



CHENNAI METRO RAIL LIMITED

CHENNAI METRO RAIL PROJECT PHASE - 1 EXTENSION

ADDENDUM - 1

TO BIDDING DOCUMENTS

for

CONTRACT ADC-03

Construction of Elevated Depot at Wimco Nagar including Architectural, Plumbing, RC Roofing, Signage, Auto Coach Washing Plant Control Rooms, Security rooms, Security Walls including Design of Temporary Works (scaffolding, staging etc.), Traffic Diversion, Utility Shifting and all Associated Works

Employer: Chennai Metro Rail Limited

Country: India

Project: Chennai Metro Rail Project Phase 1 – Extension

Loan Agreement No.: ID-P258

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GENERAL INFORMATION

CMRL Bank Account Details

Beneficiary name: M/s Chennai Metro Rail Limited

Bank: Corporation Bank, Ashok Nagar Branch, Chennai

Account no: 510341000054264

IFSC Code: CORP0000578

Loan agreement No. **ID-P258**

ADDENDUM TO PART-1: BIDDING PROCEDURES

S. No.	Clause of Bid Document	Original Clause	Revised Clause
A	Part 1		
A1.	Section II Bid Data Sheet	Bid Data Sheet ITB 19.1	Add the following at the end of ITB 19.1 The bank guarantee for the bid security amount shall be valid till 18 June 2018 or later

S. No.	Clause of Bid Document	Original Clause	Revised Clause
A2.	Section III Evaluation and Qualification Criteria	1.1.3 Equipment	Replace clause 1.1.3 Equipment entirely with the following.

1.1.3 Equipment

For ADC-03 package, the Bidder must demonstrate that it has the key equipment listed hereafter:

S. No.	Equipment Type and Characteristics	Minimum Number required
1	Hydraulic Rotary Piling Rigs	10 *
2	50 tonne Safe Working Load (SWL) Crane	2
3	Batching Plant (60 cum)	1
4	Batching Plant (30 cum)	1 #
5	Transit Mixers	16
6	Concrete Pump	4
7	Boom Placer	2
8	Automatic Bending and Cutting machinery for Reinforcement	1 \$
9	Tower Crane	2

- * 2 additional rigs may have to be deployed in case the employer asks for.
- # Batching plant 30m³/hr or tie-up with 3 alternate Ready Mix Concrete (RMC) plants with due approval from employer after award of work.
- \$ The successful bidder should either deploy the machine at the site/ yard or may give proof of deployment in case of out-sourcing the same after award of work.

The Bidder shall provide further details of proposed items of equipment using Form EQU in Section IV, Bidding Forms as well as copies of invoices and rental or lease agreement. Arrangement with RMC plant to provide concrete in the event of breakdown of the batching plant shall be furnished after award of work. 50% of the plant and machinery shall not be older than five years. The rest can be 5 to 8 years old and shall be certified by independent agencies from functional and environmental point of view. However, in case of frequent breakdowns, the employer shall insist on deploying plant and machinery not older than five years. In case of non-deployment of machinery, CMRL will hire the same and recover the cost from the contractor

S. No.	Clause of Bid Document	Original Clause	Revised Clause
A3.	Section III Evaluation and Qualification Criteria 2.4 Experience	<p>2.4.2 (b) Specific Construction Experience</p> <p>Minimum construction experience in the following key activities that has been satisfactorily and substantially completed in an urban context between 1st January 2012 and bid submission deadline</p> <p>(b1) <u>1000 mm</u> diameter or higher piling by using Rotary drilling rig for <u>20,000</u> running meters (RM) or more in a single contract.</p> <p>and</p> <p>(b2) Construction of One Metro Rail Depot Or Two Elevated Metro Stations Or One Railway Workshop Or One multi-storied building (6 stories & above) having a minimum overall built up area of 8,000m².</p>	<p>Replace 2.4.2 (b) Specific Construction Experience with the following</p> <p>Minimum construction experience in the following key activities that has been satisfactorily and substantially completed in an urban context between 1st January 2012 and bid submission deadline</p> <p>(b1) <u>800 mm</u> diameter or higher piling by using Rotary drilling rig for <u>13,000</u> running meters (RM) or more in a single contract.</p> <p>and</p> <p>(b2) Construction of One Metro Rail Depot Or Two Elevated Metro Stations Or One Railway Workshop Or One multi-storied building (6 stories & above) having a minimum overall built up area of 8,000m².</p>

S. No.	Clause of Bid Document	Original Clause	Revised Clause
A4.	Section IV Bidding Forms 1.7.2 Payment Schedule (BoQ)	Item C.5 Dynamic Load Tests on Piles/ Sonic Integrity Tests Low Strain Pile Integrity Tests	Replace the title with the following Item C.5 Dynamic Low Strain Pile Integrity Tests
A5.	Section IV Bidding Forms 1.7.3 Risks, Table 2	S. No. 11: Public assets protection/ relocation/ Utility diversion/ protection/ demolition and reinstatement Public assets relocation such as Bus stop/ Electrical wire/ Telephone cables/ poles, electrical poles/ lighting poles/ traffic signal or any other similar activity of minor nature, the Tenderer shall make necessary allowances in their price for safety in implementation of these activities in accordance to statutory and public authority guidelines.	Replace Item 11 with the following S. No. 11: Public assets protection/ relocation/ Utility diversion/ protection/ demolition and reinstatement Public assets relocation such as Bus stop/ Electrical wire/ Telephone cables/ poles, electrical poles/ lighting poles/ traffic signal or any other similar activity of minor nature, the Tenderer shall make necessary allowances in their price for safety in implementation of these activities in accordance to statutory and public authority guidelines. <u>All damages resulting out of contractor's work throughout the project duration shall be rectified by the contractor at his own risk and cost. Also, strengthening of roads, culverts, manholes etc. required for the transportation of girders, pre-cast elements and construction material/ equipment shall be deemed to be included in the quoted rates and shall not be paid for separately</u>
A6.	Section IV Bidding Forms	1.7.1 Pricing Summary	Add the following after note No. 3 4. For works that are executed under provisional sums, GST shall be reimbursed separately on production of proof of payment

S. No.	Clause of Bid Document	Original Clause	Revised Clause
A7.	Form of invitation of bids		Replace the Form of invitation of bids with the following

Form of Invitation for Bids

Date:

Loan Agreement N^o: ID-P258

IFB N^o: ADC-03

1. The *Chennai Metro Rail Limited (CMRL)* has applied for a loan from Japan International Cooperation Agency (JICA) towards the cost of *Chennai Metro Rail Project Phase 1 Extension*. It is intended that part of the proceeds of this loan will be applied to eligible payments under the contract for *Construction of Elevated Depot at Wimco Nagar including Architectural, Plumbing, RC Roofing, Signage, Auto Coach Washing Plant Control Rooms, Security rooms, Security Walls including Design of Temporary Works (scaffolding, staging etc.), Traffic Diversion, Utility Shifting and all Associated Works*.

2. The *Chennai Metro Rail Limited (CMRL)* now invites sealed Bids from eligible Bidders for the construction and completion of *Elevated Depot at Wimco Nagar including Architectural, Plumbing, RC Roofing, Signage, Auto Coach Washing Plant Control Rooms, Security rooms, Security Walls including Design of Temporary Works (scaffolding, staging etc.), Traffic Diversion, Utility Shifting and all Associated Works* (“the Works”).

3. Bidding will be conducted through procedures in accordance with the applicable Guidelines for Procurement under Japanese ODA Loans, and is open to all Bidders from eligible source countries, as defined in the Loan Agreement.

4. Interested eligible Bidders may obtain further information from the office of the **Additional General Manager (Contract Management)**

Chennai Metro Rail Limited, CMRL Depot,

Admin Building, Poonamallee High Road,

Koyambedu, Chennai 600 107

Tel no: +91-44-2379 2000, Extn. 22347

Fax. No.: +91-44-2379 2200

Email id: agmcm@cmrl.in

5. A complete set of Bidding Documents may be purchased by interested Bidders on the submission of a written application to the address above and upon payment of a non-refundable fee of *Rs. 50,000/- (Rupees Fifty Thousand Only)/ \$780 USD (Seven Hundred and Eighty US Dollars only) including GST from CMRL office in the form of Demand Draft (DD) drawn in favour of Chennai Metro Rail Limited payable at Chennai*

The Tender documents can be downloaded if so desired from the internet address www.chennaiemtorail.org. A non-refundable Tender submission fee of Rs. 40,000/- (Rupees Forty Thousand Only)/ \$625 USD (Six Hundred and Twenty Five US Dollars only) including GST in the form of Demand Draft (DD) drawn in favour of Chennai Metro Rail Limited payable at Chennai to be submitted along with the bid.

6. The provisions in the Instructions to Bidders and in the General Conditions of Contract are the provisions of the Standard Bidding Documents under Japanese ODA Loans for the Procurement of Works.

7. Bids must be delivered to the address above on or before *14.00 Hrs. on 22 November 2017* and must be accompanied by a security of *INR 5,31,20,577 (Indian Rupees Five Crores Thirty One Lakhs Twenty Thousand Five Hundred and Seventy Seven only) or USD 829,167 (Eight Hundred and Twenty Nine Thousand One Hundred and Sixty Seven US Dollar Only)* in the form of a Bank Guarantee.

8. Bids will be opened in the presence of Bidders' representatives who choose to attend at *14.30 Hrs. on 22 November 2017* at the following address.

*Additional General Manager (Contract Management)
Chennai Metro Rail Limited, CMRL Depot,
Admin Building, Poonamallee High Road,
Koyambedu, Chennai 600 107
Phone: +91-44-2379 2000, Extn. 22347
Facsimile: +91-44-2379 2200

Email: agmcm@cmrl.in*

S. No.	Clause of Bid Document	Original Clause	Revised Clause
A8.	Section II Bid Data Sheet ITB 22.1	Date: 15 November, 2017	Replace the date as follows Date: 22 November, 2017
A9.	Section II Bid Data Sheet ITB 25.1	Date: 15 November, 2017	Replace the date as follows Date: 22 November, 2017

ADDENDUM TO PART-2: WORKS REQUIREMENTS

B1.	Part 2 Section VI Volume 1 Employer's Requirements	Appendix-1 Work Areas	Add the below given details at the end of Appendix-1
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The contractor shall arrange land for casting yard, batching plant, site office, labour camp etc. at his own risk and cost. On the request of the bidder, CMRL may provide land on temporary basis for casting yard if available. Annual lease charges payable shall be 1% of the prevailing guideline value notified by the Government of Tamilnadu. The land is to be taken as is where-is basis. Levelling of land, boundary wall, internal roads, site security and P&M etc. shall be the responsibility of the contractor. While handing over the land back to CMRL, the land is to be cleared of all debris and construction materials

S. No.	Clause of Bid Document	Original Clause	Revised Clause
B2.	Part 2 Section VI Volume 1 Employer's Requirements	Appendix-2 Contract Key Dates	Replace the entire table 1) key dates and 2) key milestones for station rooms with the tables given below

Key date	No. of days from date of commencement	Details of Works to be completed
General		
KD 1	30	Submission of initial work programme, establishing site office, Mobilisation of key personnel and P&M, Mobilisation of 2 pile rigs
KD 2	45	Commissioning of batching plants
KD 3	60	Completion of barricading, traffic diversion and site preparation
KD 4	60	Completion of 100% mobilisation of the piling rigs
KD 5	75	Completion of 3 Nos. of initial pile load tests including approval of mix design and shifting of all utilities
KD 6	105	Completion of 100% of initial pile load tests
KD 7	120	Completion of drilling and concreting of first 50% piles
KD 8	135	Completion of 50% of security wall
KD 9	165	Concreting of first 50% of raft foundation
KD 10a	190	Completion of drilling and concreting of 100% piles
KD 10b	190	Completion of auto coach-washing plant foundation
KD 11	225	Concreting of 100% of raft foundation and pile caps
KD 12	240	Completion of 100% of first floor slab

Key date	No. of days from date of commencement	Details of Works to be completed
KD 13a	240	Completion of auto coach-washing plant first floor level slab
KD 13b	240	Completion of 100% of security wall and security rooms
KD 14	270	Completion of first 50% of deck slab
KD 15	285	Completion of architectural works at ground floor level to degree 2
KD 16a	330	Completion of 100% of deck slab and platform level slab
KD 16b	330	Completion of auto coach-washing plant terrace level slab
KD 16c	330	Completion of first 50% of depot roof
KD 17	360	Completion of architectural works of system rooms at ground and first floor to degree 3 (signalling lab, signalling store, AFC lab, AFC store, SER, TER, telecom lab, telecom store, ASS, SCADA for lab and store, UPS, HVAC services)
KD 18	390	Completion of 100% of the complete Roof
KD 19	420	Completion of Architectural Works at Platform and Deck Level to Degree 3 (SCR, EFO, Ticket office, TVM, DCC)
KD 20	450	Completion of Architectural Works at All Levels to Degree 4
KD 21	480	Completion of water treatment (WTP) and effluent treatment plant (ETP)
KD 22	500	Completion of Signage
KD 23	525	Issue of Taking over Certificate
KD 24	1270	Issue of Performance Certificate
Interfacing part		
KID 1	180	Space for ECV 102 contractor to execute Pier and Viaduct
KID 2a	285	Providing shared access on ground floor to MEP contractor
KID 2b	285	Providing shared access to RSS/ TSS/ ASS area on Ground Level
KID 3	330	Providing complete access to Auto Coach Wash area for other contractors
KID 4a	360	Providing complete access on ground floor to MEP contractor
KID 4b	360	Providing complete access to RSS/ TSS/ ASS area on Ground Level
KID 4c	360	Providing shared access on first floor to MEP contractor
KID 4d	360	Providing shared access to SER/ TER/ UPS area
KID 5	390	Providing shared access to track work contractor on Deck Level
KID 6a	420	Providing complete access to track work contractor on Deck Level
KID 6b	420	Providing shared access to traction and S&T contractors
KID 6c	420	Providing complete access to SER/ TER/ UPS area
KID 7	450	Providing complete access to traction and S&T contractors
KID 8	450	Providing complete access at all levels to MEP contractor

Key milestones for Station Rooms

Degree 1	Degree 2	Degree 3	Degree 4
Structure complete, clean, dry and all works area watertight and weatherproof	Earthing and bonding complete	Complete wall, ceiling and floor finishes	Louvres and grilles installed
	Contractor's Equipment removed	Complete wall plastering and painting	Complete handrails, balustrade and barriers

<p>Cast-in and concealed components complete</p> <p>Movement and expansion joints installed</p> <p>Partition walls complete with penetrations and plant delivery openings formed</p> <p>Plant plinths complete and survey accepted</p> <p>Complete floor screed</p> <p>Complete permanent framing for doors, hatches, and other openings</p> <p>Complete sealant for ceiling and floor</p>	<p>Temporary power and lighting available</p> <p>Suitable work and storage areas available for Interfacing Contractors</p> <p>Drainage system and discharge connection complete</p> <p>Survey reference lines available</p> <p>Lift shaft alignment, location of openings surveyed and accepted</p> <p>Temporary safety barrier at escalator landings and all openings</p>	<p>Complete raised floor, and false flooring except for locations where panels have to be installed after completion of works by the Interfacing Contractors</p> <p>Complete internal glazing</p> <p>Permanent doors and ironmongery installed</p> <p>Plumbing and Sanitary fittings complete and ready for testing</p>	<p>All openings and service penetrations sealed</p> <p>All works complete and ready for testing and commissioning</p>
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S. No.	Clause of Bid Document	Original Clause	Revised Clause
B3.	<p>Part 2 Section VI</p> <p>Volume 2 Technical Specifications</p>	<p>Part–A: Technical Specification for Civil Works</p> <p>Section – 1.4 Structural Concrete: Plain, Reinforced and Prestressed</p>	<p>Add the following specification at the end of Cl. 1.4.1.10 Fine Aggregates</p> <p><i>Manufactured sand if used should have particles in proper gradation to satisfy the requirements of IS: 383. Silt in crushed sand should not be more than 2%. Crushing shall be done using vertical shaft impactor or rotary compactor to minimise flakiness.</i></p>

S. No.	Clause of Bid Document	Original Clause	Revised Clause
B4.	<p>Part 2 Section VI</p> <p>Volume 2 Technical Specifications</p>	<p>Part–A: Technical Specification for Civil Works</p> <p>1.3.4 Piles</p>	<p>Replace the entire</p> <p>Section 1.3.4: Piles with the text given below</p>

1.3.4 Piles

Use of bentonite is not permitted to minimise environmental pollution.

1.3.4.1 General

1.3.4.1.1 Piling plant and Methods

Suggested method for piling is cast in situ-bored piles with hydraulic drilling rigs using partial depth casing with polymer drilling solution and oscillator arrangement.

- 1 Not less than 2 weeks before any piling work is commenced the Contractor shall submit to the Engineer for approval full details of his proposed piling plant and detailed method statements for carrying out the Works.

Details of casings and concreting methods in respect of bored cast in place concrete piles are to be provided.

- 2 The Contractor shall not commence any piling until the plant and methods which he proposes to use have been approved by the Engineer but such approval shall not relieve the Contractor from any of his obligations and responsibilities under the Contract. If for any reason the Contractor wishes to make any change in the plant and methods of working which have been approved by the Engineer, he shall not make any such change without having first obtained the Engineer approval thereof.
- 3 List and number of equipment and accessories proposed to be used for the present job shall be submitted along with the technical bid.
- 4 The contractor shall carryout trial probes and trial pits down to depths decided by the Engineer with the objective of locating underground utilities well in advance of the piling. The locations shall be decided by the Engineer after consultation with the contractor.

1.3.4.1.2 Records:

The Contractor shall keep complete records of all data required by the Engineer covering the fabrication, driving and installation of each pile and shall submit two signed copies of these records to the Engineer not later than noon of the next working day after installation of the piles.

1.3.4.1.3 Programme and Progress Report

- 1 The Contractor shall inform the Engineer each day of the programme of piling for the following day and shall give adequate notice of his intention to work outside normal hours and at weekends, where approved.
- 2 The Contractor shall submit to the Engineer on the first day of each week, or on such other date as the Engineer may decide, a progress report showing the rate of progress to that date and progress during the previous week or period of all main items of piling works, as required by the Engineer.

1.3.4.1.4 Setting Out

The Contractor shall establish and maintain permanent datum level points, base lines and grid lines to the satisfaction of the Engineer and shall set out with a suitable identifiable pin or marker the position of each pile. The setting out of each pile shall be agreed with the Engineer at least 8 working hours prior to commencing work on a pile and adequate notice for checking shall be given by the Contractor.

Notwithstanding such checking and agreement, the Contractor shall be responsible for the correct and proper setting out of the piles and for the correctness of the positions, levels.

- 1.3.4.1.5** After all piles are cast and weak concrete is chipped out the Contractor shall submit the drawing showing the exact location of piles with respect to the column centre line.

1.3.4.1.6 Disturbances and Noise

1. The Contractor shall carry out the piling work in such a manner and at such times as to minimise noise and disturbance.
2. The Contractor shall take precautions adequate enough to avoid damage to existing services and adjacent structures. Fig. 1 of IS 2974 (Part 1) may be used as a guide for studying qualitatively the effect of vibration of persons and structures. In case of deep excavation adjacent to piles, proper shoring or other suitable arrangement shall be done to guard against the lateral movement of soil stratum or releasing the confining soil stress. Reference may be made to BS 5573 for safety precautions in the construction of large diameter bored piles. Any such damage shall be repaired by the contractor to the satisfaction of the Engineer.
3. The Contractor shall ensure that damage does not occur to complete piling works and shall submit to the Engineer for approval his proposed sequence and timing for driving or boring piles having regard to the avoidance of damage to adjacent piles.

1.3.4.1.7 Obstructions

If during the execution of the Works the Contractor encounters obstructions in the ground, he shall forthwith notify the Engineer accordingly, submit to him details of proposed methods for overcoming the obstruction and proceed according to the Engineer instructions.

1.3.4.2 Scope of Work

1. These specifications cover the works of providing pile foundations. Work included consists of all necessary services and furnishing of all labour material, tools, equipment and related items for the full and satisfactory performance of the contract, conforming to these specifications and as shown in the Contract Drawings or reasonably implied therein or any authorised conditions or alterations thereof.
2. The tenderer is advised to visit the site and familiarise himself with the conditions at site. The Engineer shall not be held responsible for the accuracy of the soil data, furnished in good faith with the tender.
3. The construction of piles shall be in accordance with the following Indian Standard Codes of Practice for Design and Construction of Pile Foundations:
IS 2911: 2010 Part I, Section 2 Bored Cast in-situ Concrete Piles or IRC 78 Standard specifications and code of practice for road bridges Foundation and Substructure
4. With the tender, the Contractor shall submit the detailed method of construction to be used. For cast-in-situ concrete piles the Contractor shall indicate the methods he proposes to concrete the piles to prevent necking of piles.
5. The Contractor shall quote rates as detailed in the Schedule of Quantities and Rates. In particular:
 - a) For piles, the rate quoted shall be for per meter of pile. The actual length of piles will be determined from site conditions and load test results after work begins.
 - b) In case the load tests and actual site conditions reveal that the piles proposed do not, in the opinion of the Engineer provide a satisfactory and economical foundation the Engineer in his sole and absolute discretion shall have power to revise the pile layout, pile diameter, pile location etc.
- 6) The items of work will generally be as follows:

- a) Boring/ drilling including provision of temporary casing.
- b) Supplying, fabrication, and placement of all reinforcing bars.
- c) Casting of concrete piles as per specifications.
- d) Load testing of piles.

1.3.4.3 Materials

1.3.4.3.1 General:

Unless otherwise specified in this section all materials shall conform to the requirements specified in separate sections for Concrete, Formwork and Reinforcement.

1.3.4.3.2 Cement:

The cement to be used for piling and all foundation work shall be conforming to Indian Standard Specifications “IS: 455 Specification for Portland Slag Cement”. The Cement shall be free from lumps and caking.

1.3.4.3.3 Concrete Mix Design:

The concrete shall be as per respective design drawings and BOQ. The maximum size of coarse aggregate shall not exceed 20mm. For cast-in-situ piles concrete with a slump of 150 to 175mm (consistent with the method of concreting) will be required. For slump more than 150mm the workability should be tested by “determination of flow” as per IS 9103. Minimum cement contents for design mix shall not be less than 400 kg/m³ of concrete in piling.

The contractor shall submit mix design calculations and get the same approved by the engineer well before the starting of installation of piles and carry out adequate numbers of tests to ensure the minimum specified strength as indicated in drawings.

1.3.4.3.4 Concrete Cube Tests

Concrete cubes shall be cast, tested and evaluated as specified in IS codes.

1.3.4.3.5 Reinforcement

- a) The reinforcement shall conform to the requirements specified in Section 6 extending for the full length of the pile and shall project 60 times bar diameters above the cut off level or as specified in the drawing. Only circular concrete cover blocks threaded on to the helix shall be used for ensuring the specified cover.
- b) Joints in main longitudinal bars will be permitted only where, in the opinion of the Engineer, each bar cannot be supplied in one complete length. Where permitted, joints shall be provided at agreed centres, designed to develop the full strength of the bar across the joint, provided with adequate extra links or stirrups and staggered in position from those of adjacent longitudinal bars, all to the approval of the Engineer.
- c) All main longitudinal bars shall be tack weld at lapping if any and to the pile cap reinforcement. The last one circle of helical stirrups at each end shall be welded to main longitudinal bars. Any extra tack welding required for handling and lowering of cage in borehole shall be done by the contractor at no extra cost.

1.3.4.3.6 Casings and Tremie Pipes

The casings and tremie pipes shall be in mild steel. The temporary casing plates and permanent liners shall have adequate wall thickness and strength to withstand driving stresses,

stresses due to soil pressure, etc. Without damage or distortion all joints shall be water tight. The internal diameter of the casing shall not be less than the nominal diameter of pile.

1.3.4.4 Cast In-Situ Bored Piles

1.3.4.4.1 General

- a) Diameters of the piles shall be the concrete shaft diameters and shall not be less than the diameters specified in the drawing.
- b) These shall be formed by boring to the founding strata specified on the drawings or as directed at site. The sides of the boring shall be prevented from collapsing by one of the following:
 - permanent mild steel liner (cased pile)
 - removable mild steel casing (uncased pile)
- c) Piles shall be constructed in a sequence approved by the Engineer. During boring, the Contractor shall, where required by the Engineer, take soil, rock or ground water samples and transport them to an approved testing laboratory or carry out soil tests as directed.
- d) The method adopted shall be chosen giving due consideration to the subsoil data, ground water conditions and to the other relevant conditions at site as well as to the presence of adjacent structures.
- e) The bottom of the steel lining shall be sufficiently in advance of the boring tool to prevent settlement of outside soil and formation of cavities.
- f) Removable mild steel casings shall be used only with extreme caution. Individual casings shall be joined together by screwing or any other approved method and not by direct butting with external lug connections. The inner surface of casings shall be smooth and free of all internal projections.

1.3.4.4.2 Boring

- a) Boring shall be done using hydraulic drilling rigs with oscillator arrangement suiting to different kinds of strata encountered.
- b) As a general guideline, size of cutting tool shall in no case be less than the diameter of the pile minus 75mm. However the size of cutting tool shall be chosen by contractor depending on the type of substrata and equipment employed by contractor so that executable pile shall not have diameter less than nominal diameter of pile as specified in drawing. The contractor shall also ensure that there is no reduction in poured concrete quantities. These calculations shall be based on consumption of concrete poured in bore (as recorded in pour log) and actual concrete required in bore on theoretical basis i.e. based on nominal diameter of pile and actual bore hole length (based on actual sounding of founding level). Above 5% reduction in consumption of poured concrete quantities in pile may be rejected. In general piling shall be done by using hydraulic rig with temporary liner. Use of liner for top 4 to 6 metres from ground level or more depth, to protect loose soil falling in bore hole) as directed by engineer, is essential. No extra payment shall be made to the contractor for using temporary liner, over the item of piling as in BOQ.
- c) Use of polymer drilling solution in stabilizing sides of the pile borehole may also be necessary together with temporary or permanent casing wherever sub soil and ground water conditions are likely to cause mud flows or instability of pile bore or sand boiling. However, this will be permitted only when deemed necessary by the Engineer.

The properties of polymer drilling solution used and quality control shall be as per requirement given below.

Polymer drilling solution shall satisfy the following properties at all times

Property of Slurry (units)	Requirement	Test Method (API Standard Method)
Density (g/cc)	< 1.0252	Mud Weight Density Balance (API 13B-1)
Viscosity (marsh cone viscosity for 946cc approximately)	32 to 135*	Marsh Funnel and Cup (API 13B-1)
pH	8 to 11.5	Glass electrode pH meter or pH paper strips
Sand content immediately prior to concrete placement (% by volume)	< 1.0 %	Sand Content (API 13B-1)

* Marsh Cone viscosity to be preferred to be maintained between 40 and 48 seconds, though AASHTO guidelines define the range to be 32-150 seconds.

When using polymer drilling solution, flushing shall be done after the lowering of the reinforcement cage and tremie before starting of concreting with fresh polymer drilling solution. No extra payment will be given for polymer drilling solution.

When borehole is stabilised by casing and drilling solution or by maintaining water head using temporary/ permanent casing, the bottom of the hole shall be cleaned very carefully before concreting work is taken up. Cleaning/ flushing methodology shall be submitted and got approved by the engineer prior to commencement of piling.

Where mud flow conditions exist or the aggressive action of ground water is to be avoided, or in the case of piles built in water or in cases where significant length of piles could be exposed due to scour – the casing should be left permanently in the ground with 8 mm thick permanent liners as directed by Engineer-in-charge.

The quantum of steel required in liners up to depth of cut off level shall be measured as per drawing though the liner might have been provided right from the level of the working platform on practical considerations, since the length of the permanent liner above the cut-off level has to be necessarily removed by gas-cutting for facilitating peeling of the top portion of the pile and for interlacing its reinforcement bars into the capping slab. There is however, no objection if the surplus pieces (if cut and removed carefully and then found reusable) are joined and are re-welded to required length for reuse in the same contract on some of the other piles. No claim shall be entertained for such pieces if the cut pieces cannot be reused by the Contractor in the aforesaid manner.

- d) Pumping from bore hole shall not be permitted unless a casing has been driven into a stable stratum which prevents flow of external ground water from other strata in significant quantities.
- e) In case of end bearing piles founded on rock, cutting of rock by hydraulic rig using diamond bits will be resorted to. Scheme adopted shall be such that noise and vibration parameters specified in tender document/ environment manual are not violated. Drilling in rock shall be carried out by hydraulic rig using diamond bits.
- f) On completion of boring, loose disturbed or remoulded soil shall be removed from the base of bore.

Penalty on mishandling of polymer drilling solution

Mishandling of polymer drilling solution (like splashing of polymer drilling solution outside specified width of barricading or non-cleaning of tyres of dumpers and transit mixers before

leaving the piling site thereby making the road dirty etc.) is strictly prohibited. Non-compliance of same shall attract a penalty as follows:

- i) On first observation – Rs. 25,000
- ii) On Second observation – Rs. 50,000
- iii) On third and each subsequent observation – Rs. 100,000

The polymer drilling solution should be environment friendly and approved by the Engineer. Upon the completion of the job, the contaminated polymer solution should be chemically treated and disposed. No additional cost is payable for safety and proper disposal of the used polymer solution.

1.3.4.4.3 Concreting

- a) Prolonged delays in the commencement of concreting after the completion of the boring shall not be permitted. The time interval between the completion of boring and placing of concrete shall not exceed 6 hour.
- b) The concrete shall have a minimum slump of 150mm in case of concreting in a water-free bore. Suitable precautions shall be taken for prevention of segregation. Internal vibrators shall not be used unless the Contractor is satisfied that segregation will not result because of vibration and unless the method of use has been approved by the Engineer.
- c) The concrete for piles underwater or in drilling mud shall be placed with a tremie pipe. The tremie pipe shall not be less than 200mm diameter for 20mm aggregate. The joint between the hopper and tremie pipe as well as the joints in the tremie pipe shall be water tight and the tremie pipes shall be thoroughly cleaned after each use. The concrete shall have a minimum slump of 150mm.

It is essential that the water level within the pile bore be in equilibrium before commencement of concreting.
- d) The Contractor shall ensure that heavily contaminated drilling solution has not accumulated at the base of boring since this could impair free flow of concrete from the tremie pipe.
- e) If the specific gravity of the drilling solution at the base of the bore exceeds 1.20 the placing of concrete shall not proceed.
- f) The first charge of concrete shall be placed in the hopper over a sliding plate of the bottom of the hopper. The charge should be adequate in volume to ensure flushing action to prevent mixing of water or drilling mud and concrete. Alternatively, floating plugs of approved specification may be used before the first charge of concrete.
- g) The tremie pipe shall at all times penetrate the previously placed concrete with adequate margin against accidental withdrawal. The tremie pipe shall not be withdrawn until the completion of concreting. At all times a sufficient quantity of concrete shall be maintained within the pipe to ensure that the pressure from it exceeds that from the seepage water.
- h) Spot measurements shall be taken at suitable intervals to check that the tremie pipe has an adequate penetration into previous concrete.
- i) Concreting of the pile shall be in one single and continuous operation. In case of long piles of large diameter, large size mixers or more mixers shall be used so that the entire concreting operation is completed in not more than six hours after termination of the bore.

- j) The top of concrete in a pile shall be brought above the cut-off level since the top concrete is loose and is weak because of contamination with water/drilling mud. This ensures good concrete at the cut-off level.
- k) Cut off level (COL)
Cut off level of piles shall be indicated in working drawings or as indicated by Engineer.
The top of concrete in pile shall be brought above the cut off level to remove all laitance and weak concrete and to ensure good concrete at cut off level.
As general guidelines, for cut off level up to 1.5m below working level, the concrete shall be cast 500mm above COL. In the circumstance where COL is below ground water level, the need to maintain a pressure should be observed and accordingly length of extra concrete above COL shall be determined by the Contractor and approval of Engineer obtained before concreting.
In case of concrete being placed by tremie method and pile cut off level less than 1meter below the ground level, concrete shall be cast to the piling platform level to permit overflow of concrete for visual inspection. In case COL of pile is more than 1meter below working level then concrete shall be cast to a minimum of one meter above COL. Before concreting contractor shall obtain the approval of the Engineer of the height above COL up to which the concrete is to cast.
Any defective concrete in the head of the completed pile shall be cut away and made good with new concrete.
- l) When a casing is being extracted a sufficient quantity of concrete shall be maintained within the bore to ensure the pressure from external ground water and soil is adequately exceeded by the pressure of concrete. Otherwise necking of the pile may result. A minimum embedment of 1.5 to 1.8m is required.
- m) No concreting shall be placed in the bore once the bottom of the casing has been lifted above the top of concrete.
- n) After each pile has been cast any empty bore shall be protected and carefully backfilled as soon as possible with approved materials.
- o) Complete boring and concreting records shall be submitted to the Engineer for each pile. The records shall include the duration of concreting, tremie lengths (individual and cumulative), tremie pipe lengths removed, theoretical sounding, actual sounding, actual lengths of pile concreted and the volume of concrete placed, cut off level, founding levels etc. For piles with temporary casings records of sequence of casing withdrawal and levels of concrete before and after withdrawal shall also be included in the reports.

1.3.4.5 Alignment of Piles

- 1) Piles shall be installed as accurately as possible according to the drawings either vertically or to the specified batter. All deviations will be measured at the cut off level of the piles. The deviation from the true axis shall not be more than 1.5% for vertical piles and 4% for rake piles. Piles should not deviate in location by more than 75mm when used in groups. For single or 2 piles used under columns, deviation shall not be more than 50mm. Particular precautions during construction shall be taken by the Contractor in the case of monopile to comply with the alignment criteria.
- 2) The Contractor shall maintain a record of actual pile locations in the form of drawing and submit the information to the Engineer at suitable intervals.

1.3.4.6 Pile Cap

Pile caps shall be of reinforced concrete. If the pile cap is in contact with earth at the bottom, a levelling course shall be provided as shown in the drawings.

The attachment of the pile head to the cap shall be adequate for the transmission of loads and forces. A portion of pile top may be stripped of concrete and the reinforcement anchored into the cap. Manual chipping may be permitted after three days of pile casting while pneumatic tools for chipping shall not be used before seven days after pile casting. The top of pile after stripping shall project at least 150mm into the pile cap. Concreting of the pile cap shall be carried out in dry conditions. All the operations and tools required for making the pile in dry condition is included in the item.

1.3.4.7 Testing of Piles

- 1) The load tests shall be in accordance with the Indian Standard Code of Practice for Design and Construction of Pile Foundations IS 2911 (Part IV) For initial load test, test load will be 2.5 times the theoretical designed capacity of pile. For initial load, test arrangement to be designed shall also cater for additional 25% above test load and nothing extra will be paid on this account. Permissible stresses in test arrangement (steel truss or plate girder) to cater for test load plus additional 25% load shall be within permissible stresses as per IS: 800 (as for permanent structure). For test frame, steel of Grade –B conforming to IS: 2062 shall be used.
- 2) Engineer will decide the locations of initial and routine horizontal and vertical load tests to be performed in different zones depending on variation in substrata. Number of initial pile load tests shall be as indicated in BOQ item. The contractor shall undertake test piles required for initial pile load test in the initial stages of work using the same methodology and equipment's which will be subsequently used for working piles. These tests shall be undertaken well in advance of working pile. No working pile would be allowed to undertaken till initial satisfactory initial pile load tests have been completed. Non-granting of permission for pile/ pile cap by Engineer in such respect will not be considered as reason for delay or any claim thereof. The test arrangement to be employed shall be of nature which is quick to install and remove and easily transferable. Number of tests will be as indicated in BOQ.
- 3) Routine horizontal and vertical load tests are performed as a check on the load carrying capacity and settlements of the pile foundations.
- 4) The Contractor shall give the Engineer at least 48 hour notice of the commencement of construction of these piles which are to be subjected to Initial Tests.
- 5) The load tests shall not normally be conducted unless the concrete is at least 28 days old. However, in special circumstances, permission can be given by Engineer for prior testing.
- 6) All testing shall be done under the direction of experienced personnel conversant with the equipment and the testing procedure.
- 7) Before the commencement of the tests all the particulars regarding the test pile including boring data and concrete cube strengths shall be made available at site and shall form a part of the test report.
- 8) On completion of each load test the Contractor shall submit a report of the load test which shall include the following information.
 - a) Description of soil conditions, ground water table, actual boring and installation records, concrete cube test results.
 - b) Method of load application
 - c) Load settlement readings during loading and unloading

- d) Time load-settlement curve
 - e) All other observation relevant to the test being conducted.
- 9) Dynamic Low Strain Pile Integrity Tests:
- The low strain pile integrity tests using pile driving analyser or approved equivalent for pile integrity shall be performed on all the piles as indicated in BOQ. The top of the pile shall be made accessible, chipped off up to hard concrete, levelled by trimming it back as far as practicable. The reinforcing bars of the piles tested shall be bent sideways. The test shall be performed after removal of bad/ weak concrete at top so that the wave propagation is steady through hard concrete. The test shall be carried out at minimum 3 locations on each pile in such a way that the entire cross section of the pile is evenly covered. The test shall be conducted with a minimum age of concrete of 15 days. A specialist approved agency shall be employed for the test and the tests shall generally be as per recommendations of the agency unless directed by the Engineer. A complete report indicating the graphical display of wave propagation under each flow shall be submitted along with interpretation of results showing discontinuities, cross-sectional changes or material changes if any are to be co-related with site data.
- (a) Reporting
 - 1) The Contractor shall submit to the Employer's Representative the test results, associated interpretive report and certificate for each tested pile within 10 days of the completion of each test.
 - 2) The interpretation of test results shall be carried out by competent specialist engineers.
 - (b) Anomalies
 - 1) If any anomalies, which indicate unacceptable weaknesses in the concrete, are reported as a result of integrity testing, the Contractor shall perform core drilling for sampling and laboratory testing to prove if the quality and bearing capacity of the concrete are adequate. The program for necessary core drilling and testing shall be consented by the Employer's Representative.
 - 2) If such anomalies are shown to be detrimental to the performance of the pile, remedial measures shall be consented by the Employer's Representative and undertaken by the Contractor to rectify this.
 - 3) No covering over of the piles shall occur until the Employer's Representative is satisfied with the results of the testing and any remedial works.

1.3.4.8 Defective Piles

- 1) The Engineer reserves the right to reject any pile which in his opinion has not been constructed in accordance with the specifications.
- 2) The Contractor will not be paid for rejected piles. The increase in cost of the pile caps, tie beams and other measures adopted for strengthening as a result of rejection of defective piles shall be borne by the Contractor.

1.3.4.9 Mode of Measurement

- 1) The Contractor shall be paid for the length of each pile as measured from the theoretical founding level (as per drawing) to the point of the vertical cut-off level. Contractor's rate shall include all items of work including all temporary/ permanent arrangements for boring in soil and weathered rock, concreting, handling, formwork

and grouting for piles, including chipping of top weak concrete, removal of excavated earth away from site and polymer drilling solution slurry, chipped concrete etc. and all other items of work for the satisfactory completion of the pile foundations. Boring in hard rock will be measured and paid over and above the item as per BOQ. Reinforcement shall be measured and paid separately.

- 2) Pile load tests initial and routine shall be measured separately and paid for separately.
- 3) Each pile integrity test shall be measured and paid for separately.
- 4) The quantity of permanent steel liners required for the job shall be measured as per specifications and paid for separately. The rate includes costs of tools and plants, cutting, welding/riveting, cutting shoe etc. complete.

1.3.4.10As - Built Drawings

On completion of the work, the Contractor will submit a plan showing the exact location and length of each pile as constructed at site, as well as dates of concreting, cube test results etc. The drawing shall be submitted to the Engineer along with As-Built drawings as per contract

B5.	Part 2 Section VI Volume 2 Technical Specifications	Part-A: Technical Specification for Civil Works	Add the following Section 1.7.6 at the end of Section 1.7.5 Spacing, Supporting and Cleaning
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1.7.6 Anti-corrosive Coating

Steel reinforcement bars shall be coated with Inhibitor and Cement Slurry. This method developed by CECRI, Karaikudi consists of application of cement based inhibitor and sealing coat on reinforcement bars. The process of coating as follows.

(Process number 1 to 3 are required only for bars with loose rust scales)

1. De-rusting by dipping the rebars in pickling solution i.e. PROTMAX-DR Derusting Solution or equivalent having patent no. 465/CAL/75 for 30 minutes (pH of the solution is 1.04)
2. Removal from acid tank and dipping in alkaline tank to neutralize and cleaning with potable water for 2 minutes.
3. Application of phosphate jelly coat (Patent no.109897) by a fibre brush and drying for 45-60 minutes (pH of the jelly is 2.5).
4. Application of inhibitor solution A i.e. PROTMAX-ICS Inhibitor Solution or equivalent having patent no.109784/67 for 2 minutes by brushing/ dipping.
5. Application of first coat of cement slurry coating with inhibitor solution A by brushing.
6. Air drying for 24 hours.
7. Application of first coat of sealing solution B i.e. PROTMAX-SS Sealing Solution or equivalent having Patent no.112440/67 for 2 minutes by brushing/ dipping.
8. Application of 2nd coat of cement slurry solution A for 2 minutes.
9. Air drying for 24 hours

10. Another coat of sealing solution B and drying for 4 hours.
11. Application of 3rd coat of sealing solution B for 2 minutes
12. Air drying for 4 hours.

The treatment of rods must be done after the bars are cut and bent to shape. Detailed specification regarding quality control aspect and chemicals/ solution used in the process may be obtained from Central Electrochemical Research Institute (CECRI) Karaikudi.

Inspection and testing: Coated rebars shall be checked for minimum average dry film thickness, uniformity of thickness, defects such as cracks, peeling, bulging and uncoated areas etc. using SSPC-PA2 method or any other method approved by engineer-in-charge. Coating shall be tested for adhesion, bond strength, abrasion resistance, chemical resistance as per specifications laid down by the manufacturer.

ADDENDUM TO PART-3: CONDITIONS OF CONTRACT AND CONTRACT FORMS

S. No.	Clause of Bid Document	Original Clause	Revised Clause
C	Part 3 Section VIII. Particular Conditions (Part A: Contract Data)	Table: Summary of Delay Damages as per clause 8.7 of GC	Replace the entire Table: Summary of Delay Damages as per clause 8.7 of GC with the following table

Key date	No. of days from date of commencement	Details of Works to be completed	Delay damages per day (INR)
General			
KD 1	30	Submission of initial work programme, establishing site office, Mobilisation of key personnel and P&M, Mobilisation of 2 pile rigs	40,000
KD 2	45	Commissioning of batching plants	40,000
KD 3	60	Completion of barricading, traffic diversion and site preparation	40,000
KD 4	60	Completion of 100% mobilisation of the piling rigs	1,50,000
KD 5	75	Completion of 3 Nos. of initial pile load tests including approval of mix design and shifting of all utilities	1,50,000
KD 6	105	Completion of 100% of initial pile load tests	1,50,000
KD 7	120	Completion of drilling and concreting of first 50% piles	1,50,000
KD 8	135	Completion of 50% of security wall	1,50,000
KD 9	165	Concreting of first 50% of raft foundation	1,50,000
KD 10a	190	Completion of drilling and concreting of 100% piles	1,50,000
KD 10b	190	Completion of auto coach-washing plant foundation	1,50,000
KD 11	225	Concreting of 100% of raft foundation and pile caps	1,50,000
KD 12	240	Completion of 100% of first floor slab	1,50,000
KD 13a	240	Completion of auto coach-washing plant first floor level slab	1,50,000
KD 13b	240	Completion of 100% of security wall and security rooms	1,50,000
KD 14	270	Completion of first 50% of deck slab	1,50,000
KD 15	285	Completion of architectural works at ground floor level to degree 2	1,50,000
KD 16a	330	Completion of 100% of deck slab and platform level slab	1,50,000

Key date	No. of days from date of commencement	Details of Works to be completed	Delay damages per day (INR)
KD 16b	330	Completion of auto coach-washing plant terrace level slab	1,50,000
KD 16c	330	Completion of first 50% of depot roof	1,50,000
KD 17	360	Completion of architectural works of system rooms at ground and first floor to degree 3 (signalling lab, signalling store, AFC lab, AFC store, SER, TER, telecom lab, telecom store, ASS, SCADA for lab and store, UPS, HVAC services)	1,50,000
KD 18	390	Completion of 100% of the complete Roof	1,50,000
KD 19	420	Completion of Architectural Works at Platform and Deck Level to Degree 3 (SCR, EFO, Ticket office, TVM, DCC)	1,50,000
KD 20	450	Completion of Architectural Works at All Levels to Degree 4	1,50,000
KD 21	480	Completion of water treatment (WTP) and effluent treatment plant (ETP)	1,50,000
KD 22	500	Completion of Signage	1,50,000
KD 23	525	Issue of Taking over Certificate	0.05% of the contract value per day of delay in completing the entire works
KD 24	1270	Issue of Performance Certificate	
Interfacing part			
KID 1	180	Space for ECV 102 contractor to execute Pier and Viaduct	5,00,000
KID 2a	285	Providing shared access on ground floor to MEP contractor	5,00,000
KID 2b	285	Providing shared access to RSS/ TSS/ ASS area on Ground Level	5,00,000
KID 3	330	Providing complete access to Auto Coach Wash area for other contractors	5,00,000
KID 4a	360	Providing complete access on ground floor to MEP contractor	5,00,000
KID 4b	360	Providing complete access to RSS/ TSS/ ASS area on Ground Level	5,00,000
KID 4c	360	Providing shared access on first floor to MEP contractor	5,00,000
KID 4d	360	Providing shared access to SER/ TER/ UPS area	5,00,000
KID 5	390	Providing shared access to track work contractor on Deck Level	5,00,000
KID 6a	420	Providing complete access to track work contractor on Deck Level	5,00,000
KID 6b	420	Providing shared access to traction and S&T	5,00,000

Key date	No. of days from date of commencement	Details of Works to be completed	Delay damages per day (INR)
		contractors	
KID 6c	420	Providing complete access to SER/ TER/ UPS area	5,00,000
KID 7	450	Providing complete access to traction and S&T contractors	5,00,000
KID 8	450	Providing complete access at all levels to MEP contractor	5,00,000