeting of the main civil contractor, so as to discuss and decide about the common provision of security, lighting, toilet, drinking water etc. and sharing the maintenance cost of the same etc.
- 7.6.2 **The general principle for sharing the cost shall be either based on the contract value of works executed at the contiguous area or the daily average number of workmen employed by each contractor in the contiguous area.**
- 7.7 Minimum time between two monthly SHE Committee meetings
- 7.7.1 A minimum period of **21 days** shall be maintained between any two SHE monthly committee meetings.
- 7.8 **Agenda**
- 7.8.1 The Secretary shall circulate the agenda of the meeting at least seven working days in advance of the scheduled date of the meeting to all members.
- 7.8.2 The agenda should broadly cover the following:
- i) Confirmation of minutes
 - ii) Chairman's review/overview of site SHE performance / condition
 - iii) Previous month SHE statistics
 - iv) Incident and Accident Investigation / dangerous occurrence / near miss report
 - v) Site SHE inspection
 - vi) Sub-contractors' SHE issues
 - vii) Safety presentation by Members
 - viii) Report from Employer
 - ix) Matters arising
 - x) Any other business
- 7.9 Minutes of the meeting
- 7.9.1 The Minutes of the meeting shall be prepared as per the format provided at **Form No.: SF-002** and sent to all members within 2 working days preferably by mail/fax followed by hardcopy. Safety Committee meeting minutes shall also be displayed in the notice board for wider publicity to all concerned.
- 7.10 **Disciplinary Action**
- 7.10.1 The chairman shall inform the members of any outstanding issues in the meeting and in case of repeated offence/ non-compliance by some members or other co/sub contractors and propose suitable disciplinary action including provisions of monetary penalty as per the relevant contract clauses, the Employer shall ensure that the same is implemented.



8.0 ID Card and First day at work, SHE orientation training

- 8.1 The Contractor shall ensure that all personnel working at the site receive an induction SHE training explaining the nature of the work, the hazards that may be encountered during the site work and the particular hazards attached to their own function within the operation. The training shall cover the contents as given in the General Instruction **JMRC/SHE/GI/004.**
- 8.2 **All personnel shall be issued a photo identity card of size 85mm x 55mm duly signed by the authorized representative of the contractor before they are engaged for any work as per the format given in the General Instruction **JMRC/SHE/GI/005.****
- 8.3 Contractor shall also issue a personnel SHE handbook in a language known to the workers, which provides information on SHE and emergency procedures that all personnel working on contract are required to know and the need to follow. Contractor shall ensure that this is distributed and its content introduced to all personnel working at the site.

9.0 SHE Training

- 9.1 The behaviour of people at all levels of the contractor is critical for SHE performance.
- 9.2 The contractor shall organise quality SHE training to engage Managers, supervisors and other personnel in behavioural change and improve safety performance.
- 9.3 The Contractor shall analyse the training requirements for all the employees and initiate a training program to demonstrate that all persons employed, including subcontractors, are suitably qualified, competent and fit. This will include:
- i) Detailed Job descriptions for all personnel, to include their specific SHE responsibilities
 - ii) Specification of qualifications, competency and training requirements for all personnel
 - iii) Assessment and recording of training needs for all personnel, including subcontractors' employees in the workforce, vendor representatives and site visitors
 - iv) A system for assessing new hirers e.g. previous training
 - v) A means of confirming that the system is effective
 - vi) A matrix and schedule of training requirements, covering general, task-specific and SHE-related training, showing the training frequency and interval between refresher courses
 - vii) Timely, competent delivery of training courses
- 9.4 The contractor shall arrange behavioural-based training programmes for all the executives to identify, recognise and eliminate unsafe act and unsafe conditions.
- 9.5 The minimum Employer's requirement of training needs for various categories of employees are given in general instruction **JMRC/SHE/GI/006**
- 9.6 The contents of SHE training to Managers/Supervisors as given in general instruction **JMRC/SHE/GI/007** shall be conducted.
- 9.7 **The refresher-training programme to all employees shall be conducted once in six months.**



- 9.8 **Toolbox talk as given in the Employer's Project SHE manual shall be conducted to all high-risk workmen everyday.**
- 9.9 **On-the spot practical skill development training on height safety including scaffold safety, crane safety, welding safety, electrical safety, traffic safety for marshals shall also be conducted to all foremen/ workmen who were associated to the concerned jobs.**
- 9.10 **Daily Safety Oath as given in Project SHE manual shall be taken by every employee including workman without fail.**
- 9.11 **All vehicle drivers including Hydra operators shall be trained on defensive driving at any Government authorized Institute or Maruti Institute of Driver Training and Research at Wazirabad Road, Adjoining Loni Road Flyover, Delhi-110094. All vehicle drivers shall also undergo refresher training on defensive driving provided by the same institute once in 6 months.**
- 9.12 All the above listed training programmes except at Clause **9.11** shall be organised by the contractor only after taking approval from the Employer for the training faculty / organisation, content and durations.
- 9.13 **In case of failure on the part of the contractor to provide all the above-mentioned training programs to all employees in time, the same shall be provided by the Employer through accredited agencies if required by formulating a common scheme to all contractors. Any administrative expenses and training fee towards the same shall be at the cost of the contractor.**
- 10.0 SHE Inspection**
- 10.1 The contractor shall evolve and administer a system of conducting SHE inspections and other risk management analysis on a periodical basis.
- 10.2 The purpose of SHE inspection is to identify any variation in construction activities and operations, machineries, plant and equipment and processes against the SHE Plan and its supplementary procedures and programs.
- 10.3 Following SHE inspections program shall be adopted.
- i) Planned General Inspection
 - ii) Routine Inspection
 - iii) Specific Inspection
 - iv) Other Inspection
- 10.3.1 **Planned General Inspection**
- 10.3.1.1 **Planned general inspections are performed at predetermined intervals and it usually involves the representation from both Contractor and the Employer.**
- 10.3.1.2 **Inspections that will be classified under this inspection program are:**
- i) Monthly contractor and subcontractors site safety committee Inspection.
 - ii) Weekly safety inspection by construction supervisors (Contractors and Sub-contractors).



- iii) Daily safety inspection by contractor site SHE team.

10.3.2 Routine Inspection

- 10.3.2.1 Routine inspections are often referring to the inspection of work site, equipment and temporary structures performed by site and equipment operators and temporary structure erectors.

Inspections that will be classified under this inspection program are:

- i) Daily Inspection of plant and equipment by operator
- ii) Weekly Inspection of scaffold by scaffolding supervisor
- iii) Monthly Inspection of electrical hand tools by competent electrical supervisor
- iv) Quarterly Inspection of temporary electrical systems by competent electrical supervisor
- v) Half-yearly inspection of lifting machinery, lifting appliances, equipment and gears by Govt. approved competent person.

- 10.3.2.2 The list mentioned above is not exhaustive. Contractor may add additional categories. Contractors' Site SHE Manager will ensure that a system of routine inspections are carried out periodically to all plants, equipment, powered tools and any other temporary structures that will pose a hazard to operators and workmen.

10.3.3 Specific Inspection

- 10.3.3.1 Specific inspections are performed on activities without a predetermined date. Competent supervisors usually perform inspections for ensuring an activity whether it is executed in accordance to a general set of rules; method statement submitted or developed procedures.

The following are examples that will be commonly performed as required on the construction site:

- i) Inspection performed before a heavy lifting operation.
- ii) Inspection performed before and after the entry of person into a confined space.
- iii) Inspection performed before and after a welding and gas cutting operation.
- iv) Inspection of formwork before concreting by formwork erector.

The list mentioned above is not exhaustive. The contractor shall ensure that a competent supervisor inspects all high-risk processes and activities.

10.3.4 Other Inspection

Other inspections includes the following:

- i) Mandatory Inspections by Labour Department of Government.
- ii) JMRC site SHE management team

- 10.3.5 The contractor shall prepare all required safety inspection checklist for all activity operations and equipment. Checklists will be prepared based on the Indian standards, rules and regulations and Employer's requirements. The formats provided in the Project SHE manual may be referred.

- 10.3.6 All inspection records and reports will be properly kept and filed for audit purpose. Inspection reports of Planned General Inspection and Routine Inspection will be used for discussion during Safety Committee Meetings.



11.0 SHE Audit

11.1 General

11.1.1 The purpose and scope of SHE audit is to assess potential risk, liabilities and the degree of compliance of construction Safety, Health & Environmental plan and its supplementary procedures and programs against applicable and current SHE legislation regulations and requirements of the employer.

11.1.2 Project Manager holds the ultimate responsibility in ensuring implementation of SHE audit program during the construction work.

11.2 Monthly Audit Rating Score (M A R S)

11.2.1 **Monthly Audit Rating Score (MARS) will be performed once in a month. A team consisting of Project manager and Employer representative based on the pre-designed score-rating format will conduct it. The details of the pre-designed monthly audit score rating formats are given in the Project SHE manual.**

11.2.2 This Monthly SHE Audit Rating Score (MARS) report will enable the Employer to evaluate the general compliance by the Contractor with the Conditions of Contract, the Employer's Project SHE Manual and the Contractor's site specific SHE Plan.

11.2.3 Monthly Audits will be conducted in accordance with JMRC Guidelines. The Project Manager accompanied by the Employer's representatives shall carry out the Audit. The Contractor's senior manager and SHE in-charge should also be invited to attend.

11.2.4 Timing

The Monthly Audit Rating Score (MARS) should be conducted at least 7 days prior to the scheduled date of Monthly SHE Committee meeting.

11.2.5 Evaluation

11.2.5.1 The numerical scoring has been weighed on a 1-10 scale. The audit team will use their observations noted in evaluating the points to be awarded against each of the elements of the audited section. Wherever some topics and sub-topics are not applicable the score rating need not be given. The overall audit ratings shall be achieved by:

$$\text{Overall Audit rating} = \frac{\text{Actual Score Achieved}}{\text{Maximum Possible Score}} \times 100$$

11.2.5.2 The criticality of the required actions for the respective sections of the Audit will be classified as:

Sl. No.	Score	Description	Action
1	< 60%	Immediate	Require Contractor to rectify within 24 hours and confirm in writing to Employer
2	< 75%	Improvement Necessary	Contractor rectification within 7 days and



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			confirmed in writing to Employer
3	< 90%	Improvement Desirable	Contractor rectification within one month and confirmed in writing to Employer

11.2.6 Report

A copy of each Audit Report will be sent to Employer and to all subcontractors, with whom it will then be discussed in detail at the Monthly SHE Committee Meeting in order to ensure that any corrective actions are agreed upon.

11.3 Monthly Electrical Safety Audit

11.3.1 A team comprising of contractor's senior SHE (Electrical) engineer and Employer's representative shall conduct monthly electrical safety audit covering the following and submit the report to Employer.

- i) Electrical accidents investigation findings and remedy
- ii) Adequacy of power generation and power requirements
- iii) Power distribution and transmission system in place
- iv) Updated electrical single line diagram showing the current condition of power source and distribution including the IP44 DBs arrangement.
- v) Electrical protection devices – selection, installation and maintenance.
- vi) Earth or ground connection and earth pit maintenance details
- vii) Education and training of electrical personnel undertaken
- viii) Routine electrical inspection details
- ix) Electrical maintenance system and register.
- x) Name plate details of major electrical equipment
- xi) Classified zones in the site, if any.

11.4 External SHE Audit

11.4.1 External SHE audits are to be conducted by external agencies that are competent with ISO qualified auditors with the prior approval of the Employer.

11.4.2 Areas of competence of Audit team

11.4.2.1 Practical understanding of BOCW Act and Rules, statutory requirements on health/medical and welfare of workmen, construction hazards and its prevention and control, traffic management, electrical safety, rigging, safety of construction equipment and environment management.

11.4.2.2 Audit shall be conducted as per the guidelines of ISO, ILO, and national standards. Audit report shall also be presented as per the above formats.

11.4.3 External SHE audit shall be conducted on a quarterly basis throughout the currency of the contract.

11.4.4 Targets of SHE Audit:

The contents and coverage of the external audit shall include the following items



11.4.4.1 SHE management:

- i) Organization
- ii) Communication and Motivation
- iii) Time office
- iv) Inspection
- v) Emergency preparedness
- vi) Budget allocation
- vii) Education and Training
- viii) Work permit system

11.4.4.2 Technical:

- i) Building and Structure
- ii) Construction operational safety
- iii) Material safety
- iv) Hand tools and Power tools
- v) Electrical system
- vi) Safety Appliances
- vii) Fire prevention and control
- viii) Housekeeping
- ix) Maintenance and Machinery safety
- x) First-aid and Medical Facilities
- xi) Welfare measures
- xii) Environmental Management

11.4.5 **Audit Documents:**

11.4.5.1 Contractor shall make the below listed documents available for the review by the Audit team.

- i) **SHE policy**
- ii) **SHE manual**
- iii) **SHE Rules and Regulation**
- iv) **SHE organization chart**
- v) **Annual SHE objectives / programs**
- vi) **Accident / near miss statistics and analysis**
- vii) **SHE Training program / records for all personnel**
- viii) **Operating manuals and maintenance manual of all equipments**
- ix) **Safe worthiness certificates of all lifting appliances and gears**
- x) **Medical fitness record for all personnel**
- xi) **Risk identification, assessment and control details**
- xii) **Environmental management reports**
- xiii) **Emergency management records including mock drill**

11.4.6 Audit Preparation:



- i) Audit team members are required to gather information by observations through interviews and by checks of hardware and documentation.
- ii) Audit team shall prepare checklist to cover all parts based on SHE legislations rules and regulations and JMRC requirements.
- iii) Audit team members shall verify the facts and findings leading to the identified gaps and weakness.
- iv) Audit leader has overall responsibility for reaching a conclusion.

11.4.7 Reporting:

11.4.7.1 Audit report shall be prepared and directly sent to the Employer within 7 days of conducting the audit with a copy to the contractor.

11.4.8 Report contents:

- i) Executing summary - based on the finalized checklists as written the findings to the Employer by the audit team members, the audit leader will compile a concise and accurate summary of observations and findings.
- ii) Introduction - this will contain basic information regarding the facilities or organization audited, the specific audit dates (inclusion of those for preparation and post-audit activities).
- iii) Principal positive findings - This will contain the summary of positive aspects as observed by the auditors. It will also contain highlights of those issue, which may warrant dissemination as best practice regarding methodology used or achievement.
- iv) Audit Findings - All audit findings as detailed in the audit checklists shall be grouped together as priority 1 and 2 as detailed below in a separate listing.
 - a) Priority 1: Actions to rectify gaps or weakness should generally be implemented within two-weeks time, if risk potential is high or unacceptable.
 - b) Priority 2: Actions should be generally implemented or rectified with a maximum of 3 – 4 weeks, if not rectified would create a likelihood of minor injury or business loss.

11.4.9 Conformity Report & Action by Employer

11.4.9.1 The auditor shall inspect the site after 14 days of conducting initial audit for checking the adequacy of implementation of items maintained under priority 1 by the contractor and shall submit a conformity / non-conformity report to the Employer with a copy to the contractor.

11.4.9.2 The auditor shall again inspect after 28 days of conducting initial audit for checking the adequacy of implementation of items mentioned under priority 2 by the contractor and shall submit a conformity / non-conformity report to the Employer with a copy to the contractor.

11.4.9.3 In case of non-conformity of items mentioned by auditor, the Employer shall take necessary steps including stoppage of work and or imposing any penalty for getting the item implemented.

11.4.10 Failure of contractor to conduct External SHE Audit

11.4.10.1 **If the contractor fails to conduct the external SHE audit in time, the Employer at the cost of contractor shall get it done.**



12.0 SHE Communication

- 12.1 The contractor shall take every effort to communicate the Safety, Occupational health and Environment management measures through posters campaigns / billboards / banners / glow signs being displayed around the work site as part of the effort to rise safety awareness amongst to the work force. Posters should be in Hindi, English and other suitable language deemed appropriate. Posters / billboards / banners/ glow signs should be changed at least once in a month to maintain the impact.
- 12.2 The contractor shall also observe important days as listed in General Instruction **JMRC/SHE/GI/008** and printing and displaying safety signage and posters as listed in General Instruction **JMRC/SHE/GI/009**.
- 12.3 The list indicated are the minimum requirements of the Employer and the contractor is encouraged to further the SHE communication activities by formulating suitable reward schemes for safety performers and any other activities, which deem fit for the purpose.

13.0 SHE Submittals to the Employer

- 13.1 The contractor's SHE management should send the following reports to the Employer periodically:
- i) Daily Reporting of total no of workmen (as given in Clause **13.2**)
 - ii) Monthly SHE Report (as given in Clause **13.3**)
 - iii) SHE Committee Meeting Minutes (as given in Clause **7.9.1**)
 - iv) SHE Inspection Reports
 - v) SHE Audit Reports
 - a) Monthly Audit Rating Score (MARS) report
 - b) External SHE Audit
 - c) Electrical Safety Audit
 - vi) Air and Noise Quality monitoring report
- 13.2 **Daily Reporting of total no of workmen**
- 13.2.1 **The contractor shall report to the Employer the total no of workmen engaged by all including any subcontractor within 2 hours of starting of any shift in any day. This reporting shall be the primary duty of the Chief SHE Manager of the contractor and reporting shall be through tele-fax / email. The onus of checking the receipt of the same by the Employer lies with the contractor. If the information is not received or received more than 2 hrs after starting of the shift, penalty shall be levied as per relevant clause.**
- 13.3 Monthly SHE Report
- 13.3.1 The contractor shall prepare a monthly SHE report consisting of the following and submit 3 copies within 7th of next month to the Employer as specified in the Project SHE manual.
- i) Monthly man-hour details as specified in the Project SHE manual
 - ii) Monthly accident / incident details as specified in the Project SHE manual
 - iii) SHE committee details



- iv) Details of SHE training conducted in the month
- v) SHE Inspection
- vi) SHE internal audit details like electrical audit etc.
- vii) SHE Communication activities under taken in the month indicating the number of posters displayed and balance availability in stock.
- viii) Air quality / Noise monitoring details
- ix) Toolbox talks details
- x) PPE details: Quantity purchased, issued to the workmen and stock available.
- xi) Details on IP 44 panel boards, lighting poles, welding and cutting equipments, Ladders, Hoists, tools & tackles.
- xii) Monthly Lux meter study results
- xiii) Housekeeping
- xiv) Barricade maintenance details
- xv) No of critical excavations
- xvi) Health & Welfare activities
- xvii) Safety walk conducted by Contractors' Project Manager in the month
- xviii) SHE Activities Planned for next month

14.0 Accident reporting and investigation

14.1 Reporting to Employer

14.1.1 All accidents and dangerous occurrences shall immediately be informed verbally to the Employer. This will enable the Employer to reach to the scene of accident / dangerous occurrences to monitor/assist any rescue work and/or start conducting the investigation process so that the evidences are not lost.

14.1.2 Reports of all accidents (fatal / injury) and dangerous occurrences shall also be sent within 24 hours as per format provided in the Employer's Project SHE manual.

14.1.3 No accident / dangerous occurrences is exempted from reporting to the Employer.

14.1.4 Any wilful delay in verbal and written reporting to the Employer shall be penalised as per relevant clause.

14.2 Reporting to Government organisations

14.2.1 In addition to the above verbal and written reporting to the Employer, as per Rule 210 of BOCWR, notice of any accident to a worker at the building or construction site that:

- a) causes loss of life; or
- b) disables a worker from working for a period of 48 hours or more immediately following the accident;
- c) shall forthwith be sent by telegram, telephone, fax, or similar other means including special messenger within four hours in case of fatal accidents and 72 hours in case of other accidents, to:
 - i) the Regional Labour Commissioner (central), wherein the contractor has registered the firm/work
 - ii) the board with which the worker involved was registered as a beneficiary;



- iii) Director General and
- iv) the next of kin or other relative of the worker involved in the accident;

14.2.2 Further, notice of accident shall be sent in respect of an accident which

- (a) causes loss of life; or
- (b) disables the injured worker from work for more than 10 days to
 - i) the officer-in-charge of the nearest police station;
 - ii) the District Magistrate or, if the District Magistrate by order so desires, to
 - iii) the Sub-Divisional Magistrate

14.2.3 In case of an accident causing minor injury, first-aid shall be administered and the injured worker shall be immediately transferred to a hospital or other place for medical treatment.

14.2.4 Where any accident causing disablement that subsequently results in death, notice in writing of such death, shall be sent to the authorities mentioned in clause 14.2.1 and 14.2.2 above within 72 hours of such death.

14.2.5 Reporting of dangerous occurrences:

14.2.5.1 The following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any disablement or death caused to the worker, namely:

- (a) collapse or failure of lifting appliances, or hoist, or conveyors, or similar equipment for handling of building or construction material or breakage or failure of rope, chain or loose gears; or overturning of cranes used in construction work;
- (b) falling of objects from height;
- (c) collapse or subsidence of soil, tunnel, pipe lines, any wall, floor, gallery, roof or any other part of any structure, launching girder, platform, staging, scaffolding or means of access including formwork;
- (d) explosion of receiver or vessel used for storage of pressure greater than atmospheric pressure, of any gas or gases or any liquid or solid used as building material;
- (e) fire and explosion causing damage to any place on construction site where building workers are employed;
- (f) spillage or leakage of any hazardous substance and damage to their container;
- (g) collapse, capsizing, toppling or collision of transport equipment;
- (h) leakage or release of harmful toxic gases at the construction site;

14.2.6 In case of failure of launching girder, lifting appliance, loose gear, hoist or building and other construction work, machinery and transport equipment at a construction site, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the Authorities;

14.2.7 Every notice given for fatal accidents or dangerous occurrences shall be followed by a written report to the concerned Authorities under Section 39 of BOCWA and the Director General in the specified Form XIV of BOCWR.

14.3 Accident investigation



14.3.1 General

14.3.1.1 Investigations should be conducted in an open and positive atmosphere that encourages the witnesses to talk freely. The primary objective is to ascertain the facts with a view to prevent future and possibly more serious occurrences

14.3.1.2 Accidents and Dangerous Occurrences which result in death, serious injury or serious damage must be investigated by the Contractor immediately to find out the cause of the accident/occurrence so that measures can be formulated to prevent any recurrence.

14.3.1.3 Near misses and minor accidents should also be investigated by the Contractor as soon as possible as they are signals that there are inadequacies in the safety management system.

14.3.2 Procedure of incident investigation

14.3.2.1 It is important after any accident or dangerous occurrence that information relating to the incident is gathered in an organised way. The following steps shall be followed;

- a) take photographs and make sketches
- b) examine involved equipment, workpiece or material and the environmental conditions
- c) interview the injured, eye-witnesses and other involved parties
- d) consult expert opinion where necessary
- e) identify the specific contractor or sub-contractor involved.

14.3.2.2 Having gathered information, it is then necessary to make an analysis of incident

- a) establish the chain of events leading to the accident or incident
- b) find out at what stage the accident took place
- c) consider all possible causes and the interaction of different factors that led up to the accident, and identify the most probable cause. The cause of an accident should never be classified as carelessness. The specific act or omission that caused the accident must be identified.

14.3.2.3 The next stage is to proceed with the follow-up action

- a) report on the findings and conclusions
- b) formulate preventive measures to avoid recurrence
- c) publicise the findings and the remedial actions taken

14.4 Employers' independent incident investigation

14.4.1 In case of fatal / dangerous occurrence the Employer shall also conduct independent investigation. Contractor and his staff shall extend necessary co-operation and testify about the accident.

14.4.2 The contractor shall take every effort to preserve the scene of accident till the Employer completes the investigation.

14.4.3 All persons summoned by the Employer in connection to witness recording shall obey the instructions without delay. Any wilful suppression of information by any person shall be removed from the site immediately and / or punishable as per relevant penalty clause.



15.0 Emergency preparedness plan

- 15.1 The Contractor shall prepare an Emergency Response Plan for all work sites as a part of the Contractor SHE Plan. The plan shall integrate the emergency response plans of the Contractor and all other subcontractors. The Emergency Response Plan shall detail the Contractor's procedures, including detailed communications arrangements, for dealing with all emergencies that could affect the Site. This include where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue.
- 15.2 The contractor shall ensure that an Emergency Response Plan is prepared to deal with emergencies arising out of:
- i) Fire and explosion
 - ii) Collapse of lifting appliances and transport equipment
 - iii) Collapse of building, sheds or structure etc.
 - iv) Gas leakage or spillage of dangerous goods or chemicals
 - v) Bomb threatening, Criminal or Terrorist attack
 - vi) Drowning of workers
 - vii) Landslides getting workers buried floods, Earthquake, storms and other natural calamities.
- 15.3 Arrangements shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the contractor with their telephone numbers and addresses for quick communication shall be adequately publicized and conspicuously displayed in the workplace.
- 15.4 Contractors shall require to tie-up with the hospitals and fire stations located in the neighbourhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.
- 15.5 Contractor shall conduct an onsite emergency mock drill once in every month for all his workers and his subcontractor's workers.
- 15.6 It shall be the responsibility of the contractor to keep the Local Law & Order Authorities informed and seek urgent help, as the case may be, so as to mitigate the consequences of an emergency. Prompt communication to JMRC, telephonically initially and followed by a written report, shall be made by the contractor.

16.0 Experts / Agencies for SHE services

- 16.1 Contractors may utilise the services of experts/agencies empanelled under Rule 250 of BOCWR and Rule 277 of RBOCWR for the purpose of training, internal audit and any other SHE services with prior approval of the Employer.
- 16.2 As an aide to contractors, a list of experts/agencies and the offered service are given in General Instruction **JMRC/SHE/GI/010** for ready reference. In addition to it if the contractor would like to use any expert/agencies' services for any SHE activities the same can also be allowed provided that they are competent and meet to the general requirements of Employer. In every case prior approval of the Employer is mandatory.



PART – II : SAFETY



17.0 Housekeeping

- 17.1 Housekeeping is the act of keeping the working environment cleared of all unnecessary waste, thereby providing a first-line of defence against accidents and injuries.
- 17.2 Contractor shall understand and accept that improper housekeeping is the primary hazard in any construction site and ensure that a high degree of house keeping is always maintained. Indeed "Cleanliness is indeed next to Godliness"
- 17.3 Housekeeping is the responsibility of all site personnel, and line management commitment shall be demonstrated by the continued efforts of supervising staff towards this activity.
- 17.4 General House keeping shall be carried out by the contractor and ensured at all times at Work Site, Construction Depot, Batching Plant, Labour Camp, Stores, Offices and toilets/urinals. Towards this the Contractor shall constitute a special group of house keeping personnel as per General Instruction **JMRC/SHE/GI/001**. This group shall ensure daily cleaning at work sites and surrounding areas and maintain a register as per the approved format by the Employer.
- 17.5 Adequate time shall be assigned to ensure that good housekeeping is maintained. This shall be carried out by team of housekeeping squad.
- 17.6 The contractor shall be responsible to provide segregated containers for disposal of debris at required places and regular cleaning of the same.
- 17.7 Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the surrounding area from excavated soil, rubbish etc, which may cause inconvenience to and endanger the public. The barricade especially those exposed to public shall be aesthetically maintained by regular cleaning and painting as directed by the Employer. These shall be maintained in one line and level.
- 17.8 The structure dimension of the barricade, material and composition, its colour scheme, JMRC logo and other details shall be in accordance with specifications laid down in tender document.
- 17.9 All stairways, passageways and gangways shall be maintained without any blockages or obstructions. All emergency exits passageways, exits fire doors, break-glass alarm points, fire fighting equipment, first aid stations, and other emergency stations shall be kept clean, unobstructed and in good working order.
- 17.10 Lumber with protruding nails shall be either bent / removed and properly stacked.
- 17.11 All surplus earth and debris are removed/disposed off from the working areas to officially designated dumpsites. Trucks carrying sand, earth and any pulverized materials etc. in order to avoid dust or odour impact shall be covered while moving. **The tyres of the trucks leaving the site shall be cleaned with water, wherever the possibility of spillage on carriageways meant for regular road traffic exists.**
- 17.12 No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.



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- 17.13 Roads shall be kept clear and materials like: pipes, steel, sand boulders, concrete, chips and brick etc. shall not be allowed on the roads to obstruct free movement of road traffic.
- 17.14 Water logging or bentonite spillage on roads shall not be allowed. If bentonite spillage is observed on road endangering the safety of road users, the contractor shall be penalised as per relevant clause.
- 17.15 Proper and safe stacking of material are of paramount importance at yards, stores and such locations where material would be unloaded for future use. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner.
- 17.16 Flammable chemicals / compressed gas cylinders shall be safely stored.
- 17.17 Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas shall be removed to identified locations(s).
- 17.18 All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).
- 17.19 Empty cement bags and other packaging material shall be properly stacked and removed.
- 17.20 The Contractor shall ensure that all his sub-contractors maintain the site reasonably clean through provisions related to house keeping

18.0 Working at Height

18.1 Definitions

- 18.1.1 "access" and "egress" include ascent and descent.
- 18.1.2 "fragile surface" means a surface, which would be able to fail if any reasonably foreseeable loading were to be applied to it.
- 18.1.3 "line" includes rope, chain or webbing
- 18.1.4 "personal fall protection" means -
(a) a fall prevention, work restraint, work positioning, fall arrest or rescue system, other than a system in which the only safeguards are collective safeguards; or
(b) rope access and positioning techniques;
- 18.1.5 "work at height" means -
(a) work in any place, including a place at or below ground level;
(b) obtaining access to or egress from such place while at work, except by a staircase in a permanent workplace,
where, if protective measures were not taken, a person could fall a distance liable to cause personal injury;
- 18.1.6 "work equipment" means any machinery, appliance, apparatus, tool or installation for use at work (whether exclusively or not) and includes
(a) a guard-rail, toe-board, barrier or similar collective means of protection



- (b) a working platform
 - (c) a net, airbag or other collective safe guard for arresting falls.
 - (d) personal fall protection system
 - (e) ladders
- 18.1.7 “working platform”
 - (a) means any platform used as a place of work or as a means of access to or egress from a place of work;
 - (b) includes any scaffold, suspended scaffold, cradle, mobile platforms, trestle, gangway, gantry and stairway which is so used.
- 18.2 Organisation and planning
The contractor shall ensure that work at height is
 - i) properly planned for any emergencies and rescue
 - ii) appropriately supervised; and
 - iii) carried out in a manner, which is reasonably practicable safe.
- 18.3 The contractor shall ensure that work at height is carried out only when the weather conditions do not jeopardise the health or safety of persons involved in the work.
- 18.4 Competence
The contractor shall ensure that no person engages in any activity, including organization, planning and supervision, in relation to work at height or work equipment for use in such work unless he is competent to do so or, if being trained, is being supervised by a competent person.
- 18.5 Avoidance of risks from work at height
The contractor shall ensure that work is not carried out at height where it is reasonably practicable to carry out the work safely otherwise than at height.
- 18.6 Where work is carried out at height, the contractor shall take suitable and sufficient measures as given below to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.
 - (a) his ensuring that the work is carried out
 - (i) from an existing place of work; or
 - (ii) (in the case of obtaining access or egress) using an existing means, complying to the requirements as given in **18.15** where it is reasonably practicable to carry it out safely and under appropriate ergonomic conditions; and
 - (b) where it is not reasonably practicable for the work to be carried out in accordance with sub-paragraph (a), his providing sufficient work equipment for preventing, so far as is reasonably practicable, a fall occurring.
- 18.7 Where the measures taken under clause **18.6** do not eliminate the risk of a fall occurring, every contractor shall
 - (a) so far as is reasonably practicable, provide sufficient work equipment to minimise -
 - (i) the distance and consequences; or
 - (ii) where it is not reasonably practicable to minimise the distance, the consequences, of a fall; and



- (b) Without prejudice to the generality of clause **18.4**, provide such additional training and instruction or take other additional suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.

18.8 Selection of 'work equipment' for work at height

- 1) the contractor, in selecting work equipment for use in work at height, shall
 - a) give collective protection measures priority over personal protection measures; and
 - b) take account of
 - i) the working conditions and the risks to the safety of persons at the place where the work equipment is to be used;
 - ii) in the case of work equipment for access and egress, the distance to be negotiated;
 - iii) the distance and consequences of a potential fall;
 - iv) the duration and frequency of use;
 - v) the need for easy and timely evacuation and rescue in an emergency; and
 - vi) any additional risk posed by the use, installation or removal of that work equipment or by evacuation and rescue from it;
- (2) The contractor shall select work equipment for work at height which:
 - a) has characteristics including dimensions which:
 - (i) are appropriate to the nature of the work to be performed and the foreseeable loadings; and
 - (ii) allow passage without risk; and
 - b) is in other respects the most suitable work equipment, having regard in particular to the purposes specified in **18.5** and **18.6**.

18.9 Fragile surfaces

18.9.1 The contractor shall ensure that no person at work passes across or near, or working on, from or near, a fragile surface where it is reasonably practicable to carry out work safely and under appropriate ergonomic conditions without his doing so.

18.9.2 Where it is not reasonably practicable to carry out work safely and under appropriate ergonomic conditions without passing across or near, or working on, from or near, a fragile surface, every contractor shall,

- (a) ensure, so far as is reasonably practicable, that suitable and sufficient platforms, coverings, guard rails or similar means of support or protection are provided and used so that any foreseeable loading is supported by such supports or borne by such protection;
- (b) where a risk of a person at work falling remains despite the measures taken under the preceding provisions of this regulation, take suitable and sufficient measures to minimise the distances and consequences of his fall.



- 18.9.3 Where any person at work may pass across or near, or work on, from or near, a fragile surface, every contractor shall ensure that
- (a) prominent warning notices are so far as is reasonably practicable affixed at the approach to the place where the fragile surface is situated; or
 - (b) where that is not reasonably practicable, such persons are made aware of it by other means.
- 18.10 Falling objects
- 18.10.1 The contractor shall, where necessary to prevent injury to any person, take suitable and sufficient steps to prevent, so far as is reasonably practicable, the fall of any material or object.
- 18.10.2 Where it is not reasonably practicable to comply with the requirements of **18.9**, every contractor shall take suitable and sufficient steps to prevent any person being struck by any falling material or object which is liable to cause personal injury.
- 18.10.3 The contractor shall ensure that no material or object is thrown or tipped from height in circumstances where it is liable to cause injury to any person.
- 18.10.4 Every employer shall ensure that materials and objects are stored in such a way as to prevent risk to any person arising from the collapse, overturning or unintended movement of such materials or objects.
- 18.11 Danger areas
- 18.11.1 Without prejudice to the preceding requirements of these Regulations, every contractor shall ensure that
- (a) where a workplace contains an area in which, owing to the nature of the work, there is a risk of any person at work
 - i) falling a distance; or
 - ii) being struck by a falling object,which is liable to cause personal injury, the workplace is so far as is reasonably practicable equipped with devices preventing unauthorised persons from entering such area; and
 - (b) such area is clearly indicated.
- 18.12 Inspection of work equipment
- 18.12.1 The contractor shall ensure that, where the safety of work equipment depends on how it is installed or assembled, it is not used after installation or assembly in any position unless it has been inspected in that position.
- 18.12.2 The contractor shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations is inspected
- (a) at suitable intervals; and
 - (b) each time that exceptional circumstances which are liable to jeopardise the safety of the work equipment have occurred,
- to ensure that health and safety conditions are maintained and that any deterioration can be detected and remedied in good time.



- 18.12.3 Without prejudice to paragraph **18.12.1**, the contractor shall ensure that a working platform
- (a) used for construction work; and
 - (b) from which a person could fall 2 metres or more,
- is not used in any position unless it has been inspected in that position or, in the case of a mobile working platform, inspected on the site, within the previous 7 days.
- 18.12.4 The contractor shall ensure that the reports of all inspections are properly maintained and shown to the Employer as and when required.
- 18.12.5 In this clause "inspection",
- (a) means such visual or more rigorous inspection by a competent person as is appropriate for safety purposes;
 - (b) includes any testing appropriate for those purposes,
- 18.13 Inspection of places of work at height
- 18.13.1 The contractor shall so far as is reasonably practicable ensure that the surface and every parapet, permanent rail or other such fall protection measure of every place of work at height are checked on each occasion before the place is used.
- 18.14 Duties of persons at work
- 18.14.1 Any workmen employed by the contractor shall report to the supervisor about any defect relating to work at height which he knows is likely to endanger the safety of himself or another person.
- 18.14.2 Every workmen shall use any work equipment or safety device provided to him for work at height by the contractor, in accordance with
- (a) any training in the use of the work equipment or device concerned which have been received by him; and
 - (b) the instructions respecting that use which have been provided to him by the contractor as per the requirements of the Employer
- 18.15 Requirements for existing places of work and means of access or egress at height
- Every existing place of work or means of access or egress at height shall
- (a) be stable and of sufficient strength and rigidity for the purpose for which it is intended to be or is being used;
 - (b) where applicable, rest on a stable, sufficiently strong surface;
 - (c) be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work to be carried out there;
 - (d) possess suitable and sufficient means for preventing a fall;
 - (e) possess a surface which has no gap
 - (i) through which a person could fall;
 - (ii) through which any material or object could fall and injure a person; or
 - (iii) giving rise to other risk of injury to any person, unless measures have been taken to protect persons against such risk;



- (f) be so constructed and used, and maintained in such condition, as to prevent, so far as is reasonably practicable -
 - (i) the risk of slipping or tripping; or
 - (ii) any person being caught between it and any adjacent structure;
- (g) where it has moving parts, be prevented by appropriate devices from moving inadvertently during work at height.

18.16 Requirements for guardrails, toe-boards, barriers and similar collective means of protection

- i) Unless the context otherwise requires, any reference in this section to means of protection is to a guardrail, toe-board, barrier or similar collective means of protection.
- ii) Means of protection shall
 - (a) be of sufficient dimensions, of sufficient strength and rigidity for the purposes for which they are being used, and otherwise suitable;
 - (b) be so placed, secured and used as to ensure, so far as is reasonably practicable, that they do not become accidentally displaced; and
 - (c) be so placed as to prevent, so far as is practicable, the fall of any person, or of any material or object, from any place of work.
- iii) In relation to work at height involved in construction work
 - (a) the top guard-rail or other similar means of protection shall be at least 950 millimetres above the edge from which any person is liable to fall;
 - (b) toe-boards shall be suitable and sufficient to prevent the fall of any person, or any material or object, from any place of work; and
 - (c) any intermediate guardrail or similar means of protection shall be positioned so that any gap between it and other means of protection does not exceed 470 millimetres.
- iv) Any structure or part of a structure which supports means of protection or to which means of protection are attached shall be of sufficient strength and suitable for the purpose of such support or attachment.

18.17 Requirements for all Working Platforms

- i) Every working platforms requires a supporting structure for holding it
- ii) Any surface upon which any supporting structure rests shall be stable, of sufficient strength and of suitable composition safely to support the supporting structure, the working platform and any loading intended to be placed on the working platform.
- iii). Stability of supporting structure
 - Any supporting structure shall
 - (a) be suitable and of sufficient strength and rigidity for the purpose for which it is being used;
 - (b) in the case of a wheeled structure, be prevented by appropriate devices from moving inadvertently during work at height;
 - (c) in other cases, be prevented from slipping by secure attachment to the bearing surface or to another structure, provision of an effective anti-slip device or by other means of equivalent effectiveness;
 - (d) be stable while being erected, used and dismantled; and
 - (e) when altered or modified, be so altered or modified as to ensure that it remains stable.
 - (f) Have suitable base plates and properly footed thereby.
- iv). Stability of working platforms



A working platform shall

- (a) be suitable and of sufficient strength and rigidity for the purpose or purposes for which it is intended to be used or is being used;
- (b) be so erected and used as to ensure that its components do not become accidentally displaced so as to endanger any person;
- (c) when altered or modified, be so altered or modified as to ensure that it remains stable; and
- (d) be dismantled in such a way as to prevent accidental displacement.

v) Safety on working platforms

A working platform shall

- (a) be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work being carried out there;
- (b) possess a suitable surface and, in particular, be so constructed that the surface of the working platform has no gap
 - i) through which a person could fall;
 - ii) through which any material or object could fall and injure a person; or
 - iii) giving rise to other risk of injury to any person, unless measures have been taken to protect persons against such risk; and
- (c) be so erected and used, and maintained in such condition, as to prevent, so far as is reasonably practicable
 - i) the risk of slipping or tripping; or
 - ii) any person being caught between the working platform and any adjacent structure.

vi) Loading

A working platform and any supporting structure shall not be loaded so as to give rise to a risk of collapse or to any deformation, which could affect its safe use.

vii) Additional requirements for scaffolding

Strength and stability calculations for scaffolding shall be carried out unless

- (a) a note of the calculations, covering the structural arrangements contemplated, is available; or
- (b) it is assembled in conformity with a generally recognised standard configuration.

viii) Depending on the complexity of the scaffolding selected, a competent person shall draw up an assembly, use and dismantling plan. This may be in the form of a standard plan, supplemented by items relating to specific details of the scaffolding in question.

- ix) A copy of the plan, including any instructions it may contain, shall be kept available for the use of persons concerned in the assembly, use, dismantling or alteration of scaffolding until it has been dismantled.
- x) The dimensions, form and layout of scaffolding decks shall be appropriate to the nature of the work to be performed and suitable for the loads to be carried and permit work and passage in safety.



- xi) While a scaffold is not available for use, including during its assembly, dismantling or alteration, it shall be marked with general warning signs in accordance with and be suitably delineated by physical means preventing access to the danger zone.
- xii) Scaffolding may be assembled, dismantled or significantly altered only under the supervision of a competent person and by persons who have received appropriate and specific training in the operations envisaged which addresses specific risks which the operations may entail and precautions to be taken, and more particularly in
 - (a) understanding of the plan for the assembly, dismantling or alteration of the scaffolding concerned;
 - (b) safety during the assembly, dismantling or alteration of the scaffolding concerned;
 - (c) measures to prevent the risk of persons, materials or objects falling;
 - (d) safety measures in the event of changing weather conditions which could adversely affect the safety of the scaffolding concerned;
 - (e) permissible loadings;
 - (f) any other risks which the assembly, dismantling or alteration of the scaffolding may entail.

18.18 Requirements for collective safeguards for arresting falls

- i) Collective safeguard are a safety net, airbag or other collective safeguard for arresting falls
- ii) A safeguard shall be used only if
 - (a) a risk assessment has demonstrated that the work activity can so far as is reasonably practicable be performed safely while using it and without affecting its effectiveness;
 - (b) the use of other, safer work equipment is not reasonably practicable; and
 - (c) a sufficient number of available persons have received adequate training specific to the safeguard, including rescue procedures.
- iii) A safeguard shall be suitable and of sufficient strength to arrest safely the fall of any person who is liable to fall.
- iv) A safeguard shall
 - (a) in the case of a safeguard which is designed to be attached, be securely attached to all the required anchors, and the anchors and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of safely supporting the foreseeable loading in arresting any fall and during any subsequent rescue;
 - (b) in the case of an airbag, landing mat or similar safeguard, be stable; and
 - (c) in the case of a safeguard, which distorts in arresting a fall, afford sufficient clearance.
- v) Suitable and sufficient steps shall be taken to ensure, so far as practicable, that in the event of a fall by any person the safeguard does not itself cause injury to that person.

18.19 Requirements for personal fall protection systems



- i) A personal fall protection system shall be used only if
 - (a) a risk assessment has demonstrated that
 - (i) the work can so far as is reasonably practicable be performed safely while using that system; and
 - (ii) the use of other safer work equipment is not reasonably practicable; and
 - (b) the user and a sufficient number of available persons have received adequate training specific to the operations envisaged, including rescue procedures.
- ii) A personal fall protection system shall
 - (a) be suitable and of sufficient strength for the purposes for which it is being used having regard to the work being carried out and any foreseeable loading;
 - (b) where necessary, fit the user;
 - (c) be correctly fitted;
 - (d) be designed to minimise injury to the user and, where necessary, be adjusted to prevent the user falling or slipping from it, should a fall occur; and
 - (e) be so designed, installed and used as to prevent unplanned or uncontrolled movement of the user.
- iii) A personal fall protection system designed for use with an anchor shall be securely attached to at least one anchor, and each anchor and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of supporting any foreseeable loading.
- iv) Suitable and sufficient steps shall be taken to prevent any person falling or slipping from a personal fall protection system.

18.20 Requirements for Ladders

- 1) Every contractor shall ensure that a ladder is used for work at height only if a risk assessment has demonstrated that the use of more suitable work equipment is not justified because of the low risk and
 - i) The short duration of use; or
 - ii) Existing features on site, which he cannot alter.
- 2) Only metal ladders shall be allowed. Bamboo ladders are prohibited.
- 3) Any surface upon which a ladder rests shall be stable, firm, of sufficient strength and of suitable composition safely to support the ladder so that its rungs or steps remain horizontal, and any loading intended to be placed on it.
- 4) A ladder shall be so positioned as to ensure its stability during use
- 5) A suspended ladder shall be attached in a secure manner and so that, with the exception of a flexible ladder, it cannot be displaced and swinging is prevented.
- 6) A portable ladder shall be prevented from slipping during use by -
 - i) securing the stiles at or near their upper or lower ends;
 - ii) an effective anti-slip or other effective stability device; or
 - iii) any other arrangement of equivalent effectiveness.
- 7) A ladder used for access shall be long enough to protrude sufficiently above the place of landing to which it provides access, unless other measures have been taken to ensure a firm handhold.
- 8) No interlocking or extension ladder shall be used unless its sections are prevented from moving relative to each other while in use.
- 9) A mobile ladder shall be prevented from moving before it is stepped on.



- 10) Where a ladder or run of ladders raises a vertical distance of 9 metres or more above its base, there shall, where reasonably practicable, be provided at suitable intervals sufficient safe landing areas or rest platforms.
- 11) Every ladder shall be used in such a way that
 - (a) a secure handhold and secure support are always available to the user; and
 - (b) the user can maintain a safe handhold when carrying a load unless, in the case of a step ladder, the maintenance of a handhold is not practicable when a load is carried, and a risk assessment has demonstrated that the use of a stepladder is justified because of
 - (i) the low risk; and
 - (ii) the short duration of use.

19.0 Overhead protection

All contractors shall provide overhead protections as per Rule 41 of BOCWR

- i) Overhead protection should be erected along the periphery of every building which is under construction and the building height shall be 15m or above after construction.
- ii) Overhead protection shall be minimum 2m wide and the outer edge shall be 150mm higher than the inner edge and an angle not more than 20° to its horizontal sloping into the building.
- iii) Overhead protection shall not be erected more than a height of 5m from the base of the building.
- iv) Areas of inadvertent hazard of falling of material shall be guarded or barricaded or roped-off thereby by the contractor.

20.0 Slipping, Tripping, Cutting, Drowning and Falling Hazards

As per Rule 42 of BOCWR,

- i) All places should be free from dust, debris or similar materials.
- ii) Sharp projections or any protruding nails or similar objects shall be suitably guarded or shall even be avoided to make the place safe to work.
- iii) Contractor shall not allow workmen to work or use platforms, scaffolds/passageways or any walkways, which has water, or oil or similar substances spilt and has a slipping hazard, unless it is cleaned off or covered or sanded or saw dusted or make it safe with any suitable material.
- iv) When workers are exposed to areas where fall into water is possible, the contractor shall provide suitable and adequate equipment for saving the workers from drowning and rescuing from such hazard. If the Employer considers, the contractor shall provide well-equipped boat or launch, manned with trained personnel at the work place.
- v) Open side or opening where worker, equipment, vehicle or lifting appliance may fall at a building or outside shall be guarded suitably except in places of free access by reasons of nature of work.
- vi) Suitable safety net shall be provided at places of material / man falling is possible in accordance with national standards.

21.0 Lifting Appliances and Gear

- 21.1 (a) Lifting appliances means a crane, hoist machinery, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, luffing machinery sheaves, pulley blocks, hooks or other equipment used for lifting materials, objects or building workers and



lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eyenuts and other accessories of a lifting appliance.

(b) Use of “Tractor Transmission Type “Pick and Carry Hydra crane

“Tractor Transmission Type “Pick and Carry Hydra crane – 1st Generation model is prohibited at JMRC works. Contractor shall mobilize ‘Truck Transmission Type’ pick and hydra crane – 2nd Generation model only

- 21.2 No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered against:
- i) the weights, dimensions and lift radii of the heaviest and largest loads
 - ii) the maximum lift height, the maximum lift radius and the weight of the loads that must be handled at each
 - iii) the number and frequency of lifts to be made
 - iv) how long the crane will be required on site
 - v) the type of lifting to be done (for example, is precision placement of loads important?
 - vi) the type of carrier required (this depends on ground conditions and machine capacity In its operating quadrants: capacity is normally greatest over the rear, less over the side, and non-existent over the front
 - vii) whether loads will have to be walked or carried
 - viii) whether loads will have to be suspended for lengthy periods
 - ix) the site conditions, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impede access or operation
- 21.3 The contractor shall ensure that a valid certificate of fitness issued as per clause **21.5** is available for all lifting appliances including synchronised mobile jacks, pre-stressing hydraulic jacks, jacks fitted with launching girders etc. and Employers approval before inducting to the site. **Only after obtaining the approval from the Employer any lifting appliances and gear shall be used.**
- 21.4 **The laminated photocopies of fitness certificate issued by competent person, the Employers’ approval letter, the operators’ photo, manufacturer’s load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.**
- 21.5 **All lifting appliances and loose gears shall be clearly marked for its safe working load and identification by stamping or other suitable means.**
- 21.6 The contractor shall also maintain a register containing a system of identification of all tools and tackles, its date of purchase, safe working load, competent person date of examination etc.
- 21.7 Test and periodical examination of lifting appliances and gears
- 21.7.1 All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability. Within the validity, if the lifting appliances are shifted to a new site, re-examination by the same competent person for ensuring its safety shall also be done.



- 21.7.2 Contractors can utilise the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories with the permission of the Employer.
- 21.7.3 All alarms and signals like automatic safe load indicators (SLI), boom angle indicators, boom extension indicators, over lift boom alarm, swing alarm, hydraulic safety valves, mechanical radius indicators, load moment indicators etc. shall be periodically examined and maintained always in working condition
- 21.8 Automatic safe load indicators
- 21.8.1 **As stipulated in Rule 100 of RBOCW Rules, every lifting appliances and gears like cranes, hydras etc, if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/ International certifying bodies which gives a warning to the operator and arrests further movements of the lifting parts.**
- 21.9 Qualification of operator of lifting appliances and of signaller etc
- 21.9.1 The contractor shall not employ any person to drive or operate a lifting machine like crane, hydra etc whether driven by mechanical power or otherwise or to give signals to work as a operator of a riggers or derricks unless he
- i) is above twenty-one years of age and possesses a valid heavy transport vehicle driving licence as per Motor Vehicle Act and Rules.
 - ii) is absolutely competent and reliable
 - iii) possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance acceptable to Employer
 - iv) is medically examined periodically as specified in schedule VII of BOCW Rules.
- 21.10 General requirements of appliances
- 21.10.1 Out-of level
- 21.10.1.1 One of the most severe effects of being out-of fit level is that side loads develop in the boom. Because of side loads all mobile cranes lose capacity rapidly as the degree of out-of-level increases and therefore
- 21.10.2 Boom
- i) The boom is one of the more critical elements of the crane and must be in perfect condition at all time. No boom section with a bent lattice member shall be allowed
 - ii) All welds shall be crack and corrosion free
 - iii) No member of the boom shall be bent
 - iv) All telescopic boom shall be free from cracks, rust, flaking or cracked paint, bulges, greases or varnishes
- 21.10.3 The sweep area (work area) of the construction machinery shall be always free from obstructions.



21.10.4 All hydraulic piping and fittings shall be maintained leak proof.

21.10.5 The operator cab shall possess good and safe:

- i) structure, windows and windshield wipers
- ii) Drivers chair and foot rest
- iii) Control handles
- iv) Cab instrumentation
- v) Telecommunication
- vi) Cab out fitting
- vii) wind indicator with an adjustable set point shall be in a position representative for the wind on the crane. The indicator shall give continuous information regarding constant speeds and gusts.

21.11 Mandatory rigging requirements

21.11.1 Rigging shall be done under experienced and qualified rigger only.

21.11.2 The primary requirement in rigging shall be to assess the weight of load before attempting any lift.

21.11.3 All hooks shall be fitted with Master Rings having certificate of fitness from the competent person, so that the hooks are subjected to balanced vertical loading only.

21.11.4 Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting.

21.11.5 Hand spliced slings up to 32mm diameter shall not be used at site for any lifting purpose.

21.11.6 No load shall be slewed over public areas without stopping the pedestrians and road traffic first.

21.11.7 Requirements of outriggers

- i) All outriggers shall be fully extended and all tyres are clear of the ground
- ii) Heavy duty blocking having large bearing area shall be necessary to prevent sinking of floats

21.11.8 All loads shall have tag-lines attached in order to ensure that the load can be controlled at all times.

21.11.9 No close working to any live overhead power line is permitted without the operation of a strict Permit to Work.

21.11.10 Minimum lighting is to be ensured at all lifting operations.

21.12 Failure to do any of the above shall attract penalty from the Employer as per relevant clause



22.0 Launching Operation

- 22.1 As launching operation is one of the riskiest job, the contractor shall take utmost precaution at all stages like; planning, establishing casing yard, casting segments, transporting segments, fabrication and erection of launching girders, launching of segments, pre-stressing, auto launching of girders and dismantling of launching girders.
- 22.2 The contractor shall prepare a comprehensive Method Statement for the launching operation, adhering to the SHE conditions laid down in conditions of contract on SHE and project SHE manual. Particular reference shall be made to the provisions on working at height. As the entire process of launching has to be undertaken at an elevated level the safety of workers and the girder is paramount important. The following general guidelines shall be adhered throughout the launching operation.
- i) Necessary 'working platforms' and fall protection anchorage arrangement shall be provided in the launching girder itself.
 - ii) Provisions for mounting light fittings shall also be made available in the launching girder.
 - iii) The casting yard shall be established ensuring the provision given in clause **38.0**
 - iv) The workmen engaged in fabrication of reinforcement, concreting the segment shall be provided with necessary PPEs including compulsory hand protection gloves.
 - v) Casting and curing of segment shall be undertaken under the direct supervision of the responsible engineer of the contractor.
 - vi) Trucks with valid registration, licence, safe worthiness certificate, Employer's approval certificate, and pollution under check certificate shall only be used for transport of segments
 - vii) Drivers engaged for driving these trucks, shall be trained once in 6 months on defensive driving at any Government authorized Institute or Maruti Institute of Driver Training and Research at Wazirabad Road, Adjoining Loni Road Flyover, Delhi-110094.
 - viii) Drivers shall also have undergone proper medical examination as per relevant clause mentioned under 'Medical Facilities'.
 - ix) The segments shall rigidly secured to the truck with necessary wooden wedges and necessary red indicators/safety tapes provided so that the vehicle is clearly seen by other road users both in day / night time.
 - x) Every launching girder shall have a responsible engineer on duty all the time.
 - xi) All the time from erection to dismantling the area between the two piers wherein launching is in progress shall always be barricaded.
 - xii) Unloading of segments from trucks, lifting of segments, shifting of segments, gluing shall be done under the direct supervision of the approved engineer of the contractor.
 - xiii) Auto launching shall be done only after approval from the Employer. After every auto launching the stability of launching girder shall be ensured.
 - xiv) The vertical deflection of launching girder shall be monitored at all critical stages like with/without loads and after every auto launching.
 - xv) A register containing all important operational details from erection to dismantling of launching girders shall be maintained and made available to Employer whenever called for.
 - xvi) Test certificate for all lifting gears including Macalloy bars shall be maintained at a location closer to the launching girder itself so that it can be referred during all inspections.
 - xvii) Adequate lighting at all time shall be ensured in the entire area of operation.
 - xviii) Access to drinking water & toilet shall be ensured to all workmen engaged for launching process.



- xix) Proper access ladders/stairways shall be maintained for safe ascending / descending of workmen / engineers.

22.3 Non-adherence to any of the clauses mentioned above shall be viewed seriously by the Employer and penalty levied as per relevant clause.

23.0 Construction machinery

23.1 Construction machineries may include dumpers and dump trucks, lift trucks and telescopic handlers piling rigs, vibro hammers, rail welding equipments, mobile elevating work platforms, cranes, tipper lorries, lorry loaders, skip wagons, 360° excavators, 180° backhoe loaders, crawler tractors, scrapers, graders, loading shovels, trenchers, side booms, pavers, planers, chippers, road rollers, locomotives, tankers and bowsers, trailers, hydraulic and mechanical breakers etc.

23.2 Safe worthiness certificate

23.2.1 Every construction equipment shall be in sound mechanical working condition and certified by either competent person under Factories Act or manufacturers' warranty in case of brand new equipments or authorized persons / firms approved by Employer before induction to any site.

23.2.2 Every such certificate shall have the date of purchase, main overhauling undertaken in the past, any accident to the equipment, visual examination details, critical components safety check, list of safety devices and its working condition, manufacturer's maintenance checklist, past projects wherein the equipments were used etc as its minimum content.

23.3 Reverse Horns

23.3.1 All Vehicles shall be fitted with audible reverse alarms and maintained in good working condition. Reversing shall be done only when there is adequate rear view visibility or under the directions of a banksman.

23.4 General operating procedures

- i) Drivers entering site shall be instructed to follow the safe system of work adopted on site. These shall be verbal instructions or, preferably, written instructions showing the relevant site rules, the site layout, delivery areas, speed limits, etc.
- ii) No passengers shall be carried, unless specific seating has been provided in accordance with the manufacturers recommendations.
- iii) Working on gradients beyond any equipments capability shall not be allowed.
- iv) Prevention of dumper and dump truck accidents should be managed by providing wheel stops at a sufficient distance from the edges of excavations, spoil heaps, pits, etc.
- v) The manufacturer's recommended bucket size must not be exceeded in excavators.
- vi) If excavators operating on a gradient which cannot be avoided, it must be ensured that the working cycle is slowed down, that the bucket is not extended too far in the downhill direction, and that travel is undertaken with extreme caution. A large excavator must never be permitted to travel in a confined area, or around people, without a banksman to guide the driver, who should have the excavator attachment close in to the machine, with the bucket just clear of the ground. On wheeled excavators, it is essential that the tyres are in good condition and correctly inflated. If stabilizing devices are fitted, they should be employed when the machine is excavating.



- vii) When the front shovel of the 180⁰ backhoe loaders is being employed, the backhoe attachment shall be in its “travel” position, with the safety locking device in place.
- viii) When operating the backhoe in poor ground conditions, the stabilisers tend to sink into the surface of the ground, reducing stability. Therefore frequent checks shall be made for the stability of the machine. The loading shovel should always be lowered to the ground to stabilise the machine when the backhoe is employed.
- ix) The netting operation of the skip wagons should be carried out prior to lifting the skip to reduce the risks of working on the rear platform
- x) If a tractor dozer is employed on clearing scrub or felling trees, it shall be provided with adequate driver protection.
- xi) When two or more scrapers are working on the same job, a minimum distance of at least 25m shall be kept between them.
- xii) In case of hydraulic breakers, hydraulic rams and hoses shall be in good working condition

23.5 All wood working machines shall be fitted with suitable guards and devices such as top guard, riving knife, push stick, guards for drive belts and chains, and emergency stop switch easily accessible by the operator.

23.6 Penalty

23.6.1 If any of the above clauses are not adhered, penalty shall be imposed as per relevant clause depending upon the gravity of the unsafe act and or condition.

24.0 Machine and general area guarding

24.1 The contractor shall ensure at the construction site all motors, cogwheels, chains and friction gearing, flywheels, shafting, dangerous and moving parts of machinery are securely fenced or legged. The fencing of dangerous part of machinery is not removed while such machinery is in motion or in use.

25.0 Manual lifting and carrying of excessive weight

25.1 The contractor shall ensure at his construction site of a building or other construction work that no building worker lifts by hand or carries overhead or over his back or shoulders any material, article, tool or appliances exceeding in weight as said below as per Rule 38 of BOCWR, Unless aided by another building worker or device.

Person	Maximum weight in kg.
Adult man	55
Adult woman	30

25.2 No building worker aided by other building worker shall lift or carry weight higher than or exceeding the sum of total of maximum limits set out for each building worker separately as mentioned in the table above.

26.0 Site Electricity

26.1 Competency of Electrical personnel:



- 26.1.1 The contractor shall employ qualified and competent electrical personnel as specified in general instruction **JMRC/SHE/GI/001**.
- 26.2 Assessment of power
- 26.2.1 The contractor shall assess the size and location of the electrical loads and the manner in which they vary with time during the currency of the contract.
- 26.2.2 The contractor shall elaborate as to how the total supply is to be obtained / generated. The details of the source of electricity, earthing requirement, substation / panel boards, distribution system shall be prepared and necessary approval from Employer obtained before proceeding of the execution of the job.
- 26.2.3 **The main contractor shall take consideration, the requirements of the sub / petty contractors' electric power supply and arrive at the capacity of main source of power supply from diesel generators.**
- 26.2.4 **As the sub / petty contractors' small capacity generators create more noise and safety hazard, no small capacity diesel generators shall be allowed for whatsoever the type of job to be executed under this contract.**
- 26.2.5 **If any unsafe noise making small capacity diesel generators are found used by sub / petty contractors the main contractor shall only be penalised.**
- 26.3 **Work on site**
- 26.3.1 **The contractor shall also submit electrical single line diagram, schematic diagram and the details of the equipment for all temporary electrical installation and these diagrams together with the temporary electrical equipment shall be submitted to the Employer's for necessary approval. Failure to do so shall invite penalty as per relevant clause.**
- 26.4 Strength and capability of electrical equipment
- 26.4.1 No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.
- 26.5 Adverse or hazardous environments
- 26.5.1 Electrical equipment which may reasonably foreseeably be exposed to-
- (a) mechanical damage;
 - (b) the effects of the weather, natural hazards, temperature or pressure;
 - (c) the effects of wet, dirty, dusty or corrosive conditions; or
 - (d) any flammable or explosive substance, including dusts, vapours or gases, shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, danger arising from such exposure.
- 26.6 Distribution system:
- 26.6.1 The contractor shall provide distribution system for control and distribution of electricity from a main AC supply of 50Hz for typical appliances,



- i) Fixed plant – 400V 3 phase
 - ii) Movable plant fed via trailing cable over 3.75 kW – 400 3 phase
 - iii) Installation in site buildings – 230V single phase
 - iv) Fixed flood lighting – 230V single phase
 - v) Portable and hand tools – 115V single phase
 - vi) Site lighting - 115V single phase
 - vii) Portable hand lamps – 115V single phase
- 26.7 Electrical protection circuits
- 26.7.1 Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeable become charged as a result of either the use of a system, or a fault in a system, becomes so charged. A conductor shall be regarded as earthed when conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth connect it to the general mass of earth.
- If a circuit conductor is connected to earth or to any other reference point, nothing which might reasonably be expected to give rise to danger by breaking the electrical continuity or introducing high impedance shall be placed in that conductor unless suitable precautions are taken to prevent that danger.
- 26.7.2 Appropriate electrical protection shall be provided for all circuits, against over load, short circuit and earth fault current.
- 26.7.3 The contractor shall provide sufficient ELCBs (maintain sensitivity 30 mA) / RCCBs for all the equipments (including Potable equipments), electrical switchboards, distribution panels etc. to prevent electrical shocks to the workers.
- 26.7.4 All protection devices shall be capable of interrupting the circuit without damage to any equipments and circuits in case of any fault may occur.
- 26.7.5 Rating of fuses and circuit breakers used for the protection of circuits should be coordinate with equipment power ratings.
- 26.7.6 Protection against lightning shall be ensured to all equipment kept in open at sites.
- 26.8 Cables:
- 26.8.1 Cables shall be selected after full consideration of the condition to which they shall be exposed and the duties for which they are required. Supply cable up to 3.3 kV shall be in accordance with BS 6346.
- 26.8.2 For supplies to mobile or transportable equipment where operating of the equipment subjects the cable to flexing, the cable shall conform to any of these codes BS 6007 / BS 6500 / BS 7375.
- 26.8.3 Flexible cords with a conductor cross sectional area smaller than 1.5 mm² shall not be used and insulated flexible cable shall conform to BS 6500 and BS 7375.
- 26.8.4 Where low voltage cables are to be used, reference shall be made to BS 7375. The following standards shall also be referred to particularly for under ground cables BS 6346 and BS 6708



- 26.8.5 Cables buried directly in the ground shall be of a type incorporating armour or metal sheath or both. Such cables shall be marked by cable covers or a suitable marking tape and be buried at a sufficient depth to avoid their being damaged by any disturbance of the ground. Cable routes shall be marked on the plans kept in the site electrical register.
- 26.8.6 Cabling passing under the walk way and across way for transport and mobile equipment shall be laid in ducts at a minimum depth of 0.6 meters.
- 26.8.7 Cables that need to cross open areas, or where span of 3m or more are involved, a catenary wire on poles or other supports shall be provided for convenient means of suspension. Minimum height shall be 6 m above ground.
- 26.8.8 Cables carrying a voltage to earth in excess of 65V other than supply for welding process shall have metal armour or sheath, which has been effectively earthed and monitored by the contractor. In case of flexible and trailing cables such earthed metal sheath and/or armour should be in addition to the earth core in the cable and shall not be used as the protective conductor.
- 26.8.9 Armoured cables having an over-sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring
- 26.9 **Plugs, socket-outlets and couplers:**
- 26.9.1 **The contractor shall ensure plugs, socket-outlets, and couplers available in the construction site as “splash proof” type. The minimum degree of Ingress Protection should be of IP44 in accordance with BS EN 60529.**
- 26.9.2 Only plugs and fittings of the weatherproof type shall be used and they should be colour coded in accordance with the Internationally recognised standards for example as detailed as follows:
- (a) 110 volts : Yellow.
 - (b) 240 volts : Blue.
 - (c) 415 volts : Red.
- 26.10 Connections
- 26.10.1 **Every joint and connection in a system shall be mechanically and electrically suitable for use to prevent danger. Proper cable connectors as per national/international standards shall only be used to connect cables.**
- 26.10.2 **No loose connections or tapped joints shall be allowed any where in the work site, office area, stores and other areas. Penalty as per relevant clause shall be put in case of observation of any tapped joints.**
- 26.11 Portable and hand-held equipments:
- 26.11.1 The contractor shall ensure the use of double insulated or all-insulated portable electrical hand equipment may be used without earthing (i.e. two core cables), but they shall still be used only on 110V because of the risk of damage to trailing leads.



26.12 Other equipments:

- 26.12.1 All equipment shall have the provision for major switch/cut-off switch in the equipment itself.
- 26.12.2 All non-current carrying metal parts of electrical equipment shall be earthed through insulated cable
- 26.12.3 Isolate exposed high-voltage (over 415 Volts) equipment, such as transformer banks, open switches, and similar equipment with exposed energized parts and prevent unauthorised access.
- 26.12.4 Approved perimeter markings shall be used to isolate restricted areas from designated work areas and entryways and shall be erected before work begins and maintained for entire duration of work. Approved perimeter marking shall be installed with either red barrier tape printed with the words "DANGER—HIGH VOLTAGE" or a barrier of yellow or orange synthetic rope, approximately 1 to 1.5 meter above the floor or work surface.

26.13 Work on or near live conductors

- 26.13.1 No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless-
 - a) it is unreasonable in all the circumstances for it to be dead; and
 - b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and
 - c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

26.14 Inspection and Maintenance

- 26.14.1 All electrical equipment should be permanently numbered and a record kept of the date of issue, date of last inspection and recommended inspection period.
- 26.14.2 Fixed installations shall be inspected at least at three monthly intervals; routine maintenance being carried out in accordance with equipment manufactures recommendations.

27.0 Lighting:

- 27.1 The contractor shall provide sufficient site lighting, of the right type and at the right place for it to be properly effective. Lighting ought not to introduce the risk of electric shock. Therefore, 230V supplies should be used for those fittings, which are robustly installed, and well out of reach e.g. flood lighting or high-pressure discharge lamps.

27.2 Selection of Luminaries:

The contractor shall select the luminaries as per the area requirement indicated below:

Type of Lighting	Area of Requirement	Luminaries
Area Lighting	Workmen and vehicles to move about in safely.	i) Shovel type: non-symmetrical ii) Symmetrical or non-symmetrical tungsten halogen



Beam flood lighting	Concentrated light over an area from a relatively great distance.	<ul style="list-style-type: none"> i) Portable flood light (Conical beam) ii) Wide angle flood (fan shaped beam) iii) Medium or narrow angle flood (Conical beam)
Dispersive lighting	Lighting for indoor	<ul style="list-style-type: none"> i) Dispersive (Mercury florescent) ii) Cargo cluster iii) Florescent trough
Walkway lighting	Lighting for stairways, ladder ways, corridors, scaffold access routs, etc.	<ul style="list-style-type: none"> i) Well glass unit ii) Bulkhead unit (tungsten filament) iii) Bulk head unit (Florescent)
Local lighting	Lighting on sites and fittings are generally accessible to operatives	<ul style="list-style-type: none"> i) PAR (Parabolic Aluminised Reflector) lamp cluster ii) Festoons (with or without shades) iii) Adjustable florescent work lamp iv) Portable flood lamp (mounted on own cable drum)

27.3 The contractor shall ensure that luminaries should always be placed so that no person is required to work in their own shadow and so that the local light for one person is not a source of glare for the others. Strongly made clamps should be available for attaching luminaries to poles and other convenient supports.

27.4 Luminaries should be robust, resistant to corrosion and rain proof especially at the point of the cable entry.

27.5 The correct type of lamp for each luminaries should always be used and when lamps need to be replaced if shall be in accordance with the supply voltage.

27.6 Lamp holders not fitted with a lamp should be capped off.

27.7 The contractor shall take every effort to illuminate the work site as per the Employer's requirement illustrated in general instruction **JMRC/SHE/GI/0011**.

28.0 Hand Tools and Power Tools

28.1 General

28.1.1 The contractor is wholly responsible for the safe condition of tools and equipment used by his employees and that of his sub-contractors.

28.1.2 Use of short / damaged hand tools shall be avoided and the contractor shall ensure all his hand tools used at his worksite are safe to work with or stored and shall also train his employees (including his sub-contractors) for proper use thereby.



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- 28.1.3 All hand tools and power tools shall be duly inspected before use for safe operation.
- 28.1.4 All hand tools and power tools shall have sufficient grip and the design specification on par with national/international standards on anthropometrics.
- 28.2 Hand tools
- 28.2.1 Hand tools shall include saws, chisels, axes and hatches, hammers, hand planes, screw drivers, crow bars, nail pullers.
- 28.2.2 The contractor shall ensure that,
- i) For crosscutting of hardwood, saws with larger teeth points (no. of points per inch) shall be preferred to avoid the saw jumping out of the job.
 - ii) Mushroom headed chisels shall not be used in the worksite where the fragments of the head may cause injury.
 - iii) Unless hatchet has a striking face, it shall be used as a hammer.
 - iv) Only knives of retractable blades shall be used in the worksite.
 - v) No screwdrivers shall be used for scraping, chiselling or punching holes.
 - vi) A pilot hole shall always be driven before driving a screw.
 - vii) Wherever necessary, usage of proper PPEs shall be used by his employees.
- 28.3 Power tools
- 28.3.1 Power tools include drills, planes, routers, saws, jackhammers, grinders, sprayers, chipping hammers, air nozzles and drills.
- 28.3.2 The contractor shall ensure that
- i) Electric tools are properly grounded or / and double insulated.
 - ii) GFCIs/ RCCBs shall be used with all portable electric tool operated especially outdoors or in wet condition.
 - iii) Before making any adjustments or changing attachments, his workers shall disconnect the tool from the power source.
 - iv) When operating in confined spaces or for prolonged periods, hearing protection shall be required. The same shall also apply to working with equipments, which gives out more noise as mentioned in clause **43.0** of this contract document.
 - v) Tool is held firmly and the material is properly secured before turning on the tool.
 - vi) All drills shall have suitable attachments respective of the operations and powerful for ease of operation.
 - vii) When any work / operation need to be performed repeatedly or continuously, tools specifically designed for that work shall be used. The same is applicable to detachable tool bit also.
 - viii) Size of the drill shall be determined by the maximum opening of the chuck in case of drill bit.
 - ix) Attachments such as speed reducing screwdrivers and buffers shall be provided to prevent fatigue and undue muscle strain to his workers.
 - x) Stock should be clamped or otherwise secured firmly to prevent it from moving.
 - xi) Workers shall never stand on the top of the ladder to drill holes in walls / ceilings, which can be hazardous, instead standing on the fourth or fifth rung shall be recommended.



- xii) Electric plane shall not be operated with loose clothing or long scarf or open jacket.
- xiii) Safety guards used on right angle head or vertical portable grinders must cover a minimum of 180° of the wheel and the spindle / wheel specifications shall be checked.
- xiv) All power tools / hand tools shall have guards at their nip points.
- xv) Low profile safety chain shall be used in case of wood working machines and the saw shall run at high rpm when cutting and also correct chain tension shall be ensured to avoid "kickback".
- xvi) Leather aprons and gloves shall be used as an additional personal protection auxiliary to withstand kickback.
- xvii) Push sticks shall be provided and properly used to hold the job down on the table while the heels moves the stock forward and thus preventing kickbacks.
- xviii) Air pressure is set at a suitable level for air actuated tool or equipment being used. Before changing or adjusting pneumatic tools, air pressure shall be turned off.
- xix) Only trained employees shall use explosive actuated tools and the tool shall also be unloaded when not in use.
- xx) Usage of such explosive actuated tools shall be avoided in case of places where explosive/flammable vapours or gases may be present.
- xxi) Explosive actuated tools and their explosives shall be stored separately and be taken out and loaded only before the time of immediate use.
- xxii) Misfired cartridges of explosive actuated tools must be placed in a container of water and be removed safely from the project.
- xxiii) No worker shall point any power operated / hand tool to any other person especially during loading / unloading.

29.0 Welding, Gouging and Cutting

- 29.1 Gas cylinders in use shall be kept upright on a custom-built stand or trolley fitted with a bracket to accommodate the hoses and equipment or otherwise secured. The metal cap shall be kept in place to protect the valve when the cylinder is not connected for use.
- 29.2 Hose clamp or clip shall be used to connect hoses firmly in both sides of cylinders and torches.
- 29.3 All gas cylinders shall be fixed with pressure regulator and dial gauges
- 29.4 Non-return valve and Flashback arrester shall be fixed at both end of cylinder and torch.
- 29.5 Domestic LPG cylinders shall not be used for Gas welding and Cutting purpose.
- 29.6 DCP or CO₂ type Fire Extinguisher not less than 5 kg shall be fixed at or near to welding process zone in an easily accessible location. Fire Extinguisher should confirm to IS 2190: 1992.
- 29.7 Use firewatchers if there is a possibility of ignition unobserved by the operator (e.g. on the other side of bulkheads).
- 29.8 Oxygen cylinders and flammable gas cylinders shall be stored separately, at least 6.6 meters (20 feet) apart or separated by a fire proof, 1.6 meters (5 feet) high partition. Flammable substances shall not be stored within 50 feet of cylinder storage areas.



- 29.9 Transformer used for electrical arc welding shall be fixed with Ammeter and Voltmeter and also fixed with separate main power switch.
- 29.10 Welding grounds and returns should be securely attached to the work by cable lugs, by clamps in the case of stranded conductors, or by bolts for strip conductors. The ground cable will not be attached to equipment or existing installations or apparatus.
- 29.11 Use a low voltage open circuit relay device if welding with alternating current in constricted or damp places.
- 29.12 Take precautions against the risk of increased fume hazards when welding with chrome containing fluxed consumables or high current metal inert gas (MIG) or tungsten inert gas (TIG) processes.
- 29.13 Avoid being in contact with water or wet floors when welding. Use duckboards or rubber protection.
- 29.14 All electrical installations shall meet the IS: 5571: 1997 and NFPA 70 for gas cylinder storage area and other hazardous areas.
- 29.15 The current for Electric arc welding shall not exceed 300 A on a hand welding operation.

30.0 Dangerous and harmful environment

As per BOCWR Rule 40,

- i) When internal combustion engines are to be used into a confined space or excavation or tunnel or any other workplace where neither natural or artificial ventilation system is inadequate to keep carbon monoxide below 50ppm, exposure of building workers shall be avoided unless suitable measures are taken and provided by the contractor.
- ii) No worker shall be allowed into any confined space or tank or trench or excavation wherein there is given off any dust, fumes / vapours or other impurities which is likely to be injurious or offensive, explosive or poisonous or noxious or gaseous material or other harmful articles unless steps are carried out by the contractor and certified by the responsible person to be safe.

31.0 Fire prevention, protection and fighting system

- 31.1 **The contractor shall ensure that construction site is provided with fire extinguishing equipment sufficient to extinguish any probable fire at construction site. An adequate water supply is provided at ample pressure as per national standard.**
- 31.2 Recharging of fire extinguishers and their proper maintenance should be ensured and as a minimum should meet Indian National Standards
- 31.3 All drivers of vehicles, foreman, supervisors and managers shall be trained on operating the fire extinguishers and fire fighting equipment.
- 31.4 The contractor shall also give consideration to the provision of adequate fire fighting arrangements within the underground and tunnelling operations including the provision of Fire Service compatible hose connections and emergency lighting



- 31.5 As per the RBOCW Rules 2009, Rule 106(a)(vii), all lifting appliances' driver cabin should be provided with a suitable portable fire extinguisher.
- 31.6 Combustible scrap and other construction debris should be disposed off site on a regular basis. If scrap is to be burnt on site, the burning site should be specified and located at a distance no less than 12 metres from any construction work or any other combustible material.
- 31.7 Every fire, including those extinguished by contractor personnel, shall be reported to the Employer representatives.
- 31.8 Emergency plans and Fire Evacuation plans shall be prepared and issued . Mock drills should be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the Telephone Number of the local fire brigade should be prominently displayed near each telephone on site.

32.0 Corrosive substances

- 32.1 As per BOCWR Rule 44, corrosive substances including alkalis and acids shall be stored and used by a person dealing with such substances at a building / construction site in a manner that it does not endanger the building worker and suitable PPE shall be provided by the contractor to the worker during such handling and work. In case of spillage of such substances on building worker, the contractor shall take immediate remedial measures.

33.0 Demolition

- 33.1 The Contractor shall ensure that
- i) all demolition works be carried out in a controlled manner under the management of experienced and competent supervision.
 - ii) the concerned department of the Government or local authority be informed and permission obtained wherever required. Media shall also be informed regarding this concern.
 - iii) **all glass or similar materials or articles in exterior openings are removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines are put-off and such lines so located or capped with substantial coverings so as to protect it from damage and to afford safety to the building workers and public.**
 - iv) examine the walls of all structures adjacent to the structure to be demolished to determine thickness, method of support to such adjacent structures
 - v) no demolishing work be performed if the adjacent structure seems to be unsafe unless and until remedial measures like sheet piling, shoring, bracing or similar means be ensured for safety and stability for adjacent structure from collapsing.
 - vi) debris / bricks and other materials or articles shall be removed by means of
 - a) chutes
 - b) buckets or hoists
 - c) through openings through floors or
 - d) any other safe means
 - vii) no person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition and the area be provided with substantial barricades.



34.0 Excavation and Tunnelling:

34.1 Excavation

34.1.1 The contractor shall ensure

- i) where any construction building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than one 1.5 m above his footing, such worker is protected by adequate piling and bracing against such bank or side.
- ii) where banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank.
- iii) excavated material is not stored at least 0.65 m from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank
- iv) metal ladders and staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where, the depth of such excavation exceeds 1.5 m and such ladders, staircases or ramps comply with the IS 3696 Part 1&2 and other relevant national standards.
- v) trench and excavation is protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection is an improved protection in accordance with the design and drawing of a professional engineer, where such depth exceeds 4m.

34.2 Tunnelling

34.2.1 The contractor shall inform in writing to the Director General within 30 days, prior to the commencement of any tunnelling work.

34.2.2 The contractor shall appoint a responsible person for safe operation for tunnelling work as per Rule 121 & 125 of BOCWR.

34.2.3 The contractor shall ensure

- i) every compressed air system in a tunnel is provided with emergency power supply for maintained continued supply of compressed air as per Rule 155 of BOCWR
- ii) watertight bulkhead doors are installed at the entrance of a tunnel to prevent flooding.
- iii) reliable and effective means of communication such as telephone or walkie-talkie are provided and maintained for arranging better effective communication at an excavation or tunnelling work as per Rule 136 of BOCWR.
- iv) all portable electrical hand tools and inspection lamp used in under ground and confined space at an excavation or tunnelling work is operated at a voltage not exceeding 24V.
- v) only flame proof equipment of appropriate type as per IS:5571:2000 and or other relevant national standard is used inside the tunnel



- vi) petrol or LPG of any other flammable substances are not used, stored inside the tunnel except with prior approval from Employer, and also no oxy-acetylene gas is used in a compressed air environment in excavation or tunnelling
- vii) adequate number of water outlets provided for fire fighting purpose, an audible fire alarm and adequate number and types of fire extinguishers are provided and maintained.
- viii) temperature in any working chamber in an excavation or tunnelling work where workers employed does not exceed 29°C as per Rule 165 of BOCWR.
- ix) all working areas in a free air tunnel are provided with ventilation system as approved by the Director General and the fresh air supplied in such tunnel is not less than 6 m³/min for each worker employed in tunnel as per Rule 153 of BOCWR.

34.3 Warning signs and notices:

34.3.1 The contractor shall ensure that

- i) suitable warning signs or notices, required for the safety of building workers carrying out the work of an excavation or tunnelling, shall be displayed or erected at conspicuous places in Hindi and in a language understood by majority of such building workers at such building such excavation or tunnelling work
- ii) such warning signs and notices with regard to compressed air working shall include
 - a) the danger involved in such compressed air work
 - b) fire and explosion hazard
 - c) the emergency procedures for rescue from such danger or hazards.

35.0 Work Permit system

35.1 The Contractor shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form an essential part of safe systems of work for many construction activities. They allow work to start only after safe procedures have been defined and they provide a clear record that all foreseeable hazards have been considered. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments.

35.2 A permit is needed when construction work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work. Examples of high-risk activities include but are not limited to:

- i) Entry into confined spaces
- ii) Work in close proximity to overhead power lines and telecommunication cables.
- iii) Hot work.
- iv) To dig—where underground services may be located.
- v) Work with heavy moving machinery.
- vi) Working on electrical equipment
- vii) Work with radioactive isotopes.
- viii) Heavy lifting operations and lifting operations closer to live power line

35.3 The permit-to-work system should be fully documented, laying down:

- i) How the system works;



- ii) The jobs it is to be used for;
- iii) The responsibilities and training of those involved; and
- iv) How to check its operation;

35.4 A Work Permit authorisation form shall be completed with the maximum duration period not exceeding 12 hours.

35.5 A copy of each Permit To Work shall be displayed, during its validity, in a conspicuous location in close proximity to the actual works location to which it applies.

36.0 Traffic Management

36.1 The basic objective of the following guidelines is to lay down procedures to be adopted by contractor to ensure the safe and efficient movement of traffic and also to ensure the safety of workmen at construction sites.

36.2 All construction workers should be provided with high visibility jackets with reflective tapes as most of viaduct /tunnelling and station works or either above or under right-of-way. The conspicuity of workmen at all times shall be increased so as to protect from speeding vehicular traffic.

36.3 The guiding principles to be adopted for safety in construction zone are to

- i) Warn the road user clearly and sufficiently in advance.
- ii) Provide safe and clearly marked lanes for guiding road users.
- iii) Provide safe and clearly marked buffer and work zones
- iv) Provide adequate measures that control driver behaviour through construction zones.

36.4 Legal permission

36.4.1 In all cases, the contractor shall employ proper precautions. Wherever operations undertaken are likely to interfere with public traffic, specific traffic management plans shall be drawn up and implemented by the contractor in consultation with the approval of local police authorities and/or the concerned metropolitan/civil authorities as the case may be.

36.4.2 Such traffic management plans shall include provision for traffic diversion and selection of alternative routes for transport of equipment. If necessary, the contractor shall carry out road widening before commencement of works to accommodate the extra load

36.5 The primary traffic control devices used in work zones shall include signs, delineators, barricades, cones, pylons, pavement markings and flashing lights.

36.6 The road construction and maintenance signs which fall into the same three major categories as do other traffic signs, that are Regulatory Signs, Warning Signs and Direction (or guidelines) Signs shall only be used. The IRC: 67 (Code of Practice for Road Signs) provide a list of traffic signs. The size, colours and placement of sign shall confirm to IRC: 67.

36.7 Regulatory signs



- 36.7.1 Regulatory signs impose legal restriction on all traffic. It is essential, therefore, that they are used only after consulting the local police and traffic authorities.
- 36.8 Warning signs
- 36.8.1 Warning signs in the traffic control zone shall be utilised to warn the drivers of specific hazards that may be encountered.
- 36.8.2 The contractor shall place detour signage at strategic locations and install appropriate warning signs. In order to minimize disruption of access to residences and business, the contractor shall maintain at least one entrance to a property where multiple entrances exist.
- 36.8.3 A warning sign as given in general instruction **JMRC/SHE/GI/012** shall be installed at all secondary road which merges with the primary road where the construction work is in progress at sufficient distance before it merges with the primary road so as to alert the road users regarding the 'Metro Work in Progress'.
- 36.8.4 Materials hanging over / protruded from the chassis / body of any vehicle especially during material handling shall be indicated by red indicator (red light/flag) to indicate the caution to the road users.
- 36.9 Delineators
- The delineators are the elements of a total system of traffic control and have two distinct purposes:
- i) To delineate and guide the driver to and along a safe path
 - ii) As a taper to move traffic from one lane to another.
- 36.9.1 These channelising devices such as cones, traffic cylinders, tapes and drums shall be placed in or adjacent to the roadway to control the flow of traffic. These should normally be retro-reflectors complying to IRC: 79 - Recommended Practice for Road Delineators.
- 36.9.2 Traffic cones and cylinders
- Traffic cones of 500mm, 750mm and 1000mm high and 300mm to 500mm in diameter or in square shape at base and are often made of plastic or rubber and normally have retro-reflectorised red and white band shall be used wherever required.
- 36.9.3 Drums
- Drums about 800mm to 1000mm high and 300mm in diameter can be used either as channelising or warning devices. These are highly visible, give the appearance of being formidable objects and therefore command the respect of drivers.
- 36.9.4 Barricades
- 36.9.4.1 Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and other temporary structures.



36.9.4.2 The structure dimension of the barricade, material and composition, its colour scheme, JMRC logo and other details shall be in accordance with specifications laid down in tender document.

36.9.4.3 All barricades shall be erected as per the design requirements of the Employer, numbered, painted and maintained in good condition and also Barricade in-charge maintains a barricade register in site.

36.9.4.4 **All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricade. Conspicuity shall be ensured by affixing retro reflective stripes of required size and shape at appropriate angle at the bottom and middle portion of the barricade at a minimum gap of 1000mm. In addition minimum one red light or red light blinker should be placed at the top of each barricade.**

36.9.5 The contractor shall ensure that all his construction vehicles plying on public roads (like dump trucks, trailers, etc.) have proper license to ply on public roads from the State Transport Authority. Drivers holding proper valid license as per the requirements of Motor Vehicles Act shall drive these vehicles

36.9.6 The contractor shall not undertake loading and unloading at carriageways obstructing the free flow of vehicular traffic and encroachment of existing roads by the contractor applying the excuse of work execution.

36.9.7 **Tow away vehicle**

36.9.7.1 **The contractor shall make arrangements keeping tow away van / manpower to tow away any breakdown vehicle in the traffic flow without losing any time at his cost.**

36.9.8 **Cleaning of roads**

36.9.8.1 **The contractor shall ensure the cleanliness of roads and footpaths by deploying proper manpower for the same. The contractor shall have to ensure proper brooming, cleaning washing of roads and footpaths on all the time throughout the entire stretch till the currency of the contract including disposal of sweepage.**

37.0 Work to adjacent railways

37.1 Whenever work is to be conducted in close proximity to the live railways then the following measures shall need to be addressed:

- (a) The rules provided for in the Railway's manual shall be followed.
- (b) No persons are allowed to encroach onto the railway unless specific authority has been given by the owner.
- (c) Adequate protection in accordance with the railway owner's requirements shall be followed. (Provision of Block Inspectors, Flagmen and Lookouts)
- (d) All persons shall wear high visibility clothing at all times.
- (e) Any induction training requirements of the railways shall be strictly observed

38.0 Batching Plant / Casting Yard

- i) The batching plant / casting yard shall be effectively planned for smooth flow of unloading and stacking the aggregates reinforcements and cement, batching plant,



transport of concrete, casting the segment, stacking the segment and loading the segments to the trucks. As far as possible the conflicts should be avoided.

- ii) The batching plant / casting yard shall be barricaded and made as a compulsory PPE zone
- iii) If in case of material unloading area is not maintainable as PPE zone, the same shall be segregated properly and made as a non-PPE zone with appropriate barrications.
- iv) Electrical system shall also be suitably planned so that location of diesel generator, if any, location of DBs, routing of cables and positioning of area lighting poles/masts does not infringe on any other utility and pose danger.
- v) Drainage shall be effectively provided and waste water shall be disposed after proper treatment
- vi) Time office, canteen, drinking water, toilet and rest place shall be suitably located for the easy access to workers. All the facilities shall be properly cleaned and maintained during the entire period of operation.
- vii) Manual handling of cement shall be avoided to a larger extent. Whenever it is absolutely necessary the workmen shall be given full body protection, hand protection and respiratory protection as a basic measure of ensuring better health.
- viii) The PPEs provided to cement handling workmen shall conform to international standards.
- ix) Access roads and internal circulation roads shall be well laid and maintained properly at all time.
- x) Non-adherence to any of the above provision shall be penalised as per relevant penalty clause.

39.0 Personal Protective Equipments (PPEs)

39.1 The contractor shall provide required PPEs to workmen to protect against safety and / or health hazards. Primarily PPEs are required for the following protection

- i) Head Protection (Safety helmets)
- ii) Foot Protection (Safety footwear, Gumboot, etc)
- iii) Body Protection (High visibility clothing (waistcoat/jacket), Apron, etc)
- iv) Personal fall protection (Full body harness, Rope-grap fall arrester, etc)
- v) Eye Protection (Goggles, Welders glasses, etc)
- vi) Hand Protection (Gloves, Finger coats, etc)
- vii) Respiratory Protection. (Nose mask, SCBAs, etc)
- viii) Hearing Protection (Ear plugs, Ear muffs, etc)

39.2 **The PPEs and safety appliances provided by the contractor shall be of the standard as prescribed by Bureau of Indian Standards (BIS). If materials conforming to BIS standards are not available, the contractor as approved by the Employer shall procure PPE and safety appliances.**

39.3 **All construction workers should be provided with high visibility jackets with reflective tapes confirming to the requirement specified under BS EN 471: 1994 as most of viaduct /tunnelling and station works are executed either above or under right-of-way. The conspicuity of workmen at all times shall be increased so as to protect them from speeding vehicular traffic.**

39.4 The contractor shall provide **safety helmet, safety shoe and high visibility clothing** for all employees including workmen, traffic marshal and other employees who are engaged for any work under this contract as per the following requirement.



All employees of the Contractor including workmen	Traffic marshals
<ul style="list-style-type: none"> i) Hard hat with company Logo ii) Safety boots iii) Hi-visibility waistcoat covering upper body and meeting the following requirements as per BS EN 471:1994: <ul style="list-style-type: none"> a) Background in fluorescent orange-red in colour b) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm² c) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm² d) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back. e) The bottom strip shall be at a distance of 5cm from the bottom of the vest. f) Strips must be retro reflective and fluorescent g) Waistcoat shall have a side adjustable fit and a side and front tear-away feature on vests made of nylon. 	<ul style="list-style-type: none"> i) Hard hat with reflective tape ii) Safety boots iii) Hi-visibility jacket covering upper body and meeting the following requirements as per BS EN 471:1994 : <ul style="list-style-type: none"> a) Background in fluorescent orange-red in colour b) Jackets with full-length sleeves with two bands of retro reflective material, which shall be placed at the same height on the garment as those of the torso. The upper band shall encircle the upper part of the sleeves between the elbow and the shoulder; the bottom of the lower band shall not be less than 5cm from the bottom of the sleeve. c) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm² d) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm² e) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back. f) The bottom strip shall be at a distance of 5cm from the bottom of the vest. g) Strips must be retro reflective and fluorescent.

39.4.1 Colour coding for helmets

Safety Helmet Colour Code (Every Helmet should have the LOGO* affixed /painted)	Person to use
White	JMRC staffs
Grey	All Designers, Architect, Consultants, etc.
Violet	Main Contractors (Engineers / Supervisors)
Blue	All Sub-contractors (Engineers / Supervisors)
Red	Electricians (Both Contractor and Sub-contractor)
Green	Safety Professionals (Both Contractor and Sub-contractor)
Orange	Security Guards / Traffic marshals
Yellow	All workmen



White (with "VISITOR" sticker)	Visitors
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Note: LOGO*

1. Logo shall have its outer dimension 2"X2" and shall be conspicuous
2. Logo shall be either painted or affixed
3. No words shall come either on Top / Bottom of Logo

Logo of the corresponding main contracting company for their employees and sub-contracting company for their employees shall only be used.

- 39.5 In addition to the above any other PPE required for any specific jobs like, welding and cutting, working at height, tunnelling etc shall also be provided to all workmen and also ensure that all workmen use the PPEs properly while on the job.
- 39.6 The contractor shall not pay any cash amount in lieu of PPE to the workers/sub-contractors and expect them to buy and use during work.
- 39.7 The contractor shall at all time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Employer during the inspections. Failing to do so shall invite appropriate penalty as per the provisions of the contract.
- 39.8 It is always the duty of the contractor to provide required PPEs for all visitors. Towards this required quantity of PPEs shall be kept always at the security post.

40.0 Visitors to site

- 40.1 No visitor is allowed to enter the site without the permission of the Employer. All authorised visitors should report at the site office. Contractor shall provide visitor's helmet (White helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the site.
- 40.2 All Visitors shall be accompanied at all times by a responsible member of the site personnel.
- 40.3 The contractor shall be fully responsible for all visitors' safety and health within the site..



**PART – III : OCCUPATIONAL HEALTH
AND WELFARE**



41.0 Physical fitness of workmen

41.1 The contractor shall ensure that his employees/workmen subject themselves to such medical examination as required under the law or under the contract provision and keep a record of the same.

41.2 The contractor shall not permit any employee/workmen to enter the work area under the influence of alcohol or any drugs.

42.0 Medical Facilities

42.1 Medical Examination

42.1.1 The contractor shall arrange a medical examination of all his employees including his sub-contractor employees employed as drivers, operators of lifting appliances and transport equipment before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, once in every two years up to the age of 40 and once in a year, thereafter.

- i) The Contractor shall maintain the confidential records of medical examination or the physician authorized by the Employer.
- ii) No building or other construction worker is charged for the medical examination and the cost of such examination is borne by contractor employing such building worker.
- iii) The medical examination shall include: -
 - a) Full medical and occupational history.
 - b) Clinical examination with particular reference to
 - i) General Physique;
 - ii) Vision: - Total visual performance using standard orthorator like Titmus Vision Tester should be estimated and suitability for placement ascertained in accordance with the prescribed job standards.
 - iii) Hearing: - Persons with normal must be able to hear a forced whisper at twenty-four feet. Persons using hearing aids must be able to hear a warning shout under noisy working conditions.
 - iv) Breathing: - Peak flow rate using standard peak flow meter and the average peak flow rate determined out of these readings of the test performed. The results recorded at pre-placement medical examination could be used as a standard for the same individual at the same altitude for reference during subsequent examination.
 - v) Upper Limbs: - Adequate arm function and grip
 - vi) Spine: - Adequately flexible for the job concerned.
 - vii) Lower Limbs: - Adequate leg and foot concerned.
 - viii) General: - Mental alertness and stability with good eye, hand and foot coordination.
 - c) Any other tests which the examining doctor considers necessary

42.1.2. If the contractor fails to get the medical examination conducted as mentioned above, the employer will have the right to get the same conducted by through an agency with intimation to the contractor and deduct the cost and overhead charges.



42.2 Occupational Health Centre

42.2.1 The contractor shall ensure at a construction site an occupational health centre, mobile or static is provided and maintained in good order. Services and facilities as per the scale lay down in Schedule X of BOCWR. A construction medical officer appointed in an occupational health centre possesses the qualification as laid down in Schedule XI of BOCWR.

42.3 Ambulance van and room

42.3.1 The contractor shall ensure at a construction site of a building or other construction work that an ambulance van and room are provided at such construction site or an arrangement is made with a nearby hospital for providing such ambulance van for transportation of serious cases of accident or sickness of workers to hospital promptly and such ambulance van and room are maintained in good repair and is equipped with standard facilities specified in Schedule IV and Schedule V of BOCWR.

42.4 First-aid boxes

42.4.1 The contractor shall ensure at a construction site one First-aid box for 100 workers provided and maintained for providing First-aid to the building workers. Every First-aid box is distinctly marked "First-aid" and is equipped with the articles specified in Schedule III of BOCWR.

42.5 HIV/ AIDS prevention and control

42.5.1 The contractor shall adopt the Employer's Policy on "HIV / AIDS Prevention and Control for Workmen Engaged by Contractors" and the copy of the policy is given in **Appendix No.: 4**.

42.5.2 The Employer will engage a professional agency for implementing the guidelines laid down in the policy and communicate to the contractor.

42.5.3 The Contractor shall extend necessary support to the appointed agency by deputing the workmen to attend the awareness creation programmes.

42.5.4 The contractor shall also extend necessary organizational support to the appointed agency for the effective implementation of the Employers' workplace policy on HIV/AIDS for workmen of the Contractors.

42.5.5 As laid down in the policy the contractor shall identify peer educators (1 for every 100 workers) and refer them for professional training to the Employers' appointed agency for the purpose.

42.5.6 **The peer educators on completion of the training shall serve as the focal point for any information, education and awareness campaign among the workmen throughout the contract period.**

42.5.7 The peer educators will be paid a monthly honorarium as fixed by the Employer for rendering his services in addition to his regular duty.

42.5.8 The total number of peer educators (1 for 100 workers) shall always be maintained by the contractor.



42.5.9 **In case if these peer educators leave the contractor by creating vacancy, then the contractor at his own expense train the new replacement peer educator from the Employers' appointed agency for the purpose.**

42.5.10 It is suggested to the contractor that due care should be taken to select the peer educators from among the group of workmen so that they remain with the contractor throughout the contract period.

42.6 Prevention of mosquito breeding

42.6.1 Measures shall be taken to prevent breeding at site. The measures to be taken shall include:

- i) Empty cans, oil drums, packing and other receptacles, which may retain water shall be deposited at a central collection point and shall be removed from the site regularly.
- ii) Still waters shall be treated at least once every week with oil in order to prevent mosquito breeding.
- iii) Contractor's equipment and other items on the site, which may retain water, shall be stored, covered or treated in such a manner that water could not be retained.
- iv) Water storage tanks shall be provided.

42.6.2 Posters in both Hindi and English, which draw attention to the dangers of permitting mosquito breeding, shall be displayed prominently on the site.

42.6.3 **The contractor at periodic interval shall arrange to prevent mosquito breeding by fumigation / spraying of insecticides. Most effective insecticides shall include SOLFAC WP 10 or Baytex, The Ideal Larvicide etc.**

42.7 Alcohol and drugs

42.7.1 The contractor shall ensure at all times that no employee is working under the influence of alcohol / drugs which are punishable under Govt. regulations.

42.7.2 Smoking at public worksites by any employee is also prohibited as per Govt. regulations.

43.0 Noise

43.1 The Contractor shall consider noise as an environmental constraint in his design, planning and execution of the Works and provide demonstrable evidence of the same on Employer's request. The Contractor shall, at his own expense, take all appropriate measures to ensure that work carried out by the Contractor and by his sub-Contractors, whether on or off the Site, will not cause any unnecessary or excessive noise which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise.

43.1.1 Without prejudice to the generality of the foregoing, noise level reduction measures shall include the following:

- i) The Contractor shall ensure that all powered mechanical equipment used in the Works shall be effectively sound reduced using the most modern techniques available including but not limited to silencers and mufflers.
- ii) The Contractor shall construct acoustic screens or enclosures around any parts of the Works from which excessive noise may be generated.



- 43.1.2 The Contractor shall ensure that noise generated by work carried out by the Contractor and his sub-Contractors during daytime and night time shall not exceed the maximum permissible noise limits, whether continuously or intermittently, as given in the project SHE Manual. The same may be varied from time to time by and at the sole discretion of the Employer. In the event of a breach of this requirement, the Contractor shall immediately re-deploy or adjust the relevant equipment or take other appropriate measures to reduce the noise levels and thereafter maintain them at levels which do not exceed the said limits. Such measures may include without limitation the temporary or permanent cessation of use of certain items of equipment.
- 43.1.3 The noise monitoring requirements including monitoring locations are given in the project SHE Manual.
- 43.2 Control Requirements
- 43.2.1 Construction material should be operated and transported in such a manner as not to create unnecessary noise as outlined below:
- i) Perform Work within the procedures outlined herein and comply with applicable codes, regulations, and standards established by the Central and State Government and their agencies.
 - ii) Keep noise to the lowest reasonably practicable level. Appropriate measures will be taken to ensure that construction works will not cause any unnecessary or excessive noise, which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise. Use equipment with effective noise-suppression devices and employ other noise control measures as to protect the public.
 - iii) Schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
 - iv) The Contractor shall submit to the Employer a Noise Monitoring and Control Plan (NMCP) under contract specific Site Environmental Plan. It shall include full and comprehensive details of all powered mechanical equipment, which he proposes to use during daytime and night time, and of his proposed working methods and noise level reduction measures. The NMCP shall include detailed noise calculations and vibration levels to demonstrate the anticipated noise generation and vibrations by the Contractor.
 - v) The NMCP prepared by the Contractor shall guide the implementation of construction activity. The NMCP will be reviewed on a regular basis and updated as necessary to assure that current construction activities are addressed. It may appear as a regular agenda item in project coordination meetings, if noise is an issue at any location in the contract.
- 43.3 Occupational Noise
- i) Protection against the effects of occupational noise exposure should be provided when the sound levels exceeds the threshold values as provided in Project SHE Manual.
 - ii) When employees are subjected to sound levels exceeding those listed in the Table, feasible administrative or engineering controls should be utilized as given in this document and JMRC's Project SHE Manual.



- iii) If such controls fail to reduce sound levels within the levels of the table, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.
- iv) When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula and sample computation as given in project SHE Manual.

43.4 Vibration Level

- 43.4.1 In locations where the alignment is close to historical / heritage structures, the contractor shall prepare a monitoring scheme prior to construction at such locations. This scheme for monitoring vibration level at such historical / heritage sites shall be submitted to Employer for his approval. This scheme shall include:
- i) Monitoring requirements for vibrations at regular intervals throughout the construction period.
 - ii) Pre-construction structural integrity inspections of historic and sensitive structures in project activity.
 - iii) Information dissemination about the construction method, probable effects, quality control measures and precautions to be used.
 - iv) The vibration level limits at work sites adjacent to the alignment shall conform to the permitted values of peak p velocity as given in article project SHE Manual.

44.0 Ventilation and illumination

44.1 Ventilation

- 44.1.1 The contractor shall ensure at a construction site of a building or other construction work that all working areas in a free tunnel are provided with ventilation system as approved by the DG/CIIBC and the fresh air supply in such tunnel is not less than 6m³/min for each building worker employed underground in such tunnel and the free air flow movement inside such tunnel is not less than 9m/min.

- 44.1.2 The oxygen level shall not be less than 19.5% in the working environment.

44.2 Illumination

- 44.2.1 The contractor shall take every effort to illuminate the work site as per the Employer's requirement illustrated in general instruction **JMRC/SHE/GI/0011**.
- 44.2.2 **The contractor shall conduct a monthly illumination monitoring by lux meter for all the locations and the report shall be sent to the Employer within 7th of the next month and the same shall be reviewed during the monthly SHE committee meeting.**

45.0 Radiation

- 45.1 The use of radioactive substances and radiating apparatus shall comply with the Govt. regulatory requirements and all subsidiary legislation



- 45.2 Operations involving ionising radiation shall only be carried out after having been reviewed without objection by the Employer's representative and shall be carried out in accordance with a method statement.
- 45.3 each area containing irradiated apparatus shall have warning notices and barriers, as required by the Regulations, conspicuously posted at or near the area.
- 45.4 Radioactive substances will be stored, used or disposed shall be strictly in accordance with the Govt. Enactments.
- 45.5 The contractor shall ensure that all site personnel and members of the public are not exposed to radiation.
- 46.0 **Welfare measures for workers**
- 46.1 Latrine and Urinal Accommodation
- 46.1.1 **The contractor shall provide one latrine seat for every 20 workers up to 100 workers and thereafter one for every additional 50 workers. In addition one urinal accommodation shall be provided for every 100 workers.**
- 46.1.2 When women are employed, separate latrine and urinals accommodation shall be provided on the same scale as mentioned above.
- 46.1.3 Latrine and urinals shall be provided as per Section 33 of BOCWA and maintained as per Rule 243 of BOCWR and shall also comply with the requirements of public health authorities
- 46.1.4 Moving sites
- 46.1.4.1 In case of works like track laying, the zone of work is constantly moving at elevated level or at underground level. In such cases mobile toilets with proper facility to drain the sullage shall be provided at reasonably accessible distance.
- 46.1.5 **In case if the contractor fail to provide required number of urinals and latrines or fail to maintain it as per the requirements of Public Health laws, the Employer shall have the right to provide/maintain through renowned external agencies like "Sulabh" at the cost of the contractor.**
- 46.2 **Canteen:**
- 46.2.1 **In every workplace wherein not less than 250 workers are ordinarily employed the contractor shall provide an adequate canteen conforming to Section 37 of BOCWA, Rule 244 of BOCWR and as stipulated in Rule 247 of BOCWR the charges for food stuff shall be based on 'no profit no loss' basis. The price list of all items shall be conspicuously displayed in such canteen.**
- 46.3 **Serving of tea and snacks at the workplace:**
- 46.3.1 **As per Rule 246 of BOCWR, at a building or other construction work where a workplace is situated at a distance of more than 200 m from the canteen provided under Rule 244(1) of BOCWR, the contractor employing building works shall make suitable arrangement for serving tea and light refreshment to such building works at such place.**



46.4 **Drinking water**

46.4.1 **As per Section 32 of BOCWA the contractor shall make in every worksite, effective arrangements to provide sufficient supply of wholesome drinking water with minimum quantity of 5 litres per workman per day. Quality of the drinking water shall conform to the requirements of national standards on Public Health.**

46.4.2 While locating these drinking water facility due care shall be taken so that these are easily accessible within a distance of 200m from the place of work for all workers at all location of work sites.

46.4.3 All such points shall be legible marked "Drinking Water" in a language understood by a majority of the workmen employed in such place and such point shall be situated within six metres of any washing places, urinals or latrines.

46.5 **Labour Accommodation**

46.5.1 **The contractor shall provide free of charges as near as possible, temporary living accommodation to all workers conforming to provisions of Section 34 of BOCWA. These accommodations shall have cooking place, bathing, washing and lavatory facilities.**

46.6 **Creches**

46.6.1 In every workplace where in more than 50 female workers are ordinarily employed, there shall be provided and maintained a suitable room for use of children under age of 6 yrs, conforming to the provisions of Section 35 of BOCWA.



PART – IV : ENVIRONMENTAL MANAGEMENT



47.0 Air Quality

- 47.1 The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer.
- 47.2 The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer.
- 47.3 If after commencement of construction activity, Employer believes that the Contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer and implemented.
- 47.4 In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional/ alternative equipment by the Contractor or maintenance/modification of existing equipment of the Contractor.
In the event that approved remedial measures are not being implemented and serious impacts persist, the Employer may direct the Contractor to suspend work until the measures are implemented, as required under the Contract.
- 47.5 Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India or the State Government from time to time. The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.
- 47.6 The Contractor shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records available for inspection by Employer.
- 47.7 The Contractor shall cover loads of dust generating materials like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free- board to avoid spills through the tail board or side boards.
- 47.8 The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Employer. The Contractor shall place excavation materials in the dumping/disposal areas designated in the plans as given in the specifications.
- 47.9 The temporary dumping areas shall be maintained by the Contractor at all times until the excavate is re-utilised for backfilling or as directed by Employer. Dust control activities shall continue even during any work stoppage.
- 47.10 The Contractor shall place material in a manner that will minimize dust production. Material shall be minimized each day and wetted, to minimize dust production. During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.



- 47.11 The Contractor shall water down construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition. The Contractor will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use. Dust screens will be used, as feasible when additional dust control measures are needed specially where the work is near sensitive receptors.
- 47.12 The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
- 47.13 The Contractor shall design and implement his blasting techniques so as to minimise dust, noise, vibration generation and prevention fly rock.
- 47.14 Blasting technique should be consistent not only with nature and quantity of rock to be blasted but also the location of blasting.
- 47.15 The contractor shall give preference to explosives with better environmental characteristics.
- 47.16 The Contractor shall protect structures, utilities, pavements roads and other facilities from disfiguration and damage as a result of his activities. Where this is not possible, the contractor shall restore the structures, utilities, pavements, roads and other facilities to their original or better, failing which the rectification/restoration work shall be carried out at the risk and cost of the contractor.
- 47.17 The Contractor shall submit to the Employer an Air Monitoring and Control Plan (AMCP) under contract specific Site Environmental Plan to guide construction activity insofar as it relates to monitoring, controlling and mitigating air pollution.

48.0 Water Quality

- 48.1 The Contractor shall comply with the Indian Government legislation and other State regulations in existence in Jaipur insofar as they relate to water pollution control and monitoring. A drainage system should be constructed at the commencement of the Works, to drain off all surface water from the work site into suitable drain outlet.
- 48.2 The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter including public roads or existing stream courses and drains within or adjacent to the site. In the event of any spoil or debris from construction works being deposited or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Employer.
- 48.3 Due to lowering of potable water supplies in Jaipur and subsequent contamination of ground water, the Contractor is not allowed to discharge water from the site without the approval of the Employer. The Contractor must comply with the requirements of the Central Ground Water Board for discharge of water arising from dewatering. Any water obtained from dewatering systems installed in the works must be either re-used for construction purposes and this water may subsequently be discharged to the drainage system or, if not re-used, recharged to the ground water at suitable aquifer levels. The Contractor must submit his proposals for approval of Employer, on his proposed locations of dewatering of excavation and collection of water for either construction re-use or recharge directly to



aquifers. The Contractor's recharge proposals must be sufficient for recharging of the quantity of water remaining after deduction of water re-used for construction. During dewatering, the contractor shall monitor ground water levels from wells to ensure that draw down levels do not exceed allowable limits. The Contractor will not be permitted to directly discharge, to the drainage system, unused ground water obtaining from the excavation without obtaining approval of Employer or the Agency controlling the system.

- 48.4 The Contractor shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited in the watercourses but are suitably collected and residue disposed off in a manner approved by local authorities.
- 48.5 All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed off at a location and in a manner that will cause neither pollution nor nuisance.
- 48.6 Any mud slurry from drilling, tunnelling, diaphragm wall construction or grouting etc. shall not be discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc. The Contractor shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.
- 48.7 The Contractor shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.
- 48.8 The bentonite mixing, treatment and handling system shall be established by the contractor giving due regard to its environmental impacts. The disposal of redundant bentonite shall be carefully considered whether in bulk or liquid form. The disposal location will be advised and agreed with the relevant authorities.
- 48.9 The Contractor shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body. Oil removal / interceptors shall be provided to treat oil waste from workshop areas etc.
- 48.10 The Contractor shall apply to the appropriate authority for installing bore wells for water supply at site.

49.0 Archaeological and Historical Preservation

- 49.1 The contractor shall seek to accommodate archaeological and historical preservation concerns that may arise due to the construction of the project especially in close vicinity of such areas where such monuments may be located.
- 49.2 The contractor shall consult the Archaeological Survey of India (ASI). Other competent authorities and other parties, on the advise of the Employer, to identify and assess construction effects and seek ways to avoid, minimize or mitigate adverse effects on such monuments.
- 49.3 Adverse effects may include reasonably foreseeable effects caused by the construction that may occur later in time, be farther removed in distance or those that alter, howsoever temporarily, the significance of the structure.



50.0 Landscape and Greenery

- 50.1 As far as is reasonably practicable, the Contractor shall maintain ecological balance by preventing deforestation and defacing of natural landscape. In respect of ecological balance, the Contractor shall observe the following instructions.
- 50.2 The Contractor shall, so conduct his construction operations, as to prevent any avoidable destruction, scarring or defacing of natural surrounding in the vicinity of work.
- 50.3 Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary works, the same shall be repaired, replanted or otherwise corrected at Contractor's expense. All work areas shall be smoothened and graded in a manner to conform to natural appearance of the landscape as directed by the Employer.
- 50.4 A suggested list of trees/shrubs suitable for planting and landscaping is found in Employer's Project SHE Manual.

51.0 Felling of Trees

- 51.1 The contractor shall identify the number and type of trees that are required to be felled as a result of construction of works and facilities related to Jaipur Metro Project and inform the Employer.
- 51.2 All trees and shrubbery, which are not specifically required to be cleared or removed for construction purposes, shall be preserved and shall be protected from any damage that may be caused by Contractor's construction operations and equipment. The contractor shall not fell, remove or dispose of any tree or forest produce in any land handed over to him for the construction of works and facilities related to Jaipur Metro except with the previous permission obtained from the Forest Department.
- 51.3 The Employer shall arrange permission from the forest department for trees to be felled or transplanted. The Employer will permit the removal of trees or shrubs only after prior approval.
- 51.4 Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by used of protective barriers or other methods approved by the Employer. Trees shall not be used for anchorage.

52.0 Fly Ash

- 52.1 The Employer may require the contractor to use fly ash as a percentage substitution of cement, in concrete for certain structures and works.
- 52.2 In all such uses of Fly Ash, the contractor shall maintain a detailed record of usage of Fly Ash. The contractor shall also collect related details and provide to the Employer.
- 52.3 The reporting details on consumption of Fly Ash are found in Employer's SHE Manual.



53.0 Waste

- 53.1 The contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works, which may include: -
- i) Identification of disposal sites.
 - ii) Identification of quantities to be excavated and disposed off.
 - iii) Identification of split between waste and inert material
 - iv) Identification of amounts intended to be stored temporarily on site location of such storage.
 - v) Identification of intended transport means and route.
 - vi) Obtaining permission, where required, for disposal.
- 53.2 Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Engineer for approval.
- 53.3 The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimizing potential for pollution. The Contractor shall maintain and clean waste storage areas regularly.
- 53.4 The Contractor shall remove waste in a timely manner and disposed off at landfill sites after obtaining approval of Jaipur Municipal Corporation for its disposal.
- 53.5 Burning of wastes is prohibited. The Contractor shall not burn debris or vegetation or construction waste on the site but remove it in accordance with **50.1** above.
- 53.6 The Contractor shall make arrangement to dispose of metal scrap and other saleable waste to authorized dealer and make available to the Employer on request, records of such sales.

54.0 Hazardous Waste Management

- 54.1 If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989, amendments 2000, 2003" shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- 54.2 Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- 54.3 The contractor shall identify the nature and quantity of hazardous waste generated as a result of his activities and shall file a 'Request for Authorisation' with Rajasthan State Pollution Control Board along with a map showing the location of storage area.
- 54.4 Outside the storage area, the contractor shall place a 'display board', which will display quantity and nature of hazardous waste, on date. Hazardous Waste needs to be stored in a secure place



- 54.5 It shall be the responsibility of the contractor to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The labelling and packaging is required to be easily visible and be able to withstand physical conditions and climatic factors.
- 54.6 The contractor shall approach only Authorised Recyclers of Hazardous Waste for disposal of Hazardous Waste, under intimation to the Employer.
- 54.7 Submittal of all environment related documents and records pertaining to monitoring and trend analysis on key parameters such as but not limited to consumption/efficient use of resources such as energy, water, material such as cement, fly ash, iron and steel, recycle/reuse of waste etc that shall have demonstrated continual improvement in the implementation of Environmental management System. Failure to do so the employer shall impose appropriate penalty as indicated under penalty clause.

55.0 Energy Management

- 55.1 The contractor shall use and maintain equipment so as to conserve energy and shall be able to produce demonstrable evidence of the same upon Employer's request.
- 55.2 Measures to conserve energy include but not limited to the following:
- i) Use of energy efficient motors and pumps
 - ii) Use of energy efficient lighting, which uses energy efficient luminaries
 - iii) Adequate and uniform illumination level at construction sites suitable for the task
 - iv) Proper size and length of cables and wires to match the rating of equipment
 - v) Use of energy efficient air conditioners
- 55.3 The contractor shall design site offices maximum daylight and minimum heat gain. The rooms shall be well insulated to enhance the efficiency of air conditioners and the use of solar films on windows may be used where feasible.



PART – V : PENALTY AND AWARDS



56.0 Charges to be recovered from contractor for unsafe act or condition

56.1 JMRC has built an image of safety conscious organisation meticulously over a period of three years. Any reportable accident (fatality / injury) results in loss of life and/or property damage. These accidents not only result in loss of life but also damage the reputation of JMRC. Most of the accidents are avoidable and caused preliminary due to contractors' negligence. Hence JMRC shall recover the cost of damages from the contractors for every reportable incident (fatality / injury).

56.2 In addition every JMRC work site is exposed to public scrutiny as the work is executed just on the right-of-way. Any unsafe act / unsafe condition observed by public further damages our reputation. Because of the non-voluntary compliance of contractors to the condition of contract on SHE and project SHE manual, JMRC has been forced to establish safety-enforcing organisation. The cost of established such organisation is to be recovered from contractors for all observed safety violations at sites.

56.3 The following table indicates the Safety, Health and Environment violation (unsafe act / unsafe condition) and charges to be recovered from contractors.

SL. NO.	TOPIC	UNSAFE ACT/UNSAFE CONDITION	DEDUCTIBLE AMOUNT
1.	SHE Policy & Plan	i) SHE policy a) non-compliance of clause 4.1 b) Inadequate coverage, not signed c) Not displayed at prominent locations	Rs.5,000 per single violation, compounded to a maximum of Rs.25,000 at any single instance.
		ii) SHE plan: a) Not as per Employers' content and coverage b) Delay in submission c) Not updated as per employer's instruction as per clause 4.4 d) Copies not provided to all required supervisors / engineers	Rs.1,00,000 per single violation, compounded to a maximum of Rs.2,00,000 at any single instance.
2.	SHE Organisation	i) Not complying to the minimum manpower requirements as mentioned in General Instruction JMRC/SHE/001 ii) Not filling up the vacancies created due to SHE personnel leaving the contractor within 14 days. iii) SHE organisation not provided with required Audio-visual and other equipments as per General Instruction JMRC/SHE/012 iv) Employing through outsourcing	i) Rs.1,00,000 per month for first month and Rs.2,00,000 for subsequent months ii) Rs.50,000 per month for first month and Rs.1,00,000 for subsequent months For items iii), iv), v) and vi) Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations



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		agencies and SHE personal are not in the payroll of the main contractor v) Disobedience / Improper conduct of any SHE personnel. vi) Chief SHE Manager not reporting directly to CPM of contractor.	
3.	SHE committee	i) Failed to formulate or conduct SHE Committee meeting for any month ii) Contractor and Sub-contractor representatives not attending SHE Committee meetings iii) Failed to conduct Site inspection before conducting SHE Committee meeting iv) Failed to send SHE Committee Meeting minutes or Agenda to Employer in time v) Non-adherence of clause 7.7.1 vi) Non-adherence of clause 7.9	i) Rs.1,00,000 for the first violation and Rs.5,00,000 for the subsequent violations ii) Rs.5,000 to the contractor of the member who had not attended the meeting for first violation and Rs.25,000 for subsequent violations. For item iii), iv), v) and vi) Rs.25,000 for first violation and Rs.50,000 for subsequent violations
4.	ID card	i) Non-adherence of clause 8.1, 8.2 and 8.3	Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations
5.	SHE Training	i) Not complying to the requirements as mentioned in conditions of contract on SHE and project SHE manual with regard to: a) Induction training not given b) Supervisor/engineer/manager training not conducted as per clause 9.6 c) Refresher training as per clause 9.7 and 9.11 not conducted d) Tool-box talk not conducted as per clause 9.8 e) Skill development training not conducted as clause 9.9 f) Daily Safety Oath not conducted as per clause 9.10 g) Top management behaviour based SHE training conducted	For item 1 a) to g) Rs.50,000 for first violation on and Rs.1,00,000 for subsequent violations
6.	SHE Inspection	i) Not complying to the requirements as mentioned in conditions of contract on SHE and project SHE manual as per clause 10.0 ii) Non compliance of clause 10.3.6	Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations
7.	SHE audit	Internal Audit: MARS i) Not conducted as per SHE Plan ii) Report not sent to Employer iii) Action not taken for any month	For item i) to iii) Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations.



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		<p>External Audit</p> <p>iv) Not conducted as per SHE Plan</p> <p>v) Report not sent to employer</p> <p>vi) Action not taken for any quarter</p>	<p>For item iv) to vi)</p> <p>Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations.</p>
8.	SHE Communication	<p>i) Important days to be observed for SHE awareness as furnished by employer not observed</p> <p>ii) Posters as furnished by Employer not printed and displayed</p>	<p>i) Rs.10,000 for first violation and Rs.50,000 for subsequent violations</p> <p>ii) 2,00,000 per contract</p>
9.	SHE Submittals	<p>i) Non compliance of clause 13.1</p> <p>ii) Non compliance of clause 13.2</p> <p>iii) Non compliance of clause 13.3</p>	<p>For item i)</p> <p>Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations</p> <p>For item ii) and iii)</p> <p>Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations</p>
10.	Injury and Incidence reporting	<p>i) Fatal accidents</p> <p>ii) Injury accident</p> <p>iii) Abnormal delay in reporting accidents or wilful suppression of information about any accidents / dangerous occurrence as per clause 14.1.4</p> <p>iv) Delay in informing about any accidents / dangerous incidents.</p> <p>v) Non-compliance of the clause 14.4</p>	<p>i. Rs.5,00,000 for first fatality and Rs.10,00,000 for every subsequent fatality.</p> <p>ii. Rs.1,00,000 for first grievously injured person and Rs.2,00,000 for every subsequent grievously injured person (Grievous Injury as defined by Workmen Compensation Act)</p> <p>iii. Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations</p> <p>For items iv) and v)</p> <p>Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations</p>
11.	Emergency preparedness Plan	Non-compliance of the clause 15.1,15.2, 15.3, 15.4, 15.5 and 15.6	Rs.1,00,000 for non-compliance of any of the clauses
12.	Housekeeping	<p>i) Housekeeping maintenance register not properly maintained up to date</p> <p>ii) Surrounding areas of drinking water tanks / taps not hygienically cleaned / maintained</p> <p>iii) Office, stores, toilet / urinals not properly cleaned and maintained.</p> <p>iv) Required dustbins at appropriate places not provided / not cleaned.</p> <p>v) Stairways, gangways, passageways blocked.</p>	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance



		<ul style="list-style-type: none"> vi) Lumber with protruding nails left as such vii) Openings unprotected viii) Excavated earth not removed within a reasonable time. ix) Truck carrying excavated earth not covered / tyres not cleaned. x) Vehicles / equipments parked / placed on roads obstructing free flow of traffic xi) Unused surplus cables / steel scraps lying scattered xii) Wooden scraps, empty wooden cable drums lying scattered xiii) Water stagnation leading to mosquito breeding 	
13.	Working at Height / Ladders and Scaffolds	<ul style="list-style-type: none"> i) Not using or anchoring Safety Belt ii) Not using Safety Net iii) Absence of life line or anchorage point to anchor safety belt iv) Non-compliance of clause 18.17 v) Using Bamboo ladders vi) Painting of ladders vii) Improper usage (less than 1m extension above landing point, not maintaining 1:4 ratio) viii) Aluminium ladders without base rubber bush ix) Usage of broken / weak ladders x) Usage of re-bar welded ladders xi) Improper guardrail, toe board, barriers and other means of collective protection xii) Improper working platform xiii) Working at unprotected fragile surface xiv) Working at unprotected edges 	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
14.	Lifting appliances and gear	<ul style="list-style-type: none"> i) Non availability of fitness certificate as per clause 21.3 ii) Documents not displayed on the machine or not available with the operator as per clause 21.4 iii) Maximum Safe Working Load not written on the machine as per clause 21.5 iv) Non-compliance of 21.6 v) Non-compliance of 21.7 vi) Automatic safe load indicator not provided or not in working condition as per clause 21.8 vii) Age of the operator less than 21 years or without any licence and non-compliance of other item as per clause 21.9 	Rs.50,000 per single violation Compounded to a maximum of Rs.5,00,000 at any single instance



		<ul style="list-style-type: none"> viii) Non-compliance of 21.10 ix) Non-compliance of any of the items mentioned regarding rigging requirements as per clause 21.11 x) Failure to submit method statement in case of all critical lifting xi) Person riding on crane. xii) Creating more noise and smoke xiii) Absence of portable fire extinguisher in driver cabin xiv) Fail to guard hoist platform xv) No fencing of hoist rope movement area xvi) Hoist platform not in the horizontal position 	
15.	Launching operation	Non-adherence of any of the provisions mentioned in clause 22.2	Rs. 50,000 for first violation and Rs.1,00,000 for subsequent violations .
16.	Site Electrical safety	<ul style="list-style-type: none"> i) Non-compliance of clause 26.1.1 ii) Non-compliance of clause 26.2.4, 26.2.5 iii) Non-compliance of clause 26.3.1 iv) Non-compliance of clause 26.7, 26.8 and 26.9.1 v) Non-compliance of clause 26.10 and 26.13 vi) Non-compliance of clause 28.3.2 vii) Exposed electric lines (fermentative damage) and circuits in the workplace. viii) Inserting of bare wires into the socket ix) Improper grounding for the electrical appliances x) Electrical cables running on the ground xi) Non-compliance clause 27.0 	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
17.	Hand tools and Power tools	<ul style="list-style-type: none"> i) Non-compliance of clause 28.0 	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
18.	Gas Cutting	<ul style="list-style-type: none"> ii) Wrong colour coding of cylinder. iii) Cylinders not stored in upright position. iv) Flash back arrester, non-return valve and regulator not present or not in working condition. v) Fail to put cylinders in a cylinder trolley. vi) Damaged hose. vii) Using domestic LPG cylinders viii) Fail to store cylinder 6.6m away from fire prone materials ix) Fail to use hose clamps x) Fire extinguisher not placed in the vicinity during operation 	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance



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19.	Welding	<ul style="list-style-type: none"> i) Voltmeter and Ammeter not working ii) Improper grounding and return path. iii) Damaged welding cable iv) Bare openings in the cable. v) Non-availability of separate switch in the transformer vi) Non-availability of main switch control to switch off power to the welding unit. vii) Usage of reinforcement rod as return conductor viii) Damaged holder ix) Fire extinguisher not placed in the vicinity during operation 	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance
20.	Fire precaution	<ul style="list-style-type: none"> i) Smoking and open flames in fire prone area ii) Using more than 24V portable electrical appliances in the fire prone area iii) Not proper ventilation in cylinder storage area. iv) Absence of fire extinguishers v) Fire extinguishers not refilled once in a year. vi) Fire extinguisher placed in a not easily accessible location 	Rs.5,000 per single violation Compounded to a maximum of Rs.25,000 at any single instance.
21.	Excavation, Tunnelling and confined space	<ul style="list-style-type: none"> i) Non-compliance of clause 34.1.1 ii) Non-compliance of clause 34.2.3 iii) Non-compliance of clause 34.3 	For any item from i) and ii) Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance. For item iii) Rs.10,000 per first violation and Rs.50,000 for subsequent violations
22.	Work permit system	<ul style="list-style-type: none"> i) Non-compliance of clause 35.2 ii) Non-compliance of clause 21.11.9 	For item i) and ii) Rs.50,000 per first violation and Rs.1,00,000 for subsequent violations
23.	Traffic Management	<ul style="list-style-type: none"> i) Non-compliance of clause 36.4.1 ii) Non-compliance of clause 36.8.3 iii) Non-compliance of clause 36.9.2 iv) Non-compliance of clause 36.9.3 v) Non-compliance of clause 36.9.7 vi) Non-compliance of clause 36.9.8 	Rs.1,00,000 per first violation and Rs.2,00,000 for subsequent violations



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		a) Barricades i) Not Cleaned ii) Not in alignment iii) Not numbered iv) Not painted v) Red lights / reflectors not working vi) Damages not repaired vii) Not secured properly viii) Barricade inspector not employed ix) Protruding parts / portions repaired x) Barricades maintaining register not properly maintained up to date	Rs.25,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
		b) Contractor Vehicles i) Over loading of vehicles ii) Unfit drivers or operators iii) Unlicensed vehicles iv) Absence of traffic marshals v) Absence of reversing alarm vi) Absence of fog light (at winter) vii) Power / hand brakes not in working condition.	Rs.25,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
		c) Splashing of Bentonite on roads / non-cleaning of tyres of dumpers and transit mixers i) Mishandling of bentonite like splashing of bentonite outside specified width of barricading ii) Non-cleaning of tyres of dumpers and transit mixers before leaving the site and thereby creating a traffic safety hazard to road users.	For item i) and ii) a) Rs.1,00,000 on first observation. b) Rs. 2,00,000 on second observation c) Rs. 3,00,000 on third and subsequent observations
24.	Batching plant / Casting yard	Non-adherence of any of the provisions mentioned in clause 38.0.	Rs. 10,000 for single violation compounded to a maximum of Rs.1,00,000 at any single instant.
25.	PPE	i) Not having ii) Not wearing (or) using and kept it elsewhere iii) Using damaged one iv) Using wrong type v) Using wrong colour helmet or helmet without logo vi) Using for other operation (e.g. Using safety helmet for storing materials or carrying water from one place to other) vii) Not conforming to BIS standard	From item i) to vi). Rs.200 per single violation For item vii) Rs.10,000 for first violation and Rs.50,000 for subsequent violations For item viii) Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations



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		viii) Non-compliance of clause 39.6, 39.7 and 39.8	
26.	Occupational Health	i) Fail to conduct Medical examination to workers ii) Absence of ambulance van & room iii) Workers not having ID card iv) Inadequate number of toilets v) Toilets not cleaned properly vi) Absence of water facilities for toilets and washing places vii) Toilet placed more than 500m from the work site viii) Absence of drinking water ix) Absence of first-aid person in work site. x) Absence or inadequacy of first-aid box. xi) Misuse of first-aid box. xii) First-aid box not satisfy the minimum Indian standard. xiii) Smoking inside the construction site xiv) Drink and drive or work xv) Excessive noise and vibration xvi) Canteen not provided xvii) Food stuff not served on no loss no profit basis xviii) Creche not provided xix) Accommodation not provided as per BOCWA xx) Fumigation / insecticides not sprayed to prevent Mosquito breeding xxi) Non-compliance of clause 44.1 and 44.2	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
27.	Labour Welfare measures	i) Non adherence of Labour welfare provisions of BOCWA ii) Fail to register establishment and display the registration certificate at workplace iii) Absence of workers register and records iv) Absence of muster roll and wages register v) Fail to display an abstract of BOCWA and BOCWR	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance
28.	Environmental Management	i) Tyre wash facility not provided ii) Spillage from vehicles not arrest iii) Air monitoring not practiced iv) Noise monitoring not practiced v) The values of air monitoring and noise monitoring not with in acceptable limits vi) Dust control measures at sites not	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance



		practiced vii) Improper disposal of debris / residues	
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56.4 **Without limiting to the unsafe acts and or conditions mentioned above in clause 56.3 the Employer shall have the right to deduct charges for any other unsafe act and or condition depending upon the gravity of the situation on a case-to-case basis. The charges shall be in comparison with that of the similar offence indicated in clause 56.3.**

57.0 Stoppage of work

57.1 The Employer shall have the right to stop the work at his sole discretion, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipments. In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury / accident.

57.2 The contractor shall not proceed with the work until he has complied with each direction to the satisfaction of Employer

57.3 The Contractor shall not be entitled for any damages / compensation for stoppage of work, due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages.

58.0 Awards

The following categories will be considered for awards as per the scheme in practice of Employer

- i) For every safe million man hour working without any reportable incidents
- ii) Zero fatality contracts
- iii) 100% adherence to voluntary reporting of all accidents throughout the currency of contract
- iv) Safest project team of the year.
- v) Best SHE team of the year.
- vi) Safest Contractor of the year.



APPENDIX



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 1	

Memorandum of Understanding between Jaipur Metro Rail Corporation (JMRC) and the Contractor for safe execution of contract work

This Memorandum of Understanding is made and executed by and between Jaipur Metro Rail Corporation Ltd. (JMRC), a Company registered under the Companies Act 1956 and having its registered office at Khanij Bhawan, Udyog Bhawan Premises, Tilak Nagar, C-Scheme, Jaipur-302005 or their authorized representative(s), hereinafter referred to as "EMPLOYER" (which expression shall wherever the context so requires or admits be deemed to mean and include its successors in business and assigns) of the one party
AND

M/s _____ having its registered office at _____ hereinafter referred to as the "CONTRACTOR" (which expression shall wherever the context so requires or admits be deemed to mean and include its successors in business and assigns) of the other party

WITNESSETH THAT

WHEREAS the EMPLOYER gives highest importance to the occupational safety, health and environment during execution of work, seeks cooperation from the CONTRACTOR in this endeavour.

Thus, this Memorandum of Understanding is for promoting the safety, health and environment aspects required to be followed at workplace/site and will be applicable to any site job to be done by the CONTRACTOR
AND

WHEREAS the CONTRACTOR has read all the terms and conditions of the EMPLOYER and whereas the CONTRACTOR has studied the following documents:

- (a) Tender Documents, including Notice Inviting Tender, General Conditions, Special Conditions,
- (b) Conditions of Contract on Safety, Health and Environment and Project Safety, Health and Environment Manual.
- (c) Building and Other Construction Workers (Regulations of Employment and Conditions of Service) Act 1996, Central Rules 1998 and subsequent Rajasthan Government Rules 2009, Building and Other Construction Workers Welfare Cess Act 1996 and Rules 1998 and Rajasthan Building and Other Construction Workers' Welfare Board Rules and
- (d) Indian Electricity Act 2003 and Rules 1956.
- (e) Corresponding International / Bureau of Indian Standard Codes.

The amendments to any of the above rules and any other rules & regulations or procedures, circulars, notices & advices laid down by the EMPLOYER from time to time.

Now it is hereby AGREED AND DECLARED by and between the EMPLOYER and the CONTRACTOR as follows:

Clause - I The CONTRACTOR shall abide by the terms and conditions stipulated in Condition of Contract on Safety, Health & Environment and Project Safety, Health



Safety, Health and Environment (SHE) Manual

& Environment Manual.

- Clause - II The CONTRACTOR shall undertake full responsibility for safe execution of job at work place/site and safety of his personnel and adjoining road users during work.
- Clause - III Without giving any prior notice, the EMPLOYER shall from time to time be entitled to add/or amend any or all terms and conditions with a view to improving safety and occupational health of personnel and safety of work, with immediate effect and the same shall be binding on the CONTRACTOR. The contractor agrees to implement all such amendments, which shall be laid down by the EMPLOYER.
- Clause - IV Besides following the guidelines, safety rules and regulations, safety codes given in various safety procedures/documents mentioned above, the CONTRACTOR shall also prepare detailed method statement which includes job safety analysis wherever there are complicated and hazardous/high risk working involved and get it approved from Employer before execution of work.
- Clause - V Any negligence or violation in implementing any of the provision of the conditions of contract on Safety, Health & Environment and JMRC project Safety, Health & Environment Manual shall be viewed seriously and the contractor is liable to compensate the employer for the loss of reputation. The cost of damage shall be fixed on case-to-case basis.

In witness thereof the Parties hereto by representatives duly authorised have executed this Memorandum of Understanding on _____ day of _____ 20____.

Signed on
For and on behalf of JMRC

Signed on
For and on behalf of (Contractor)

Signature:
Name:
Title:

Signature:
Name:
Title:



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 2	

Safety, Welfare and Occupational Health requirements as per BOCW Act 1996 and Rules 1998 and Rajasthan BOCW Rules 2009.

(This list has been prepared in chronological order with primary importance to Section of Act and secondary importance to Rules)

- S -** Refers relevant Sections in BOCWA
R - Refers relevant Rules in BOCWR
C - Refers relevant Chapter No. in BOCWR

Sl. No.	1. Items	Relevant Sections / Rules in BOCWA and BOCWR and RBOCWR
2.	Registration of establishment	S – 7, R – 23 to 27
3.	Display of registration certification at workplace	R – 26 (5)
4.	Hours of work	S – 28 R – 234 to 237
5.	Register of overtime	S – 28; S – 29 R – 241(1) Form XXII
6.	Weekly rest and payment at rest	R – 235
7.	Night shift	R – 236
8.	Maintenance of workers registers and records	S – 30 R – 238
9.	Notice of commencement and completion	S – 46 R – 239
10.	Register of persons employed as building workers	R – 240
11.	Muster roll and wages register	R – 241(1) (a); Form XVI and XVII
12.	Payment of wages	R – 248
13.	Display of notice of wages regarding	R – 249
14.	Register of damage or loss	R – 241(1)(a); Form XIX, XX, XXI
15.	Issue of wages book	R – 241(2)(a); Form XXIII
16.	Service certificate for each workers	R – 241(2)(b); Form XXIV
17.	Display an abstract of BOCWA and BOCWR	R – 241(5)
18.	Annual return	R – 242; Form XXV
19.	Drinking water	S – 32
20.	Latrines and Urinals	S – 33 R - 243
21.	Accommodation	S – 34
22.	Creches	S – 35
23.	First-aid boxes	S – 36 R – 231 and Schedule III
24.	Canteens	S – 37 R – 244
25.	Food stuff and other items served in the canteens	R – 245
26.	Supply of tea and snacks in work place	R – 246
27.	Food charges on no loss no profit basis	R - 247
28.	Delhi BOCW welfare Board Rules	R – 250 to 296



29.	Safety committee	S – 38 R – 208
30.	Safety officer	S – 38 R – 209 and Schedule VII
31.	Reporting of accidents and dangerous occurrences	S – 39, R – 210
32.	Procedure for inquiry in to the causes of accidents	R – 211
33.	Responsibility of employer	S - 44 R – 5
34.	Responsibility of Architects, Project engineer and Designers	R – 6
35.	Responsibility of workmen	R – 8
36.	Responsibility for payment of wages and compensation	S – 45
37.	Penalties and Procedures	S – 47; S – 55
38.	Excessive noise, vibration etc	R – 34
39.	Fire Protection	R – 35
40.	Emergency action plan	R – 36
41.	Fencing of motors	R – 37
42.	Lifting of carrying of excessive weight	R – 38
43.	Health, Safety and Environmental Policy	R – 39
44.	Dangerous and Harmful Environment	R – 40
45.	Overhead protection	R – 41
46.	Slipping, Tripping, Cutting, Drowning and Falling Hazards	R – 42
47.	Dust, Gases, Fumes, etc	R – 43
48.	Corrosive substance	R – 49
49.	Eye Protection	R – 45
50.	Head Protection and other protection apparel	R – 46; R – 54
51.	Electrical Hazards	R – 47
52.	Vehicular traffic	R – 48
53.	Stability of structure	R – 49
54.	Illumination	R – 50; R – 124
55.	Stacking of materials	R – 51
56.	Disposal of debris	R – 52
57.	Numbering and marking of floors	R – 53
58.	Lifting appliances and gears	C – VII; R – 55 to 81
59.	Runways and Ramps	C – VIII; R – 82 to 85
60.	Working on or adjacent to water	C – IX; R – 86 & 87
61.	Transport and earthmoving equipments	C – X; R – 88 to 95
62.	Concrete work	C – XI; R – 96 to 107
63.	Demolition	C – XII; R – 108 to 118
64.	Excavation and Tunnelling works	C – XIII; R – 119 to 168
65.	Ventilation	R – 153
66.	Construction, repair and maintenance of step roof	C – XIV; R – 169 to 171
67.	Ladders and Step ladders	C – XV; R – 172 to 174
68.	Catch platform and hoardings, chutes, safety belts and nets	C – XVI; R – 175 to 180
69.	Structural frame and formworks	C – XVII; R – 181 to 185
70.	Stacking and unstacking	C – XVIII; R – 186 & 187
71.	Scaffold	C – XIX; R – 188 to 205
72.	Cofferdams and Caissons	C – XX; R – 206 to 211
73.	Explosives	C – XXI; R – 212 & 213
74.	Piling	C – XXII; R – 214 to 222
75.	Medical Examination for building and other construction worker, Crane operator an Transport vehicle drivers	R – 81; R – 223(a)(iii) and Schedule XII



Safety, Health and Environment (SHE) Manual

76.	Medical examination for occupational health hazards	R – 233(a)(iv)
77.	Charging of workers for Medical Examination	R – 223(b)
78.	Occupational health centres and Medical officers	R – 225 and Schedule X & XI
79.	Ambulance van & room	R – 226 & 227 and Schedule IV & V
80.	Stretchers	R – 228
81.	Occupational health service for building workers	R – 229
82.	Medical examination for occupational health hazards	R – 223(a)(iv)
83.	Emergency care services and emergency treatment	R – 232
84.	Panel of experts and agencies	Central Rule 250 Rajasthan Rule 277
85.	Power of inspectors	Central rule 251 Rajasthan rule 278



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 3	


CONTENT OF SHE PLAN	
Contract No	
Contractor Name	
Project Name	

1	Project Highlights <ul style="list-style-type: none">i. Title of the contentii. Contractor Numberiii. Brief scope of workiv. Location map/ key planv. Period of the project
2	SHE Policy
3	Site Organisation Chart Chart indicating reporting of SHE personnel
4	Roles & Responsibility Individual responsibility of the <ul style="list-style-type: none">i. Project Managerii. Construction Manageriii. Construction Supervisorsiv. SHE Committee Membersv. SHE Inchargevi. Site Engineersvii. First Line Supervisorsviii. Sub-contractors
5	SHE Committee <ul style="list-style-type: none">i. Details - Chairman, Members, Secretary and Employer's representative,ii. Procedures for effective conduct of meeting
6	SHE Training
7	Subcontractor Evaluation, Selection and Control
8	SHE Inspection
9	SHE Audit
10	Accident Investigation And Reporting Procedures



11	Occupational Health Measures
12	Labour Welfare Measures
13	Risk assessment and mitigation procedures
14	Safe Work Procedures <ul style="list-style-type: none">i. Work at Heightii. Structural Steel Erectioniii. Launching of segmentsiv. Floor, Wall Openings and Stairwaysv. Welding, Cutting and Bracingvi. Lifting appliancesvii. Work Permit Systemsviii. Electrical Equipmentsix. Mechanical Equipmentsx. Excavationxi. Fire Preventionxii. Hazardous Chemicals and Solventsxiii. Ionising Radiationxiv. Lightingxv. Abrasive Blasting
15	Work Permit System
16	List of standard job specific PPEs to be used in the site
17	Maintenance of Regime for construction Equipment and Machinery
18	Traffic management
19	Housekeeping
20	Environmental Management
21	Emergency Management
22	Visitors and Security arrangement



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 4	

WORKPLACE POLICY ON HIV/AIDS PREVENTION & CONTROL FOR WORKMEN ENGAGED BY CONTRACTORS

“Being mobile in and of itself is not a risk factor for HIV infection. It is the situations encountered and the behaviours possibly engaged in during mobility or migration that increase vulnerability and risk regarding HIV / AIDS.”

UNAIDS, Technical update on ‘Population, Mobility and AIDS’, February 2001, p.5

Jaipur Metro Rail Corporation (JMRC) recognizes HIV / AIDS as a developmental challenge and realizes the need to respond to it by implementing regular HIV / AIDS prevention programmes and creating a non-discriminatory work environment for HIV infected workmen engaged by contractors. For the purpose of making conscientious, sensitive and compassionate decision in addressing the realities of HIV / AIDS, JMRC has established these guidelines based on ILO code of practice on HIV / AIDS.

- ▶ Creating awareness through professional agency using IEC (Information, Education and Communication) package specially designed for migrant workers.
- ▶ Institutional capacity building by training the project implementation team, Safety, Health & Environment (SHE) Managers, establishing linkages for efficient diagnosis and treatment of the affected workers, effective monitoring of implementation and documentation for further learning.
- ▶ Establishing peer educators by selecting them in consultation with contractors and training them through professional agencies so that they become focal point for any information, education and awareness campaigns among the workmen throughout the contract period.
- ▶ Promotion of social marketing of condoms through Rajasthan State Aids Control Society (RSACS).



Safety, Health and Environment (SHE) Manual

	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/001	

MINIMUM MANPOWER REQUIREMENTS OF SHE ORGANIZATION BASED ON CONTRACT VALUE

	1	2	3	4	5	6
Awarded Contract value (in Cr.)	Chief SHE Manager	Senior SHE Manager	Junior SHE Manager	Safety Steward	Senior SHE (Electrical) Engineer	Junior SHE (Electrical) Engineer
Upto 2	-	-	1	Refer Note 1	-	1
Upto 10	-	1	Refer Note 1		1	Refer Note 2
Upto 25	1	Refer Note 1			1	
Upto 100	1				1	
Upto 250	1				1	
More than 250	1				1	

	7	8	9	10	11	12	13
Awarded Contract value (in Cr.)	*Junior SHE (Fire) Manager / **Senior SHE (Fire) Manager	Occupational Health officer with Necessary Nursing Assistants (Refer Note3)	Environmental Manager	Senior SHE (Traffic) Engineer (Refer Note4)	Barricade Maintenance Squad (Refer Note4)	House Keeping Squad	Labour Welfare Officer
Upto 2	-	-	-	-	Refer Note 5	Refer Note 6	-
Upto 10	-	1 (PT)	1	1			1
Upto 25	1*	1 (PT)	1	1			1
Upto 100	1*	1 (FT)	1	1			1
Upto 250	1**	2(FT)	1	1			1 with support staff
More than 250	2**	2(FT)	1 with support staff	1			1 with support staff

Note 1: Adequate, qualified and trained SHE Professionals with required support staff to be deployed at each worksite at each shift.

Note 2: Adequate, qualified and trained Electrical Engineers / supervisors to be deployed at each worksite at each shift.



Note 3: (PT) means Part-Time and (FT) means Full-time.

Note 4: Senior SHE (Traffic) Engineer Post and Barricade Manager (including the staff) Posts are applicable to contracts where the work has to be executed either below or over the right-of-way like Viaduct, Tunnel Contracts wherein erection and maintenance of barricades are paramount important.

Note 5: One Barricade Manager supported by required supervisors and workmen

Note 6: One Housekeeping Manager supported by required supervisors and workmen



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/002	

MINIMUM QUALIFICATION AND EXPERIENCE FOR (SHE) SAFETY, ELECTRICAL, ENVIRONMENTAL, TRAFFIC ENGG. AND OCCUPATIONAL HEALTH PROFESSIONALS

Sl. No	Designation	Qualification	Experience (in years)
1	Chief SHE Manager	The Chief SHE Manager shall have qualified in any of the following degree/diploma: i) Post Graduate Diploma in Industrial Safety & Environmental Management (PGDISEM) from National Institute of Industrial Engineering, Mumbai ii) M.E. in Industrial Safety from NIT, Trichy, Tamil Nadu iii) M.E. in Industrial Safety from Mepco Schlenk Engineering College, Sivakasi, Tamil Nadu iv) B.E. in Fire and Safety Engg. From Cochin University of Science and Engg. Cochin, Kerala v) B.E. with advanced Safety Management Diploma from CLI / RLI Mumbai / Chennai / Kolkata and Kanpur. vi) B.E / B.Arch., with one year Full Time advanced Safety diploma from NICMAR, Hyderabad. vii) B.E/B.Tech with any other equivalent State and Central Govt. recognized full time Degree / Diploma in Safety. viii) International qualifications like CSP (Certified Safety Professional), NEBOSH, MIOSH, MSISO etc.	2 {for all category except (iv) and 5yrs for category (iv)}
2	Senior SHE Manager (Refer Note 3)	As stated in Sl. No:1 and in addition the following categories: i) B.Sc.(Physics/Chemistry/Maths) with one year Full Time advanced Safety diploma from NICMAR, Hyderabad ii) B.Sc. / Diploma in Engg. with advanced Safety Management Diploma from CLI / RLI / Mumbai / Chennai / Kolkata and Kanpur. iii) B.Sc. (Physics/Chemistry/Maths) with One year Full Time diploma in Safety Engineering offered by West Bengal State Technical Education Departments and similar courses by other states. iv) Any Graduate or diploma holder with 7 years of work experience in full fledged SHE department of any Public Sector / Leading Private Sector / MNC / with prior approval of employer on a case to case basis	2 {for category (i), (ii) and (iii) only}
3	Junior SHE Manager (Refer Note 3)	i) Degree in Science / Diploma in Engineering with Govt. recognized safety diplomas from Correspondence	2 (for category (i) only)



Safety, Health and Environment (SHE) Manual

		course of NICMAR, Annamalai University, National and State Productivity Councils, Other State Technical Education Boards etc. ii) Any Graduate or diploma holder with 5 years of work experience in full fledged SHE department of any Public Sector / Leading Private Sector / MNC / with prior approval of employer on a case to case basis	
4	Safety Steward (Refer Note 3)	Any basic qualification with any SHE related certificate courses.	2
5	Senior SHE (Electrical) Manager	Degree in Electrical Engineering + Govt. recognized Electrical Licence holder	2
6	Junior SHE (Electrical) Manager	Diploma in Electrical Engineering + Govt. recognized Electrical Licence holder	1
7	Senior SHE (Fire) Manager	i) B.E. (Fire) from National Fire Service College, Nagpur ii) B.E (Fire & Safety) from Cochin University iii) Graduate with any Govt. recognized diploma in Fire Safety with 5 years of experience	2 (for category (i) and (ii) only)
8	Junior SHE (Fire) Manager	Any Diploma holder with any Govt. recognized diploma in Industrial Fire Safety.	1
9	Occupational Health Officer	MBBS with Govt. recognized degree/diploma in Industrial/ occupational health	1
10	Environment Manager	Govt. recognized PG Degree / PG Diploma / Degree in Environmental Engineering / Science	2
11	Senior SHE (Traffic) Engineer	Govt. recognized PG Degree / Degree / Diploma in Traffic/Transportation Engineering or Planning	1
12.	House Keeping Squad -Manager	Any Diploma in Engineering	1
13	Barricade Manager	Any Diploma in Engineering	1
14	Labour Welfare Officer	Any Degree with Govt. Recognized Degree / Diploma / P G Diploma in Labour Welfare related fields like Law, Personnel / Industrial Relations etc.	2

Note 1: In some extraordinary cases where the candidate had earlier worked in JMRC Projects they can be considered for the following posts:

- i) Senior SHE Manager
- ii) Junior SHE Manager
- iii) Safety Steward

depending upon the qualification and no. of years of experience on a case to case basis even if they do not possess the prescribed qualification as listed above.

Note 2: In all other cases other than listed under note 3 (i), (ii) and (iii) irrespective their earlier experience with JMRC projects the candidates shall qualify as specified above.



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/003	

MINIMUM REQUIREMENTS OF SHE MONITORING AND AUDIO-VISUAL EQUIPMENTS

- For the purpose of minimum requirements of Audio-visual and Other equipment the contracts are categorized into the following groups:

Contract Value (Initial awarded value of contract)	Group
Upto 25 Cr	A
Upto 100 Cr	B
Upto 250 Cr	C
More than 250 Cr	D

- Every contractor falling into the above groups shall provide the following minimum required audio visual aids for conducting weekly review, monthly safety committee and other post review meeting of all fatal and major incidences effectively. These audio-visual equipments are a must for conducting periodical in-house safety presentations in the training programmes.
- In addition to the above portable hand held digital sound level meter (SLM) and portable hand held digital lux meter are also to be provided.

Sl.No	SHE monitoring and Audio-Visual Equipment details	SHE monitoring and Audio-Visual equipment required for			
		Group A Contract	Group B Contract	Group C Contract	Group D Contract
1.	Portable hand held Digital Sound Level Meter (SLM)	1	1	1	1
2.	Portable hand held Digital Lux Meter	1	1	1	1
3.	Laptop Computer with standard configuration including multi media facilities	1	1	1	1
4.	Colour Printer	1	1	1	1
5.	Computer projector with screen	-	1	1	1
6.	Overhead projector	1			
7.	35mm Camera (For taking accident investigation photos in which case the images can not be easily altered)	1	1	1	1



Safety, Health and Environment (SHE) Manual

8.	Digital camera with flash of minimum 4 mega pixel and video facility	1	1	1	2
9.	Digital still camera with flash of minimum 4 mega pixel	1	2	4	6
10.	Portable loudspeaker (for tool-box talk and emergency purpose)	1	1	2	6
11.	Communication facility like mobile phone, walky-talky etc	For all supervisors and managers/engineers working in Safety, Health & Environment			
12.	Accident investigation Kit containing the following:	1	1	1	2
a)	Chalk piece for marking				
b)	Measuring tape for measuring <ul style="list-style-type: none"> Flexible tape – 2m length Metal Foot long scale and Metal tape – 30m 				
c)	Equipment tags				
d)	Multipurpose Flash light				
e)	Barrier tape of 20m length				
f)	Accident investigation Forms and checklists				
g)	Enough Paper for witness recording and other noting				
h)	Emergency Phone Numbers list				



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction: JMRC/SHE/GI/004	

Training of Contractor's Employees/Staff/Worker's

Contractor shall provide a training/workshop on safety, health & environment (SHE) to all its workers/staff/employees/subcontractors of at least 2 weeks (96 hrs) at the time of induction. Before posting of any his worker's/staff/employees/subcontractors, the contractor shall give a certificate that the said person had undergone the requisite SHE training. Non compliance of the above will invoke penalties as per the condition of contract on SHE, of Tender Document.

The training shall cover following aspects:-

1. Hazard Identification Procedure

Hazards on site:

- Falls
- Earthing work
- Electricity
- Machinery
- Handling materials
- Transport
- Site housekeeping
- Fire

2. Personal Protective Equipment

- What is available?
- How to obtain it?
- Correct use and care.

3. Health

- Site welfare facilities
- Potential health hazards
- First Aid/CPR


4. Duties of the contractor

- Brief outline of the responsibilities of the Contractor by law
- Details of Contractor's accident prevention policy
- JMRC's SHE manual
- Building and other Constructions Welfare Law

5. Employee's Duties

- Brief outline of responsibilities of employee under law
- Explanation of how new employees fit into the Contractor's plan for accident prevention. (induction and orientation).



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/005	

ID Card Format

(85 mm x 55mm)

Front side of ID Card:

Name & Address of Main/Sub Contractor	
LOGO of Main/Sub Contractor Company	Location Jaipur Metro Rail Project
Name: Designation: Blood Group: Valid from: Valid up to:	Photo
Contractor's Authorised Signatory with seal	

Backside of ID Card:

Employee Address: _____ _____ _____
<div>1. This card is the property of "XX" (Main / Sub / Labour Contractor) and must be returned on demand and on transfer / cancellation of employment. 2 A charge will be levied for replacement of the card due to loss or theft 3 If found please return to</div>
Main contractors' Address



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/006	

SHE Training details for Managers and Supervisors

1. The Law and Safety	2. Policy and Administration
Statutory requirement Appropriate regulations Duties of employer and employee	Effect of incentive on accident prevention Human relations Consultation Safety Officer: duties, aims, objectives
3. Safety and the Supervisor	4. Principles of Accident Prevention
Safety and efficient production go together Accidents affect morale and public relations	Attitudes of management, supervision and operations Methods of achieving safe operations Accident and injury causes
5. Site Inspection	6. Human Behavior
The role of management Hazard Identification Procedure Records results Follow-up procedures Feedback	Motivating agencies Individual behavior Environmental effects Techniques of persuasion
7. Site housekeeping	8. Health
Site organization Relationship of site housekeeping to accident occurrence Site access Equipment storage Material stacking Materials handling	Medical examination Hazard to health on site Sanitation and welfare Protective clothing First Aid/CPR
9. Personal Protective Equipment	10. Electricity
Eye, face, hands, feet and legs Respiratory protective equipment Protection against ionizing radiation	Appreciation of electrical hazards Power tools Arc welding Low voltage system Lighting and power system on sites ELCB, RRCB, Grounding/Ground fault circuit interrupters (GFCIs)
11. Oxygen and Acetylene Equipment	12. Equipment
Cylinder storage and maintenance Condition and maintenance of valves, regulators, and gauges Condition and maintenance of hoses and fittings Pressures	Accidents related to moving parts of machinery Appreciation of principles of guarding Importance of regular maintenance



3. Transportation	14. Excavations
Transport to and from site Hazard connected with site transport Competent drivers Dumpers Tipping trucks Movement near excavations	Method of shoring Precautions while shoring Precautions at edge of excavations Removal of shoring Sheet steel piling
15. Working platforms, Ladders, and Scaffolding	16. Cranes and other Lifting Machines
Hazards connected with the use of ladders Maintenance and inspection Type of scaffold Overloading Work on roofs Fragile material Openings in walls and floors Use of safety belts and nets	Licensing, certification and training required for operation of cranes Slings methods Signaling Access to crane(s) Maintenance and examination Ground conditions Hazards and accident prevention methods connected with the use of different types of cranes/heavy equipment Crane Lift Plan for all lifts
17. Lifting Tackle	18. Fire Prevention and Control
Slings - single and multi-legged Safe working loads (SWLs) Safety hooks and eyebolts Cause of failure Maintenance and examination	Principle causes determining fire Understanding fire chemistry Fire fighting equipment Fire fighting training
19. Communications	
Effective methods of communication (particular interest to non-English speaking workers) Method and preparation of reports Safety committees Safety meeting	



General Instruction : JMRC/SHE/GI/007


SHE Training Matrix

SHE/ Page 108 of 122



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DAYS TO BE OBSERVED FOR CREATING SHE AWARENESS

	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/008	

1 st Monday to Sunday of January	Road Safety Week (Subjected to confirmation from Ministry of Road Transport, Govt. of India every year.)
16 th February	Kyoto Protocol Day
March	Red Cross Month
May 1 to 7	Emergency Preparedness Week
4 th March	National Safety Day
7 th April	World Health Day
14 th April	Fire Safety Day
April 18 to 22	Earth Week
20 th April	Earth Day
20 th April	Noise Awareness Day
28 th April	ILO World Day for Safety and Health at Work Day
5 th June	World Environmental Day
12 th June	World Day against Child Labours
9 th July	Occupational Health Day
17 th October	World Trauma Day
1 st December	World AIDS Day



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/009	

Minimum Requirements of SHE Communication Posters / Signage / Video

- For the purpose of Minimum requirements of SHE Communication Posters / Signages / Video the contracts are categorized into the following groups:

Contract Value (Initial awarded value of contract)	Group
Upto 25 Cr	A
Upto 100 Cr	B
Upto 250 Cr	C
More than 250 Cr	D

- Every contractor falling into the above groups shall prepare a SHE Communication Plan as a part of site specific SHE Plan and shall include the following minimum requirement of Posters / Signages / Video as applicable. In case readymade posters are available in any of the category from National Safety Council, Loss Prevention Association of India or any other safety related organisations they may procure the same and display it. In case the same is not available then the contractors' shall make necessary arrangements to get the posters designed and printed on their own.

All the above are to be detailed in the Site SHE Plan and get an approval from the Employer before displaying the posters.

Table No.: 1 - Minimum No. of Posters

Sl.No	SHE Poster Title	Minimum No. of concepts in each title	No. of Posters / Signage / Video			
			Group A Contract	Group B Contract	Group C Contract	Group D Contract
1.	Safety Culture	5	Each 10	Each 50	Each 75	Each 100
2.	Daily Safety Oath	1 English & 1 Hindi	Each 100	Each 200	Each 500	Each 1000
3.	Mandatory PPE Usage					
a)	Signages to display the messages like PPE ZONE, NO PPE ZONE, HARD HAT AREA etc.	2 types of sizes made up of metal sheet to be mounted at different locations	Each 25	Each 50	Each 75	Each 200
b)	Helmet	5	Each 25	Each 50	Each 75	Each 200



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c)	Shoe	5	Each 25	Each 50	Each 75	Each 200
d)	Goggles & Ear Protection	5	Each 25	Each 50	Each 75	Each 200
e)	Full Body Harness	5	Each 25	Each 50	Each 75	Each 200
f)	Hi-Vi Jacket	5	Each 25	Each 50	Each 75	Each 200
4.	Emergency Management Plan	5	Each 25	Each 50	Each 75	Each 200
5.	Working at Heights	10	Each 25	Each 50	Each 75	Each 200
a)	Ladder, Stairway, Scaffold - Signages to display the messages like SAFE, UNSAFE, FIT FOR USE, AVOID USE etc.	5 types of sizes made up of metal sheet to be mounted at different locations	Each 25	Each 50	Each 75	Each 200
6.	Site Electricity	5	Each 25	Each 50	Each 75	Each 200
7.	Crane Safety	5	Each 25	Each 50	Each 75	Each 200
8.	Slings	5	Each 25	Each 50	Each 75	Each 200
9.	Rigging Procedures	5	Each 25	Each 50	Each 75	Each 200
10.	Excavation	5	Each 25	Each 50	Each 75	Each 200
11.	Occupational Health (Mosquito Control, HIV/AIDS awareness, Dust Control, Noise Control, No Smoking/Spitting, etc.)	10	Each 25	Each 50	Each 75	Each 200
12.	First – Aid	3	Each 25	Each 50	Each 75	Each 200
13.	Labour Welfare Measures (Payment of Minimum Wages, Avoidance of Child labour, Signing in the Muster Roll, In case of accidents-what to do? etc	5	Each 25	Each 50	Each 75	Each 200
14.	Importance of “Safety Handbook”	1	25	50	75	200
15.	Traffic Safety (Speed limit, safe crossing and working within barricaded area etc.)	5	Each 25	Each 50	Each 75	Each 200
16.	Environmental Monitoring (Spillage of Muck, hazardous material, Improper drainage, water spray for dust containment etc.)	5	Each 25	Each 50	Each 75	Each 200
17.	Video in Hindi on PPE usage – 15 minutes duration	1	-	-	-	1



Safety, Health and Environment (SHE) Manual

Note 1: Items mentioned under 17 is **video**. Items under 3 (a) and 5 (a) are **metal signage boards** and all other items are **posters**.


Table No.: 2 – Size of Posters / Signages

Sl.No	Item	Size
1.	Posters – Standard	17"x22" –135 GSM 4 Colour Printing
2.	Posters – Special (Wherever required)	17"x22" card laminated FA Poster
3.	Posters - Mega size (Wherever required)	32"x40" Flex FA Poster
4.	First-Aid Booklet	6"x4"
5.	Safety Handbook	6"x4"
6.	Signages	Small : 12"x6" Big : 24"x12"
7.	Road Traffic Sign Boards	Strictly as per Indian Road Congress (IRC) specifications

Table No.: 3 – Safety Signage Colour (as per IS 9457)

Sl.No	Type of signage	Colour
1	Mandatory	Blue
2	Danger	Yellow
3	Prohibitory	Red
4	Safe conditions	Green



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/010	

Experts / Agencies for SHE Services

Sl. No.	Organisation	Services
1.	Bureau Veritas India Pvt. Ltd., B-21 & 22, First Floor, Sector-16, NOIDA-201 301 (U.P.) Phone: 0120 – 2515055, Fax: 0120 - 2515248 E-mail: enp.delhi@in.bureauveritas.com	<ul style="list-style-type: none">• External SHE Audit• SHE Management / Technical Training
2.	Central Labour Institute Post box no: 17851 N.S.Monkikar Marg Sion , Mumbai- 400 022 Tel.: 022- 4092203, Fax: 022 – 4071986 E-mail: cli@dgfasli.nic.in	<ul style="list-style-type: none">• SHE Management / Technical Training
3.	Construction Industry Development Council 801, 8 th Floor, Hemkunt Chambers, 89, Nehru Place,, New Delhi – 110 019	<ul style="list-style-type: none">• SHE Management / Technical Training
4.	Delhi Productivity Council 1E/10, Swami Ramtirath Nagar New Delhi – 110 055 Tel.: 23522835	<ul style="list-style-type: none">• SHE Management / Technical Training
5.	Det Norske Veritas AS, 203, Savitri Sadan 1, 11 Preet Vihar Community Centre, New Delhi-110 092 Phone: 011-2253 1502/2253/1503, 2242 7688/2253 1278 Fax: 011-2253 0247 Website: www.dnv.com	<ul style="list-style-type: none">• External SHE Audit• SHE Management / Technical Training
6.	Dr. A. V. Baliga Memorial trust Link House Bagadur Shah Zafar Marg Press Area, New Delhi – 110 002 Phone: 011 – 23311119	<ul style="list-style-type: none">• HIV / AIDS awareness



7.	DuPont Safety Resources, E.I. DuPont India Private Limited, Arihant Nitco Park 6 th Floor, 90, Dr. Radhakrishnan Salai, Mylapore, Chennai-600 004 Phone: 044-2847 2800, 2847 3752 Fax: 044-2847 3800 Mobile: 9381201040 Website: in.dupont.com	<ul style="list-style-type: none"> • SHE Management Training
8.	EQMS INDIA PVT. LTD. E-49, 1 st Floor, Dazzle House, Jawahar Park, Main Vikas Marg, Laxmi Nagar, Delhi-110 092 Phone: 91-11-220 17639/2204 4754 Fax: 91-91 2201 5150 E-mail: eqms@eqmsindia.org Website: www.eqmsindia.com	<ul style="list-style-type: none"> • ISO Certification • SHE Management / Technical Training
9.	Green Cross Consultants 59, 7 th Cross, 1 st Floor, Jai Bharath Nagar, Bangalore-560 033 Phone: 080-2549 6782 E-mail: etgrangan@yahoo.com	<ul style="list-style-type: none"> • SHE Management / Technical Training
10.	HSRTC, PENTASAFE, 201, 2 nd Floor, Town Centre, Andheri Kurla Road, Marol, Andheri (East), Mumbai-400 059 Phone: 022-2850 2210/20/50 Fax: 022-2850 2260 E-mail: training@penta-safe.com Website: www.penta-safe.com	<ul style="list-style-type: none"> • SHE Practical Field Training for Height Safety
11.	Institute of Driving Training & Research, Wazirabad Road, Adjoining Loni Road flyover. New Delhi – 110 094 Phone: 011 – 22813474, 22815833 Fax: 011 - 22811131	<ul style="list-style-type: none"> • SHE Technical Training for Vehicle Drivers.
12.	Institute for Research, Development & Training of Construction Trades & Management, An Educational Institute, Society and Trust, 1 st Floor, UVCE Alumni Association Building, K.R. Circle, Bangalore-560 001 Phone: 080-22294291/22243257 Fax: 080-22243257 E-mail: ubrco@vsnl.com Website: www.instructindia.org	<ul style="list-style-type: none"> • SHE Technical /Field Training



13.	International Engineering Company K – 10, South Extension, Part – 2, New Delhi – 110 049 Phone: 011 – 26254761, 26258130 Mobile: 9312260130 E-mail: ashok@intenco.net	<ul style="list-style-type: none"> • Crane and Lifting appliances and Gears Certification • SHE Practical Field Training for Crane Safety
14.	L & T Eutectic 32, Sivaji Marg New Delhi – 110 015 Phone: 011 - 51419538, 51419539 Fax: 011 - 51419600 Website: www.Inteutecticwelding.com	<ul style="list-style-type: none"> • SHE Practical Field Training for Welding Safety
15.	Loss Prevention Association of India Ltd. Warden House, Sir P.M. Road, Mumbai – 400 001 Website: www.lpaidia.org	<ul style="list-style-type: none"> • SHE Management / Technical Training
16.	MFA Crucial Moments Healthcare Pvt. Ltd., 42, Okhla Industrial Estate, Phase – II New Delhi – 110 020 Phone: 011 – 55624000 Fax: 011 – 55624010 E-mail: contact@crucialmoments.net	<ul style="list-style-type: none"> • First-aid Training
17.	Modicare Foundation 4 Community Centre, New Friends Colony, New Delhi – 110 065 Phone: 011 – 5167235059 Fax: 011 – 26915469 E-mail: nivedita@modi.com , nivedita@gmail.com Website: www.modicarefoundation.org	<ul style="list-style-type: none"> • HIV / AIDS awareness
18.	National Safety Council HQ and Institute Building 98A, Sector 15, industrial Area C.B.D Belapur, Navi Mumbai – 400614 Phone: 27579924	<ul style="list-style-type: none"> • SHE Management / Technical Training
19.	NICMAR (National Institute of Construction Management and Research) 910,9 th Floor, Hemkunt Chambers, 89, Nehru Place, New Delhi – 110 019 Phone: 011 – 51618415, 51618417, 51618418 Fax: 011 – 51618416	<ul style="list-style-type: none"> • SHE Management / Technical Training



20.	<p>Quality Growth Services Pvt. Ltd. H-13, Kirti Nagar, New Delhi – 110 015 Fax: 011 – 25431737 / 25438598 / 25918332 E-mail: qgs@qgspl.com Website: www.qgspl.com</p>	<ul style="list-style-type: none"> • ISO Certification
21.	<p>Safety Engineers Association / Safety Educational Trust – India 2/257, First Floor, Dr. Ambedkar Nagar, Manapakkam, Chennai – 600 116 Phone: 044 – 22523461 E-mail: safetrustindia@rediffmail.com</p>	<ul style="list-style-type: none"> • SHE Management / Technical Training
22.	<p>SHE Management Consultancy & Support Services, 145 A, Pocket-VI, (DDA Flats), Kondli Gharoli, Mayur Vihar-II, Delhi-110 096 Fax: 011-2262 5015 Mobile: 9811153873 E-mail: r_k_p@vsnl.net</p>	<ul style="list-style-type: none"> • SHE Management / Technical Training
23.	<p>St. Johns' Ambulance Red Cross Road New Delhi – 110 001</p>	<ul style="list-style-type: none"> • First-aid Training
24.	<p>Vexil Business Process Services Pvt. Ltd. 208, A/4, Savitri Nagar, New Delhi – 110 017 Mobile: 9350232714, 98102832201, 9350232716 E-mail: info@vexilbps.com Website: www.vexilbps.com</p>	<ul style="list-style-type: none"> • Emergency Preparedness Mock drill • SHE Management / Technical Training
25.	<p>Welding Research Institute Bharat Heavy Electricals Ltd. (BHEL) Trichirappalli, Tamil Nadu – 620 014 Phone: 0431 – 2577029, 2577283 Fax: 0431 – 2520770 E-mail: wri@bheltry.co.in</p>	<ul style="list-style-type: none"> • SHE Practical Field Training for Welding Safety
26.	<p>Dr Cris Research Centre for Occupational Health & Safety 306, Guru Arjuna Dev Bhawan Ranjit Nagar Complex, New Delhi-08 Ph: 9810040406 Fax: 011-25702929 Email: team@drcri.com www.drcri.com</p>	<ul style="list-style-type: none"> • Ambulance • Communication Material • First Aid Training • HIV/AIDS Awareness • ID Card • Medical Facilities • SHE training




	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction: JMRC/SHE/GI/011	

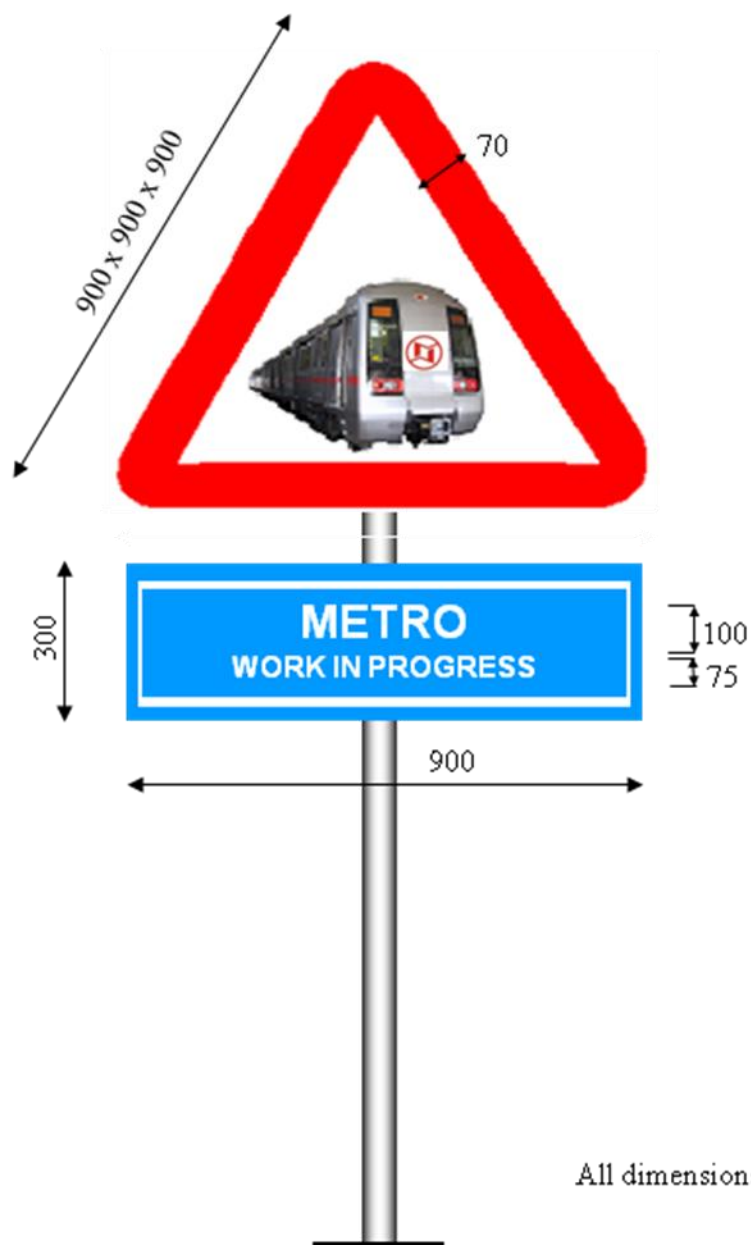
Minimum Lighting Requirements

S.N.	A. Facility or Function	Luminance – lx (lm/ft ²)
B. 1.	Administrative areas (offices, drafting and meeting rooms, etc.)	540 (50)
C. 2.	D. Construction areas <ul style="list-style-type: none"> - general indoor - general outdoor - tunnel and general underground work areas (minimum 110 lux required at tunnel and shaft heading during drilling, mucking and scaling) 	55 (5) 33 (3) 55 (5)
E. 3.	F. Access ways <ul style="list-style-type: none"> - exit ways, walkways, ladders, stairs 	110 (10)
4.	G. Maintenance / Operating areas / shops <ul style="list-style-type: none"> - vehicle maintenance shop - carpentry shop - outdoors field maintenance area - refueling area, outdoors - shops, fine details work - shops, medium detail work - welding shop 	325 (30) 110 (10) 55 (5) 55 (5) 540 (50) 325 (30) 325 (30)
5.	Mechanical/electrical equipment rooms	110 (10)
6.	Hoists, Elevators, freight and passenger	215 (20)
7.	H. Warehouses and storage rooms/area <ul style="list-style-type: none"> - indoor stockroom, active/bulk storage - indoor rack storage - outdoor storage 	110 (10) 270 (25) 33 (3)
8.	Health Centers and First aid stations and infirmaries	325 (30)
9.	Toilets, wash and dressing rooms	110 (10)
10.	Work areas – general (not listed above)	325 (30)
11.	Parking areas	33 (3)
12.	Visitor areas	215 (20)
13.	Laboratories	540 (50)



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction: JMRC/SHE/GI/012	

SIGNAGE





	JAIPUR METRO RAIL CORPORATION LTD.
FORM No. : SF/001	

FORMATION OF SITE SHE COMMITTEE	
Contract No	
Contractor Name	
Contract Title	

<u>CIRCULAR</u>	
<u>Committee</u> The following SHE Committee is constituted with immediate effect: Chairman: Members: 1) 2) 3) 4) 5) Secretary:	
<u>Periodicity</u> The committee will meet at least once in a month on the day (specify date)	
<u>Agenda</u> Secretary will circulate agenda of the meeting at least two days in advance of the schedule date of the meeting.	
<u>Circulation</u> Gist of the meeting will be minuted in the standard format and circulated to the following under the signature of the secretary 1. Chairman 2. Members 3. JMRC Representatives 5. Others concerned	
Date: CHAIRMAN	Signed By: -----



	JAIPUR METRO RAIL CORPORATION LTD.
FORM No. : SF/002	

MINUTES OF SHE COMMITTEE MEETING			
Contract No.			
Contractor Name			
Contract Title			
Meeting No.		Date of Meeting	
Location of Meeting			

MEMBERS PRESENT	INVITEES	MEMBERS ABSENT



Safety, Health and Environment (SHE) Manual

REPORT SENT TO					
No. of Copies	Name / Dept.	No. of Copies	Name / Dept.	No. of Copies	Name / Dept.
Prepared by: _____ Location: _____ Date: _____					

MINUTES OF SHE MEETING				
Item No.	Description of Discussion	Action By	Target	Remarks
1	Complaints received from Clients and corrective and preventive action			
2	Review of MOM of previous meeting			
3	NCR's / Observation from third party			
4	First - Aid cases / Reportable accident cases			
5	Future jobs and specific requirement			
6	Status of implementation of Safety plan			
7	Sub-contractor performance			



Safety, Health and Environment (SHE) Manual

8	Analysis of first-aid cases			
9	Need for any specific system / training / PPE's / resources			
10	Observation of SHE committee during last walk down			

Next SHE Meeting is scheduled on:

Date:	Chief SHE Manager (Signature & Name)
Date:	Project Manager (Signature & Name)

Section 7 - General Conditions of Contract

These General Conditions of Contract (GCC) are based on the Model Form of International Contract for Process Plant Construction published by the Engineering Advancement Association of Japan (ENAA). The Multilateral Development Banks (MDBs) participating in the procurement harmonization process gratefully acknowledge the contribution of ENAA to the advancement of good contracting practices by its borrowers. The GCC contain general clauses to be applied on all contracts. The GCC in this section, read in conjunction with the Special Conditions of Contract in Section 8 and other documents listed therein, should be a complete document expressing all the rights and obligations of the contracting parties. The General Conditions herein shall not be altered.

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General Conditions of Contract

A. Contract and Interpretation

1. Definitions

1.1 The following words and expressions shall have the meanings hereby assigned them:

“Contract” means the Contract Agreement entered into between the Employer and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term “the Contract” shall in all such documents be construed accordingly.

“Contract Documents” means the documents listed in Article 1.1 (Contract Documents) of the Contract Agreement (including any amendments thereto).

“GCC” means the General Conditions of Contract.

“SCC” means the Special Conditions of Contract.

“day” means calendar day.

“year” means 365 days.

“month” means calendar month.

“Party” means the Employer or the Contractor, as the context requires.

“Employer” means the person named as such in the SCC and includes the legal successors or permitted assigns of the Employer.

“Project Manager” means the person appointed by the Employer in the manner provided in GCC Subclause 17.1 (Project Manager) hereof and named as such in the SCC to perform the duties delegated by the Employer.

“Contractor” means the person(s) named as Contractor in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.

“Contractor’s Representative” means any person nominated by the Contractor and approved by the Employer in the manner provided in GCC Subclause 17.2 (Contractor’s Representative and Construction Manager) hereof to perform the duties delegated by the Contractor.

“Construction Manager” means the person appointed by the Contractor’s Representative in the manner provided in GCC Subclause 17.2.4.

“Subcontractor,” including manufacturers, means any person to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.

“Dispute Board” means the person or persons named as such in the SCC appointed by agreement between the Employer and the Contractor to make a decision on or to settle any dispute or difference between the Employer and the Contractor referred to him or her by the parties pursuant to GCC Subclause 45.1 (Dispute Board) hereof.

“The Bank” means the financing institution named in the SCC.

“Contract Price” means the sum specified in Article 2.1 (Contract Price) of the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

“Facilities” means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.

“Plant” means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor under GCC Subclause 7.3 hereof), but does not include Contractor’s Equipment.

“Installation Services” means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor’s Equipment and the supply of all construction materials required), installation, testing, precommissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc. as the case may require.

“Contractor’s Equipment” means all facilities, equipment, machinery, tools, apparatus, appliances, or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Facilities.

“Country of Origin” means the countries and territories eligible under the rules of the Bank as further elaborated in the SCC.

“Site” means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.

“Effective Date” means the date of fulfillment of all conditions stated in Article 3 (Effective Date) of the Contract Agreement, upon which the period until the Time for Completion shall be counted from.

“Time for Completion” means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, as referred to in GCC Clause 8 and in accordance with the relevant provisions of the Contract.

“Completion” means that the Facilities (or a specific part thereof where specific parts are specified in the Contract) have been completed operationally and structurally and put in a tight and clean condition, that all work in respect of Precommissioning of the Facilities or such specific part thereof has been completed, and that the Facilities or specific part thereof are ready for Commissioning as provided in GCC Clause 24 (Completion) hereof.

“Precommissioning” means the testing, checking and other requirements specified in the Employer’s Requirements that are to be carried out by the Contractor in preparation for Commissioning as provided in GCC Clause 24 (Completion) hereof.

“Commissioning” means operation of the Facilities or any part thereof by the Contractor following Completion, which operation is to be carried out by the Contractor as provided in GCC Subclause 25.1 (Commissioning) hereof, for the purpose of carrying out Guarantee Test(s).

“Guarantee Test(s)” means the test(s) specified in the Employer’s Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement in accordance with the provisions of GCC Subclause 25.2 (Guarantee Test) hereof.

“Operational Acceptance” means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor’s fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of GCC Clause 28 (Functional Guarantees) hereof and shall include deemed acceptance in accordance with GCC Clause 25 (Commissioning and Operational Acceptance) hereof.

“Defect Liability Period” means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in GCC Clause 27 (Defect Liability) hereof.

- | | |
|------------------------------|--|
| 2. Contract Documents | 2.1 Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole. |
| 3. Interpretation | 3.1 In the Contract, except where the context requires otherwise, <ul style="list-style-type: none"> (a) words indicating one gender include all genders; (b) words indicating the singular also include the plural and words indicating the plural also include the singular; (c) provisions including the word “agree,” “agreed,” or “agreement” require the agreement to be record in writing; |

- (d) the word "tender" is synonymous with "bid," "tenderer" with "Bidder," and "tender documents" with "Bidding Documents;" and
- (e) "written" or "in writing" means handwritten, typewritten, printed or electronically made, and resulting in a permanent record.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

3.2 Incoterms

Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms.

"Incoterms" means international rules for interpreting trade terms published by the International Chamber of Commerce (latest edition), 38 Cours Albert 1^{er}, 75008 Paris, France.

3.3 Entire Agreement

Subject to GCC Subclause 16.4 hereof, the Contract constitutes the entire agreement between the Employer and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations, and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract.

3.4 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.

3.5 Independent Contractor

The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture, or other joint relationship between the parties hereto. Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives, or Subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Employer, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives, or Subcontractors and the Employer.

3.6 Non-Waiver

3.6.1 Subject to GCC Subclause 3.6.2 below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, nor shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

3.6.2 Any waiver of a party's rights, powers, or remedies under the

Contract must be in writing, must be dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

3.7 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity, or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

3.8 Country of Origin

"Origin" means the place where the plant and component parts thereof are mined, grown, produced, or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially in its basic characteristics or in purpose or utility from its components.

4. Communications

4.1 Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests, and discharges, these communications shall be

- (a) in writing and delivered against receipt; and
- (b) delivered, sent, or transmitted to the address for the recipient's communications as stated in the Contract Agreement.

When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Project Manager, a copy shall be sent to the Project Manager or the other Party, as the case may be.

5. Law and Language

5.1 The Contract shall be governed by and interpreted in accordance with laws of the country specified in the SCC.

5.2 The ruling language of the Contract shall be that stated in the SCC.

5.3 The language for communications shall be the ruling language unless otherwise stated in the SCC.

6. Fraud and Corruption

6.1 ADB's Anticorruption Policy requires Borrowers (including beneficiaries of ADB-financed activity), as well as Bidders, Suppliers, and Contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB

- (a) defines, for the purposes of this provision, the terms set forth below as follows:
 - (i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
 - (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party

to obtain a financial or other benefit or to avoid an obligation;

- (iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - (iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;
 - (v) "obstructive practice" means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an Office of Anticorruption and Integrity (OAI) investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or (e) materially impeding ADB's contractual rights of audit or access to information; and
 - (vi) "integrity violation" is any act which violates ADB's Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of ADB sanctions, retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standard.
- (b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;
 - (c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;
 - (d) will impose remedial actions on a firm or an individual, at any time, in accordance with ADB's Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a

stated period of time, to participate¹ in ADB-financed, administered, or supported activities or to benefit from an ADB-financed, administered, or supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and

- (e) will have the right to require suppliers and contractors to permit ADB or its representative to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

B. Subject Matter of Contract

7. Scope of Facilities

- 7.1 Unless otherwise expressly limited in the Employer's Requirements, the Contractor's obligations cover the provision of all Plant and the performance of all Installation Services required for the design, the manufacture (including procurement, quality assurance, construction, installation, associated civil works, pre-commissioning and delivery) of the Plant and the installation, completion, and commissioning of the Facilities in accordance with the plans, procedures, specifications, drawings, codes, and any other documents as specified in the section Employer's Requirements. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labor, materials, equipment, spare parts (as specified in GCC Subclause 7.3 below) and accessories; Contractor's Equipment; construction utilities and supplies; temporary materials, structures, and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works, and services that will be provided or performed by the Employer, as set forth in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement.
- 7.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.
- 7.3 In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities for the period specified in the SCC and the provisions, if any, specified in the SCC. However, the identity, specifications, and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in Price Schedule No. 6, which shall be added

¹ Whether as a Contractor, Subcontractor, Consultant, Manufacturer or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document).

to the Contract Price. The price of such spare parts shall include the purchase price therefore and other costs and expenses (including the Contractor's fees) relating to the supply of spare parts.

8. Time for Commencement and Completion

- 8.1 The Contractor shall commence work on the Facilities within the period specified in the SCC and without prejudice to GCC Subclause 26.2 hereof, the Contractor shall thereafter proceed with the Facilities in accordance with the time schedule specified in the Appendix 4 (Time Schedule) to the Contract Agreement.
- 8.2 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time stated in the SCC or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

9. Contractor's Responsibilities

- 9.1 The Contractor shall design, manufacture, including associated purchases and/or subcontracting, install, and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.
- 9.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities, including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date 28 days prior to bid submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.
- 9.3 The Contractor shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the country where the Site is located, which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals, and/or licenses that are not the responsibility of the Employer under GCC Subclause 10.3 hereof and that are necessary for the performance of the Contract.
- 9.4 The Contractor shall comply with all laws in force in the country where the Facilities are to be implemented. The laws will include all local, state, national, or other laws that affect the performance of the Contract and bind upon the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties, and expenses of whatever nature arising or resulting from the violation of such laws by the Contractor or its personnel, including the Subcontractors and their personnel, but without prejudice to GCC Subclause 10.1 hereof.
- 9.5 Any plant and services that will be incorporated in or be required for the Facilities and other supplies shall have their origin as specified under GCC Clause 1 (Country of Origin). Any Subcontractors retained

by the Contractor shall be from a country as specified in GCC Clause 1 (Country of Origin).

9.6 The Contractor shall permit ADB to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by ADB, if so required by ADB.

9.7 If the Contractor is a joint venture or consortium of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfillment of the provisions of the Contract and shall designate one of such persons to act as a leader with authority to bind the joint venture or consortium. The composition or the constitution of the joint venture or consortium shall not be altered without the prior consent of the Employer.

9.8 Protection of the Environment

(a) The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise, and other results of his operations.

(b) The Contractor shall ensure that emissions, surface discharges, and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

10. Employer's Responsibilities

10.1 All information and/or data to be supplied by the Employer as described in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement shall be deemed to be accurate, except when the Employer expressly states otherwise.

10.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix.

10.3 The Employer shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities, or public service undertakings in the country where the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement.

10.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals, and/or licenses necessary

for the execution of the Contract from all local, state, or national government authorities, or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain.

- 10.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Pre-commissioning, Commissioning, and Guarantee Tests, all in accordance with the provisions of the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement at or before the time specified in the program furnished by the Contractor under GCC Subclause 18.2 hereof and in the manner thereupon specified or as otherwise agreed upon by the Employer and the Contractor.
- 10.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Subclause 24.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Subclause 25.2.
- 10.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 10 shall be the responsibility of the Employer, except those incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Subclause 25.2.
- 10.8 In the event that the Employer shall be in breach of any of his obligations imposed by the Contract, then the additional cost reasonably incurred by the Contractor in consequence thereof shall be added to the Contract Price.

C. Payment

- 11. Contract Price**
- 11.1 The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement.
- 11.2 Unless an adjustment clause is provided for in the SCC, the Contract Price shall be a firm lump sum not subject to any alteration, except in the event of a Change in the Facilities or as otherwise provided in the Contract.
- 11.3 Subject to GCC Subclauses 9.2, 10.1, and 35 hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.
- 12. Terms of Payment**
- 12.1 The Contract Price shall be paid as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement and in the Appendix (Terms and Procedures of Payment) to the Contract

Agreement, which also outlines the procedures to be followed in making application for and processing payments.

- 12.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.
- 12.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendix (Terms and Procedures of Payment) to the Contract Agreement for the period of delay until payment has been made in full, whether before or after judgment or arbitration award.
- 12.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendix (Terms and Procedures of Payment) to the Contract Agreement, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's bid.

13. Securities

13.1 Issuance of Securities

The Contractor shall provide the securities specified below in favor of the Employer at the times, and in the amount, manner, and form specified below.

13.2 Advance Payment Security

13.2.1 The Contractor shall, within 28 days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix (Terms and Procedures of Payment) to the Contract Agreement, and in the same currency or currencies.

13.2.2 The security shall be in the form provided in the Bidding Documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.

13.3 Performance Security

13.3.1 The Contractor shall, within 28 days of the notification of contract award, provide a security for the due performance of the Contract in the amount specified in the SCC.

13.3.2 The security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in one of the forms of bank guarantees provided in the Bidding Documents, as stipulated by the Employer in the SCC, or in another form acceptable to the Employer.

13.3.3 Unless otherwise specified in the SCC, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced

pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, 540 days after Completion of the Facilities or 365 days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Subclause 27.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Subclause 27.10, is liable for an extended defect liability obligation, the performance security shall be extended for the period and up to the amount specified in the SCC.

14. Taxes and Duties

- 14.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies, and charges assessed on the Contractor, its Subcontractors, or their employees by all municipal, state, or national government authorities in connection with the Facilities in and outside of the country where the Site is located.
- 14.2 Notwithstanding GCC Subclause 14.1 above, the Employer shall bear and promptly pay all customs and import duties as well as other local taxes like, e.g., a value-added tax (VAT), imposed by the law of the country where the Site is located on the Plant specified in Price Schedule No. 1 and that are to be incorporated into the Facilities.
- 14.3 If any tax exemptions, reductions, allowances, or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
- 14.4 For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies, and charges prevailing at the date 28 days prior to the date of bid submission in the country where the Site is located (hereinafter called "Tax" in this GCC Subclause 14.4). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of Contract, which was or will be assessed on the Contractor, Subcontractors, or their employees in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction therefrom, as the case may be, in accordance with GCC Clause 36 hereof.

D. Intellectual Property

15. License/Use of Technical Information

- 15.1 For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and nontransferable license (without the right to sublicense) to the Employer under the patents, utility models, or other industrial property rights owned by the Contractor or by a third

party from whom the Contractor has received the right to grant licenses thereunder, and shall also grant to the Employer a nonexclusive and nontransferable right (without the right to sublicense) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how, or other intellectual property right from the Contractor or any third party to the Employer.

- 15.2 The copyright in all drawings, documents, and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.

16. Confidential Information

- 16.1 The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during, or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data, and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16.
- 16.2 The Employer shall not use such documents, data, and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data, and other information received from the Employer for any purpose other than the design, procurement of Plant, construction, or such other work and services as are required for the performance of the Contract.
- 16.3 The obligation of a party under GCC Subclauses 16.1 and 16.2 above, however, shall not apply to that information, which
- (a) now or hereafter enters the public domain through no fault of that party;
 - (b) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto; and
 - (c) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.
- 16.4 The above provisions of this GCC Clause 16 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.

- 16.5 The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.

E. Execution of the Facilities

17. Representatives 17.1 Project Manager

If the Project Manager is not named in the Contract, then within 14 days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals, and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided.

All notices, instructions, information, and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided.

17.2 Contractor's Representative and Construction Manager

17.2.1 If the Contractor's Representative is not named in the Contract, then within 14 days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within 14 days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within 14 days giving the reason therefor, then the Contractor shall appoint a replacement within 14 days of such objection, and the foregoing provisions of this GCC Subclause 17.2.1 shall apply thereto.

17.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information, and all other communications under the Contract.

All notices, instructions, information, and all other communications given by the Employer or the Project Manager to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the

procedure set out in GCC Subclause 17.2.1.

17.2.3 The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions, and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager.

Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Subclause 17.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.

17.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick, or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, the Contractor's Representative or the Construction Manager shall appoint a suitable person to act as the Construction Manager's deputy.

17.2.5 The Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Subclause 22.4. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

17.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Subclause 17.2.5, the Contractor shall, where required, promptly appoint a replacement.

18. Work Program

18.1 Contractor's Organization

The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within 21 days of the Effective Date. The chart shall include the identities of the key personnel, and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.

18.2 Program of Performance

Within 28 days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture,

transport, assemble, install, and pre-commission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning, and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix (Time Schedule) to the Contract Agreement and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion given in the SCC and any extension granted in accordance with GCC Clause 40, and shall submit all such revisions to the Project Manager.

18.3 Progress Report

The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Subclause 18.2 above, and supply a progress report to the Project Manager every month.

The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.

18.4 Progress of Performance

If at any time the Contractor's actual progress falls behind the program referred to in GCC Subclause 18.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Subclause 8.2, any extension thereof entitled under GCC Subclause 40.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

18.5 Procedures

The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements.

The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

19.Subcontracting

- 19.1 The Appendix 5 (List of Major Items of Plant and Services and List of Approved Subcontractors) to the Contract Agreement specifies major items of plant and services and a list of approved Subcontractors against each item, including manufacturers. Insofar as no Subcontractors are listed against any such item, the Contractor shall prepare a list of Subcontractors for such item for inclusion in such list. The Contractor may from time to time propose any addition to or deletion from any such list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient

time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties, or responsibilities under the Contract.

- 19.2 The Contractor shall select and employ its Subcontractors for such major items from those listed in the lists referred to in GCC Subclause 19.1.
- 19.3 For items or parts of the Facilities not specified in the Appendix (List of Major Items of Plant and Services and List of Approved Subcontractors for Major Items) to the Contract Agreement, the Contractor may employ such Subcontractors as it may select, at its discretion.
- 19.4 Each subcontract shall include provisions which would entitle the Employer to require the sub-contract to be assigned to the Employer under GCC 19.5 (if and when applicable), or in event of termination by the Employer under GCC 42.2.
- 19.5 If a Sub-contractor's obligations extend beyond the expiry date of the relevant Defects Liability Period and the Project Manager, prior to that date, instructs the Contractor to assign the benefits of such obligations to the Employer, then the Contractor shall do so.

20. Design and Engineering

20.1 Specifications and Drawings

- 20.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice.

The Contractor shall be responsible for any discrepancies, errors, or omissions in the specifications, drawings, and other technical documents that it has prepared, whether such specifications, drawings, and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors, or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.

- 20.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification, or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager.

20.2 Codes and Standards

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date 28 days prior to date of bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 39.

20.3 Approval/Review of Technical Documents by Project Manager

- 20.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix (List of Documents for Approval or Review) to the Contract Agreement for its approval or review as

specified and in accordance with the requirements of GCC Subclause 18.2 (Program of Performance).

Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.

GCC Subclauses 20.3.2 through 20.3.7 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only.

20.3.2 Within 14 days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Subclause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes.

If the Project Manager fails to take such action within the said 14 days, then the said document shall be deemed to have been approved by the Project Manager.

20.3.3 The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice. If the Project Manager disapproves a document, he shall specify the reasons for his decision.

20.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Subclause 20.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved.

20.3.5 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be referred to a Dispute Board for determination in accordance with GCC Subclause 45.3 hereof. If such dispute or difference is referred to a Dispute Board, the Project Manager shall give instructions as to whether and, if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Dispute Board upholds the Contractor's view on the dispute and if the Employer has not given notice under Subclause 45.3 hereof, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Dispute Board shall decide, and the Time for Completion shall

be extended accordingly.

20.3.6 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.

20.3.7 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Subclause 20.3.

If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 39 shall apply to such request.

21. Procurement

21.1 Materials

Subject to GCC Subclause 14.2, the Contractor shall procure and transport all materials in an expeditious and orderly manner to the Site.

21.2 Employer-Supplied Materials

If the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply:

21.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Subclause 18.2, unless otherwise mutually agreed.

21.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect, or default. The Employer shall immediately remedy any shortage, defect, or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect, or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody, and control of the Contractor. The provision of this GCC Subclause 21.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired.

21.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody, and control shall not relieve the Employer of liability for any undetected shortage, defect, or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 27 or under any other provision of Contract.

21.3 Transportation

21.3.1 The Contractor shall at its own risk and expense transport all the materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable

under all the circumstances.

21.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment.

21.3.3 Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile, or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the parties.

21.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges, or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site.

21.4 Customs Clearance

The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Subclause 14.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 40.

22. Installation

22.1 Setting Out/Supervision

22.1.1 Benchmark

- (a) The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks, and lines provided to it in writing by or on behalf of the Employer.
- (b) If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level, or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be

borne by the Employer.

22.1.2 Contractor's Supervision

The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

22.2 Labor

22.2.1 Engagement of Staff and Labor

- (a) Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, housing, feeding, and transport.
- (b) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled, and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.
- (c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.
- (d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.

22.2.2 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst the Employer's Personnel.

22.2.3 Labor Laws

- (a) The Contractor shall comply with all the relevant labor

Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration, and emigration, and shall allow them all their legal rights.

- (b) The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous, or disorderly conduct or behavior by or amongst its employees and the labor of its Subcontractors.
- (c) The Contractor shall, in all dealings with its labor and the labor of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious, or other customs and all local laws and regulations pertaining to the employment of labor.

22.2.4 Rates of Wages and Conditions of Labor

- (a) The Contractor shall pay rates of wages, and observe conditions of labor, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.
- (b) The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, and allowances as are chargeable under the Laws for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

22.2.5 Working Hours

- (a) No work shall be carried out on the Site on locally recognized days of rest, or outside the normal working hours stated in the SCC, unless
 - (i) otherwise stated in the Contract;
 - (ii) the Project Manager gives consent; or
 - (iii) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Project Manager.
- (b) If and when the Contractor considers it necessary to carry out work at night or on public holidays so as to meet the Time for Completion and requests the Project Manager's consent thereto, the Project Manager shall not unreasonably withhold such consent.
- (c) This Subclause shall not apply to any work which is customarily carried out by rotary or double shifts.

22.2.6 Facilities for Staff and Labor

- (a) Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.
- (b) The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

22.2.7 Health and Safety

- (a) The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay, and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.
- (b) The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the performance of the Contract, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.
- (c) The Contractor shall send to the Project Manager, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety, and welfare of persons, and damage to property, as the Project Manager may reasonably require.

22.2.8 Funeral Arrangements

In the event of the death of any of the Contractor's personnel or accompanying members of their families, the Contractor shall be responsible for making the appropriate arrangements for their return or burial, unless otherwise specified in the SCC.

22.2.9 Records of Contractor's Personnel

The Contractor shall keep accurate records of the Contractor's personnel, including the number of each class of Contractor's Personnel on the Site and the names, ages, gender, hours worked, and wages paid to all workers. These records shall be summarized on a monthly basis in a form approved by the Project Manager and shall be available for inspection by the Project Manager until the Contractor has completed all work.

22.2.10 Supply of Foodstuff

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

22.2.11 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

22.2.12 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce their danger to health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

22.2.13 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give barter, or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift barter, or disposal by Contractor's Personnel.

22.2.14 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

22.2.15 Prohibition of All Forms of Forced or Compulsory Labor

The contractor shall not employ "forced or compulsory labor" in any form. "Forced or compulsory labor" consists of all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty.

22.2.16 Prohibition of Harmful Child Labor

The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

22.3 Contractor's Equipment

22.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.

22.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon.

- 22.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.

22.4 Site Regulations and Safety

The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld.

Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention.

22.5 Opportunities for Other Contractors

- 22.5.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site.

- 22.5.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Contractor reasonable remuneration for the use of such equipment or the provision of such services.

- 22.5.3 The Contractor shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other contractors. The Project Manager shall determine the resolution of any difference or conflict that may arise between the Contractor and other contractors and the workers of the Employer in regard to their work.

- 22.5.4 The Contractor shall notify the Project Manager promptly of any defects in the other Contractors' work that come to its notice, and that could affect the Contractor's work. The Project Manager shall determine the corrective measures, if any, required to rectify the situation after inspection of the Facilities. Decisions made by the Project Manager shall be binding on the Contractor.

22.6 Emergency Work

If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the

Contractor shall immediately carry out such work.

If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.

22.7 Site Clearance

22.7.1 Site Clearance in Course of Performance

In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store, or remove any surplus materials, clear away any wreckage, rubbish, or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract.

22.7.2 Clearance of Site after Completion

After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish, and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition.

22.8 Watching and Lighting

The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.

23. Test and Inspection

- 23.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.
- 23.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.
- 23.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.

- 23.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.

If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

- 23.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.
- 23.6 If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Subclause 23.3.
- 23.7 If any dispute or difference of opinion shall arise between the parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the parties within a reasonable period of time, it may be referred to a Dispute Board for determination in accordance with GCC Subclause 45.3.
- 23.8 The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.
- 23.9 The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Subclause 23.4, shall release the Contractor from any other responsibilities under the Contract.
- 23.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.
- 23.11 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.

If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Subclause 23.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.

24. Completion of the Facilities

24.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

24.2 Within 7 days after receipt of the notice from the Contractor under GCC Subclause 24.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement for Pre-commissioning of the Facilities or any part thereof.

Pursuant to the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement, the Employer shall also provide, within the said 7-day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services, and other matters required for Pre-commissioning of the Facilities or any part thereof.

24.3 As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services, and other matters have been provided by the Employer in accordance with GCC Subclause 24.2, the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Subclause 25.5.

24.4 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready for Commissioning, the Contractor shall so notify the Project Manager in writing.

24.5 The Project Manager shall, within 14 days after receipt of the Contractor's notice under GCC Subclause 24.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Subclause 24.4, or notify the Contractor in writing of any defects and/or deficiencies.

If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Subclause 24.4.

If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within 7 days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached

Completion as of the date of the Contractor's repeated notice.

If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within 7 days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

24.6 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within 14 days after receipt of the Contractor's notice under GCC Subclause 24.4 or within 7 days after receipt of the Contractor's repeated notice under GCC Subclause 24.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.

24.7 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

24.8 Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.

25. Commissioning and Operational Acceptance

25.1 Commissioning

25.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Subclause 24.5, or immediately after the date of the deemed Completion, under GCC Subclause 24.6.

25.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services, and other matters required for Commissioning.

25.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.

25.2 Guarantee Test

25.2.1 Subject to GCC Subclause 25.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and

results of the Guarantee Test and any repeats thereof.

25.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion specified in the SCC or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Subclauses 28.2 and 28.3 shall not apply.

25.3 Operational Acceptance

25.3.1 Subject to GCC Subclause 25.4 below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when

- (a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or
- (b) the Guarantee Test has not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the period from the date of Completion specified in the SCC, or any other agreed upon period as specified in GCC Subclause 25.2.2 above; or
- (c) the Contractor has paid the liquidated damages specified in GCC Subclause 28.3 hereof; and
- (d) any minor items mentioned in GCC Subclause 24.7 hereof relevant to the Facilities or that part thereof have been completed.

25.3.2 At any time after any of the events set out in GCC Subclause 25.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's Requirements (Forms and Procedures) in respect of the Facilities or the part thereof specified in such notice as of the date of such notice.

25.3.3 The Project Manager shall, after consultation with the Employer, and within 7 days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

25.3.4 If within 7 days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.

25.4 Partial Acceptance

25.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be

issued accordingly for each such part of the Facilities.

25.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate.

25.5 Delayed Pre-Commissioning and/or Guarantee Test

25.5.1 In the event that the Contractor is unable to proceed with the Pre-commissioning of the Facilities pursuant to Subclause 24.3, or with the Guarantee Test pursuant to Subclause 25.2, for reasons attributable to the Employer either on account of non availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Employer's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Subclause 24.6, and Operational Acceptance, pursuant to GCC Subclause 25.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Subclause 27.2, Functional Guarantee, pursuant to GCC Clause 28, and Care of Facilities, pursuant to GCC Clause 32, and GCC Clause 41.1, Suspension, shall not apply. In this case, the following provisions shall apply.

25.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to above Subclause 25.5.1, the Contractor shall be entitled to the following:

- (a) the Time of Completion shall be extended for the period of suspension without imposition of liquidated damages pursuant to GCC Subclause 26.2;
- (b) payments due to the Contractor in accordance with the provision specified in the Appendix (Terms and Procedures of Payment) to the Contract Agreement, which would not have been payable in normal circumstances due to noncompletion of the subject activities, shall be released to the Contractor against submission of a security in the form of a bank guarantee of equivalent amount acceptable to the Employer, and which shall become null and void when the Contractor will have complied with its obligations regarding those payments, subject to the provision of Subclause 25.5.3 below;
- (c) the expenses towards the above security and extension of other securities under the contract, of which validity needs to be extended, shall be reimbursed to the Contractor by the Employer;
- (d) the additional charges towards the care of the Facilities pursuant to GCC Subclause 32.1 shall be reimbursed to

the Contractor by the Employer for the period between the notification mentioned above and the notification mentioned in Subclause 25.5.4 below. The provision of GCC Subclause 33.2 shall apply to the Facilities during the same period.

25.5.3 In the event that the period of suspension under above Subclause 25.5.1 actually exceeds 180 days, the Employer and Contractor shall mutually agree to any additional compensation payable to the Contractor.

25.5.4 When the Contractor is notified by the Project Manager that the plant is ready for Pre-commissioning, the Contractor shall proceed without delay in performing all the specified activities and obligations under the contract.

F. Guarantees and Liabilities

26. Completion Time Guarantee

26.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified) within the Time for Completion specified in the SCC pursuant to GCC Subclause 8.2, or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

26.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40, the Contractor shall pay to the Employer liquidated damages in the amount specified in the SCC as a percentage rate of the Contract Price or the relevant part thereof. The aggregate amount of such liquidated damages shall in no event exceed the amount specified as "Maximum" in the SCC as a percentage rate of the Contract Price. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Subclause 42.2.2.

Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 40. The Contractor shall have no further liability whatsoever to the Employer in respect thereof.

However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.

Save for liquidated damages payable under this GCC Subclause 26.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix (Time Schedule) to the Contract Agreement and/or other program of work prepared pursuant to GCC Subclause 18.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.

- 26.3 If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 40, the Employer shall pay to the Contractor a bonus in the amount specified in the SCC. The aggregate amount of such bonus shall in no event exceed the amount specified as "Maximum" in the SCC.

27. Defect Liability

- 27.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials, and workmanship of the Plant supplied and of the work executed.

- 27.2 The Defect Liability Period shall be 540 days from the date of Completion of the Facilities (or any part thereof) or 1 year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the SCC pursuant to GCC Subclause 27.10.

If during the Defect Liability Period any defect should be found in the design, engineering, materials, and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace, or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement, or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:

- (a) improper operation or maintenance of the Facilities by the Employer,
- (b) operation of the Facilities outside specifications provided in the Contract, or
- (c) normal wear and tear.

- 27.3 The Contractor's obligations under this GCC Clause 27 shall not apply to:

- (a) any materials that are supplied by the Employer under GCC Subclause 21.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;
- (b) any designs, specifications or other data designed, supplied, or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or
- (c) any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Subclause 27.7.

- 27.4 The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.

- 27.5 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its

obligations under this GCC Clause 27.

The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

- 27.6 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.

- 27.7 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than 15 days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due the Contractor or claimed under the Performance Security.

- 27.8 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons.

- 27.9 Except as provided in GCC Clauses 27 and 33, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design, or engineering, or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, criminal, or willful action of the Contractor.

- 27.10 In addition, any such component of the Facilities and during the period of time as may be specified in the SCC shall be subject to an extended Defect Liability Period. Such obligation of the Contractor shall be in addition to the Defect Liability Period specified under GCC Subclause 27.2.

28. Functional Guarantees

- 28.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement, subject to, and upon the conditions therein specified.
- 28.2 If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix (Functional

Guarantees) to the Contract Agreement are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications, and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications, and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Subclause 42.2.2.

- 28.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either
- (a) make such changes, modifications, and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or
 - (b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix (Functional Guarantees) to the Contract Agreement.
- 28.4 The payment of liquidated damages under GCC Subclause 28.3, up to the limitation of liability specified in the Appendix (Functional Guarantees) to the Contract Agreement, shall completely satisfy the Contractor's guarantees under GCC Subclause 28.3, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.

29. Patent Indemnity

- 29.1 The Contractor shall, subject to the Employer's compliance with GCC Subclause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions, or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract by reason of (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located, and (b) the sale of the products produced by the Facilities in any country.

Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant, or materials not supplied by the Contractor, pursuant to the Contract

Agreement.

- 29.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Subclause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within 28 days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the 28-day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

- 29.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers, and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.

30. Limitation of Liability

- 30.1 Except in cases of criminal negligence or willful misconduct,
- (a) the Contractor shall not be liable to the Employer, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer, and
 - (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed a multiple of the Contract Price specified in the SCC or, if a multiple is not so specified, the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

G. Risk Distribution

31. Transfer of Ownership

- 31.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the

Plant from the country of origin to that country.

- 31.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.
- 31.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.
- 31.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant in question are no longer required for the Facilities.
- 31.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.

32. Care of Facilities

- 32.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 24 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 27. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Subclauses 32.2 and 38.1.
- 32.2 If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of
 - (a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or
 - (b) any use or occupation by the Employer or any third party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or
 - (c) any use of or reliance upon any design, data, or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed

responsibility herein,

the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed, or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed, or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 39. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Subclause 42.1 hereof.

32.3 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Subclause 32.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Subclauses 32.2 (b) and (c) and 38.1.

32.4 With respect to any loss or damage caused to the Facilities or any part thereof or to the Contractor's Equipment by reason of any of the matters specified in GCC Subclause 38.1, the provisions of GCC Subclause 38.3 shall apply.

**33. Loss of or
Damage to
Property;
Accident or Injury
to Workers;
Indemnification**

33.1 Subject to GCC Subclause 33.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions, or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers, or agents, except any injury, death, or property damage caused by the negligence of the Employer, its contractors, employees, officers, or agents.

33.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Subclause 33.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within 28 days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the 28-day period, the Employer shall make no admission that may be

prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

- 33.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers, and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion, or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 34, provided that such fire, explosion, or other perils were not caused by any act or failure of the Contractor.
- 33.4 The party entitled to the benefit of an indemnity under this GCC Clause 33 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the party fails to take such measures, the other party's liabilities shall be correspondingly reduced.

34. Insurance

- 34.1 To the extent specified in the Appendix (Insurance Requirements) to the Contract Agreement, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.
- (a) Cargo Insurance During Transport
Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the Contractor's Equipment.
- (b) Installation All Risks Insurance
Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.
- (c) Third Party Liability Insurance
Covering bodily injury or death suffered by third parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities.
- (d) Automobile Liability Insurance
Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(g) Other Insurances

Such other insurances as may be specifically agreed upon by the parties hereto as listed in the Appendix (Insurance Requirements) to the Contract Agreement.

34.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Subclause 34.1, except for the Third Party Liability, Workers' Compensation, and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Subclause 34.1 except for the Cargo Insurance During Transport, Workers' Compensation, and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

34.3 The Contractor shall, in accordance with the provisions of the Appendix (Insurance Requirements) to the Contract Agreement, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than 21 days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.

34.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.

34.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix (Insurance Requirements) to the Contract Agreement, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insureds under all such policies. All insurers' rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than 21 days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Subclause 34.5.

- 34.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Subclause 34.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 34.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein.
- 34.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 34, and all monies payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

**35. Unforeseen
Conditions**

- 35.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing of
- (a) the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen;
 - (b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions;
 - (c) the extent of the anticipated delay; and

- (d) the additional cost and expense that the Contractor is likely to incur.

On receiving any notice from the Contractor under this GCC Subclause 35.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken.

35.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Subclause 35.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price.

35.3 If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Subclause 35.1, the Time for Completion shall be extended in accordance with GCC Clause 40.

36. Change in Laws and Regulations

36.1 If, after the date 28 days prior to the date of Bid submission, in the country where the Site is located, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated, or changed, which shall be deemed to include any change in interpretation or application by the competent authorities, that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with the SCC, pursuant to GCC Subclause 11.2.

37. Force Majeure

37.1 "Force Majeure" shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected, and shall include, without limitation, the following:

- (a) war, hostilities, or warlike operations whether a state of war be declared or not, invasion, act of foreign enemy and civil war;
- (b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion, and terrorist acts;
- (c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler or any other act or failure to act of any local state or national government authority;
- (d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or

restriction of power supply, epidemics, quarantine, and plague;

- (e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear, and pressure waves or other natural or physical disaster; and
 - (f) shortage of labor, materials, or utilities where caused by circumstances that are themselves Force Majeure.
- 37.2 If either party is prevented, hindered, or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within 14 days after the occurrence of such event.
- 37.3 The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered, or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40.
- 37.4 The party or parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfill its or their obligations under the Contract, but without prejudice to either party's right to terminate the Contract under GCC Subclauses 37.6 and 38.5.
- 37.5 No delay or nonperformance by either party hereto caused by the occurrence of any event of Force Majeure shall
- (a) constitute a default or breach of the Contract; or
 - (b) give rise to any claim for damages or additional cost or expense occasioned thereby, subject to GCC Subclauses 32.2, 38.3 and 38.4
- if and to the extent that such delay or nonperformance is caused by the occurrence of an event of Force Majeure.
- 37.6 If the performance of the Contract is substantially prevented, hindered, or delayed for a single period of more than 60 days or an aggregate period of more than 120 days on account of one or more events of Force Majeure during the currency of the Contract, the parties will attempt to develop a mutually satisfactory solution, failing which either party may terminate the Contract by giving a notice to the other, but without prejudice to either party's right to terminate the Contract under GCC Subclause 38.5.
- 37.7 In the event of termination pursuant to GCC Subclause 37.6, the rights and obligations of the Employer and the Contractor shall be as specified in GCC Subclauses 42.1.2 and 42.1.3.
- 37.8 Notwithstanding GCC Subclause 37.5, Force Majeure shall not apply to any obligation of the Employer to make payments to the Contractor herein.

38. War Risks

38.1 "War Risks" shall mean any event specified in paragraphs (a) and (b) of GCC Subclause 37.1 and any explosion or impact of any mine, bomb, shell, grenade, or other projectile, missile, munitions or explosive of war, occurring or existing in or near the country (or countries) where the Site is located.

38.2 Notwithstanding anything contained in the Contract, the Contractor shall have no liability whatsoever for or with respect to

- (a) destruction of or damage to Facilities, Plant, or any part thereof;
- (b) destruction of or damage to property of the Employer or any third party; or
- (c) injury or loss of life

if such destruction, damage, injury or loss of life is caused by any war risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges, or expenses arising in consequence of or in connection with the same.

38.3 If the Facilities or any Plant or Contractor's Equipment or any other property of the Contractor used or intended to be used for the purposes of the Facilities shall sustain destruction or damage by reason of any war risks, the Employer shall pay the Contractor for

- (a) any part of the Facilities or the Plant so destroyed or damaged to the extent not already paid for by the Employer and so far as may be required by the Employer, and as may be necessary for completion of the Facilities;
- (b) replacing or making good any Contractor's Equipment or other property of the Contractor so destroyed or damaged; and
- (c) replacing or making good any such destruction or damage to the Facilities or the Plant or any part thereof.

If the Employer does not require the Contractor to replace or make good any such destruction or damage to the Facilities, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby destroyed or damaged or, where the loss, destruction, or damage affects a substantial part of the Facilities, shall terminate the Contract, pursuant to GCC Subclause 42.1.

If the Employer requires the Contractor to replace or make good on any such destruction or damage to the Facilities, the Time for Completion shall be extended in accordance with GCC 40.

38.4 Notwithstanding anything contained in the Contract, the Employer shall pay the Contractor for any increased costs or incidentals to the execution of the Contract that are in any way attributable to, consequent on, resulting from, or in any way connected with any war risks, provided that the Contractor shall as soon as practicable notify the Employer in writing of any such increased cost.

38.5 If during the performance of the Contract any war risks shall occur that

financially or otherwise materially affect the execution of the Contract by the Contractor, the Contractor shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its and its Subcontractors' personnel engaged in the work on the Facilities, provided, however, that if the execution of the work on the Facilities becomes impossible or is substantially prevented for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of any war risks, the parties will attempt to develop a mutually satisfactory solution, failing which either party may terminate the Contract by giving a notice to the other.

- 38.6 In the event of termination pursuant to GCC Subclauses 38.3 or 38.5, the rights and obligations of the Employer and the Contractor shall be specified in GCC Subclauses 42.1.2 and 42.1.3.

H. Change in Contract Elements

39. Change in the Facilities

39.1 Introducing a Change

39.1.1 Subject to GCC Subclauses 39.2.5 and 39.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition, or deletion to, in or from the Facilities hereinafter called "Change," provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract.

39.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer with a copy to the Project Manager, any Change that the Contractor considers necessary or desirable to improve the quality, efficiency, or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor, provided that the Employer shall approve any Change proposed by the Contractor to ensure the safety of the Facilities.

39.1.3 Notwithstanding GCC Subclauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Subclauses 39.2 and 39.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures).

39.2 Changes Originating from Employer

39.2.1 If the Employer proposes a Change pursuant to GCC Subclause 39.1.1, it shall send to the Contractor a "Request for Change

Proposal,” requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a “Change Proposal,” which shall include the following:

- (a) brief description of the Change,
- (b) effect on the Time for Completion,
- (c) estimated cost of the Change,
- (d) effect on Functional Guarantees (if any),
- (e) effect on the Facilities, and
- (f) effect on any other provisions of the Contract.

39.2.2 Prior to preparing and submitting the “Change Proposal,” the Contractor shall submit to the Project Manager an “Estimate for Change Proposal,” which shall be an estimate of the cost of preparing and submitting the Change Proposal.

Upon receipt of the Contractor’s Estimate for Change Proposal, the Employer shall do one of the following:

- (a) accept the Contractor’s estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal,
- (b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate
- (c) advise the Contractor that the Employer does not intend to proceed with the Change.

39.2.3 Upon receipt of the Employer’s instruction to proceed under GCC Subclause 39.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Subclause 39.2.1.

39.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the parties thereto shall agree on specific rates for the valuation of the Change.

39.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than 15%, the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor’s objection, the Employer shall withdraw the proposed Change and shall

notify the Contractor in writing thereof.

The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

- 39.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within 14 days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

If the Employer is unable to reach a decision within 14 days, it shall notify the Contractor with details of when the Contractor can expect a decision.

If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of 14 days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Subclause 39.2.2.

- 39.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

If the parties cannot reach agreement within 60 days from the date of issue of the Pending Agreement Change Order, then the matter may be referred to the Dispute Board in accordance with the provisions of GCC Subclause 45.3.

39.3 Changes Originating from Contractor

- 39.3.1 If the Contractor proposes a Change pursuant to GCC Subclause 39.1.2, the Contractor shall submit to the Project Manager a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Subclause 39.2.1.

Upon receipt of the Application for Change Proposal, the parties

shall follow the procedures outlined in GCC Subclauses 39.2.6 and 39.2.7. However, should the Employer choose not to proceed, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

40. Extension of Time for Completion

40.1 The Time(s) for Completion specified in the SCC shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

- (a) any Change in the Facilities as provided in GCC Clause 39;
- (b) any occurrence of Force Majeure as provided in GCC Clause 37, unforeseen conditions as provided in GCC Clause 35, or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Subclause 32.2;
- (c) any suspension order given by the Employer under GCC Clause 41 hereof or reduction in the rate of progress pursuant to GCC Subclause 41.2; or
- (d) any changes in laws and regulations as provided in GCC Clause 36; or
- (e) any default or breach of the Contract by the Employer, or any activity, act or omission of the Employer, or the Project Manager, or any other contractors employed by the Employer; or
- (f) any other matter specifically mentioned in the Contract; or
- (g) any delay on the part of a sub-contractor, provided such delay is due to a cause for which the Contractor himself would have been entitled to an extension of time under this Subclause

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

40.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Employer's estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter to a Dispute Board, pursuant to GCC Subclause 45.3.

40.3 The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

In all cases where the Contractor has given a notice of a claim for an extension of time under GCC 40.2, the Contractor shall consult with the Project Manager in order to determine the steps (if any) which can be taken to overcome or minimize the actual or anticipated delay. The Contractor shall there after comply with all reasonable instructions,

which the Project Manager shall give in order to minimize such delay. If compliance with such instructions shall cause the Contractor to incur extra costs and the Contractor is entitled to an extension of time under GCC 40.1, the amount of such extra costs shall be added to the Contract Price.

41. Suspension

- 41.1 The Employer may request the Project Manager, by notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons therefor. The Contractor shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Facilities, until ordered in writing to resume such performance by the Project Manager.

If, by virtue of a suspension order given by the Project Manager, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than 90 days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within 28 days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 39, excluding the performance of the suspended obligations from the Contract.

If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 39 or, where it affects the whole of the Facilities, as termination of the Contract under GCC Subclause 42.1.

- 41.2 If
- (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix (Terms and Procedures of Payment) to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Subclause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within 14 days after receipt of the Contractor's notice; or
 - (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Subclause 10.2, or failure to obtain any governmental permit

necessary for the execution and/or completion of the Facilities,
then the Contractor may by 14 days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.

- 41.3 If the Contractor's performance of its obligations is suspended, or the rate of progress is reduced pursuant to this GCC Clause 41, then the Time for Completion shall be extended in accordance with GCC Subclause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.
- 41.4 During the period of suspension, the Contractor shall not remove from the Site any Plant, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.

42. Termination

42.1 Termination for Employer's Convenience

42.1.1 The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Subclause 42.1.

42.1.2 Upon receipt of the notice of termination under GCC Subclause 42.1.1, the Contractor shall, either immediately or upon the date specified in the notice of termination,

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition;
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii) below;
- (c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition; and
- (d) subject to the payment specified in GCC Subclause 42.1.3,
 - (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination;
 - (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and
 - (iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of

termination in connection with the Facilities.

42.1.3 In the event of termination of the Contract under GCC Subclause 42.1.1, the Employer shall pay to the Contractor the following amounts:

- (a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination;
- (b) the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel;
- (c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges;
- (d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Subclause 42.1.2; and
- (e) the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above.

42.2 Termination for Contractor's Default

42.2.1 The Employer, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons therefor to the Contractor, referring to this GCC Subclause 42.2:

- (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up, other than a voluntary liquidation for the purposes of amalgamation or reconstruction, a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt;
- (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43; and
- (c) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices, as defined in GCC Clause 6, in competing for or in executing the Contract.

42.2.2 If the Contractor

- (a) has abandoned or repudiated the Contract;
- (b) has without valid reason failed to commence work on the Facilities promptly or has suspended, other than pursuant to GCC Subclause 41.2, the progress of Contract performance for more than 28 days after receiving a written instruction from the Employer to proceed;
- (c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause;
- (d) refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program furnished under GCC Subclause 18.2 at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended;

then the Employer may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor, stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within 14 days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Subclause 42.2.

42.2.3 Upon receipt of the notice of termination under GCC Subclauses 42.2.1 or 42.2.2, the Contractor shall, either immediately or upon such date as is specified in the notice of termination,

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition;
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) below;
- (c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination;
- (d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and
- (e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection

with the Facilities.

- 42.2.4 The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third party. The Employer may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Employer and with an indemnification by the Employer for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities.

Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

- 42.2.5 Subject to GCC Subclause 42.2.6, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as of the date of termination, the value of any unused or partially used Plant on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Subclause 42.2.3. Any sums due the Employer from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract.

- 42.2.6 If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to GCC Subclause 42.2.5, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the Contractor shall be liable for such excess.

If such excess is greater than the sums due the Contractor under GCC Subclause 42.2.5, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due the Contractor under GCC Subclause 42.2.5, the Employer shall pay the balance to the Contractor.

The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

42.3 Termination by Contractor

42.3.1 If

- (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix (Terms and Procedures of Payment) to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Subclause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within 14 days after receipt of the Contractor's notice; or
- (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities;

then the Contractor may give a notice to the Employer thereof, and if the Employer has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within 28 days of such notice, or if the Contractor is still unable to carry out any of its obligations under the Contract for any reason attributable to the Employer within 28 days of the said notice, the Contractor may by a further notice to the Employer referring to this GCC Subclause 42.3.1, forthwith terminate the Contract.

42.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Employer to that effect, referring to this GCC Subclause 42.3.2, if the Employer becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Employer takes or suffers any other analogous action in consequence of debt.

42.3.3 If the Contract is terminated under GCC Subclauses 42.3.1 or 42.3.2, then the Contractor shall immediately

- (a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition;
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii);
- (c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractors'

personnel from the Site; and

- (d) subject to the payment specified in GCC Subclause 42.3.4,
 - (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination;
 - (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and
 - (iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.3.4 If the Contract is terminated under GCC Subclauses 42.3.1 or 42.3.2, the Employer shall pay to the Contractor all payments specified in GCC Subclause 42.1.3, and reasonable compensation for all loss, except for loss of profit, or damage sustained by the Contractor arising out of, in connection with or in consequence of such termination.

42.3.5 Termination by the Contractor pursuant to this GCC Subclause 42.3 is without prejudice to any other rights or remedies of the Contractor that may be exercised in lieu of or in addition to rights conferred by GCC Subclause 42.3.

42.4 In this GCC Clause 42, the expression "Facilities executed" shall include all work executed, Installation Services provided, and all Plant acquired, or subject to a legally binding obligation to purchase, by the Contractor and used or intended to be used for the purpose of the Facilities, up to and including the date of termination.

42.5 In this GCC Clause 42, in calculating any monies due from the Employer to the Contractor, account shall be taken of any sum previously paid by the Employer to the Contractor under the Contract, including any advance payment paid pursuant to the Appendix (Terms and Procedures of Payment) to the Contract Agreement.

43. Assignment

43.1 Neither the Employer nor the Contractor shall, without the express prior written consent of the other party which consent shall not be unreasonably withheld, assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or thereunder, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.

I. Claims, Disputes, and Arbitration

44. Contractor's

44.1 If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause

Claims

of these Conditions or otherwise in connection with the Contract, the Contractor shall submit a notice to the Project Manager, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Subclause shall apply.

The Contractor shall also submit any other notices, which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Project Manager. Without admitting the Employer's liability, the Project Manager may, after receiving any notice under this Subclause, monitor the record keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Project Manager to inspect all these records, and shall (if instructed) submit copies to the Project Manager.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Project Manager, the Contractor shall send to the Project Manager a fully detailed claim, which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect,

- (a) this fully detailed claim shall be considered as interim;
- (b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Project Manager may reasonably require; and
- (c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Project Manager.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Project Manager and approved by the Contractor, the Project Manager shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time.

Each payment certificate shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

The Project Manager shall agree with the Contractor or estimate: (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with GCC Clause 40, and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

The requirements of this Subclause are in addition to those of any other Subclause, which may apply to a claim. If the Contractor fails to comply with this or another Subclause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Subclause.

In the event that the Contractor and the Employer cannot agree on any matter relating to a claim, either party may refer the matter to the Dispute Board pursuant to GCC 45 hereof.

45. Disputes and Arbitration

45.1 Appointment of the Dispute Board

Disputes shall be referred to a Dispute Board for decision in accordance with GCC Subclause 45.3. The Parties shall appoint a Dispute Board by the date stated in the SCC.

The Dispute Board shall comprise, as stated in the SCC, either one or three suitably qualified persons ("the members"), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of activities involved in the performance of the Contract and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the Dispute Board shall comprise three persons, one of whom shall serve as chairman.

If the Parties have not jointly appointed the Dispute Board 21 days before the date stated in the SCC and the Dispute Board is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members is included in the SCC, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the Dispute Board.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed

between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the Dispute Board consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment of the member or such expert (as the case may be). Each Party shall be responsible for paying one-half of this remuneration.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Subclause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the Dispute Board (including each member) shall expire when the Operational Acceptance Certificate has been issued in accordance with GCC Clause 25.3.

45.2 Failure to Agree Dispute Board

If any of the following conditions apply, namely:

- (a) the Parties fail to agree upon the appointment of the sole member of the Dispute Board by the date stated in the first paragraph of GCC Subclause 45.1;
- (b) either Party fails to nominate a member (for approval by the other Party) of a Dispute Board of three persons by such date;
- (c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the Dispute Board by such date; or
- (d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation, or termination of appointment;

then the appointing entity or official named in the SCC shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the Dispute Board. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

45.3 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with the performance of the Contract, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Project Manager, either Party may refer the dispute in writing to the Dispute Board for its decision, with copies to the other Party and the

Project Manager. Such reference shall state that it is given under this Subclause.

For a Dispute Board of three persons, the Dispute Board shall be deemed to have received such reference on the date when it is received by the chairman of the Dispute Board.

Both Parties shall promptly make available to the Dispute Board all such additional information, further access to the Site, and appropriate facilities, as the Dispute Board may require for the purposes of making a decision on such dispute. The Dispute Board shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the Dispute Board and approved by both Parties, the Dispute Board shall give its decision, which shall be reasoned and shall state that it is given under this Subclause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the performance of the Facilities in accordance with the Contract.

If either Party is dissatisfied with the Dispute Board's decision, then either Party may, within 28 days after receiving the decision, give notice to the other Party of its dissatisfaction and intention to commence arbitration. If the Dispute Board fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give notice to the other Party of its dissatisfaction and intention to commence arbitration.

In either event, this notice of dissatisfaction shall state that it is given under this Subclause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in GCC Subclauses 45.6 and 45.7, neither Party shall be entitled to commence arbitration of a dispute unless a notice of dissatisfaction has been given in accordance with this Subclause.

If the Dispute Board has given its decision as to a matter in dispute to both Parties, and no notice of dissatisfaction has been given by either Party within 28 days after it received the Dispute Board's decision, then the decision shall become final and binding upon both Parties.

45.4 Amicable Settlement

Where notice of dissatisfaction has been given under GCC Subclause 45.3 above, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of dissatisfaction and intention to commence arbitration was given, even if no attempt at amicable settlement has been made.

45.5 Arbitration

Unless settled amicably, any dispute in respect of which the Dispute Board's decision (if any) has not become final and binding shall be finally settled by international arbitration. Unless otherwise agreed by both Parties,

- (a) arbitration proceedings shall be conducted as stated in the Special Conditions;
- (b) if no arbitration proceedings is so stated, the dispute shall be finally settled by institutional arbitration under the Rules of Arbitration of the International Chamber of Commerce;
- (c) the dispute shall be settled by three arbitrators; and
- (d) the arbitration shall be conducted in the language for communications defined in GCC Subclause 5.3.

The arbitrator(s) shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Project Manager, and any decision of the Dispute Board, relevant to the dispute. Nothing shall disqualify the Project Manager from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the Dispute Board to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the Dispute Board shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Project Manager and the Dispute Board shall not be altered by reason of any arbitration being conducted during the progress of the Works.

45.6 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a Dispute Board decision which has become final and binding, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under GCC Subclause 45.5. GCC Subclauses 45.3 and 45.4 shall not apply to this reference.

45.7 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with the performance of the Contract, and there is no Dispute Board in place, whether by reason of the expiry of the Dispute Board's appointment or otherwise,

- (a) GCC Subclauses 45.3 and 45.4 shall not apply, and
- (b) the dispute may be referred directly to arbitration under GCC Subclause 45.5.

APPENDIX A

General Conditions of Dispute Board Agreement

1 Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between

- (a) the "Employer";
- (b) the "Contractor"; and
- (c) the "Member" who is defined in the Dispute Board Agreement as being
 - (i) the sole member of the "Dispute Board" and, where this is the case, all references to the "Other Members" do not apply; or
 - (ii) one of the three persons who are jointly called the "Dispute Board" and, where this is the case, the other two persons are called the "Other Members".

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2 General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

- (a) the Commencement Date defined in the Contract;
- (b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement; or
- (c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Board Agreement shall terminate upon the expiry of this period.

3 Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Project Manager. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is

- (a) experienced in the work, which the Contractor is to carry out under the Contract,
- (b) experienced in the interpretation of contract documentation, and
- (c) fluent in the language for communications defined in the Contract.

4 General Obligations of the Member

The Member shall

- (a) have no interest financial or otherwise in the Employer, the Contractor or the Project Manager, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;
- (b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor, or the Project Manager, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;
- (c) have disclosed in writing to the Employer, the Contractor, and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer, or employee of the Employer, the Contractor, or the Project Manager, and any previous involvement in the overall project of which the Contract forms part;
- (d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor, or the Project Manager, except as may be agreed in writing by the Employer, the Contractor, and the Other Members (if any);
- (e) comply with the annexed procedural rules and with GCC Subclause 45.3;
- (f) not give advice to the Employer, the Contractor, the Employer's Personnel, or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;
- (g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor, or the Project Manager regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;
- (h) ensure his/her availability for all site visits and hearings as are necessary;
- (i) become conversant with the Contract and with the progress of the Facilities (and of any other parts of the project of which the Contract forms part) by studying all documents received, which shall be maintained in a current working file;
- (j) treat the details of the Contract and all the Dispute Board's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor, and the Other Members (if any); and
- (k) be available to give advice and opinions on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5 General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the Dispute Board's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any)

- (a) be appointed as an arbitrator in any arbitration under the Contract;
- (b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or
- (c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the Dispute Board under GCC Subclause 45.3, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6 Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

- (a) a retainer fee per calendar month, which shall be considered as payment in full for
 - (i) being available on 28 days' notice for all site visits and hearings;
 - (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
 - (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
 - (iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one-third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

- (b) a daily fee, which shall be considered as payment in full for
 - (i) each day or part of a day up to a maximum of 2 days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);
 - (ii) each working day on site visits, hearings, or preparing decisions; and
 - (iii) each day spent reading submissions in preparation for a hearing.
- (c) all reasonable expenses, including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, facsimiles, and telexes, and use of the internet: a receipt shall be required for each item in excess of 5% of the daily fee referred to in sub-paragraph (b) of this Clause;
- (d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the SCC shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the Dispute Board; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in accordance with GCC Subclause 12.3.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the

payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7 Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member, or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8 Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 concerning his impartiality or independence in relation to the Employer or the Contractor, he/she shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the Dispute Board which are rendered void or ineffective by the said failure to comply.

9 Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

Annex - DISPUTE BOARD GUIDELINES

1. Unless otherwise agreed by the Employer and the Contractor, the Dispute Board shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor, and the Dispute Board, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.
2. The timing of and agenda for each site visit shall be as agreed jointly by the Dispute Board, the Employer, and the Contractor, or in the absence of agreement, shall be decided by the Dispute Board. The purpose of site visits is to enable the Dispute Board to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to prevent potential problems or claims from becoming disputes.
3. Site visits shall be attended by the Employer, the Contractor, and the Project Manager and shall be coordinated by the Employer in cooperation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the Dispute Board shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.
4. The Employer and the Contractor shall furnish to the Dispute Board one copy of all documents which the Dispute Board may request, including Contract documents, progress reports, variation instructions, certificates, and other documents pertinent to the performance of the Contract. All communications between the Dispute Board and the Employer or the Contractor shall be copied to the other Party. If the Dispute Board comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.
5. If any dispute is referred to the Dispute Board in accordance with GCC Subclause 45.3, the Dispute Board shall proceed in accordance with GCC Subclause 45.3 and these Guidelines. Subject to the time allowed to give notice of a decision and other relevant factors, the Dispute Board shall
 - (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case; and
 - (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.
6. The Dispute Board may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.
7. Except as otherwise agreed in writing by the Employer and the Contractor, the Dispute Board shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor, and the Project Manager, and to proceed in the absence of any party who the Dispute Board is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.
8. The Employer and the Contractor empower the Dispute Board, among other things, to

- (a) establish the procedure to be applied in deciding a dispute;
 - (b) decide upon the Dispute Board's own jurisdiction, and as to the scope of any dispute referred to it;
 - (c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Guidelines;
 - (d) take the initiative in ascertaining the facts and matters required for a decision;
 - (e) make use of its own specialist knowledge, if any;
 - (f) decide upon the payment of financing charges in accordance with the Contract;
 - (g) decide upon any provisional relief such as interim or conservatory measures;
 - (h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Project Manager, relevant to the dispute; and
 - (i) appoint, should the Dispute Board so consider necessary and the Parties agree, a suitable expert at the cost of the Parties to give advice on a specific matter relevant to the dispute.
9. The Dispute Board shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the Dispute Board shall make and give its decision in accordance with GCC Subclause 45.3, or as otherwise agreed by the Employer and the Contractor in writing. If the Dispute Board comprises three persons
- (a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
 - (b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
 - (c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless
 - (i) either the Employer or the Contractor does not agree that they do so, or
 - (ii) the absent Member is the chairman and he/she instructs the other Members to not make a decision.

Section 8 - Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC. The clause number of the SCC is the corresponding clause number of the GCC.

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1.	Sub Clause 1.1	<p>Definitions</p> <p>The Employer is: Jaipur Metro Rail Corporation (JMRC) and its legal successors or permitted assigns.</p> <p>The Project Manager is: Authorized Officer of DMRC</p> <p>The Bank is : Asian Development Bank</p> <p>Country of Origin: As per list of Eligible countries defined in section-5</p>
2.	Sub Clause 5.1	<p>Law and Language</p> <p>The Contract shall be interpreted in accordance with the laws of Republic of India</p>
	Sub Clause 5.2	The ruling language is English
	Sub Clause 5.3	The language for communications is English
3.	Sub Clause 7.3	<p>Scope of Facilities</p> <p>(a) The Contractor shall submit along with the bid a schedule of spare parts duly indicating, for each item of spares, its description, part number, lead time, shelf life and number of units required for the system during the first ten years, principal as well as secondary sources of supply. The Contractor/Bidder shall submit the above list duly unit priced with escalation/de-escalation formula in the Package as part of Schedule no.6(a), Section 4- Bidding Forms. This price will not be used for bid evaluation.</p> <p>(b) The Employer may, during a period of ten years from the date of taking over of the whole works, purchase as many parts as required by him, at the rates indicated in this schedule.</p> <p>(c) If during the period of ten years, the Contractor intends to discontinue the manufacture of spare or replacement parts for the Signalling systems, the Contractor shall immediately give notice to the Employer of such intention. The Employer shall be given the opportunity of ordering at reasonable prices such quantities of such spare or</p>

		<p>replacement parts as the Employer requires in relation to the anticipated life of the equipment.</p> <p>In the event of Contractor failing to supply the spare parts in accordance with this Clause, he shall in respect of each item of spare, furnish free of cost to the Employer, the drawings, specifications, patterns and other information to enable the Employer to make or have made such spare parts. The Employer shall be entitled to retain the aforesaid drawings etc., for such time only as is necessary for the exercise by the Employer of his rights under this clause and the drawings, if the Contractor so requires, shall be returned by the Employer to the Contractor in good order and condition (fair wear and tear excepted).</p> <p>Under such circumstances, the Contractor shall also grant to the Employer, without payment of any royalty or charge, full right and liberty to make or have made spare or replacement parts as aforesaid and for such purposes only to use, make and have made copies of all drawings, patterns, specifications and other information supplied by the Contractor to the Employer pursuant to the Contract.</p> <p>(d) The Contractor will so far as it is reasonably able to bind his sub-contractors to conform with the requirements of this Clause and shall, prior to entry into any sub-contracts, provide the Employer with full details of any sub-contractor who will not so conform in which event the Employer may direct the Contractor to seek an alternative sub-contractor.</p> <p>If the Contractor fails to provide spare or replacement parts as described in this Sub-clause and these are available from the Contractor's sub-contractor, the Employer shall have the right to obtain such spare and replacement parts from the sub-contractor or any other supplier and any additional cost incurred by the Employer shall be recoverable from the Contractor.</p> <p>(e) The foregoing shall hold equally good for the Contractor, any or all of his sub-contractors and venders.</p>
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		(f) The Employer may require the Contractor to enter into a Maintenance Contract with the Employer for the System / Machine provided under the Contract under terms and conditions to be mutually agreed.
4.	Sub Clause 8.1	<p>Time for Commencement</p> <p>The Contractor shall commence work on the Facilities on the date specified in the Letter of Acceptance or if no date is specified in the Letter of Acceptance, on the date specified in an instruction in writing to that effect from the Project Manager (Notice to Proceed).</p> <p>Thereafter the Contractor shall proceed with due diligence, without delay, and in accordance with the programme or any revised or modified programme of the Works. Time will be the essence of Contract and time for Completion shall run from the date the Contractor is to commence the Works under this Clause.</p> <p>The Contractor shall not commence the construction, manufacture or installation of the Works or of any part of the Works unless and until the Project Manager has endorsed the relevant Working Drawings in accordance with the Employer's Requirements.</p>
5.	Sub Clause 8.2	<p>Time for Completion</p> <p>The Time for Completion of the whole of the Facilities shall be as per Key dates defined in Appendix 4 of Section 9- Contract Forms.</p> <p>The Access Dates shown in the Employer's Requirements are for planning purposes only.</p> <p>The Employer reserves the right to make each site available to the Contractor any time during the period from 60 days before to 90 days after the Access Dates. The Project Manager will notify the Contractor of the actual Access Dates at least 30 days in advance for each part of the works. This Notice will specify the area to which it refers is accessible and in a sufficient state of completion to permit the Contractor to begin installation and testing therein. It shall not imply that the Contractor will enjoy exclusive use of the area or that the work of other Contractor's therein is complete. The Contractor shall begin installation in each area by the actual Access Date, and shall complete all installation and testing in each area by the relevant Key Date.</p>

		Notwithstanding the actual Access Date, whether before or after the stipulated Access Dates, the Employer shall not accept any increase in cost to the Employer.
6.	Sub Clause 9.8	<p>Protection of the Environment</p> <p>The contractor shall refer SHE Manual (part of Employer's Requirements) for all such activities.</p>
7.	Sub Clause 11.1	<p>Contract Price</p> <p>The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement as given in Section 9.</p> <p>The rates and prices quoted in the Bill of Quantities shall be quoted separately in the following currencies:</p> <ol style="list-style-type: none"> For inputs to the Works, which are expected to be supplied from within India, in Indian Rupees. For those inputs to the Works, which are expected to be supplied from outside India, in foreign currencies. <p>The Contract Price shall not be adjusted on account of fluctuations in the rates of exchange between the foreign currencies of the Contract and Indian Rupees.</p> <p>The Bidder is required to note the following while quoting his prices:-</p> <p>As this project is funded by Asian Development Bank (ADB), the project is governed by the following exemptions.</p> <p>A. Custom Duty and Excise Duty</p> <ol style="list-style-type: none"> The project is eligible for exemption of custom duty as per notification no. 84/97-customs dated 11.11.1997, as amended by notification no. 85/99-cus. Dated 06.07.1999 and no. 119/99-cus. Dated 02.11.1999 and notification no. 75/2001 dated 01-07-01 and notification no. 107/2001-cus. Dated 12.10.2001 The project is eligible for exemption

		<p>of Excise duty as per notification no. 108/95- CE, dated 28.08.1995, as amended vide central excise notification no. 7/98-CE, dated 02.06.1998; 33/98-CE, dated 13.10.1998; 4/99- CE dated 11.02.1999 and 40/99- CE, dated 02.11.1999.</p> <p>Note: 1. Amendments to above notifications, if any, up to the date 28 days prior to the deadline for submission of bids shall also be deemed to be taken into consideration in the Contract Price. The copy of above notification is attached as Annexure-I to the SCC.</p> <p>Note: 2. In order to seek exemptions of Custom Duty and/or Excise Duty the JMRC shall issue the required certificates for the project on the request of the contractor.</p> <p>B. VAT, Rajasthan Entry Tax and Service Tax :-</p> <p>Bidder to note that as per the following Notifications of Government of Rajasthan, Rajasthan Value Added Tax and Rajasthan Entry Tax on certain goods are exempted for this Contract and Bidder shall take into consideration these exemptions in their Contract Price:</p> <p>1. Rajasthan Tax on Entry of Goods into Local Areas Act, 1999:</p> <p>a. Notification No. F.12 (100)FD/Tax/10-81 dated 6th October 2010 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>(i)Amendment No. F 12(100)FD/Tax/10-76 dated 08th December 2011</p> <p>(ii) Amendment No. F 12 (100)FD/Tax/2010-10 dated 17th April 2013</p> <p>2. Rajasthan Value Added Tax Act</p>
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		<p>2003</p> <p>a. Notification No. F.12 (100)FD/Tax/10-78 dated 6th October 2010 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>(i)Amendment No. F 12(100)FD/Tax/10-73 dated 08th December 2011</p> <p>(ii) Amendment No. F12 (100)FD/Tax/10-11 dated 24th April 2013</p> <p>(iii) Amendment No. F 12 (79)FD/Tax/2014-Pt-I-151 dated 8th Feb 2016</p> <p>b. Notification No. F.12 (100)FD/Tax/10-79 dated 6th October 2010 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>(i) Amendment No. F12 (100)FD/Tax/10-74 dated 8th Dec 2011</p> <p>c. Notification No. F.12 (63)FD/Tax/2005-81 dated 8th August 2006 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>(i)Amendment No. F 12(100)FD/Tax/10-80 dated 06th October 2010</p> <p>(ii) Amendment No. F12 (100)FD/Tax/10-75 dated 8th Dec 2011</p> <p>3. Service Tax</p> <p>Exemption on construction, erection, commissioning or installation of original works pertaining to monorail or metro as per notification no. 25/2012 Service Tax dated 20.06.2012, in respect of contracts entered</p>
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		<p>into on or after 1st March 2016 has been withdrawn vide notification no. 09.2016 dated 01.03.2016 w.e.f 01.03.2016 & now the service tax is applicable on all such contracts to be executed on or after 01.03.2016. However, the abatement as available on original works may also be available as per the provision of the Act and service tax may be leviable on 40% of total value @ 14% = 5.6% on gross value plus cess/surcharge etc as applicable</p> <p>Note:1 Amendments to above notifications, if any, up to the date 28 days prior to the deadline for submission of bids shall also be deemed to be taken into consideration in the Contract Price. The copies of above notification are attached as Annexure – I to the SCC.</p> <p>Note:2 In addition to above exemptions (Custom Duty, Excise Duty, VAT, Rajasthan Entry Tax and Service Tax), if any other exemptions which are available to the contractor by virtue of any notification of Govt./Local Bodies existing as on 28 days prior to the submission of the bids, may be availed by the contractor and JMRC will issue the necessary required certificates for availing such exemptions on the request of the contractor.</p> <p>C. Bid Evaluation:-</p> <ol style="list-style-type: none"> 1. The bidders shall quote fix lump sum price or as per BOQ price (as the case may be) inclusive of all taxes, levies, duties, cess, freight, insurance and all other incidental charges required to fulfill the contract requirements including statutory deduction viz., TDS towards Income Tax T/Works Contract Tax etc., except the exemptions stated in clause A, B above to the extent the same are applicable and available. 2. However, any new taxes/duties or any statutory variation in the existing taxes/duties applicable to the JMRC project during the contractual completion shall be to the employers account i.e. reduction is to be passed on to the employer and increase to be reimbursed
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		<p>by the employer, The contractor shall furnish the documentary evidence in support of their claims for reimbursement from JMRC. However, any increase in cost due to new taxes/duties or any statutory variation in the existing taxes/duties applicable to the JMRC project during extended contractual period due to contractors fault shall be to contractor account, whereas any decrease in the taxes/duties shall be employers account.</p> <p>D. Taxes and duties paid to the sub-vendors shall not be paid separately and therefore are to be included in the price.</p>
	Sub Clause 11.2	No price escalation shall be provided.
8.	Sub Clause 12.1	<p>Terms of Payment</p> <p>The fixed Lump Sum Price shall be apportioned by the Contractor amongst the various Cost Centers in accordance with Appendix-1 of Contract forms, wherever applicable. The amount thus apportioned under each Cost Centre will be further apportioned amongst various Milestones with the approval of the Employer. The Contractor shall be entitled to submit to the Project Manager requests for interim payments only upon the achievement of one or more of the Milestones described in the Cost Centre.</p> <p>At the beginning of each month, the Project Manager shall issue to the Contractor certificate in respect of each Milestone due to be achieved in the preceding month stating:</p> <ul style="list-style-type: none"> (a) the date on which the Milestone was achieved; or (b) the non-achievement of the Milestone. <p>The Contractor shall submit a statement in three copies to the Project Manager at the beginning of each month, in a form approved by the Project Manager, showing the amounts to which the Contractor is entitled, together with supporting documents, including Milestone Certificates. The statement shall include the following items, as applicable, which shall be</p>

		<p>expressed in the various currencies in which the Contract Price is payable, in the sequence listed:</p> <ul style="list-style-type: none"> a) the amount due in respect of Milestones certified achieved by the Project Manager under each Cost Centre; b) any amounts to be added and deducted for the advance payments and recovery thereof; c) any other additions or deductions is due and approved by the Project Manager in accordance with the Contract; and d) the deduction of the amounts certified in all previous Interim Payment Certificates. <p>The Contractor shall not submit more than one request for interim payment per month.</p> <p>If any Milestone is not achieved by the end of the month in which it is scheduled to be achieved, the Project Manager shall suspend the payment relating to the Cost Centre in which the Milestone is included.</p> <p>Payments suspended under this Clause shall be resumed by being included in the next application for interim payment made after the Milestone is achieved.</p>
		<p>A. Payment- Interim and Final</p> <p>(a) After preliminary scrutiny and certification by the Engineer, payment of 80% of the certified interim amount shall be made by the Employer within 14 days. The amount certified shall account for all deductions, including statutory deductions, recoveries for advances and any amounts due from the Contractor. The balance 20% shall be paid within 28 days, from the date of the preliminary certification of the bill by the Engineer.</p> <p>(b) Next 80% interim payment shall be made only after 100% payment of preceding interim payment certified has been completed.</p> <p>(c) the Employer shall pay the amount certified in the Final Payment Certificate within 56 days from the date of issue of the Certificate.</p> <p>Payments shall be made into a bank account, nominated by the Contractor in Indian rupees in a</p>

		<p>bank in India unless otherwise permitted in Special Conditions of Contract. If payments are to be made in more than one currency, separate bank accounts may be nominated by the Contractor for each currency, and payments shall be made by the Employer accordingly.</p> <p>If and to the extent that the Pricing Document expressly specifies in relation to a Cost Centre that the Contractor is entitled to payment in a currency other than Indian Rupees, or the Engineer makes a determination of Cost in a currency other than Indian Rupees, all such payments shall be made in the relevant foreign currency and no adjustment shall be made to any payment or to the Final Contract Sum on account of any fluctuation in the exchange rate between Indian Rupees and such other currency from the Base Date.</p> <p>All payments in a foreign currency shall be made against an irrevocable Letter of Credit or through Electronic funds transfer.</p> <p>Contractor may apply for part completion of any milestone, if the milestone activity has been at least 50% completed, along with supporting details justifying the percentage completion being requested. The Employer's Engineer shall have the full authority to accept, modify or reject any such request. The decision of the Engineer is final.</p>
		<p>B. Application for Final Payment Certificate</p> <p>Not later than 56 days after the issue of the Performance Certificate, the Contractor shall submit to the Engineer three copies of a draft final statement with supporting documents showing in detail, in a form approved by the Engineer:</p> <ul style="list-style-type: none"> (a) the value of all work done in accordance with the Contract, and (b) any further sums which the Contractor considers to be due to him under the Contract or otherwise. <p>If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the Final Statement as agreed.</p>

		<p>If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Employer shall pay those parts of the draft final statement as certified by the Engineer as not being in dispute. The remainder of the dispute may then be resolved under Clause 45, GCC in which case the Contractor shall then prepare and submit to the Engineer a Final Statement in accordance with the outcome of the dispute.</p> <p>Discharge</p> <p>When submitting the final statement, the Contractor shall submit a written discharge which confirms that the total of the Final Statement represents full and final settlement of all monies due to the Contractor under the Contract. Such discharge may state that it shall become effective only after payment due under the Final Payment Certificate has been made and the Performance security referred to in Sub-Clause 13.3, GCC has been returned to the Contractor.</p>
		<p>C. Issue of Final Payment Certificate</p> <p>The Engineer shall issue to the Employer, with a copy to the Contractor, the Final Payment Certificate within 28 days after receiving the Final Statement and written discharge in accordance with Clause 8(C) , stating:</p> <ul style="list-style-type: none"> (a) the amount which is finally due, and (b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer, as the case may be. <p>If the Contractor has not applied for a Final Payment Certificate in accordance with Clause 8(B), the Engineer shall request the Contractor to do so. If the Contractor fails to make such an application within a period of 28 days, the Engineer shall issue the Final Payment Certificate for such amount as he considers to be due.</p>

		<p>D. Signature On Receipts For Payments</p> <p>Every receipt of payment to Contractor including refund of the Performance Security shall be signed by the person authorized to do so on his behalf. In the event of death of any of the Contractor's partners in case the Contractor is a partnership firm, during the currency of the Contract, it is hereby expressly agreed that every receipt by any one of surviving Contractor's partners, shall, if so signed as aforesaid, be a good and sufficient discharge as aforesaid, provided that nothing in this Clause shall be deemed to prejudice or affect any claim, which the Employer may hereafter have against the legal representatives of any Contractor's partner so dying, for or in respect of breach of any of the conditions of the Contract. Provided also that nothing contained in this clause shall be deemed to prejudice or affect the respective rights and obligations of the Contractor's partners, or of the legal heirs / representatives of any deceased Contractor / partner inters.</p>
		<p>E. Recovery of money due to the Employer</p> <p>All damages (including, without limitation, liquidated damages), costs, charges, expenses, debts, or sums for which the Contractor is liable to the Employer under any provision of the Contract may be deducted by the Employer from monies due to the Contractor under the Contract (including, without limitation, liquidated damages) and the Employer shall have the power to recover any balance not so deducted from monies due to the Contractor under any other contract between the Employer and the Contractor.</p> <p>When the Contractor has assigned to a third party the right to receive monies due, or, to become due, under the Contract to the Contractor or charged such monies in favour of a third party, the Employer's right to deduct damages (including without limitation liquidated damages), costs, charges, expenses, debts or sums for which the Contractor is liable to the Employer from monies due to the Contractor under the Contract shall be limited to the right expressed above.</p>
9.	Sub Clause 13.1	<p>Issuance of Securities</p> <p>The forms of Performance security and Advance Payment Guarantee shall be in the formats given in the contract forms , Section 9 of the contract. The forms of Parent Company Undertaking, Parent Company Guarantee and Contractor's warranty shall be in the</p>

		<p>formats given in the annexures VI, VII & VIII respectively to these Special Conditions of Contract. Even if not described or stated in the Employer's Requirements and the Contractor's Technical Proposals, the Contractor shall carry out and complete the design of the Works, including the selection of specifications for the kind and standard of Plant, Materials and workmanship to be used therein.</p> <p>The Contractor warrants to the Employer (Annexure VIII) that:</p> <ul style="list-style-type: none"> (a) the Works will, when completed, comply in all respects with the Employer's Requirements. (b) the Works have been or will be manufactured, constructed, executed, supplied, installed and tested to the highest standards available using proven up-to-date good practice; (c) the Works will, when completed, comply with enactments and regulations relevant to the Works; and (d) no Materials generally known to be deleterious or not in accordance with good engineering practice have been or will be selected or incorporated in the Works, by the Contractor. <p>The Contractor shall not, under any circumstance, have or make any claim for additional payment or an extension of time or be relieved from any liability or obligation under the Contract, where the cause of delay, suspension, impediment to or adverse effect upon the progress of the Works is due to failure by the Contractor.</p> <p>The Schedules attached to SCC may be modified as considered necessary at the time of finalisation of the Contract.</p>
10.	Sub Clause 13.2	<p>Advance Payment Security</p> <p>Mobilisation advance shall be paid interest free against acceptable Bank Guarantee from a scheduled commercial bank in India. The value of Bank Guarantee taken towards security of "Mobilisation advance" shall be 110% of the advance taken by the contractor.</p> <p>The Advance Payment shall be</p>

		<p>a) Mobilisation advance of 10% of the Fixed Lump Sum Price when the Contract becomes effective.</p> <p>b) The advance payment shall be in the same proportion of currencies in which the Fixed Lump Sum Price has been quoted.</p> <p>c) The first installment shall be paid after mobilisation has started and next installment shall be paid after satisfactory utilization of earlier installment.</p> <p>d) Amount of advance payment guarantee will be reduced by an amount by which mobilization advance has been recovered from the contractor's interim payment requests. Such adjustment in the amount of advance payment guarantee will be carried out every six months.</p> <p>Recovery of Advance</p> <p>a) The recovery of advances shall commence when 20% of the original contract value of the work has been paid and it will be completed by the time 85% of the contract value has been paid or the original completion date whichever is earlier. As far as possible the recovery of advances shall be limited to 30% of an account bill.</p> <p>b) No advance shall be given after 40% of the original contract amount has been paid.</p> <p>c) The contractor shall always have the option to have the recoveries commenced and/ or completed earlier, and /or to have recoveries affected in installments of higher amount and also to repay part or whole of the advance by direct payment rather than through On-account Bills</p> <p>d) In case the contract is terminated due to default of the contractor or rescinded/foreclosed due to any other reason, the contractor shall return the un recovered amount of all advances within 15 days of issue of notice of termination</p>
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		<p>/rescission/fore closer of the contract and if the contractor fails to do so due to any reason whatsoever , then interest at an interest rate equal to State Bank of India prime lending rate plus 2% per annum or 10% per annum whichever is higher shall be charged on the unrecovered amount of such advances from 16th day onwards till the same is returned by the contractor .</p> <p>Interest in case of Delay in repayment of Advances</p> <p>Should there be delay in progress and completion of work, as a result of which is not possible to recover the advance and interest thereon, before the date of completion stipulated in the Contract, then the interest to be charged from the Contractor on the remaining portion of the advance beyond the original completion date specified in the Contract, shall be the State Bank of India prime lending Rate plus 2% per annum or 10% per annum whichever is higher.</p> <p>Advances to be used only for this work</p> <ul style="list-style-type: none"> a) The advances shall be used by the Contractor strictly for the purpose of the Contract, and for the purpose for which they are paid. Under no circumstances, shall the advances be diverted for other purposes. Any such diversion shall be construed as a breach of the contract and the contractor shall be asked to return the advance at once and pay interest at 15% per annum till the advance is recovered back from him .The Contractor shall return the advance and pay the interest in one go without demur. b) Employer retains the right for any other remedy prescribed for breach of Contract in this regard. c) The Contractor, if required by the Project Manager shall provide the details of utilization of Mobilization advance.
11.	Sub Clause 13.3.1	<p>Performance Security</p> <p>Within 28 days of receipt of the Letter of Acceptance, the successful Bidder shall furnish</p>

		Performance Security in the form of a bank guarantee from a branch in India of a scheduled foreign bank or from a scheduled commercial bank in India acceptable to the Employer for an amount of 10% of the Contract value in types and proportions of currencies in which the Contract Price is payable.
		Whenever the contract value exceeds beyond 25% of the original contract value either due to Employer's variation or due to Contractor's variation, the contractor shall submit additional performance security equal to an amount of 10% of the variation reduced by an amount equal to 5% of the work already certified as completed by the Project Manager -in-Charge on the date of variation subject to a maximum limit of 10% of the variation amount.
		No additional performance security will be required to be submitted if the variation is within 25% of the original contract value.
		The performance security shall be in the form of the bank guarantee as per form included in Section 9 (Contract Forms).
	Sub Clause 13.3.3	Forfeiture <ul style="list-style-type: none"> i. Failure of the successful Bidder to furnish the required Performance Security shall be a ground for the annulment of the award of Contract and forfeiture of the tender security. ii. The whole of the Performance Security amount shall be liable to be forfeited by the Employer at the discretion of the Employer, in the event of any breach of contract on the part of the Contractor. iii. On termination of contract due to contractor's default as per GCC Clause 42.2 the performance security shall be forfeited by encashing the bank guarantee and the balance work shall be got done independently without risk and cost of the failed contractor. The failed contractor shall be debarred from participating in the bid for executing the balance work. If the failed contractor is a JV or a partnership firm,

		<p>then every member/partner of such JV or partnership firm shall be debarred from participating in the bid for the balance work either in his/her individual capacity or as a partner of any other JV/partnership firm.</p> <p>The Project Manager shall not make a claim under the Performance Security except for amounts to which the JMRC is entitled under the contract (Not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:</p> <ul style="list-style-type: none"> a) Failure by the contractor to extend the validity of the Performance Security, in which event the Project Manager may claim the full amount of the Performance Security. b) Failure by the contractor to pay JMRC any amount due, either as agreed by the contractor or determined under any or the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Project Manager. <p>The contractor being determined or rescinded under provision of the GCC, the Performance Security shall be forfeited in full and shall be absolutely at the disposal of the JMRC.</p>
		<p>Release</p> <ul style="list-style-type: none"> i. On completion of the entire work, one half of the Performance Security shall be refunded to the Contractor, on issue of Completion Certificate by the Project Manager. This shall not relieve the Contractor from his obligations and liabilities, to make good that may be detected during the Defects Liability Period. ii. The balance amount shall become due and shall be paid to the Contractor on signing of the Performance Certificate after the expiry of the final Defects Liability Period in accordance with GCC Clause 27 & SCC Clause 29 & 55.

12.	Sub Clause 15	<p>Intellectual Property</p> <p>In addition to GCC following shall also apply-</p> <p>As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design Documents made by (or on behalf of) the Contractor.</p> <p>The Contractor shall be deemed (by signing the Contract) to give to the Employer an on-terminable transferable non-exclusive royalty-free license to Copy, use and communicate the Contractor's Documents, including making and using modifications of them .This license shall:</p> <p>a) Apply throughout the actual or intended working life(whichever is longer)of the relevant parts of the Works,</p> <p>Entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and in the case of Contractor's Documents which are in the form of computer Programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of Any computers supplied by the Contractor.</p>
13.	Sub Clause 17	<p>Project Manager's Authority to Delegate</p> <p>i. The Project Manager, may from time to time assign and delegate authority to Project manager's representatives/assistants and may also revoke such assignments and delegations. The delegation or revocation shall be in writing and shall be applicable only after same has been notified in writing to the Contractor.</p> <p>ii. Each Assistant to whom duties have been assigned or authority has been delegated, shall be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any determination, approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test or similar act by an</p>

		<p>assistance shall have the same effect as though the act had been an act of the Project manager. However:</p> <p>(a) Any failure to disapprove any Plant, Goods , Material, design and workmanship shall not prejudice the right of the Project manager to reject such Plant, Goods , Material, design and workmanship;</p> <p>(b) if the Contractor questions any determination or instruction of an assistant of the Project manager, the Contractor may refer the matter to the Project manager within three days of such decision having been given, who shall confirm, reverse or vary such determination or instruction</p> <p>Project Manager's Instructions</p> <p>The Contractor shall comply with instructions given by the Project manager in accordance with the Contract.</p> <p>The Contractor shall give reasonable notice to the Project manager of any instruction, which he considers necessary for the execution of the Works, to enable the Project manager to issue the instruction so that progress of the Works is not delayed. The Project manager shall not, however, be bound to issue any instruction which, in his opinion, is unnecessary.</p> <p>No act or omission by the Project manager or the assistants to the Project manager in the performance of any of the Project manager's duties or the exercise of any of the Project manager's powers under the Contract shall, in any way, operate to relieve the Contractor of any of the duties, responsibilities, obligations or liabilities imposed upon the Contractor by any of the provisions of the Contract.</p> <p>Project manager to Attempt Agreement</p> <p>When the Project manager is required to determine value, cost or extension of time, he shall consult with the Contractor and the Employer in an endeavour to reach agreement. If agreement is not achieved, the Project manager shall determine the matter fairly, reasonably and in accordance with the Contract, with the approval of Employer</p>
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14.	Sub Clause 18.2	<p>Work Programme</p> <p>The Contractor shall submit a detailed programme to the Project Manager after receipt of the Letter of Acceptance within the period stipulated in the Employer's Requirements. . The Contractor shall also submit a revised programme whenever the Project Manager finds that the previous programme is inconsistent with actual progress or with the Contractor's obligations.</p> <p>The Works Programme and any other document submitted along with the Tender shall not in any event be construed as a submission of the Programme under Employer's Requirements.</p> <p>Manufacture, Supply, Installation, Testing and Commissioning (Including Integrated Testing and Commissioning) Methods</p> <p>The Contractor shall submit complete documents and information pertaining to the methods of manufacture, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) which the Contractor proposes to adopt or use on Corridors. The Engineer / Project Manager will then check to see whether, if such methods are adhered to, the Works can be executed in accordance with the Contract and without detriment to the Works (when completed) and to other works comprising the Project.</p> <p>The Engineer / Project Manager shall inform the Contractor in writing within 21 days after receipt of the above information</p> <ul style="list-style-type: none"> (a) that the Contractor's proposed methods of manufacture, testing and commissioning (including Integrated Testing and Commissioning) have the consent of the Project Manager; or (b) in what respects, in the opinion of the Project Manager the Contractor's

		<p>proposed methods of manufacture, etc:</p> <ul style="list-style-type: none"> (i) fail to comply with the Employer's Requirements and/or the Final Design; (ii) would be detrimental to the Works and/or to the other works comprising the Project; (iii) do not comply with the other requirements of the Contract; or (c) as to the further documents or information which are required to enable the Project Manager to properly assess the proposed methods of manufacture, etc. <p>In the event that the Project Manager does not give his consent, the Contractor shall take such steps or make such changes in the said methods or supply such further documents or information as may be necessary to meet the Project Manager 's requirements and to obtain his consent. The Contractor shall not change the methods of manufacture, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) which have received the Project Manager 's consent without further review and consent in writing of the Project Manager.</p> <p>Notwithstanding the foregoing provisions of this Clause, or that certain of the Contractor's proposed methods of manufacture, etc. may be the subject of the consent of the Project Manager, the Contractor shall not be relieved of any liability or obligation under the Contract.</p>
15.	Sub Clause 19	<p>Sub-contracting</p> <p>19.1 The Employer shall screen in detail the sub-contractors and vendors listed in Appendix 5 during the Contract execution Phase. It will be obligatory for the Contractor to obtain Notice of No Objection from the Project Manager to the identity of the sub-contractors and vendors selected by the Contractor from the list included at the time of the Tender.</p>

		<p>For installation and other sub-contracts for items not included in Appendix 5, each costing over INR Five Lakh, it will be obligatory on the part of the Contractor to obtain consent of the Employer to the identity of the sub-contractor. The Employer will give his consent after assessing the technical suitability of the sub-system/system including proven performance, and feasibility of its maintenance in India, etc.</p> <p>The terms and conditions of the sub-contract/vending agreement are the sole prerogative of the Contractor and are deemed to be included in the Lump Sum Price.</p> <p>In case the Employer intends to withhold his consent, he shall inform the Contractor in time to enable him to make alternative arrangements to fulfill his programme.</p> <p>(a) The Contractor shall provide sufficient superintendence, whether on the Site or elsewhere, to ensure that the work to be carried out by a sub-contractor complies with the requirements of the contract.</p> <p>(b) The proposed sub-contract terms and conditions shall impose on the sub-contractor such of the terms of the Contract as are applicable and appropriate to the part of the Works to be sub-contracted, to enable the Contractor to comply with his obligations under the Contract.</p> <p>(c) In case of urgency and on receipt of application from the contractor the Project Manager may shorten the notice period from 28 days required for a sub-contractor's work to be commenced.</p> <p>(d) After the Notice of No Objection issued by the Project Manager to the identity of the sub-contractor/vendor, any change in the identity of sub-contractor/vendor shall require prior</p>
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		<p>approval of the Project Manager.</p> <p>Notwithstanding any consent to sub-contract given by the Project Manager, if in his opinion he considers it necessary, the Engineer shall have full power to order the removal of any sub-contractor from the Site or off-Site place of manufacture or storage, which power shall not be exercised unreasonably.</p> <p>For the subcontractor submitted at the time of bidding:-</p> <p>For the work proposed for sub contracting at the time of submission of bid (for evaluation of this contract) as per section 3 (EQC), no change in sub-contractor (submitted for the said work) shall be allowed from LOA to completion of works.</p> <p>The form of the Sub-Contractor's Warranty shall be in the format given in Annexure IV.</p>
16.	Sub Clause 20	<p>Design and Engineering</p> <p>Following shall be read in conjunction with GCC clause:</p> <p>General Obligations/Statutory Requirements</p> <p>The Design and Construction Standards shall be in conformity with the requirements of "Rules for Opening of a Railway or a Section of a Railway for Public Carriage of Passengers" and "Rules for Introduction of New Type of Rolling Stock" and to the satisfaction of the Commissioner of Railway Safety whose sanction is mandatory for commissioning of the System. The Contractor shall in this regard carry out all statutory tests and trials necessary for obtaining sanction of the competent authority for opening the system for public carriage of passengers and provide assistance and information as required by the appropriate statutory authorities in India.</p> <p>In the event that the Contractor employs a Designer, then the Contractor shall furnish a Designer's Warranty in the format given in Annexure V.</p> <p>Construction and/or Manufacture Documents</p> <p>The Contractor shall submit drawings and</p>

		<p>documents, as required by the Contract, to the Project Manager/ Engineer in accordance with any submittal schedule agreed with the Project Manager. This submittal shall be made sufficiently before the Works are to be carried out to give the Project Manager and the Employer reasonable time to examine the drawings or other documents, to prepare comments and for any changes to be accommodated by the Contractor.</p> <p>Where the consent of the Project Manager is required, the Project Manager shall notify the Contractor in writing of his decision either within such period as may expressly be stipulated in the Contract or otherwise within a reasonable time.</p> <p>If the Project Manager has reasonable cause for being dissatisfied with the proposals set out in the Contractor's drawings or documents, the Project Manager shall, within a period of 28 days from the date of submittal, require the Contractor in writing to make such amendments thereto as the Project Manager may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended drawings or documents for Project Manager's consent.</p> <p>Within 14 days of notification of the Engineer / Project Manager's consent the Contractor shall provide the Project Manager with the type and number of sets of the relevant drawings or documents as stipulated in the Employer's Requirement.</p> <p>Should it be found at any time after notification of consent that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Project Manager has previously notified his consent, the Contractor shall, at his own expense, make such alterations or additions as, in the opinion of the Project Manager, are necessary to remedy such non-compliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Project Manager.</p> <p>No examination by the Project Manager of the drawings or documents submitted by the Contractor, nor any consent of the Project Manager in relation to the same, with or without amendment, shall absolve</p>
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		<p>the Contractor from any of his obligations under the Contract or any liability for or arising from such drawings or documents.</p> <p>The Operation and Maintenance Manuals and drawings submitted by the Contractor shall, if required, be updated during the Defects Liability Period and re-submitted for approval by the Project Manager.</p>
17.	Sub Clause 21.1	<p>Material</p> <p>The Contractor shall adequately record the condition of roads, agricultural land and other infrastructure prior to the start of transporting materials, goods and equipment, and construction.</p>
18.	Sub Clause 22.1.1	<p>Bench Mark</p> <p>The Contractor shall comply with</p> <p>i) The measures and requirements relevant to the Contractor which are set forth in the Resettlement Plan ("RP") /Environmental Management Plan ("EMP") attached as Annexure – IX to the SCC, to the extent it concerns impacts on affected people during construction; and</p> <p>ii) Any corrective or preventive actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the resettlement plan</p>
19.	Sub Clause 22.2.3	<p>Labour laws</p> <p>The Contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The Contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline.</p> <p>The Contractor shall provide equal wages and benefits to men and women for work of equal value or type.</p>
20.	Sub Clause 22.2.5	<p>Working Hours</p> <p>Normal working hours are: 8 Hours per day. The Contractor, if required, shall carry out work during night and in shifts. No extra payments shall be admissible for night work. The Contractor shall provide adequate lightning and safety arrangements.</p>

		<p>The Contractor shall take due approval from the employer before carrying out any works necessitated by the provisions of contract in or around the sites deemed part of the works of phase 1-A, JMRTS. All work permits shall be taken in accordance with the procedures laid down by employer and work shall be done in accordance with safety and quality provisions of this contract.</p>
21.	<p>Sub Clause 22.2.7</p>	<p>Health and Safety</p> <p>a. The Contractor shall throughout the contract (including the Defect Liability Period):</p> <ul style="list-style-type: none"> (i) conduct Information, Education and Consultation Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labor (including all the Contractor's employees, all Sub-Contractors and Employer's and Project Manager's employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behavior with respect to of Sexually Transmitted Diseases (STD)—or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labor as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counseling and referral to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labor. <p>The Contractor shall include in the program to be submitted for the execution of the Facilities under Sub-Clause 18.2 an alleviation program for Site staff and labor and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation program</p>

		<p>shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the program shall detail the resources to be provided or utilized and any related sub-contracting proposed. The program shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and implementation this program shall not exceed the Provisional Sum dedicated for this purpose.</p>
		<p>b. Safety Precautions</p> <p>After the date of Notice to Proceed, the Contractor shall submit a detailed and comprehensive contract-specific Site Safety Plan based on the Employer's Safety, Health and Environmental Manual (SHE Manual). The Contractor is required to make himself aware of all the requirements of the Employer's Safety, Health and Environmental Manual in this regard and comply with them. The Site Safety Plan shall include detailed policies, procedures and regulations which, when implemented, will ensure compliance with 22.2.7 of General Conditions of Contract. The Contractor shall, from time to time and as necessary or required by the Project Manager, produce supplements to the Site Safety Plan such that it is at all times a detailed, comprehensive and contemporaneous statement by the Contractor of his site safety and industrial health obligations, responsibilities, policies and procedures (under the laws of India) or as stated in the Contract or elsewhere relating to work on Site.</p> <p>If at any time the Site Safety Plan is, in the opinion of the Project Manager, insufficient or requires revision or modification to ensure the security of the Works and the safety of all workmen upon, and visitors to the Site, the Project Manager may instruct the Contractor to revise the Site Safety Plan. The Contractor shall, within 14 days, submit the revised plan to the Project Manager for review.</p> <p>Any omission, inconsistency or error in the Site Safety Plan or the Project Manager concurrence or rejection of the Site Safety Plan and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to site safety and industrial health and shall not excuse any failure by the</p>

		<p>Contractor to adopt proper and recognised safety practices throughout the execution of the Works.</p> <p>The Contractor shall adhere to the Site Safety Plan and shall ensure that all sub-contractors of all tiers have a copy of the Site Safety Plan and comply with its provisions.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Project Manager and the Employer to carry out surveillance to verify that the Site Safety Plan is being properly and fully implemented.</p> <p>The Contractor shall notify the Project Manager immediately of any occurrence or incident that results in death or serious injury as defined in the Indian Penal Code. Such initial notification may be verbal and confirmed in writing thereafter and shall be followed by a comprehensive written report within 24 hours of the occurrence/incident. The Contractor shall duly complete standard forms as required by the Project Manager and Statutory Authorities.</p> <p>The Contractor shall provide and maintain all necessary temporary fire protection and fire fighting facilities on the Site during the construction of the Works in accordance with the statutory regulations and as required by the Project Manager. The Contractor shall ensure that all gases, fuels and other dangerous Materials and goods are stored and handled in a safe manner and in accordance with the statutory regulations and as required by the Project Manager.</p> <p>The obligations and requirements for safety and industrial health under this Contract are entirely without prejudice to, and do not derogate from, the Contractor's statutory obligations, with respect to safety and industrial health.</p> <p>A minimum penalty of Rs. 10000/- shall be imposed along with the cost of non provision of services as per Jaipur Metro SHE manual for each instance.</p>
22.	Sub Clause 22.2.8	<p>Funeral Arrangements</p> <p>Funeral arrangements: The bidder shall be responsible for making funeral arrangements if required.</p>

23.	Sub Clause 22.2.16	<p>Prohibition of Harmful Child Labour</p> <p>"Child" means a child below the statutory minimum age specified under applicable national, provincial or local law of India.</p>
24.	Sub Clause 22.4	<p>Site Regulations and Safety</p> <p>The following is added to existing GCC Clause.</p> <p>The Contractor shall take all measures necessary to ensure such security, including exercising control over all persons and vehicles which are employed or engaged on the Site or in connection with the Works or the other works comprising the Project and with the security arrangements applicable to any other site within the Project.</p> <p>The Contractor shall arrange the issue of passes for the admission of all persons and vehicles to the Site or to any part thereof and may refuse admission to or remove from the Site any person or vehicle failing to show an appropriate pass on demand to any duly authorised person. If required by the Engineer/ Project Manager, the Contractor shall submit a list identifying all persons to whom passes have been issued together with two photographs of each person and all entities to which a pass has been issued in respect of any vehicle and shall satisfy the Project Manager of the bonafides of any such person or entity.</p> <p>The Contractor shall not, without the written permission of the Engineer / Project Manager or otherwise in accordance with the Contract, allow access to the Site to any person unless the presence on Site of such person is necessary in connection with the execution of the Works or with the discharge of the duties of any relevant authority.</p> <p>All lights provided by the Contractor shall be so placed or screened as not to interfere with signs, signals or lights. The Contractor shall not in any way obscure or affect signs, signals or lights, in use by any relevant authority. In the event that the Contractor does so, the Contractor shall pay all costs associated with the re-setting, re-instating or provision of alternatives for any sign, signal or light, obscured or affected.</p> <p>For the purposes of this Clause only, "Site" shall</p>

		include off-Site places of manufacture or storage and the Contractor's Work Areas and shall include, areas provided to the Contractor by others.
25.	Sub Clause 24	<p>Completion of the Facilities</p> <p>The Works shall be taken over by the Employer when the same have been completed in accordance with the Contract, have passed the Tests on Completion, including Integrated Testing and Commissioning where ever applicable as per the contract, and a Completion Certificate/ Taking Over Certificate for the Works shall be issued. If the Works are divided into Sections, the Contractor shall be entitled to apply for a Completion Certificate for each Section.</p> <p>No Completion certificate/ Taking Over Certificate shall be issued before successful completion of Integrated Testing and Commissioning as per Employer's requirements and the contractor shall be responsible for care and custody of the works including risk of loss or damage thereto before works are taken over by employer with issuance of Taking Over Certificate.</p> <p>The Contractor may apply by notice to the Engineer / Project Manager for a Completion Certificate/ Taking Over Certificate not earlier than 14 days before the works or section (as the case may be) will, in the Contractor's opinion, be complete and ready for taking over. The Engineer / Project Manager shall, within 28 days after the receipt of the Contractor's application shall conduct a complete joint survey of the works including carrying out any tests prescribed in the contract and prepare a list of defects and outstanding works and :</p> <p>(a) issue the Completion Certificate/ Taking Over Certificate to the Contractor, stating the date on which the Works or Section were completed, including the Tests on Completion and Integrated Testing and Commissioning where ever applicable as per the contract in accordance with the Contract if defects and/or outstanding works are minor that does not affect the use and safety of the Works or Section for their intended purposes. The list of such works along with the target date of completion for each work shall be enclosed with the Completion certificate and completion</p>

		<p>of all these works /rectification of defects within the stipulated time shall be the responsibility of the contractor and any failure in it may be considered a reason by the Project Manager to cancel the taking over certificate issued earlier; or</p> <p>(b) reject the application, giving his reasons and specifying the work required to be done by the Contractor to enable the Completion Certificate/ Taking Over Certificate to be issued. The Contractor shall then complete such work before issuing a further notice under this Sub-Clause.</p> <p>The Engineer / Project Manager may, at the sole discretion of the Employer issue a Completion Certificate/ Taking Over Certificate for any part of the Permanent Works by following the procedure stipulated in this SCC clause if:.</p> <p>(a) the Employer uses that part of the Works for revenue service before the Completion Certificate/ Taking Over Certificate is issued for the entire work.</p> <p>(b) the balance part is not completed not due to the fault of the contractor and contractual date of completion for the completed part is over.</p> <p>Upon the completion of construction, the Contractor shall fully reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition as recorded by the Contractor in consonance with its obligation in Clause 21.1</p> <p>Scope of Works and Supply by the Employer</p> <p>Except for the facilities as stated in Employer's Requirements, Section 6 of this Contract, no other facilities/works shall be provided by the Employer to the Contractor.</p>
26.	Sub Clause 25.1	<p>Commissioning</p> <p>The Contractor shall undertake commissioning of the system after successful completion of installation of the systems with Employer's consent and without issuance of any certificates to proceed or provision of any facilities by the employer except as stated in SCC Clause 25, so as to achieve the completion dates as specified in Time Schedule, Section 9.</p>

27.	Sub Clause 25.3 & 25.4	<p>Operational & Partial Acceptance</p> <p>The Integrated tests and System acceptance tests shall be successfully completed within the time stipulated in Key Dates specified in Time Schedule, Section 9, prior to which, no acceptance certificate of any kind whatsoever shall be issued.</p> <p>The only certificate for which contractor is entitled other than that of Performance Certificate shall be the Completion Certificate/Taking Over Certificate in accordance with SCC Clause 25 herein.</p>
	Sub Clause 25.5	<p>Delayed Pre-Commissioning and/or Guarantee Test</p> <p>For any delays in commissioning of system arising whether on part of contractor or not, the Contractor shall not be entitled for any additional charges towards care of facilities or any other additional compensation.</p> <p>The contractor shall only be entitled for Extension of Time for Completion in accordance with SCC Clause 35.</p> <p>Payment to contractor shall only be released after completion of milestones as per terms of payment specified herein and in Appendix-1, Section 9.</p>
28.	Sub Clause 26.2	<p>Completion Time Guarantee</p> <p>Time is the essence of the contract and therefore if the work is delayed on account of the contractor, liquidated damage shall be recovered as provided for in the contract. Annexure-III to SCC shall include in respect of the Works and in respect of any Stage, a percentage of the total contract value which will be recoverable from the Contractor as liquidated damages for delay in completion of the Works or in achievement of a stage by a particular Key Date. The total amount of liquidated damages in respect of the Works in all stages shall, however, not exceed the limit of liquidated damages stated in the Annexure-III to SCC. The aforesaid liquidated damages do not, however, include the sums payable by the Employer to Designated Contractors on account of delay caused by the Contractor to Designated Contractors which sums shall be recoverable from the Contractor in addition to any liquidated damages payable under this clause, the</p>

		<p>total ceiling limit of which is 10% of the contract value including liquidated damages levied under the provision of Annexure-III to the SCC.</p> <p>The liquidated damages are recovered by the Employer from the Contractor for delay and not as penalty.</p> <p>The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any sum due, or to become due, to the Contractor. In the event of an extension of time being granted, the amount due under this Sub-Clause shall be recalculated accordingly, and any over-payment refunded. The payment or deduction of such damages shall not relieve the Contractor from his obligations to complete the Works, or from any other of his duties, obligations or responsibilities under the Contract.</p> <p>The Contractor shall use and continue to use his best endeavours to avoid or reduce further delay to the Works, or any relevant Stages.</p> <p>At any time after the Employer has become entitled to liquidated damages, the Engineer /Project Manager may give notice to the Contractor under clause 42 of GCC requiring the Contractor to complete the Works within a specified reasonable time. Such action shall not prejudice the Employer's entitlements to recovery of liquidated damages, under this Sub-Clause and to terminate under clause 42 of GCC.</p>
	Sub Clause 26.3	No bonus will be given for earlier Completion of the Facilities or part thereof.
29.	Sub Clause 27.2	<p>Defect Liability</p> <p>During the Defects Liability Period the Contractor shall provide, free of cost, competent and skilled personnel and maintain adequate stock of spares so as to promptly fulfil his obligations during the Defects Liability Period as laid down in GCC and Employer's Requirements.</p> <p>The Defect Liability Period of a section shall start from the date of opening of the section for revenue services</p>

		<p>and shall continue until 24 months.</p> <p>For the equipment and software supplied for OCC, the Defect Liability Period shall start from the date of opening of the first section for revenue services and shall continue until 24 months.</p> <p>The Employer may require the Contractor to enter into a Maintenance Contract with the Employer for the Signalling & Telecommunication Systems provided under the Contract under terms and conditions as specified in Employer's requirements at the rates as quoted by the contractor in Schedule 6(b).</p>
		<p>Failure to Remedy Defects :</p> <p>If the Contractor fails to remedy any defect or damage within such time as the Employer / Engineer may deem to be reasonable, the Employer or the Engineer may fix a date on or by which to remedy the defect or damage, and give the Contractor reasonable notice of such date. If the Contractor fails to remedy the defect or damage by such date and the necessity for such work is due to a cause stated below :-</p> <ul style="list-style-type: none"> • the design of the Works; • Plant, Systems, Materials or workmanship not being in accordance with the Contract; or • failure by the Contractor to comply with any of his other obligations <p>If in the opinion of the Engineer, such necessity is due to any other cause, he shall determine an adjustment to the Contract Price, with the approval of the Employer, and shall notify the Contractor accordingly.</p> <p>The Employer may (at his sole discretion):</p> <ol style="list-style-type: none"> 1. carry out the work himself or by others, in a reasonable manner and at the Contractor's risk and cost, but the Contractor shall have no responsibility for such work: the costs incurred by the Employer in remedying the defect or damage shall be recoverable from the Contractor by the Employer; 2. require the Engineer to determine and certify a reasonable reduction in the Contract Price; or

		<p>3. if the defect or damage is such that the Employer has been deprived of substantially the whole of the benefit of the Works or parts of the Works, terminate the Contract in respect of such parts of the Works as cannot be put to the intended use, the Employer shall then be entitled to recover all sums paid for such parts of the Works together with the cost of dismantling the same, clearing the Site and returning Plant, Rolling Stock and Materials to the Contractor</p>
		<p>Supervision of Maintenance</p> <p>The Contractor shall provide experts for Supervision of Maintenance. The deployment of these Experts may not be continuous and they may be required to supervise the maintenance in short periods at a time. The number of man-months of Experts shall be Four.</p> <p>These Experts shall work under the administrative control of the Employer. These Experts shall ensure that the Client's maintenance staff acquire necessary skills and follow correct procedures and practices in the maintenance, overhaul and repairs of equipment and components for Signalling Systems as well as for the maintenance of the related software.</p> <p>The qualification and experience of the Experts to be deployed by the Contractor shall be reviewed by employer.</p> <p>Prior approval of the Employer shall be necessary before the Experts are deployed for supervision of maintenance. The Contractor shall replace promptly, Contractor's experts who are not considered suitable by the Project Manager.</p>
30.	Sub Clause 30.1	<p>Limitation of Liability</p> <p>(b) The multiplier of the Contract Price is: One</p>
31.	Sub Clause 34.3	<p>Insurance</p> <p>The Contractor shall, within the respective periods stated in the Annexure-III to SCC (calculated from the Commencement Date), submit to the Employer:</p>

		<p>(a) evidence that the insurances described in this Clause have been effected, with an Indian Insurance Company ,and</p> <p>(b) copies of the policies for the insurances described in Sub-Clause 34.1.</p> <p>When each premium has been paid, the contractor shall submit copy of receipts to the employer. The contractor shall also, when providing such evidence, policies and receipts to the employer, notify the Project Manager of so doing.</p> <p>The contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the employer. Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify such loss or damage. Payments received from insurers shall be used for the rectification of such loss or damage.</p> <p>The contractor (and, if appropriate, the employer) shall comply with the conditions stipulated in each of the insurance policies. The contractor shall make no material alteration to the terms of any insurance without the prior approval of the employer. If an insurer makes (or purports to make) any such alteration, the contractor shall notify the employer immediately.</p>
	Sub Clause 34.6	<p>If the contractor fails to effect and keep in force any of the insurances required under the contract, or fails to provide satisfactory evidence, policies and receipts in accordance with this sub-clause, the employer may, without prejudice to any other right or remedy, effect insurance for the coverage relevant to such default, and pay the premiums due. In such cases the premium paid by the employer plus overheads (equal to 50% of the premium paid) shall be recoverable from the contractor by the employer, and may be deducted by the employer from any monies due, or to become due, to the contractor or recover the same as debt due from the contractor. The contractor shall not dispute the amount of premium paid by the employer or the overhead charges thereon.</p> <p>Nothing in this clause limits the obligations, liabilities or responsibilities of the contractor or the employer,</p>

		<p>under the other terms of the contract or otherwise. Any amount not insured or not recovered from the insurers shall be borne by the contractor.</p> <p>The Contractor shall submit to the Project Manager, the details of all claims made with the insurer and claims accepted by the insurer or any other details as required by the Project Manager on monthly basis.</p>
32.	Sub Clause 36.1	<p>Change in Laws and Regulations</p> <p>Legislation in respect of taxes, duties, levies, cess etc. means any new tax, duty, levy, cess etc. which is imposed or deleted after the due date of submission of tender resulting into increase/ decrease in cost. The fixed lump sum contract price shall be adjusted to take account of this increase or decrease in cost.</p> <p>Such increase or decrease in cost shall be certified by the Project Manager after examining records provided by the contractor.</p> <p>The fixed lump sum contract price shall not be adjusted in respect of the variation in the rates of taxes, duties, levies, cess etc. till completion of the contract including extended period of completion, if any.</p>
33.	Sub Clause 39.	<p>Change in the Facilities</p> <p>Following is added to the clause 39 of GCC</p> <p>Employer's Variations</p> <p>"Employer's Variation" means a change in the Employer's Requirements which makes necessary alteration or modification of the Design, quality or scope of Works as described by or referred to in the Employer's Requirements. Changes to any sequence, method or timing of manufacture, supply, installation, testing and Commissioning including Integrated Testing and Commissioning and changes to any part of the Site or access thereto will not constitute Employer's Variation.</p> <p>If the Project Manager requests a proposal, prior to instructing a Variation which may be for additional work or alteration in the work on deletion / reduction in the scope of work, the Contractor shall submit at his own cost within 14 days or such period as the</p>

		<p>Project Manager may allow of the receipt of such request of the Project Manager</p> <ul style="list-style-type: none"> a a description of the proposed design and/or work to be performed and a programme for its execution, b the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 18.2, and c the Contractor's proposal for adjustment to the Contract Price, Time for Completion and/or modifications to the Contract. <p>Variation Procedure</p> <p>The Project Manager shall, as soon as practicable after receipt of proposals under this Sub-Clause and Sub-Clause 39.3, respond with approval, rejection or comments.</p> <p>After receipt of proposal, it will be the prerogative of the Employer, whether to Instruct and proceed ahead with the variation or drop the proposal in part or full. In that case, no cost of preparing And submitting the proposal will be payable to Contractor. In case, the design part of variation has been completed on submission of same to the Project Manager, the Employer decides to abandon the variation, only cost for design to the extent of work done will be paid to the Contractor.</p> <p>If the Project Manager instructs or approves a Variation, he shall proceed to agree or determine adjustments to the Contract Price, Time for Completion and Schedule of Payments in consultation with the Contractor and the Employer in an endeavour to reach agreement. If agreement is not achieved, the Project Manager shall determine the matter fairly, reasonably and in accordance with the Contract, with the approval of Employer</p> <p>An Employer's Variation shall be requested and implemented in accordance with and subject to the following provisions:</p> <ul style="list-style-type: none"> (a) within 14 days (or such other period as the Project Manager may allow) of the
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		<p>Project Manager informing the Contractor in writing of the intention to request an Employer's Variation, the Contractor shall notify the Project Manager in writing whether in his opinion the Employer's Variation would, if ordered:</p> <p>(i) give rise to any entitlement to an extension of time; or</p> <p>(ii) affect the achievement of any Milestone; or</p> <p>(iii) give rise to any entitlement to additional payment; or</p> <p>(iv) affect the warranties of the Contractor set out in Clause 6 of Special Conditions of Contract,</p> <p>and shall submit his proposals as to the terms upon which he would agree to implement the Employer's Variation.</p> <p>(b) The Project Manager shall determine the amount well in advance that should be added to or deducted from the relevant Cost Centre Total and/or the revisions (if any) which should be made to the Milestone Payment Schedules as a result of the Variation and get it prior approved by the Employer.</p> <p>In the event of the Project Manager and the Contractor failing to reach agreement on the revisions to be made to the Cost Centre Totals, the Project Manager shall, with the approval of the Employer, determine such revisions as shall be reasonable.</p> <p>In assessing work covered by any sub-contract, the Project Manager will have, where he deems necessary, access to the original sub-contract conditions, rates, prices and details of the variation claimed, to assist in evaluating any Variations.</p>
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		<p>c) if the Project Manager withdraws the request for an Employer's Variation, the Contractor shall have no claim of any kind whatsoever arising out of or in connection with any of the proposals made or any failure to reach agreement. In case the Employer's Variation involves omission of part of the Works, the agreement shall address the issue of reduction in the Contract Price.</p> <p>i) The quantities of items shown in the Bill of Quantities are approximate, and liable to vary during the actual execution of the work. Some items/group of items may have to be altered, added or omitted. The Contractor shall be bound to carry out and complete the stipulated work as instructed by the Project Manager, irrespective of the magnitude of variations including additions, alterations or omissions in the Bill of Quantities, individual items or group of items, specified in the Bill of Quantities.</p> <p>ii) Such variations shall be paid as follows:</p> <p>a) At the accepted rates of the Contract for Positive variation in quantities to the extent of 25%, , except in the case of foundation works. Unless otherwise specifically provided for in the Bill of Quantities or elsewhere in the Contract, the variation of 25% shall be applicable to a group of items mentioned therein and not to individual items. In case of variation in quantities on minus side, contract rates will be payable for executed quantities.</p> <p>b) For items against which the quantity given in the Bills of Quantities is "if or as required", there shall be no increase/decrease of rates whatever be the quantity finally executed.</p> <p>c) Variation in the quantity of items individually costing upto 1% of the total contract value, shall be payable at the rates stated in the Contract.</p>
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		<p>notwithstanding the magnitude of variation upto 2% of the original Contract Value for each item.</p> <p>d) In case the variation in individual items or the group of items as stipulated above, is more than 25% (positive or negative) , the rate for the varied quantity beyond 25% shall be negotiated between the Project Manager and the Contractor and mutually agreed rates arrived at before actual execution of the extra quantity.</p> <p>e) In case Project Manager introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Bill of Quantities of the accepted Bid. In case this is not possible, the rate may be decided on the following basis:</p> <p>i) Cost of Materials at current market price, as actually utilised in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.</p> <p>ii) Cost of enabling works if any(unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of work and cost of material released as scrap.</p> <p>iii) Cost of labour actually used at the site of work at rates under Payment of Minimum Wages Act for the area of work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilised at Site and other ancillary and incidental expenses on labour.</p> <p>iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various</p>
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		<p>trades shall not be counted as Plant & Machinery for this purpose.</p> <p>v) An amount of 20% of items (i), (ii), (iii) and (iv) above to allow for Contractor's overheads, profits and corporate taxes. This percentage shall also apply to estimated cost of Materials supplied free to the Contractor.</p> <p>vi) In all cases where extra items of work are involved, for which there are no rates in the accepted Bill of Quantities the Contractor shall give a notice to the Project Manager, of at least 7 days before the need for their execution arises.</p> <p>f) In the event of disagreement in respect of items (d) and (e) above, the Project Manager shall fix such rates of price as are, in his opinion appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Project Manager shall determine provisional rates or prices to enable on account payments to the Contractor. Alternatively, in the event of disagreement, the Contractor shall have no claim to execute extra quantities/new items and the Project Manager shall be free to get such additional quantities beyond 25% new items executed through any other agency. However, if the Project Manager or the Employer so directs the Contractor shall be bound to carry out any such additional quantities beyond the limits stated above original quantities and or new items and the disagreement or the difference regarding rates to be paid for the same shall be settled in the manner laid down under the conditions for the settlement of dispute.</p>
34.	Sub Clause 39.3	<p>Changes Originating from Contractor</p> <p>The Contractor may submit to the Employer, in writing at its own cost, any engineering proposal as contractor's variation for modifying the Employer's</p>

		<p>Requirements, provision of additional land, access or feasibility over and above that is provided in the Contract for the purpose of saving in time, construction or manufacture costs. Such variation proposal shall not impair the essential character, functions or characteristics or the Work, including service life, economy of operation, ease of maintenance, desired appearance, or design and safety standards.</p> <p>The Contractor shall provide his variation proposal in a time limit prescribed by the Engineer / Project Manager. The Engineer / Project Manager's decision in this regard shall be communicated to the Contractor within a reasonable period of time. If by any reason the time limit specified by the Project Manager is exceeded, the proposal may not be considered. The decision of the Project Manager in this regard shall be final and binding.</p> <p>If the Employer requires or accepts it, and if the Contractor wants to proceed with the proposal, the Contractor must provide (at no cost to the Employer) a detailed report prepared by a consultant acceptable to the Employer and which shall include:</p> <ul style="list-style-type: none"> a. a general description of the original Contract requirements for the Works and the proposed changes b. a detail of all the proposed modifications to the drawings and specifications c. a detail of all Work and goods affected by the value engineering proposal d. detailed estimate of the construction cost based on the original Contract requirements and based on the proposed changes. e. any resultant time extensions or reductions for the Contract. f. statement to the extent of minimum saving expected. The Contractor's cost of preparing the variation proposal shall be excluded in determining the estimated net savings in construction costs. <p>The Employer may in his sole discretion, accept or reject the contractor's variation or any part thereof and determine the estimated net saving in the construction cost. The Employer shall not be liable</p>
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		<p>for delays or damages to the Contractor due to any failure of the Employer to accept or act upon any such variation proposal submitted pursuant to this Clause.</p> <p>Once, the Employer or the Project Manager rejects the contractor's variation during proposition due to any reason, it shall not be pursued by Contractor in any other form.</p> <p>If the variation proposal is acceptable to the Employer/ Project Manager in whole or in parts, it will accept by execution of an amendment. Such amendment shall identify all the changes in the specifications, Contract Period etc. and shall specify net savings on construction costs which shall be adjusted in the contract value by the Employer.</p> <p>The Contractor shall either accept or reject any proposed amendment executed by the Project Manager pursuant to this section within 5 working days of its receipt date from the Employer. If the Contractor does not reject the same in the period stipulated above, the amendments shall be deemed to be accepted by the Contractor and shall become a variation to the Contract. The Contractor's acceptance shall be unconditional and the contract value / price shall be adjusted by the amount of saving due to the variation.</p>
35.	Sub Clause 40	<p>Extension of Time for Completion</p> <p>Time is the essence of Contract and will remain so at all times during the pendency of the Contract including the extended period of Contract. The Contractor shall ensure defect free completion and have passed the tests on the completion, including integrated testing where ever in the scope of work and commissioning of the whole of the Works and/or parts thereof before the same is taken over by the Employer.</p> <p>In case of delay on the part of the Contractor, the Contractor shall be liable to pay liquidated damages and any other compensation for the damages suffered by the Employer as per relevant clause. This is without prejudice to the right of the Employer to rescind the Contract.</p>

		<p>Failure or delay by the Employer or the Project Manager, to hand over to the Contractor the Site necessary for execution of Works, or any part of the Works, or to give necessary notice to commence the Works, or to provide necessary Drawings or instructions or clarifications or to supply any material, plant or machinery, which under the Contract, is the responsibility of the Employer, shall in no way affect or vitiate the Contract or alter the character thereof; or entitle the Contractor to damages or compensation thereof but in any such case, the Project Manager shall extend the time period for the completion of the Contract, as in his opinion is / are reasonable. The Contractor may apply for an extension of the Time for Completion if the Work is or will be delayed either before or after the Time for Completion by any of the following causes:</p> <ul style="list-style-type: none"> a. "Force Majeure" referred to in Clause 16 b. The Contractor's work held up for not being given possession of or access to the Site in accordance with the Contract c. Instruction of the Project Manager to suspend the Works and the Contractor not being in default as to reasons of suspension. d. Acts or omissions of other Designated Contractors in executing work not forming part of this Contract and on whose performance, the performance of the Contractor necessarily depends. e. Any act of prevention or Breach of Contract by the Employer and not mentioned in this Clause f. Any order of Court restraining the performance of the Contract in full or in any part thereof g. Any other event or occurrence which, according to the Employer is not due to the Contractor's failure or fault, and is beyond his control without Employer being responsible for the same.
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		<p style="text-align: center;">h. An Employer's Variation</p> <p>However, the Contractor shall not be entitled to any extension of time where the instructions or acts of the Employer or the Project Manager are necessitated by or intended to cure any default of or breach of Contract by the Contractor or where any delay is due to</p> <ul style="list-style-type: none"> a. the failure of sub-contractor, to commence or to carry out work in due time, b. non-availability, or shortage of Contractor's equipment, labour, utility services, Plant and Materials, c. inclement weather conditions, and d. the Contractor not fulfilling his obligations under contract. <p>If the Contractor considers himself to be entitled to an extension of time for Completion, he shall give notice to the Project Manager of such intention as soon as possible and in any event within 28 days of the start of the event giving rise to the delay and full and final supporting details of his application within 21 days of the last day of delay, together with any notice required by the Contract and relevant to such Clause.</p> <p>The Project Manager shall proceed in consultation with the Contractor and the Employer in an endeavour to reach agreement or determine either prospectively or retrospectively such extension of the Time for Completion as may be due.. If agreement is not achieved, the Project Manager shall determine the matter fairly, reasonably and in accordance with the Contract, with the approval of Employer. The Project Manager shall notify the Contractor accordingly.</p> <p>The extension of time including that of key date shall not entitle the contractor to retain the advance which shall be governed by SCC Sub-Clause13.2.</p> <p>The Contractor shall not be entitled to an extension of time by reason of any delay to any activity in the carrying out of the Works unless in the opinion of the Project Manager such delay results in or may be expected to result in a delay to completion of the Works, or achievement of any Stage by the relevant Key Date. Whether or not the Contractor fails to</p>
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		<p>achieve any Milestone by reason of any delay shall not by itself be material to the Contractor's entitlement to an extension of time.</p> <p>Any extension to a Key Date shall not by itself entitle the Contractor to an extension to any other Key Date.</p>
36.	Sub Clause 45	<p>Disputes and Arbitration</p> <p>The DB shall be appointed within 30 days after the Effective Date.</p> <p>If the efforts to resolve all or any of the disputes through conciliation fails, then such disputes or differences, whatsoever arising between the parties, arising out of touching or relating to construction/ manufacture, measuring operation or effect of the Contract or the breach thereof shall be referred to Arbitration in accordance with the following provisions:</p> <p>(a) Matters to be arbitrated upon shall be referred to a sole Arbitrator if the total value of the claim is upto Rs.5 million and to a panel of three Arbitrators if total value of claims is more than Rs.5 million. The Employer shall provide a panel of three arbitrators for the claims upto Rs.5 million and a panel of five Arbitrators for claims of more than Rs.5 million. The Contractor shall have to choose the sole Arbitrator from the panel of three and/or one Arbitrator from the panel of five in case three Arbitrators are to be appointed. The Employer shall also choose one Arbitrator from this panel of five and the two so chosen will choose the third arbitrator from the panel only. . The Arbitrator(s) shall be appointed within a period of 30 days from the date of receipt of written notice/ demand of appointment of Arbitrator from either party. Neither party shall be limited in the proceedings before such arbitrator(s) to the evidence or arguments put before the Project Manager for the purpose of obtaining his decision. No decision given by the Project Manager in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the</p>

		<p>arbitrator(s) on any matter, whatsoever, relevant to dispute or difference referred to arbitrator/s. The arbitration proceedings shall be held in Jaipur only. The language of proceedings, that of documents and communication shall be English.</p> <p>(b) The Employer at the time of offering the panel of Arbitrator(s) to be appointed as Arbitrator shall also supply the information with regard to the qualifications of the said Arbitrator nominated in the panel along with their professional experience, phone nos. and addresses to the contractor.</p> <p>(c) The award of the sole Arbitrator or the award by majority of three Arbitrators as the case may be shall be binding on all parties.</p> <p>Interest on Arbitration Award</p> <p>Where the arbitral award is for the payment of money, no interest shall be payable on whole or any part of the money for any period, till the date on which the award is made.</p> <p>Cost of Arbitration</p> <p>The cost of arbitration shall be borne by the respective parties. The cost shall, inter alia, include the fees of the arbitrator (s) as agreed by both the parties or provided under the International Arbitration Rules.</p> <p>Jurisdiction of Courts</p> <p>Where recourse to a Court is to be made in respect of any matter, the court at Jaipur shall have the exclusive jurisdiction to try all disputes between the parties.</p> <p>Suspension of Work on Account of Arbitration</p> <p>The reference to Conciliation / Arbitration shall proceed notwithstanding that the Works shall not then be or be alleged to be complete, provided always that the obligations of the Employer, Project Manager and the Contractor shall not be altered by reasons of arbitration being conducted during the progress of the Works. Neither party shall be entitled to suspend the work or part of the work to which the dispute relates on account of arbitration and payments to the Contractor shall continue to be</p>
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		made in terms of the Contract.
	Sub Clause 45.2	Appointment (if not agreed) to be made by: Employer Rules of procedure for arbitration proceedings: As per law of the Republic of India
37.	Additional Clause	<p>Eligibility</p> <ol style="list-style-type: none"> 1. The Contractor shall have the nationality of an ADB member country. The Contractor shall be deemed to have the nationality of a country if the Contractor is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services. 2. The materials, equipment and services to be supplied under the Contract shall have their origin in eligible source countries and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, the Contractor may be required to provide evidence of the origin of materials, equipment and services. 3. For purposes of SCC Clause 37(2), —"origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.
38.	Additional Clause	<p>Claims, Disputes and Conciliation</p> <p>(i) Procedure for Claims</p> <p>If the Contractor intends to claim any additional payment under any clause of these Conditions or otherwise, the Contractor shall give notice to the Project Manager as soon as possible and in any event within 28 days of the start of the event giving rise to the claim.</p>

		<p>The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at any other location acceptable to the Project Manager. Without admitting the Employer's liability, the Project Manager shall, on receipt of such notice, inspect such records and may instruct the Contractor to keep further contemporary records. The Contractor shall permit the Project Manager to inspect all such records, and shall (if instructed) submit copies to the Project Manager.</p> <p>Within 28 days of such notice, or such other time as may be agreed by the Project Manager, the Contractor shall send to the Project Manager an account, giving detailed particulars of the amount and basis of the claim. Where the event giving rise to the claim has a continuing effect, such amount shall be considered as interim. The Contractor shall then, at such intervals as the Project Manager may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further particulars. Where interim accounts are sent to the Project Manager, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event.</p> <p>If the Contractor fails to comply with this Sub-Clause, he shall not be entitled to claim any additional payment.</p> <p>(ii) Payment for Claims</p> <p>The Contractor shall be entitled to have included in any Interim Payment Certificate such amount for any claim as the Project Manager considers due, after taking approval from the Employer. If the particulars supplied are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment for such part of the claim as has been substantiated.</p> <p>(iii) No legal action Till Dispute Settlement Procedure is Exhausted</p> <p>Any and all Disputes shall be settled in accordance with the provisions of this clause. No action at law concerning or arising out of any Dispute shall be commenced unless and until all applicable Dispute resolution procedures set out in this clause shall have been finally exhausted in relation to that Dispute or any Dispute out of which that Dispute shall have arisen with which it may be or may have</p>
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		<p>been connected.</p> <p>(iv) Notice of Dispute</p> <p>For the purpose of clause (v), a Dispute shall be deemed to arise when one party serves on the other party a notice in writing (hereinafter called a "Notice of Dispute") stating the nature of the Dispute provided that no such notice shall be served later than 28 days after the date of issue of Performance Certificate by the Project Manager.</p> <p>(v) Two Stages for Dispute Resolution</p> <p>Disputes shall be settled through two stages:</p> <p>Conciliation procedures as established by "The Arbitration and Conciliation Act-1996" (as amended from time to time) and in accordance with this Clause. In the event this procedure fails to resolve the Dispute then;</p> <p>Arbitration procedures undertaken as provided by "The Arbitration and Conciliation Act - 1996" (as amended from time to time) and in accordance with this Clause.</p> <p>(vi) Conciliation</p> <p>Within 60 days of receipt of Notice of Dispute, either party shall refer the matter in dispute to conciliation.</p> <p>Conciliation proceedings shall be initiated within 30 days of one party inviting the other in writing to Conciliation. Conciliation shall commence when the other party accepts in writing this invitation. If the invitation is not accepted then Conciliation shall not take place. If the party initiating conciliation does not receive a reply within 30 days from the date on which he sends the invitation he may elect to treat this as a rejection of the invitation to conciliate and inform the other party accordingly.</p> <p>The Conciliator shall assist the parties to reach an amicable settlement in an independent and impartial manner.</p> <p>(vii) Conciliation Procedure</p> <p>For the purpose of conciliation in this contract, the conciliation shall be undertaken by one conciliator selected from panel of conciliators maintained by the employer, who shall be from serving or retired engineers of Government Departments, or of Public Sector Undertakings. Out of this panel, a list of three</p>
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		<p>Conciliators shall be sent to the Contractor who shall choose one of them to act as Conciliator and conduct conciliation proceedings in accordance with "The Arbitration and Conciliation Act, 1996", of India.</p> <p>The Employer and the Contractor shall in good faith co-operate with the Conciliator and, in particular, shall endeavour to comply with requests by the Conciliator to submit written materials, provide evidence and attend meetings. Each party may, on his own initiative or at the invitation of the Conciliator, submit to the Conciliator suggestions for the settlement of the dispute.</p> <p>When it appears to the Conciliator that there exist elements of a settlement which may be acceptable to the parties, he shall formulate the terms of a possible settlement and submit them to the parties for their observations. After receiving the observations of the parties, the Conciliator may reformulate the terms of a possible settlement in the light of such observations.</p> <p>If the parties reach agreement on a settlement of the dispute, they may draw up and sign a written settlement agreement. If requested by the parties, the Conciliator may draw up, or assist the parties in drawing up, the settlement agreement.</p> <p>When the parties sign the settlement agreement, it shall be final and binding on the parties and persons claiming under them respectively.</p> <p>The Conciliator shall authenticate the settlement agreement and furnish a copy thereof to each of the parties.</p> <p>As far as possible, the conciliation proceedings should be completed within 60 days of the receipt of notice by the Conciliator.</p> <p>The parties shall not initiate, during the conciliation proceedings, any arbitral or judicial proceedings in respect of a dispute that is the subject matter of the conciliation proceedings.</p> <p>(viii) Termination of Conciliation Proceedings</p> <p>The conciliation proceedings shall be terminated:</p> <p>by the signing of the settlement agreement by the parties on the date of agreement; or</p> <p>by written declaration of the conciliator, after</p>
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		<p>consultation with the parties, to the effect further efforts at conciliation are no longer justified, on the date of declaration; or</p> <p>by a written declaration of the parties to the conciliator to the effect that the conciliation proceedings are terminated, on the date of declaration; or</p> <p>by a written declaration of a party to the other party and the conciliator, if appointed, to the effect that the conciliation proceedings are terminated, on the date of declaration.</p> <p>Upon termination of the conciliation proceedings, the conciliator shall fix the costs of the conciliation and give written notice thereof to the parties. The costs shall be borne equally by the parties unless settlement agreement provides for a different apportionment. All other expenses incurred by a party shall be borne by that party.</p>
39.	Additional Clause	<p>Variation in the Bill of Quantities</p> <p>The Tenderer shall provide a Bill of Quantity (BoQ) in the format given in Schedule 1,2,3,4 of Section 4- Bidding Forms, to meet the entire scope of whole of works as stipulated in the Employer's Requirements using Table-I as a reference. The Tenderer shall note that the Contract is a lump sum contract and any change in quantities, other than those due to a change in scope of work, shall have no impact on the Contract price.</p> <p>Change of any item in Schedule 1, 2,3,4 up to $\pm 25\%$ in quantity due to change in scope of work during execution, shall be applied at the unit rate quoted by the Tenderer in Schedule 1,2,3,4 of Section 4- Bidding Forms and no additional amount whatsoever shall be payable to the Contractor,</p> <p>The Employer shall advise the Contractor about any reduction in quantities due to change in Scope of work within twelve months of Commencement date. However, the Employer may exercise any increase in quantity on any date before three months of scheduled opening (as per Key Date Table) of the last section.</p>

40.	Additional Clause	<p>Deployment of Personnel by the Employer</p> <p>The Contractor shall deploy personnel sponsored by the Employer during the Contract Period in areas stipulated in the Employer's Requirements.</p> <p>The travel expenses, salary and allowances, boarding and lodging expenses of these sponsored personnel shall be borne by the Employer but the Contractor shall provide other facilities required for the purpose of performing their duties. The sponsored personnel shall be under the technical and administrative control of the Contractor.</p>
41.	Additional Clause	<p>Indemnity Bond</p> <p>The contractor shall submit an Indemnity Bond in the format given in Annexure-II against payments made for Plant and Equipment delivered to Jaipur.</p>
42.	Additional Clause	<p>Quality Plan</p> <p>The detailed Quality Plan shall be developed from the Outline Quality Plan to meet the stipulations of the Employer's Requirements.</p> <p>Upon the Project Manager notifying his consent to the Site Quality Plan, or any supplement thereto, the Contractor shall, adhere to the principles and procedures contained in such document, except where the Project Manager gives his consent to any amended or varied version thereof. The Contractor shall cause any sub-contractors to adhere to this Plan.</p> <p>The Contractor shall appoint a suitably qualified and experienced person, not otherwise engaged in the performance of the Contract, to act as manager of the quality assurance system and shall provide such other personnel and resources as required to ensure effective operation of the quality assurance system. The said manager shall carry out audits of the application of the quality assurance system, and ensure effective quality control and delivery of quality assurance.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Project Manager to carry out surveillance visits both on and off the Site to verify that the quality assurance system is being properly and fully implemented. No extra payment shall be made in this regard and the</p>

		cost of the Work under this element shall be deemed to be included in the Contract Price.
43.	Additional Clause	<p>Work by persons other than the Contractor</p> <p>If the Contractor shall fail to carry out any work required under the Contract or refuse to comply with any instruction or order given by the Employer or Project Manager in accordance with the Contract within a reasonable time, the Project Manager may give the Contractor 14 days' notice in writing to carry out such work or comply with such instruction. If the Contractor fails to comply with such notice, the Employer shall be entitled to carry out such work or instruction by his own workmen or by other contractors. Without prejudice to any other right or remedy, all additional expenditure properly incurred by the Employer in having such work or instruction carried out shall be recoverable by the Employer from the Contractor.</p> <p>If by reason of any accident or failure or other event occurring to, in, or in connection with the Works any remedial or other work shall, in the opinion of the Project Manager, be urgently necessary and the Contractor is unable or unwilling at once to do such remedial or other work, the Project Manager may authorise the carrying out of such remedial or other work by a person other than the Contractor. If the remedial or other work so authorised by the Project Manager is work, which, in the Project Manager's opinion, the Contractor was liable to do under the defect liability period Contract, all expenses properly incurred in carrying out the same shall be recoverable by the Employer from the Contractor, provided that the Project Manager shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.</p>
44.	Additional Clause	<p>Entry with full preparation as per SHE</p> <p>The contractor need to mobilize at site with full preparation with proper provision of display boards (mentioning various details like Contract Name, Contract Value, Scope, Organization, Contract Details, Labour Laws obligations as per agreement with the Project Manager), lighting, Water Supply, Ventilation Facility, Toilet Facility, Tea & Coffee facility, Cleaning arrangement etc (this list is</p>

		indicative not exhaustive). The Project Manager shall approve after inspection and shall issue no objection certificate for erection of the equipment.
45.	Additional Clause	<p>Nuisance</p> <p>Contractor will be responsible for any unhygienic conditions in the area under their possession and liable to be penalized if condition does not improve despite warnings/notices</p>
46.	Additional Clause	<p>Interface Requirement</p> <p>The contractor shall be responsible to interface with the other contractors as per the interface table provided in the contract. JMRC will supervise/facilitate the coordination between the contractor and other designated contractors. However, the contractor will allow for liaison with, and modifications to his design to cater for the work of such other contractors. The list of interface items is indicative only and the ultimate responsibility of commissioning lies with the contractor.</p>
47.	Additional Clause	<p>Site Progress</p> <p>The contractor shall prepare Performa in consultation with the Project Manager and submit to Project Manager the monthly progress report and will be required to deliver the Power Point presentation as and when instructed by the Project Manager.</p>
48.	Additional Clause	<p>Maintaining the Site</p> <p>In general the cleanliness, lighting, safety, security, drinking water, first aid etc will be the responsibility of the civil contractor as specified in the interface document.</p> <p>The contractor shall be responsible for maintaining the site. The daily sweeping and cleaning of the area under his possession/work shall be his responsibility.</p> <p>In case of repeated aberrations noticed by the Project Manager a minimum penalty of Rs. 5000/- shall be imposed for each instance.</p>
49.	Additional Clause	<p>BOCW (Building and Other Construction Works) Cess</p> <p>Bidders need to judge the applicability of BOCW for the work. Any liabilities on account of BOCW at any stage shall be on part of bidder and the quoted price</p>

		<p>shall be inclusive of BOCW charges.</p> <p>If same is not applicable, the bidder needs to submit required undertaking/certificates. The JMRC shall make the deduction accordingly and deposit the amount to the concerned authorities.</p>
50.	Additional Clause	<p>Bank Guarantee for Supplementary Agreement</p> <p>The contractor shall submit the Bank Guarantee for 10 % value for works to be executed through supplementary agreement at the time of signing of the supplementary agreement. The bank Guarantee shall be valid till the 28 days beyond the completion of the works to be executed through supplementary agreement.</p>
51.	Additional Clause	<p>Service Tax for AMC Work</p> <p>The contractor shall submit his offer for AMC works(if applicable) beyond DLP inclusive of service tax.</p>
52.	Additional Clause	<p>Professional Indemnity Insurance (PII)</p> <p>The Contractor shall effect and maintain professional indemnity insurance, preferably in the name of JMRC, for the amount in Indian Rupees stipulated in Contract forms in respect of any design of the Works to be carried out by, or on behalf of the Contractor. This insurance, which shall ensure the Contractor's liability by reason of professional negligence and errors in the design of the works, shall be valid from the date of commencement of Works, until 5 years after the date of issue of Performance Certificate. Alternatively the Contractor shall redeem the insurance before the expiry of the Yearly Insurance in such a way that the entire validity period is covered.</p> <p>The Project Manager will not issue Final Payment Certificate until the Contractor has produced evidence that coverage of the professional indemnity insurance has been provided for the aforesaid period.</p> <p>The Contractor shall, within the respective periods stated in the Bid documents (calculated from the Commencement Date), submit to the Employer:</p> <p>(a) evidence that the insurances described in this Clause have been effected, with an Insurance Company operating in India, and</p>

		<p>(b) copies of the policies for the insurances.</p> <p>When each premium has been paid, the contractor shall submit copy of receipts to the employer. The contractor shall also, when providing such evidence, policies and receipts to the employer, notify the Project Manager of so doing.</p> <p>The contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the employer. Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify such loss or damage. Payments received from insurers shall be used for the rectification of such loss or damage.</p> <p>The contractor (and, if appropriate, the employer) shall comply with the conditions stipulated in each of the insurance policies. The contractor shall make no material alteration to the terms of any insurance without the prior approval of the employer. If an insurer makes (or purports to make) any such alteration, the-contractor shall notify the employer immediately.</p> <p>If the contractor fails to effect and keep in force any of the insurances required under the contract, or fails to provide satisfactory evidence, policies and receipts in accordance with this sub-clause, the employer may, without prejudice to any other right or remedy, effect insurance for the coverage relevant to such default, and pay the premiums due. In such cases the premium paid by the employer plus overheads (equal to 50% of the premium paid) shall be recoverable from the contractor by the employer, and may be deducted by the employer from any monies due, or to become due, to the contractor or recover the same as debt due from the contractor. The contractor shall not dispute the amount of premium paid by the employer or the overhead charges thereon.</p> <p>Nothing in this clause limits the obligations, liabilities or responsibilities of the contractor or the employer, under the other terms of the contract or otherwise. Any amount not insured or not recovered from the insurers</p>
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		<p>shall be borne by the contractor.</p> <p>The Contractor shall submit to the Project Manager, the details of all claims made with the insurer and claims accepted by the insurer or any other details as required by the Project Manager on monthly basis.</p>
53.	Additional Clause	<p>As Built Record</p> <p>The Contractor shall prepare, and keep up-to-date, a complete set of “as-built records of the execution of the works, showing the exact “as-built” locations, sizes and details of the works as executed, with cross reference to relevant specifications and data sheets. These records shall be kept on the Site and shall be used exclusively for the purpose of this sub-clause. Four copies shall be submitted to the Project Manager prior to the CMRS inspection of the section.</p> <p>The Contractor shall prepare and submit to the Project Manager “as Built drawings” of the works, showing all works as executed. The drawing shall be prepared as the works proceed and shall be submitted to the Project Manager for his inspection. The Contractor shall obtain the consent of the Project Manager as to their size, the referencing system and other pertinent details.</p> <p>Prior to the issue of any Completion Certificate, the Contractor shall submit to the Project Manager/ Employer one electronic copy, 6 copies of all as built drawings in which 3 copies shall be colored, bound into circuit books, two copies of O&M manuals(if applicable) and any further construction and/or Manufacture Documents specified in the Employers Requirements. The works shall not be considered to be completed for the purpose of Taking Over under Sub- Clause 24.5 until such documents have been submitted to the Project Manager.</p>
54.	Additional Clause	<p>Non-Payment by main Contractors to Sub-Contractors</p> <p>Timely payment to the sub-contractors is the sole responsibility of the main contractor for smooth execution of the work. Though JMRC or Project Manager shall not interface in the day to day management of the contract between the main</p>

		contractor and the sub-contractor, but if frequent complaints are received from any sub-contractor regarding non-payment or delay in payment by the main contractor to him then JMRC will notify to the main contractor to resolve the issue within the reasonable period (to be specified in the notice) and provide the details to JMRC. In case, the issue is not resolved and the details provided by the main contractor are not considered satisfactory, JMRC at its sole discretion may make direct payment to sub-contractor as per his claim and recover the same from any payment due to the main contractor.
55.	Additional Clause	Performance Certificate The Contract shall not be considered to be completed until the Performance Certificate has been signed by the Project Manager and delivered to the Contractor at the end of Defect Liability Period, stating the date on which the Contractor completed his obligations related to completion of works and rectification of defects during Defect Liability Period to the Project manager's satisfaction. Only the Performance Certificate shall be deemed to constitute approval of the Works.

ANNEXURE-I

9/3/13

Notification No. 84/97-Customs

	Search	List	c
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Seeks to Exempt Imports by United Nations or International organisation for execution of projects in India.

11-11-1997

Notification No. 84/97-Customs

In exercise of the powers conferred by sub-section (1) of section 25 of the Customs Act, 1962 (52 of 1962), read with sub-section (4) of section 68 of the Finance (No. 2) Act, 1996 (33 of 1996), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby exempts all the goods imported into India for execution of projects financed by the United Nations or an International Organisation and approved by the Government of India, from the whole of the duty of customs leviable thereon under First Schedule to the Customs Tariff Act, 1975 (51 of 1975), the whole of the additional duty of customs leviable thereon under section 3 of the said Customs Tariff Act and the whole of the special duty of customs leviable under section 68 of the Finance (No. 2) Act 1996 (33 of 1996):

Provided that the importer, at the time of clearance of the goods, produces before the Assistant Commissioner of Customs or Deputy Commissioner of Customs, as the case may be, having jurisdiction, -

(i) in case the said goods are -

(a) Imported by an international organisation listed in the Annexure appended to this notification and intended to be used in a project that has been approved by the Government of India and financed (whether by a loan or a grant) by such an organisation, a certificate from such organisation that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India; or

(b) imported for use in a project that has been approved by the Government of India and financed (whether by a loan or a grant) by an international organisation listed in the said Annexure, a certificate from an officer not below the rank of Deputy Secretary to the Government of India, in the Ministry of Finance (Department of Economic Affairs) that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India;

(ii) in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation other than those listed in the Annexure, and the said project has been approved by the Government of India, a certificate from the executive head of the Project Implementing Authority and countersigned by an officer not below the rank of a Joint Secretary the Government of India, in the concerned Line Ministry in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and

(iii) in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation, other than those listed in the Annexure and the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory, a certificate from the executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance), as the case may be, in the concerned State Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been approved by the Government of India for implementation by the concerned State Government.

Explanation. - For the purposes of this notification, -

(a) "international organisation" means an international organisation to which the Central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said Act shall apply;

(b) "Line Ministry" means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs).

www.cbec.gov.in/customs/cs-act/notifications/notifs-before2k/cs84-97c.htm

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9/5/13

Notification No. 84/97-Customs

133-5-

ANNEXURE

1. United Nations Development Programme,
2. United Nations International Childrens' Fund,
3. Food and Agricultural Organisation,
4. International Labour Organisation,
5. World Health Organisation,
6. United Nations Population Fund,
7. United Nations World Food Programme,
8. United Nations Industrial Development Organisation.

Notification No. 84/97-Cus., dated 11-11-1997 as amended by Notification No. 85/99-Cus., dated 6-7-1999 and No. 119/99-Cus., dated 2-11-1999, and Notification No. 75/2001 dt. 0-07-01 and Notification No. 107/2001-Cus., dated 12.10.2001.

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Cus Ntf No.85/1999 Date 6/7/1999

Imports for Projects financed by UN - Duty Exemption conditions changed

In exercise of the powers conferred by sub-section (1) of section 25 of the Customs Act, 1962 (52 of 1962), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby makes the following amendment in the notification of the Government of India in the Ministry of Finance (Department of Revenue), No.84/97 Customs, dated the 11th November, 1997, namely:

In the said notification,-

- i. for the words "all the goods imported into India by the United Nations or an international organisation for execution of projects financed by them", the following words shall be substituted, namely:-

"all the goods imported into India for execution of projects financed by the United Nations or an international organisation"

- ii. for the proviso, the following shall be substituted, namely: -

"Provided that the importer, at the time of clearance of the goods, produces before the Assistant Commissioner of Customs or Deputy Commissioner of Customs, as the case may be, having jurisdiction:-

- i. in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the United Nations and the said project has been approved by the Government of India, a certificate from an officer not below the rank of a Deputy Secretary to the Government of India, in the Ministry of Finance (Department of Economic Affairs), that the said goods are required for the execution of the said project financed by the United Nations and that the said project has duly been approved by the Government of India, or
- ii. in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation, and the project has been approved by the Government of India, a certificate from the executive head of the Project Implementing Authority and countersigned by an officer not below the rank of a Joint Secretary to the Government of India, in the concerned Line Ministry in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and
- iii. in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation, and the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory a certificate from the executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance), as the case may be, in the concerned State

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Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been approved by the Government of India for implementation by the concerned State Government";

iii. for the Explanation, the following Explanation shall be substituted, namely:-

"Explanation For the purposes of this notification,-

- a. "international organisation" means an international organisation to which the central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said Act shall apply;
- b. "Line Ministry" means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs)".

Sd/-
(Prashant Kumar Sinha)
Under Secretary to the Government of India

Issued by:
Ministry of Finance Department of Revenue
New Delhi.

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Notification No. 108/95-CE, Dt. 28-8-95**Goods supplied to UN/Intnl. Organisations or Proj.****As amended vide Central Excise Notification No. 7/98-CE, dt. 2-6-1998; 33/98-CE, dt. 13-10-1998; 4/99-CE, dt. 11-2-99 and 40/99-CE, dt. 2-11-99.**

In exercise of the powers conferred by sub-section (1) of section 5A of the Central Excises and Salt Act, 1944 (1 of 1944) read with sub-section (3) of section 3 of the Additional Duties of Excise (Goods of Special Importance) Act, 1957 (58 of 1957), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby exempts all goods falling under the Schedule to the Central Excise Tariff Act, 1985 (5 of 1986) (hereinafter referred to as the said goods) when supplied to the United Nations or an international organisation for their official use or supplied to the projects financed by the said United Nations or an international organisation and approved by the Government of India, from the whole of-

(i) the duty of excise leviable thereon under section 3 of the Central Excises Act, 1944 (1 of 1944); and

(ii) the additional duty of excise leviable thereon under sub-section (1) of section 3 of the Additional Duties of Excise (Goods of Special Importance) Act, 1957 (58 of 1957):

Provided that before clearance if the said goods, the manufacturer produces before the Assistant Commissioner of Central Excise having jurisdiction over his factory :-

(a) in case the said goods are intended for the official use by the United Nations or an international organisation, a certificate from the United Nations or that international organisation that the said goods are intended for such use;

(b) in case of the said goods are-

(i) Supplied to an international organisation listed in the Annexure appended to this notification for use in a project that has been approved by the Government of India and financed (whether by a loan or a grant) by such an organisation, a certificate from such an organisation that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India; or

(ii) Supplied to a project that has been approved by the Government of India and financed (whether by a loan or a grant) by an international organisation listed in the said annexure, a certificate from an officer not below the rank of Deputy Secretary to the Government of India, in the Ministry of finance (Department of Economic Affairs) that the said goods are required for the execution of the said project and that the said project has duly been approved by the government of India;

(Above b) i & ii have been substituted vide Cen Exc NTF 40/99 dt. 2-11-99)

(c) in case the said goods are intended to be supplied to a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any international organisation, other than those listed in the

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Annexure, and

(Above c) has been amended vide Cen Exc NTF 40/99 dt. 2-11-99)

(i) if the said project has been approved by the Government of India, a certificate from the executive head of the Project Implementing Authority and countersigned by an officer not below the rank of a Joint Secretary to the Government of India, in the concerned Line Ministry in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and

(ii) if the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory, a certificate from the executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance), as the case may be, in the concerned State Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been approved by the Government of India for implementation by the concerned State Government.

(Above proviso has been amended vide Central Excise Notification No. 4/99 dt. 11-2-99)

Explanation.-For the purpose of this notification,-

(a) "international organisation" means an international organisation to which the Central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said Act shall apply;

(b) "Line Ministry" means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs).'

(Above explanation has been amended vide Central Excise Notification No. 4/99 dt. 11-2-99)

ANNEXURE

1. United Nations Development Programme,
2. United Nations International Childrens' Fund,
3. Food and Agricultural Organisation,
4. International Labour Organisation,
5. World health Organisation,
6. United Nations Population Fund.
7. United Nations World Food Programme

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8. United Nations Industrial Development Organisation.

(Above SI. No. (8.) has been inserted vide Ntf. No. 50/2001-CE, dt. 12-10-2001)

(Above SI. No. (7.) has been inserted vide Ntf. No. 36/2001-CE, dt. 6-7-2001)

(Above ANNEXURE has been added vide Cen NTF 40/99 dt. 2-11-99)

(Note:-see Ntf. No. 31/2001-CE(NT), dt. 21/06/2001)

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, Dated: 06.10.2010

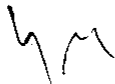
In exercise of the powers conferred by section 9 of the Rajasthan Tax on Entry of Goods into Local Areas Act, 1999 (Act No. 13 of 1999), the State Government being of the opinion that it is expedient in the public interest so to do, hereby exempts from payment of tax payable under the said Act by any registered dealer on goods and equipments mentioned in Annexure-A of this notification, which are brought into the local area for exclusive use in execution of works contracts related to Metro Rail project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project on the condition that such dealer shall submit a declaration to the assessing authority, in the form as specified in Annexure-'B' of this notification duly certified by the authorized officer of the Delhi Metro Rail Corporation Limited.

ANNEXURE-'A'

List of goods required for execution of Metro Rail Project in Jaipur City

S.No.	Name of Goods	S.No.	Name of Goods
1.	Cement	10.	Marble/granite/tiles/ kota stone
2.	Steel (a) TOR, TMT (b) HTS (c) Binding wire (d) Plate, structural Steel (i) Angle (ii) Channel (iii) SMB etc. (iv) Pipe	11.	Sanitary fitting/wares
3.	Aggregate	12.	Sheet AC/GI/others
4.	Sand	13.	Paver block/ CC blocks
5.	Ply	14.	Bitumen
6.	Batten- wooden	15.	Stainless steel pipe/hollow section
7.	Hardware -Nail etc	16.	Paint/snow-cem/putty etc
8.	Bearing i. Neoprene ii. Pot /PTFE	17.	Diesel/petrol
9.	Bentonite	18.	Tyre

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19.	Ready mix concrete	26.	Spare part of 4 wheeler dumper, Tractor, Crane, Gantry
20.	Jacks	27.	Electrical cable/ fitting
21.	GI/CI/PVC/SW Pipes	28.	Signal& telecom cable & fittings equipments
22.	JCB, excavator, loader, truck, Car, Jeep, dumper, tractor, trailer, cranes, battery plant, concrete pump, placer, transit mixer, gantry, launchings girder, piling rig	29.	Rail
23.	Bricks/stone	30.	PSC sleeper, CI inserts
24.	Aluminum	31.	Track fittings: - Points and crossing, pandrol clip, rubber pad, liner
25.	Wooden/ply doors	32.	Ballast

List of electrical equipment:

- 25 Km. (S.P.) AC. Traction:** All equipment used for erecting of overhead (25 KV - A.C. traction System including. Contact wire, centenary wire, Droppers, Insulators, Masts, Portals, Drop Arm, Steel structures, Automatic Tensioning Device, Traction Return Rail Bonding, Earthing System etc.
- Power & Distribution transformers:** 220/132 KV, 132/33 KV, 33 KV /25 KV - Power 33/0.415 Aux.transformers, Booster transformers etc.
- Sub Stations:** All the equipments installed in substation including single Bus Bar with Bus sectioning or Double Bus Bar with Bus coupler, circuit breakers, interrupters (220 KV, 132 KV, 25 KV single phase) for traction load and 33 KV side for Auxiliary loads, lightening protection equipment, Instrument transformers (current & Voltage), Protection Relays etc.
- H.T. & L.T. Cables :** All cables used for connecting the Equipments in the above stated system for operation & control.
- Stand By arrangement:** A) D.G. Set. 200 KVA at elevated Stations, D.G. Set. 2x1000/750 KVA at U.G. Station (chandpole)
(B) Battery Chargers with Batteries for control supply.
- Equipments used in supervisory control & Data Acquisition (SCADA) system with Optical Fibre Glass Cables.
- All the Equipment used in Ventilation & Air Conditioning System.
- Equipments used for Illumination.
- Equipments used for provision of Fans.
- Equipments used for provision of exhaust fans.
- Equipments used for provision of Escalators/Lifts.
- Equipments used for provision of Pump Sets.
- Equipments required for cool drinking water.
- Equipments for provision of Sign age on P.F & Sin Bldg's

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ANNEXURE-‘B’**DECLARATION FOR GOODS BROUGHT INTO LOCAL AREA**

No.

Dated:

To,

.....

(Name of the assessing authority of the registered dealer)

It is hereby certified that the goods brought by M/s
into the local area vide invoice No.....
 dated.....for ₹..... (in words) have been
 exclusively utilized in completion of Metro Rail Project in Jaipur City.

Seal

Signature of Authorized officer of DMRC
 Name
 Designation

[No. F.12(100) FD/Tax/10-81]
 By Order of the Governor,

(Bhawani Singh Detha)
 Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

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**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by section 9 of the Rajasthan Tax on Entry of Goods into Local Areas Act, 1999 (Act No.13 of 1999), the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendments in this Department's notification number F.12(100)FD/Tax/2010-81 dated 06-10-2010, namely:-

AMENDMENTS


In the said notification,-

- (i) for the existing expression "Delhi Metro Rail Corporation Limited" wherever occurring, the expression "Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited" shall be substituted.
- (ii) the existing expression "of DMRC" appearing in Annexure "B", shall be deleted.

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10 - 76]

By Order of the Governor,


(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.


Dy. Secretary to Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, April 17, 2013

In exercise of the powers conferred by section 9 of the Rajasthan Tax on Entry of Goods into Local Areas Act, 1999 (Act No.13 of 1999), the State Government being of the opinion that it is expedient in the public interest so to do hereby, with immediate effect, makes the following amendments in this Department's notification No.F.12 (100)FD/Tax/10-81 dated 06.10.2010, as amended from time to time, namely:-

AMENDMENTS

In the List of goods required for execution of Metro Rail Project in Jaipur City of Annexure 'A' of said notification.-

- (i) the existing serial number 28 and entries thereto shall be substituted by the following, namely:-

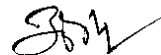
28.	Equipments required for provision of Signaling, Telecommunication and Ticketing systems (including electronic, electrical & IT), Cables, Batteries, Equipments racks and UPS
-----	--

- (ii) after existing serial number 32 and entries thereto the following new serial number 33 and entries thereto shall be added, namely:-

33.	Rolling stock including Sub-assemblies, Components, Accessories and Spares thereof
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[No. F.12 (100)FD/Tax/2010-10]

By Order of the Governor,

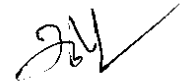


(Aditya Pareek)

Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur along with a soft copy in CD for publication of this notification in part 4(c) of extra ordinary gazette. It is requested that 10 copies of this notification may be sent to this department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy as provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, UDH & LSG.
6. PS to Principal Secretary, Finance.
7. PS to Secretary, Finance (Revenue).
8. Director, Public Relations, Jaipur.
9. SA (Joint Director), Finance (Computer Cell) Department, Secretariat, Jaipur.
10. Guard File.



Dy. Secretary to the Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, Dated:- 06-10-2010

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby exempts from payment of tax payable on purchases of taxable goods and equipments mentioned in annexure-'A' of this notification, made by any registered dealer for exclusive use in execution of works contracts related to Metro Rail Project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project on the following conditions, namely:-

1. That the purchasing registered dealer has a valid contract with the Delhi Metro Rail Corporation Limited for execution of works contracts related to Metro Rail project in Jaipur City;
2. That the purchasing registered dealer shall ensure that the sale invoice of goods contains the expression "The goods purchased by this invoice have been purchased in pursuance to contract with Delhi Metro Rail Corporation Limited for exclusive use in the Jaipur Metro Rail Project";
3. That the purchasing registered dealer shall submit a monthly statement of such taxable purchases to his assessing authority within fifteen days from the close of the month; and
4. That the purchasing registered dealer shall submit a declaration to the selling dealer in the form specified in Annexure- 'B' of this notification, for every taxable purchase made by him, duly certified by the authorized officer of the Delhi Metro Rail Corporation Limited. Exemption from payment of tax on such sales made by the selling dealer shall be allowed only on furnishing of the said declaration to his assessing authority.



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ANNEXURE-‘A’**List of goods required for execution of Metro Rail Project in Jaipur City**

S.No.	Name of Goods	S.No.	Name of Goods
1.	Cement	17.	Marble/granite/tiles/ kota stone
2.	Steel (a) TOR, TMT (b) HTS (c) Binding wire (d) Plate, structural Steel (i) Angle (ii) Channel (iii) SMB etc. (iv) Pipe	18.	Sanitary fitting/wares
3.	Aggregate	19.	Sheet AC/GI/others
4.	Sand	20.	Paver block/ CC blocks
5.	Ply	21.	Bitumen
6.	Batten- wooden	22.	Stainless steel pipe/hollow section
7.	Hardware -Nail etc	23.	Paint/snow-cem/putty etc
8.	Bearing i. Neoprene ii.Pot /PTFE	24.	Diesel/petrol
9.	Bentonite	25.	Tyre
10.	Ready mix concrete	26.	Spare part of 4 wheeler dumper, Tractor, Crane, Gantry
11.	Jacks	27.	Electrical cable/ fitting
12.	GI/CI/PVC/SW Pipes	28.	Signal& telecom cable & fittings equipments
13.	JCB, excavator, loader, truck, Car, Jeep, dumper, tractor, trailer, cranes, battery plant, concrete pump, placer, transit mixer, gantry, launchings girder, piling rig	29.	Rail
14.	Bricks/stone	30.	PSC sleeper, CI inserts
15.	Aluminum	31.	Track fittings: - Points and crossing, pandrol clip, rubber pad, liner
16.	Wooden/ply doors	32.	Ballast



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List of electrical equipment:

1. **25 Km. (S.P.) AC. Traction:** All equipment used for erecting of overhead (25 KV -A.C. traction System including. Contact wire, centenary wire, Droppers, Insulators, Masts, Portals, Drop Arm, Steel structures, Automatic Tensioning Device, Traction Return Rail Bonding, Earthing System etc.
2. **Power & Distribution transformers:** 220/132 KV, 132/33 KV, 33 KV /25 KV - Power 33/0.415 Aux.transformers, Booster transformers etc.
3. **Sub Stations:**All the equipments installed in substation including single Bus Bar with Bus sectioning or Double Bus Bar with Bus coupler, circuit breakers, interrupters (220 KV, 132 KV, 25 KV single phase) for traction load and 33 KV side for Auxiliary loads, lightening protection equipment, Instrument transformers (current & Voltage), Protection Relays etc.
4. **H.T. & L.T. Cables :** All cables used for connecting the Equipments in the above stated system for operation & control.
5. **Stand By arrangement:** A) D.G. Set. 200 KVA at elevated Stations, D.G. Set. 2x1000/750 KVA at U.G. Station (chandpole)
B) Battery Chargers with Batteries for control supply.
6. Equipments used in supervisory control & Data Acquisition (SCADA) system with Optical Fibre Glass Cables.
7. All the Equipment used in Ventilation & Air Conditioning System.
8. Equipments used for Illumination.
9. Equipments used for provision of Fans.
10. Equipments used for provision of exhaust fans.
11. Equipments used for provision of Escalators/Lifts.
12. Equipments used for provision of Pump Sets.
13. Equipments required for cool drinking water.
14. Equipments for provision of Sign age on P.F & Sin Bldg's



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ANNEXURE-‘B’**DECLARATION FOR PURCHASE OF GOODS**

To,

.....

.....

(Name and complete address of the seller)

I/We hereby declare that the goods.....ordered vide our order
 No.....dated.....and purchased from you as per your
 VAT Invoice No..... dated.....for ₹
 (in words) have been purchased in
 pursuance to contract with Delhi Metro Rail Corporation Limited for exclusive
 use in the Jaipur Metro Rail Project

Seal

Signature

Name

TIN

**Certification to be made by the authorized officer of the Delhi Metro Rail
 Corporation limited**

No.

Dated:

It is hereby certified that the goods mentioned above have been utilized in
 completion of Metro Rail Project in Jaipur City.

Seal

Signature of Authorized officer of DMRC

Name

Designation

[No. F.12(100) FD/Tax/10- 78]

By Order of the Governor,

(Bhawani Singh Detha)

Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC .
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendments in this Department's notification number F.12(100)FD/Tax/2010-78 dated 06-10-2010, namely:-

AMENDMENTS

In the said notification,-

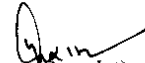
(i) for the existing expression "Delhi Metro Rail Corporation Limited" wherever occurring, the expression "Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited" shall be substituted.

(ii) the existing expression "of DMRC" appearing in Annexure "B", shall be deleted.

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10 -73]

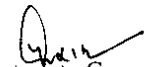
By Order of the Governor.


(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.


Dy. Secretary to Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION
Jaipur, April 24 , 2013

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003, (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do hereby, with immediate effect, makes the following amendments in this Department's notification No.F.12(100)FD/Tax/10-78 dated 06.10.2010, as amended from time to time, namely:-

AMENDMENTS

In the List of goods required for execution of Metro Rail Project in Jaipur City of Annexure 'A' of said notification.-

- (i) the existing serial number 28 and entries thereto shall be substituted by the following, namely:-

28.	Equipments required for provision of Signaling, Telecommunication and Ticketing systems (including electronic, electrical & IT), Cables, Batteries, Equipments racks and UPS
-----	--

- (ii) after existing serial number 32 and entries thereto the following new serial number 33 and entries thereto shall be added, namely:-

33.	Rolling stock including Sub-assemblies, Components, Accessories and Spares thereof
-----	--

[No. F.12(100)FD/Tax/10-11]

By Order of the Governor,




(Aditya Pareek)

Deputy Secretary to the Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur along with a soft copy in CD for publication of this notification in part 4(c) of **today's extra ordinary Gazette**. It is requested that 10 copies of this Notification may be sent to this department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy as provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, UDH & LSG.
6. PS to Principal Secretary, Finance.
7. PS to Principal Secretary, Law
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.


Deputy Secretary to the Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated : February 08, 2016

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No.4 of 2003), the State Government being of the opinion that it is expedient in public interest so to do, hereby, with effect from 01.01.2016, makes the following amendments in this department's notification number F.12(100)FD/Tax/10-78 dated 06.10.2010, as amended from time to time, namely :-

Amendments

In the said notification,-

- (i) the existing condition 4 shall be substituted by the following, namely:-
"That the purchasing registered dealer shall generate a declaration in Form VAT-72 electronically through the official website of the Commercial Taxes Department, in the manner as provided therein and furnish a duly signed copy of Form VAT-72 so generated, to the selling dealer along with the duly filled in and signed certificate of the authorized officer of the Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited, as provided in ANNEXURE-B appended hereto."; and
- (ii) the existing Annexure-B appended to the said notification shall be substituted by the following, namely:-

"ANNEXURE-B

Certificate to be made by the authorized officer of the Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited

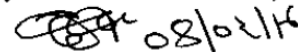
No. _____ Dated: _____
It is hereby certified that the goods mentioned in Form VAT-72 No.
generated by M/S.have been utilized in completion of
Metro Rail Project in Jaipur City.

Seal

Signature of Authorized officer of DMRC:
Name:
Designation:....."

[F.12(79)FD/Tax/2014-Pt-I-151]

By order of the Governor,




(Dr. Devraj)

Joint Secretary to the Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur along with a soft copy in CD for publication of this notification in part 4(c) of **today's extra ordinary Gazette**. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to Principal Secretary, Finance.
6. PS to Principal Secretary, Law.
7. PS to Secretary, Finance (Revenue).
8. Director, Public Relations, Jaipur.
9. Additional Director, Finance (Computer Cell) Department for uploading the notification on website of Finance Department.
10. Guard File.

 08/02/16

Joint Secretary to the Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, Dated: 06-10-2010

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby exempts from payment of tax payable by any registered dealer on transfer of property in goods involved in execution of works contracts related to Metro Rail project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project.

[No. F.12(100) FD/Tax/10-79]
By Order of the Governor,

(Bhawani Singh Detha)
Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No.4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendment in this Department's notification number F.12(100)FD/Tax/2010-79 dated 06-10-2010, namely:-

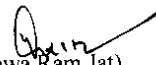
AMENDMENT

In the said notification, after the existing expression "awarded by the" and before the existing expression "Delhi Metro Rail Corporation Limited", the expression "Jaipur Metro Rail Corporation Ltd. or the" shall be inserted.

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10 -74]

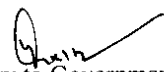
By Order of the Governor,


(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.


Dy. Secretary to Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

Jaipur, Dated: 11.8.2006

In pursuance of clause (3) of Article 348 of the Constitution of India, the Governor is pleased to authorize the publication of this Notification No F.12(63)FD/Tax/2005-81 dated 11.8.2006, in English language, in the Rajasthan Gazette of Finance (Tax) Department.

By Order of the Governor,


(Arun Gupta)

Deputy Secretary to Government

NOTIFICATION

Jaipur, Dated: 11.8.2006

In exercise of the powers conferred by sub-section (2) of section 20 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), read with sub-rule (2) of rule 40 of the Rajasthan Value Added Tax Rules, 2006, the State Government hereby notifies that the awarder or any person authorised by him, at the time of credit of any sum to the account of the contractor or at the time of making such payment by any mode, for carrying out any work, shall deduct, in lieu of tax, an amount equal to 3% of such sum:

Provided that in case of contractors having exemption certificate under notification No. F.12(63)FD/Tax/2005-80 dated 11.8.2006, the awarder or any person authorised by him shall deduct in lieu of tax an amount equal to rate of exemption fee as mentioned in the said exemption certificate.

[No.F.12(63)FD/Tax/2005-81]

By Order of the Governor,


(Arun Gupta)

Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette. 10 copies of this notification may sent to this department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department Raj. Jaipur.
2. Principal Secretary to Chief Minister (Finance Minister).
3. PS to Chairman, Rajasthan VAT Grievances Redressal Committee, Jaipur.
4. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
5. PS to Principal Secretary, Finance.
6. PS to Secretary, Finance (II).
7. PS to Director, Public Relations Jaipur.
8. ACP, Finance Department, Secretariat, Jaipur.
9. Guard file.


Deputy Secretary to Government

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, Dated: 06.10.2010


In exercise of the powers conferred by sub-section (2) of section 20 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), read with sub-rule (2) of rule 40 of the Rajasthan Value Added Tax Rules, 2006, the State Government hereby makes the following amendment in this department's notification No.F.12(63) FD/Tax/ 2005-81 dated 11.08.2006, as amended from time to time, namely:-

AMENDMENT

In the said notification, after the existing last proviso, the following new proviso shall be added, namely:-

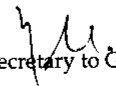
"Provided further that in case of works contracts related to Metro Rail Project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project, no amount in lieu of tax shall be deducted by the Delhi Metro Rail Corporation Limited or any person authorized by him."

[No. F.12(100) FD/Tax/10-80]
By Order of the Governor,


(Bhawan Singh Detha)
Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.


Deputy Secretary to Government

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**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by sub-section (2) of section 20 of the Rajasthan Value Added Tax Act, 2003 (Act No.4 of 2003), read with sub-rule (2) of rule 40 of the Rajasthan Value Added Tax Rules, 2006, the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendment in this Department's notification number F.12(63)FD/Tax/2005-81 dated 11-08-2006, as amended from time to time, namely:-

AMENDMENT

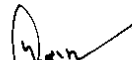
In the said notification, the existing last proviso shall be substituted by the following, namely:-

"Provided further that in case of works contracts related to Metro Rail Project in Jaipur City awarded by the Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project, no amount in lieu of tax shall be deducted by the Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited or any person authorized by them."

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10 -75]

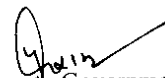
By Order of the Governor.


(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

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2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.


Dy. Secretary to Government

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[TO BE PUBLISHED IN THE GAZETTE OF INDIA, EXTRAORDINARY, PART II,
SECTION 3, SUB-SECTION (i)]

GOVERNMENT OF INDIA
MINISTRY OF FINANCE
(DEPARTMENT OF REVENUE)
NOTIFICATION
No.9/2016-Service Tax,

New Delhi, the 1st March, 2016

G.S.R.....(E).-In exercise of the powers conferred by sub-section (1) of section 93 of the Finance Act, 1994 (32 of 1994), the Central Government being satisfied that it is necessary in the public interest so to do, hereby makes the following further amendments in the notification of the Government of India in the Ministry of Finance (Department of Revenue) No.25/2012-Service Tax, dated the 20th June, 2012, published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number G.S.R. 467 (E), dated the 20th June, 2012, namely:-

1. In the said notification,-

(a) in the first paragraph,-

(i) in entry 6, for clause (b) and clause (c), the following clauses shall be substituted, namely,-

“(b) a partnership firm of advocates or an individual as an advocate other than a senior advocate, by way of legal services to-

(i) an advocate or partnership firm of advocates providing legal services;

(ii) any person other than a business entity; or

(iii) a business entity with a turnover up to rupees ten lakh in the preceding financial year; or

(c) a senior advocate by way of legal services to a person other than a person ordinarily carrying out any activity relating to industry, commerce or any other business or profession;”;

(ii) after entry 9A, the following entry shall be inserted with effect from 1st March, 2016, namely,-

“9B. Services provided by the Indian Institutes of Management, as per the guidelines of the Central Government, to their students, by way of the following educational programmes, except Executive Development Programme, -

- (a) two year full time residential Post Graduate Programmes in Management for the Post Graduate Diploma in Management, to which admissions are made on the basis of Common Admission Test (CAT), conducted by Indian Institute of Management;
- (b) fellow programme in Management;
- (c) five year integrated programme in Management.”;

(iii) after entry 9B as so inserted, the following entries shall be inserted, namely:-

“9C. services of assessing bodies empanelled centrally by Directorate General of Training, Ministry of Skill Development and Entrepreneurship by way of assessments under Skill Development Initiative (SDI) Scheme;

9D. services provided by training providers (Project implementation agencies) under Deen Dayal Upadhyaya Grameen Kaushalya Yojana under the Ministry of Rural Development by way of offering skill or vocational training courses certified by National Council For Vocational Training.”;

(iv) after entry 12, with effect from the 1st March, 2016, the following entry shall be inserted, namely-

“12A. Services provided to the Government, a local authority or a governmental authority by way of construction, erection, commissioning, installation, completion, fitting out, repair, maintenance, renovation, or alteration of -

- (a) a civil structure or any other original works meant predominantly for use other than for commerce, industry, or any other business or profession;
- (b) a structure meant predominantly for use as (i) an educational, (ii) a clinical, or (iii) an art or cultural establishment; or
- (c) a residential complex predominantly meant for self-use or the use of their employees or other persons specified in the Explanation 1 to clause (44) of section 65 B of the said Act;

under a contract which had been entered into prior to the 1st March, 2015 and on which appropriate stamp duty, where applicable, had been paid prior to such date:

provided that nothing contained in this entry shall apply on or after the 1st April, 2020.”;

(v) in entry 13, after item (b), the following items shall be inserted with effect from 1st March, 2016, namely –

“(ba) a civil structure or any other original works pertaining to the ‘In-situ rehabilitation of existing slum dwellers using land as a resource through

private participation under the Housing for All (Urban) Mission/Pradhan Mantri Awas Yojana, only for existing slum dwellers.

- (bb) a civil structure or any other original works pertaining to the 'Beneficiary-led individual house construction / enhancement under the Housing for All (Urban) Mission/Pradhan Mantri Awas Yojana;';

(vi) in entry 14, with effect from 1st March, 2016,

A. for item (a), the following shall be substituted, namely:-

“(a) railways, excluding monorail and metro;

Explanation.-The services by way of construction, erection, commissioning or installation of original works pertaining to monorail or metro, where contracts were entered into before 1st March, 2016, on which appropriate stamp duty, was paid, shall remain exempt.”.

B. after item (c), the following item shall be inserted, namely –

“(ca) low cost houses up to a carpet area of 60 square metres per house in a housing project approved by the competent authority under:

- (i) the “Affordable Housing in Partnership” component of the Housing for All (Urban) Mission/Pradhan Mantri Awas Yojana;
- (ii) any housing scheme of a State Government.”.

(vii) after entry 14, with effect from the 1st March, 2016, the following entry shall be inserted, namely-

“14A. Services by way of construction, erection, commissioning, or installation of original works pertaining to an airport or port provided under a contract which had been entered into prior to 1st March, 2015 and on which appropriate stamp duty, where applicable, had been paid prior to such date:

provided that Ministry of Civil Aviation or the Ministry of Shipping in the Government of India, as the case may be, certifies that the contract had been entered into before the 1st March, 2015:

provided further that nothing contained in this entry shall apply on or after the 1st April, 2020;”;

(viii) in entry 16, for the words “one lakh rupees”, the words “one lakh and fifty thousand rupees” shall be substituted;

(ix) in entry 23,-

(A) after clause (b), the following clause shall be inserted with effect from 1st June 2016, namely,-

“(bb) stage carriage other than air-conditioned stage carriage;”;

(B) clause (c) shall be omitted;

(x) in entry 26, after clause (p), the following clause shall be inserted, namely,-

“(q) Niramaya’ Health Insurance Scheme implemented by Trust constituted under the provisions of the National Trust for the Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999 (44 of 1999).”;

(xi) after entry 26B, the following entry shall be inserted, namely,-

“26C. Services of life insurance business provided by way of annuity under the National Pension System regulated by Pension Fund Regulatory and Development Authority of India (PFRDA) under the Pension Fund Regulatory And Development Authority Act, 2013 (23 of 2013);”;

(xii) after entry 48, the following entries shall be inserted, namely,-

“49. Services provided by Employees’ Provident Fund Organisation (EPFO) to persons governed under the Employees’ Provident Funds and Miscellaneous Provisions Act, 1952 (19 of 1952);

50. Services provided by Insurance Regulatory and Development Authority of India (IRDA) to insurers under the Insurance Regulatory and Development Authority of India Act, 1999 (41 of 1999);

51. Services provided by Securities and Exchange Board of India (SEBI) set up under the Securities and Exchange Board of India Act, 1992 (15 of 1992) by way of protecting the interests of investors in securities and to promote the development of, and to regulate, the securities market;

52. Services provided by National Centre for Cold Chain Development under Ministry of Agriculture, Cooperation and Farmer’s Welfare by way of cold chain knowledge dissemination;”;

(xiii) after entry 52 as so inserted, the following entries shall be inserted with effect from 1st June 2016, namely:-

“53. Services by way of transportation of goods by an aircraft from a place outside India upto the customs station of clearance in India.”;

(b) in paragraph 2, -

(i) after clause (b), the following clause shall be inserted with effect from such date on which the Finance Bill, 2016 receives assent of the President of India, namely: -

‘(ba) “approved vocational education course” means, -

(i) a course run by an industrial training institute or an industrial training centre affiliated to the National Council for Vocational Training or State Council for Vocational Training offering courses in designated trades notified under the Apprentices Act, 1961 (52 of 1961); or

(ii) a Modular Employable Skill Course, approved by the National Council of Vocational Training, run by a person registered with the Directorate General of Training, Ministry of Skill Development and Entrepreneurship;’;

(ii) for clause (oa), the following shall be substituted with effect from such date on which the Finance Bill, 2016, receives assent of the President of India, namely: -

‘(oa) “educational institution” means an institution providing services by way of:

(i) pre-school education and education up to higher secondary school or equivalent;

(ii) education as a part of a curriculum for obtaining a qualification recognised by any law for the time being in force;

(iii) education as a part of an approved vocational education course;’;

(iii) after clause (zd), the following clause shall be inserted, namely:-

‘(zdd) “senior advocate” has the meaning assigned to it in section 16 of the Advocates Act, 1961 (25 of 1961);’

2. Save as otherwise provided in this notification, this notification shall come into force on the 1st of April, 2016.

[F. No.334/8/2016 -TRU]

(K. Kalimuthu)

Under Secretary to the Government of India

Note:-The principal notification was published in the Gazette of India, Extraordinary, *vide* notification No. 25/2012 - Service Tax, dated the 20th June, 2012, *vide* number G.S.R. 467 (E), dated the 20th June, 2012 and last amended *vide* notification number 07/2016 - Service Tax, dated the 18th February, 2016 *vide* number G.S.R. 184(E), dated the 18th February, 2016.

Annexure-II

(Refer Clause 28 of SCC)

(To be stamped in accordance with Stamp Act)

INDENTURE FOR STAGE PAYMENT

THIS INDENTURE made onbetween(hereinafter called the contractor) which expression shall where the context do admits or implies be deemed to include its executors, administrators and assigns of the one part and the Jaipur Metro Rail Corporation Ltd. (hereinafter called JMRC of the other part.

WHEREAS by the agreement (LOA No dated.....) (hereinafter called the said agreement) the contractor has agreed to “Design, Manufacture, Supply, Installation, Testing and Commissioning of Train Control & Signalling System for two underground Metro Stations at Choti Chaupar and Badi Chaupar on East–West Corridor of Jaipur Metro Phase- 1B” and whereas the contractor has applied to the JMRC Ltd. That they may be allowed advance on the security of materials absolutely belonging to them and brought by them to the site of the works covered under the project of the said agreement for use in the construction of such of the work as they have under taken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges).

AND WHEREAS the JMRC Ltd. Has agreed to make stage payment to the contractor the total sum of Rs.----- (Rupees -----only) for stage payment Bill. The quantities and other particulars of which are detailed in this bill for the said works signed by the Contractor on “.....” and JMRC Ltd has reserved to itself option of making any further advances till date on the security of other materials brought by the contractor to site of the said work.

NOW THIS INDENTURE WITNESS that in pursuance of the said agreement and its consideration of the sum of Rs. ----- (Rupees -----only) on or before the execution of these present amount paid to the contractor by the JMRC Ltd (the receipt where of the contractor) both hereby acknowledge and of such further Stage payment, if any, as may be made to him so aforesaid to the contractor do the covenant and agreed with the JMRC Ltd and declare as follows:

1. That the said sum of **Rs. ----- (Rupees ----- only)** so Stage Payment by the JMRC Ltd to the contractors as aforesaid and all or any further sum or sum’s advanced as aforesaid shall be employed by the contractor in or towards the execution of the said works and for no other purpose whatsoever.
2. That the Stage Payment detailed in the said running account bill which have been offered to and accepted by the JMRC Ltd as security are absolutely the contractor’s own property and free from encumbrances of any kind and the contractor’s shall not make any application for or receive any further payments on the security of work executed which are not absolutely his own property and free from encumbrances of any kind the Contractor indemnifies the JMRC Ltd against all claims on any materials in respect of which any Stage Payment has been made to him as aforesaid.
3. That the Stage Payment detailed in the said running account bill and all other stage payments on the security of which further payments or Stage Payment any hereafter be made as aforesaid (hereinafter

called the said materials) shall be used by the contractor solely in the execution of the said works in accordance with the directions of the Project Manager / JMRC Ltd and in the terms of the said agreement.

4. That the contractor shall be fully liable for the materials/components and shall make at his own cost all necessary and adequate arrangement for the proper watch, safe custody and protection against all risks including, acts of the God of the said materials/components and provide on approved insurance in favour of JMRC Ltd that until used in construction as aforesaid the said materials shall remain at the site of said works in the contractor's custody and on his own responsibility and shall at the time be open to inspection by the Project Manager /JMRC Ltd. This insurance will be valid for a period until this material is approved and fixed in the building or advance has been fully recovered from contractor.
5. That the said materials/components shall not on any account be removed/shifted from the site of the works except with the written permission of the Project Manager /JMRC Ltd.
6. That issue of any Stage Payment excess of what is finally required to be used at site would be the contractor's property without any liability on JMRC Ltd., who would recover the cost of this from the contractor.
7. That the contractor hereby charges all the said materials components with the repayment to the JMRC of the said sum of **Rs. ----- (Rupees -----only)** and any further sum or sums advanced as aforesaid and all cost charges. Damages and expenses payable under these presents provided always and it is hereby agreed and declared that not with power contained therein, if any, whenever the convenient for payment, and repayment herein before contained shall become enforceable and the money owned shall not be paid in accordance therewith, the JMRC Ltd., may at any time thereafter adopt all or any of the following courses as he may deem best.
 - a. That if the contractor shall at any time not be able to complete any part of the Component / equipment as per provision in contract Agreement it shall be considered as the work being left incomplete by the contractor and action as per the conditions of the contract shall be taken.
 - b. Deduct all or any of the money owing out of the performance security or any sum due to the contractor under the said agreement.

That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail.

This widening shall be co-extensive to the agreement dated between Jaipur Metro Rail Corporation Limited, Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur (Rajasthan), India, PIN-302 005. (Client) and (Contractor).

IN WITNESS where of the said contractor and by the order under the direction of JMRC Ltd has here set their respective hands the day and years first above written.

Signed, Sealed & Delivered by the said Contractor:

**IN THE PRESENCE OF:
WITNESS:**

1. NAME:

Signature:

SIGNED BY (ADDRESS)

BY THE ORDER AND DIRECTION OF THE JMRC LTD IN THE PRESENCE OF:

SIGNATURE:

WITNESS

(NAME AND ADDRESS)

Annexure-III**REQUIREMENTS UNDER GCC/SCC**

S.N	DESCRIPTION	Clause Ref.	REQUIREMENT
i	Amount of Performance Security	Clause 11 of the SCC	10% of the Contract Price in types and proportions of currencies in which the contract price is payable. In the event of variations during the execution of the contract which result in payments to the Contractor over and above the contract price, the Performance Security shall be suitably adjusted.
ii	Latest 'date for commencement' of the Works	Clause 4 of the SCC	As per the referred clauses of SCC
iii	'Time for completion' of the work from the date of commencement of the work	Clause 8.2 of the GCC	<i>As per key dates in Appendix-4, Section 9 of Contract.</i>
iv	Liquidated Damages	Clause 28 of the SCC	i) 0.05% of the fixed Lump Sum price per day of delay for the Key Dates related to the Taking-Over of a Section, and the Taking-Over of the whole of the Works. ii) 0.005% of the fixed Lump Sum price per day of delayed other than the ones relating to the Taking-Over of a Section. iii) The maximum limit shall be 10% of the contract price.
v	'Defects Liability Period' for the whole of the Works	Clause 29 of the SCC	As per clause 29 of SCC from the date of ROD for the equipments and systems employer starts using and accepted by employer for DLP.
vi	Amount of advance payment	Clause 10 of the SCC	As per the referred clauses of SCC
vii	Amount of Professional Indemnity Insurance (PII). (for	Clause 52 of SCC	Rs 1 million

	the contracts having Design in scope of work)		
viii	Insurance cover for Contractor's All Risk and other requirements as specified in the GCC	Clause 34 of the GCC	100% of the Total Contract Price.
ix	Amount of Third Party Insurance	Clause 34 of GCC	INR 0.50 Million for any one incident, with no. of incidents unlimited.
x	Period in which all insurances have to be submitted	Clause 34 of GCC	Within 12 weeks from the "Date of commencement of Work"
xi	Contract Key Dates		As per Appendix-4 of Contract Forms

- (a) he will execute and complete the Sub-contract works/supply, and will carry out each and all of the obligations, duties and undertakings of the Sub-contractor/Vendor under the Sub-contract when and if such obligations, duties and undertakings shall become due and performable, in accordance with the terms of the Sub-contract (as the same may from time to time be varied or amended with the consent of the Employer); and
 - b) he will supply to the Contractor and in specific cases wherever required to the Employer's Representative with all information as may be required from time to time in relation to progress of the Sub-contract works/supply.
- 2. The Sub-contractor/Vendor undertakes to indemnify the Employer against each and every liability which the Employer may have to any person whatsoever and against any claims, demands, proceedings, loss, damages, costs and expenses sustained, incurred or payable by the Employer provided that the Sub-contractor/Vendor shall have no greater liability to the Employer by virtue of this Warranty than the liability of the Contractor to the Employer under the Contract insofar as and to the extent that the same has arisen by reason of any breach by the Sub-contractor/Vendor of his obligations under the Sub-contract.
- 3. No allowance of time by the Employer hereunder or by the Contractor under the Sub-contract nor any forbearance or forgiveness in or in respect of any matter or thing concerning this Warranty or the Sub-contract on the part of the Employer or the Contractor, nor anything that the Employer or the Contractor may do or omit or neglect to do, shall in any way release the Sub-contractor/Vendor from any liability under this Warranty.
- 4. The Sub-contractor/Vendor agrees that he will not without first giving the Employer not less than 21 day's prior notice in writing exercise any right he may have to terminate the Sub-contract or treat the same as having been repudiated by the Contractor or withhold performance of his obligations under the Sub-contract.
- 5.
 - (1) In the event that the Contract or the employment of the Contractor under the Contract is terminated for any reason whatsoever and if so requested by the Employer in writing within 21 days of such termination, the Sub-contractor/Vendor shall carry out and complete his obligations under this Warranty and shall enter into a novation agreement with the Employer and the Contractor in which the Sub-contractor/Vendor will undertake inter alia to perform the Sub-contract and be bound by its terms and conditions as if the Employer had originally been named as a contracting party in place of the Contractor. The said novation agreement will be in such form as the Employer may reasonably require.
 - (2) In the event that the Employer does not require the Sub-contractor/Vendor to enter into a novation agreement as required by Sub-clause 5(1), the Sub-contractor/Vendor shall have no claim whatsoever against the Employer for any damage, loss or expense howsoever arising out of or in connection with this Warranty.
- 6. Insofar as the copyright or other intellectual property rights, in any plans, calculations, drawings, documents, materials, know-how and information relating to the Sub-contract works/supply shall be vested in the Sub-contractor/Vendor, the Sub-contractor/Vendor grants to the Employer, his successors and assignees a royalty free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs or inventions incorporated and

referred to in such documents or materials and any such know-how and information for all purposes relating to the works of the Mass Rapid Transport System – Jaipur Metro, without limitation the design, manufacture, installation, reconstruction, completion, reinstatement, extension, remedy of any defect of the works. To the extent beneficial ownership of any such copyright or other intellectual property right is vested in anyone other than the Sub-contractor/Vendor, the Sub-contractor/Vendor shall use best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. For the avoidance of doubt, any such licence granted shall not be determined if the Sub-contractor/Vendor shall for any reason cease to be employed in connection with the Sub-contract Works.

7. In the event of any ambiguity or conflict between the terms of the Sub-contract and this Warranty, the terms of this Warranty shall prevail.
8. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Employer may have against the Sub-contractor/Vendor whether in tort or otherwise.
9. Nothing contained in this Warranty shall vary or affect the Sub-contractor's/Vendor's rights and obligations under the Sub-contract.
10. The Employer shall be entitled to assign the benefit of this Warranty at any time without the consent of the Sub-contractor/Vendor being required.
11. All documents arising out of or in connection with this Warranty shall be served:
 - (1) upon the Employer at [], marked for the attention of [];
 - (2) upon the Sub-contractor/Vendor, at [] India.
12. The Employer and the Sub-contractor/Vendor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
13. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
14.
 - (1) Any dispute or difference of any kind whatsoever between the Employer and the Sub-contractor/Vendor arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with the Arbitration as described in the Contract.
 - (2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed pursuant to Clause 14(1), the Employer may by notice in writing to the Sub-contractor/Vendor require and the Sub-contractor/Vendor shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
 - (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objection, assessment or valuation by the Employer's Representative or the Contractor relating to the dispute or difference.

IN WITNESS whereof this Warranty has been executed as a deed on the date first before written.

THE COMMON SEAL of)

[])

was affixed hereto in)

the presence of:-)

3. The Designer further agrees that he will not, without first giving the Employer not less than 21 days' previous notice in writing, exercise any rights it may have to terminate the Consultancy Agreement or to treat the same as having been as repudiated by the Contractor or to discontinue the performance of any duties to be performed by the Designer pursuant thereto. The Designer's right to terminate the Consultancy Agreement or to treat the same as having been repudiated or to discontinue the performance thereof shall cease if, within such period of notice and subject to Clause 4, the Employer shall give notice in writing to the Designer requiring the Designer to accept the instructions of the Employer or his appointee to the exclusion of the Contractor in respect of the carrying out and completion of the Contract Works upon the terms and conditions of the Consultancy Agreement.
4. Any notice given by the Employer under Clause 2 or 3 shall state that the Employer or his appointee accepts liability for payment of the fees payable to the Designer under the Consultancy Agreement and for performance of the Contractor's obligations under the Consultancy Agreement, including payment of any fees outstanding at the date of such notice.
5. The Employer shall be entitled to assign the benefit of this Warranty at any time without the consent of the Designer being required.
6. All documents arising out of or in connection with this Warranty shall be served:
 - (1) upon the Employer at [] marked for the attention of [];
 - (2) upon the Designer at [].
7. The Employer and the Designer may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
9. Except to the extent (if any) expressly permitted by the Consultancy Agreement, the Designer shall not sub-contract any of the Designer's obligations under the Consultancy Agreement without the prior written consent of the Employer's Representative.
10. Without prejudice to its obligations under this Warranty, the Designer shall maintain with well established underwriters of repute and on terms and conditions reasonably acceptable to the Employer, professional indemnity insurance (as per Clause 41 of the Special Conditions of Contract) in respect of the Designer and its sub-consultants for Indian Rupees One Million ~~two hundred fifty thousand~~ (11,250,000 10,00,000 Rupees) in relation to his design of the Works for any one occurrence or series of occurrences arising out of any one event from the date of notification of acceptance until 5 years after the issue of Performance Certificate for the whole of works. The Designer shall immediately inform the Employer if for any reason professional indemnity insurance is not maintained in accordance with this Warranty or becomes void or unenforceable.

11. Insofar as the patent, copyright or other intellectual property rights in any Design Data (as defined in the Contract), plans, calculations, drawings, documents, materials, computer software, know-how and information relating to the Works shall be vested in the Designer, the Designer grants to the Employer his successors and assigns a royalty-free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works (including without limitation the design, construction, reconstruction, completion, reinstatement, extension, repair and operation of the Works). To the extent beneficial ownership of any such patent, copyright or other intellectual property right is vested in anyone other than the Designer or the Contractor, the Designer shall use his best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. Any such licence granted shall not be determined if the Designer shall for any reason cease to be employed in connection with the Works.
12. (1) Any dispute or difference of any kind whatsoever between the Employer and the Designer arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with Clause 45 of GCC . "Dispute" as defined in the Contract shall be deemed to include any such dispute or difference between the Employer and the Designer.
- (2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed, the Employer may by notice in writing to the Designer require and the Designer shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
- (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, statement of objection, determination, certificate, assessment or valuation by the Employer's Representative or the Contractor, relating to the dispute or difference.

IN WITNESS whereof this Warranty has been executed as a deed on the date first before written.

THE COMMON SEAL of)
 [Designer])
 was affixed hereto in)
 the presence of:-)

Annexure-VI**PARENT COMPANY UNDERTAKING**

(On Non-Judicial Stamp Paper)

(Refer Clause 9 of SCC)**THIS UNDERTAKING** is made the _____ day of _____

BY [_____] [whose registered office is at]/[of] [_____] ("the Parent Company").

TO The JAIPUR METRO RAIL CORPORATION LIMITED together with its successors and assigns, "the Employer") of:

RAJSICO Building
 3rd Floor,
 Udhog Bhawan Premises ,
 C-Scheme, Jaipur ,
 India.

1.1.a.c.1.1.1 WHEREAS

(A) By a contract _____ dated [_____] ("the Contract") made between (1) the Jaipur Metro Rail Corporation Limited ("the Employer") and

(2) [_____] ("the Contractor") the Contractor has agreed to design, execute, complete and remedy any defects in the works ("the Works") upon the terms and conditions contained in the Contract.

(B) Pursuant to the terms of the Contract, the Contractor has agreed to procure the provision of an undertaking in the terms hereof.

(C) The Parent Company is the beneficial owner of [_____] % [see Note 1] of the issued share capital of [the Contractor] [see Note 2].

(D) At the request of the Contractor, the Parent Company has agreed to provide this undertaking.

NOW IT IS HEREBY UNDERTAKEN AND AGREED as follows:

1. In consideration of the Employer entering into the Contract with the Contractor, the Parent Company hereby undertakes to the Employer that, without the written consent of the Employer, it will not [and will ensure that none of the companies referred to in Recital (C) will] [see Note 5]:-

- (a) sell transfer assign or otherwise dispose of or deal with ownership of the whole or any part of EITHER [the share holding or other interest in the [Contractor] [see Note 3] OR [the share holdings or other interests] [see Note 4] referred to in Recital (C) in any way which will affect the beneficial ownership and control in [the Contractor] [see Note 3] of the Parent Company [and the other companies referred to in Recital (C)] [see Note 5]; and
- (b) take any action which may result in the Contractor being unable to comply with his obligations or perform in any way his duties under the Contract [or take any action which may result in [the

subsidiary forming part of the Contractor] [see Note 3] being unable to comply with his obligations or perform in any way his duties under the [joint venture or other relevant] agreement] [see Note 6]

until such time as the Works shall have been completed, all the Contractor's obligations under the Contract shall have been performed and the Maintenance and Defects Liability Period (as defined in the Contract) for the whole and every part of the Works shall have elapsed and further that it will ensure [that the subsidiary forming part of the Contractor will take all steps necessary to ensure [see Note 6]] compliance by the Contractor with the provisions of the Contract.

2. The obligations of the Parent Company under this Undertaking shall remain in full force and effect and shall not be affected or discharged in any way and the Parent Company hereby waives notice of:-
 - (a) any suspension of the Works, variation or amendment to the Contract (including without limitation extension of time for performance) or any concession or waiver by the Employer in respect of the Contractor's obligations [and/or the obligations of [] [see Note 7];
 - (b) any provision of the Contract being or becoming illegal, invalid, void, voidable or unenforceable;
 - (b) the termination of the Contract or of the employment of the Contractor [and/or [] [see Note 7] under the Contract for any reason;
 - (d) any forbearance or waiver of any right of action or remedy the Employer may have against the Contractor [and/or [] [see Note 7] or negligence by the Employer in enforcing any such right of action or remedy;
 - (e) any bond, undertaking, security or other guarantee held or obtained by the Employer for any of the obligations of the Contractor [and/or [] [see Note 7] under the Contract or any release or waiver thereof.
3. This Undertaking shall extend to any variation of or amendment to the Contract and to any agreement supplemental thereto agreed between the Employer and the Contractor [and/or [] [see Note 7] and for the avoidance of doubt the Parent Company hereby authorises the Employer and the Contractor [and/or [] [see Note 7] to make any such amendment, variation or supplemental agreement.
4. All documents arising out of or in connection with this Undertaking shall be served:
 - (a) upon the Employer, at [] marked for the attention of [];
 - (b) upon the Parent Company, at [] India. [Note 8]
5. The Employer and the Parent Company may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
6. This Undertaking shall be governed by and construed according to the laws for the time being in force in India and the Parent Company agrees to submit to the jurisdiction of the courts of India.

IN WITNESS whereof this Undertaking has been executed as a deed on the date first before written.

THE COMMON SEAL of)

[])

was affixed hereto)

in the presence of:-)

Notes: (for preparation of but not for inclusion in the engrossment of this Undertaking)

1. If the Parent Company is not the immediate parent company, the chain of ownership must be recited, identifying each company in the chain and the shareholdings or other interests in each subsidiary.
2. If the Contractor comprises more than one company, that fact and the joint venture or other relevant agreement must be recited. In such case, insert the name of the subsidiary forming part of the joint venture, partnership or consortium, and in respect of which the parent company undertaking is being given.
3. If Note 2 applies, refer to the subsidiary of the Parent Company and not the Contractor.
4. If Note 1 applies, use this alternative.
5. If Note 1 applies, add this provision.
6. If Note 2 applies, add this provision.
7. If Note 2 applies, add this provision and insert the name of the subsidiary.
8. The address for service shall be in India.

Annexure-VII**PARENT COMPANY GUARANTEE**

(On Non-Judicial Stamp Paper)

(Refer Clause 9 of SCC)THIS GUARANTEE is made the day of**BETWEEN:-**

- (1) [] whose registered office is at [] [and [] whose registered office is at [] ("the Guarantor").
- (2) The Jaipur Metro Rail Corporation Limited (together with its successors and assigns, "the Employer") of:

RAJSICO Building
3rd Floor,
Udhyog Bhawan Premises ,
C-Scheme, Jaipur ,
India.

WHEREAS

- (A) By a contract _____ dated [] ("the Contract") made between (1) the Jaipur Metro Rail Corporation Limited ("the Employer") and
- (2) [] ("the Contractor"), the Contractor has agreed to design, execute, complete and remedy any defects in the Works upon the terms and conditions contained in the Contract.
- (B) Pursuant to the terms of the Contract, the Contractor has agreed to procure the provision of a guarantee in the terms hereof. [see Note 1].
- (C) At the request of the Contractor, the Guarantor has agreed to guarantee performance of the Contract by the [Contractor] [see Note 2] as set out herein.

IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the Employer entering into the Contract with the Contractor, the Guarantor irrevocably and unconditionally guarantees to the Employer as a primary obligation and not as a surety due performance by the [Contractor] [see Note 2] of all of its obligations and liabilities under and in accordance with the Contract save that nothing herein shall be construed as imposing greater obligations or liabilities on the Guarantor than are imposed on the [Contractor] [see Note 2] in the Contract.
2. The obligations of the Guarantor under this Guarantee shall remain in full force and effect and shall not be affected or discharged in any way by and the Guarantor hereby waives notice of:-

- (a) any suspension of the Works, variation to or amendment of the Contract (including without limitation extension of time for performance) or any concession or waiver by the Employer in respect of the Contractor's obligations [and/or the obligations of []] [see Note 3] under the Contract;
 - (b) any provision of the Contract being or becoming illegal, invalid, void, voidable or unenforceable;
 - (c) the termination of the Contract or of the engagement of the Contractor [and / or [....]] [see Note 3] under the Contract for any reason;
 - (d) any forbearance or waiver of any right of action or remedy the Employer may have against the Contractor [and / or [....]] [see Note 3] or negligence by the Employer in enforcing any such right of action or remedy;
 - (e) any bond, undertaking, security or other guarantee held or obtained by the Employer for any of the obligations of the Contractor [and / or [....]] [see Note 3] under the Contract or any release or waiver thereof.
3. This Guarantee shall extend to any variation of or amendment to the Contract and to any agreement supplemental thereto agreed between the Employer and the Contractor [and/or []] [see Note 3] and for the avoidance of doubt the Guarantor hereby authorises the Employer and the Contractor [and/or []] [see Note 3] to make any such amendment, variation or supplemental agreement.
 4. This Guarantee is a continuing guarantee and accordingly shall cover all of the obligations and liabilities of the [Contractor] [see Note 2] under the Contract and remain in full force and effect until all the said obligations and liabilities of the Contractor shall have been carried out, completed and discharged in accordance with the Contract. This Guarantee is in addition to any other security which the Employer may at any time hold and may be enforced without first having recourse to any such security or taking any steps or proceedings against the Contractor.
 5. Until expiry of the Maintenance and Defects Liability Period (as defined in the Contract) for the whole and every part of the Works, the Guarantor shall not on any ground whatsoever make any claim or threaten to make any claim whether by proceedings or otherwise against the Contractor [and/or []] [see Note 3] for the recovery of any sum paid by the Guarantor pursuant to this Guarantee. Any such claim shall be subordinate to any claims (contingent or otherwise) which the Employer may have against the Contractor [and/or []] [see Note 3] arising out of or in connection with the Contract until such time as such claims shall be satisfied by the Contractor [and/or []] [see Note 3] or the Guarantor as the case may be. To that intent the Guarantor shall not claim or have the benefit of any security which the Employer holds or may hold for any monies or liabilities due or incurred by the Contractor [and/or []] [see Note 3] to the Employer and, in case the Guarantor receives any sum from the Contractor [and/or []] [see Note 3] in respect of any payment by the Guarantor hereunder, the Guarantor shall hold such sum in trust for the Employer for so long as any sum is payable (contingently or otherwise) under this Guarantee.
 6. The Employer shall be entitled to assign the benefit of this Guarantee at any time without the consent of the Guarantor or the [Contractor] [see Note 2] being required.
 7. All documents arising out of or in connection with this Guarantee shall be served:

- (a) upon the Employer, at [], marked for the attention of [];
- (b) upon the Guarantor, at [] India [Note 4]
8. The Employer and the Guarantor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
9. This Guarantee shall be governed by and construed according to the laws for the time being in force in India and the Contractor agrees to submit to the jurisdiction of the courts of India.

IN WITNESS whereof this Guarantee has been executed as a deed on the date first before written.

THE COMMON SEAL of)
[])
was affixed hereto in)
the presence of:-)

Notes (for preparation of but not inclusion in the engrossment of this Guarantee)

1. If the Contractor comprises more than one company, that fact, the joint venture or other relevant agreement and the relationship of the Guarantor to its subsidiary forming part of the Contractor must be recited.
2. If Note 1 applies, replace the word "Contractor" with name of the subsidiary being guaranteed.
3. If Note 1 applies, add additional wording and insert the name of the subsidiary being guaranteed.
4. The address for service shall be in India

Annexure-VIII**CONTRACTOR'S WARRANTY**
(On Non-Judicial Stamp Paper)**(Refer Clause 9 of SCC)****THIS AGREEMENT** is made the _____ day of _____**BETWEEN:**

1. [_____] of [_____] [and [see Note 1]] ([jointly] "the Contractor")
2. [_____] [of]/[whose registered office is at] [_____] (together with its successors and assigns, "the Employer")

(d) WHEREAS

- (A) By a contract _____ dated [_____] ("the Contract") made between (1) the Jaipur Metro Rail Corporation Limited ("the Employer") and (2) the Contractor, the Contractor has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defect in the Works upon the terms and conditions contained in the Contract.
- (B) [See Note 3].
- (C) At the request of the Employer and pursuant to the terms of the Contract the Contractor has agreed to enter into this Warranty.

(e) NOW IT IS AGREED AS FOLLOWS:

1. The Contractor hereby warrants and undertakes that:
 - (a) he will design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defect in the Works in accordance with the terms of the Contract; and
 - (b) he owes a duty of care to the Employer in relation to the performance of its duties under the Contract; and
 - (c) he will replace free of cost to the Employer any defect or failure of equipment provided in the Works for a period of 24 months from the date of issue of Completion Certificate of the last Section of the Works; and
 - (d) he agrees that should any design modification be required to any equipment or component as a consequence of failure analysis, the period of 24 months shall re-commence from the date when the modified part is commissioned into service, and such modification shall be carried out free of cost to the Employer in all sub-systems and systems for all sections; and
 - (e) he shall maintain the manufacture or spare of replacement parts for at least 10 years.

2. The liability of [the companies comprising [see Note 3]] the Contractor under this Warranty [shall be joint and several and [see Note 3]] shall not be released, diminished or in any way affected by any independent inquiry or investigation into the Works or any matter related to the Contract whether carried out by or on behalf of the Employer or any liability or right of action which may arise out of such inquiry or investigation.
3. Insofar as the copyright or other intellectual property rights in any plans, calculations, drawings, documents, materials, plant, know-how and other information relating to the Works shall be vested in the Contractor, the Contractor grants to the Employer his successors and assigns a royalty free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works or the Mass Rapid Transport System – Phase Two including without limitation the design, manufacture, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) reinstatement, extension and the remedy of any defect in the Works. To the extent that beneficial ownership of any such copyright or other intellectual property rights is vested in anyone other than the Contractor, the Contractor shall use best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. For the avoidance of doubt, any such licence granted shall not be determined if the Contractor shall for any reason cease to be employed in connection with the Works.
4. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Employer may have against the Contractor, whether in tort or otherwise.
5. Nothing contained in this Warranty shall vary or affect the Contractor's rights and obligations under the Contract.
6. The address for service of all documents arising out of or in connection with this Warranty shall be:-
 - (a) upon the Employer at [] India. [Note 4]
 - (b) upon the Contractor at [] India. [Note 4]
7. The Employer and the Contractor may change their respective nominated addresses to another address in India but only by prior written notice to each other. All notices must be in writing.
8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
9.
 - (1) Any dispute or difference of any kind whatsoever between the Employer and the Contractor arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with the Conciliation and Arbitration rules set out in the General Conditions of Contract. "Dispute" as defined in the Contract shall be deemed to include any such dispute or difference between the Employer and Contractor.
 - (2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed pursuant to Clause 9(1), the Employer may by notice in writing to the Contractor

require and the Contractor shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.

- (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objections relating to the dispute.
- (4) Subject to the foregoing provisions of this clause 9, the Employer and the Contractor agree to submit to the jurisdiction of the Courts of India at Delhi.

IN WITNESS whereof this Warranty has been executed as a deed on the date written at the head hereof.

THE COMMON SEAL of)

[])

was affixed hereto in)

the presence of:-)

Notes (for preparation of and not inclusion in the engrossment of this Warranty)

- (1) If the Contractor comprises more than one company, each such company shall be a party and liability under this warranty will be joint and several, with consequential grammatical changes.
- (2) If Note 1 applies, that fact and the joint venture or other relevant agreement must be recited.
- (3) Delete if Note 1 does not apply.
- (4) The address for service shall be in India.

Annexure-IX

59.0 ADB Environment Management Plan

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
PRE-CONSTRUCTION					
PC1	Contractor Preparatory Works (Upon Issuance of Notice to Proceed)		<p>The Contractor will complete the following activities no later than 30 days upon issuance of Notice to Proceed</p> <ol style="list-style-type: none"> 1.) Submit appointment letter and resume of the Contractor's Health and Safety Officer (HSO) and environmental focal person to CSC 2.) HSO will engage CSC-Environment Specialist to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary 3.) HSO will request CSC-ES copy of monthly monitoring formats and establish deadlines for submission. 4.) HSO will submit for CSC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites and disposal management plan, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. 5) HSO will submit for approval of CSC-ES the construction camp layout before its establishment. 	Contractor and CSC	Part of contractor's cost
PC2	Coordinate with the Jaipur Development Authority on Traffic Management Plan	Nuisance from traffic congestion	<p>The Contractors will discuss and coordinate the implementation of the traffic re-routing scheme particularly in Chotti Chaupad and Badi Chaupad when it starts the cut and cover activities and the hauling and disposal of excavated materials to the Ambabari village.</p> <p>At the minimum, the traffic management plan will have the following components: construction traffic, ensuring access to properties, accommodating pedestrians, parking, access by construction vehicles, faulty traffic lights and problem interchanges, use of public roads, parking provision during construction, use of residential streets and traffic diversion due to temporary road closures, and construction and use of temporary access roads.</p>	Contractor and CSC	Part of Contractor's cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
PC3	Community Liaison	Complaints	To ensure that ongoing feedback is provided on the progress of the JMRC together with feedback on the environmental management performance of the project. Contractor will provide a minimum of two (2) weeks notification to directly affected residents, businesses and other relevant groups of the intended construction commencement date. In providing a mechanism for communication between the contractor and the community and informing the public of construction details (timing, expected impacts), the concessionaire will undertake consultation and information activities. At least 30 days before the start of tunneling, the Contractor with supervision from the Archeology Department will employ a ground penetrating radar (GPR), detect the presence of buried artifacts along the tunnel alignment.	Contractor, CSC and JMRC Safeguards cell	Part of Contractor's cost
PC4	Ground staking	Chance find of artifacts	The Contractor, on behalf of the JMRC, will coordinate with the Archeology Department to designate an on-site representative during the entire duration of the project.	Contractor, CSC	Part of construction cost
PC5	Briefing on working near heritage resource.	Damage to heritage resource. Cultural conflicts	All workers will undergo a briefing with the Archeology Department to ensure safeguarding of heritage resource and cultural/religious practices. A proof of compliance to this requirement to include the name of participants and date and location of briefing will form part of the monthly report to the CSC.	Contractor, CSC	Part of construction cost
CONSTRUCTION					
C1.0	Tunnel boring and cut and fill	Damage to heritage resources. Tunnel boring namely Chandpole Gate, Krishna Temple, Isar Lat, Jantar Mantar, Hawa Mahal, Chhoti Chaupad, and Badi Chaupad.	No heritage resources are inadvertently damaged during construction.		

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C1.1			<p>The contractor will ensure that no inadvertent damage is incurred to the Chandpole gate.</p> <p>Ground settlement cannot be avoided in tunneling works due to the loss of volume loss, which is estimated at 0.45% for the JMRP. Estimated settlement under the Chandpole gate is less than 5mm. The contractor will ensure that the design value is not exceed and the trigger value = 3.5mm and Allowable value = 4.2 meters are implemented.</p> <p>Tilt meters will be installed at key positions on the gate to ensure the 2/1000 design value is observed with trigger and allowable values of 1.4/1000 and 1.7/1000, respectively</p> <p>Crack meters will be installed at key positions to ensure design value of 3.0mm is not exceeded with 2.1mm trigger value and 2.5 mm allowable value</p> <p>The contractor will immediately cease all operation if any of the trigger values are breached. The CSC will advise the contractor mitigation measures and practices to control settlement, tilt, and cracks to include but not limited to structural reinforcement and operation parameters of the TBM.</p> <p>The contractor will ensure that no structural damage is incurred and cosmetic damages are repaired under the supervision and control of the Jalpur Archeology Department.</p>	Contractor and CSC	Part of Contractor's cost
C1.2	Ground Settlement under the Chandpole Gate	Ground settlement	<p>Expected vibration at the Chandpole Gate during tunneling is 0.682 mm/s which is lower than internationally accepted 5mm/s. However, to be on the safe side and as practice in DMRC, the Contractor is to ensure that vibration levels at the Chandpole Gate foundation will not exceed 2.0 mm/s</p>	Contractor and CSC	Part of Contractors Cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C1.3	Surface noise from excavating equipment in Chotti and Badi Choupad	Damage and nuisance to Krishna Temple, Jantar Mantar, and Hava Mahal. Disturbance of patients in the Pink City Hospital near Chanpole, Chaudary Hospital, Majaraja School at the corner of Chotti Choupad.	<p>The contractor will ensure that noise from construction activities does not result to exceedances of relevant limits prescribed in the Indian Ambient Air Quality Standards for Commercial Area and Silence Zone. Mitigation measures to be implemented by the Contractors are:</p> <ol style="list-style-type: none"> 1) liaise with local residents on how to best minimize construction noise along the Chotti and Badi Choupads. 2) local residents and shop owners should be informed of the nature and duration of intended activities prior to commencement and kept updated as to changes in the management and mitigation plan 3) equipment compounds will be located off-site 4) noise barriers will be installed at critical work areas particularly around the Choupads 5) enclose especially noisy activities if above the noise limits 6) employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities 7) maximize the possibility of scheduling noisy activities at the same time to minimize the duration of exposure <p>Noise from vehicles particularly for hauling of excavated materials to the dump site will be controlled through strict adherence to operating and maintenance instructions, routing of heavy vehicles away from noise sensitive areas whenever possible, conform with speed limits, and construction vehicles will only use routes specified in the traffic management plan.</p>		
C1.4	Demolition of of Chotti and Badi Choupads	Loss of heritage structures	The project calls for the demolition of the Chotti and Badi Choupads and its restoration to its original condition as a requirement from Jaipur Development Authority. The demolition and restoration will be under the supervision and control of these agencies.	Contractor, CSC	Part of construction cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C1.4.1		Chance heritage finds during the cut and fill operations	Please refer to FIDIC Sec. 4.24 Fossils. Recording (including chain of custody) will be made by the contractor to be validate by the CSC, and expert verification will be made by the Jaipur Archeology Department. Temporary work stoppage in the immediate area of the chance find for up to 72 hours to allow for the on-site representative of Archeology Department to visit the site to make an assessment and provide instructions. Work in the areas adjacent to the chance find will continue as provided in the detailed design.	Contractor and CSC	
C2	Spill Disposal (Ambabari Village)	Generate sediment laden runoff from the work site during monsoon. Contamination of disposal sites from construction debris. Community hazard of uncollected and improperly disposed materials.	A spill management plan will be implemented that details the location of spill disposal sites, transporting soil, and disposing of soil. The Contractor will perform the following: 1) disposed spoils on permitted sites as instructed by the JMRC 2) ensure the adequacy of the disposal site to handle the volume of spoils that will be generated 3) Prepare, submit and seek approval from the CSC a spill dump plan that provides the: i) dump size, layout, and form, ii) means of controlling water and wind erosion, iii) measures to prevent spoil dump contamination, vehicular, and public access. 4) Explore the possibility of using spoil materials to rehabilitate borrow pits to 5) All hauling vehicles should be maintained at an acceptable working order and serviced regularly 6) Haul vehicles should be routed away from noise sensitive areas 7) Speed limit in built up areas is 40 km/h 8) All haul vehicles should be covered or soil sprayed with water before leaving the site specially during windy condition 9) Spoil dumps shall have slopes no steeper than 1V:2.5H 10) Final shaping, topsoiling, and immediate revegetation 11) No vehicles are to be allowed to enter a revegetated spoils dump The Contractor shall secure necessary permits from pertinent groundwater authorities before establishing borewells.		
C3	Groundwater Extraction	Depletion of groundwater Compete with existing groundwater users	Water conservation and recycling will be observed in all aspects of constructions to include water main breaks, watering roads for dust control, spraying concrete, equipment cleaning and site clean-up.	Contractor and CSC	Part of Construction Cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C4	Disruption of essential services	Nuisance from temporary damage or shifting in utilities particularly buried water pipes and electrical lines	<p>The Contractor will ensure that the public will be minimally affected when constructing in close proximity to essential services through:</p> <ol style="list-style-type: none"> 1) coordinate and secure necessary permits for utility shifting with the Jaipur Development Authority and other service utility agencies to locate all services prior to construction in any particular area 2) inform residents of planned interruptions through local media, fliers, and public address system 3) all planned interruptions schedules will be submitted to the safeguards cell JMRC no later than 10 working days before the interruption 4) all affected landowners, tenants, institutions, and businesses to be notified in writing prior to commencement and kept updated in changes of schedule 5) in the event of unforeseen disruptions, the contractor will take all reasonable actions to have the service promptly restored 6) relevant utility agencies will be informed of the construction proximity to essential service line and be kept on standby in the event of unforeseen disruption <p>All unplanned interruption will be immediately reported to the safeguards cell within 24-hour through an incident report.</p>		
C5	Construction camp, Batching plant and casting yard operations, and occupational safety	<p>Solid and liquid waste generation.</p> <p>Communicable diseases</p> <p>Hazardous materials storage</p> <p>Re-fueling</p> <p>Lighting</p> <p>Emergency preparedness</p> <p>Excavation and tunneling</p> <p>Personal protective equipment</p> <p>Energy management</p>	Please refer to SHE.	Contractor and CSC	Part of construction cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C6	Cleanup Operations, Restoration and Rehabilitation		Contractor shall prepare site restoration plans, which shall be subject for review and approval by the CSC, JMRC Safeguard Cell, Jaipur Development Authority and the Archeology Department to ensure consistency with zoning and town plans. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. All spaces excavated and not occupied by the foundation or other permanent works shall be refilled with earth up to surface of surrounding ground.	Contractor and CSC	Part of construction cost
OPERATION					
O1	Noise and Vibration	Vibration from train operation may cause structural or cosmetic damage to Chandpole Gate, Krishna Temple, Isar Lat, Jantar Mantar, and Hawa Mahal.	The JMRC will continue and maintain the monitoring sites established by the contractor for noise and vibration and will observe the same trigger values	JMRC	Operating cost
O2	Waste water from Depot	Contamination of groundwater by petroleum laden waste	JMRC will install wastewater treatment plant at the Mansarovar depot station capable for removing petroleum contaminants and will meet national standards before re-injection to the groundwater.	JMRC	Operating Cost
O3	Depletion of groundwater	Water requirement for train and facility cleaning, and water for commuters. Each station will require 18,000 liters per day, platform washing is 5 liters/square meter, 70,000 li.day for car washing, and plus passenger water requirement.	Rain water harvesting facilities will be installed at Mansarovar station. All stations will employ a cooling water recirculation system for air-conditioning. Only recycled water will be use for facility cleaning and landscape irrigation. All toilets will be equipped with low-flow fixtures.	JMRC	Operating Cost

ADB Environmental Monitoring Plan						
Envtl Indicators	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Approx. Cost
Construction Phase						
Air Quality	TSPM, PM ₁₀ , NOx, SOx, COx	Qualitative analysis of dust development at selected sites/sensitive spots through High Volume Sampler	2 locations at Chotti and Badi Choupad where cut and fill activities will be implemented	24 hours continuous every month until the stations are completed	National Ambient Air Quality Standards (NAAQS)	36@10,000 =Rs. 360,000
Water Quality	DO, Conductivity, pH, E.Coli, TSS, Oil and Grease and TDS	<ul style="list-style-type: none"> Collect and analyze sample from source Observation of blockage of waterways - extent and secondary impacts Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries Observations on vehicle and equipment washing practices in rivers 	Ground water at construction camps and	Quarterly	National Drinking Water Quality Standards (NDWQS) and Water Quality Guidelines	12@3,750 =Rs. 45,000
Noise Levels	(1 hr L _{eq} dB(A)) WHO Standards	<ul style="list-style-type: none"> Point source measurements in dB (A) at settlement sites/sensitive spots for noise level at 2, 5 and 15 m from road shoulder Traffic volume measurements 	Krishna Temple, Janlar Mantar, and Hawa Mahal. Pink City Hospital near Chaudhary Hospital, Maharaja School at the corner of Chotti Choupad	Monthly	Indian Ambient Air Quality Standards for Noise	8x12x3@2,450 =Rs. 705,600
						Contractor
						Contractor
						SC, PD/DOR

Env'tl Indicators	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Approx. Cost	Implementation	Supervision
Vibration	PPV mm/s	Accelerometer	Krishna Temple, Jantar Mantar, and Hawa Mahal. Pink City Hospital near Chandpole, Chaudary Hospital, Majaraja School at the corner of Chotti Chaupad	Monthly	Commercial: 10 mm/s (day). Archeological structures: 2.5 mm/s	36*200,000 = Rs7,200,000	Contractor	GSC
Underground artifacts	Number and location	Ground Penetrating Radar	Along the entire tunnel length	Once 30 days before tunneling	None	Rs200,000	Contractor	GSC
Operation Phase								
Water Quality	DO, Turbidity, Conductivity, pH, E.Coli, TSS, Oil and Grease and TDS	<ul style="list-style-type: none"> Collect and analyze sample from source Observation of blockage of waterways - extent and secondary impacts Water pollution incidents due to unsafe disposal of waste and spoil, analyzing effects on local fisheries Observations on vehicle and equipment washing practices in rivers 	2 stations	Annual	National Drinking Water Quality Standards (NDWQS) and Water Quality Guidelines	Rs. 45,000	JMRC	SPCB
Vibration	PPV mm/s	Accelerometer	Krishna Temple, Jantar Mantar, and Hawa Mahal. Pink City Hospital near Chandpole, Chaudary Hospital, Majaraja School at the corner of Chotti Chaupad	Annual	Commercial: 10 mm/s (day). Archeological structures: 2.5 mm/s	Rs200,000	JMRC	Department of Archeology

Section 9 - Contract Forms

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Notification of Award

[*Employer's letterhead*]

Letter of Acceptance

[*date*]

To: [*Name and address of the contractor*]

1. This is to notify you that your Bid dated [*date*] for execution of the [*Design, Manufacture, Supply, Installation Testing and Commissioning of Train Control & Signalling System (JPJS02 Phase-1B)*] for the Contract Price in the aggregate of [*amounts in numbers and words*] [*name of currency*], as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by Jaipur Metro Rail Corporation.
2. The resulting Contract for JP/JS02-Phase-1B will consist of and be constituted by this Letter of Acceptance together with
 - a. Notice of invitation for Bid and Instructions To Bidder
 - b. Employer's Requirements- General Specification
 - c. Employer's Requirements- Particular Specification
 - d. Employer's Requirements Safety, Health and Environment
 - e. The Special Conditions of Contract
 - f. The General Conditions of Contract
 - g. Bid Drawings
3. All the works will be executed in accordance with conditions, specifications & standards stipulated in the bid.
4. You shall furnish.
 - a. Power of Attorney, Board Resolution, MOU between the consortium members as per contract conditions.
 - b. Performance Security/Bond, Parent Company Undertaking, Parent Company Guarantee, contractor's Warrantee, Designer's Warrantee as applicable.
 - c. Advance Payment Bank guarantee in the stipulated format.
5. You shall also undertake not to use information gained in the contract for any purpose without obtaining the prior approval of JMRC and shall not make any public announcement or divulge any material relating to project both in India & overseas without the prior written consent of JMRC.
6. The DLP is to be administrated by JMRC/O&M, however at any time during the DLP, JMRC at its sole discretion may assign any of their nominated third party for administering the DLP obligation by [*Name of the contractor*]. Acceptance of assignment of any such party by JMRC shall be binding on [*Name of the contractor*]
7.
 - a). The date of issue of this "Letter of Acceptance" shall be treated as the "Notice to Proceed" for the purpose of this contract for the commencement of the works.
 - b). The completion period of contract will be as per key date.

8. This letter to acceptance shall form part of the Contract Agreement to be signed later and shall be binding as Contract Agreement till detailed agreement is signed.
9. The Letter of Acceptance is sent to you in duplicate. You are required to return one copy duly signed on all pages including your unconditional acceptance thereof so as to reach the undersigned within two days of issuance of this letter.

Thanking You.

Authorized Signature:

Name and Title of Signatory:

Name of Agency:

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made on the [*insert number*] day of [*insert month*], [*insert year*],

BETWEEN

(1) [*Jaipur Metro Rail Corporation*], a corporation incorporated under the laws of [*India*] and having its principal place of business at [*address of employer*] (hereinafter called “the Employer”), and (2) [*name of contractor*], a corporation incorporated under the laws of [*country of contractor*] and having its principal place of business at [*address of contractor*] (hereinafter called “the Contractor”).

WHEREAS the Employer desires to engage the Contractor to design, manufacture, test, deliver, install, complete and commission certain Facilities, viz. [*list of facilities*] (“the Facilities”) and the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1 Contract Documents

- 1.1 **Contract Documents** (Reference GCC Clause 2)
The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:
 - a) This Contract Agreement and the Appendixes hereto
 - b) Letter of Acceptance.
 - c) Post Bid Proceeds
 - d) Letter of Bid and Price Schedules submitted by the Contractor
 - e) Employer's Requirements
 - f) List of Eligible Countries that was specified in Section 5 of the Bidding Document
 - g) Special Conditions of Contract SCC
 - h) General Conditions of Contract GCC
 - i) Other completed Bidding Forms submitted with the Letter of Bid
 - j) Any other documents forming part of the Employer's Requirements
- 1.2 **Order of Precedence** (Reference GCC Clause 2)
In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.
- 1.3 **Definitions** (Reference GCC Clause 1)
Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.

Article 2 Contract Price and Terms of Payment

- 2.1 **Contract Price** (Reference GCC Clause 11 & SCC Clause 7)
The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of [*. . . amounts of foreign currency in words . . .*], [*. . . amounts in figures. . .*] as

specified in Price Schedule No. 5 (Grand Summary), [. . . *amounts of local currency in words* . . .], [. . . *amounts in figures*. . .], or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.2 **Terms of Payment** (Reference GCC Clause 12 & SCC Clause 8)

The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in the Appendix (Terms and Procedures of Payment) hereto.

Payments shall be made into a bank account, nominated by the Contractor in Indian rupees in a bank in India unless otherwise permitted in Special Conditions of Contract. If payments are to be made in more than one currency, separate bank accounts may be nominated by the Contractor for each currency, and payments shall be made by the Employer accordingly.

In the event that the amount payable under Schedule No. 1 is adjusted in accordance with GCC 11.2 or with any of the other terms of the Contract, the Employer shall arrange for the documentary credit to be amended accordingly

Article 3 Effective Date

3.1 **Effective Date** (Reference GCC Clause 1 & SCC Clause 5)

The Effective Date for this Contract for commencement of work shall be the date of issue of Letter of Acceptance(LOA)

3.2 Each party shall use its best efforts to fulfill the following conditions for which it is responsible as soon as practicable.

- (a) This Contract Agreement has been duly executed for and on behalf of the Employer and the Contractor.
- (b) The Contractor has submitted to the Employer the performance security and the advance payment Bank guarantee.
- (c) The Employer has paid the Contractor the advance payment.
- (d) The Contractor has been advised that the documentary credit referred to in Article 2.2 above has been issued in its favor

Article 4 Communications

4.1 The address of the Employer for notice purposes, pursuant to GCC 4.1 is: [*Employer's address*].

4.2 The address of the Contractor for notice purposes, pursuant to GCC 4.1 is: [*Contractor's address*].

Article 5. Appendixes

5.1 The Appendixes listed in the attached List of Appendixes shall be deemed to form an integral part of this Contract Agreement.

5.2 Reference in the Contract to any Appendix shall mean the Appendixes attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by, for and on behalf of the Employer

[*Signature*]

[*Title*]

in the presence of

[*Signature*]

[*Title*]

Signed by, for and on behalf of the Contractor

[*Signature*]

[*Title*]

in the presence of

[*Signature*]

[*Title*]

APPENDIXES

Appendix 1 - Terms and Procedures of Payment

Appendix 2 - Price Adjustment

Appendix 3 - Insurance Requirements

Appendix 4 - Time Schedule

Appendix 5 - List of Major Items of Plant and Services and List of Approved Subcontractors

Appendix 6 - Scope of Works and Supply by the Employer

Appendix 7 - List of Documents for Approval or Review

Appendix 8 - Functional Guarantees

Appendix 1 - Terms and Procedures of Payment

General Requirements

1. This Contract is a fixed Lump Sum priced Contract for Design, Manufacture, Supply, Installation, Testing and Commissioning (Including Integrated Testing and Commissioning) of Train Control & Signalling System for two underground Metro Stations at Choti Chaupar and Badi Chaupar on East–West Corridor of Jaipur Metro Phase- 1B.

The price to be quoted shall be in accordance with provisions of SCC Clause 7.

A. Apportionment of Fixed Lump Sum Price To Section and To Cost Centres and Milestones under each Section.

2. The whole of Works including design are divided into Section EW-B and section MS as detailed in Annexure-B to this appendix. Each Section is divided into the various Cost Centres named according to their general scope of work as detailed. The scope of the work for EW-B section also includes the corresponding work in the respective OCC at Mansarovar.
3. The fixed Lump Sum price for whole of the Works shall be apportioned by the Contractor amongst the various sections . The apportioned amount for each Section will be further distributed among various Cost Centres included in that Section, separately for foreign currency and for the Rupee portion. The apportioned amount for each Cost Centres will be further distributed amongst various Milestones included in that Cost Centre, separately for the foreign currency and the Rupee portion as in annexure C & D in this appendix.
4. The sum of amounts shown against Milestones in a Cost Centre is the Cost Centre Total that is to be carried forward to the Section Summary. The division of the respective Cost Centre Total between Indian Currency and Foreign currency shall be shown in the said Summary. The Section Summary will be carried forward to the bid's Total.
5. The scope and extent of the Works are to be ascertained by reference to the Contract Documents as a whole and shall not be limited in any manner whatsoever by the descriptions of the Cost Centres under each Section or of the Milestones under each Cost Centre, as given in the Appendices to the Pricing document.
6. The sum of the amounts apportioned to section MS shall not be more than 10% of fix lump sum prize refer to clause 9 below.
7. The sum of the amounts apportioned to Cost Centres 'A' and 'B' of a EW-B Section except section MS shall not exceed 5% and 10% respectively of the apportioned amount for that Section.
8. The sum of the amounts apportioned to Cost Centres 'D' and 'E' of a Section except section MS shall not be less than 15% and 5% respectively of the apportioned amount for that Section.
9. The contractor shall note that the apportionment of a Section Total into Cost Centres and them in to milestones should have relation to the Content of work involved. The Total Price of a Section shall not be apportioned more than 5% and 10% against Cost Centre A and B respectively. Also Total Price against a Section shall not be apportioned less than 15% and 5% against Cost Centre D and E respectively.

B. Milestones Achievement Periods

10. The Milestones under each Cost Centre identify verifiable steps towards the completion of the work within that Cost Centre under a Section. The contractor shall indicate the date - within which he shall achieve each Milestone.

C. Milestone Payment Schedule (MPS)

10. The Contractor shall submit with his bid the Milestone Payment Schedule which shall show in tabular form the anticipated accumulated value to work done of all Cost Centres for Section put together.
The contractor shall also submit monthly cash flows for the Contract as a whole
Both Milestones Payment Schedules and monthly cash flows shall be submitted for each currency of the Contract separately.
12. The MPS covers the period which will commence on the first day of the calendar month next after the month containing the Commencement Date of the Works as per the Contract. The first application for interim payment may be made not earlier than during the month following the calendar month next after the month containing the Commencement Date of the Works, such first application relating to the first month (i.e. month 1) of the MPS.

D. Bid Total

12. The Bid Total submitted by the contractor shall be in the format shown in the Pricing Document, Annexure A to Appendix 1 , Contract Forms, Section 9.
13. The Pricing Document contains Section, with Cost Centres under each Section and Milestones under each Cost Centre. The Section, Cost Centres and Milestones have been prepared to indicate the extent of detail required in the Bid. The Bidder shall prepare and complete documents, in this format, as being his Bid and submit as part of the Financial Package. A minimum BOQ is given in Bidding Documents, Table-I of Section 4 gives the minimum BOQ to be covered as part of the scope of the work. The bidder should fill Schedule 1,2,3,4,5 of Section 4 using the minimum BOQ as a baseline reference classifying specified items into various schedules . Any other item or enhancement to the listed items required to complete the JP/JS02-Phase-1B Contract shall also be provided as part of this lumpsum Contract and should be filled in schedules.
14. The prices quoted by the Bidder in **Schedule 1,2,3,4,5 of Section 4** and activities given as part of the pricing document, shall be evaluated for reasonability. Bidder is advised to quote reasonable and appropriate/correlated rates for the bill of quantities so as to enable evaluating the reasonability of price.
Offer found unreasonable may be rejected.
JMRC reserves the right of deleting/adding some of the items in **Schedule 1,2,3,4,5 of Section 4** of the pricing document during project implementation stage based on the Project Requirement.
JMRC reserves the right of variation of any items in **Schedule 1,2,3,4,5 of Section 4** upto +/- 25% at the same unit prices during Project implementation stage based on the Project Requirement.

15. The Pricing Document completed and submitted by the Bidder, as part of his Bid, should use an indexing and page numbering system such that its extent and completeness is clearly evident.

E. Currency

16. Section Totals, Cost Centre Totals and Milestone amounts shall be indicated in Indian Rupees and in a foreign currency wherever required.

F. Cost Centres

17. Cost Centres under each Section are fixed and shall not be changed by the Bidder. The Bidder, however, may add additional Milestones in a Cost Centre provided such Milestones genuinely relate to that Cost Centre activity. The Cost Centres represent the major items of the Works for which the Employer will pay the Contractor, and the contractor shall ensure that he has allowed for all his costs he requires for the Contract to meet the Employer's Requirements.

18. If during the course of execution, it becomes necessary, to meet the Employer's Requirements (as indicated in these bid Documents), to add more Milestones in a Cost Centre, the Lump Sum Price of the whole of Works, which will remain unaltered, will be reapportioned amongst the Sections, and further redistributed under the Cost Centres in Section and the Milestones in each Cost Centre. The liability of the Employer will be limited to the fixed Lump Sum price already accepted and the Contractor will have no right to claim any thing over and above the fixed Lump Sum price for any such addition of Milestones in any Cost Centre. The decision of the Employer will be final and binding in such matters and will not be subject to Conciliation or Arbitration.

G. Milestones

19. The Milestones represent the completion of verifiable activities to be undertaken by the Contractor. A date for the achievement of each of the Works shall be entered in the column provided. Milestones that lead to the achievement of a Stage must always precede the Key Date for achievement of that Stage.

H. Employer's Default

20. In the event that the Employer fails to make any payment on its respective due date, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate equal to State Bank of India prime lending rate plus 2% per annum or 10% per annum whichever is lower for period of delay until payment has been made in full.

(B) Payment Procedures

The terms of payment shall be in accordance with provisions of SCC, Clause 8.

Annexure A – BID TOTAL

(THIS DOCUMENT IS TO BE PREPARED AND COMPLETED BY THE BIDDER)

The fixed Lump Sum Price of this Contract is:

Rupees _____ (In figures)

and _____ (In words)

(In Foreign Currencies) _____ (In figures)

_____ (In words)

The above fixed Lump Sum Price shall be apportioned among the Section as below:

SN	Sections	Total Apportioned Amounts of Sections	
		Foreign Currency	Rupees Amount
EW-B	CHOTI CHAUPAR TO BADI CHAUPAR		
MS	MISCELLANEOUS		
BID TOTAL (TOTAL FOR ALL SECTION)			

Annexure B – SECTION SUMMARIES**SECTION EW-B - CHOTI CHAUPAR TO BADI CHAUPAR**

Cost Centres	Description of Cost Centres	Foreign Currency	Rupee Amount
A	Preliminaries and General Requirements		
B	Detailed Design		
C	Manufacture and Delivery		
D	Installation and Site Testing		
E	System Acceptance Tests, Integrated Testing and Commissioning.		
SECTION TOTAL CARRIED TO BID TOTAL			

SECTION MS - MISCELLANEOUS

Cost Centres	Description of Cost Centres	Foreign Currency	Rupee Amount
A	Training ,Contract Spares and Special Tools		
B	Supervision of Maintenance & Manuals		
SECTION TOTAL CARRIED TO BID TOTAL			

Annexure C -SECTION EW-B - CHOTI CHAUPAR TO BADI CHAUPAR

COST CENTRE A – PRELIMINARIES AND GENERAL REQUIREMENTS

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This Cost Centre includes but is not limited to:

- Contractor's Project Plan, Document Submission Procedure, Designation System for Documents Submission, Health, Safety & Environment Plans, Interface Management Plan with Designated Contractors.
- Works Programme and Document Submission Programme for complete JP/JS02-Phase-1B Contract.
 - EMC Management Plan
 - RAMS Plans
 - Software Quality Assurance Plan
 - Quality Plan
 - Migration Plan
- Preliminary System Design for Train Control & Signalling Systems, consisting of:
 - System and Sub-system Overview,
 - System requirement specification, System traceability specification,
 - System safety plan,
 - System Verification & Validation Plan
 - System Assurance Plans consisting of:
 - EMC Management Plan
 - RAMS Plans
 - Software Quality Assurance Plan
 - Quality Plan
 - ATC interface with Rolling stock, including the design of driver's MMI for ATP etc.
- Software and System Verification and Validation Standards. Complete Verification and Validation Documents for each Generic Product – CBI, Trackside ATP, Onboard ATP/ ATO, CBI, ATS and Track Circuit
- Signaling Plan for entire Main Line including Phase-1A & 1B section.
- Earthing and Lightening Protection Plan
- Specifications for Indoor and Lineside Equipments including the requirement for power, space and preliminary mounting details for main line and depot
- Layout Plan for equipments and cables in stations of phase-1B.
- Any other item(s) considered necessary to comply with the Scope of Work of EW-B section.

MILE STONE NO.	WORK DESCRIPTION	Apportioned Amount		Date for completion of Milestone
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
	Obtain the "Notice of No Objection" or "Notice of No Objection subject to..." from the Employer's Representative for:			
A1	Contractor's Project Plan, Documents Submission Procedure, Designation System for Documents, Submission, Health, Safety & Environment Plan for complete JP/JS02-Phase-1B contract			
A2	Works Programme, Document Submission Programme, Migration Plan for complete JP/JS02-Phase-1B contract			
A3	Preliminary System design for Train Control & Signaling System for complete JP/JS02-Phase-1B contract			
A4	Software and System Verification and Validation Standards. Complete Verification and Validation Documents for each Generic Product – CBI, Trackside ATP, Onboard ATP/ATO, CBI, ATS and Track Circuit			
A5	Signaling Plan for entire Main Line including Phase-1A & 1B section.			
A6	Earthing, Lightening, and Surge Protection Plan for complete JP/JS02-Phase-1B contract			
A7	Specification for Indoor and Line side Equipments including the requirement for power, space and preliminary mounting details for Phase-1B section			
A8	Layout Plan for equipments and cables in stations of phase-1B			
A9	Any other item(s) considered necessary to comply with the scope of Works related to Phase-1A & Phase-1B work			
COST CENTRE TOTAL CARRIED TO EW SECTION SUMMARY				

COST CENTRE B – DETAILED DESIGN

This Cost Centre comprises all those obligations and ongoing activities through out of the Contract not associated directly with any other Cost Centre.

This Cost Centre includes but is not limited to:

Train Control & Signalling

- Delivery Schedules for Materials
- Detailed Interface Documents with the Designated Contractors
- Final Design of Signalling & Train Control System consisting of:
 - Specifications of all Sub-systems: CBI including wayside equipment (Track circuits, Signals, Point Machines), Onboard ATP/ ATO, Trackside ATP including wayside equipment, ATS, Cables, Communication network
 - Design of MMIs viz. ATS, Onboard ATP, CBI Control Workstation
 - Verification and Validation Plans of all sub-systems
 - Design Verification Table
 - Train performance curves, run time calculations and simulation of required headway
 - Hazard Analysis
 - Preliminary Hazard analysis,
 - System Hazard analysis,
 - Sub system hazard analysis,
 - Interface hazard analysis
 - Operating & Support Hazard Analysis
 - Final System Assurance Plans
 - Migration Plan
- Application/ Configuration Documents –
 - Train Movement Specification
 - Control/ Route Table
 - ATP, ATS Configuration documents
- Factory Acceptance Test Plans and Type Test Plans including planning, methodology and checklists
- Equipment installation methods for all indoor and outdoor equipment.
- Application drawings including Bonding Plan, Cable Layout Drawing, Cable Termination and Distribution Drawing, Beacon Layout Plan, Room Layout Plans, Circuit Diagrams including interconnection details of all subsystems, Equipment Installation Drawings.
- Complete configuration software backup data for all subsystems including EW-B section (Phase-1B), .

Any other item(s) considered necessary to comply with Scope of Work related to Phase-

1A & Phase-1B work

MILES- TONE NO.	WORK DESCRIPTION	Apportioned Amount		Date of Completion
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
B1	List of materials required and delivery schedule thereof			
B2	Final Design of Train Control & Signalling System			
B3	Application/Configuration Documents for Phase-1B section			
B4	Factory Acceptance Test Plans and Type Test Plans including planning, methodology and checklist for complete JP/JS02-Phase-1B contract.			
B5	Equipment installation method for all indoor and outdoor equipment for complete JP/JS02-Phase-1B contract.			
B6	Application Drawing for Phase-1A (Railway Station interlocking updatation due to boundary) & phase-1B work			
B8	Complete Configuration software backup data for all subsystems including section (Phase-1B).			
B9	Any other item(s) considered necessary to comply with Scope of Work related to Phase-1A & Phase-1B work			
COST CENTRE TOTAL CARRIED TO EW-B SECTION SUMMARY				

COST CENTRE C – MANUFACTURE AND DELIVERY

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This includes but is not limited to:

Receipt /delivery of following equipment for the JS02-Phase-1B Section after type test, factory acceptance test, and proof of insurance:

TRAIN CONTROL & SIGNALLING

- Delivery of CBI equipment & associated accessories at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of T-ATC, TWC equipment and associated accessories at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of Power Distribution Cubicle at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of ATS equipment for station and other SCR equipment and associated accessories at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of signalling and power cable at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of line side signals and associated accessories at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of track circuits and associated accessories at Contractor's premises, Mansarovar Depot in Jaipur.
- Delivery of point machines and associated accessories at Contractor's premises, Mansarovar Depot in Jaipur.
 - Supply and handing over of Contract Spares for Train Control & Signalling systems for the Contract JP/JS02-Phase-1B along with relevant documentation to JMRC.
- Any other item(s) considered necessary to comply with Scope of Work related to Phase-1A & Phase-1B.

MILE STONE NO.	WORK DESCRIPTION	Apportioned Amount		Date of Completion
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
Obtain the "Notice of No Objection" or "Notice of No Objection subject to..." from the Employer's Engineer for each of the following Milestones after certification of type tests, Certification of factory acceptance test, Proof of insurance				
C1	Delivery of T-ATC equipment along with trackside modules and associated accessories for Mainline (Phase-1B) at Contractor's premises in Jaipur			

C2	Delivery of CBI equipment with all associated accessories for Mainline (Phase-1B) at Contractor's premises in Jaipur			
C3	Delivery of ATS equipment & associated accessories including stations, and OCC at Contractor's premises in Jaipur			
C4	Delivery of signaling and power cable for Mainline (Phase-1B) at Contractor's premises in Jaipur			
C5	Delivery of Line Side Signals, Track Circuits, Point Machines, Power Distribution Cubicles, and all associated accessories for Mainline (Phase-1B) at Contractor's premises in Jaipur			
C6	Delivery and handing over of contract spares along with relevant documentation to JMRC			
C7	Any other item(s) considered necessary to comply with scope of work.			
COST CENTRE TOTAL CARRIED TO EW-B SECTION SUMMARY				

COST CENTRE D – INSTALLATION AND SITE TESTING

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This shall include but not be limited to:

Indoor & Outdoor Equipment:

- Delivery to Site from Contractor's premises in Jaipur, installation and testing of all indoor equipment such as CBI, ATP/ ATO, AFTC, ATS, TWC including rack, wiring & termination etc.; and outdoor equipment such as line side signals, track circuits, point machines, Beacons, DLR including erection of junction boxes, wiring and terminations, etc.
- Receipt of equipment at Site, pre-installation tests, inspection of equipment and Site preparations.
- Complete fixing and wiring of equipment in accordance with circuit and installation diagrams.
- Post installation tests including: Pre-power up checking, power up, customization and configuration of equipment.

MILE STONE NO	WORK DESCRIPTION	Apportioned Amount		Date for completion
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
	Obtain the "Notice of NO Objection" or "Notice of NO Objection subject to..." from the Employer's Representative for:			
D1	Delivery to Site from contractor's premises in Jaipur, installation and installation testing (includes pre-installation test, post installation tests for all sub-system) of all station indoor and outdoor equipment such as CBI, T-ATP, AFTC, TWC, LATS, Signals, Track circuits, Point machines, Beacons, DLR etc. for section Phase-1B and Phase-1A, if required.			
D2	Completion of Partial Acceptance Tests for Train Control & Signalling System for the section Phase-1B and Phase-1A, if required.			
COST CENTRE TOTAL CARRIED TO EW-B SECTION SUMMARY				

COST CENTRE E – SYSTEM ACCEPTANCE TESTS AND INTEGRATED TESTING & COMMISSIONING, SUPERVISION OF MAINTENANCE.

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This shall include but not be limited to:

- Testing & Commissioning Documents including Interface Testing Plans
- Integrated testing and commissioning documents
- System Acceptance Tests in accordance with accepted System Acceptance Plan
- Integrated Testing and Commissioning
- Service Trials
- System Safety Case of the Train Control & Signalling Systems and Assessment Report of Independent Safety Assessor.
- Submission of As built Drawings
- Any other item(s) considered necessary to comply with the Scope of Work.

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Date of Completion
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
	Obtain the "Notice of No Objection" or "Notice of No Objection Subject to ---" from the Employer's Representative for the System Acceptance Test (SAT) for the Section as a whole.			
E1	Testing & Commissioning Documents including Interface Testing Plans, System Acceptance Test Plan, Integrated Testing & Commissioning Plan complete JP/JS02-Phase-1B Contract.			
E2	Completion of System Acceptance test for section Phase-1B and Phase-1A, if required.			
E3	Completion of Integrated Testing & Commissioning for section Phase-1B and Phase-1A, if required.			
E4	Completion of Service Trials for the Section Phase-1B.			
E5	As built drawing for the section: Indoor and outdoor equipment of all System & sub-systems.			

E6	Submission of System Safety Case and Assessment Report of Independent Safety Assessor for the entire section.			
E7	Any other item(s) considered necessary to comply with the Scope of Work.			
COST CENTRE TOTAL CARRIED TO SECTION EW-B SUMMARY				

Annexure D

Section MS – MISCELLANEOUS

COST CENTRE- MS-A Training, Contract Spares and Special Tools

Training:

This cost centre comprises all those obligation and ongoing activities throughout Contract not associated directly with any other Cost Centre.

This Cost centre includes but not limited to:

- Submission of Training Plan, training Guide, Training Manuals and their review by Employer's Representative with "No Objection" or "No Objection Subject to".
- Training of Employer's Maintenance Personal as per provisional of Contract.
- Submission of training Report and it review by Employer's Representative with "No Objection" or as "No Objection Subject To".
- Any other item(s) considered necessary to comply with the scope of work.

Spares and special Tools:

This cost centre comprises all those obligation and ongoing activities throughout Contract not associated directly with any other Cost Centre.

This Cost centre includes but not limited to:

Supply of spares for train Control & Signaling system for the Contract JP/JS02

Supply of special tools and equipments, testing and measuring instruments.

Any other item(s) considered by the Contractor to comply with the Scope of Work.

Notes:

1. The travels boarding and lodging expenses for the trainees sent overseas shall be borne by the Employer.

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Date Completion of
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
A1	Provision of Contractor's Instructors (1 instructor Man- month) for training of Employer's operating and Maintenance personnel in India.			
A2	Submission of Training Manuals (Original plus Five Hard Copies) and in Electronic format.			
A3	Delivery to Site of Spares.			
A4	Delivery to Site of Special Tools.			
A5	Any other item(s) considered necessary to comply with the Scope of Work.			

Cost Centre MS-B- Supervision of Maintenance and Manuals

Supervision of Maintenance:

This Cost centre Comprises of Maintenance of Train control & Signaling System.

- The Contractor shall provide experts for supervision of Maintenance* in accordance with the Employer's Requirements.

*This excludes Contractor's obligations and responsibilities during the Defects Liability Period.

Notes:

The deployment of the experts under this Cost centre may not be continuous and they may be required to supervise the maintenance* in short periods at a time. The numbers of man -months of experts shall, however, not exceed 4 man months. Payment for this Cost Centre will be made on Man-Months Basis.

* This excludes Contractor's obligations and responsibilities during the Defects Liability Period.

Manuals:

This cost centre comprises all those obligation and ongoing activities throughout Contract not associated directly with any other Cost Centre.

This Cost centre includes but not limited to:

- Provision of Operating Manuals- (hard copies and electronic format)
- Provision of Maintenance Manuals- (hard copies and electronic format)
- Provision of Sub- System/system and Spare parts catalogue- (hard copies and electronic format)
- Any other item(s) considered necessary to comply with the Scope of work.

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Date of Completion
	MILESTONE ACTIVITY	Foreign Currency	Rupee Amount	
	Obtain the "Notice of No Objection" or "Notice of No Objection to....." From the employer's Representative for Completion of the following in accordance with the Employer's Requirements:			
B1	Supervision of Maintenance			
B2	Operating Manual (Original plus five hard copies) & in electronic format and Maintenance Manuals (Original plus five hard copies) & in electronic format.			
B3	Any other item(s) considered necessary to comply with the Scope of Work.			

Appendix 2- Price Adjustment

Not Used

Appendix 3 - Insurance Requirements

(A) Types of Insurance to Be Taken Out by the Contractor

In accordance with the provisions of GCC Clause 34, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the types of insurance set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

(a) Cargo Insurance

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefore) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the Site for the purpose of performing its obligations during the defect liability period.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property (including the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the Facilities.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors (whether owned by them or not) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurance

The Contractor is also required to take out and maintain at its own cost the following types of insurance:

Details:

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub clause 34.1, except for the Third Party Liability, Workers' Compensation, and Employer's Liability Insurance, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub clause 34.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurance. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

(B) Types of Insurance to Be Taken Out by the Employer

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurance policies.

Details:

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

Appendix 4 - Time Schedule

KEY DATES

1 KEY DATES

The work includes a number of stages. These stages, which are inter-related with, and essential to, the completion of the Signalling & Train Control systems, are to be achieved by the Key Dates indicated in the Schedule of Key Dates.

If the identified stage is not achieved by the stated Key Date, liquidated damages may become applicable as set out in the Contract.

STAGE 1 – Key Date 1 (KD1): Preliminary Design Submission

Achievement: Submission to the Employer's Engineer of the Preliminary Design as specified in paragraph 6.10.1 (2) of Particular Specifications.

STAGE 2 – Key Date 2 (KD2): Final Design Submission

Achievement: Submission to the Employer's Engineer of the Final Design as specified in paragraph 6.10.1 (3) of Particular Specifications.

STAGE 3 – Key Date 3 (KD3): Obtain “No Objection”/ “No Objection Subject to Comments” from Employer's Engineer on Final Design Submission

Achievement: Obtain “No Objection”/ “No Objection Subject to Comments” from Employer's Engineer on Final Design Submission as detailed above.

STAGE 4 – Key Date 4 (KD4): Delivery of Train Control & Signalling System/equipments at Contractor's premises in Jaipur.

Achievement: Delivery of Interlocking, Trackside ATP, Track Circuit, Point Machines, Cables, Signals etc. at Jaipur.

STAGE 5 – Key Date 5 (KD5): Completion of SAT & ITC including ATO

Achievement: This Key Date relates to the following:
Completion of System Acceptance Test (SAT) and Integrated Testing & Commissioning (ITC) including ATO.

STAGE 6 - Key Date 6 (KD6): Submission of Safety Certificate

Submission of safety case along with ISA Assessment Report for revenue service

STAGE 7 - Key Date 7 (KD7): Revenue Operation

Taking Over of the section by the Employer for running Revenue Services.
Delivery of As-Built Drawings & Documents.

STAGE 8 – Key Date 8 (KD8): Completion of Contract

Achievement: This Key Date relates to the following:
Completion of all Contract responsibilities including:
Satisfaction of the Defects Liability period requirements;
Issue of a Performance Certificate in accordance with SCC, and
Completion of the period of Supervision of Maintenance

Schedule of Key Dates

Key Date	Description	Choti Chaupar- Badi Chaupar Section
KD1	Submission of Preliminary Design Document	Within 10 weeks from LOA
KD2	Submission of Final Design Document	Within 20 weeks from LOA
KD3	Obtain Consent of Employer's Engineer on Final Design submission	40 weeks prior to KD7
KD4	Delivery of Train Control & Signalling system / equipments at Contractor's premises in Jaipur	34 weeks prior to KD7
KD5	Completion of System Acceptance Test (SAT) & Integrating System Testing including ATO.	8 weeks prior to KD7
KD6	Submission of Safety Certificate	4 weeks prior to KD7
KD7	Revenue operation	31/03/2018
KD8	Completion of Contract	31/03/2020

Appendix 5 - List of Major Items of Plant and Services and List of Approved Subcontractors

A list of major items of plant and services is provided below.

The following Subcontractors and Manufacturers are approved for carrying out the item of the facilities indicated. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with GCC Sub-clause 19.1, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Employer and their names have been added to this list of Approved Subcontractors.

Major Items of Plant and Services	Approved Subcontractors and Manufacturers	Nationality

Appendix 6- Scope of Works and Supply by the Employer

Refer Section 6: Employer's Requirement

Appendix 7 - List of Documents for Approval or Review

Refer Section 6: Employer's Requirement

Appendix 8 - Functional Guarantees

Not Used

Performance Security

..... Bank's name, and address of issuing branch or office¹

Beneficiary: Name and address of employer

Date:

Performance Guarantee No.:

We have been informed that name of the contractor. (hereinafter called "the Contractor") has entered into Contract No. reference number of the contract. dated with you, for the execution of name of contract and brief description of plant and services. (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we name of the bank. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of name of the currency and amount in figures². (..... amount in words.) such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire no later than the earlier of

(a) 18 months after our receipt of

- (i) a copy of the Completion Certificate; or
- (ii) a registered letter from the Contractor, attaching a copy of the notice to the project manager that the Facilities are ready for commissioning, and stating that 14 days have elapsed from receipt of such notice (or 7 days have elapsed if the notice was a repeated notice) and the project manager has failed to issue a Completion Certificate or inform the Contractor in writing of any defects or deficiencies; or
- (iii) a registered letter from the Contractor stating that no Completion Certificate has been issued but the Employer is making use of the Facilities; or

(b) the ____ day of ____, 2____.

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 (or ICC Publication No. 758 as applicable), except that subparagraph (ii) of Sub-Article 20(a) is hereby excluded.³

¹ All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

² The guarantor shall insert an amount representing the percentage of the contract price specified in the contract and denominated either in the currency(ies) of the contract or a freely convertible currency acceptable to the employer.

³ Or the same or similar to this clause specified in the Uniform Rules for Demand Guarantees, ICC Publication No. 758, where applicable.

.....
Seal of bank and signature(s)

If the institution issuing the performance security is located outside the country of the employer, it shall have a correspondent financial institution located in the country of the employer to make it enforceable.

Advance Payment Security

..... *Bank's name, and address of issuing branch or office*¹

Beneficiary: *Name and address of employer*

Date:

Advance Payment Guarantee No.:

We have been informed that *name of the contractor*. (hereinafter called "the Contractor") has entered into Contract No. *reference number of the contract*. dated with you, for the execution of *name of contract and brief description of works*. (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum *name of the currency and amount in figures*². (..... *amount in words*.) is to be made against an advance payment guarantee.

At the request of the Contractor, we *name of the bank*. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in figures*³. (..... *amount in words*.) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number *contractor's account number*. at *name and address of the bank*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates, which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate, indicating that 80% of the Contract Price has been certified for payment, or on the ... day of,, ⁴ whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 (*or ICC Publication No. 758 as applicable*).

.....
Seal of bank and signature(s)

¹ All italicized text serves as a guide for preparing this demand guarantee and shall be deleted from the final document.

² The guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the contract, or in a freely convertible currency acceptable to the employer.

³ Footnote 2.

⁴ Insert the expected expiration date of the time for completion. The employer should note that in the event of an extension of the time for completion of the contract, the employer would need to request an extension of this guarantee from the guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [6 months][1 year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

-- Note to contractor --

If the institution issuing the advance payment security is located outside the country of the employer, it shall have a correspondent financial institution located in the country of the employer to make it enforceable.