INDEPENDENT SAFETY ASSESSMENT
FOR
COMMUNICATION BASED TRAIN CONTROL & SIGNALLING SYSTEM

OF

ALUVA TO PETTA CORRIDOR OF KOCHI METRO RAIL PROJECT

TENDER No. KMRL/ISA/01/2014

Kochi Metro Rail Limited,
8th Floor, Revenue Tower, Park Avenue,
Kochi-682011, Kerala, India

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Information provided in this TENDER to the Applicants may be on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. The Authority accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on the law expressed herein.

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completeness of the TENDER and any assessment, assumption, statement or information contained therein or deemed to form part of this TENDER or arising in anyway in this Selection Process.

The Authority also accepts no liability of any nature whether resulting from negligence or otherwise however caused arising from reliance of any Applicant upon the statements contained in this TENDER.

The Authority may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumption contained in this TENDER.

The issue of this TENDER does not imply that the Authority is bound to select an Applicant or to appoint the Selected Applicant, as the case may be, for the Consultancy and the Authority reserves the right to reject all or any of the Proposals without assigning any reasons whatsoever.

The Applicant shall bear all its costs associated with or relating to the preparation and submission of its Proposal including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by the Authority or any other costs incurred in connection with or relating to its Proposal. All such costs and expenses will remain with the Applicant and the Authority shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by an Applicant in preparation or submission of the Proposal, regardless of the conduct or outcome of the Selection Process.

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NOTICE OF INVITATION TO TENDER

Tender for Independent Safety Assessment of Communication Based Train Control & Signalling system is being called by KMRL, from firms having experience of conducting assessment of Communication Based Train Control & Signalling System for Kochi-Aluva to Petta Corridor.

Copies of the tender documents can be downloaded from KMRL's official website www.kochimetro.org free of cost.

The Tender submission should be accompanied by a non-refundable Processing fee of Rs. 20,000 (Rupees TwentyThousand Only) in the form of Banker's Cheque / Demand Draft, drawn in favour of Kochi Metro Rail Ltd., payable at Kochi, valid for 3 months.

The following tender information should also be noted:

Tender Processing Fee	INR 20,000 or $ 400 **To be deposited at the time of tender submission in the form of Banker's Cheque/ Demand Draft, drawn in favour of Kochi Metro Rail Ltd., payable at Kochi, valid for 3 months**
Tender validity	180 days from the latest date of submission of Tender
Tender Security amount	INR 2 Lakhs or equivalent amount in single freely convertible foreign currency as described in (Clause 5) of the Instructions to Tenderers. **The validity should be for 180 days + 28 days i.e. For 208 days from the latest date of tender submission.**
Completion Period of the Contract (Subject to the achievement of Key Dates)	Refer SCC 4
Download Tender Document (From Kochi Metro website)	02/01/2015 to 09/01/2015
Last date of seeking clarification	16/01/2015
Pre-bid Meeting	23/01/2015 **at** 14:30 Hrs
Date & Time of Submission of Tender	13/02/2015 upto 15:00 hrs
Date & Time of opening of Tender	13/02/2015 at 15:30 Hrs
Authority for seeking clarifications both hard and soft copy (on MS-Excel format by E-mail) to	**General Manager (S&T)** Kochi Metro Rail Limited, 8th Floor, Revenue Tower, Park Avenue, Kochi-682011, Kerala, India E-mail address: gmsig@kochimetromail.com Fax: +91-484-2380686
Authority and place of submission of completed Tender Documents	**General Manager (S&T)** **Kochi Metro Rail Limited,** 8th Floor, Revenue Tower, Park Avenue, Kochi -682011, Kerala, India

One set of tender document along with addendum and corrigendum, if any, shall be submitted with tender submittal duly signed and stamped on each page.

Please note carefully the requirements for submitting tenders, and the date and time for submittal. Late or delayed tenders will not be accepted.

INSTRUCTIONS TO TENDERER

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1 Proposal

1.1 General Description of the Work

Kochi Metro Rail Limited (KMRL) is constructing ALUVA TO PETTA CORRIDOR. It is covering a distance of around **25.612 Km**. There are 22 stations (all elevated) and a Depot at Muttom which is at grade.

The project is being financed through Agence Française de Développement, **hereinafter referred to as the AFD** will be subject, in all respects, to the terms and conditions of the Loan Agreement, including the disbursement procedures and the 'Guidelines for Procurement under AFD Loans. No party other than KMRL shall derive any rights from the Loan Agreement or have any claim to loan proceeds. The above Loan Agreement will cover only a part of the project cost. The remaining portion is being financed through equity participation by the Government of India and Government of Kerala and other appropriate means.

The services under this Tender comprises independent safety audit and assessment of the safety aspects of the Communication Based Train control and Signalling system to be implemented in the above sections.

The detailed Scope of Services for the Contractor is described in the section "Scope of services'.

1.2 KMRL is calling for Lump Sum Tenders for Tender No. KMRL/ISA/01/2014.

1.3 The Tenderer to qualify for award of Contract, shall submit a written power of attorney authorizing the signatories of the tender to commit each member of the partnership, consortium or joint venture.

1.4 Where the Tenderer comprises a partnership, consortium or joint venture, the Tenderer shall complete the following information to continue to meet the minimum threshold criteria "

a. Documents evidencing company registration for each company and any joint venture contract, if appropriate

b. Memorandum of Understanding duly registered shall be provided;

c. 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;

d. Details of the intended participation expanded with complete details of the proposed division of responsibilities and corporate relationships among the individual members.

e. The joint venture/ consortium agreement must contain a clause stating "All the partners are jointly and severally liable to KMRL." The joint venture agreement, duly registered, should be provided so as to be legally valid and binding on partners/ members of the joint venture.

f. 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.

1.5 The Tenderer shall submit with his Tender full details of his ownership and control or, if the Tenderer is a partnership, joint venture or consortium, full details of ownership and control of each member thereof.

1.6 Documents provided under Para 1.4 shall be confirmed by an appropriate Chamber of Commerce or other similar organisation. Each power of attorney shall be notarised by a competent authority in the country of the issuing company. Documents provided under para 1.4 (a) and (b) shall be certified with a conformant apostille if the country of issue has signed the Hague Legislation Convention of 1961. Document provided from countries, which are not signatories to the 1961 convention shall be legalised by a Consular Officer of the country from which the document is issued.

1.7 Indian Tenderers, or Indian members of a partnership, joint venture or consortium shall submit, a certified copy of the income tax registration details (PAN/TAN).

1.8 Tenderer (each member in the case of a partnership, joint venture or consortium) or any associate is required to confirm and declare with his Tender that no agent, middleman or any intermediary has been, or will be, engaged to provide any services, or any other item or work related to the award and performance of this Contract. They will have to further confirm and declare in the submittal that no agency commission or any payment which may be construed as an agency commission has been, or will be, paid and that the tender price will not include any such amount. If the Employer subsequently finds to the contrary, the Employer reserves the right to declare the Tenderer as non-compliant, and declare any Contract if already awarded to the Tenderer to be null and void.

1.9 Canvassing or offer of an advantage or any other inducement by any person with a view to influencing acceptance of a tender will be an offence under laws of India. Such action will result in the rejection of the tender, in addition to other punitive measures.

1.10 The Tenderer is required to confirm that they (including all Partners/Members of a Partnership, Consortium or Joint Venture) are not one of the following:

(i) A firm or an organization which has been engaged by the KMRL/DMRC or the S&T(Signalling and Telecommunications) Contractor to provide consulting services for

procurement for or implementation of this project, either at the design, installation or Commissioning stage.

(ii) Any association/affiliates (inclusive of parent firm) of a firm or an organization mentioned in subparagraph (i) above.

(iii) A firm or an organization who lends, or temporarily seconds its personnel to firms or organizations which have been engaged by the KMRL or S&T (Signalling and Telecommunications) Contractor to provide consulting services for procurement for or implementation of this project, either at the design, installation or Commissioning stage, if the personnel would be involved in any capacity for these Services.

1.11 The evaluation of the proposal will be rejected if it is determined that the tenderer has engaged in corrupt practices in competing for the contract in question.

1.12 Site visit

The Tenderer is advised to visit and examine the Site of works and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the Tender and entering into a contract for the proposed Works. The costs of visiting the Site shall be borne by the Tenderer. It shall be deemed that the tenderer has undertaken a visit to the site of Works and is aware of the site conditions, the existing details and those proposed in Train Control and Signalling System for the purpose of this tender prior to the submission of Tender Documents.

The Tenderer and any of his personnel will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the Tenderer, and his personnel, shall release and indemnify the Employer and his personnel from and against all liability in respect thereof and shall 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.

2 Tender Documents

21 Content of Tender Documents

2.1.1 The Tender Invitation Documents, as listed below, have been prepared for the purpose of inviting a tender for Independent Safety Assessment of Communication Based Train Control & Signalling system in connection with Tender No. KMRL/ISA/01/2014 of the KOCHI-ALUVA TO PETTA CORRIDOOR. **In the order of precedence as follows:**

a. Notice of Invitation to Tender;

b. Instructions to Tenderer including Annexure;

c. Form of Tender and Appendices;

d. Special Conditions of Contract

e. General Conditions of Contract

f Scope of Services

2.1.2 The Tenderer is expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of the tender submittal will be at the Tenderer's own risk.

2.1.3 The Tenderer shall not make or cause to be made any alteration, erasure or obliteration to the text of the Tender Documents.

2.2 Content of Supporting Documents

2.2.1 The supporting documents include Particular Specification of Train Control and Signalling System, Scope of Services and project master program of KS1 contract.

2.3 Clarification of Tender Documents

2.3.1 The Tenderer shall check the pages of all documents against page numbers given in indexes and summaries and, in the event of discovery of any discrepancy; the Tenderer shall inform KMRL forthwith.

2.3.2 Should the Tenderer for any reason whatsoever, be in doubt about the meaning of anything contained in the Invitation to Tender, Tender documents or the extent of detail in the Employer's Requirements, the Tenderer shall seek clarification from KMRL, **on or before the latest date of seeking clarification given in the Notice of Invitation to Tender**. All communications between the Tenderer and KMRL shall be in writing.

2.3.3 Except for any such written clarification by KMRL which is expressly stated to be by way of an addendum to the documents referred to in paragraph 2.1.1 above and/or for any other document issued by the Employer which is similarly described, no written or verbal communication, representation or explanation by any employee of the Employer shall be taken to bind or fetter the Employer under the Contract.

2.4 Amendment of Tender Documents

2.4.1 Tenderer is advised that further instructions to Tenderer and addenda to the Tender Documents may be issued during the tender period. Theses addenda & corrigenda are the part of Tender documents. Therefore Tenderer shall confirm receipt of such documents in the FORM OF TENDER - Appendix 10 and list them in the Tender Submittal.

2.4.2 The Tenderer should note that there might be aspects of his Tender and/or the evaluation documents submitted with the Tender that will necessitate discussion and clarification. It is intended that any aspect of the said evaluation documents and any amendments or clarification which are to have contractual effect will be incorporated into the Contract either:

a. by way of Special Conditions of Contract to be prepared on behalf of the Employer and agreed in writing by the Tenderer prior to and conditional upon acceptance of the Tender; or

b. by the Tenderer submitting, at the written request of the Employer, documents which are expressly stated to form part of the tender, whether requested before or after submission of the documents forming part of the Tender, identified in paragraph 3.2.1.1 to 3.2.1.3 below, and whether as supplements to, or amended versions of such documents.

Save as aforesaid, all such amendments or clarifications shall not have contractual effect.

3 Preparation of Tenders

3.1 Language

Tenders and all accompanying documents shall be in English. In case any accompanying printed literature is in other language, it shall be accompanied by an English translation. The English version shall prevail in matters of interpretation.

3.2 Documents Comprising the Tender

3.2.1 The Tenderer shall, on or before the date given in the Notice of Invitation to Tender, submit their Tender in two separate sealed envelopes clearly marked with the name of the Tenderer and with "Tender No.KMRL/ISA/01/2014 Technical Package", and "Tender No.KMRL/ISA/01/2014 Financial Package". This shall be addressed and submitted to the Office of the General Manager (Signal & Telecomm) at the address given in the Tender Documents. The Tenderer shall ensure that a receipt is obtained for the submission of his Tender, such receipt being issued free of charge.

3.2.1.1 The original Tender Guarantee shall be submitted in a sealed envelope independent of the sealed tender, at the time of opening the Tenders.

3.2.1.2 The Tenderer shall submit the following documents duly completed with the Technical Package of his tender submission:

a. Form of Tender (without appendices)
b. Appendix 1 to the Form of Tender – Contract conditions.
c. Appendix 2 to FOT with prices left blank.
d. Appendix 3 to the Form of Tender -Tenderer's Technical proposals (see paragraph 3.4 below)
e. Appendices 4 to the Form of Tender – Outline Project Management Plan (See Paragraph 3.6 below)
f. Appendix 5 to the Form of Tender – The Structure of the Tenderer including details of ownership and control of the Tenderer. (see paragraph 1.4 above)
g. Appendix 6 to the Form of Tender – Details of Tender index (see paragraph 3.9 below);
h. Appendix 7 to Form of Tender – Minimum eligibility criterion duly filled
i. Appendix 8 to Form of tender – Proposed Safety Audit Plan

j. Appendix 9 to Form of tender – Copy Right Undertaking

k. Appendix 10 to Form of tender – Confirming Receipt of all Tender Addenda

l. Appendix 11 to Form of Tender – Statement of Deviation

3.2.1.3 The tenderer shall submit the following documents duly completed with the financial package of his tender submission:

a. Form of Tender (without appendices)

b. Appendix 2 to the Form of Tender – completed pricing document

c. Copy of tender guarantee

d. Income Tax clearance certificate (see paragraph 4.7)

3.2.1.4 The tenderer shall submit with his technical package the documents that are identified in paragraphs below.

These documents will be used for the purpose of evaluating and analysing the tender but will not form part of the Contract, unless the same shall have been expressly incorporated into the Contract in accordance with paragraph 2.4.1 or 2.4.2 above.

a. Documents amplifying the Tenderer's Technical proposal.

b. Any further documents which are requested in writing by Employer before submission of the Tender by way of evaluation documents but which are not to form part of the Contract.

c. Documents relating to performance, current contracts, relevant experience.

(i) The Tenderer will be appropriately certified or accredited by an International Body or by a National Railway to assess the Communication Based Train Control and Signalling Systems of Metro Railways.

Certification/Accreditation Details (Certificate/proof to be attached) (details)

(ii) The individual or members of the JV/Consortium (could have been a member of some other JV/consortium) collectively should successfully completed a minimum of two projects of Safety Assessment of Train Control and Signalling Systems of a Metro Railway, of not less than 10 km each, in the last 7 years ending 31st Oct 2014. The projects must demonstrate Safety Assessment of systems involving Communication Based Train Control, electronic interlocking, and their interfaces (One project must include Communication Based Train Control and Signalling System)

Name of Project *1	**Details of Safety Assessment Activities** **2	**Length of Project (km)**	**Commencement and Completion Dates**	**System Details** ***3

Notes:

*1 **Only Metro Railways projects to be shown**.Client name to be included.

**2 Only Signalling and Train Control Safety Assessment activities. Brief description and cost of Services and details of specific tasks undertaken, including staffing and man-months.

***3 Name of system, country of origin, specify details of type of system, i.e. Communication Based Train Control, electronic interlocking,etc., interfacing details, and any other pertinent information.

(i) User (Project Owner) Certificates demonstrating achievement of each and all of the requirements in paragraph above shall be provided.

User (Client) Certificates for Projects listed in Table 1.2 ii) b) (proof to be attached)
(details)
(details)
(details)

d Documents relating to the financial condition of the Tenderer

i **Annual Audited Reports/Accounts for each of the last 3 full accounting periods**.

3.2.1.5 Should any further document be required in pursuance to paragraph 3.2.1.3(b), the Tenderer will be instructed by the employer which package the tenderer's submission is to contain such documents.

3.3 Form of tender

The form of tender shall be completed and signed by a duly authorized and empowered representative of the tenderer. If the tenderer comprises a partnership, consortium or a joint venture, the form of tender shall be signed by a duly authorized representative of each member or participants thereof. Signature on the form of tender shall be witnessed and dated. Copies of relevant powers of attorney shall be attached.

3.4 ISA Technical Proposal

3.4.1 The ISA technical proposal shall cover in details the following:

- Understanding and comprehension of the work involved, including a discussion on the major challenges of the contract covering each of the major elements of the Communication Based Train Control and signaling systems. S&T contract has been awarded to M/s ALSTOM comprising of M/s Alstom Transport India Limited, India (Leader) and M/s Alstom Transport SA, France as its members. Their train control and Signalling system shall include, but not be limited to, ZC, LC, Smart IO, point machine, Axle Counters and ATS servers.
- The general approach and methodology proposed for carrying out the services covered in the scope of services, including such detailed information, as deemed

relevant.

- A detailed overall Safety audit and assessment plan on services indicated in the scope of services including any other relevant information.

In addition, the technical proposal shall contain:

- A detailed overall safety audit and assessment programme and a bar chart indicating the duration and timing of assignment of each key expert staff or other staff member assigned to the project.
- An estimate of the total man months required together with the justification for the same.
- Proposed organization chart together with clear description of the responsibilities of each key staff member within the overall safety audit programme.
- A task list of deliverables including full description and delivery dates of each, and the person responsible for performing the deliverable.
- The name, background and professional experience of each key expert staff member to be assigned to the project, with particular reference to his experience of a nature similar to that of the proposed assignment (The majority of the key expert staff must have been regular members of the firm for at least 6 months in the last 1 year). Suitable documents from the Metro/Railway authorities shall be submitted about the association of the proposed expert staff or this assignment.
- The details of the name, background and CV of any sub-contracted staff who will be employed on the project.
- The name and addresses of any firm who may be given sub-contracts, if any, or any other work together with details of their experience.
- Details of safety assessment tasks, together with their location.
- Previous Safety audit and assessment experience as detailed in para 3.2.1.4 (c). Suitable documents from the Metro/Railway authorities clearly stating which of the signalling system/sub-system was audited shall be submitted about jobs performed by the ISA.
- A typical list of proformas to be used to tabulate various parameters related to audit and assessment of similar of the various subsystems/systems.
- Table of contents of Safety Audit and assessment report.
- Table of contents of ISA's quarterly report

The entire scope of services, laid out in the appendices is required to be covered

.4.2 The Memorandum of Understanding (See clause 1.3 and 1.4)

3.4.3 No information relating to estimated costs or financial terms of **the Tenderer's** services should be included in the Technical Proposal

3.4.4 The tenderer shall submit with his tender his technical proposals as described in 3.4.1 above

3.4.5 The tenderer may require amplifying, explaining and developing the technical proposals in substantially greater detail during the tender evaluation period such that they may be confirmed as complying clearly with the Employer's requirements and, in accordance with paragraph 2.4.2 herein, can be incorporated into the contract. Only those aspects of the contractor's technical proposal that the employer (at his sole discretion) considers clearly conforming will form part of the contract.

3.4.6 Notwithstanding paragraph 2.3.2, and subject to paragraph 2.3.3 of the Instructions to Tenderers, the Employer is willing to hold a meeting or meetings with the Tenderers for the purpose of discussing any matter relating to ISA of Communication Based Train Control & Signalling systems which the Tenderer may wish to include in his technical proposals. The Tenderer should address any request for a meeting along with the clarification regarding the tender to KMRL in writing not later than 3 weeks before latest date submission of Tender. The Employer will, as soon as practicable after receipt of such request, inform the Tenderer whether the Employer considers it appropriate for the requested meeting to be held and, where applicable, the time and place for such meeting. Such a meeting will be held in confidence but the Employer reserves the right to circulate to all other Tenderers any written response it may decide to issue in relation to matters raised at any such meeting and affecting all Tenderers, without identifying with whom the meeting has been held.

3.5 Safety Audit and Assessment Plan

3.5.1 The tenderer shall submit a detailed overall safety audit plan and assessment, Appendix 8 of FOT on services indicated in the scope of services including any other relevant information.

3.5.2 The safety audit plan programme shall be prepared in terms of weeks from Letter of Acceptance.

3.6 Project Management Plan

3.6.1 The Tenderer shall submit with his Tender a Project Management Plan as prescribed in Employer's Requirements as Appendix 4 to Form of Tender, inter-alia, indicating names, qualifications, professional experience, location during the Contract period and corporate affiliation of all proposed key management and engineering personnel (above the level of supervisor) and specialists.

3.6.2 The Tenderer shall include his proposals for his Co-ordination Control Team and include the name and qualifications of the Team Leader.

3.7 Pricing Document

3.7.1 The Pricing document is included in Annexure 1 to these Instructions to Tenderer. The Tenderer shall complete the Pricing Document in accordance with the instructions given in Annexure 1. The completed Pricing Document shall be submitted as Appendix 2 to the Form of Tender

3.7.2 The Tenderer is to note that Key Dates are to be determined by reference to periods from the commencement date of works.

Period for each stage of work are given in **Appendix E to Annexure of ITT**. Milestone dates shall be, likewise, determined by reference to the date of Letter of Acceptance.

3.7.3 Prior to award, the Tenderer shall reformat the Pricing Document, Schedule of Milestones, and the safety audit plan and Programme, so as to correlate between these documents, as required by the Employer.

3.8 Currencies of Tender and Payment

3.8.1 The Tenderer may give his priced offer in Indian Rupees, and/or freely convertible international trading currencies. Payment to the contractor shall be made in the currencies quoted.

3.8.2 For the purpose of comparative evaluation of the offer, the tender prices will be converted to Rupees by using the Exchange (selling) rates for those currencies on the latest date for submission of tenders (Base Date) as detailed in clause **7.5** of ITT.

3.9 Tender Index

The tenderer shall include with his tender an index Appendix 6 to the form of tender which cross refers all of the Employer's tender requirements elaborated in these documents to all the individual sections within Tender No. KMRL/ISA/01/2014 : Technical package and Tender No. KMRL/ISA/01/2014: Financial package that the tenderer intends to be the responses to each and every one of those requirements.

3.10 Modification, Substitution and Withdrawal of Tenders

3.10.1 Except where expressly permitted by these instructions, the Tenderer shall not make or cause to be made any alteration, erasure or obliteration to the text of the documents prepared by the Employer and submitted by the Tenderer with or as part of his Tender.

3.10.2 The Tenderer's modification or withdrawal notice shall be prepared, sealed, marked and delivered, with the outer and inner envelopes additionally marked "MODIFICATION" or "WITHDRAWAL", as appropriate.

3.10.3 No Tender may be modified by the Tenderer after the deadline for submission of Tenders.

3.10.4 Withdrawal of a tender during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Tender shall result in the forfeiture of the Tender Guarantee.

3.11 Pricing of condition, Qualification, Deviation etc.

3.11.1 Tenderer shall further note that except for deviations listed in Appendix F to Annexure 1 of ITT, tender shall be deemed to comply with all the requirements in the tender documents including employer's requirements, without any extra cost to the employer irrespective of any mention to contrary, anywhere else in the tender.

4 Financial Package

4.1 The Tenderer shall submit the following documents duly completed with the Financial Package of his tender submission:

Copy of tender guarantee

All items covered in clause 3.2.1.3

4.2 The financial proposal, which is Appendix 2 of form of tender should be separately completed and submitted in a separate sealed envelope clearly labelled "FINANCIAL PROPOSAL". The prices entered into the form of tender shall include all costs associated with the contract. These will cover remuneration for staff, transportation, equipment, printing of documents, surveys etc. No adjustment will be made for inflation and any fluctuation in the exchange rates between Indian Rupees and other currencies. The financial proposal should be prepared using, but not limited to, the formats attached in Annexure 1 of ITT.

4.3 The tenderer should quote fixed lump sum price in Indian Rupees and in a foreign currency wherever required keeping in view the stage payment schedule described in Annexure 1 to the ITT and Scope of Services.

4.4 This Contract is a fixed Lump Sum priced Contract for Independent Safety Assessment of Communication Based Train Control & Signalling system. The contract price shall be fixed throughout the performance of the contract and not subject to variation on any account except as provided for in the Contract.

Tenderer shall quote all prices inclusive of all taxes, duties, levies, cess and any other charges leviable, including tax to be deducted at source.

4.4.1 **Change in Cost Due to Legislation**.

"Change in Law" means the occurrence or coming into force of the following, at any time after 28 days before the closing date of submission of tender.

(a) Any new tax imposed which impacts the performance of the Contractor with increased cost or which results in extra financial gains to the Contractor due to decreased cost in execution of Works.

(b) Change in any law pertaining to work having the above said impact.

Then such additional or reduced cost shall be certified by the Employer after examining records provided by the Contractor and shall be paid by or credited to the Employer.

4.4.2 If any rates of Taxes/Duties/levies are increased or decreased, or a new Taxes/Duties/Levies are introduced, or an existing Tax/Duty/Levy is abolished, after 28 days before the closing date of submission of the tender, which was or will be assessed on the Contractor, 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 there from, as the case may be, in accordance with Clause 4.4.1 thereof

4.5 All tax liabilities and the cost of insurance related to this contract shall be separately shown.

4.6 a) All payments shall be subject to tax deduction at source in accordance with the provisions of the Indian Income Tax act and any other applicable law. The contractor shall ensure full compliance with tax laws of India with regard to this contract and shall be solely responsible for the same. He shall submit copies of acknowledgements evidencing filing of returns every year and shall keep the employer fully indemnified against liability of tax, interest, penalty etc of the contractor in respect thereof, which may arise.

b) The contractor should obtain necessary certificate from the Assessing Officer, under the relevant provisions of the Income Tax Act of India, for the rate at which income tax is to be deducted from the payments made to him. Pending submission of such certificate, KMRL will deduct income tax at source as per applicable provisions under the Income Tax act. The contractor may, therefore, submit the certificate before the advance payment becomes due.

4.7 The Financial package shall contain an attested photocopy of the latest Income Tax clearance certificate (ITCC) in the required pro-forma of the Government of India. For foreign based consultants a suitable certified similar document from their country of origin, or a certified statement from their auditors stating that Income Tax/Corporation tax has been paid will be accepted.

4.8 The tender total submitted by the tenderer shall be in the format shown in the Pricing document.

4.9 The pricing document completed and submitted by the tenderer, as part of his tender, should use an indexing and page numbering system such that its extent and completeness is clearly evident.

5 Period of Validity of Proposal and Tender Guarantee

5.1 The offer submitted by the tenderer shall be valid for a period of 180-days from the last date of submission of the tender, with a provision that it will be suitably extended on request of Employer.

5.2 The Tenderer shall submit with his Tender a Tender Security for the sum of **Rs. Two Lakhs**

or equivalent amount in a single freely convertible foreign currency in the form of an irrevocable bank guarantee issued by a Scheduled Commercial Bank (including Scheduled Commercial Foreign Banks) in India in the Standard Pro-Forma SF2. The Bank Guarantee should be in the name of the Applicant or "JV/Consortium". In the case where the Tenderer is a JV or consortium, the Bank Guarantee for Tender Security shall be from JV/Consortium and not from individual members, except that a local member of the JV/Consortium is permitted to furnish the Tender Security with an assurance from the other JV/Consortium members to back such a Security. The Tender Security shall be submitted in a sealed envelope clearly marked on top **"Tender Security for Tender No. KMRL/ISA/01/2014".** The Tender Security shall remain valid for a period of 28 days beyond the validity period for the Tender.

5.3 **The original of this tender guarantee is to be submitted in a separate sealed envelope in addition to the Technical and Financial proposal envelopes at the time of submittal.** This envelope will be opened in the presence of the tenderers to determine compliance of this requirement. Offers submitted without the tender guarantee or with invalid bank guarantees will be rejected outright.

5.4 The tender guarantee of the successful tenderer will be returned upon receipt of a performance guarantee and the signing of the contract as required herein.

5.5 The tender guarantees furnished by the unsuccessful tenderers will be returned to them within **30 days** of the signing of the contract by the successful tenderer and the receipt of the Performance guarantee from the successful tenderer whichever is later.

5.6 KMRL reserves the right to call-in the tender guarantee under the following circumstances:

Withdrawal of tender during period of tender validity

Failure to sign the contract if so awarded to the tenderer

Failure to submit a performance guarantee

6 Submission of Tenders

6.1 Tender submittals comprising:

Power of attorney to submit the tender

Original of tender guarantee

Technical package

Financial package

Each page of both the "Technical Package" and "Financial Package" must be machine serial numbered and signed by the authorised signatories of the consortium in token of the acceptance of the conditions stipulated in the page of the tender document.

All the inner and outer envelopes shall be addressed to the Employer at the following address:

The Managing Director,

Kochi Metro Rail Limited
8th Floor, Revenue Tower, Park Avenue,

Kochi-682011, Kerala, India

(a) **Bear the following identification:**

ISA TENDER PACKAGE

Tender Reference Number: KMRL/ISA/01/2014

DO NOT OPEN BEFORE ..... Hrs. on .....

Name and address of the Tenderer to enable the tender to be returned unopened in case it is late or delayed.

6.2 The Tenderer shall seal the original and copies of his Technical Package in separate envelopes, duly marking them as "Original", "Copy 1" and "Copy 2". All the envelopes of the Technical Package shall then be sealed in an outer envelope. Soft Copy in CD shall also be submitted.

6.3 **Likewise, the Tenderer shall seal the Original and Copy of the Financial Package in separate envelopes duly marking the envelopes as "Original" and "Copy".** Both envelopes of the Financial Package shall be sealed in an outer envelope.

6.4 If the outer envelope is not sealed and marked as above the Employer will assume no responsibility for the misplacement or premature opening of the tender.

7 Tender Opening and Evaluation

7.1 Tender Opening

7.1.1 The Employer or his authorised representative will open the Technical Package in the presence of tenderers or their representatives who choose to attend at the appointed day and time in the conference hall of Kochi Metro Rail Limited 8th Floor, Revenue Tower, Park Avenue, Kochi-682011, Kerala, India. If such nominated date for opening of Tender is subsequently declared as a Public Holiday by the Employer, the next official working day shall be deemed as the date of opening of Tender. The Tender of any Tenderer who has not complied with one or more of the foregoing instructions may not be considered.

The Tenderer is advised that the Employer's policy in respect of comparison of tenders is that the Technical Packages will be opened and reviewed to determine their eligibility and responsiveness to the Employer's Requirements. Unacceptable and unresponsive tenders will be rejected and the corresponding Financial Package will be returned unopened.

7.1.1.1 The Tenderer is to note that Financial Package of these tender submissions for which the associated Technical Package has satisfied the review in sub-paragraph 7.7, will be opened

and the tender sums posted. **The date, time, and place of opening will be advised to tenderers whose Technical Package have been found acceptable so that they can be present at the stipulated time of opening of Financial Package.**

7.1.2 Tender if not accompanied by a valid Tender Guarantee, or is accompanied by an unacceptable or fraudulent Tender Guarantee shall be considered as non-compliant and rejected.

7.1.3 All decisions whether a tender is non-responsive, unacceptable or whether a guarantee is fraudulent or unacceptable or non-compliant will be that of the Employer.

7.2 Confidentiality of Tender Information

The Tender Invitation Documents, as listed in paragraph 2.1.1 above, and any addenda thereto, together with any further communications are issued for the purpose of inviting tenders only. The Tenderer shall not disclose any information contained in the documents or otherwise supplied in connection with this tender invitation to any third party except for the purpose of preparing his Tender. The Tenderer shall maintain complete confidentiality till the Contract is awarded. In the event that such confidentiality is breached, the Employer may reject the Tender. A letter of undertaking is attached to Appendix – 9 (FOT) - Copyright undertaking and shall be completed by the tenderer and returned in Technical package.

7.3 Clarification of Tender

To assist in the examination, evaluation of tender, the Employer may, at his discretion, ask the tenderer for clarification of his tender. The request for clarification and the response shall be in writing or by facsimile. No change in the price or substance of the tender shall be sought, offered or permitted, except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the tenders in accordance with paragraph 7.4.

7.4 Correction of Errors

7.4.1 The fixed Lump Sum Price stated by the Tenderer in words (at the top of the Tender Total Page) shall prevail. If arithmetical errors are discovered in the apportionment of this amount into Sections, Cost Centres and/or Milestones, corrections will be made by the Employer proportionately to the amounts shown against the relevant Sections, Cost Centres and/or Milestones so that the sum total of all milestones in all Sections, Cost Centres is equal to the Fixed Lump Sum Price stated in words. If the tenderer does not accept the corrected tender his Tender will be rejected, and the Tender Guarantee forfeited. Where there is a discrepancy between the amounts in figures and in words, the amount in words will govern.

7.5 Conversion to Single Currency for Evaluation of Tender

The Employer will convert the amounts in various currencies in which the tender price is payable to Indian National Rupees(INR) at Bill Selling Exchange Rates officially prescribed for similar transactions at the close of business of the State Bank of India on the last working day,28 days before the closing date of submission of tender..

7.6 Not Used

7.7 Evaluation of Tender: Technical Package

7.7.1 The Employer will evaluate whether each Tenderer is eligible and each Tender is responsive to the requirements of the Tender documents.

7.7.2 Eligibility of Tenderer:

An eligible Tenderer is one, who fulfils all the requirements of Appendix 7 to Form of Tender. If a Tenderer is not eligible, it will be rejected by the Employer and further evaluation will not be carried out.

7.7.3 Responsiveness of Tenderer:

7.7.3.1 A responsive Tender is one, which conforms to all the terms, conditions and specifications of the Tender documents without material deviation or reservation. A material deviation or reservation is one:

(i) Which affects in any substantial way the scope, quality or performance of the Works; or

(ii) Which limits in any substantial way, is inconsistent with the Tender documents, the Employer's rights or the Tenderers obligations under the Contract; or

(iii) Seeks to shift to the Employer, another Government Agency or another contractor all or part of the risk and / or liability allocated to the Contractor in the Tender Invitation Documents; or

(iv) Includes a deviation from the Tender Invitation Documents which would render the works, or any part thereof, unfit for their intended purpose; or

(v) Fail to commit to the date specified for the completion of the Works.

7.7.3.2 Fail to commit to the date specified for the completion of the Works. The Employer will determine:

(i) Whether the Tender has been properly signed;

(ii) Whether the Tender is accompanied by the required Tender Guarantee

(iii) Whether the proposed work plan including staffing schedule and methodology in responding to the scope of work is adequate.

(iv) qualification, experience and competency of the key staff to be deployed for the assignment

(v) Whether the Tender is substantially responsive to the requirements of the Tender documents;

7.7.3.3 The employer may waive any minor deviation, non-conformity or irregularity in a Tender that does not constitute a material deviation.

7.7.3.4 If the Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming

deviation or reservation.

7.7.3.5 If any change in the Employer's Requirements (Scope of Works) and/or Conditions is considered necessary during Tender evaluation, the Tenderer, if his technical offer is found to be substantially responsive in accordance with Tender requirements, will be given opportunity to revise his financial package.

7.7.4 The financial proposal, will be evaluated only if, the Tenderer is eligible and the Tender is substantially responsive.

7.7.5 Rejection of Tenders

KMRL may reject the tenders that are considered to be substantially non-responsive to the requirements of the Proposal. Such matters may include:

Incorrect or Fraudulent Power of Attorney.
Incorrect or Fraudulent "Tender Security"
Incomplete "Technical Proposal".
Incomplete "Price schedule".
Tenderer/Bidder requires an increase in Tender Offer price during negotiations.
Failure to provide the Performance Guarantee.
Failure to sign the Contract Agreement within the time limit given by KMRL.

7.8 Evaluation of Tender: Financial Package

7.8.1 Evaluation of Reasonableness of Rates

The financial proposal, in accordance with paragraph 7.7, will be evaluated only if the Tenderer is eligible and the Tender is substantially responsive. The prices quoted by the Tenderer in Part II of Annexure 1 to ITT, will be compared with the estimated rates.

7.8.2 Financial Evaluation:

For purpose of comparative evaluation and determination of inter-se position of Tenders received as per clause 7.5, the Employer will adjust the Base Tender Total to take into account the followings:

a) Corrections for errors pursuant to clause 7.4 of ITT and

b) Pricing of un-qualified withdrawals of conditions, qualifications, deviations etc. in accordance with Appendix F of Annexure 1 to Instructions to Tenderers and subject to clause 3.11 of ITT for the purpose of comparative evaluation of the Tenders.

7.8.3 The Employer reserves the right to accept or reject any variation, deviation or alternative offer. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in Tender evaluation.

8 Award of Contract

8.1 The Employer will issue a letter of acceptance to the Tenderer, if he has been determined to be substantially responsive to the Tender documents and has offered the reasonable Evaluated Tender Price, and whose offer is balanced in terms of paragraph 7.7.

8.2 Signing of Agreement

The Tenderer should note that in the event of acceptance of the tender, the Tenderer will be required to execute the Contract Agreement as per the proforma "Form of Agreement", within 28 days from the date of issue of Letter of Acceptance.

8.3 Employer's Right to accept any Tender and to reject any or all Tenders

8.3.1 The Employer is not bound to accept the lowest or any tender and may at any time by notice in writing to the Tenderer, terminate the tendering process.

8.4 The work location of the ISA is covered in the scope of Service.

8.5 The employer may request the tenderer to withdraw any of the conditions, qualifications, deviations etc at the price shown in ITT, Annexure 1. In case the tenderer does not withdraw the conditions, qualifications, deviations etc proposed by him, if any, at the cost stated in Appendix F of Annexure 1, his tender will be rejected and the tender guarantee forfeited.

9 Performance Guarantee

9.1 The performance guarantee will be 10% of the contract price in the form of an irrevocable bank guarantee issued by a Scheduled Commercial Bank (including Scheduled Commercial Foreign Banks) in India. The pro-forma for the guarantee is included in these documents. The performance guarantee should be submitted immediately after the ISA contractor receives the letter of acceptance, but not later than the date of agreement is signed between the parties.

9.2 The performance guarantee shall remain valid upto 90 days after after the expiry of Liability Period for whole of the work.

9.3 The Tenderer should note in particular that without prejudice to the Employer's other rights under the Contract and the Tender Guarantee, the Employer may terminate the Contract in the event that the Tender is accepted but the Tenderer fails to supply the Performance Guarantee or other specified documents or fails to execute the Contract Agreement.

10 Additional Information

10.1 Every effort will be made to provide additional information to tenderers that has been requested in writing. However, requests for additional information, and any delay in providing information is entirely at tenderer's risk, and shall not be considered as a reason for late delivery of tenders or a reason for delaying the submission of tenders by the stated date.

10.2 Any information provided by KMRL that is **not given in writing**, in response to request for additional information, shall not be considered by KMRL and shall not be accepted as a

reason for late delivery of tenders or a reason for delaying the submission of tenders by the stated date.

11 Date of completion

11.1 The date of completion of the services shall be: ISA services to be performed for the different sections of works shall be in synchronism of the S&T contract project master schedule submitted by S&T contractor and as updated by S&T contractor during contract period.

12 Tender Preparation Costs

Any costs associated with the preparation of the proposal by any tenderer will not be reimbursed.

CONTRACT AGREEMENT No……..

This Contract is made at Kochi on day of by and between:

(1) Kochi Metro Rail Limited, represented by the GM(S&T), with office located at 8th Floor, Revenue Tower, Park Avenue, Kochi-682011, Kerala, India hereinafter referred to as the "KMRL" or the "Employer", as the case may be, of the one part, and;

(2) The Consortium comprising of:

a) .....a company registered and existing under the laws of ..... with head office located at ..... represented by Mr. ..... and Mr. ……. Authorised to sign and bind the company under the power of attorney dated.....

And board Resolution dated .....

b) .....a company registered and existing under the laws of .....with head office located at ..... represented by Mr. ..... and Mr. ..... Authorised to sign and bind the company under the power of attorney dated.....

And board Resolution dated .....

c)..... a company registered and existing under the laws of

.....with head office located at ....
represented by Mr. ..... and Mr. ……. Authorised to sign and bind the company under the power of attorney dated.....

And board Resolution dated .....

(Note2) Who shall be jointly and severally liable for the undertaking of this Contract, hereinafter (Note3) collectively referred to as the "Contractor" of the other part.

WHEREAS the Contractor has established a consortium in accordance with Indian law and offered a tender for Independent Safety Assessment of the Communication Based Train Control and Signalling System and agrees to undertake performance of such services under the terms and conditions set forth in this Contract.

Both parties hereby agree as follows:

Clause 1:KMRL agrees to hire and the Contractor agrees to be hired for Independent Safety Assessment of Communication Based Train Control & Signalling system for Kochi Metro Rail Project under the terms and conditions specified in this Contract Agreement and the other Contract Documents attached hereto as. The order of preference of these documents is as follows:

Letter of Acceptance

Form of Agreement

Special Conditions of Contract

General Conditions of Contract

The Schedules

Scope of services

Contractor's Proposal

Any other documents forming part of the Contract

All of the foregoing documents, together with this Contract Agreement, are referred to herein as the Contract Documents. Also incorporated into these Contract Documents, and made part hereof, are all codes, standard specifications, and similar requirements that are referred to therein. In the event of a conflict, ambiguity or discrepancy between the contents of the Contract Documents, the contractor will seek clarification from the Employer, whose decision shall be final.

Clause 2 Obligation of the Contractor:

The Contractor agrees, subject to the terms and conditions of the Contract Documents, to perform efficiently and faithfully all of the services for Independent Safety Assessment of Communication Based Train Control & Signalling system and in carrying out all duties and obligations imposed by the Contract Documents.

Clause 3 Obligation of the Employer:

The Employer agrees, subject to the terms and conditions of the Contract Documents, to pay the Contractor the amount specified, and at the rates and terms and in the manner set forth in the Contract Documents.

Clause 4 Value of Work and Completion Time:

The Employer agrees to pay for the total cost of the Works and the Contractor agrees to accept the sums mentioned below in the following currencies, to be the total cost for the Work carried out by him as part of his obligations, responsibilities and liabilities under and according to the provisions and obligations imposed on him by the Contract.

Total Fixed Lump Sum Price

(i) In Rupees _____(_____Rs) ;and

(i) In Foreign Currency of: ..... (.....)

The above amounts include all taxes, duties, levies, cess and any other charges leviable, and tax to be deducted at source.

The Contractor shall complete The services within (_____) week from the date stipulated in the letter of acceptance, issue by the Employer .

Clause 5 Notices:

All notices called for by the terms of the Contract Documents shall be in writing in the English language and shall be delivered by hand or by registered mail, acknowledgement due, to the parties' addresses given below. All notices shall be deemed to be duly made when received by the party to whom it is addressed at the following addresses or such other addresses as such party may subsequently notify to the other:

Employer

Kochi Metro Rail Limited KMRL,

8th Floor, Revenue Tower, Park

Avenue, Kochi-682011, Kerala, India

Consultant

.....

.....

.....

Clause 6 Obligation of tax law

a) The contractor shall ensure full compliance with tax laws of India with regard to this contract and shall be solely responsible for the same. He shall submit copies of acknowledgement evidencing filling of returns every year and shall keep the employer fully indemnified against liability of tax, interest, penalty, etc. of the contractor in respect thereof which may arise.

b) The contractor should obtain necessary certificate from the assessing officer, under the relevant provisions of the income Tax act of India, for the rate at which income tax is to be deducted from the payments to be made to him. Pending submission of such certificate, KMRL will deduct income tax at source as per applicable provisions under the income Tax act. The contractor may, therefore, submit the certificate before the advance payment becomes due.

Clause 7 Integration:

The Employer and the Contractor agree that this Contract Agreement, together with the other

Contract Documents, expresses all of the agreements, understandings, promises, and covenants of the parties, and that integrates, combines, and supersedes all prior and contemporaneous negotiations, understandings, and agreements, whether written or oral and that no modification or alteration of the Contract Documents shall be valid or binding on either party, unless expressed in writing and executed with the same formality as this Contract Agreement, except as may otherwise be specifically provided in the Contract Documents.

Clause 8 Governing Law

This Contract is enforceable and construed under the laws of the Republic of India.

Clause 9 Language

This Contract Agreement and the other Contract Documents are made in the English language. Three copies of the contract document shall be prepared.

Clause 10 Jurisdiction of court

Courts at Kochi shall have the exclusive jurisdiction to try all the disputes arising out of this agreement.

This Contract is made in three copies with identical wording. Both parties having thoroughly read and understood the contents hereof sign their names and affix the seal (if any) in the presence of witness and each shall retain one copy.

The Employer ..... The Consultant……

(Kochi Metro Rail Limited)

a)……. a)…….

b)…… b)……

(Witness)

INSTRUCTIONS TO TENDERER

FORM OF TENDER

TABLE OF CONTENTS

FORM OF TENDER

Date: .....

To: The General Manager (S&T)
Kochi Metro Rail Limited KMRL 8th
Floor, Revenue Tower, Park Avenue,
Kochi-682011, Kerala, India

Sub: INDEPENDENT SAFETY ASSESSMENT OF COMMUNICATION BASED TRAIN CONTROL & SIGNALLING SYSTEM TENDER No. KMRL/ISA/01/2014

GENTLEMEN,

1. Having inspected, examined the Employer's Requirements, General Conditions of Contract, Special Conditions of Contract and Instruction to Tenderers including Pricing Document, and addenda thereto (if any) issued by the KMRL for Independent Safety Assessment of Communication Based Train Control & Signalling system, and the matters set out in Appendix 1 hereto, and having completed and prepared Appendices 2, 3, 4, 5, 6 7, 8, 9, 10 and 11 hereto and visited the site as required, we hereby [jointly and severally]* offer for Independent Safety Assessment in conformity with the above documents for the sum stated in the Pricing Document as completed by us and appended hereto.

2. We undertake [jointly and severally]* to complete and deliver the whole of the Works and achieve all Stages, within the times stated in Appendix B (Annexure 1 to ITT).

3. We undertake [jointly and severally]*:

   a. to keep this Tender open for acceptance without unilaterally varying or amending its terms for the period stated in Notice of Invitation to Tender hereto [(the withdrawal of any member or any other change in the composition of the partnership/joint venture/consortium on whose behalf this Tender is submitted shall constitute a breach of this undertaking)]*; and

   b. if this Tender is accepted, to provide Guarantees, Undertakings & Warranties for the due performance of the Contract as stipulated in the General Conditions of Contract, Special Conditions of Contract and Appendix 1 hereto; and

   c. to hold in confidence all documents and information whether technical or commercial supplied to us at any time by or on behalf of the KMRL in connection with this Tender

or with the above-mentioned Works and, without your written authority or as otherwise required by law, not to publish or otherwise disclose the same.

4. We submit with this Tender a duly executed Tender Guarantee in respect of our obligations under this Tender.

5. Unless and until a formal agreement is prepared and executed, this Tender together with your written acceptance thereof, shall constitute a binding contract between us.

6. We understand that you are not bound to accept the tender.

7. We declare that the submission of this Tender confirms that no agent, middleman or any intermediary has been, or will be engaged to provide any services, or any other item or work related to the award and performance of this Contract. We further confirm and declare that no agency commission or any payment, which may be construed as an agency commission, has been, or will be paid and that the tender price does not include any such amount. We acknowledge the right of the Employer, if he finds to the contrary, to declare our Tender to be non-compliant and if the Contract has been awarded to declare the Contract null and void.

8. This Tender shall be governed by and construed in all respects according to the laws for the time being in force in India.

Yours faithfully,

Signature:

Witness: Date.....

Signature: Name.....

Date ..... For and on behalf of .....

Name .....Address .....

Address.....

Signature:

Witness: Date.....

Signature: Name.....

Date ..... For and on behalf of .....

Name .....Address .....

Address .....

* Note: If the Tenderer comprises a partnership, joint venture or consortium.

APPENDIX 1 of FOT

CONTRACT CONDITIONS

1.	Amount of Performance Guarantee (ITT Clause 9)	10% of the Contract Price in types and proposition of currencies in which the contract price is payable.
2	Amount of Tender Security	Rs Two lakhs or equivalent amount in a single freely convertible foreign currency.
3.	Latest date for commencement of the Works	Date of Issue of Letter of Acceptance issued by Employer.
4.	Liquidated Damages	0.05% of the total amount apportioned to the milestone relevant of Key Dates as per Appendix B to Annexure 1 of ITT per week of delay. Maximum limit of liquidated damages shall be 10% of the fixed lump sum price accepted for whole of the works. There is no maximum limit in levy LD for delay in individual Key Dates.
5.	Liability Period Works (SCC clause 3)	Duration of liability/non-conformance to the tender specifications shall be a period of 1 year reckoned from the date each section is brought into use for the carriage of the fare paying public.
6.	Value of Tenderers Professional Indemnity Insurance (SCC clause 10)	**
7.	Period in which all insurance have to be effected (SCC clause 10)	**
8.	Tenderers Name and Address	**
9.	Employer's Name and Address	Kochi Metro Rail Limited 8th Floor, Revenue Tower, Park Avenue,Kochi-682011, Kerala, India

** (Tenderer to Complete)

APPENDIX 2 of FOT

PRICING DOCUMENT

To be prepared from Appendices A, B, C and F to Annexure 1 to the Instructions to Tenderer with price left blank.

APPENDIX 3 of FOT

THE TENDERERS TECHNICAL PROPOSALS

The Tenderer shall prepare his Technical Proposals Based on the contents of the instructions to Tenderers (as per clause 3.2.1.4 of ITT).

PPENDIX 4 of FOT

OUTLINE PROJECT MANAGEMENT PLAN

The Tenderer shall submit with his Tender an Outline Project Management Plan as prescribed in Employer's Requirement -inter-alia including names, qualifications, professional experience and corporate affiliation of all proposed key management and engineering personnel (above the level of supervisor) and specialists, for conducting the safety audit.

APPENDIX 5 of FOT
STRUCTURE OF THE TENDERER

The Tenderer shall supply a chart particularising the structure of the Tenderer (identifying all companies comprising the Tenderer in the event that the Tenderer is a joint venture, partnership or consortium) and the ownership of each of the companies comprising the Tenderer, identifying all respective intermediate and ultimate holding companies.

COMPOSITION OF THE TENDERER

1. A copy of any Memorandum of Understanding (MOU) relating to the composition of the Tenderer shall be submitted. For guidance, if the Tenderer is a joint venture, consortium or a partnership then the joint venture, consortium or partnership agreement is to be submitted by the Tenderer. Should the Tenderer be an entity established or to be established to tender for this Contract, details of the shareholders' agreement or proposed shareholders' agreement shall be supplied together with the percentage participation and percentage equity in the agreements. Where the Tenderer comprises a partnership, consortium or joint venture, the Tenderer shall submit the information referred to in Para 1.4 to 1.7 of Instructions to Tenderer.

2. The contractual arrangements and copies of agreements in relation thereto must, as a minimum, provide information on all members or participants involved, their respective participation in the Tenderer, the management structure, ownership and control of the members or participants comprising the Tenderer and if, appropriate, the name of the member or participant who would have overall lead management responsibility for the Works, the registered addresses of all parties and the names of their respective senior partners, chairmen or managing directors as appropriate. Such agreements should also reflect the joint and several liabilities of the members to the Employer in the event that the Contract is awarded to them and provide "deadlock" provisions in the event that decisions of the joint venture, consortium or partnership cannot be reached by unanimous agreement.

3. The Tenderer shall provide written confirmation that:

   a. The agreement or agreements submitted represent the entire agreement between the members or participants comprising the Tenderer as to the Tenderer's legal persona;

   b. There is or are no other agreements relating to the Tenderer's incorporation, powers or organization which may affect in any way his ability to carry out the Works; and

   c. No changes will be made to any such agreements during the tender period without first obtaining the Employer's agreement to the proposed change or changes.

APPENDIX 6 of FOT

TENDER INDEX

The Tenderer shall include with his Tender an index (as per clause 3.9 of ITT) which cross refers all of the employer's tender requirement elaborated in these document to all the individual section within Tender package 1: Technical package and Tender package 2: Financial package which the Tenderer intends to be the response to each and every one of those requirements.

APPENDIX 7 of FOT

MINIMUM ELIGIBILITY CRITERION

(Refer Clause 7.7.2 of ITT)

Name of Applicant: .....

No.	Criterion	Yes	No
1	Has the applicant[1] abandoned any work in last 7 years?		
2	Has the applicant[1] been blacklisted by any organization in the last 7 years?		
3	Has the applicant[1] been penalized by the poor quality of work in the last three years?		
4	Has any agent/middleman been engaged or will be engaged or has any agency commission been or will be paid for this work?		
5	Has the individual or members of the JV/Consortium (could have been a member of some other JV/consortium) collectively successfully completed a minimum of two projects of Independent Safety Assessment of Train Control and Signalling System of a Metro Railway, involving Automatic Train Control, electronic interlocking, and their interfaces (one project must include a Communication Based Train Control & Signalling System), of not less than 10 km each, in the last 7 years ending 31st October '2014?		
6	Is the Tenderer/Bidder included in the Panel of **Independent Safety Assessors for Signalling Projects/Systems, Annexure A** issued by **RDSO, Lucknow** vide their letter no. STS/E/ISA-Approval dated 16/09/13 and amendment dated 12/12/13?		
7	Does the Tenderer/Bidder included in the panel as per item 6 above, has/will achieve the accreditation against ISO/IEC 17065 before September 15th 2015 (Copy of certificate to be furnished with the bid.)? If accreditation is to be achieved by 15th September 2015, an undertaking to this effect shall be submitted by the top management of the tenderer/bidder.		
8	Will the organization holding the accreditation, carry out the assessment/auditing and not its Indian representative?		

[1] In case of JV/ consortium, each member individually.

Note: A "**YES**" answers to question 1 to 4 will disqualify the Applicant. A "**No**" answer to any of the questions 5 to 8 will disqualify the Applicant.

APPENDIX 8 of FOT

PROPOSED SAFETY AUDIT AND ASSESSMENT PLAN

APPENDIX 9 of FOT

COPYRIGHT UNDERTAKING

Dated:

To

The General Manager (S&T)
Kochi Metro Rail Limited, KMRL 8th Floor, Revenue Tower, Park Avenue,
Kochi-682011, Kerala, India

Sub: INDEPENDENT SAFETY AUDIT ASSESSMENT SERVICES FOR SIGNALLING & TRAIN CONTROL SYSTEM TENDER No. KMRL/ISA/01/2014

We, (name of individual Tenderer/Joint venture/Consortia), hereby undertake that the Tender drawings and the Tender documents downloaded/purchased as a necessary part of our preparation of this Tender shall be used solely for the preparation of the Tender and that if the Tender is successful, shall be used solely for the Independent Safety Audit and Assessment of the Signalling and Train Control Systems for Kochi Metro Rail Project.

We further undertake that the aforesaid Tender drawings (if any) and documents shall not be used in whole, in part or in any altered form on any other project, scheme, design or proposal that the individual Tenderer/Consortium/Joint venture, their parent companies or sub consultants of the individual Tenderer/Consortium/Joint venture are, or will be involved with either in India or any other country.

Signed
For and on behalf of
(Name of Tenderer/Joint venture/Consortia)

APPENDIX 10 of FOT

FORM OF CERTIFICATE CONFIRMING RECEIPT OF ALL TENDER ADDENDA

This is to certify that we, M/S _____ [* Name of the Company] have received all Tender Addenda to this Tender as listed below:

1. Addendum No. .....
2. .....
3.
4. .....

.

.

.

SIGNATURE OF TENDERER

***** In case of a partnership, joint venture or consortium, to be submitted by each constituent member.

APPENDIX 11 of FOT

STATEMENT OF DEVIATION

Clause No.	Details of Deviations	Reason for deviation and why it may be considered by Employer

1. We hereby confirm that the pricing for unconditional withdrawal of the above deviations 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 Appendix 11, our proposal is fully and truly compliant.
4. We hereby confirm that all implicit and explicit deviations, comments and remarks mentioned in this Appendix11 but are not priced in Annexure F to ITT for its unqualified withdrawal, shall be treated as NULL and VOID and stand withdrawn.

SIGNATURE OF TENDERER

Instructions to Tenderer

Annexure 1

LIST OF CONTENTS

ITT Annexure 1

(Part I) Instruction for completing the pricing document

A. General Requirements

1 This contract is a fixed Lump sum priced contract for Independent Safety Assessment of Train control & Signalling Systems for KOCHI-ALUVA TO PETTA CORRIDOOR. The price to be quoted shall be inclusive of all taxes, levies, duties and any other charges leviable, including tax deducted at source. The contractor shall be solely responsible for payment of all custom duties, custom clearances, post handling charges if any, etc., of all the imports.

B. Tender total

1. The tender total submitted by the tenderer shall be in the format shown in the pricing document.
2. The pricing document completed and submitted by the tenderer, as part of his tender, should use an indexing and page numbering system such that its extent and completeness is clearly evident.

C. Currency

1 The Lump sum price shall be indicated in Indian rupees and / or in a foreign currency wherever required.(Refer to clause 3.8 of ITT)

D. Rate per man month

1 The tenderer shall submit the Rate per man month of each key staff and other staff member and their category as per the format in Appendix C

ITT Annexure 1

(Part-II) Pricing Document

Part II (Pricing Document)

Appendix A - TENDER TOTAL (Base Tender)

(THIS DOCUMENT IS TO BE PREPARED AND COMPLETED BY THE TENDERER)

The fixed Limp Sum price of the Contract is:

Rupees _____ (In figures)

_____ (In words)

and / or (Strike out which is not applicable)

(In foreign currencies) (In figures)

_____(In words)

Note:

"and" means in addition to Rupees.

"or" means either in Rupees or in Foreign Currency.

Part II (Pricing Document)

Appendix B - Schedule of Payments and Milestones

KMRL shall make payments to the ISA based on the stage payments as shown below. The stage payments shall be made on completion of the corresponding activities after necessary deductions.

The percentages shown will be made for each activity based on the amount quoted in each currency.

Note: The progress schedule (weeks from letter of Acceptance) is indicative and will be finalized during contract execution.

The schedule of key dates for S&T Contractor for Kochi Metro Rail Project is attached in appendix E of this annexure. These dates are likely to change. The Tenderer shall coordinate with S&T contractor to get the revised dates.

S.No.	Activity completed	Reference clause as per Appendix A- Scope of Services	Stage of payment of Lump Sum	Progress schedule (weeks from date of letter of acceptance)
A	B	C	D	E
	Obtain the "Notice of No Objection" or "Notice of No objection subject to ----" from the Employer's representative for:			
1	Safety Audit and Assessment Plan	7.1	10%	
2	Quarterly Audit Reports (A proportionate amount of the 24% of Lump Sum price will be paid based on actual activity during the quarter. It is currently envisaged to be approximately 3% per report but, as above, this may vary)	7.4	24%	
3	ISA Safety Certificate for Stage R1	7.6	12%	
4	Combined safety audit and assessment report for Stage R1	7.5	20%	
5	ISA Safety Certificate for Stage R2	7.6	12%	
6	Combined safety audit and assessment report for Stage R2	7.5	22%	

The percentages shown will be made for each activity based on the amount quoted in each currency.

Note:

1. Please specify the weeks for completion of milestone activities when Notice to Proceed was

issued to S&T Contractor in column (E) above adopting to suit the date of completion of each section given by S&T Contractor.

2. The Tenderer should comply with the key dates for ISA contract or any amendments therein as per Employer's Requirements (Scope of Services).

Part II (Pricing Document)

Appendix C - Rate per Man Month

Rate per man month of each category of staff deployed and their details :

The tenderer shall submit the rate per man month of each key staff and other staff member and their category in the format given below.

Sr. No.	Name of Staff	Category	Rate Per Man Month

Part II (Pricing Document)

Appendix D

Not Used

Part II (Pricing Document)

Appendix E
Schedule of Key Dates for -ALUVA TO PETTA CORRIDOOR of Kochi Metro Rail Project
based on
Train control and Signalling Contract KS1

S&T KEY DATES

Key Date	Description	ALUVA - PETTA	
		R1	R2
KD1	Submission of Preliminary Design	9 weeks[1]	
KD2	Submission of Final Design	22 weeks[1]	
KD3	Obtain Consent of Employer's Engineer on Final Design Submission	30 weeks[1]	
KD4	Deliver Onboard Equipment to Rolling Stock Contractor	In accordance with approved Rolling stock Schedule by Engineer	
KD5	Delivery of CBI, T-ATP, Track Circuits/Axel counters, Point Machine, Signals, Radio equipments and Telecommunication system at Contractor's premises in Kochi	57 weeks[1]	
KD6	Revenue Operation in ATO mode	31st Mar 2016	30th Jun 2016#
KD7	Completion of Contract	On Completion of DLP of complete works	

[1] Weeks from the Commencement Date of the Works

S&T ACCESS DATES

AD No.	Access Date	Aluva - Palarivattam (inclusive) & Depot at Muttom	Palarivattam - Petta
AD1	Access to Equipment Rooms.		
AD1.1	Any Two Stations	15.11.2014	20.12.2014
AD1.2	Next Two Stations	15.01.2015	15.02.2015
AD1.3	Balance Stations	28.02.2015	31.03.2015
AD2	Access to Cable Ducts/ Hangers/ Trays along the Viaduct	15.02.2015	31.05.2015
AD3	Shared Access to Track	30.04.2015	15.07.2015
AD4	Access to Permanent Power & Third Rail	30.04.2015	15.07.2015

Note:The above Access Dates are likely to change

Part II (Pricing Document)

Appendix F
Pricing of Unqualified withdrawal of Conditions, Qualifications, Deviations etc.

Item	Condition, Qualification, Deviation	Activity affected by each condition, qualification, Deviation etc.	Increase or Decrease for unqualified withdrawal of each condition, qualification, deviation etc.	
			Foreign Currency	Rupee Portion
Total				

Notes:

1. In this Appendix, the Tenderer shall indicate every key date that will be affected by each remark, comment, condition, qualification or deviation, etc. that has been specified in Appendix FT-11 and prices for unqualified withdrawal of which has been quoted in this Appendix.

2. In case price for unqualified withdrawal of any remark, comment, condition, qualification or deviation etc. indicated in Appendix FT-11 is not quoted in this Appendix, it shall be considered that the remark, comment, condition, qualification or deviation is unconditionally withdrawn without any financial implication.

3. Where there are no deviations, the statement should be returned duly signed with an endorsement indicating 'No Deviations'.

4. The tenderer shall indicate price adjustment against each deviation, condition, qualification, reservation, etc. that he shall like to add to the tender price for withdrawing his deviations, conditions, qualifications, reservations, etc if the same are unacceptable to the Employer.

SIGNATURE OF TENDERER

GENERAL CONDITIONS OF CONTRACT

Kochi Metro Rail Limited
8th Floor, Revenue Tower, Park Avenue,
Kochi-682011, Kerala, India

TENDER No.KMRL/ISA/01/2014

GENERAL CONDITIONS OF CONTRACT (GCC)

1 Definitions

The following words and expressions shall have the meanings assigned to them except where the context otherwise requires:

(i) "Agreement" means the Conditions of Agreement (General Conditions of Contract and Special Conditions of Contract) together with Scope of Services, Standard Pro-forma, Letter of Acceptance and Formal Agreement, Remuneration and Payment.

(ii) "Applicable Law" means the laws and any other instruments having the force of law in India, as they may be issued and in force from time to time.

(iii) "Approved/approval" means the approval in writing.

(iv) "Contract" means the Contract signed by the Parties, to which these General Conditions of Contract are attached, together with all the documents listed in letter of award.

(v) "Consultant/Tenderer/Bidder' means any entity or person that may provide or provides the Services to the Employer under the Contract.

(vi) "Day" means the period between any one midnight and the next.

(vii) "Employer" means the KOCHI METRO RAIL LIMITED (also referred to as KMRL) which expression shall also include their legal successors and permitted assigns.

(viii) "Effective Date" means the date on which this Contract comes into force.

(ix) "Foreign Personnel" mean such persons who at the time of being so hired had their domicile outside India.

(x) "Independent Safety Assessor" (ISA) means the Tenderer/Bidder named in the Agreement, who has been awarded the contract & entered into agreement, and which expression shall include his/their legal successors and permitted assigns.

(xi) "Local Personnel" mean such persons who at the time of being so hired had their domicile inside India.

(xii) "Month" means a period of one month according to the Gregorian calendar commencing with any day of the month.

(xiii) "Party" means KMRL or ISA as the case maybe and "parties" means both of them.

(xiv) "Project" means the project named in Special Conditions of Contract.

(xv) "Personnel " means persons hired by the Contractor as employees and assigned to the performance of the Services or any part thereof;

(xvi) 'Proposal/Package/Tender' means the Technical Proposal/Packages/Tender and the Financial Proposal/packages/Tender as the context so requires.

(xvii) "Rupees" means the currency of India, and shall be the currency used for the Project.

(xviii) "Services" means the work to be performed by the Consultants pursuant to this

Contract for the purposes of the Project, as described in Tender document hereto.

(xx) "Third Party" means any person or entity other than the Government, the Employer or the Consultants.

2 Interpretation

(i) The headings shall not limit, alter or affect the meaning of this Contract and in the Agreement shall not be used in its interpretation.

(ii) The singular includes the plural, the masculine includes the feminine, and vice-versa where the context requires.

(iii) If there is a conflict between provisions of the Agreement, the last to be written chronologically shall prevail, unless otherwise specified in Conditions of Contract.

3 Obligations of ISA

3.1 Scope of Services to be performed by the ISA

(i) ISA shall perform Services related to the Scope of Services as stated in the section Scope of Services.

(ii) ISA shall exercise reasonable skill, care and diligence in the performance of his obligations under the Agreement.

(iii) Where the Services include the co-ordination between the ISA and other consultants and contractors employed on the Project, KMRL shall provide such co-ordination with ISA and S&T Contractor.

3.2 Performance Guaranty

As stated in the 'Instructions to Tenderers' the ISA shall provide KMRL with a Performance Guarantee in the form of Bank Guarantee provided by a/any scheduled Indian Bank (excluding co-operative bank) located in Kochi acceptable to KMRL. The Performance Guarantee shall remain valid for the duration of liability as described in Special Conditions of Contract.

KMRL reserves the right to forfeit the performance guarantee amount, in the event of termination of the Services in accordance with below Clause 17 (ii) or (iii).

In the event of any non performance on the part of ISA coming to the notice of KMRL within the period of the Contract Period as described in Clause 12 herein and in the eventuality of the ISA failing to rectify the same, KMRL will forfeit the amount of the Performance Guarantee.

4 Change in Constitution

ISA shall promptly notify KMRL of any changes in the constitution of the ISA. KMRL reserves the right to terminate the Agreement upon death, retirement, insanity or insolvency of any person being the proprietor/partner in the ISA, or on the addition or introduction of a new partner managing the Project for the ISA without the previous approval in writing of

KMRL. But in absence of and until its termination by KMRL as aforesaid, this Agreement shall be in full force and effect, notwithstanding any changes in the constitution of the firm by death, retirement, insanity or insolvency of any of its proprietors/partners or addition or introduction of any new partners. In case of death or retirement, the surviving or remaining partners of the firm shall be jointly and severally liable for the due and satisfactory performance of all terms and conditions of the Agreement, and likewise on the addition of a new partner, the latter will also become jointly and severally liable. **The clause shall not apply in case of the companies incorporated with limited liability.**

5 Information

KMRL shall within a reasonable time give to ISA, free of cost, all information which he is able to obtain and which may pertain to the Services.

6 Decisions

On all matters referred to it in writing by ISA, KMRL shall give a decision in writing within 28 days.

7 Assistance

KMRL shall assist ISA in:

(i) providing unobstructed access wherever it is required for providing the Services as per the Scope of Work.

(ii) Providing access to other organisations/Institutions for collection of information if so required under the scope of the work.

8 Mobilisation of Personnel

The qualifications and experience of the personnel who are sent by ISA to work on the project shall be acceptable to KMRL. The ISA hereby agree to engage the Key professional personnel and sub-consultants listed by title as well as by Name in the Appendix 3 of Form of Tender in order to fulfil the contractual obligations under the Contract.

9 Representatives

For the administration of the Agreement the ISA shall designate the official or individual to be his representative and who shall be responsible to the Engineer/Employer for various deliverables as per the Scope of services.

10 Changes in Personnel

(a) Except as the Employer may otherwise agree, no changes shall be made in the Key Personnel. If, for any reason beyond the reasonable control of the Consultants, it becomes necessary to replace any of the Personnel, the Tenderer/Bidder shall forthwith provide as a replacement a person of equivalent or better qualifications with the approval of KMRL

(b) If the Employer (i) finds that any of the Personnel has committed serious misconduct or has been charged with having committed a criminal action, or (ii) has reasonable cause

to be dissatisfied with the performance of any of the Personnel, then the Tenderer/Bidder shall, at the Employer's written request specifying the grounds therefore, forthwith, provide as a replacement a person with qualifications and

experience acceptable to the Employer.

(c) For any of the Personnel provided as a replacement under Clauses (a) and (b) above the ISA shall bear all additional travel and other costs arising out of or incidental to any removal and/or replacement.

11 Liability of ISA to KMRL

Tenderer/Bidder shall be liable to pay compensation to KMRL arising out of or in connection with the Agreement if a breach of Contract is established against him. Such compensation shall be limited to the Contract price.

12 Duration of Liability

Tenderer/Bidder shall not be considered liable for any loss or damage resulting from any occurrence unless a claim is formally made on him before the expiry of the relevant period stated in Special Conditions of Contract, or such earlier date as may be prescribed by law.

13 Agreement Effective Date

This Contract shall come into force and effect on the date of issue of Letter of Acceptance (LOA) by the Employer. The LOA shall continue to remain an active agreement between Employer and the Consultant till formal Contract Agreement has been signed.

14 Commencement and Completion

The Services shall be commenced and completed at the times or within the periods stated in Special Conditions of Contract subject to extensions in accordance with the Agreement.

15 Modifications

The Contract can be modified in writing on application by either party only by written agreement of ISA and KMRL.

16 Exceptional Circumstances

16.1 Force Majeure

If, at any time during the currency of the Contract, the performance in whole or in part by either party of any obligation under this Contract shall be prevented or delayed by reasons of any war, hostilities, invasion, acts of public or foreign enemies, rebellion, revolution, insurrection, civil commotion, sabotage, large scale arson, floods, earthquake, large scale epidemics, nuclear accidents, any other catastrophic unforeseeable circumstances, quarantine restrictions, any statutory rules, regulations, proclamation, orders for requisitions issued by a Government department or competent authority or acts of God (hereinafter

referred to as "event') or any other cause whether of similar or dissimilar nature beyond the reasonable control of the party affected then, provided notice of the happening of such an event as given by either party to the other within 21 days of the occurrence thereof:-

(a) Neither party shall, by reason of such event, be entitled to terminate the Contract or have claim for damages against the other in respect of such non-performance or delay in performance.

(b) The obligation under the Contract shall be resumed as soon as practicable after the event has come to an end or ceased to exist.

(c) If the performance in whole or part of any obligation under the Contract is prevented or delayed by reason of the event beyond a period mutually agreed to if any, or 90 days, whichever is more, either party may at its option terminate the Contract.

(d) In case of doubt or dispute, whether a particular occurrence should be considered an "event' as defined under this clause, the decision of the Engineer shall be final and binding.

(e) If the Contract is terminated under this Clause, the Consultant shall be paid fully for the work done under the Contract up to date of termination of contract.

(f) If neither party issues notice regarding the event within 21 days of its occurrence, the said event shall be deemed not to have occurred and the Contract will continue to have effect as such.

16.2 If circumstances arise for which the Tenderer/Bidder is not responsible and which make it impossible for him to perform in whole or in part the Services in accordance with the Contract including force majeure, he shall promptly notify to KMRL. In these circumstances, including force majeure, if certain Services have to be suspended, the time for their completion shall be extended until circumstances no longer exist plus a reasonable period not exceeding 7 days for resumption of them.

17 Abandonment, Suspension or Termination by Notice by KMRL

(i) KMRL may suspend all or part of the Services or terminate the Agreement by notice of at least 30 days to Tenderer/Bidder who shall immediately make arrangements to stop the Services and minimise the expenditure.

(ii) If KMRL considers that Tenderer/Bidder is not discharging its obligations, KMRL can inform the ISA by written notice, stating grounds thereof. If a satisfactory reply is not received within 7 days of receipt of the notice by Tenderer/Bidder KMRL can by further notice terminate the Agreement provided that such further notice is given within 30 days of the KMRL's former notice.

(iii) If Tenderer/Bidder is adjudged a bankrupt, or if he makes a general assignment for the benefit of his creditors, or if a receiver is appointed on account of his insolvency, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a breach of the Agreement, then KMRL may terminate the Services of the Tenderer/Bidder as per the procedure given in the Contract Document.

KMRL may complete the Project by whatever method may be deemed expedient and the Tenderer/Bidder shall not be entitled to receive any additional payment. Also Clause 11 of GCC shall be applied in cases of (ii) and (iii) above.

18 Rights and Liabilities of the Parties

Termination of the Agreement shall not prejudice or affect the accrued rights or claims and liabilities of either party.

19 Payment to the Consultant

KMRL shall pay the Lump Sum Price exclusive of all taxes, duties, cess etc. (which shall

cover the sum total of all costs incurred by the Tenderer/Bidder as set out in Special Conditions of Contract Clause 5) to the Tenderer/Bidder towards the performance of services as described in Appendix B of Annexure 1(Schedule of Payments and milestone).

20 Time for Payment

The Engineer shall, within 21 days of receiving a statement and supporting documents, deliver to the Employer, with a copy to the Contractor a Payment Certificate showing the amount which the Engineer considers to be due. The payment of the certified amount shall be made by the Employer within 28 days.

21 Currency of Payment

All payments shall be made in Indian Rupees and in tradable foreign currency wherever applicable.

22 Disputed Invoices

If any item or part of an item in an invoice submitted by the Tenderer/Bidder is contested by KMRL then KMRL shall give prompt notice with reasons and shall not delay payment on the balance of the invoice.

23 Languages and Law

This Contract shall be executed in the English language, which shall be binding and controlling language for all matters relating to the meaning or interpretation of this contract.

This Contract, its meaning and interpretation, and the relation between the Parties shall be governed by the Applicable Law in India. The Consultants shall perform the Services in accordance with the Applicable Law and shall take all practicable steps to ensure that any Personnel of the Tenderer/Bidder comply with the Applicable Law.

24 Copyright

The copyright of all documents and drawings prepared by the Tenderer/Bidder in performance of the Services under the Agreement shall be vested in KMRL provided that the Tenderer/Bidder may retain copies of the documentation prepared by them and may use and

adapt the contents of such documentation for his own use.

25 Confidentiality

The Tenderer/Bidder shall during the tenure of the contract and at any time thereafter maintain strict confidence for all information relating to the work and shall not, unless so authorized in writing by the KMRL, divulge or grant access to any information about the work or its results and shall prevent anyone becoming acquainted with either through managers or its personnel. The Tenderer/Bidder shall not, either during the term or after the expiration of this Contract, disclose any proprietary or confidential information relating to the Project, the Services, this Contract or the Employer's business or operations without the prior written consent of the Employer. The Tenderer/Bidder shall also return all reports, notes and technical data relating to the operational matters to the KMRL.

The Tenderer/Bidder shall keep secret and confidential and shall not disclose to any third party not use any unauthorized manner any confidential information regarding the present

processing technology and the business affairs of the KMRL which the Tenderer/Bidder may have acquired through the negotiations, discussions, examination of drawings, designs, process layout, use of infrastructures, etc., leading to the conclusions of this Contract. The parties further agree not use such information for any purpose whatsoever except in the manner expressly provided for in this Contract. The obligations hereunder shall survive any termination or cancellation of this Contract.

The documents, all original field records, reports, spread sheets or other materials developed by the Tenderer/Bidder under this Contract shall be delivered to KMRL and shall become the property of KMRL, to be used by KMRL in any manner required for the implementation of the project.

However, Tenderer/Bidder may retain and use copies of the Documents for the limited purposes for its reference and record in connection with the Project, and for statutory and regulatory requirements to which Tenderer/Bidder is subject, but Tenderer/Bidder shall not divulge the information collected, or conclusions drawn or recommendations made by it during the performance of the "Services" to any third party unless, and only to the extent, expressly authorised in writing by KMRL to do so, for a period of 5 years from the completion of the contractual obligations.

26 Patents

The Tenderer/Bidder shall at all times indemnify KMRL against all claims which may be made in respect of the items for infringement of any right protected by patent, registration of design or trade mark.

27 Conflict of Interest

The remuneration of the Tenderer/Bidder shall constitute the Tenderer/Bidder's sole remuneration in connection with this Contract or the Services and, the Tenderer/Bidders shall not accept for their own benefit any trade commission, discount or similar payment in connection with activities pursuant to this Contract or to the Services or in the discharge of their obligations hereunder, and the Tenderer/Bidder shall use their best efforts to ensure that

any Personnel either of them, similarly shall not receive any such additional remuneration.

Neither the Tenderer/Bidder nor the Personnel of either of them shall engage, either directly or indirectly, in any of the following activities:

(a) During the term of this Contract, any business or professional activities in India which would conflict with the activities assigned to them under this Contract.

The Tenderer/Bidder shall not be one of the following:

(i) A firm which has been engaged by the Employer or by S&T Contractor to provide consulting services for the preparation related to procurement for or implementation of this Project.

(ii) Any association/affiliation (inclusive of parent firms) of a firm or an organisation mentioned in Para (i) above.

(iii) A Tenderer/Bidder who lends, or temporarily seconds its personnel to firms or organisations which were engaged in consulting services for the preparation related to procurement for or implementation of the project, if the personnel would be involved in any capacity on the same project.

28 Notices

Notices under the Agreement shall be in writing and will take effect from receipt at the address stated in SCC clause 5 of Contract Agreement. Delivery can be by hand or facsimile message against a written confirmation of receipt or by registered letter or by e-mail subsequently confirmed by letter.

29 Publication

Unless otherwise specified in Condition of Contract, Tenderer/Bidder, either alone or jointly with others, can publish material relating to the Services. Publication shall be subject to prior approval by KMRL, if it is within two years of completion or termination of the Services.

30 Claims for Loss or Damage

Subject to Clause 11, any claim for loss or damage arising out of breach or termination of the Agreement shall be agreed between KMRL and the Tenderer/Bidder, failing which the same shall be referred to arbitration in accordance with Clause 34.

31 Taxes and Duties

KMRL shall pay such taxes, duties, fees and other impositions as may be levied under the Applicable Laws,

32 Conciliation and Arbitration

Any dispute or claim arising out of or relating to this Agreement or the breach, termination or the invalidity thereof, shall firstly be attempted to be settled by conciliation.

All disputes relating to this Contract on any issue whether arising during the progress of the Services or after the completion or abandonment thereof or any matter directly or indirectly connected with this Agreement shall in the first place be referred to a mutually agreed sole conciliator to be appointed by KMRL. The conciliator shall make the settlement agreement after the parties reach agreement and shall give an authenticated copy thereof to each of the parties. The settlement agreement shall be final and binding on the parties. The settlement agreement shall have the same status and effect of an arbitral award. The views expressed, or the suggestions made or the admissions made by either party in the course of conciliation proceedings shall not be introduced as evidence in any arbitration proceedings. Any dispute that cannot be settled through the Conciliation procedure shall be referred to Arbitration in accordance with the Rules stipulated in Tender document in force on the effective date of the Agreement. No dispute or difference shall be referred to Arbitration after expiry of 60 days from the date of decision by the Employer/Conciliator.

33 Settlement of Disputes

If the parties cannot resolve any such dispute, then dispute shall be referred to arbitration. If any dispute or difference of any kind whatsoever, concerning suitability or otherwise of the personnel employed by the Tenderer/Bidder, defective work, etc. compliance with the procedure of the Employer in respect of which the Employer's decision shall be final and binding on Tenderer/Bidder, such disputes shall not be arbitrate.

1. If any dispute or difference arises other than specified above, in connection with or arising out of the Contract Agreement or its construction or the carrying out of the services (whether during the progress or after their completion and whether before or after the determination, abandonment, breach of the Contract Agreement), it shall be referred to Arbitration as per the provisions of the Arbitration and Conciliation Act, 1996 & amendments if any.
2. Disputes to be arbitrated upon shall be referred to a Sole Arbitrator where the individual claim does not exceed Rupees fifteen lakhs or the total value of the claims does not exceed Rupees Fifty lakhs. The Managing Director from the panel of the Engineers/Professionals shall appoint the sole Arbitrator. The panel will be of three Engineers/Professionals, out of which contractor will choose one.
3. Beyond the limits stipulated in (2) above, there shall be three Arbitrators. For this purpose, Managing Director will make out a panel of Engineers with the requisite qualifications and professional experience relevant to the field in which the Contract/Services relates. This panel will be from serving or retired Engineers of the Government Department of Public Sector Undertaking residing in India only. In case three Arbitrators to be appointed, the Employer will make out a panel of five. The Tenderer/Bidder and Employer will choose one Arbitrator each from the above and the two so chosen will choose the third Arbitrator from the above panel only who will act as the "presiding Arbitrator' of the arbitration panel. If in a dispute, the two chosen Arbitrators fail to appoint third Arbitrator – presiding Arbitrator (Arbitration Panel's case) with in 30 (Thirty) days after these have been appointed, the Employer may apply to the 'Indian Council of Arbitration, New Delhi', to nominate the third Arbitrator from the same panel of Arbitrators given by the Employer for the matter in dispute.
4. Neither party shall be limited in the in the proceedings before such Arbitrator(s) to the evidence or arguments put before the Engineer for the purpose of obtaining his decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the Arbitrators on any matter, whatsoever, relevant to dispute or difference referred to Arbitrators.
5. If any reason an Arbitrator is unable to perform his function, a substitute shall be appointed in the same manner as the original Arbitrator.
6. While invoking Arbitration, the contractor shall give a list of disputes with amounts in respect of each dispute along with the notice of appointment of Arbitrator. If the Tenderer/Bidder does not make demand for appointment of Arbitrator in respect of any claims in writing as aforesaid, before certification of final stage of payment by the Employer, the claim of Tenderer/Bidder shall be deemed to have been waived and absolutely barred and the Employer shall be discharged and absolved of all liabilities under the contract.

7. English language shall be the official language for all purpose.
8. Where the arbitral award is for payment of money, no interest shall become payable on the whole or any part of the money for any period till the date on which the award is made.
9. The reference to the arbitration shall proceed notwithstanding that works/services shall not then be or alleged to complete, provided always that the obligations of the Employer, the Engineer and the Tenderer/Bidder shall not be altered by the reasons of Arbitration being conducted during the progress of work/services. Neither party shall be entitled to suspend the work/services to which the dispute relates on reason of Arbitration nor payments to the Tenderer/Bidder shall continue to be made in terms of the Contract.
10. The venue of Arbitration proceedings shall be in Kochi,Kerala, India. The fees of the Arbitrators shall be borne by the each party equally.
11. In case of any dispute or difference referred to above, the Tenderer/Bidder shall not stop the work but shall proceed with the work with due diligence and until the receipt of the award in the dispute, decision of the Employer on all such matters shall be binding on the Tenderer/Bidder.
12. The Arbitrator (s) shall always give item-wise and reasoned awards irrespective of the value of claim(s) in the dispute in all cases.
13. The cost inter alia includes the fees of the Arbitrator (s) as per the rate fixed by the Kochi Metro Rail Limited from time to time.
14. In arbitral proceedings with more than one arbitrator, any decision of the arbitral tribunal shall be made by a majority of all its members.

34 Clarification

(i) If the work to be done is not sufficiently detailed or explained in the contract document, the contractor shall apply to the Employer in writing for further written clarification and shall conform to the clarification provided. The Tenderer/Bidder shall promptly notify the Employer of all errors, omissions, inconsistencies, or other defects (including inaccuracies and inconsistencies) which it discovers in the Contract Documents, and shall obtain from Employer specific instructions in writing regarding any such error, omission, or defect before proceeding with the services affected thereby.

(ii) The Tenderer/Bidder is fully responsible for all the designs of the work. The Tenderer/Bidder is responsible for correcting any errors, omissions and defects in such design through the design and/or construction process, and shall not be entitled to an increase in the Lump Sum Fixed price or extension of the contract time in connection with such correction.

35 Relations between the Parties

Nothing contained herein shall be construed as establishing a relation of master and servant or of agent and principal as between the Employer and the Tenderer/Bidder. The Tenderer/Bidder, subject to this contract, has complete charge of Personnel performing the Services and shall be fully responsible for the services performed by them or on their behalf hereunder.

36 Amendment to Agreement

Modification of the terms and conditions of this Contract, including any modification of the scope of the Services, may only be made by written agreement between the Parties.

37 Standard of Performance

The Tenderer/Bidder shall perform the Services and carry out their obligations hereunder with all due diligence, efficiency and economy, in accordance with generally accepted professional techniques and practices, and shall observe sound management practices, and employ appropriate advanced technology and safe and effective equipment, machinery, materials and methods. The Tenderer/Bidder shall always act, in respect of any matter relating to this Contract or to the Services, as faithful advisers to the Employer, and shall at all times support and safeguard the Employer's legitimate interest in any dealings with sub-consultants.

38 Indemnifications

The Tenderer/Bidder shall indemnify, protect and defend at the Tenderer/Bidder's own expense, the Employer and employees from and against any and all actions, claims, losses or damages arising out of any violation by the consultant or in the course of the services of any legal provisions, or any rights or third parties, in respect of literary property rights, copyrights, or patents, Tenderer/Bidder' actions requiring Employer's prior Approval. The Tenderer/Bidder shall obtain the Employer's prior approval in writing before taking any of the following actions:

(a) Appointing such members of the Personnel which are not listed in proposed key personnel.

(b) Documents Prepared by the Tenderer/Bidder to be the Property of Employer All plans, drawings, specifications, designs, reports correspondence and other documents prepared by the Tenderer/Bidder in performing the Services shall become and remain the property of the Employer, and the Tenderer/Bidder shall, not later than 30 days upon termination or expiration of this Contract, deliver all such documents to the Employer, together with a detailed inventory thereof. The Tenderer/Bidder shall not use these documents for purposes unrelated to this Contract without the prior written approval of the Employer.

SPECIAL CONDITIONS OF CONTRACT

Kochi Metro Rail Limited
8th Floor, Revenue Tower, Park Avenue,
Kochi-682011, Kerala, India
India

Special Conditions of Contract (SCC)

Clause No.	Ref to GCC clause no.	Special Condition of Contract
1	1(xv)	The Project is Kochi Metro Rail Project.
2	3.2	The **Performance Guarantee shall be 10% of the Contract Price.** Performance Guarantee shall be released within 90 days after the expiry of Liability Period for whole of the work. Performance guarantee will be submitted before Sign of Contract Agreement i.e. within 28 days after issue of LOA.
3	12	**Duration of Liability** shall be a period of 1 year reckoned from the date the each section is brought into use for the carriage of the fare paying public.
4	14	The date of commencement shall be the date of Letter of Acceptance. Completion of the all deliverable period shall be in accordance with the work schedule submitted by the S&T Contractor and subsequently approved by KMRL. A schedule of key dates (Appendix E to Annexure 1 to ITT) is attached for reference. Completion of the activities of the ISA for each section during the Train Control And Signalling System Construction Phase shall be regarded to be the date of the revenue service.
5	19	The Lump Sum Price shall cover the sum total of all costs incurred by the ISA for performing the Services. This shall not only include salaries, overheads and non-salary expenses; an allowance for contingencies, fees and profits; but all other costs and expenses, taxes, duties and other imposition under the Applicable Laws, incurred in carrying out the services. This Lump Sum Price shall include all costs of sub-consultants, sub contractors, and any other professional fees or services incurred by the ISA. The Lump Sum Price shall also include all costs, travel & hotel charges, expenses and allowances paid to or on behalf of expatriate staff working in their own country or in India.
6	28	**Notices shall be delivered to:** General Manager (S&T) Kochi Metro Rail Limited 8th Floor, Revenue Tower, Park Avenue, Kochi-682011, Kerala, India

7	33	**The complete clause shall be replaced by:** **Arbitration** 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: a) The Arbitration Board will consist of three Arbitrators. The Contractor and the Employer shall appoint their own Arbitrator and the two appointed Arbitrators shall appoint the third Arbitrator in accordance with the Section 11 of "Arbitration and Conciliation Act, 1996", of India.All Arbitrators shall be Indian nationals, ordinary residing in India with technical competence and experience. 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 Engineer for the purpose of obtaining his decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the arbitrator(s) on any matter, whatsoever, relevant to dispute or difference referred to arbitrator(s). The arbitration proceedings shall be held in Kolkata only. The language of proceedings that of documents and communication shall be English. b) The award of majority of three arbitrators shall binding on all parties. c) 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. d) The cost of arbitration, excluding fees and expenses of the third arbitrator shall be borne by both the parties. The fees and expenses of the third arbitrator shall be shared equally by between the Employer and the Contractor.

Clause No.	Ref to GCC Clause No.	Special Conditions of Contract Special Condition of Contract
8	(New clause)	**1 Delays** 11 Time is the essence of the Contract. It shall be the responsibility of the ISA to strictly adhere to the time for performance of various services indicated in the Contract. 11 **Liquidated damages** shall be imposed as described in Appendix 1 to FOT- contract condition.
9	New Clause	NOT USED

Clause No.	Ref to GCC clause no.	Special Condition of Contract
10	New Clause	**Insurance:** The contractor shall effect and maintain professional indemnity insurance for the amount in Indian Rupees not less than the contract value in respect of safety assessment work to be carried out by ISA contract . The insurance which shall insure the contractor's liability by the reason of professional negligence and errors in safety audit and assessment work. The validity period of insurance shall be from date of commencement of works until five years after date of submission of Combined Safety Audit And Assessment Report for Phase II as appendix B to Annexure 1 of ITT. **Where the Contractor maintains a corporate Professional Indemnity Insurance on an annual basis this requirement may be waived**. The Contractor will be required to submit evidence to KMRL on an annual basis that this insurance is being maintained.
11	New Clause	**Jurisdiction of Court** Jurisdiction of Court in case of dispute or differences arising on account of this Tender: Any suit or application shall be filed in a competent court at Kochi,Kerala only and no other court or any other district of the country shall have any jurisdiction in the matter

STANDARD PROFORMA

TABLE OF CONTENT

SF 1

FORM OF BANK GUARANTEE FOR PERFORMANCE GUARANTEE

(Reference Clause 3.2 of GCC)

(To be stamped in accordance with the Stamp Act of the Country of Issuing Bank)

To:
Kochi Metro Rail Limited,
8th Floor, Revenue Tower, Park Avenue,
Kochi-682011, Kerala, India

WHEREAS---------- (Name and address of Independent Safety Assessor) (hereinafter called "the ISA") has undertaken, in pursuance of Tender No KMRL/ISA/01/2014 dated ……to execute the Independent Safety Assessment Services ISA of KOCHI-ALUVA TO PETTA CORRIDOOR(hereafter called contract).

AND WHEREAS it has been stipulated by you in the said Contract that the ISA shall furnish you with a Bank Guarantee by a Scheduled Indian Bank located in Kochi for the sum specified herein as security for compliance with his obligations in accordance with the Contract in lieu of cash deposits held by you for such compliance of obligations/performance Guarantee.

AND WHEREAS we _____(Name of the Bank with address) have agreed to give the ISA such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the ISA up to a total of (amount of Guarantee) (in words), such sum being payable in Indian Rupees, and we hereby unconditionally, irrevocably and without demur undertake to immediately pay you, upon your first written demand and without cavil or argument any sum or sums within the limits of (amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the ISA before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the contract or of the Works to be performed there under or of any of the contract documents which may be made between you and the ISA shall in any way release us from any liability under the guarantee and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid upto 90 days after the expiry of defect liability period for whole of the work.

The pendency of any dispute or arbitration or other proceedings shall not affect this guarantee in any manner.

SIGNATURE AND SEAL OF THE GUARANTOR

NAME OF BANK ----------

ADDRESS ------- ----------

DATE ---------- ----------

Notes:

1. The stamp papers of appropriate value shall be purchased in the name of the Bank, who issue the 'Bank Guarantee'
2. The 'Bank Guarantee' shall be from a scheduled Bank located in Delhi, acceptable to Employer

SF 2

FORM OF BANK GUARANTEE FOR TENDER GUARANTEE

(Revised 1)

(Reference Clause 5.2 of the Instructions to Tenderers)

(To be stamped in accordance with Stamp Act of India)

KNOW ALL MEN by these presents that we _____ (Name of Bank), having our registered office at _____ (hereinafter called "the Bank") are bound unto KOCHI METRO RAIL LIMITED (hereinafter called "the Employer") in sum of * for which payment well and truly to be made to the said Employer, the Bank binds himself, his successors and assigns by these presents.

WHEREAS _____ (Name of Tenderer) (hereinafter called "the Tenderer") has submitted his tender dated ……..for Tender No. KMRL/ISA/01/2014 (hereinafter called "the Tender".

WHEREAS the Tenderer is required to furnish a Bank Guarantee for the sum of *. _____ (Amount in figures and words) as Tender Guarantee against the Tenderer's offer as aforesaid.

AND WHEREAS _____(Name of Bank and address) have, at the request of the Tenderer, agreed to give this guarantee as hereinafter contained.

We further agree as follows:

(i) That the Employer may without affecting this guarantee grant time or other indulgence to or negotiate further with the Tenderer in regard to the conditions contained in the said tender and thereby modify these conditions or add thereto any further conditions as may be mutually agreed upon between the Employer and the Tenderer.

(ii) That the guarantee herein before contained shall not be affected by any change in constitution of our Bank or in the constitution of the Tenderer.

(iii) That any account settled between the Employer and the Tenderer shall be conclusive evidence against us of the amount due hereunder and shall not be questioned by us.

(iv) That this guarantee commences from the date hereof and shall remain in force till :

a. The Tenderer in case his tender is accepted by the Employer, executes a formal agreement after furnishing the Performance Guarantee on a scheduled Indian Bank located in India acceptable to the Employer

b. 28 days beyond the Tender Validity period of 180 days from the last date of

submission of the tender, this shall be suitably extended on the request of KMRL.

c. That the expression "the Tenderer" and "the Bank" herein used shall, unless such an interpretation is repugnant to the subject or context, include their respective successors and assigns.

THE CONDITIONS of this obligation are:

(i) if the Tenderer withdraws his Tender during the period of Tender validity specified in the Form of Tender, or

(ii) if the Tenderer having been notified of the acceptance of his Tender by the Employer during the period of tender validity:

a. fails or refuses to furnish the Performance Guarantee and/or

b. fails or refuses to enter into a Contract within the time limit specified in Clause 8.2 of the "Instructions to Tenderers".

We undertake to pay to the Employer the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of any one or more of the conditions (I) & (ii), mentioned above, specifying the occurred condition or conditions.

Signature of

Authorised Official

Of the Bank:

SIGNATURE OF WITNESS

Name of Official: _____

Designation _____

NAME OF WITNESS

STAMP/SEAL OF BANK

_____
Address of witness

_____

**The currency of the amount shall be in Rupees. or equivalent amount in a single freely convertible foreign currency.*

SF3

FORM OF BANK GUARANTEE FOR ADVANCE PAYMENTS

Not Used

SCOPE OF SERVICES

TABLE OF CONTENT

1 INTRODUCTION

11 Scope Overview

This document describes the Scope of Services to be provided by the Independent Safety Assessor for KMRL project.

In brief, the Independent Safety Assessor shall carry out an Independent Safety Assessment (ISA) of the Communication Based Train Control and Signalling system. The ISA will include the interfaces with any other safety systems.

The Works of the Signalling and Train Control will be carried out by the S&T Contractor. The S&T contract has been awarded to M/s ALSTOM consortium.

12 Applicable Documents

The Applicable Documents for the Services are:

The ISA Agreement

- all documents of the Agreement

The S&T Contract (KS1)

- Volume 3 - Works's Requirements - General Specifications including Appendices
- Volume 4 –Work's Requirements - Particular Specifications Including Appendices

1.3 Definitions and Abbreviations

Kochi Metro Rail Limited (KMRL) is the Employer and is responsible for construction, operation, maintenance & safety of ALUVA TO PETTA CORRIDOOR of Kochi Metro Rail Project.

The System Safety Assurance Plan refers to the Safety Plans and Procedures developed by the S&T Contractor for the Signalling & Train Control associated trackside and train borne systems and equipment. These Plans and Procedures will detail the activities and analyses to ensure that adequate measures have been taken to implement a safe and reliable system as required in the Systems Specifications of the S&T Contract.

Abbreviations:

Acronym	Description
ATC	Automatic Train Control
ATO	Automatic Train Operation
ATP	Automatic Train Protection
ATS	Automatic Train Supervision
BDR	Baseline Design Review
BIS	Bureau of Indian Standards
CENELEC	European Committee for Electrotechnical Standards (Comité Européen de Normalisation Electrotechnique)
CDS	Conceptual Design Stage
CLC	Centralized Logic Controller
CMRS	Commissioner of Metro Railway Safety
DMC	Driving Motor Car
GCC	General Conditions of Contract
GS	General Specification
IEC	International Electrotechnical Commission
IR	Indian Railways
IRS	Indian Railway Standards
ISA	Independent Safety Assessment
ISO	International Standards Organisation
KMRL	Kochi Metro Rail Limited
LC	Line Controller
PDS	Preliminary Design Stage
QR	Quarterly Report
RAMS	Reliability, Availability, Maintainability, Safety
SCC	Specific Condition of Contract
T&C	Testing and Commissioning
TC	Trailing Car

ZC Zone Controller

2 OVERVIEW OF THE PROJECT

2.1 General

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

2.2 Aluva – Petta Corridor of the Kochi Metro Rail Project has a total length of 24.91 Kms between Centre Lines of end stations (25.61 Kms between deadends) fully constructed on elevated viaduct with 22 elevated stations, of which 7 station will have points & crossings required to be interlocked for train movements.

2.2.1 It is envisaged that there may be two stages of commissioning to revenue service with about six months interval between the four dates of revenue service. The proposed two stages are:

1st Stage R1 section: ALUVA to PALARIVOTTAM (inclusive) = About 13 KMs with ELEVEN stations

2nd Stage R2A Section: PALARIVOTTAM (Excl.) to MAHARAJA'S COLLEGE (Inclusive) = About 5 KMs with FIVE Stations

R2B Section: MAHARAJA'S COLLEGE (Excl.) to Kadavanthra (Incl.) = About 2 KM with TWO stations

R2C Section: Kadavanthra (Excl.) to PETTA (Inclusive) = About 4.8 KM with FOUR Stations.

2.2.2 Not used

2.2.3 There may be a possibility of further extension of the network during the pendency of the contract by another 1.8 Kms to Triupunithura from PETTA with two Stations. Feasibility is also being explored for expansion of the Metro in future on a branch line of about 9.5 KM with 6 stations to Kakkanad taking off from JLN stadium.

2.2.4 Line diagram indicating stations and turnouts may be seen in Drawings of S&T Contract.

2.3 Date of revenue service

2.3.1 The line will open for revenue services as per the schedule given in Appendix V of these specifications.(Likely to change)

2.4 Salient Features

S.No	Features
1	Track Gauge (nominal) with UIC 60 Rails : 1435 mm
2	Route Length between dead ends : Elevated 25.61 KM
3	No. Of Stations : 22
4	Typical Dwell time: 30 sec;
5	Traction Supply : 750 V D.C Third Rail system
6	Revenue service Hours: 0500 Hrs to 2300 Hrs Normal service days
7	Rolling Stock: Air-conditioned, 3-Car, Stainless Steel or aluminium, max 2.9 Meters wide,

	about 21.6 Meters Long,15 Ton Maximum Axle load
8	Operations Control Centre at depot
9	Depot: Adjoining Muttom Metro Station

In future, KMRL plans to upgrade to DTO (Driverless Train Operation) / UTO (Unattended Train Operation) in accordance with the relevant standards.

2.5 Employer and Engineer

The Delhi Metro Rail Corporation (DMRC) was entrusted with the tasks of preparing the Feasibility Studies, the Detailed Project Report (DPR) .

DMRC were later been appointed as the Employer and Engineer for execution of the Kochi Metro Rail Project

A preliminary list of Project Contracts is given below :

KOCHI METRO RAIL LIMITED –

SL No	Contract Name	Description of Work	Name of the Contractor
I	CIVIL works		
1	KC 1	Road diversion works and Mass Earth filling	Bridge & Roof Co. (I) Ltd.
2	KC 2	Construction of Elevated Viaduct and 6 Stations (Aluva to kalamassery) from Chainage -120.00 m to 7055.218 m.	L&T Construction
3	KC 3	Construction Elevated Viaduct and 6 Stations (CUSAT to JLN Stadium) from Chainage 7055.218 m to 14580.00 m	L&T Construction
4	KC 4	Construction of Elevated Viaduct and 5 Stations (Kaloor to Ernakulam South) from Chainage 14580.00 m to 19329.685 m	Soma Construction
5	KC 5	Construction of Elevated Viaduct and 3 Stations (Vytila to Petta) from Chainage 22330 m to 25119.278 m	ERA Rankein JV
6	KC 5A	Segmental Balanced Cantilever Bridge across South Railway	L&T Construction
7	KC 5B	Construction of Elevated Viaduct and station from Manorama Jn to Elamkulam including Kadavanthra Station	Soma Construction
8	KC 5C	Construction of viaduct from Elamkulam to Vytila including Elamkulam Station from Chainage 21236.702 to 22330	Soma Construction
9	KC 6	Work Cancelled	
10	KC 7	Construction of box pushing type RCC - RUB at NH 47	Vijaya Infra Project Pvt. LTD
11	KC 8	Work Cancelled	
12	KC 9	Mass earth filling in Muttom Depot	DEENS Constructions
13	KC 10	Construction of RCC Retaining wall etc for Muttom Depot	Bridge & Roof Co. (I) Ltd.
14	KC 11	Construction of civil works, internal drainages,roads etc for Muttom Depot	McNally Bharat Engineering Company Limited
II	**TRACK**		
1	KT1	Supply of 7000MT UIC60,1080 Grade HH rails	Tata Steel France Rail S.A.
2	KT2	Design Manufacturing and supply of standard gauge UIC 60Turnouts	Consortium of Voestalpine VAE GmbH-Voestalpine VAE And VKN India Pvt Ltd
3	KT3	Ordinary Rail for Muttom Depot	Jindal Steel & Power Ltd.

4	KT 4	Supply Installation Testing and Commissioning of Ballast less Track of Standard Gauge	Ircon International Limited
5	KT 5	Supply testing and commissioning of standard guage track work in muttom depot	-
III	**ELECTRICAL**		
1	KE 1	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 340, Pack-1	Vindhya Telelinks Ltd
2	KE 2	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 2477, Pack-2	Vindhya Telelinks Ltd
3	KE 3	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 3110 & 6292	Vindhya Telelinks Ltd
4	KE 4	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 2623 & 2888	Vindhya Telelinks Ltd
5	KE 5	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 5282, 5492, 5605 & 8006	Fathima Engg Co.
6	KE 6	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 23525	Amritha Associates
7	KE 7	Shifting/Raising/Converting to UG cable of EHT lines crossing kochi metro route for Maintaining statutory clearance Chainage 24959	Vindhya Telelinks Ltd
8	KE 8	Shifting/Raising of EHT line along the muttom depot yard of kochi metro project for maintaining statutory clearance from locations 12 to 17 of KAT/KLK 66KV DC feeder	Red Star Construction
9	KE 9	Modification of three EHT lines behind Vytilla hub, two lines to be lifted up & one line to be made in to U/G	-
10	KE 10	Supply,installation, testing & commissioning of E & M, Fire detection & fire suppression systems including DG sets for elevated stations of Aluva-Petta line and Muttom Depot of Kochi metro rail project.	JAKSON
11	KE 11	Design, Manufacture, supply, installation, testing and commissioning of machine room less elevators for kochi metro rail project.	-
12	KE 12	Design, Manufacturing, supply, installation, testing and commissioning of escalators for kochi metro rail project.	Consortium of Johnson and SJEC,China

13	KE 13	Design, Verification, Detail Engg, Manufacturing, supply, installation,testing and commissioning of 750V DC third rail traction Electrification system and Auxiliary Substation (ASS) & associated SCADA system for KOCHI MASS RAPID TRANSPORT SYSTEM.	Consortium of Alstom Transport India Limited and Alstom Transport SA, France
14	KE 14	Supply, Installation, testing & commissioning of main S/S including HV cabling from grid S/S for Alwaye-Petta line of KMRL project.	Consortium of Alstom Transport India Limited and Alstom Transport SA, France
15	KE 15	Utility Shifting at EDAPALLY FLYOVER	Fathima Engg Co.
16	KE 16	Installation of street lighting arrangements along the metro corridor	Bajaj Electricals Limited
17	KE 17	Utility Shifting at JLN	Antony Leenus Ltd.
IV	**RS and S&T,AFC**		
1	KRS1	Design, Manufacture, Supply, Testing, Commissioning and Training of 75 No. Standard Gauge Cars with an option to procure Additional Cars (Upto 75 Nos.) for Kochi Metro Rail Project Tender 'KRS1'	Consortium of Alstom Transport India Limited and Alstom Transport SA, France
2	KS1	DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SIGNALLING & TRAIN CONTROL AND TELECOMMUNICATION SYSTEM FOR KOCHI METRO RAIL PROJECT CONTRACT KS1	Consortium of Alstom Transport India Limited and Alstom Transport SA, France
3	KS2	DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AUTOMATIC FARE COLLECTION SYSTEM FOR 22 STATIONS INCLUDING CENTRAL SYSTEM FOR KOCHI METRO RAIL (ALWAYE – PETTA CORRIDOR).	-

3 PRILIMENARY TRAIN OPEARTION PLAN

31 The Aluva to Petta Line

3.1.1 The line is elevated Between Aluva and Petta

3.1.2 There are twenty two stations from Aluva to Petta

3.2 Stages of the Project

3.2.1The line is planned for opening in following two stages:

1st Stage R1 section: ALUVA to PALARIVOTTAM (inclusive) = About 13 KMs with ELEVEN stations

2nd Stage R2A Section: PALARIVOTTAM (Excl.) to MAHARAJA'S COLLEGE (Inclusive) = About 5 KMs with FIVE Stations

R2B Section: MAHARAJA'S COLLEGE (Excl.) to Kadavanthra (Incl.) = About 2 KM with TWO stations

R2C Section: Kadavanthra (Excl.) to PETTA (Inclusive) = About 4.8 KM with FOUR Stations

3.3 Depot and exchange of rakes

The Depot is located at Muttom at grade.

The entry and exit lines of depot are connected to Up line at Muttom station.

Trains are exchanged between main line and depot through a pair of lines on ramp at grade at Muttom Depot.

The Depot has stabling lines for 13 trains of 3 car composition.

3.4 Operational Control Centre/Depot Control Centre/Backup Control Centre

OCC is located at Muttom Depot. All train control activity on main line is managed from this centre.

Depot Control Centre is also located at Muttom Depot in the same building as OCC and controls all train movements inside the designated area inside the depot.

3.5 Terminal & turn back

Aluva and Petta are terminal stations.

Turn back facilities are also available at Muttom, Pathadipalam, Palarivattam, Maharaja's College, Kadvanthara and Thaikoodam.

3.6 Operating plan

3.6.1 Trains will be run between Aluva to Petta

.

3.6.2 **Hours of operation**

0500 hrs to 2300 hrs

3.6.3 Normal Operations Principle

The line is designed for headway of 90s in order to permit a sustained operating headway of 100s.

The maximum designed operating speed of trains is 80 Kmph.

On Sunday and public Holiday there will be no peak hours.

Only 3 Car train sets will be operated.

The trains will run on left hand track.

Trains stop at each station.. The dwell time is adjustable.

One train driver in front cab operates the train. At terminal driver changes ends or a driver shift arrangement is provided as per headway requirements.

Trains will normally be operated on CBTC using ATO mode.

Speed in RM/ROS mode is restricted on the main line to 25 Kmph.

Trains negotiate a 1 in 9 turn out at 40 kmph maximum and a 1 in 7 turn out at 25 kmph.

3.7 Degraded Operation

Single track operation shall be possible whenever required by using bi-directional ATP capability and using crossovers on the line.

All speed restrictions shall be enforced when trains operate in reverse direction: trains can be operated on ATP mode, ROS mode etc.

All faulty trains shall be worked to Depot for attention at RM/ROS mode or as specified by OCC.

3.8 Communication

Telecommunication system shall comprise of CCTV, Passenger Information Display system, Public Address System for public and Fibre Optic Transmission System, Telephone system, Radio system and etc. for train operation and control.

3.9 Rolling Stock

Number of rakes of 3 car formation shall be available for the Aluva to Petta Corridoor to achieve the desired headway. The rolling stock compositions shall be:

DMC-TC-DMC

3.10 Train operator management

Train operators shall be managed from Crew Control Centre at Depot. For operational purposes crew can also be relieved and report at terminus.

For driver shift train operators shall be positioned at terminals.

3.11 Operating modes and Degraded Operation

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

(6) Automatic Turn back Mode (ATB)

The normal mode of operation for trains equipped for ATP Mode shall be ATO Mode. In the event of failure, ATO mode degrades to ATP mode. In the event of ATP failure, ATP Mode degrades to ROS Mode after stopping of train and a conscious action of the train operator of pressing the ROS button . In Cut out mode safety by ATP is bypassed and train operator operates the train by line side signals and verbal instructions from the controller.

3.12 Communication

Telecommunication system shall comprise of CCTV, Passenger Information Display system, Public Address System for public and Fibre Optic Transmission System, Telephone system, Radio system etc. for operation and control.

3 .13 Rolling Stock

Rolling stock shall comprise of 3 car train.
The basic unit of 3-car train comprising of DMC-TC- DMC .

3.14 Train operator management

Train operators shall be managed from Crew Control Centre at Depot. For operational purposes crew can also be relieved and report at terminus.

For driver shift, train operators shall be positioned at terminals.

4 SCOPE OF SERVICES

4.1 Scope of the ISA

The Works to be executed under the S&T Contract KS1 include design, manufacture, supply, installation, testing, commissioning of signalling & train control and Telecommunications. The ISA Consultant's safety activities shall follow every stage of the S&T Contractor's development process.

The ISA Consultant shall verify that the required level of safety/quality is achieved by the Signalling & Train Control System, and the interfaces with other systems, to ensure the safe operation of the Metro as per the Safety Requirements.

The ISA Services will be limited to safety aspects of the S&T Contractor's activities regarding design, installation, T&C, and inputs to O&M.

Aspects such as Core Reliability, Availability, Maintainability (RAM) issues, as well as, non-safety functions, health & safety issues (during the construction phase), and security are not part of the ISA Services.

The ISA Consultant shall assess both the Hardware and Software components of the Signalling & Train Control.

The ISA Services shall be performed following the principles and processes described in the CENELEC Railway Application Standards EN 50126, EN50128 and EN 50129, and CENELEC Guides for the implementation of these Standards.

The ISA objective is to collect, inspect and analyse all necessary data from all stakeholders to assess whether the S&T Contractor has, throughout the project duration, applied appropriate processes and safety solutions in accordance with the requirements of the applicable safety standards, the Contract between the Employer and the S&T Contractor, and local and national applicable laws/acts.

The ISA shall be focused on Signalling and Train Control System and ensure that all hazards are mitigated. Specifically, the ISA consultant shall ensure, either by direct assessment or by **examination or acceptance** of the assurance work of other agencies, that all SIL4 interfaces with Signalling and Train Control System meet the required safety standards. The conclusions of the ISA will be given by the ISA Consultant through signed ISA Certificates at the completion of the design stage of the Signalling & Train Control systems and at the opening of each revenue operation.

4.2 ISA Activities

a) General ISA Activities

To perform the Safety Assessment of the Signalling & Train Control, the ISA Consultant shall:

- Assess the S&T Contractors development process of the systems and their interfaces, during every stage of the process.
- To assess the systems based on the S&T Contractors design approach and specifications and in-built safety principles, safety demonstrations and safety analyses
- The ISA Consultant may adapt the level of detail of the Safety Assessment according to following factors:
    - Sub-system Safety Integrity Level SIL or SSIL
    - Existing safety demonstrations for the related system/sub-systems

The Safety Assessment shall be based upon two types of activities:

- Review of the S&T Contractors documentation as pertaining to quality/safety aspects throughout the various stages of development of the Signalling & Train Control
- Inspections and Safety Audits within the S&T Contractor entities and on site

b) Documentation Review

The ISA Consultant shall independently review the S&T Contractors documents for compliance with the selected standards, and consistency with the respective specifications, as well as for adequacy of the determined Safety Integrity Level according to EN 50126/EN 50128/EN 50129.

The ISA Consultant shall provide comments on the Contractors documents within a maximum of 21 calendar days from the date of submittal by the said Contractor.

The ISA Consultant shall pay special attention to the applicability and appropriateness of the available pre-certificates and reports, fulfilment of safety-related application conditions, impact and requirements on the operational concept, including the safety-related systems directly or indirectly interfacing with the Signalling & Train Control. This will include audit of the S&T Contractors report on EMC/EMI analysis, Signalling & train control interface documentation and test data.

The ISA documentation review, and meetings with S&T Contractor and other stake-holders, shall be systematically recorded and any comments, recommendations or actions required shall be entered into one master Tracking Log. This Tracking Log shall be used to monitor the S&T Contractors activities.

c) Safety Audits

For each Safety Audit the ISA Consultant should:

- Prepare the Safety Audit Plan at least 2 weeks prior to the Safety Audit
- Develop the Safety Audit protocol

- Carry out the Safety Audit
- Record all discussions and observations
- Produce the Safety Audit Report

The ISA Consultant shall submit the draft version of the Safety Audit Reports to the Employer within a maximum of ten working days of completing the Safety Audits.

The ISA Consultant shall discuss the draft Safety Audit Reports with the audited party and the Employer before the final version is completed and submitted.
After completion of the Safety Audits, the ISA Consultant shall document all observations and enter them in the Tracking Log.

For each Non Conformance item, the ISA Consultant shall verify the implementation and effectiveness of the corrective action performed by the Contractor.

5 INTERACTION

5.1 Authority

The S&T Contractor will provide access to all the relevant design and product information at the ISA Consultants request

The S&T Contractor shall also supply all the documents as well as analyses as required by the ISA Consultant for his necessary verification and validation

The ISA Consultant shall closely coordinate and cooperate with KMRL and the S&T Contractor during the ISA process.

The ISA Consultant shall be present during the statutory inspection of the Commissioner of Metro Railway Safety (CMRS), and assist the Employer in providing answers to the questions of the CMRS related to the ISA.

5.2 Disputes with the S&T Contractor

In the event that there is a dispute or lack of cooperation by the S&T Contractor, the ISA Consultant shall notify the Employer in writing within 48 hours and provide details of the full circumstances, impact to program and possible solutions to the overcome the dispute.

5.3 Coordination between the ISA Consultant and the S&T Contractor

The Employer and the ISA Consultant will meet with the S&T Contractor at the kick-off meeting of the ISA, to discuss and agree on the Safety Assessment Plan. After the kick-off meeting, the ISA Consultant shall regularly coordinate and interface directly with the S&T Contractor, with all communications or notes of discussions forwarded to the Employer. The ISA Consultant shall submit the ISA schedule of meetings and Safety Audits with advance notice to enable the Employer to attend, if necessary.

5.4 Notification of Safety Audits

The ISA Consultant shall conduct Safety Audits in accordance with the approved Safety Audit and Assessment Plan. The ISA Consultant shall be responsible for liaising with the S&T Contractor to ensure that he is fully aware of the scope and timing of the Safety Audits and must give a minimum of 14 days notice, in writing, before conducting the Safety Audits.

5.5 Safety Audit Locations

The Safety Audits of the S&T Contractor shall be performed at the S&T Contractor's main premises, as well as sub-contractor/suppliers/other designated project contractor premises as appropriate, and at site in Kochi. The location of the S&T Contractor's, subcontractor's and other designated project contractor's premises will be intimated to the ISA Consultant as soon as they are known and transmitted by the S&T Contractor.

6 DOCUMENTATION

6.1 The S&T Contractors Documentation

An estimated, but non exhaustive, view of the documentation intended to be assessed by the ISA Consultant could be divided into the following categories:

General understanding documentation

System/sub-system safety documentation

System/sub-system technical documentation (design, procurement, manufacture, installation)

Verification and validation, and test and commissioning, documentation.

Operational & Maintenance documentation

6.2 Other documentation

The following documents will be made available to the ISA Consultant upon request:

The S&T Contract Agreement

Interfaces Specifications (relevant portions) for the Rolling Stock, Track, Traction, Power Supply, and Civil Works

Safety-related systems relevant interface specifications

The ISA Consultant may request the Employer to provide any other document considered necessary to perform the ISA.

7 DELIVERABLES

7.1 Safety Audit and Assessment Plan

The ISA Consultant shall prepare, and submit to the Employer, a Safety Assessment Plan. This document is to provide a detailed plan covering all activities of the ISA.

The Safety Assessment Plan shall present the organization of the ISA Consultants team required to perform all the activities of the ISA.

The Safety Assessment Plan shall give a breakdown of the activities of the ISA into individual tasks, their start and end dates, and their interdependences, and shall provide details of the methods used and the resources involved in individual tasks as well as the associated deliverables.

7.2 Project Management Plan

The ISA Consultant shall prepare, and submit to the Employer, the Project Management Plan. This document shall define how the Contractor intends to execute, monitor and control the Services.

7.3 The ISA Overall Safety Audit Plan

The ISA Consultant shall prepare, and submit to the Employer, a detailed Overall Safety Audit Plan based on the Scope of Services and including any other relevant information arising during the Signalling & Train Control development.

7.4 Quarterly Reports

The ISA Consultant shall prepare, and submit to the Employer, a Quarterly Report (QR) including as a minimum; highlights, summary of work completed, matters of concern and an updated action list of all Safety Audit findings and summary conclusions in regard to the achievements in each Safety Audit.

This report shall also contain the program of the scheduled activities for the next quarter.

7.5 ISA Reports

The ISA Consultant shall submit an Assessment Report at the end of the final detailed design of the Signalling & Train Control for stages R1 and R2. The ISA Consultant shall submit intermediate draft reports as requested by the Employer.

The ISA Consultant shall include the results of the activities, document reviews, inspections, audits, etc., defined in the Safety Assessment Plan.

The ISA Consultant shall include the Tracking Log in the reports.

The ISA Consultant shall supply all supporting information as requested by the Employer.

7.6 ISA Safety Certificates

The ISA Consultant shall provide a **Safety Assessment Certificate (SAC)** on completion of each Stage, in a format agreed by the Employer and/or CMRS, attesting that the Signalling & Train Control systems are safe for opening for Revenue Operation.

Each SAC shall:

- Identify the Stage of the Project which it relates to
- Either state that the system complies with the relevant Safety Requirements, or identify the relevant Safety Requirement with which the system is non-compliant and in which matter it does not comply

8 SERVICES AND INFORMATION

All Services and information to be provided by the ISA Consultant to the employer is free of copyright or any other encumbrance to the future use by the Employer in the design, construction and operation of the Metro and any other railways.

Attachment A to Scope of Works

PERFORMANCE AND DESIGN REQUIREMENTS CHAPTER OF VOLUME 4-Part I OF BIDDING DOCUMENTS OF CONTRACT S&T

1 PERFORMANCE REQUIREMENTS

1.1 **General**

1.1.1 The Train Control and Signalling System shall achieve all performance requirements specified in this PS.

1.1.2 All the sub systems, equipments to be used for Train control & Signalling system (including but not limited to ATP, ATO, Radio for CBTC, DCS, ATS, Interlocking, mainline point machine) shall be of proven design and in use in transit systems in at least one country outside the country of origin of the sub system / equipments. These reference transit systems must have design headway of 2 min or better. The Bidder shall provide certificate from the user of the transit systems that the proposed sub-system/ equipments are working satisfactorily and no unsafe failure has been reported.

1.1.3 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.

1.1.4 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.

1.1.5 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.

1.1.6 The calculation of RAMS requirement will take into consideration only relevant failures. A relevant failure of an item is an independent failure which results in a loss of function of that item caused by

- A fault in an equipment or sub-system while operating within its design and environmental specification limits
- Improper operation, maintenance or testing of the item as a result of contractor supplied documentation
- Failure of transient nature including those with post investigation status as “No fault found”, shall be considered as relevant failure if in the opinion of the Engineer these are attributable to signalling. The decision of engineer shall be final.

1.2 **Reliability Requirements**

1.2.1 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.

1.2.2 The Reliability measure for the Train Control and Signalling System shall be Mean Time Between Maintenance Action (MTBMA).

1.2.3 The Train Control and Signalling System shall achieve a Mean Time between Maintenance Action (MTBMA) of no less than 7 days per 13 route km approx of the Line. MTBMA is the average time between maintenance being required on a piece of equipment, sub-system or a system. The equipment shall be clubbed as (a) Trackside ATC (b) Onboard ATC (c) ATS (d) CBI including track circuit/axle counter, signal, point machine etc (e) TWC and MTBMA of 7 days shall be achieved for each group.

1.2.4 Maintenance actions shall include hardware failures requiring a repair or software reboot/ reconfiguration/reloading.

1.2.5 The Reliability of the Train Control and Signalling System shall be demonstrated by the Contractor in accordance with the processes defined in the Specification.

1.2.6 The contractor shall ensure that the reliability of UPS system shall meet the figure >50,000 hrs of MTBF

1.3 **Availability Requirements**

1.3.1 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.

1.3.2 The measures for Train Control & Signalling System's Availability shall be Mean Time Between Service-Affecting Failures (MTBSAF).

1.3.3 The availability figures shown in Table 4-1 shall be met by the Train Control and Signalling System per 13 route km approx of the line. For calculation purpose, only relevant failures viz failure of track detection device, signal, point machine, interlocking, on-board ATC, beacons, ATS, bidirectional communication etc shall be covered. The discretion of determining delay on account of any relevant failure rests solely with the Engineer and shall be final. The delay is calculated by the time lost by the first affected train due to a relevant failure. The determination of delay shall be further developed during DLP.

Description	**MTBSAF**
(i) Delay to train service exceeding 2 minutes from the schedule / timetable as noted at the destination station, or fault preventing a train from entering service at its scheduled time.	3000 hours

(ii)	Delay to train service exceeding 15 minutes, or requiring temporary closure of signalling /ATP functionality for 900m on both up and down lines in the normal direction of travel	16300 hours
(iii)	Delay to train service exceeding 30 minutes, or closure of signalling /ATP functionality for 900m on both up and down lines in the normal direction of travel for more than 2 hours, or implementation of single line working for a period of 1 hour or more.	200,000 hours

Table 1-1 Availability Performance Figures

For item (i) of the table, MTBSAF will be demonstrated by analysis and actual calculation. MTBSAF shall be calculated as the ratio of "Total test Duration" and "Number of relevant failures" for any of the component / sub-system of the entire signalling system in the considered section of 13 route km approx.
For items (ii) & (iii) of the table MTBSAF will be demonstrated by statistical analysis.

1.3.4 For the purposes of availability calculations, the Contractor shall assume that the service operating hours are 18 hours per day (05:00 to 23:00) for 365 days a year. The total test duration will be taken accordingly.

1.3.5 The availability of the Train Control and Signalling System shall be demonstrated by the Contractor in accordance with the processes defined in the Specification. The availability figure as described in Para 4.3.3 shall be reached by the end of 24 months of revenue operation of the 13 route km approx in consideration. The availability figure shall be calculated on a monthly basis and the Contractor shall demonstrate that the availability figures are met in 6 consecutive months of observation. If the availability figure is not met in 6 consecutive months by the end of DLP period then the DLP for that section shall be extended by 1 month every time till the requirement of achieving availability figures for 6 consecutive months is reached.

1.3.5.1 Detrainment of passengers, during DLP period, caused due to a failure of Signalling & Train Control system shall call for imposition of penalty on the Contractor, equal to Rs. Two Lakh per such event. This provision will become effective section wise after 6 months of revenue operation of that section. The detrainment will be done under following scenario:

- Failure of onboard ATC system or any sub-system/module thereof such that train cannot move in ATP/ATO mode in any direction of travel
- Failure of onboard ATC equipment such that door authorization is not provided by ATP system in any direction of travel.
- Failure of wayside signalling system such that a train has to be terminated short and passengers are detrained.

The discretion of detrainment of passengers on account of any relevant failure rests solely with the Engineer and shall be final. The scenario for detrainment shall be

further developed during DLP.

1.3.5.2 Any break in power supply to Signalling & Train Control system, Telecommunication system and/or Automatic Fare Collection system, caused due to any failure of the UPS or associated sub-systems during the Defect Liability Period, may call for imposition of penalty of Rs. Two Lacs per such event on the Contractor.

1.3.6 Perturbation Analysis

1.3.6.1 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.

1.3.6.2 The service interruption analysis shall document all failure modes capable of causing revenue service disruptions.

1.3.6.3 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.

1.3.6.4 UPS system shall have an overall availability of better than 99.99%.

1.4 **Maintainability Requirements**

1.4.1 Systems and Equipment Design

1.4.1.1 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.

1.4.2 Mean Time To Restore

1.4.2.1 The maintainability measure for the Train Control and Signalling System shall be Mean Time To Restore (MTTR).

1.4.2.2 The required MTTR shall be achieved for failures of the whole System or any part of the System, whether service affecting or not.

1.4.2.3 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; and

(4) 15 minutes for equipment located in equipment rooms or control rooms.

1.4.2.4 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.

1.4.2.5 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.

1.4.2.6 The maintainability requirements of the Train Control and Signalling System shall be demonstrated by the Contractor in accordance with the processes defined in the Specification.

1.4.2.7 The UPS System shall be designed such that the MTTR figures for restoring the operation of the System from fault condition shall not be more than four hours (all inclusive).

1.4.2.8 The System shall be so designed as to avoid the need for a total shutdown for preventive maintenance. In the event that a total shutdown is inevitable, the preventive maintenance shall not require the System to be non-operational for more than two hours.

1.4.2.9 All components, materials, software and supports required for repair and servicing of the System shall be available throughout 10 years beyond the DLP

1.4.2.10 All line replaceable items should normally not exceed the size and weight, which an average individual person can handle.

1.4.3 Line Replaceable Unit Replacement

1.4.3.1 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).

1.4.3.2 The design of the system shall avoid as far as possible maintenance operations along the track. Consequently, the contractor shall avoid implementing along the track equipment that can fail or require regular maintenance/servicing.

1.4.4 Service Life

1.4.4.1 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, except the monitors, key boards, DMI which shall be available for at least 7 years.

1.4.4.2 All updated components shall be fully backward compatible with the originally installed component.

1.4.4.3 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.

1.5 **Safety Requirements**

1.5.1.1 The Train Control and Signalling System shall provide for the safe routing, spacing, movement and control of trains.

1.5.1.2 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.

1.5.2 The safety level of Primary Train Detection system realized with software, ATP system and Interlocking shall satisfy the SIL4 in IEC 61508 or equivalent safety level. Similarly the Secondary Train Detection system realized through Audio Frequency Track circuit or Axle counter shall be SIL4.

1.5.3 The Train Control and Signalling System shall not lead to an unsafe condition when the plug in module/ card/ equipment is taken out.

1.5.4 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.

1.5.5 The safety performance requirement shall be achieved with a calibration/ inspection interval of not less than 1 year.

1.5.6 The safety of the Train Control and Signalling System shall be demonstrated by the Contractor in accordance with the process defined in GS.

1.5.7 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.

1.6 **Service Capacity**

1.6.1 Service Capacity Requirements

1.6.1.1 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.

1.6.1.2 In degraded scenarios, single line operation i.e. bi-directional traffic on Up or Down line, may be resorted to on main running lines. The CBTC system shall be capable of catering to such requirements

1.6.2 Service Capacity Conditions

1.6.2.1 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 A of this PS.

(5) Tender drawings and Systems being provided by other Project Contractors.

1.6.3 Train Types

1.6.3.1 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

1.7 **Signalled Headway**

1.7.1 Notwithstanding the service capacity requirement above, the Train Control and Signalling System shall provide a minimum theoretical signalled headway of 90 seconds and an operational headway of 100 seconds on signalled routes between Aluva and Petta terminals, including turn back operation at the two terminal stations. This headway shall be measured on the line using the respective EMU performance for 3-car trains with 30-second dwells at intermediate stations and a minimum 2-minute layover at the terminal stations (minimum 30-second layover at stations when front crossover is used).

1.7.2 Not Used

1.7.3 The Signalled Headway requirement of the Train Control and Signalling System shall be demonstrated by the Contractor. 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.

1.7.4 The design headway shall be based on an average travel speed of 30kmph or higher with a station dwell time of 30-sec.

1.8 **Equipment Response Time**

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

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

1.8.3 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).

1.8.4 The time between the OCC initiating the command at the ATS workstation, and the trainborne ATC commanding the application of the brakes shall be less than 3 seconds.

1.8.5 The time necessary to the initialization of a sub-system (trackside ATC, trainborne ATC, interlocking, track to train transmission, train detection) shall be as short as possible and no greater than 40 seconds.

1.8.6 The Contractor shall outline any significant variance from the usual parameters of IEEE standard 1474.1 Annex C concerning speed, distance and equipment response times, and justify their innocuousness on overall performance requirements.

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

1.9 **Station Stopping**

1.9.1 Stopping Position

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

1.9.2 Stopping Accuracy

1.9.2.1 All trains in ATO mode shall stop within ± 300 mm for 99.98% of station stops.

1.9.2.2 When a train is stopped within ± 300 mm of the Stopping Position and proved to be stationary, it is said to be “docked”.

1.9.2.3 These stopping accuracy requirements shall be achieved with a 1% soap solution sprayed on the surface of the rails throughout the braking distance.

1.9.3 Door opening authorisation in ATP mode

1.9.3.1 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.

1.9.3.2 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; 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.

1.10 **Recoverability**

1.10.1 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.

1.10.2 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.

1.10.3 The Contractor shall demonstrate that the Train Control and Signalling System can recover delays to scheduled train service

1.10.4 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, shall be recovered within 20 minutes. Recovery, in this context, shall be defined as all trains operating to a constant required headway, within the configurable tolerance (e.g. dwell time), subject to review by the Employer's Engineer.

1.10.5 **Bi-Directional Running**

1.10.5.1 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/ATO mode of the train running.

1.10.5.2 The bi-directional running requirement shall be demonstrated by the Contractor.

1.10.6 **Degraded Operation Modes**

1.10.6.1 The normal mode of operation for trains equipped for ATP Mode shall be ATO Mode

1.10.6.2 In the event of failure, ATO mode degrades to ATP mode. In the event of ATP failure, ATP Mode degrades to ROS Mode after stopping of train and a conscious action of the train operator of pressing the ROS button.

1.10.6.3 An alarm indication shall be provided within the train operator cab to indicate degraded mode of operation.

1.10.6.4 The degraded operation performance requirements shall be demonstrated as specified in Chapter 5 of this PS.

1.11 **Ride Quality**

1.11.1 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 theheadway and capacity requirements.

1.11.2 The Train Control and Signalling System shall ensure that the jerk limit (0.75 m/s^3) specified for the EMU consist is not exceeded.

1.12 **Electro-magnetic Compatibility**

1.12.1 This Paragraph defines the minimum Electro-magnetic compatibility (EMC) requirements for all electronic and electrical equipment supplied under this Contract. For the 750 V DC traction area, the contractor shall follow EN50121 (Part 1 to 5) or better. The following standards and documents are also applicable, in addition to the reference documents and standards given in the GS:

(1) EU Directive on EMC (89/336/EEC);

(2) European Generic Emission Standard - Part 2: Industrial Environment EN50081-2.

1.12.2 EMC control plan shall be submitted by the Contractor for review by the Employer's Engineer.

1.12.3 The EMC control plan 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.

1.12.4 The plan shall specify basic protective measures proposed for all electrical and electronic subsystems and components and specific measures to be adopted for the selected subsystems and components.

1.12.5 The plan shall analyse EMI/ EMC impacts on the design of the Train control and signalling system including train-borne equipment , trackside equipment and bidirectional train to wayside data communication as well as the general environment. Particular attention should also be paid to additional requirements in grounding, bonding, shielding, filtering and cabling arrangements.

1.12.6 The Contractor shall co-ordinate with Project Contractors and ensure 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.

1.12.7 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.

1.13 **EMC Tests**

1.13.1 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

1.13.2 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)

1.13.2.1 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).

1.13.3 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
(3) Psophometrically weighted transverse voltage 1mV

1.13.4 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.

1.13.5 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.

1.13.6 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

1.13.7 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.

1.13.8 Fast Transient Burst

In regard of fast transient burst, equipment supplied shall be tested to 2 kV peak in accordance with IEC61000-4-4.

1.13.9 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.

1.13.10 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.

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

1.13.12 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.

1.14 **Off-the-shelf Products**

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

1.15 **Inter System EMC**

1.15.1 The contractor shall ensure that all the Train control & Signalling equipment 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.

1.16 **Intra System EMC**

1.16.1 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.

1.16.2 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.

1.17 **Safety-related systems interference**

1.17.1 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, of radiated conform to 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.

1.18 **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.

Additionally, protection from external sources such as Bluetooth and wi-fi must be assured by adopting appropriate security layers and/or advanced encryption or other methods as prescribed in the relevant standards.

(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 the Metro grounding system as well as electrolytic weakening of underground structures should be considered wherever applicable.

1.19 **Installation and Mitigation Guidelines for Cabling**

1.19.1 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 and EN 50343 wherever possible.

1.19.2 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.

2 DESIGN REQUIREMENTS

2.1 General

2.1.1 The design 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 of S&T contract. In case of conflict between any of them the contractor shall seek the advice of Employer's Engineer.

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

2.1.3 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.

2.1.4 No Single point failure shall cause the failure of an equipment or sub system of the Train Control & Signalling system.

2.2 **Design Process**

2.2.1 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.

2.3 **Software Requirements**

2.3.1 General

2.3.1.1 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 5.3.3.2 (8) below shall be fulfilled.

2.3.1.2 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.

2.3.1.3 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.

2.3.2 Security

2.3.2.1 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.

2.3.2.2 All software delivered to site shall be accompanied by evidence that demonstrates the media is free of viruses.

2.3.3 Software & System Design, Verification & Validation Standards with Complete Verification and validation Documents

2.3.3.1 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.

2.3.3.2 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

2.4 **System Safety Design Requirements**

2.4.1 System Safety Objectives

2.4.1.1 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

2.4.2 System Safety design

The system safety design requirements 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.

2.4.3 System Safety Engineering

2.4.3.1 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.

2.4.3.2 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.

2.4.3.3 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. The contractor shall submit report that the safety of Train Detection, ATC system with CBTC and interlocking system meet SIL4.

2.4.3.4 Development process of ATS and ATO systems shall be designed, manufactured and validated to 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).

2.4.3.5 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.

2.4.3.6 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 train detection due to any reason when a train operator is to be authorized to pass a signal at red/ blank.

2.4.3.7 CBTC user interfaces for ATO/ATP/RM mode of operation shall be included for hazard analyses as defined in Para 5.4.1.1 (2). The hazard analyses shall take into account the following as a minimum:

a) Probability of safety related commands not being executed when initiated by a CBTC user
b) Probability of the CBTC system prematurely removing safety-related commands initiated by a CBTC user
b) Probability of the CBTC system executing safety-related commands that were not initiated by a CBTC user
c) Probability of incorrect information being displayed by the CBTC system to the CBTC user.

2.5 **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 Work'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 5.3.3.2 above, for all the subsystems including but not limited to Trackside ATP, On board ATP, CBI, Train detection system, Bidirectional train to wayside data communication system, ATO and 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, Train detection system, Bidirectional train to wayside data communication system, ATO and 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.

2.6 **Trackside Equipment**

2.6.1 General

2.6.1.1 All trackside equipment shall be verified against the structure gauge and submitted for the Employer's Engineer review. Kochi Metro Rail Schedule of Dimensions (SoD) shall be followed for the structure gauge.

2.6.1.2 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.

2.6.2 Rail Connections

2.6.2.1 All connections to the rail shall be suitably welded (thermo welding or pin brazing technology) to give resistance & corrosion free smooth contact. The rail welding material shall confirm to IRS: S103-2004 or the latest.

2.6.2.2 Prior to the selection of the connection, the Contractor shall demonstrate the reliability and maintainability of its chosen method. In meeting these criteria, the Contractor shall provided 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.

2.7 **Environmental**

2.7.1 All Train Control & Signalling equipment shall be suitable for the environmental conditions of Kochi.

2.7.2 All Train Control and Signalling System equipment shall operate correctly to the environmental conditions broadly as per IS: 9000 & other specifications herein.

2.7.3 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.

2.7.4 The Train Control and Signalling System shall be able to withstand following the environmental conditions stipulated below:

2.7.4.1 Temperature

(1) Trainborne equipment: 0°C to 70°C;
(2) Trackside equipment: 0°C to 70°C;
(3) CER and SER equipment:
(4) Control room 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

2.7.4.2 Humidity

(1) Trainborne equipment:
(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).

2.7.4.3 All UPS equipment shall be capable of withstanding any combination of the following external environmental conditions:

(1) Operating ambient temperature: 0°C to 50°C
(2) Relative humidity: Up to 95 %
(3) Storage temperature: 0°C to 70°C

2.7.4.4 The UPS equipment shall be designed to provide rated output at 40°C.

2.8 **Shock and Vibration**

2.8.1 All Train Control and Signalling equipment shall be protected from damage or reliability degradation due to shock or vibration.

2.8.2 Vibration and Shock (sinusoidal and random): The vibration and shock requirements will conform to the ranges and classification contained in IEC721.

2.9 **Applicable Standards**

2.9.1 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.

2.10 **Design Documentation**

2.10.1 The Contractor shall, in addition to the documentation requirements specified in the GS, supply, as a minimum, the following hardware and software design documentation:

(1) Conceptual design specifications, details and drawings;

(2) Preliminary design specifications, Software and system verification and validation standards, Signalling plans with final location of signals, Earthing and lightening protection plan, Specifications for Indoor and Lineside 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

(3) Final design specifications, details and drawings including Complete Specifications for various sub-systems e.g. CBI, ATP, ATO, ATS, Point

Machines, Train Detection, Train to Wayside communication devices, Radio and Data 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;
- 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 and numbering plan;
- Control table;
- Data preparation validation report;
- Signalling principles;
- Overall signalling principle report;
- Installation design;
- Systems Engineering Plan;
- Final System Assurance Plan; and

2.10.2 The submission of the above documentation shall be included in the Submission Programme specified in GS.

2.11 **Equipment Cabinet and Equipment Enclosure**

2.11.1 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.

2.11.2 The Contractor shall provide to the Employer, as a minimum, 3 keys per cabinet or equipment enclosure.

2.11.3 Sufficient ventilation shall be provided for the indoor equipment cabinets and enclosures in which active equipment are housed.

2.11.4 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.

2.11.5 All metallic cabinets/ parts shall be properly earthed.