

SECTION 8A PART 1 EMPLOYERS REQUIREMENT**GENERAL INFORMATION & SCOPE OF WORK****NAME OF THE WORK**

Construction of Permanent Boundary wall around the depot of Bengaluru Sub-Urban Transport (BSTP) at Akkupete, Bengaluru.

I) BRIEF SCOPE

The proposed work is in near Devanahalli of BSTP station. The work mainly consists of site clearance, excavation, casting footing and columns, precast boundary walls panels and erection of the same and any other miscellaneous works. The scope also includes interfacing and coordination with other contractors at the intersection points and with Indian railways/other agencies/authorities/local authorities, wherever required, for construction of boundary wall around Akkupete depot.

II) DETAILED SCOPE OF WORK**1.0 OBJECTIVE**

The objective of the contract is to construct the boundary wall around Akkupete depot as per Employer's drawings. Temporary drains, water streams diversions wherever required and rectification of defects appearing in Permanent Works by the contractor in the manner as stipulated in the Contract. In full recognition of this objective, and with full acceptance of the obligations, liabilities and risks which may be involved, the contractor shall undertake the execution of the Works. The general and specific requirements of the employer are detailed out in this document for understanding of the bidders and for mandatory compliance by the contractor. The Employer's requirements have been divided into different sections / sub-heads for convenience only. They do not restrict any cross-references. The contractor shall take into account inter-relations between various parts of works. No claim shall be entertained on account of compartmental interpretations.

1.1 SCOPE OF THE WORK.

- i. Construction of Precast panels boundary wall around Akkupete depot as per the drawings supplied by Engineer/Employer.
 - ii. Open Foundations (M35 Grade) resting at any depth depending upon the site condition shall include excavation, leveling course, PCC, dewatering, sheet piling / soldier piling & wooden lagging, if required, Backfilling complete in all respects.
 - iii. if required by the Engineer/Employer, Precast boundary wall panels shall be checked for UPV (Ultra sonic pulse velocity) test by NABL Accredited Agency. Rates for the test are included in Scope,.
 - iv. Providing and laying M35 grade concrete using 20mm maximum nominal size aggregates, reinforced cement concrete including the cost of cement, fine aggregates, coarse aggregates and using required dosage of admixture in concrete for obtaining required workability as per specification for all structures of all size, shape & heights for RCC precast wall, including centering, shuttering, propping, staging, scaffolding, curing, necessary tools, plants, machinery and all related operations etc. using steel shuttering & steel props. Scope shall include cost of providing grooves, chamfers, molding's, cut-outs, necessary fixtures, insert plates, sleeves for various purposes, shear connectors etc. complete as per drawings, specifications and as directed by the Engineer. The scope shall also include preparation of construction joints as per specification and providing approved wire mesh/weld mesh at such location as approved by Engineer or as shown in drawings.
- The scope also includes loading, unloading and disposal of surplus excavated material using covered trucks to contractor's dumping yard with all leads and lifts and as directed by the Engineer/Employer. Contractor shall ensure that during transportation, the carried material does not spill out.

- v. Providing Retained soil/fill or Reinforced soil/fill in the approaches as per relevant code, design, drawings or as per instruction of Engineer.
- vi. Providing, placing and compacting to desired density approved backfill material in layers as per approved methodology including testing for reinforced fill portion and random fill portion in the approaches between the

Reinforced Soil (RS) wall panels as per approved drawings as per clause 3103 of MORTH specification. The soil should be predominately coarse grained, not more than 10% of particles should pass 75-micron sieve.

- vii. Conducting all relevant tests on, soil reinforcements, soil used in backfill etc. as per relevant code, design, drawings or as per instruction of Engineer.
- viii. Providing & laying Reinforced cement concrete M35 grade using 20mm maximum nominal size aggregates or as per approved design and drawing, Reinforced cement concrete using Portland slag cement (Directly from manufacturer or blending of OPC+GGBS for the following concrete works:
 - a. Open Foundation / stepped foundation / Raft, Combined Footing, Columns, Grade beam, , backfilling in foundation with good earth / quarry dust / sand watering, compacting with a vibratory plate compactor complete as per specifications.
 - b. The Scope includes loading, unloading and disposal of surplus excavated material using covered trucks to contractor's dumping yard with all leads and lifts and as directed by the Engineer.
 - c. The contractor shall ensure that during transportation, the carried material does not spill out.
 - d. The scope shall include cost of using required dosage of admixture in concrete for obtaining required workability as per approval of Engineer, curing of concrete.
- ix. Providing TMT-500D / 550D grade steel bar reinforcement (conforming to IS:1786, HYSD Fe 500 / 550 grade) at all heights & depth including straightening bars, cutting, bending, hooking binding with approved quality 18 gauge G.I binding wire, after placing in position tying, lapping and / or welding wherever required and anchoring to the adjoining members wherever necessary as per drawings (Laps, Hooks and Wastages shall not be measured and paid) including cost of all materials, bar bending charges, labour, lead & lifts etc., Complete as per specifications and as directed including welding involved towards stray current protection effects as per the system approved by Engineer.

As far as possible bars of the maximum length available shall be used. For bars having larger diameter more than 20mm mechanical couplers shall be provided as per Technical Specifications and no lap shall be permitted. Welding in lieu is not permitted unless specified in the drawings or as instructed by the Engineer. Lap joints are permitted wherever required. However, mechanical couplers in place of lap joints may be permitted by the Employer without any extra payment, with the specific approval of Employer/Engineer for the specific elements / members / works / locations on case-to-case basis.

The scope includes all welding and providing mechanical couplers, all types of laps, standard laps, spacer bar, U-bar, chair, bend deduction as required and nothing extra is payable on this account.

The scope includes all welding and providing mechanical couplers, all types of laps, standard laps, spacer bar, U-bar, chair, bend deduction as required and nothing extra is payable on this account. Anti-corrosive treatment / paints exposed steel surfaces and all other related operations as required to complete the work as per specifications.

- x. Levelling Course: Providing & laying plain cement concrete M20 grade using 20mm maximum nominal size aggregates in pile foundation, open foundation, stepped foundation, combined footing, raft foundation, retaining walls, return walls, walls, levelling course or any other works as directed by the Engineer, etc. rate is inclusive of required dosage of admixture in concrete for obtaining required workability and as per specifications, approved drawings, laid in layers not exceeding 15 cm thick layers, as per drawing including cost of all material, form work / shuttering, dewatering during concreting, vibrating, compacting, curing, hire charges of machinery, all lead and lift, loading, unloading, transporting, stacking, finishing the exposed faces etc., complete. Skin reinforcement, if necessary, shall be provided.
- xi. Providing Boulder under foundations, hand packed boulders & cobbles with smaller size boulders toward the back including all lead, lift, labour & other incidental charges as complete work in all respects.
- xii. Providing and fixing GI brackets with suitable covering arrangement at required locations for electric cables & Signaling and Telecom cables as per tender drawing.
- xiii. Preparation of temporary Arrangement Drawings (TAD), Erection Scheme, Fabrication/Detailed Shop Drawings including drawing office dispatch lists (DODL), and other documentation as required by Engineer.
- xiv. Preparation of Quality Assurance Plan (QAP) for super-structure including bearings.

- xv. Transportation of pre-cast boundary wall panels from casting yard to the site, launching and erection in position. Loading, transporting precast panels from casting yard to work site, launching and erection in position with suitable capacity of crane. including, applying epoxy based bounding agent on end surface of boundary wall panels.

- xvi. Excavation Support:

The Contractor shall prepare and submit a detailed Design Report including calculations, schedules and drawings for each proposed excavation support wall construction, prior to the commencement of any such works, if required. This Design Report shall take into account but not be limited to the following:

- a) Earth pressure.
- b) Hydrostatic pressure.
- c) Deck load
- d) Surcharge loads.
- e) Seismic and/or vibratory loads
- f) Support types and arrangement.
- g) Temperature loads
- h) Any other incidental/accidental load.
- i) Construction/deconstruction sequence.
- j) Calculated ground and adjacent EBS movements and distortions.
- k) Calculated fluctuations in groundwater levels both within and outside of the excavation and support walls.
- l) Calculated changes in EBS loading conditions.
- m) For Deep Excavation in rocky strata, Rock bolt and Shotcrete to be used.

- xvii. Method Statement

- a) The Contractor shall prepare a Method Statement giving the full details of materials, plant and operations involved in the construction of excavation support walls. This Method Statement shall be incorporated into the Design Report submission for the Employers Representatives notice and shall include but not be limited to the following details:
 - b) Formation of the joints between panels and installation of water stops.
 - c) Method of producing the workable concrete.
 - d) Methods of handling within the excavations and disposing of groundwater outside of the excavations.
 - e) Sequence of excavation and concreting of panels.
 - f) Methods of instrumenting, monitoring and reporting of the performance of all adjacent EBS that may be affected by the works.
 - g) Type and construction of permanent lining wall.
 - h) Emergency procedures to be implemented in the event that monitoring indicates tolerances associated with the excavation support wall may be exceeded.
 - i) Where temporary ground support is to be provided using bentonite slurry, the following additional information shall be provided in the Method Statement for these works.
 - j) Mixing, transporting and placing equipment for the bentonite slurry.
 - k) Type, source, chemical and physical properties of the bentonite to be used.
 - l) Method of disposal of contaminated bentonite slurry.
 - m) Stability, dimensions and details of guide walls.
 - n) Cleaning and re-use of the bentonite slurry.
 - o) Calculations to show that the density of the bentonite and lowest head of slurry are sufficient to maintain the stability of the trench excavated for the support wall, in the ground conditions envisaged, to its full depth.

Construction Dewatering

Temporary dewatering of construction excavations will be required to provide an undisturbed, stable and dry subgrade to permit construction and backfilling of the Permanent Works under dry conditions.

In general, the groundwater within the excavations shall be maintained at a level the permits achievement of the above and avoids heave, piping or base failure of the excavation.

Temporary dewatering methods and system operations, along with other required temporary works, shall not lower the groundwater outside the walls supporting the excavations, nor result in settlement, distortion or loss of ground at adjacent structures.

The Contractor shall prepare and submit his design of his construction dewatering system to the Employer's Representative for his notice. The construction dewatering design shall include determination of subsurface conditions and geotechnical design parameters, analyses to establish feasible methods, and system definition in sufficient detail to demonstrate that the general objectives can be achieved without adverse effect on adjacent structures. The selected system shall generally provide for continuous (24-hour-per-day) operation, adequate reserve equipment, and standby power.

Ground Improvement

Ground-improvement may be required along certain alignment of the boundary wall to control ground and EBS (existing building structure) movement and distortion that may be induced by excavation at boundary wall locations.

The Contractor shall prepare and submit his designs and method statements supported by analysis for all ground improvement to the Employer's Representative for his notice. These designs shall define performance objectives for the ground improvement.

Instrumentation, monitoring and reporting details for verifying achievement of ground improvement performance objectives in accordance with this Contract shall be included in the ground improvement design submission.

The information and assumptions on which the ground improvement is based shall be shown on the design drawings.

List of Codes and Standards

6.1 Indian Railway Standards (IRS) Codes and Manuals

IRS	2008	Bridge Rules
IRS	1997	Concrete bridge Code (Reprint 2014)
IRS	1991	Bridge substructures and foundation code.
IRS	1997	Steel bridge Code

IRS	1998	Indian Railway Bridge Manual
IRS	1985	Manual on the Design and Construction of Well and Pile Foundations
IRS	2017	Earthquake resistant design of Railway Bridges

6.2 Indian Roads Congress Standards (IRC)

IRC 5:	2015	Standard Specifications and Code of Practice for Road Bridges. Section I – General Features of Design
IRC 6:	2017	Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses
IRC 11:	1962	Recommended Practice for the Design of Layout of Cycle Tracks
IRC 19:	1977	Standard Specifications and Code of Practice for Water Bound Macadam
IRC 22:	2008	Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction
IRC 24:	2010	Standard Specifications and Code of Practice for Road Bridges, Section V – Steel Road Bridges
IRC 37:	1984	Guidelines for the Design of Flexible Pavement
IRC 45:	1972	Recommendations for Estimating the Resistance of Soil below the maximum Scour Level in the Design of Well Foundations of Bridges
IRC 48:	1972	Tentative Specifications for Bituminous Surface Dressing Using Pre- Coated Aggregates
IRC 78:	2014	Standard Specifications and Code of Practice for Road Bridges, Section VII Parts 1 and 2, Foundations and Substructure
IRC 87:	1984	Guidelines for the Design and Erection of False Work for Road Bridges
IRC 89:	1997	Guidelines for Design and Construction of River Training and Control Works for Road Bridges
IRC:	SP 11	1988 Handbook of Quality Control for Construction of Roads and Runways

IRC:112 2011 Code of Practice for Concrete Road Bridges

6.3 Bureau of Indian Standards Codes

SP 7:	2005	National Building Code
IS 73:	1992	Paving Bitumen
IS 150:	1950	Ready mixed paint brushing, finishing stoving for enamel colour as required
IS 205:	1992	Non-ferrous metal Butt Hinges
IS 206:	1992	Tee and strap hinge
IS 207:	1964	Gate and shutter hooks and eyes
IS 208:	1987	Door handles
IS 210:	1993	Grey iron castings
IS 215:	1995	Road tar
IS 217:	1988	Cutback Bitumen
IS 269:	1989	33 grade Ordinary Portland Cement.
IS 278:	1978	Galvanised steel barbed wire for fencing
IS 280:	1978	Mild Steel wire for general engineering Purposes
IS 281:	1991	Mild Steel sliding door bolts for use with Padlocks
IS 362:	1991	Parliament hinges
IS 363:	1993	Hasps and staples
IS 383:	1970	Coarse and fine aggregates from natural Sources for concrete
IS 432:	1982	Mild steel and medium tensile steel bars and hard- drawn steel wire for concrete reinforcement
		Part 1 Mild steel and medium tensile steel bars
		Part 2 Hard-drawn steel wire
IS 453:	1993	Double-acting spring hinges

IS 3067	1988:	Code of Practice for General Design Details and Preparatory Work for Damp-Proofing and Water-Proofing of Buildings
IS 3370:	2009	Code of practice for concrete structures for the storage of liquids
IS 3564:	1995	Hydraulically regulated door closers
IS 3812:	1981	Fly ash for use as pozzolan and admixture
IS 3847:	1992	Mortice night latches
IS 3955:	1967	Code of practice for design and construction of well foundations
IS 3989:	1984	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories
IS 4082:	1996	Recommendations on stacking and storage of construction materials and components at site
IS 4138:	1977	Safety code for working in compressed air
IS 4326:	1993	Earthquake resistant design and construction of buildings – code of practice
IS 4656:	1968	Form vibrators for concrete
IS 4736:	1986	Hot-dip zinc coatings on mild steel tubes
IS 4826:	1979	Hot-dipped galvanised coatings on round steel wires
IS 4925:	1968	Concrete batching and mixing plant
IS 4926:	1976	Ready mixed concrete
IS 4968:	1976	Method for sub surface sounding for soils
IS 5525:	1969	Recommendations for detailing of reinforcement in reinforced concrete works
IS 5529:	1985	Code of practice for in-situ permeability tests
IS 5640:	1970	Method of test for determining aggregate impact value of soft coarse aggregate
IS 5816:	1970	Method of test for splitting tensile strength of concrete cylinders

IS 5889:	1994	Vibratory plate compactor
IS 5892:	1970	Concrete transit mixers and agitators
IS 6003:	1983	Specification for indented wire for prestressed concrete
IS 6006:	1983	Specification for uncoated stress relieved strands for prestressed concrete
IS 6051:	1970	Code for designation of aluminium and its alloys
IS 6248:	1979	Specification for metal rolling shutters and rolling grills
IS 6403:	1981	Code of practice for determination of bearing capacity of shallow foundations
IS 6603:	1972	Stainless steel bars and flats
IS 6760:	1972	Slotted countersunk head wood screws
IS 6911:	1992	Stainless steel plate, sheet and strip
IS 7181:	1986	Horizontally cast-iron double flanged pipes for water,gas and sewage
IS 7196:	1974	Hold fast
IS 7205:	1974	Safety code for erection of structural steel work
IS 7231:	1984	Specifications for plastic flushing cisterns for water closets and urinals
IS 7273:	1974	Method of testing fusion-welded joints in aluminium andaluminium alloys
IS 7293:	1974	Safety code for working with construction machinery
IS 7320:	1974	Concrete slump test apparatus
IS 7534:	1985	Sliding locking bolts for use with padlocks
IS 7861:	1975	Code of practice for extreme weather concreting
		Part 1 For Hot Weather concreting
		Part 2 For Cold Weather concreting
IS 7969:	1975	Safety code for handling and storage of building Materials

IS 8009	1976	Calculation of settlement of foundations
IS 8041:	1990	Rapid – hardening Portland cement
IS 8112:	1989	43 grade ordinary Portland cement
IS 8142:	1994	Method of test for determining setting time of concrete by penetration resistance
IS 8500:	1991	Structural steel-micro alloyed (medium and high strength qualities)
IS 9013:	1978	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens
IS 9103:	1979	Admixtures for concrete
IS 9284:	1979	Method of test for abrasion resistance of concrete
IS 9417:	1989	Recommendations for welding cold worked bars for reinforced concrete construction
IS 9595:	1996	Recommendations for metal arc welding of carbon and carbon manganese steels
IS 9762:	1994	Polyethylene floats (spherical) for float valves
IS 10262:	2009	Recommended guidelines for concrete mix design
IS 10379:	1982	Code of practice for field control of moisture and compaction of soils for embankment and subgrade
IS 10500:	1991	Drinking water specification
IS 12269:	1987	53 grade ordinary Portland cement
IS 12894:	1990	Fly ash lime bricks
IS 13630:	1994	Ceramic tiles – methods of tests
IS 13920:	2016	Ductile detailing of reinforced concrete structures subjected to seismic forces
IS 15388:	2003	Specifications for Silica Fume
SP 36	(Part 1):	Compendium of Indian Standards on Soil Engineering

(Laboratory Testing)

SP 36 (Part 2): Compendium of Indian Standards on Soil Engineering (Field Testing)
 Indian Standard Hand Book on Steel Sections Part-ICRRI and IOC,
 New Delhi Bituminous Road Construction Hand Book

6.4 British Standards

BS 812		Testing Aggregates - Parts 117 to 119.
BS 1377		Methods of Test for Civil Engineering Purposes - Parts 1 thru 9.
BS 4395	Part 2	High strength friction grip bolts and associated nuts and washers for Structural Engineering Higher Grade
BS 4447		The performance of pre-stressing anchorages for post-tensioned construction
BS 4449		Specification for Carbon Steel Bars for the Reinforcement of Concrete
BS 4486		Hot rolled and hot rolled & processed high tensile alloy steel bars for pre-tensioning of concrete
BS 4550		Methods of testing cement
BS 4592		Industrial Type Metal Flooring, walkways and stair treads
BS 4604	Part 2	The use of high strength friction grip bolts in structural steel work. Higher grade (parallel shank)
BS 4870		Approval testing of welding procedures
BS 4871		Approval testing of welders working to approved welding Procedures
BS 4872		Approval testing of welders when welding procedure approval is not required
BS 5075		Concrete admixtures
BS 5135		Process of arc welding of carbon and carbon manganese Steels
BS 5212	Part 2	Cold poured joint sealants for concrete pavements

BS 5328		Methods for specifying concrete, including ready mixed Concrete
BS 5400		Steel, concrete and composite bridges
BS 5400	Part 4	Code of practice for design of concrete bridges
BS 5400	Part 6	Specification for materials and workmanship, steel
BS 5606		Accuracy in building
BS 5896		High tensile steel wire and strand for the pre-stressing of concrete.
BS 5930:		Code of Practice for Site Investigations.
BS 5950	Part 2	Specification for materials, fabrication and erection: hot rolled sections
BS 6031		Code of Practice for Earthworks.
BS 6105		Corrosion-resistant stainless-steel fasteners
BS 6164		Safety in tunnelling in the construction industry.
BS 6349		Code of Practice for Dredging and Land Reclamation.
BS 6443		Penetrant flaw detection
BS 6681		Specification for malleable cast iron
BS 7079		Preparation of Steel substrates before application of paints and related products
BS 7385	Part 2	Evaluation and measurement for Vibrations in Buildings – E to Damage levels from Ground-Borne Vibrations
BS 7542		method of test for curing compound for concrete
BS 8000	Part 4	Code of Practice for Waterproofing
BS 8000	Part 5	Code of Practice for Below Ground Drainage
BS 8002		Code of Practice for Earth Retaining Structures
BS 8004		Code of Practice for Foundations

BS 8007		Design of Concrete Structures for Retaining Aqueous Liquids
BS 8081		Code of Practice for Ground Anchorages
BS 8110		Structural use of concrete
BS 8301	Section 5	Code of practice for building drainage
BS 8550		Concrete – Specification of Materials
BS EN	1997	Eurocode 7: Geotechnical design
BS EN	1998	Eurocode 8: Design of structure for earthquake resistance
CIRIA	Report 44	Medical Code of Practice for working in compressed air
CIRIA	Report 80	A review of instruments for gas and dust monitoring Underground
CIRIA	Report 81	Tunnel water proofing
CIRIA	Report C515	Groundwater Control – Design and Practice
CIRIA	Report C580	Embedded Retaining Walls – Guidance for Economic Design
CIRIA	Report C660	Early Age Thermal Crack Control in Concrete

6.5 ASTM Standards

ASTM	C-1202	Test methods for Electrical indication of concrete's ability to resist chloride ion penetration.
ASTM	C-1240	Micro Silica/Silica fume in concrete
ASTM	D-297	Methods for Rubber Products-Chemical Analysis
ASTM	D-395	Compression set of vulcanized rubber
ASTM	D-412	Tension testing of vulcanized rubber
ASTM	D-429	Adhesion of vulcanized rubber to metal
ASTM	D-573	Accelerated aging of vulcanized rubber by the oven method

ASTM	D-624	Tear resistance of vulcanized rubber
ASTM	D-797	Young's modulus in flexure of elastomer at normal and subnormal temperature
ASTM	D-1075	Effect of water on cohesion of compacted bituminous mixtures
ASTM	D-1143	Test method for piles under static axial comp. test
ASTM	D-1149	Accelerated ozone cracking of vulcanized rubber
ASTM	D-1556	In-situ density by sand replacement
ASTM	D-1559	Test for resistance to plastic flow of bituminous mixtures using Marshall apparatus
ASTM	D-2172	Extraction, quantitative, of bitumen from bituminous paving mixtures
ASTM	D-2240	Indentation hardness of rubber and plastic by means of a Durometer
ASTM	D-3689	Testing method of testing individual piles under static axial tensile load
ASTM	D-4945	Test method for high strain dynamic testing of piles
ASTM	E-11	Specification for wire cloth sieve for testing purpose
ASTM:	Section 4:	Construction, Vol. 04.08: Soil and Rock I, and Volume 04.09: Soil and Rock II,

6.6 AASHTO Standards

AASHTO	M6-81	Fine aggregate for Portland cement concrete
AASHTO	M31-82	Deformed and plain billet-steel bars for concrete reinforcement
AASHTO	M42-81	Rail-steel deformed and plain bars for concrete reinforcement
AASHTO	M54-81	Fabricated steel bar or rod mats for concrete reinforcement
AASHTO	M 81-75	Cut-back asphalt (rapid-curing type)
AASHTO	M 82-75	Cut-back asphalt (medium-curing type)

AASHTO	M85-80	Portland cement
AASHTO	M 140-80	Emulsified asphalt
AASHTO	M 147-67	Materials for aggregate and soil–aggregate sub-base, base and surface courses
AASHTO	M148-82	Liquid membrane-forming compounds for curing concrete
AASHTO	M154-79	Air-Entraining admixtures for concrete
AASHTO	M173-60	Concrete joint-sealer, hot-poured elastic type
AASHTO	M194-82	Chemical admixtures for concrete
AASHTO	M213-81	Preformed expansion joint fillers for concrete paving and structural construction
AASHTO	M 282-80	Joints sealants, hot poured, elastomeric-type, for port-land cement concrete pavements
AASHTO	M 294-70	Fine aggregate for bituminous paving mixtures
AASHTO	T22-82	Compressive strength of cylindrical concrete specimens
AASHTO	T23-80	Making and curing concrete compressive and flexural strength test specimens in the field
AASHTO	T26-79	Quality of water to be used in concrete
AASHTO	T96-77	Resistance to abrasion of small size coarse aggregate by use of the Los Angeles machine
AASHTO	T99-81	The moisture-density relations of soils using a 5.5-lb(2.5kg) rammer and a 12-in (305mm) Drop
ASHTO	104-77	Soundness of aggregate by use of sodium sulphate or magnesium sulphate
AASHTO	T176-73	Plastic fines in graded aggregates and soil by use of the sand equivalent test
AASHTO	T180-74	The moisture density relations of soils using a 10-lb (4.54kg) rammer and an 18-in (457mm) Drop

B. Initial site Preparatory works

- i. Before carrying out the work at site, necessary permissions from local agencies / authorities / road authorities' / railway authorities such as BBMP, Zilla Panchayat, PWD, BWSSB, BESCOM, GAIL, KPTCL, traffic police etc., shall be required to be obtained by the contractor. Employer will assist only by the way of issue of necessary letters.
- ii. Any work affected by the construction must be temporarily supported by the contractor. The work of temporarily supporting the utilities and services during the execution of works shall be deemed to be part of the contract.
- iii. The contractor shall take all precautions for safe guarding the environment during the course of construction works. He shall abide by all laws, rules and regulations in force governing pollution and environmental protection that are applicable in the area where the works are situated. The contractor must take all necessary steps to fix specially dust nuisance during the construction of the works.
- iv. The levels, measurements and other information concerning the existing site as shown on drawings are believed to be correct, but the contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any error or omission in the levels or strata turning out different during execution from what is shown in the drawings.
- v. The contractor shall at all time carryout the work on highway/road/service road/railways tracks in a manner creating least interference to the flow of traffic or train operations. The contractor shall take prior approval of Engineer, traffic police, BBMP/ZP/PWD, Railways, traffic police etc., for approval of traffic diversion plan during construction works.
- vi. Site to be cleared of any obstruction along the boundary wall works.
- vii. Demolition of RCC framed structures, Brick masonry buildings including basement etc. as existing at site without making damage to adjacent structures, utilities and taking away and disposing all the debris and released materials etc.
- viii. Conducting survey and fixing bench marks and alignment markers.
- ix. Necessary permanent / temporary diversion of Utilities, if required as per site condition.
- x. Temporary barricading, if required.
- xi. Surveying by establishing DGPS control points and TBMs, True and proper setting out and layout of the works marking of alignment and pier locations, vertical & horizontal clearances for the elevated section including modifications, if any, as per drawings

No extra amount will be paid to re-do or to re-establish any of the survey points. The control points shall be fixed using DGPS double frequency and the accuracy of 1 in 50,000 or better shall be assured.
- xii. Supply of caution watchmen at locations where caution orders is imposed and at all work sites near the IR track at the rate of one caution watchman per 8 hours shift round the clock with necessary three cell electrical torch, banner flags, hand flags etc. for continuous vigil and to exhibit necessary signals to the trains for their safe passage over the caution spot as directed by the Engineer in charge.
- xiii. Transportation of all usable materials like B.S slabs / precast RCC slab, cement concrete blocks, interlocking paver blocks, kerb stones, steel items, Telephone Poles. Electric Poles to designated site as directed by Engineer by mechanical transportation including all lift, lead, loading, unloading, labour, machinery etc.

The scope also includes surveying and taking coordinates of the existing Utility and submitting the reports (hard & soft copy) of the same as per the directions of the Engineer.
- xiv. The scrap materials will be the property of the contractor except the materials of local authorities (BBMP, BWSSB, BESCOM, BSNL) and Railways.
- xv. Casting yard may be developed within the premises of available depot land. However, required statutory approvals are included in the scope of contractor. Necessary assistance may be provided by Employer.
- xvi. The contractor shall carry out
 - a. Setting up of fully fledged site laboratory as per the requirements.
 - b. Setting up concrete batching & mixing plant.

- c. Contractor's site office setup.
- d. Casting yard with complete facilities
- xvii. The Contractor shall implement a Project Quality Management Plan in accordance with ISO-9001 "Quality System – Model for Quality Assurance in Design/Development, Production, Installation and Servicing" or any other system as approved by Engineer to ensure that all materials, workmanship, plant and equipment supplied and work done under the contract meets the requirements of the contract.
- xviii. The Contractor shall provide the Key Personnel as per Appendix-IV.
- xix. The Contractor shall provide the Key Plant and Equipment's as per Appendix-V.
- xx. Wherever night working is carried out by Contractor, temporary lighting arrangements as per approved layout shall be provided, installed, maintained for the duration of the contract.
- xxi. The contractor shall at all-time carryout the work on either side of existing IR tracks/ highway/road/service road in a manner creating least interference to the flow of traffic. The contractor shall take prior approval of the Engineer and traffic police regarding traffic arrangements and diversion of traffic during construction.
- xxii. The contractor shall take suitable and sufficient measures as per SHE manual for working at height.

2. RELEVANT DOCUMENTS

The following Documents shall be referred in conjunction with each other by the Contractor for construction work as these are mutually complimentary to each other:

- a) Good for Construction Drawings issued by the Engineer
- b) Employer's Requirements as part of Contract
- c) Technical Specifications as part of Contract
- d) Indian and International Standards referenced therein.
- e) The schedules and any other documents forming part of the Contract.

The Contractor shall always seek advice from the Engineer in the event of conflicts among above cited documents. In case of conflict, Engineer's decision shall be final and binding.

3. GENERAL

The project site is located in and around Bengaluru City. The proposed work is near to Devanahalli BSTP station. The work mainly consists of Site clearance, excavation, casting footing and columns , precast boundary wall panels and erection of the same and any other miscellaneous works. The scope also includes interfacing and coordination with other contractors at the intersection points and with Indian railways/other agencies/authorities/local authorities, wherever required, for construction of boundary wall around Akkupete depot.

Availability of Land:

The required land for the execution of works is available with Bi-RIDE. However, the contractor may have to take lease of the land temporarily for installation of his facilities like batching plant/ Casting Yard/ Site Work Shop etc, if land is available adjacent to permanent land. The bidders are advised to make detailed study and cater for such expenditure in the bid.

Approaches to the project site:

The land acquired for the project caters for construction and operation of the proposed line. Project site is located along the existing BBMP/ZP/PWD roads. The contractor shall conduct detailed survey and should include the cost of inputs for any such approach roads in his bid for the work.

However, in case of any existing road has to be utilized for transportation of materials to the site of work and in the process the road gets damaged or needs to be strengthened and the authority owning the said road submits demand to Employer to carry out some specific works in order to strengthen/repair the road, Employer shall get such works executed through the existing contractor.

Bidders should find out the capacity of the quarries and accordingly plan procurement of course/fine aggregates either from the existing quarries or establish their own quarries and crushing arrangements.

It is the responsibility of the contractor to thoroughly examine the site of work and all constraints before submitting the bid(s).

- i. Before carrying out the work at site, necessary permissions from various local agencies / Railway authorities' / road authorities such as SWR, BBMP, PWD, Traffic Police etc., shall be required to be obtained by the contractor. The Employer shall assist only by way of issue of necessary support letters.
- ii. Any services affected by the works must be temporarily supported by the contractor. The work of temporarily supporting and protecting the public utility, services during execution of the works shall be deemed to be part of the contract. Nothing extra shall be payable on this account.
- iii. The contractor shall take all precautions for safeguarding the environment during the course of the construction of the works. He shall abide by all laws, rules and regulations in force governing pollution and environmental protection that are applicable in the area where the works are situated. The contractor must take all necessary steps to fix specially dust nuisance during the construction of the works.
- iv. The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct and indicative, but the contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any error or omission in the levels or strata turning out different during execution from what is shown on the drawings. The contractor should validate the L- Section and horizontal alignment using MX Rail/ applicable latest software.
- v. In case any new items are required for such works, the same will be processed as per the need on mutual consent. It shall be paid as per the corresponding items rate available in the SoR of KPWD/ USSOR/BESCOM/BWSSB/KPTCL.
- vi. The preliminary works such as site clearance, barricading, trail trenching etc., wherever required, shall be taken up simultaneously along with mobilization activities.
- vii. The contractor shall at all-time carryout the work on either side of existing IR tracks/ highway/road/service road in a manner creating least interference to the flow of traffic. The contractor shall take prior approval of the Engineer and traffic police regarding traffic arrangements and diversion of traffic during construction.
- viii. All temporary traffic diversion works, which will be required for the smooth flow of running traffic in order to carry out the works without any interruption including all safety precautions, signage, barricading, emergency lighting, traffic marshals, look-out men / watchmen etc.; shall be carried out.
- ix. The permanent traffic diversions shall be carried out in consultation with traffic police. Contractor has to provide traffic diversion proposals, traffic marshals, cones, traffic diversion boards etc., as desired by Traffic Police.
- x. Deleted.
- xi. Deleted.
- xii. Deleted
- xiii. Deleted
- xiv. All disposable excavated material shall be collected and transported for disposal at contractors dumping yard which has to be approved by relevant authorities & Employer. Dumping yard area cannot be provided by the employer.
- xv. The tyres of the vehicles leaving Site have to be cleaned with Jet Wash to avoid spillage of earth / mud on public roads. The Contractor has to ensure cleanliness of the roads and footpaths by deploying man power for the same. The Contractor shall have to ensure proper cleaning and washing of roads and footpaths on all the times throughout the entire stretch till the currency of the contract including disposal of sweep age. Nothing extra shall be payable on this account.
- xvi. The construction programme and project monitoring is to be given as mentioned in General Conditions of Contract. The detailed programme has to be in the form of a quantified bar chart or MSP / Primavera activities from start to completion of the work.
- xvii. Maintaining and keeping the Existing Railway banks, structures and adjacent roads clean in the area of work and where construction machineries ply.
- xviii. Measures to minimize water, air and noise pollution;
- xix. All aspects of quality assurance, including testing of materials and other components of the work, as specified and as directed;
- xx. Clearing of site and handing over of all the Works, as specified or as directed
- xxi. Maintenance of the completed Work during the maintenance period as directed;
- xxii. Submission of completion (i.e., 'As-Built') drawings and other related documents as specified; and
- xxiii. The contractor shall not display any name-board for the works without the written permission of the engineer.

xxiv. No labor camp shall be allowed at work site or any unauthorized place.

4. OBTAINING CLEARANCES/CERTIFICATES FROM AUTHORITIES

The contractor shall arrange well in advance stage wise as may be required, submission of all the required documents and drawings for approval from other authorities and installation of the works and their inspection and obtain approval/completion certificates with respect to his work as required for use and connection of the utilities and occupation from the Statutory Authorities. The Contractor shall obtain and deliver to the Engineer, on completion of the works, the final Inspection Report and approval from the Authorities.

5. INTER COMMUNICATION FACILITIES

Deleted

6. SITE INFORMATION

The project site is located in and around Bengaluru City. Bengaluru is well connected to other parts of the country by Road, Rail and Air. It has an international Airport. The location of the work and the General site particulars are shown in the General Arrangement Drawings enclosed in the bid documents.

7. RESTRICTIONS IN WORKING

It has to be noted by the Bidder that

- a) The various items of construction work have to be carried out in narrow roads / streets of Bengaluru city/Beside/across/Parallel to the existing railway line where there are buildings adjacent to the road/track and railway traffic may be heavy. b. There are restrictions for movement of trucks and heavy vehicles (ex: trailers) carrying construction materials, cleaning during the day hours on some roads.
- b) There are some one-way roads where traffic can't move in both directions.
- c) Generally, at least two lanes of traffic in both directions have to be kept while the works are on, including foundation works.
- d) The construction of structures will have to be planned in such a manner that they do not obstruct or interfere with the existing roads; railways tracks and other utilities. erection of pre-cast members may have to be planned in such a way that the erection shall be done from one end with Back feeding. Unless the competent authorities permit to execute such works using cranes and restricting the movement of the Vehicles/trains, the same may be planned to carry out during night Also, while working in the night hours' noise pollution should be kept to an acceptable level. The bidder should take all these facts into account while quoting rates and devise his methodology of working accordingly.
- e) Where work is required to be carried out at locations adjacent to such Existing IR tracks, roads, utilities, structures, monuments, religious structures, etc., suitable safety and protection arrangements will have to be ensured. Nothing extra will be payable on these accounts. It should also be ensured that no damage is caused to any such element and Engineer/ Employer shall be indemnified against such damage at no extra cost.

8. GENERAL CLIMATIC CONDITIONS

Bengaluru is located in meridians of 12° N latitude and 77°3' E Longitude, spread over an area of 531 sqm km. located at an altitude of 900m, Bengaluru boasts of delightful weather around the year registering maximum temperature of 34° centigrade in summer and minimum temperature of 14° centigrade in winter. Bengaluru receives both the Southwest and Northeast Monsoons, getting an annual average rainfall of 760 mm, generally during the months of May to September/October. Bengaluru falls in Seismic Zone II.

9. DAMAGE TO PROPERTY

The contractor shall organize all his activities so as not to cause any damage to the property of Railway or that of other agencies or any third party. In spite of taking all precautions, in the unfortunate event of any damage to the property, then the contractor shall not only indemnify the Employer of the claims made by the affected parties but also settle the matters with the affected parties as per law. If the nature of damage is one of that affecting the train movements or causing a safety hazard to the public, then the situation will be treated as an emergency and the Engineer reserves the right to take all necessary steps as deemed necessary to restore train operations or to remove the hazardous situation or to mitigate the damage, at the risk and cost of the contractor.

9.1 Survey Equipment

The contractor should provide the survey equipment and other accessories as per the instructions of Engineer as and when required. He should also provide all necessary help as required by the Engineer for checking the works, whenever required.

9.2 All power requirements for execution of works shall be arranged by the Contractor from his own resources. Subject to availability of power, the Employer/Engineer will recommend to the Railway Authorities for providing power connection. The Contractor shall bear the cost of installation and payment of necessary charges for providing such power connections as per the Terms and Conditions of the Railway.

9.3 Structural elements, shape and form

The bidder shall note different structural elements in shape, form and structural configuration in plain. The structural elements may be skew, tapered, curved etc. The bidder shall include these factors while quoting his rates. All the above are to be covered in the quoted rates and nothing extra shall be payable towards this.

9.4 Stability of the elements

During construction, the stability of each element must be ensured until the connections through which the stability is achieved, are fully operative. This might require temporary, supporting, bracing etc. This is contractor's responsibility, and no extra payment is to be made.

9.5 Stability of the Structure

The overall stability of the structure must be ensured during each phase of constructions. This might require special provisions. This is also contractor's responsibility and no extra payment will be made.

9.6 Temporary Works

Traffic barricade with reflective tapes and other necessary traffic signage's should be provided wherever required so that safety is ensured during day and night continuously. Temporary traffic diversion for smooth flow of traffic during construction including necessary traffic signs, repairs to the diverted route/service lanes, if required, restoration of diverted route to original condition etc. shall be done by contractor.

The above listed works are only brief but the actual scope of work shall be as specified in the concerned document and/or as specified or directed by the Engineer.

9.7 Design for Temporary Works

The Design should cover all the items pertaining to all temporary works, traffic diversion scheme, form work, casting and stacking yard, staging, launching scheme for girders / beams and/or transportation scheme for various structural elements and materials to be transported to and from site during construction period.

The Contractor shall himself formulate a practical and viable scheme for design/ fabrication of shuttering, casting, curing, testing and launching/erection of girders / beams/ and all other structures. The bidder should, along with the bid, specify the scheme that he proposes to adopt for carrying out all the works including fabrication, transportation, stacking and erection of steel structure and casting, curing, stressing, testing and launching/erection of girders / beams.

The contractor shall formulate the erection scheme, design the staging, including all necessary temporary structure, prepare fabrication drawings in accordance with relevant provision of applicable IRC standards and submit the same to the Engineer for approval with third party certificates. These works will be executed only after the approval has been obtained from Engineer

C. DRAWINGS:

GFC DRAWINGS:

Errors, Omissions and Discrepancies in Specifications and Drawings:

It shall be the responsibility of the Contractor to promptly bring to the notice of Engineer any error, omission fault, defects or discrepancy in the contract documents, specifications and drawings for the work which are discovered while reviewing the contract documents or in the process of execution of the works and obtain his orders thereon. In case any feature of the work is not fully described and set forth in the drawings and specifications, the Contractor shall forthwith apply to the Engineer for further instructions, drawings or specifications.

Only stated dimensions are to be taken and not those obtained from scaling drawings.

In case of errors, omissions, faults, defects and/or disagreement on the drawings or between the drawings and specifications the following principles shall be followed.

As between the written description or written dimensions on the drawing and the corresponding one in the specifications, the former shall apply.

As between the written description of the item in Bill of Quantities and the detailed description in the specification of the same item, the **former shall prevail**.

The drawings on a **large scale** shall take precedence over those on a smaller scale; and

Drawings approved as construction drawings from time to time shall supersede corresponding drawings previously approved.

Meaning and intent of specifications and Drawings:

If any ambiguity arises as to the meaning and intent of any portion of the specifications and drawing or as to execution or quality of any work or material, or as to the measurement of the works, the decision of the Engineer thereon shall be final subject to the appeal (within 7 days of such decision being intimated to the Contractor) to Engineer/Employer who shall have the power to correct any errors, omissions, or discrepancies in the specifications, drawings, classifications of works or materials and whose decision in the matter in dispute or doubt shall be final and conclusive.

Responsibility for Specifications, Design and Drawings

a. Specifications

One copy of technical specifications shall be supplied to the Contractor.

MORTH / CPWD, KPWD specification / other Specifications / Codes viz. IS, IRS, IRC, DSR etc. shall be procured by the Contractor from the market. One set of these specifications shall always be kept at contractor's site office for reference.

b. Drawings for Permanent Works:

- i. GAD showing general dimensions & details elaborating the scope of work (not based on detailed design) are supplied along with the tender documents. These drawings are broadly indicative of the work to be carried out. These drawings are not "Construction Drawings" and details indicated therein are for general guidance only and shall be modified by the Engineer, to incorporate additional details as per design, and as described in the Specifications. Construction drawings shall be supplied progressively depending on the progress of work by the contractor during execution of work well in time for each activity. The contractor cannot claim as a matter of right that all GFCD (Good For Construction drawings) shall be given soon after award of contract. GFCD/Advance copies required for the next three months work shall ordinarily be given by the Engineer for his planning, procuring etc. The GFCD will be released as and when it is required without any delay to the successful Tenderer after the issue of Letter of Acceptance.

No claim whatsoever shall be admissible on account of any changes that may be introduced by the Engineer

- ii. The "Good for Construction" drawings which shall be issued to the Contractor by the Engineer after the award of work shall delineate the extent of work to be done by the Contractor
- iii. No deviation shall be made from these drawings without a written authorization from the Engineer.

c. Design, Drawings and Specifications for Temporary/ Ancillary works.

- i. Contractor's proposal for erection of all Ancillary and Temporary works shall be in conformity with the proposals submitted along with the tender and / or as approved by Engineer.
- ii. The contractor would design all the Ancillary and Temporary works including truss, temporary supports, false work, formwork, staging scheme etc. and will submit the same and related working drawings to the Engineer for approval. After check by an independent third-party designer. Bar Cutting and bending schedule for the reinforcement, shop drawings for fabrication work, detailed drawings for anchorage

and temporary supports for prestressing cables etc. shall also be prepared by the Contractor and submitted for Engineer's approval

- iii. Approval of Engineer of any such proposal / drawings shall not relieve the contractor of his responsibility of sufficiency of such works
- iv. Drawing Management

The Contractor shall submit all such drawings for Temporary / Ancillary works and shop drawings to the Engineer well in advance before he desires to commence the works and get the same approved from the Engineer. These drawings should be submitted only after they have been duly detailed, checked and verified within the Contractor's organization ensuring that the details and data shown/furnished on the drawings are correct and that the requirements of other disciplines have been taken care of. The names and complete signatures of the Contractor's personnel responsible for the drawings shall be contained on each drawing. Any drawing which does not contain the above names and signatures shall be summarily returned to the Contractor and treated as not having been submitted.

The drawings submitted for approval shall be in any one of the standard sizes - AO, AI, A2, A3 or A4, in accordance with Indian standards.

All drawings shall show the following particulars in the lower right hand corner in addition to the Contractor's name

- Project Title
- Name of the Employer
- Name of Consultant
- Contract No.
- Title of Drawing.
- Scale
- Date of Drawing.
- Contractor's Drawing Number.
- Space for the Engineer's drawing number.
- Name of the Engineer.
- Name of Review Consultant.
- This drawing is based on Drawing No. (s).
- Further detail is given on Drawing No. (s).

- d. Each drawing shall carry a revision number, date of revision and brief details of revisions carried out. Whenever any revision is carried out, the revision number must be updated. The revisions carried out on the drawing shall be clearly marked by clouding and each cloud revision numbered by marking the revision number in triangle. The clouding shall be done on the backside of the tracing by pencil. All dimensions on drawings shall be metric units, unless otherwise specified. However, all levels shall be in meters.

All shop drawings shall be prepared on CAD using AUTO-CAD Version 2008 or higher.

Shop drawings shall be prepared for the following works:

- Reinforcing bar bending schedules
- Working drawings for placing of reinforcement
- All form works, Shuttering and Scaffoldings
- Shop drawings for structural steel
- Shop drawings for launching Girder / Truss including support arrangement
- Metal work (ferrous and non-ferrous) for, rolling shutters, railings, balustrades, grilles gratings, screens, inserts, structural work in built up sections etc.
- Seismic joints
- Expansion joints
- Construction joints
- Waterproofing

All MEP services
Any proprietary system

e. Drawing Management at Site

The Contractor shall ensure that all drawings meant for further engineering, fabrication, erection and field work are issued to his personnel in a controlled manner - a proper record shall be maintained to show to whom the drawing is issued and to ensure that the latest revisions of the drawing is being followed for further work. All superseded drawings shall be promptly withdrawn from the personnel to whom they are issued and stamped "SUPERSEDED" in RED. The Contractor shall maintain a register of drawings, with their revision/issue number, as received from the Engineer and a record of their distribution to the designated personnel within their organization.

The Contractor shall maintain at Site a set of the drawings issued by the Engineer on which changes shall be progressively marked and initialed by the Engineer so that "As-Built" drawings can be made correctly and expeditiously at the end of their Work at Site.

Revision of Approved Drawings for Temporary/ Ancillary and Shop Drawings

If, at any time before the completion of the Work, changes are made necessitating revision of approved Shop drawings/ drawings for Temporary/ Ancillary works, the Contractor shall make such revisions and proceed in the same manner and observe procedure for obtaining approval of the Engineer as for the approval of the original drawings

iv. Documents by Contractor

The contractor shall submit to the Engineer, for approval, Quality Assurance plans, design calculations, material specifications for each item and system, samples, as may be called for in the Specifications or as the Engineer may reasonably require. Wherever necessary the Contractor shall provide as built dimensions to facilitate proper Good for Construction drawings being prepared for various construction detailing.

v. Number of Copies of Drawings for Temporary/ Ancillary works/ Shop drawings and Documents

All Shop drawings / drawings for Temporary and Ancillary works, Documents, Schedules etc. and revisions thereof shall be submitted by the Contractor to the Engineer in 6 copies in size as required by Engineer. Copies required in excess of these shall be borne by the Contractor at his own cost.

d. Completion Drawings:

On completion of the work in all respects the contractor shall submit the following:

Three sets of "As Built Drawings" in the standard sizes each containing complete set of drawings for every component of work on approved scale indicating the work "As Built". Each set shall also contain technical literature.

These drawings shall be prepared on CAD using Auto-Cad version (latest/as directed by Engineer) and shall be recorded on writable CDs and one set of these CDs shall also be submitted.

Four sets of catalogues of all manufactured materials with the name and addresses of the manufacturers for all equipment's provided by him.

The Contractor shall also submit one original "As Built" drawings on polyester film or as directed by Engineer of quality as approved by Engineer/ Engineer's Representative.

The Certificate of Completion of Works as per the provisions in the General Conditions of Contract shall not be issued by the Engineer in the event of Contractor's failure to furnish aforesaid "As Built" drawings for the entire works.

e. Plans and Drawings for Layout of Plant and Equipment

The Contractor shall submit the following information, in triplicate, to the Engineer, for approval, within the time stipulated against each item given below:

A general layout plan for construction plant and equipment required for execution of work, within thirty days from the date of issue of "Letter of Acceptance".

drawings or prints showing the locations of major facilities which he proposes to put up at site, at least fourteen days prior to the commencement of the respective work; and

Any other details and drawings as required under the contract, within the time as specified in the contract.

Cost of all the above activities shall be deemed to be included in the quoted rates of various items of the Bill of Quantities and nothing extra shall be paid for on this account.

Appendix – I - Programme Requirements

1.1 General

Construction Programme and project monitoring

- I. The contractor shall propose and submit his detailed construction program separately and as per the procedure detailed in the scope of work. Contractor may be asked to schedule and complete the work block wise / area wise in a phased manner fixing priorities to different stretches of the work to give access to other interfacing contracts as mentioned in the Bid documents.
- II. The tentative construction program shall be submitted within the period as specified in the Bid document for approval of the Engineer as 'Baseline Program'. The base line program shall clearly reflect interface and access dates for other civil/ system-wide contracts. The basis of the time schedule for each activity such as productivity of man and machines and time cycle of each activity and resource planning shall be submitted along with the base line program.
 1. After the work has started, the Contractor shall deliver in the first week of every month to the Engineer an update of the Construction Program showing changes, if any, in planning or progress scheduling and reflecting the progress of all the activities of the network and the project status as at the end of previous month.
 2. If the Contractor falls behind the approved Construction Program by more than one month, he shall, within fourteen days of the date of such information, submit for approval, a revision of the construction program showing the proposed measures, including augmentation of plant, labor and material resources to complete the works on time.
 3. Whenever the Contractor proposes to change the construction program, he shall immediately advise the Engineer in writing and, if the Engineer considers the change a major one, the Contractor shall submit a revised program for approval.
 4. Detailed Network Plan (Works Program): Detailed Network Plan shall be prepared by the Contractor for each and every activity within the same time frame and in the same sequence. Activity at this level shall not be more than 15 days' duration, except for summary items like procurement/ mobilization etc.
- III. The Contractor shall select a PC-based broad planning and control software (licensed version of Primavera etc.). The two networks shall be implemented on works as detailed in the Scope of work. The Contractor shall supply one original licensed copy of the software selected including manuals and any subsequent versions thereof at no extra cost along with the Baseline program network and detailed network plan and load it on the PC system of the Engineer so that uniform monitoring of the project is done and any slippages are identified well in time and corrective action taken. The contractor shall also arrange suitable training of the personnel of Engineer on the selected software, if required, at no extra cost.
- IV. The following reports, in agreed formats and frequency, shall be submitted by the Contractor at his own cost:
 - i. Progress Reports
 - ii. Material Status Reports
 - iii. Equipment and Manpower Deployment Reports
 - iv. Any other Report desired by the Employer or the Engineer
- V. The Engineer's monitoring team will have access to all the data/information of the Contractor, required for the assessment of the progress and monitoring. If necessary, the monitoring team will visit the Vendor/Contractor's works in order to assess the status of critical activities.

- VI. Periodic Project Status Review Meetings will be held by the Employer or the Engineer. The Contractor shall depute his Engineers/Managers at appropriate level as decided by the Engineer to attend the Review Meetings.
- VII. Progress photographs of the major events shall be submitted by the Contractor along with the Progress Reports. Video Recording of the progress of works shall be maintained from beginning till completion of work as directed by the Engineer.
- VIII. The Contractor shall provide additional inputs whenever the PERT-CPM/ network diagram (Primavera) indicates a possible slippage in the completion schedule. Such additional inputs may require supplementing of equipment, personnel, work in excess of the normal work per day, and work in excess of the normal work per week or other resources. Provisions in the relevant Clause of Conditions of Contract and Particular of conditions of contract will be applicable in cases of delays due to Contractor.

1.2 Purpose of Program

- a) The purpose for the requirement of Program (Scheduling) information described in this document is to provide the Engineer with status reports for managing, monitoring and coordinating the awarded contract during the execution within the overall multi-contract project schedule. It describes a series of reports to be submitted by the Contractor to the Engineer during the execution of the contract, following the award of Contract.
- b) The Bidder/ Contractor shall program his work at all times to meet the Key Dates and the Works Area Hand-over Dates specified in the bid documents and the specified interface periods for the design and installation of the Works with those of the Designated Contractors and shall during the progress of the Works constantly monitor his progress against the programs described below.
- c) The Bidder/ Contractor shall include in all programs his work obligations towards shared access, shared Site areas and other coincident or adjacent Works Areas.
- d) The Works Program, and all more detailed or revised versions, shall be submitted to the Engineer for his consent.

1.3 Methodology

- a) The computerized Primavera network using the Precedence Diagramming Method (PDM) has been selected by the Employer as the technique for contract management system and in coordinating the multi-contract project. This technique shall also be employed by the Bidder in preparing their Bid submissions and by the Contractor in their Construction Stage submissions.
- b) Unless otherwise agreed by the Engineer, all programs submitted by the Contractor shall be produced using computerized Primavera Networks developed implementing the Precedence Diagramming Method (PDM) with Resource Loaded Charts and Tables.
- c) The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design, pre-construction, construction, and sub-contracts in executing the Primavera scheduling by PDM. The reports, documents and data shall be provided monthly and shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; work planned to be taken up during next month, shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.
- d) Program management software
Primavera programming software used shall be Primavera 6.0 v 21.12 programming software shall be used.

1.4 Submissions

- 1.4.1 The Contractor shall develop bid Program into the Initial Works Program including an outline Narrative Statement and submit within 28 days of the date of receipt of Letter of acceptance and its more detailed version within 15 days of receiving the Engineer's consent to the proposed Initial Works Program.
- 1.4.2 Activities in the initial works program should be arranged as per the Works Break down Structure (WBS) of the work. The WBS of the work would be developed by the contractor in consultation with the Engineer. Contractor would get the WBS approved by the Engineer and the program expert.
- 1.4.3 The first Three Month Rolling Program shall also be submitted along with Initial Works Program within 28 days of the date of receipt of Letter of Acceptance and all subsequent editions shall accompany the Monthly

Progress Report. The Monthly Progress Reports shall also include a Program Update as described below. These programs shall subsequently be updated as described below.

- 1.4.4 Following the Engineer's consent to Contractor's Initial Works Program submission, the contractor shall make submissions of the Detailed Works **Program** suitably amended to take into account the programs of Designated Contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to review, revise and finalize his Initial Work Program so as not to affect the progress of Works/ and or the works of the Interfacing Contractors. The resubmitted program when approved by the Engineer and the program expert shall form the **Baseline Program** against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline program but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.
- 1.4.5 For Initial & Detail Work Program submission, one (1) original and six (6) copies each (along with electronic copy) of the following Programs and Reports shall be submitted to the Engineer:
 - a) Program: Baseline Primavera Network
 - b) Program: Baseline Milestone based Cost Activity Schedule
 - c) Baseline Schedule Report
 - d) Narrative
 - e) Baseline Physical Progress 'S' curve
 - f) Baseline Resource Charts (with Resource levelling)
 - g) Detailed Method Statement
- 1.4.6 The Engineer shall review and comment on the Contractor's programs and information submitted. The Engineer will confirm his consent or otherwise of the submissions.
- 1.4.7 The Engineer shall require the Contractor to re-submit within fifteen (15) calendar days if he is of the opinion that the programs and information submitted by the Contractor is unlikely to meet the Contract key dates.
- 1.4.8 If in the opinion of the Engineer, any of the Contractor's revised programs or Baseline Schedule Report is not acceptable, it shall be construed as a failure of the Contractor to meet a Milestone.
- 1.4.9 Notwithstanding the above, the Engineer may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if" statements. The initial computer-generated report after receiving the Engineer's consent will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.
- 1.4.10 Failure to include any element of work required for performance of the Contract shall not relieve the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

1.5 Works Programme

- 1.5.1 The Works Programme shall show the Contractor's plan for organizing and carrying out whole of the Works.
- 1.5.2 The Works Programme shall be a computerized Primavera network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly time scale.
- 1.5.3 Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:
 - (a) Key Dates, and Works Area Hand-over Dates and Interface dates.
 - (b) All physical work to be undertaken in the performance of the Contract obligations, including Temporary Works,
 - (c) The requested date for issue of any drawings or information by the Engineer,
 - (d) Procurement of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment,
 - (e) Commissioning date of Contractor's major equipment
 - (f) Any off-site work such as production or pre-fabrication of components,
 - (g) installation of temporary construction facilities,
 - (h) Interface periods with Designated Contractors or utility undertakings,

- (i) Design, supply and/or construction activities of sub-contractors,
- (j) Any outside influence which will or may affect the Works.

1.5.4 The Works Programme shall show achievement of all Key Dates, Interface dates and Works Area Hand-over Dates. The Works Program shall also show all Milestones, but the Milestones shall not be taken as imposing any constraints that in any way affect the logic or limit any other dates in the program.

1.5.5 Activity descriptions shall be unique, describing discrete elements of work. Any activity creating an imposed time or other constraint shall be fully defined by the Contractor.

1.5.6 The Works Programme shall be organized in a logical work-breakdown-structure including work stages and phases, and shall clearly indicate the critical path(s).

1.5.7 Activity duration shall not exceed 15 days, unless otherwise consented to by the Engineer, except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The Contractor shall submit a Program/Project Calendar cross reference clearly indicating the allowance for holidays.

1.5.8 The Works Program, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic and hard copy format (time scale logic diagrams in A1/A3 size, reports in A4 size).

1.5.9 Activity Report shall list all activities, and events in the Works Program, sorted by activity identification number. The Activity Report shall include the following for each activity and event:

- i. *Activity identification number and description,*
- ii. *Duration expressed in Days,*
- iii. *Early and late start & early and late finish dates. Planned start and finish dates,*
- iv. *Calculated total float and free float,*
- v. *Predecessor and successor(s), accompanying relationships and lead/lag duration,*
- vi. *Imposed time or date constraints,*
- vii. *Calendar.*

1.5.10 Narrative Statement

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of key dates, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences, launching scheme, resources required including primary item of plant, Construction Equipment required, person responsible, quality checks, inspection and test procedures, tolerances, Temporary Works and the like, risk analysis, etc. for carrying out that activity. It shall fully explain the reasons for the main logic links in the Program and include particulars of how activity duration is established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

1.5.11 Baseline Physical Progress 'S' Curve

The Contractor shall also submit a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the Primavera Network Logic Diagram, expressed in percentage terms. This 'S' curve shall be generated from the computerized Primavera Network Logic Diagram.

1.5.12 Baseline Resource Charts

The Contractor shall also submit a Resource Charts, generated from the Contractor's Primavera Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project. The Resources shall be properly levelled using primavera VP6 software.

All submissions of proposed Works Programs subsequently, after approval of the Initial Works Program, shall include the actual physical progress of work and forecast of the remaining work. Actual progress shall be stated in percent complete, remaining duration, and actual start and finish dates for each activity in the Works Program.

1.6 Initial Works Programme

1.6.1 The Initial Works Programme submitted as under Clause 1.4.1 need not include the full details given under Clause 1.5 above. It should be a condensed version with combined activities of longer duration but must show

clearly how the requirements of the Contract are to be achieved. Activities in the initial works program should be arranged as per the Works Break down Structure (WBS) of the work. The WBS of the work would be developed by the contractor in consultation with the Engineer. Contractor would get the WBS approved by the Engineer. The outline Narrative Statement shall be in sufficient detail to clearly show the Contractor's intention.

- 1.6.2 Within 15 days of the Engineer's consent to the Initial Works Program, the Contractor shall submit to the Engineer an expanded and more detailed version of the Initial Works Program containing all of the information and detail required under Clause 1.4 and 1.5 above.
- 1.6.3 Such submission shall make use of the Program submitted earlier but refined to include the best estimates of dates for the work of Designated Contracts which has impact on the Contractor's program. Such programs shall be amended subsequently to incorporate the actual dates/ schedule of the affecting contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to finalize the Initial Program, without affecting progress of the work.

1.7 Works Programme Revisions

- 1.7.1 The Contractor shall immediately notify the Engineer in writing of the need for any changes in the Works Program, whether due to a change of intention or of circumstances or for any other reason. Where such proposed change affects timely completion of the Works or any other Key Date the Contractor shall within fourteen (14) days of the date of notifying the Engineer submit for the Engineer's consent its proposed revised Works Program and accompanying Narrative Statement. The proposed revised Works Program shall show the sequence of operations of any and all works related to the change and the impact of changed work or changed conditions.
- 1.7.2 If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Program, he may request the Contractor to submit a proposed revised Program which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the Contractor within fourteen (14) days after the Engineer's instruction. The proposed revised Works Program shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions. Revisions should not affect the overall completion of the project.
- 1.7.3 All activities that have negative float must be analyzed by the Contractor to identify the impact on the timely completion of the Works or on the achievement of Key Dates.

1.8 Three-Month Rolling Programme

- 1.8.1 The Three-Month Rolling Programme shall be an expansion of the Detailed Works Program, covering sequential periods of three months. The Three-Month Rolling Program shall provide more detail of the Contractor's plan, organization and execution of the work within these periods. In particular, the Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary, to a daily level of detail.
- 1.8.2 The Three-Month Rolling Program shall be developed as an Primavera network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A4 and time-scaled networks diagrams on an A3 size reproducible media. Tasks in the program shall be derivatives of and directly related to tasks in the approved Works Program.
- 1.8.3 The Contractor shall describe the discrete work elements and work element inter-relationships necessary to complete all works and any separable parts thereof including work assigned to sub-contractors within the contract period.
- 1.8.4 Activity duration shall not exceed two (2) weeks unless and otherwise consent of Engineer is granted.
- 1.8.5 Each activity in the Three-Month Rolling Program shall be coded, or described so as clearly to indicate the corresponding activity in the Works Program.

1.9 Three-Month Rolling Programme Revisions and update

- 1.9.1 The Three-Month Rolling Programme shall be extended forward each month as described under Clause 1.8.1 above. Each submission of the Three-Month Rolling Program shall be accompanied by a Program Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month

period in order to achieve progress as per the approved Works Program.

- 1.9.2 If the Three-Month Rolling Program is at variance with the Works Program, the Program Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities to be undertaken over the three-month period, including program assumptions and methods to be employed in achieving timely completion.
- 1.9.3 The Contractor shall revise the Three-Month Rolling Program or propose revisions of the Works Program, or both, on a monthly basis to ensure consistency between them.
- 1.9.4 Three-Month Rolling Program (revised) to be submitted on a monthly basis by 5th of every month with respect to the progress achieved by the last day of the previous month. A penalty of ₹. 100,000/- (Rupees One Lakh) per instance will become applicable to the contractor for non-submission of the revised Three-monthly rolling program as per above clauses, irrespective of the causes lead to variances if any and the penalty will be deducted in the subsequent IPC which will be non-refundable.

1.10 Weekly review

Once a week, on a day mutually agreed to by the Engineer and the Contractor, a meeting will be held to assess progress by the Contractor during the previous week, progress review which will also be attended by the programs Expert and the Contractor's Program Engineer. The Contractor shall submit a construction schedule listing activity completed and in-progress from the previous week and the activities scheduled for the succeeding two weeks based on the detailed Works Program. Copies of the schedule shall be submitted on A3 sized papers.

1.11 Project Calendar

For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 6 days' week – Monday through Saturday. For Project purposes, a week begins at 0001 hours on a Monday and ends at 2359 hours on a Sunday. The completion of an activity or the achievement of an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered week. An access date or activity start date when given as a week number shall be taken to mean 0001 hours on a Monday of the Numbered week.

1.12 Programming Personnel

The Contractor shall submit, as part of its Staff Organization Plan, the names and required information for the staff to be employed on Works Programming. The principal Works Programmer shall hold reputable professional qualifications acceptable to the Engineer including at least five (5) years relevant experience in programming civil engineering works. Others in the group shall have at least three (3) years' experiences in such work. The programmers shall be employed by the Contractor full time on the Contract until the completion or such earlier time the Engineer may give his consent.

1.13 Programme and Report Submission Format

The Contractor shall submit one (1) original and six (6) copies and one (1) reproducible (for Programs) of all submissions to the Engineer. All submissions shall be in A0, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Engineer. In addition, the computerized program and report shall be submitted in compatible discs. The format for all Program and Report submissions shall be strictly in accordance with the format as stated herein or as requested by the Engineer.

2. Monthly Progress Reports

2.1 General

The Contractor shall submit to the Engineer, a Monthly Progress Report. This Report shall be submitted by the end of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty-fifth (25th) day of the month of the submission. It shall be submitted in a format to which the Engineer shall have given his consent and shall contain sections/sub-sections for, but not be limited to, the topics listed in clauses below.

2.2 Physical Process

- a) It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.
- b) It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Program.

2.3 Programme Update (For Entire Project)

Programme updating shall include

- (a) The monthly Program Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Program Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the Contractor's submittal:
 - (i) Early Work and Baseline Submittals – explains determination of activity duration and describes the Contractor's approach for meeting required Key Dates as specified in the Contract.
 - (ii) Updated Detail Program Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:
 - a) If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.
 - b) Identify by activity number and description, activities in progress and activities scheduled to be completed.
 - c) Discuss Variation Order Work Items, if any.
- (b) The Program Status which shall: -
 - (i) Show Works Program status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.
 - (ii) Be presented as a bar-chart size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings;
- (c) The Activity Variance Analysis which shall analyze activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works Program.

2.4 Three Month Rolling Program

The monthly issue of the Three-Month Rolling Program.

2.5 Financial Status

It should include following

- a) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.
- b) A spread sheet indicating the status of all payments due and made.
- c) A status report on status of extra items, if any

2.6 Status of Claims

A report on of the status on any claims outstanding. The report shall in particular provide interim updated accounts of continuing claims.

2.7 Milestones/Key Dates Status

A report on the status of all milestones/ key dates due to have been achieved during the month and forecasts of achievement of any non-achieved key dates and those due in the next month

2.8 Resources Status

- 2.8.1 The Contractor shall submit to the Engineer each month a detailed list by trade classification, of manpower

employed during the report period, stock of all major construction materials as also a list of all serviceable major items of construction plant and equipment on site including those which are proposed to be mobilized during the next month.

2.8.2 A report on the status of deployment of all key personnel and other manpower by trade Vis – a - Vis their deployment schedule and explaining constraints if any.

2.8.3 Status of stock of all the major construction material vis -a- vis its requirements for next month.

2.8.4 Status of all serviceable major construction plant and equipment at site.

2.9 Procurement Report

2.9.1 A summary of all significant procurement activities during the month, including reasons of delay (if any) and action taken to overcome problems.

2.9.2 A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

- (a) purchase Order Date – Scheduled/ Actual,
- (b) manufacturer/ Supplier and Origin,
- (c) letter of Credit Issued Date,
- (d) manufacturer/ Supplier Ship Date – Scheduled/ Actual,
- (e) method of Shipment,
- (f) Arrival Date in India – Scheduled/ Actual.
- (g) Arrival date at site and commissioning date

The report should also explain the delays (if any) in arrivals of the major equipment at site and the actions taken by the Contractor to expedite the same and the measures proposed to makeup the time loss.

2.10 Production and testing

It should include following:

- (a) A review of all production and manufacturing activities during the month.
- (b) Summaries of all production and manufacturing outputs during the month together with forecasts for the next month.
- (c) Review of all testing activities (both at site and at the manufacturer's premises) during the month.

2.11 Safety

A review of all safety aspects during the month including safety inspections / audits, reports on all accidents and actions proposed to prevent further occurrence.

2.12 Environment

2.12.1 A review of all environmental issues during past month shall include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

2.12.2 In case of failure of the Contractor to make submissions as per section 1.4 herein above, the Employer/ Engineer shall retain 5% of the due progress payment till the submissions. For non-submission of Monthly Update and Progress Reports as per Clause 2 herein above, the Employer/ Engineer shall retain 5% of the due progress payment in each case, which shall be released upon submission of the same. In case the submissions are not made in the month it is due, the retained payment would be released only in the next Monthly Running Bill.

Appendix – II - Method of Measurements for Permanent Works**1 Introduction**

- 1.1 The detailed procedure to be followed for the recording of measurements and for the preparation and passing of Contractors Bills for permanent works is set out in the following paragraphs.

2 Measurement of Works**2.1 General**

- 2.1.1 Measurements shall be taken at such intervals as are found necessary or convenient. Generally, one bill will be preferred in a month or as specified in the contract.
- 2.1.2 Entries should be made only in ink, and no entry should be erased or defaced so as to make it illegible. Correction of mistake, if any, shall be made by neatly crossing out the incorrect entry and rewriting and correct words or figures. All such corrections should be initialed by the Contractor's Engineer as well as by the Engineer's Representative at site.
- 2.1.3 Format of Record of Measurements sheets and procedure for issue of these measurement sheets shall be as decided by Engineer / Employer.
- 2.1.4 Before starting the earth work for embankment, cutting, bridge excavations etc., the initial ground levels shall be taken jointly along with engineer.

2.2 Items for which Good-for-Construction GFC Drawing is issued

- 2.2.1 As soon as the Good-For-Construction GFC drawing for a work is issued, the Contractor will calculate the details of quantities of various items of PRICE SCHEDULE involved, in a format approved by Engineer, and submit the calculations and schedule of quantities to the Engineer / Engineer's Representative and get them approved for the drawing.
- 2.2.2 Once the schedule of quantities is thus approved, the Contractor will submit five copies of the approved schedule to Engineer's Representative in an approved format.
- 2.2.3 The Contractor will submit his payment claims based on the approved schedule of quantities along with certification of actual work done as per specifications, drawings and contract conditions and within the tolerances as specified. Measurement will be entered in Record of Measurement Sheet duly signed jointly on each page by Contractor's authorized qualified engineer and Engineer's Representative.
- 2.2.4 Abstract of measurement will be prepared by the contractor in the approved form based upon these measurements.

2.3 Items for which Good-For-Construction GFC Drawing is not issued

- 2.3.1 For all such works, whose measurement cannot be calculated from any Good-For-Construction (GFC) drawing, all measurements will be taken by the Contractor's authorized qualified Engineer in the presence of the Engineer's Representative at site. These measurements will be recorded on approved form of Record Measurement Sheet and signed jointly by contractor and Engineer's Representative.
- 2.3.2 Contractor will ensure that a properly qualified Engineer is deputed for taking measurements and also that all the measurements taken are witnessed and signed by the Engineer's Representative.
- 2.3.3 All measurements should be recorded at site on the Record of Measurement Sheet in the presence of the Engineer's Representative.
- 2.3.4 Each Measurement Sheet should be signed by the Contractor's Engineer as well as by the witnessing Engineer's Representative.
- 2.3.5 Based on the recorded measurement contractor will prepare abstract of quantities in the approved format.

Appendix III - Quality Manual

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1 Purpose

This document titled 'Construction Quality Guideline' sets the minimum Quality Standards that are to be adopted and implemented across all the projects of the BSTP project Programs. This document only provides an outline and overview of the obligations, the detailed and specific quality requirements are described in Indian Legislation.

2 Scope

- a. This procedure applies to Bangalore Suburban Rail Projects and sub projects at BSTP, project information / records created regardless of format, which includes information generated by the General Consultant, D&B Contractor(s) and 3rd Parties.
- b. BiRide contracts complete packages. These packages consist in detail engineering, construction / production, quality planning, assurance and control and at last quality verification.
- c. BiRide requires the fulfilment of the BiRide CMS Quality Policy, the quality objectives and the project quality plan(s) throughout the lifecycle of the contracted work

3 Definitions

Table 1: Definitions

Term	Definition
BiRIDE	The Employer and Client
General Consultant	Bangalore Suburban Rail Projects' General Consultant (Egis, AECOM & WSP JV).
The Engineer	General Consultant
Initiator / Originator	The person who starts the process.
Participant	The person who is or may be involved in the implementation of the procedure.
D&B Contractor	The organization contracted by the Employer to carry out the Project D&B works.
3 rd Parties	3 rd party Project stakeholders.
Project Partners	The term 'Project Partners' used throughout this document includes the Client, General Consultant, other Consultants, Contractors, Subcontractor's, Suppliers and anyone else who undertake works on the Bangalore Suburban Rail projects.

4 Responsibilities

4.1 Project Directors

- a. Provide positive leadership on quality issues.
- b. Promote an enthusiastic quality culture that delivers positive commitment to and engages all employees in continuous improvement in quality performance.
- c. Keep abreast of developments of Indian quality legislation and industry standards.
- d. Ensure that a quality management system is implemented within their sphere of responsibility and monitor and review its effectiveness and take necessary improvement action.

- e. Monitor that personnel under their control comply with their individual responsibilities in quality matters.
- f. Ensure that the disciplinary process to address breaches of the quality policy or management system is applied where necessary.

4.2 Senior Managers

- a. Senior Managers are people in the organisation at any level above senior supervisor and below director.
- b. Provide positive leadership on quality issues within their area of operation.
- c. Promote an enthusiastic quality culture that delivers positive commitment to and engages all employees in continuous improvement in quality performance.
- d. Implement the business unit quality management system. In particular:
 - i. Identify quality training needs and have the necessary training arranged and when arranged, release those who require training.
 - ii. Make arrangements for quality induction training for all new starters at the workplace under their control.
 - iii. Implement operating procedures, for the planning and control of activities associated with identified risks.
 - iv. Ensure that written method statements, risk assessments and/or quality rules are brought to the attention of management.
 - v. Appoint appropriate personnel to undertake quality duties.
 - vi. Ensure that suitable arrangements are in place for the effective control of changes to planned methods of work.
 - vii. Keep abreast of developments in Indian quality legislation and industry standards.
 - viii. Monitor and review the effectiveness of the quality management system and report deficiencies.
 - ix. Monitor that personnel under their control comply with their individual responsibilities in quality matters.
 - x. Give personnel under their control, including contractors, clear instructions as to their responsibilities to ensure correct working methods.

4.3 Designers

- a. Ensure staff, are competent and adequately resourced to address the quality issues likely to be involved in the design.
- b. Consider quality when designing structures, equipment systems, temporary works.
- c. When carrying out the design, provide adequate information about any quality risks associated with the design.
- d. Coordinate activities with that of others to improve the way in which quality is managed and controlled.

4.4 Quality Managers and Officers

- a. Provide positive leadership within their area of operation and promote the adoption of best practice.
- b. Promote an enthusiastic quality culture that delivers positive commitment to and engages all employees in continuous improvement quality performance.
- c. Keep abreast of developments in quality legislation and industry standards.
- d. Monitor and report on the effectiveness of the quality management system and progress against the quality performance standards and make recommendations for improvement as appropriate.
- e. Monitor and report on operational quality performance and make recommendations for improvement and monitor to ensure that effective action is taken.
- f. Lead and provide functional management for any quality personnel under their control.
- g. Assist with the identification of quality training needs, and monitor delivery and recording.

- h. Monitor and report on the implementation of the approved quality objectives.
- i. Produce quality performance reports as required.
- j. Promptly alert line and functional management to significant quality issues and where appropriate be involved in the investigation and ensure that the findings are reported.
- k. Review quality reports, identify any trends and ensure that there is an appropriate response to prevent future recurrence.

4.5 Section, Site, Discipline Engineers and Foremen

- a. Appreciate the responsibility allocated to individuals within the operative and management structure.
- b. Set a good example and leadership on the site.
- c. Ensure that only trained and authorised workers use plant and equipment and that persons undergoing training do not operate plant and equipment unless closely supervised by a competent person.
- d. Ensure that employees under their control attend quality induction training before working on the site and that they are correctly supervised at all times
- e. Ensure that materials, plant and equipment under their control or brought to site by the subcontractor has any necessary certificates of test, inspection and examination and is safe to use
- f. Ensure that clear instruction and information is given to persons under their control.
- g. Carry out recorded quality inspections of site conditions.
- h. Attend any meeting on quality issues as required and as applicable, co-operate with all personnel on matters of quality.

4.6 Supervisors

- a. Supervisors are people at the first level in the organisation that have responsibilities over the work of others.
- b. Provide positive leadership on quality issues for the members of the work team for which they are responsible.
- c. Promote a positive attitude in the workforce and encourage behaviours that protect both people and the environment.
- d. Monitor that personnel under their control comply with their individual responsibilities in quality matters.
- e. Give personnel under their control, including contractors, clear instructions about the required methods of work.
- f. Identify any quality training requirements of personnel under their control and advise appropriate management accordingly.
- g. See that all quality issues are reported immediately to the relevant manager.

4.7 All Employees

Set a good personal example on quality issues within your area of operation.

5. Legal and Other Requirements

- a. All work is to be undertaken in compliance with the requirements of Indian Law. If no local standard exists or the applicable standard is not specified, the appropriate and compatible internationally recognised standard or code of practice shall be adopted.
- b. The hierarchy of standards is as follows:
 - i. Indian Standards (IN),
 - ii. Euro Norm (EN),
 - iii. British Standards (BS),

- iv. International Standards and Codes of Practice
- v. Alternative standards may be proposed if they can satisfactorily be demonstrated that they are equivalent, in all respects, to the defined standards. Where there is a discrepancy or a conflict, the higher or stricter standards shall take precedence. Project Partners are to ensure that all prescribed registers, certificates and records are maintained and available for inspection at the relevant work locations by any authorised person.

6. Quality Objectives

- a. Quality objectives must be defined and made available for all internal and external stakeholders. The completion of the quality objectives must be checked on a regular basis and the measures must be adopted accordingly in line with the BiRide's Quality Strategy and to achieve Right the First Time.
- b. These quality relevant objectives (KPI) will be defined by the BiRide's Executive Management and Program Team as appropriate.
- c. Quality goals which are applicable to each program and/or project contract and particular type of work will be defined by the Project Partner with agreement of the Engineer.

7. Quality Standards, Codes and Specifications

- a. Quality standards, codes and specifications must be defined during design and engineering by the engineering disciplines (infrastructure and civil works, system/MEP, rolling stock, operation and maintenance) for the different packages.
- b. The program will comply with all pre-defined international codes and standards which satisfies the requirements of ISO 9001:2015 and deliver a state-of-the-art BSTP.

8. Tender and Procurement

- a. Quality during tendering and procurement will be ensured by the following measures:
 - i. All tendering documents must fulfil the requirements of ISO 9001:2015.
 - ii. All program partners must be certified according to ISO 9001:2015. The certification must include the scope of services being provided to BiRide and include the specific project location.
 - iii. Basic quality requirements for all tendered parts must be defined (during design and construction) with documentation by engineering discipline (e.g. infrastructure and civil works, system/MEP, rolling stock, operation and maintenance).
 - iv. Define selection criteria based on selected capabilities and experiences.
 - v. Define pre-qualification in line with BiRide processes and procedures.
 - vi. Detailed quality requirements must be defined by program partners according to the complexity of their scope of supply (to be defined during procurement Process).
 - vii. Potential program partners must provide a provisional quality plan according to the complexity of their scope of supply (to be defined during procurement). This provisional quality plan must be submitted together with the bidding documents.
 - viii. Ongoing improvements of quality requirements (e.g. change of standards) by the BiRide program and potential program partners must be incorporated throughout the project lifecycle.
 - ix. Tendering documents must be approved by engineering discipline, where applicable (e.g. infrastructure and civil works, system/MEP, rolling stock, operation and maintenance).

9. Design and Engineering

- a. The contractor must define:
 - i. Design and engineering stages.

- ii. Review, verification and validation appropriate to each design and engineering stage.
- iii. Responsibilities and authorities for design and engineering.
- iv. Inputs, related to the contract requirements, must be defined as there are:
- v. Functional and performance requirements:
 - Applicable statutory and regulatory requirements.
 - When applicable, information derived from previous similar designs.
 - Other requirements essential for design and engineering.
- b. Design and engineering outputs must:
 - i. Define relevant standards, codes and specifications.
 - ii. Meet the project requirements.
 - iii. Define testing/inspection procedures as appropriate.
 - iv. Provide appropriate information and documentation (e.g. for purchasing,
 - v. Construction/production, testing, training, operation, maintenance etc.).
 - vi. Be reviewed at suitable stages by an independent Design Verification Engineer (DVE) in order to:
 - Evaluate the ability of the results or design and engineering to meet requirements.
 - Identify any problems and propose necessary actions.
- c. Design and engineering changes must be identified and records maintained
- d. Design and engineering changes must be reviewed, verified and validated as appropriate, and approved by DVE before implementation.
- e. Changes must be explicitly mentioned in order to highlight that the initial requirements have been altered.
- f. During testing phase special attention should be paid to changes (of scope or quality requirements) to the project.
- g. All defined quality relevant measures must be integrated in the contractor's Quality Management Plan (QMP).
- h. Design and engineering results must be checked, evaluated and validated by DVE before construction/production begins. These checks, evaluations and approvals must be documented and reported (communicated). The quality of the design work must be validated by the DVE at the end of the contract.

10. Construction

- a. To ensure adequate quality planning during the construction phase the following measures are foreseen:
 - i. Program Partners must have a validated QMP
 - ii. Copy of the contractor's current QMP
 - iii. Schedule showing all foreseen tests/inspections
 - iv. Schedule to perform audits in the contracted work
 - v. Procedure describing the handling of corrective action
 - vi. Procedure describing non-conforming items
 - vii. Process for continuous improvement.
- b. Program Partners must accomplish their work according to their validated QMP and have to:
 - i. Fulfil quality requirements.
 - ii. Accomplish the work according to the relevant standards, codes and specifications.
 - iii. Document and report the accomplished work.
 - iv. Train their personnel and assess their competencies.
 - v. Fulfil the requirements related to the contracted work.
 - vi. Perform and document planned tests/inspections.
 - vii. Deliver as-built-drawings to BiRide.
 - viii. Demonstrate the traceability of all quality relevant issues.
 - ix. Preserve products.
 - x. Control the monitoring and measuring equipment, including documentation.

- xi. Perform and document internal audits.
- xii. Handle non-conformities according to the related procedure. Nonconformities must be demonstrated to BiRide propositions/solutions resulting from nonconformities
- xiii. Carry out a continuous improvement (corrective and preventive action) with documentation. Solutions resulting from the continuous improvement process must be analysed
- c. The Engineer will, as regularly as deemed appropriate, monitor work samples with a frequency to ensure quality:
 - i. By inspecting the contractor's work on site.
 - ii. Verify the contractor's work according to the QMP.
 - iii. Perform and document planned tests/inspections.
 - iv. Verify the as-built-drawings of the contractor.
 - v. Analyse and approve changes within the contract.
 - vi. Pay special attention to project changes (scope or requirements) during test phase.
 - vii. Perform internal audits for each applicable contract.
 - viii. Analyse non-conformities with the contractor and approve solutions.
 - ix. Analyse solutions resulting from the continuous improvement process of the contractor within the contract and approve them.
 - x. Testing
- d. To ensure adequate quality planning during the test phase the following measures are foreseen:
 - i. Involving of end-user
 - ii. Organisation of test performance
 - iii. Definition of test results
 - iv. Test scheduling
 - v. Definition of any quality procedures during test performance
 - vi. Training of personnel, as required
 - vii. Test documentation.
- e. Performing quality assurance during the testing phase will be guaranteed by the following measures:
 - i. Definition of functions
 - ii. Observance and fitting of new designed functions with documentation
 - iii. Observance and fitting of functions which caused problems during design and
 - iv. Engineering or construction phase with documentation
 - v. Observance and fitting of functions which have been changed or optimised during design and engineering or construction phase with documentation
 - vi. Testing documentation in general.
- f. BiRide contracts complete packages. These packages consist in detail engineering, construction / production, quality planning, assurance and control and at last quality verification.
- g. BiRide requires the fulfilment of the BiRide Quality Policy, the quality objectives and the project quality plan(s) throughout the lifecycle of the contracted work.

11. Commissioning and Handover

- a. To ensure adequate quality planning during the commissioning and handover phase the following measures are foreseen:
 - i. Involving of end-user
 - ii. Organisation of commissioning procedures
 - iii. Definition of commissioning results
 - iv. Commissioning scheduling
 - v. Definition of specific quality procedures for commissioning process
 - vi. Training of personnel
 - vii. Commissioning documentation

- viii. As-built-drawings must be prepared and supplied upon completion.
- b. To ensure adequate quality assurance during the commissioning and handover process a number of measures have to be foreseen. These measures include, but are not limited to a general check of project, project packages and interfaces, including check of:
 - i. Documentation
 - ii. Materials
 - iii. Buildings and installations
 - iv. Electrical equipment
 - v. HVAC equipment (all building services)
 - vi. Earthworks
 - vii. Concrete works
 - viii. Structural works
 - ix. Waterproofing
 - x. Painting and coating
 - xi. Operation processes and procedures
 - xii. Training processes
 - xiii. Regular testing and inspection processes and equipment
 - xiv. Emergency and escape procedures and equipment.

12. Operations and Maintenance

Deleted

13. Training

- a. To ensure adequate quality planning for the training the following measures are foreseen:
 - i. Operation personnel must be trained according to a pre-defined training schedule with demonstration of the fulfilling (e.g. examination, depending on the job description) of the requirements.
 - ii. Inspection and maintenance personnel must be trained according to a pre-defined training schedule with demonstration of the fulfilling (e.g. examination, depending on the job description) of the requirements.
 - iii. New personnel must be trained according to the job requirements before starting. Fulfilling of the job requirements (e.g. examination, depending on the job description) must be demonstrated and documented.
- b. To ensure adequate quality assurance for the training the following measures are foreseen:
 - i. Personnel ability procedure
 - ii. Personnel training documentation and planning procedure.

14. Closing

- a. To ensure adequate quality planning for the closing process of the contract the following measures are foreseen:
 - i. Operation ability must be demonstrated over a pre-defined period
 - ii. Tests and inspections must be finished and documented
 - iii. Personnel must be trained.
- b. To ensure adequate quality assurance for the closing of the project all previous quality planning, assurance and control measures must be closed. Therefore, all project elements must be checked to ensure the required documentation is available and handed over to BiRide. For example:
 - i. Tendering and Procurement
 - ii. Contracting
 - iii. Design and Engineering

- iv. Construction
- v. Testing
- vi. Commissioning and Handover
- vii. Operation and Maintenance
- viii. Training.
- c. A completion list will be implemented and all missing documentation must be compiled within an adequate timeframe. The contract will be closed when BiRide gives a written confirmation of the final acceptance of all deliverables before handover to the operator.

15. Quality Surveillance, Non-Conformities and Improvement

- a. The Quality Manager (QM) must conduct internal audits at planned intervals to determine whether the QMP:
 - i. Conforms to the planned arrangements and to the requirements of BiRide
 - ii. Is effectively implemented and maintained.
- b. An audit program must be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods must be defined. An audit schedule must be prepared.
- c. If non-conforming project execution is detected the following measures are required:
 - i. Take action to eliminate the detected non-conformity
 - ii. Authorise its use, release or acceptance under concession by a relevant authority
 - iii. and, where applicable, by BiRide
 - iv. Take action to preclude its original use or application
 - v. Take action appropriate to the effects or potential effects of the non-conformity, if the non-conforming project execution is detected after beginning of operation.
- d. When non-conforming project execution is corrected it must be subject to re-verification to demonstrate conformity to the requirements.
- e. Records on the nature of non-conformities and any subsequent actions taken, including concessions obtained must be maintained.
- f. The QM must continually improve the effectiveness of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and project quality reviews.
- g. The QM must take action to eliminate the causes of non-conformities in order to prevent recurrence. Corrective actions must be appropriate to the effects of the nonconformities encountered and include, but are not limited to:
 - i. Reviewing non-conformities
 - ii. Establish the causes of non-conformities
 - iii. Evaluating the need for action to ensure that non-conformities do not recur
 - iv. Assessing and implementing corrective action
 - v. Recording the results of action taken
 - vi. Reviewing the effectiveness of the corrective action taken.
- h. The QM must determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive actions must be appropriate to the effects of the potential problems, at least:
 - i. State potential non-conformities and their causes
 - ii. Evaluating the need for action to prevent occurrence of non-conformities
 - iii. Set and implement the needed action
 - iv. Records of results of action taken
 - v. Reviewing the effectiveness of preventive action taken.

16. Quality Monitoring and Reporting

- a. To ensure the effectiveness of the quality monitoring and reporting BiRide will implement a quality committee who will meet regularly. This quality committee will analyse and report to the management team of the BiRide program the following matters at least (not limited to the list below):
- Minutes of the previous meeting/review of pending actions and decisions
 - Quality key issues
 - Project status
 - Project documentation and reporting
 - Inspection and testing
 - Surveillance
 - Non-conformities and improvement
 - Audits
 - Next meeting

Appendix-IV - Organisation Chart and Key Positions

The Contractor shall provide the following organization chart for the Works as follows:

1) Head office Organization Chart

One organization chart shall be provided for the Contractor head office indicating the management and staff structure, with responsible personnel/departments described for all aspects of the work.

2) Site organization Chart

The Contractor shall provide the proposed site organization indicating the proposed structure, staff partners and positions necessary to adequately manage and control the Works.

The Contractor shall have a competent team of Managers, Engineers, Technical staff etc. so as to complete the work satisfactorily as per various requirements of the contract.

Key positions (not limited to) and corresponding qualification and experience are as under

Sl. No	DESIGNATION	QUALIFICATION	EXPERIENCE LEVEL (FOR SIMILAR WORKS)	MIN. NO. REQUIRED
1	Project Manager/ Construction Manager	Bachelor's Degree in Civil Engineer	Minimum 15 years total experience and 5-year experience in the role of Construction Manager in the execution of similar type of work. For Diploma holder, additional 2 years of experience will be considered for above.	1
2	QA & QC Engineer	Bachelor's Degree in Civil Engineer	Minimum 6 years total experience and 4-year experience in execution of similar type of work. For Diploma holder, additional 2 years of experience will be considered for above.	1
3	Billing Engineer/ Quantity Surveyor.	Graduate / Diploma in Civil Engineering	Total minimum experience of 5 years with knowledge of computer applications for Degree and 7 years for Diploma with knowledge of Computer applications.	1
4	Senior Civil Engineer	Bachelor's Degree in Civil Engineer	Total minimum 5 Years for graduate & 7 years for Diploma in relevant field.	2

NOTES:

- The above categories of key positions shall be minimum required for successful completion of the work which shall be deployed at different points of time as per the progress and requirement of work and may not be required to deploy simultaneously and continuously. However, these personnel shall be deployed at site in advance as per requirement and as directed by the Engineer and the decision of Engineer/Employer in this regard shall be

final and binding. The above Manpower deployment plan shall be submitted by the contractor within the 14 days of award of work and shall be approved by Engineer in charge / Employer.

2. The Contractor shall submit the CVs of the above key positions to Engineer for his approval within 28 days of issue of letter of Acceptance (LOA).
3. The contractor shall deploy resources as per the above-mentioned minimum requirement and also confirm to deploy manpower over and above the minimum numbers indicated above, if the work requires so.
4. The performance of project personnel deployed will be evaluated periodically by Employer during the contract period. In case the performance of any of the project personnel is not satisfactory, the Contractor shall replace them with better or equivalent personnel immediately as per directions of the Engineer.
5. Tenderer may propose any number of names of Personnel for each Key Position. Any of the proposed personnel as approved by the Employer for each key position have to be mandatorily deployed in case of award of work.
6. Non-deployment of the Key personnel as per approved personnel for Sl.no 1,2,3 & 4 as per approved man power plan leads to imposition of Penalty of Rs 1,00,000 /- Per Key personnel per month. For other personnel, a penalty of Rs. 25,000/- per person per month shall be levied.
7. The proposed Key personnel are not to be changed till the completion of the work. Under emergent circumstances, in case they are required to be changed, the new incumbent should have similar or better experience and qualification than as required above. These changes are permitted only with the approval of the Employer. Change in key personnel for one time without penalty is permitted. However, for subsequent changes there will be Penalty at Rs 1,00,000 /- Per Key personnel for Sl.no 1,2,3 & 4.
8. All Key Personnel must be permanently stationed at Bangalore till the completion of the work.
9. The penalties imposed are non-refundable.

Appendix-V - Plant and Equipment

The Tenderer or JV as a whole must deploy the minimum required Contractor's Equipment for the Works as given below.

S. No.	Type of equipment required for the work.	Minimum No. of Units of equipment required for the work	Remarks
1.	Concrete pumps with sufficient pipes	1nos	
2.	Transit Mixtures	1nos	
3.	Crane of suitable capacity for erections and lifting	1nos	
4.	Trailers of Suitable capacity as per site requirement	1nos	
5.	Hydraulic excavator (1 cum bucket)	As required	
6.	Tippers/trucks (10 cum capacity)	3nos	
7.	Generators 125 KVA	1nos	
8.	Vibratory roller 8-ton capacity	As required	
9.	Water tanker of 6000 lit capacity	1nos	
10.	Plate Vibratory Roller	As required	
11.	Survey equipment's: Total stations and auto level	1 set	

Notes:

- i. The Tenderer shall undertake to deploy sufficient resources to carry out the Works. These resources are for peak period of each activity and shall be mobilised by the Contractor to suit his works programme.
- ii. If the Contractor opts for short line method for casting, the number of pre-cast bed shall be increased accordingly.
- iii. The Contractor's Equipment shall not be more than five years old reckoned from the date of original manufacture.
- iv. Hiring of Cranes shall be as per approved vendors for supply of cranes. The contractors are free to propose and utilize plant and machinery after getting approval from the Engineer. Third party certification of cranes, competency certification of the operators etc. would be required before grant of approval.
- v. Deleted
- vi. The proposed Contractor's Equipment shall not in any event be construed as a submission of final requirement for the Works.
- vii. Plant and equipment indicated above is minimum to be deployed at appropriate stage of the work. However, depending on the requirement to complete the work within the stipulated completion period the Tenderer shall deploy additional machinery as circumstances warrant at no extra cost. Plant and machinery above shall not be older than 5years. In case of failure of any plant and machinery deployed at site the same shall be repaired/replaced within 7days from the time of failure.
- viii. Tenderer shall submit the copies of ownership of the equipment, In case of hire / purchase, Copies of MOU with the supplier/ owner of the equipment.
- ix. *Contractor shall be penalized as deemed fit.
- x. The above type of plant and equipment (but not limited to) may be required for execution of the work. The contractor shall submit the details of plant & equipment to be deployed in the above table within 28 days of issue of LOA to the Engineer for approval.
- xi. Deleted.
- xii. Deleted.

Appendix – VI – Office Accommodation, Equipment and Personnel

Deleted

Appendix VII - Document Submission and Response Procedure

- 1 **Project Management Information System (PMIS)**
Deleted
IFC format (Industry foundation Classes)
Deleted
- 2 **Submissions To the Engineer**
The general requirements are as follows:
 - 2.1 **Project Management Information System (PMIS)**
 - 2.2 Deleted
 - 2.3 **Drawing and Specification Register**
The Contractor shall submit drawings and specifications register to the Engineer in electronic copy and hard copy with each submission of drawings and at an interval agreed by the Engineer. The drawings and specifications register shall be in a format submitted for review and agreed without objection by the Engineer and shall include each document reference number, version, date, title and data-filename.
2. **Records and Reports**
 - a) **Format**
Reports and records are to be submitted via the system to the Engineer and shall be in a format agreed by the Engineer. Reports and records shall be signed prior to submission by the Contractor's agent or by a representative authorized by the Contractor.
 - b) **Project Document Control Procedure**
Within twenty-eight (28) days after Commencement Date, the Contractor shall submit via the system a Project document control procedure to the Engineer for review, which shall include but not be limited to the following:
 - 1) a document approval system which shall specify the level of authority for approval of all documents and material before submission to the Engineer;
 - 2) a system of issuing documents to ensure that pertinent documents are issued to all appropriate locations;
 - 3) a document changes or re-issue system to ensure that only the latest revision of a document can be used; and
 - 4) a submission identification system that identifies each submission uniquely by the following:
 - a) contract number;
 - b) discipline;
 - c) submission number; and
 - d) revision indicator.
 - c) **Project Record**
Project records will eventually be used by the Employer to manage, operate and maintain the Works after the completion of the Project under construction and for future reference.
 - d) **Adequacy of the Project Record**
The Contractor shall submit the documents as required by the Engineer as Project records in full and on time. The Engineer shall determine the adequacy of the Project record.
3. **Submission and Response Procedure**
 - 4.1 **General**
Except where specific procedures are given for certain items, all submissions shall be submitted and reviewed according to the procedure laid down in the following clauses.
 - 4.2 **Proposal**
Each submission shall be accompanied by a brief introduction to explain which sub-system, part or section of the Works to which the submission refers, listing the documents enclosed with the submission, and

describing in outline how all relevant requirements of the Employer's Requirements are achieved by the proposals.

4.3 Submission Response Request

For each stage of submittal, the Contractor shall prepare a Submission Response Request (SRR) carrying the date of submission, the submission reference number as defined in Clause 2.2 (4) above, the submission title, the stage of submission (e.g., Technical Design, etc.), and the authorized signature of the Contractor's responsible engineer to confirm that, in the opinion of the Contractor, the submission:

- 1) Complies with all relevant requirements of the Employer's Requirements;
- 2) conforms to all interface requirements;
- 3) contains, or is based on auditable and proven or verified calculations or design criteria;
- 4) has been properly reviewed by the Contractor, according to the Contractor's Quality Assurance System, to confirm its completeness, accuracy, adequacy and validity; and
- 5) has taken account of all requirements for approval by statutory bodies or similar organizations, and that where required, such approvals have been granted.
- 6) contains 2 (two) properly signed copies of Independent Design Checker Certificate (Form IDCC) and 2 (two) properly signed copies of the Construction Design Pack Certificate (Form CDPC).

4.4 The Engineer's Response

The Engineer's response to all the submission from the Contractor will be made within 21 calendar days of receipt of the submission. If the submission is made later on the Design Submissions Programme, the Engineer may extend the review period depending on the amount of documentation accompanying the submission.

4.5 Monthly Design Review Meetings

Throughout each Design Stage, the Contractor shall attend monthly design review meetings with the Engineer. At these Engineer's review meetings, the Contractor shall present information, drawings and other documents to the Engineer in respect of all submissions programmed to occur during the following five-week period. The Contractor's presentations shall be in sufficient depth to enable the Engineer to obtain a clear understanding of the Contractor's proposals and to discuss the methodology and process used in reaching the proposed design solutions.

4.6 The Engineer's Observations

The Contractor shall record all of the Engineer's observations and any agreed actions resulting from the Engineer's review meeting and shall address each of these fully before submission of the respective documents for formal review.

4.7 Notification

If, in the Engineer's opinion, following receipt of a submission there is benefit to be gained from a meeting with the Contractor to clarify or discuss any of the contents of the submission, he will notify the Contractor accordingly with not less than 3 days' advance notice, and the Contractor shall attend at the time and place appointed by the Engineer.

4.8 Notice Of No Objection

The Contractor in respect of the Works or any sub-system, part or section may make no submission thereof unless a Notice of No Objection with Comments has been received for the previous stage of the same Works or any sub-system, part or section thereof.

5. Responded Procedure

5.1 Responded Procedures

The Engineer will respond in one of the following three ways:

- 1) "Notice of Rejection" (with "A" Comments)
- 2) "Notice of No Objection"
- 3) "Notice of No Objection with Comments" (with "B" or/and "C" Comments)

5.2 Response Definition

Definition of the Engineer's response:

- 1) "Notice of Rejection" (with "A" Comments) if following his review of the submission, the Engineer discovers major non-compliance, discrepancies or omissions etc. that in his opinion are of a critical nature, the Engineer will issue a "Notice of Rejection" (NOR) with type "A" comments. The Contractor shall revise and Re-Submit within 15 calendar days of receipt of "Notice of Rejection" from the Engineer addressing the Engineer's comments. Subsequently the Engineer shall respond within 15 calendar days of receipt of the resubmission. Following the issue of a NOR by the Engineer the Contractor is not entitled to proceed to the next programmed stage for that section of the work until all of the Engineer's comments have been fully addressed and a NONO issued.
- 2) "Notice of No Objection" if following his review of the submission the Engineer has not discovered any non-compliance with the contract the Engineer will issue to the Contractor a formal "Notice of No Objection (NONO)". A NONO from the Engineer irrespective of with or without comments does not in any way imply the Engineer's consent of the submission nor does it remove any responsibility from the Contractor for complying with the Contract. Issue of a NONO from the Engineer entitles the Contractor to proceed to the next stage of the programmed work.
- 3) "Notice of No Objection" (With Comments) if following his review of the submission the Engineer discovers discrepancies or omissions etc. that in his opinion are not of a critical nature the Engineer may issue a "Notice of Objection" with Comments, (NOWC) the comments will be of either type B or type C as defined below. The Contractor shall respond to the comments in accordance with the requirements of Clause 4.3. Following the issue of a NOWC by the Engineer the Contractor is entitled to proceed to the next stage of the programmed work subject to the inclusion of amendments necessary to address the comments.

6.0 The Contractor shall respond to Type B and C comments and get the Engineer agreement and closure prior to full inclusion in the Final Design.

6.1 The Engineer's Comments

Definition of the Engineer's comments:

- 1) Type "A" Comments are of a critical nature that renders the submission non-compliant with the Contract, the submission shall be corrected and resubmitted.
- 2) Type "B" Comments are of an intermediate nature that shall be responded, agreed and incorporated.
- 3) Type "C" Comments are of a minor nature or may affect future submissions.

7 Records

The Contractor shall establish and maintain a place for the storage and archiving of all the documents relating to the Works and are not required to be submitted to the Engineer under Clause 2.

8 Implementation of BIM System

Deleted

(i) IFC format (Industry foundation Classes)

Deleted

Appendix VIII - Drawing List

Deleted

Appendix-IX - Work Areas

Land shall be made available by the Employer within the depot premises for casting yard, site offices, and site laboratories. Contractor shall make his own arrangements at his own cost.

Appendix-X - Works Areas & Temporary Power Supply

1. Introduction

- (1) The Contractor shall provide within the designated principal Works Areas, at locations agreed with the Engineer, the compounds and facilities for the Engineer and other contractors of the Employer defined under Clause 2 of this Appendix.
- (2) The standard conditions applying to the use of any Works Area by the Contractor for its site facilities are given under Clause 2 of this Appendix.
- (3) The Conditions for supply of electricity by the Contractor to Designated Contractors are given under Clause 3 of this Appendix.

2. Standard Engineering Conditions

The following standard engineering conditions apply to all Works Areas:

- (1) Formation
 - (a) The Works Areas shall be formed to the levels that the Engineer has given his consent. No such levels shall be amended without prior consent of the Engineer.
 - (b) The Works Areas shall be surfaced in a manner agreed with the Engineer, compatible with their intended use, and, in particular, footpaths and roadways connecting facilities shall be clearly defined. Measures shall be taken to the satisfaction of the Engineer to ensure all areas are properly drained and kept free of static water.
 - (c) The removal, diversion or reinstatement elsewhere as may be required of any existing works or installation whatsoever within the Works Areas shall be carried out to the satisfaction of the Engineer.
- (2) Roads & Parking
 - (a) Space shall be provided within the Works Areas for parking, loading / unloading and maneuvering of motor vehicles.
 - (b) Any damage done to the adjoining public roads and fixtures and properties (public or private) shall be made good to the satisfaction of the Engineer.
- (3) Drainage & Sewerage
 - (a) All storm or rainwater from the Work Areas including any access roads thereto shall be conveyed to the nearest stream course, catch-pit, channel or storm water drain as required by the Engineer. All temporary and permanent works shall be carried out in such a manner that no damage or nuisance are caused by storm water or rain water to the adjacent property.
 - (b) No drain or water course shall be used without consent of the Engineer.
 - (c) Damages or obstructions caused to any water course, drain, water-main or other installation within or adjoining the Works areas shall be made good to the satisfaction of the engineer.
 - (d) Treatment and disposal of sewage and waste water from the works areas shall be provided to the satisfaction of the engineer.
- (4) Buildings
 - (a) No permanent structures other than those required for the Permanent Works shall be Temporary permitted on the Works Areas.
 - (b) Electricity, water, telephone and sewerage shall be provided by the Contractor, as required, for all temporary buildings.
 - (c) No potable water obtained from the Govt. Sources shall be used for heating, cooling and humidification purposes, or vehicle washing without the written consent of the Engineer.
- (5) Pedestrian Access

Every existing pedestrian access throughout the Works Areas shall be maintained in a usable condition at all times to the satisfaction of the Engineer including lighting, signing and guarding.
- (6) Fencing

The Works Areas shall be secured against unauthorised access at all times. In particular fencing or the like shall be maintained, removed and re-erected in the new location wherever and whenever a Works Area is relinquished in stages.

3. **Applicability**

- (1) Where the Contractor is required to provide temporary electrical supplies, or to use, extend or expand on temporary supplies installed by others, all such activity shall be executed in accordance with Paragraphs of this Appendix.
- (2) When the Contractor makes use of temporary electrical supplies provided by others he will observe and comply with the requirements of this Appendix.

4. **Work On Site**

- (1) The contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Engineer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring all the necessary electrical equipment on site. The contractor shall not install or operate any temporary site electrical systems until his representative is appointed and has commenced duties.
- (2) The name and contact telephone number of the representative having been reviewed without objection by the Engineer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.
- (3) Schematic diagrams and the details of the equipment for all temporary electrical installations shall be submitted by the Contractor, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for his consent.
- (4) All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorized electricians, who are registered as such under the Electricity Ordinance 1990 / Electricity (Registration) Regulations 1990.

5. **Electrical General**

Temporary electrical Site installation and distribution systems shall be in accordance with: -

- (1) Indian Electricity Rules
- (2) The Power Companies' Supply Rules;
- (3) Electricity and its subsidiary Regulations;
- (4) IEE Wiring Regulations (16th Edition);
- (5) BS 7375 Distribution of Electricity on Construction and Building Sites;
- (6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and
- (7) BS 6164 Safety in Tunneling in the Construction Industry.
- (8) Any other applicable national standards

6. **Materials, Appliances and Components**

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

7. **Design Considerations**

- (1) Distribution equipment utilized within the temporary electrical distribution system shall incorporate the following features: -
 - a) Flexibility in application for repeated use;
 - b) Suitability for transport and storage;
 - c) Robust construction to resist moisture and damage; and
 - d) Safety in use.
- (2) All cabling shall be run at high level whenever possible and firmly secured to ensure they do not present a hazard or obstruction to people and equipment.
- (3) The installation on Site shall allow convenient access to authorized and competent operators to work on the apparatus contained within.

8. **Mains Voltage**

- (4) The site mains voltage shall be as per the electricity authority, 415V/3 phase 4 wire system.
- ii. Single phase voltage shall be as per the electricity authority, 230V supply.
 - iii. Reduced voltages shall conform to BS7375.

2. **Types of Distribution Supply**

The following voltages shall be adhered to for typical applications throughout the distribution systems:

- iv. fixed plant-415V/3phase;
 - v. movable plant fed by trailing cable-415V/3 phase;
 - vi. installations in Site buildings- 230V/1phase;
 - vii. Fixed flood lighting-230V/1phase;
 - viii. Portable and hand held tools-115V/1phase;
 - ix. Site lighting (other than flood lighting)-115V/1phase; and
 - x. Portable hand-lamps (general use)-115V/1phase.
3. When the low voltage supply is energized via the Employer's transformer, any power utilized from that source shall be- either 415 V. 3 phase or 230 V. 1 phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.
4. **Protection of Circuits**
- a) Protection shall be provided for all main and sub-circuits against excess current, under and over voltage, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.
 - b) Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with: -
 - (i) BS 88;
 - (ii) BSEN 60898; and
 - (iii) BS 7375;
 - (iv) Any other appropriate Indian Standards.

9. **Earthing**

- (1) Earthing and bonding shall be provided for all electrical installation and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.
- (2) Earthing systems shall conform to the following standards: -
- a) IEE Wiring Regulations (16th Edition);
 - b) BS 7430;
 - c) BS 7375; and
 - d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

10. **Plugs, Socket Outlet and Couplers**

Low voltage plugs, sockets and couplers shall be colors coded in accordance with BS 7375, and constructed to conform BSEN 63809 high voltage coupler and 'T' connections shall be in accordance with BS3905.

11. **Cables**

- (1) Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.
- (2) For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following specifications appropriate to the duties imposed on it:
- c) BS6708 flexible cables for use at mines and quarries;
 - d) BS6007 rubber insulated cables for electric power and lighting; and
 - e) BS6500 insulated flexible cords and cables.
- (3) Where low voltage cables are to be used, reference shall be made to BS 7375. The following specifications shall also be referred to particularly for under ground cables:-
- a) BS6346 for armored PVC insulated cables; and

- b) BS6708 Flexible cables for use at mines and quarries.
- (4) All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.
 - (5) Armoured cables having an over sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.
 - (6) For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.
 - (7) Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be of a type insulated and sheathed with a general purpose or heat resisting elastomer.
 - (8) All cables which are likely to be frequently moved in normal use shall be flexible cables. Flexible cables shall be in accordance with BS 6500 and BS 7375.
12. **Lighting Installation**
- (1) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS4363.
 - (2) Voltage shall not exceed 55V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.
 - (3) Luminaires shall have a degree of protection not less than IP54. In particularly bad environments where the luminaires are exposed to excesses of dust and water, a degree of protection to IP65 shall be employed.
 - (4) The Contractor shall upgrade the lighting level to a minimum of 200 lux by localized lighting in all areas where required by the Engineer.
 - (5) Mechanical protection of luminaires against damage by impact shall be provided by use of wire guards or other such devices whenever risk of damage occurs.
13. **ELECTRICAL MOTORS**
- (1) Totally enclosed fan cooled motors to BS4999:Part 105 shall be used.
 - (2) Motor control and protection circuits shall be as stipulated in BS 6164. The emergency stops for machinery shall be provided
14. **Inspection And Testing.**
- Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16th Edition).
15. **Identification**
- Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.
16. **Maintenance:**
- (1) Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.
 - (2) All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.
17. **Metering**
- The Contractor shall install separately metered and invoiced supply or supplies of electricity for: -
- (a) Site fabrication facilities;
 - (b) Site work shops and work yards; and
 - (c) Site offices and stores.

Appendix - XI – Utilities

Deleted

DEFINITIONS**1. Utilities:**

Utilities are defined as public utilities above or below ground and include all live water mains, sewer mains, water wells, power cables, streetlights, transformers, pillar boxes, telephone posts, telecommunication cables, gravity sewers, storm water drains, gas lines which are either shown on the Employer's Drawings (charted) or identified on site by the Contractor (uncharted).

1.1 Charted Utilities:

Charted Utilities are the utilities (as defined above) which are shown on the Employer's Drawings.

1.2 Uncharted Utilities:

Uncharted Utilities are the utilities (as defined above) which are not shown on the Employer's Drawings.

1.3 Responsibility of the Contractor.

- 1.3.1 The Contractor shall make his own enquiries and investigations, including excavating trial holes/pits, to ascertain the existence, nature, location, and size of utilities. A schedule of utility diversions and utilities to remain but to be supported / protected (the utility diversion plan) shall be prepared by the Contractor and submitted.

The schedule will list out utilities that:

- will be diverted by the Contractor during the course of the Works, and
- will remain in place and require the use of specific construction protection methods to complete the underground structures around and below the utilities including support of the utilities during construction by the Contractor.

- 1.3.2 The Contractor shall take into consideration the time required for utility diversions into the overall Works Programme for the Contract. However, efforts shall be made to avoid diverting/disturbance of any utility and continue the Works by supporting the same but the required services being provided by these utilities shall be maintained at all the times by the Contractor. Any delay to construction works due to delay in Utility diversion work will be responsibility of contractor, no claims shall be entertained in this regard.

- 1.3.3 The diversion work shall be undertaken by the Contractor as per the approval of the Utility owning Agencies and a notice from the Engineer. Temporary supports and protection by methods proposed by the Contractor and agreed by the Utility Agency shall be provided to the utilities. Permanent supports and protection shall be provided wherever required for the safety and security of the utility service.

- 1.3.4 The Contractor shall immediately inform the Engineer and the Utility Agencies of any
- (a) damage to utilities.
 - (b) leakage of utilities.
 - (c) discovery of utilities not previously identified.

- 1.3.5 When diverting and/or protecting sewerage and storm water lines the Contractor shall ensure that drainage to the site and adjacent areas is maintained at all times and that at no times flooding/overflow or other nuisance occurs.

- 1.3.6 The Contractor shall inform the Employer/Engineer of the programme of all works of utility diversion/ protection works and shall take all steps to enable the utility diversions to proceed in accordance with the programme. The Contractor shall maintain close liaison with the Utility Agencies. The Contractor shall set up and manage a Utility Liaison Group of experienced personnel for the duration of the Contract.

- 1.3.7 Records of the existing utilities encountered shall be kept by the Contractor on the Site and a copy provided for the Employer/Engineer. The records shall contain the following details:

- (d) location of utility.
- (e) date on which the utilities were encountered.
- (f) nature and sizes of the utilities.

- (g) condition of utility.
 - (h) temporary or permanent supports provided, and
 - (i) Diversions made –Temporary or permanent
- 1.3.8 The Contractor shall include the details (plan, location, ownership, size, and material) of all such utilities on the As Built Drawings.
- 1.3.9 .Deleted.
- 1.3.10 Temporary diversion of each utility is allowed for one time. If the utility is to be restored, permanent restoration shall be considered in addition to the temporary diversion.
- 1.3.11 NOC & Approval of schemes for Diversion of Utilities from the concerned regulatory /statutory/Local Authority is the responsibility of the Contractor in coordination with Employer, Employer will only assist in getting permission and nothing extra is payable on this account. Similarly, necessary precautions which are specified from time to time by the utility owning agencies shall be followed. Contractor should make his own survey for identification of underground/above ground utilities.

2. Diversion and Protection of Underground/Overhead Utility Lines

- 2.1 The work comprises of replacement, relocation, diversion and protection of existing subsurface, surface and overhead public utilities viz. sewer mains, water lines, water wells, storm water drains, gully pits including connection pipes, house drains, gas pipe lines, electric and telephone cables, optical fibre cables including their appurtenance structure, O.H. electrical transmission line, electric poles, traffic signals, etc. which will be disturbed due to construction of the stations, where applicable.
- 2.2 The Contractor shall effectively protect all public utilities falling within the stations, station entry & exit locations and their immediate adjoining areas or which are likely to be exposed, disturbed or damaged during the execution of the work or in consequence thereof, in such a manner and using such materials as required or specified by the concerned public Utility Agencies and as per instruction of the Engineer, and hold them in proper position without any damage being caused to them during execution of work.
- 2.3 The contractor shall provide and lay pipes, water wells, gas mains/gully pit connections/house drains and other electric, telephones, copper telecom cable, optical fibre cables and other cables or any other underground structures or services falling within the station and their immediate adjoining areas which may be found to have been disturbed or damaged due to the Contractor's fault and/or defective and careless workmanship. The decision of the Engineer in this respect shall be binding and final and all costs of rebuilding or repairing of such damaged services or structures as foresaid shall be deducted from the Contractor, if the same is not taken care of within a reasonable time frame, mutually agreed between the Engineer and the Contractor. The claim or penalty imposed by the concerned utility department for the damage of utilities done by the contractor shall be recovered from the Contractor.
- 2.4 The Contractor shall enquire of and collect information from all concerned public Utility agencies, owners, Government Departments and local bodies in connection with the sewer lines, water mains, water wells, cables, wires and any other obstruction either overhead or on ground or underground which may be encountered in the course of execution of the work and which are likely to affect the progress of the work, at his own cost and risk. No idle labour charge will be admissible on account of delay in collecting the above-mentioned information.
- 2.5 The Contractor shall have to excavate trial trenches of suitable sizes for satisfactorily exploring all the underground utilities as required and as instructed by the Engineer before commencement of any permanent work below ground level. All works related to utility identification and preparation of drawings obtaining stake holders approval shall be included in the Contractors quoted price. The time of completion for the project is inclusive of diverting and/or protection (temporary as well permanent) of utilities.

3. Additional Conditions for Diversion/Protection of BWSSB Utilities

- 3.1 It is the responsibility of the Contractor to get the approval of the proposed water/sewer/storm water/ pipeline etc., diversion/shifting from the concerned Agency/Authority. However, Engineer / Employer may facilitate the co-ordination work with concerned agency for getting the necessary approval.
- 3.2 In case the concerned utility agency/authority maintains a list of registered/approved contractors for undertaking such works and desires such shifting/diversion of pipeline/utility etc. work to be undertaken by such registered/approved contractors, then such shifting/diversion of pipeline/utility etc., shall have to be carried out by engaging the registered/approved contractors.
- 3.3 In case the Engineers of concerned utility agency intend to supervise the work, the Contractor (or sub-contractors engaged by the Contractor) have to carry out the work as per the instruction of the utility agency during diversion work by the Contractor.
- 3.4 In case of permanent diversion of water/sewer/storm water/pipelines etc., it is the responsibility of the Contractor to carry out such work without affecting water supply/without affecting sewage disposal etc. If required alternative temporary arrangement shall have to be made by the Contractor without any additional cost.
- 3.5 In case of temporary water pipe/sewer pumping mains (without manholes) diversion (which means divert the pipeline temporary away from station box and brought back to the original position after completion of station work), it is the responsibility of the Contractor either to use the retrieved diverted pipes or new pipes to restore back the original place without affecting the water supply/utility service.
- 3.6 In case of temporary diversion of gravity sewer pipelines with manholes are required, the Contractor, initially before taking up the station work has to ensure that the flow is diverted by laying sewer pipeline and constructing manholes away from the station box and then only divert the flow. After completion of station work, the Contractor shall have to lay again another sewer pipelines and again construct new manholes for restoring back to the original place.
- 3.7 In case of temporary supporting of water/sewer pipelines, if any damages occur during construction period it is the responsibility of the Contractor to rectify the damages to the satisfaction of concerned agency. The cost of the rectification works shall have to be borne by the Contractor.
- 3.8 It is the responsibility of the Contractor to obtain completion certificate from concerned utility agency for each diversion work. The payment for such diversion work will be made to the Contractor after obtaining completion certificate from concerned utility agency.
- 3.9 The Contractor shall handover all the retrieved material to the stores of the concerned utility agency/concerned department at the Contractor's cost and submit the proof of handing over.

4. Electrical Utilities (BESCOM/KPTCL)

- 4.1 The Contractor shall submit the utility diversion programme to Engineer / Employer with diversion justification based on trial pit information.
- 4.2 The Contractor shall submit the diversion plan to Engineer at least 60 (sixty) days in advance of work commencing to obtain approval from Electrical utility agencies. For utility diversion proposals of BESCOM / KPTCL, the Contractor shall submit diversion justification with trial pit information and drawing(s) with the proposed diversion route(s).
- 4.3 The Contractor would submit application of diversion works to electrical utility agencies with diversion plans. The Contractor shall render necessary assistance.
- 4.4 The Contractor shall coordinate with the local officials to assess quantities and specifications of materials required for diversion works. Necessary assistance would be provided by the Employer and the Engineer.
- 4.5 The Contractor shall obtain necessary permission from the concerned departments/agencies to carry out the diversion/shifting works and get necessary permission from Traffic Police Department.

- 4.6 Wherever possible, horizontal directional drilling method shall be adopted at location where utility diversion works crosses roadways and require lane closures for excavation to avoid inconvenience to the traffic.
- 4.7 The electrical utilities diversion/ shifting should be carried out by the Contractors/agencies registered with the electrical utility agencies / KPWD and have the required grade license from the Chief Electrical Inspector to Government. The Contractor should be well acquainted with electrical works so as to maintain the standard. The Contractor shall inform the same to Employer/Engineer for getting consent from the concerned electrical utility agency.
- 4.8 The Contractor shall identify the quantity of materials required for the contract such that the material can be procured by the Contractor in bulk and in advance to the implementation of the utility diversion works. The quality of materials to be procured shall be approved by the concerned utility agency. Materials used for diversion/ shifting shall be of quality conforming to the applicable standard of the electrical utility agency and as per relevant BIS.
- 4.9 The source of materials and the guarantee for the materials to be used shall be submitted to Engineer for obtaining approval from the concerned utility agency. Any failure of the material within the guarantee period shall be replaced and installed free of cost by the Contractor.
- 4.10 Contractor shall inform the local officers/officials of the concerned utility agency about the diversion works at least 15 (fifteen) days before the execution of diversion.
- 4.11 The diversion / shifting utility work shall be carried out under the direct supervision of officials and the utility agency decision shall be final in this regard. The Contractor shall provide free access to officers/ officials / workman for the purpose of inspection/supervision.
- 4.12 After restoration of regular service completion certificate shall have to be obtained from the concerned departments/agencies. The regulations for working with utility agencies shall be as follows.
- The diversion/shifting utility work should be carried out without causing any inconvenience to the operation and maintenance of Sub-Station and other departmental works of the concerned utility agency.
 - The Contractor shall execute and complete the work strictly in adherence to the time schedule and to the satisfaction of the engineers and adhere strictly the direction of the utility agency in any matter.
 - The Contractor shall be responsible to protect the public and the employees of the utility agency against any accident that may arise during the execution of diversion/shifting utility works. The Contractor shall indemnify the Employer for any claims for damages/injuries to the person/property resulting from any such accident. The Contractor shall Compensation Act by the way of obtaining an accident risk type insurance to meet all purpose of relief, failing which or otherwise the Contractor shall be solely responsible for meeting the compensation awarded under the said Act.
 - The Contractor shall undertake to ensure free flow of traffic during execution of the diversion / shifting works and shall be responsible for any accident/loss of lives/property. Damage to the other existing utilities during diversion shall have to be rectified by the Contractor at his own cost.
 - The Contractor shall employ qualified technical personnel to carry out the diversion/shifting of utility works.
 - The Contractor shall apply well in advance for Line Clearance (LC) for carrying out the joint works/shifting works. Employer would authorise the Contractor to take LC from the concerned utility agency. If needed, Employer would provide assistance to the Contractor to get the LC. LC will be given by the concerned utility agency depending upon exigencies, which have to be strictly adhered to.
 - The Contractor shall handover all the retrieved / unused material to the stores of the concerned utility agency /concerned department at the Contractor's cost.
 - Contractor to pay the penalty/charges imposed by the utility agency for damage to the utilities on their own.

- i. The Contractor shall undertake not to revoke the above conditions until the completion of diversion/shifting works.

5. BBMP Utilities diversion

- 5.1 Diversion of Storm water drain shall be carried out as per the design, standard and general specifications of BBMP /PWD/concerned Highways Department.
- 5.2 The diversion route for storm water drain shall be approved by BBMP /concerned PWD/ Highways Department.
- 5.3 The invert level of diverting drain shall be maintained on par with upstream/downstream of connecting drains.
- 5.4 The Contractor shall make alternate arrangements to divert and ensure smooth flow of water from upstream side during construction.
- 5.5 The Contractor shall provide the adequate sizes of drain or follow the existing sizes as agreed by the concerned agency.
- 5.6 Diversion of storm water drain shall be carried out through the registered Contractors of BBMP/PWD/Highways Department (if such a list of approved/registered contractors is maintained by the utility agency).
- 5.7 Streetlights shifting shall be carried out as per the specification of BBMP.

6. BSNL Utilities diversion

BSNL utilities such as copper cable and OFC cables which are likely to be affected to be identified based on trial pit information. Contractor to prepare the diversion plan in coordination with the BSNL utilities agencies and get approval for the diversion plan. Employer/Engineer may provide assistance in this regard. Contractor to assess the required quantities based on the diversion plan. Cables procured to be Quality control checked by the concern wing of BSNL. Contractor to coordinate and arrange for the Quality control check by BSNL. Diversion of BSNL utilities to be done by the BSNL approved subcontractors and the completion certificate to be obtained from BSNL for the utility's diversion done. Private Telecom/OFC cable Contractor to manage the existing private telecom and OFC cables.

7. GAIL Utilities diversion

GAIL utilities such as gas pipelines which are likely to be affected to be identified based on trail pit information. Contractor to prepare the diversion plan in coordination with the GAIL authorities / agencies and get approval for the diversion plan. Employer/Engineer may provide assistance in this regard. Contractor to assess the required quantities based on the diversion plan. Contractor to coordinate and arrange for the Quality control check by GAIL Authority. Diversion of GAIL utilities to be done by the GAIL approved subcontractors and the completion certificate to be obtained from GAIL for the utility's diversion done.

8. Indian Railway (IR) Utilities diversion

IR utilities which are likely to be affected to be identified based on trail pit information. Contractor to prepare the diversion plan in coordination with the Railway authorities / agencies and get approval for the diversion plan. Employer/Engineer may provide assistance in this regard. Contractor to assess the required quantities based on the diversion plan. Contractor to coordinate and arrange for the Quality control check by Railway Authority. Diversion of Railway utilities to be done by the Railway approved subcontractors and the completion certificate to be obtained from Railway for the utility's diversion done.

9. General

Deleted

Appendix-XII - Contractor's Site Laboratory

1. SITE LABORATORY

Site Laboratory may be arranged by contractor at his own cost. However, contractor has to arrange and complete the all construction related tests as per the Inspection Test Plan (ITP) in NABL certified Labs.

- (1) The Site Laboratory shall be approximately 250 sqm in area. It shall consist of the following accommodation:

1 concrete laboratory	60 Sqm floor area
Soil laboratory	30 Sqm floor area
2 Office each	15 Sqm floor area
1 store room	10 Sqm floor area
1 kitchen	10 Sqm floor area
Male/Female toilets, changing room & shower	sufficient for 6 persons

- (2) The remainder of the 250 sqm shall consist of storage area for concrete cube curing tanks. The laboratory, office etc. shall be in one building; the curing tank storage building may be in a separate building, but if so, it shall be adjacent to the laboratory building & connected to it by a level, weather proof passageway. In addition, an area of covered hard standing of 50 sqm for motor vehicles shall be provided adjacent to the laboratory.

2. STANDARD OF CONSTRUCTION

- (1) The laboratory shall be constructed to the best Engineering practice and as approved by the Engineer. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be located in areas as agreed with the Engineer.
- (2) A water tank with minimum capacity of 2000 liters shall be installed. Constant water pressure of 15Kpa minimum shall be ensured in each laboratory.
- (3) In the case of sinks used for washing samples, adequate trapping and/or separating devices shall be provided to ensure the proper functioning of the facility.

3. FURNISHINGS AND FIXTURES

The contractor's site laboratory shall be provided with required furnishings and fixtures.

4. LABORATORY EQUIPMENT

- (1) The laboratory equipment, as listed below, shall be approved by the Engineer. The Contractor shall submit for the Engineer's approval within 2 weeks of the order to commence work the name of the supplier it intends to use for each piece of apparatus together with the relevant catalogue number.
- (2) The layout of the equipment in the testing laboratory shall be instructed by the Engineer. The equipment shall be maintained to accuracy appropriate to the required testing methods with routine calibration by an accredited organisation as recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.
- (3) The Contractor's site laboratory shall be equipped with the following material testing equipment as a minimum. The nature and quality of equipment required for pre-stressing maybe varied by the Engineer

depending on the detail of the Contractor's Design and Construction methods or for any other reason which he deems to be valid and necessary for the proper control of quality:

- (4) The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests shall be carried out in the Contractor's laboratory, unless otherwise permitted or required by the Engineer. Where the laboratory is not appropriately equipped and/or staffed for some tests, or if agreed to by the Engineer, tests may be carried out in other laboratories. All materials required approval of Engineer after 3 rd party test at approved or reputed NABL accredited laboratory at the discretion of engineer.
- (5) Employer / Engineer in charge may recommend any test pertain to work or material to any laboratory of repute if they are accredited for the relevant work to a standard acceptable to the Engineer. The cost of such tests shall be borne by contractor.

Determining Liquid Limit (1 complete set)

Liquid limit device (Casagrande type)	1set
Grooving tools	1No
Evaporating dish	1No
Spatula 100mm blade	1No
Laboratory balance, capacity 500gm, (Sensitivity 0.01gms.)	1No
Wash bottle, capacity 500ml.	1No
Moisture cans capacity 50ml.	24No

Determining Plastic Limit (1 complete set)

Evaporating dish	1No
Spatula 100mm blade	1No
Glass plate 250mm x 250mm x 12mm	2No
Moisture cans capacity 50 ml	12 No
Stainless steel rods, 3mm dia.	2No

Determining Moisture Content (1 complete set)

Micro Oven, capacity 35 liters, control temperature upto	200°C
1 No weighing machine, capacity 200gm., sensitivity 0.01gm.	1No
Lab. Tongs	1No
Moisture cans 75ml. with lid	36No

Compaction Characteristics (1complete set)

Standard compaction mould 100mm dia.	1No
Modified compaction mould 150 mm dia.	1N
Standard compaction Rammer,2.5kg.	1No
Modified compaction Rammer,4.5kg.	1No
Straight edge 300mm long	1No
Sample ejector for 100mm and 150mm	1No
Mould Sample tray 60x60x8cm	3No
Wash bottle, 500ml.	2No
Moisture cans 250ml	24No

Density of soilin-place by sand replacement method (2 complete set)

Sand density cone apparatus150ml	2No
Plate,300mm X 300mm	2No
Chisel 25mm X 150mm	2No
Hammer	2No
One gallon's field cans	24No
Sampling spoons	2No
Soft hair brush	2No
Moisture cans 250ml	48No

Sieve Analysis

Sieve shaker (portable)	1unit Coarse sieves in sizes from
100mm to10mm	(1set Fine sieves #4, #8, #16,
#30, #40, #50, #100, #200 each)	

Pans & covers

Specific gravity and absorption of coarse aggregate

Wire basket, 200mm dia Heavy duty suspension balance,

20kg X 1gm with accessory for weight in water 1set

Suitable water container	1 No.
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Unit weight of aggregate

Balance, 100Kg cap. With 10gm precision	1No
Tamping rod 16mm dia X 600mm long	1No
Measuring containers (3,10,15, 30 ltrs)	1each

Flakiness & Elongation

Flakiness gauge, Elongation Index	1set
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Soundness Test

Sodium Sulphate	25Kg
Soaking Tank	1nos
Balance, Cap. 3Kg, sensitivity 0.1gm	1set
Sieves: coarse, Fine	1set

Concrete

Bickets for concrete sampling	12Nos
Slump Cone	12Nos
Tamping rod	12No
Base plate	12No
Mixing pan for concrete	2No
Scoop for general purpose	2No
Concrete thermometer	2 No
Concrete cylinder mould 150mm*300mm; 100mm*300mm	10each
Concrete cube mould,100mm cube &150 mm cube	10each
Adjustable spanners for Dismantling cube moulds	6No.
Capping set	2No

Capping compound

Concrete curing tank with capacity for 270 cubes, temperature controlled, with circulation system drain and lockable cover	5No.
Schmidt test hammer	1No.
Compression testing machine (simple hand operated)	1 No.
Mould oil Temperature chart recorder	1No.

Miscellaneous

Vernier callipers to measure up to 200 mm, with elongated jaws	5 Nos
Steel rule, 300mm long graduated	2Nos
Rubber gloves	10Pair
Cotton working gloves	20Pair
First aid kit	1set
Wire brush	6Nos
Steel tape, 3m, 5m, 30m	3each
Ball peen hammer, 1kg	2Nos
Paint scraper. Approx. 100mm wide	8Nos
Float, steel Approx. 280 x 120mm	8Nos
Sack barrow	1No
Shovel: Square Mouthed	2Nos
Round Mouthed	2Nos
24-wheel trolley, heavy duty, approx. 0.7m X 1.0m long Pneumatic tyred type	1no
Wheelbarrow, rubber tyred	
Comprehensive tool kit	1no
Claw hammer, multi-grips, spanners (adjustable)	1No
Type NR Schmidt Hammer and tester with recording device	1No
Testing Anvil for Schmidt Hammer test (SHT)	1No.
Chart recording paper for SHT	10 pkts

Cover meter for detecting metal objects to depth of 100mm	
Below the surface of non-magnetic objects	3 No.
Noise meter	1 No.
RCPT Testing Machine	1No.
Permeability Testing Machine.	

**APPENDIX-XIII
PROJECT INTERFACE MATRIX**

DELETED

APPENDIX XIV
IGBC NORMS

Deleted

APPENDIX XV

KEY DATES

For Key dates, refer PCC

Annexure – I : Right of Access to the Site

Time for access to, and possession of the Site

The Right of access for the land for the permanent works shall be handed over Progressively from the date of agreement.

The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which he may require, including those for access to the Site. The Contractor shall also indicate the, extra railway land or Govt land or private land beyond what is shown in the tentative tender drawing with the view to achieve best fit alignment for improved operational efficiency. On review by Engineer and Employer, the Contractor will be advised with the approved Horizontal/Vertical alignment for permanent works. For additional land if needed by the Contractor beyond the right of way the same shall be arranged by the contractor at his own cost.

In case any operation connected with traffic necessitates diversion, obstruction or closure of any road, railway or any other right of way, the proposal is to be developed by the contractor for review for the approval of the Engineer/Employer and the consents and approval of the concerned authorities shall be obtained well in advance by the Contractor.

Provided that if it is found necessary for the Contractor to move one or more loads of heavy constructional plants and equipment, materials or Pre-constructed units or parts of units of work over roads, highways, bridges on which such oversized and overweight items that are not normally to be moved, the contractor shall obtain prior permission from the concerned authorities.

Payments for complying with the requirements, if any, for protection or strengthening of the roads, highways or bridges shall be made by the contractor and such expenses shall be deemed to be included in his quoted contract price.

Annexure – II:

-Deleted-

Annexure – III: Tree Cutting and Forest Clearances-in Process

The permission obtaining tree cutting / translocation is in progress with BBMP and Forest Department. The tree numeration list and joint inspection with Forest officers / BBMP / TEC is in progress.

Tree cutting, preservation and disposal (or) Translocation along the alignment for cutting / disposal / translocation / afforestation (as per the norms of Forest Department) in lieu of cutting / translocation will be arranged by Employer at her / his own cost. The applicable permits / permissions for felling of tress / Translocation shall be arranged by Employer.

Annexure – IV :

- Deleted -

Annexure – V : Applicable Permits

i. Applicable Permits

1.0 The Contractor shall obtain, as required under Applicable Laws, the following Applicable Permits:

- (a) Permission of the State Government for extraction of boulders from quarry;
- (b) Permission of Village Panchayats and Pollution Control Board for installation of crushers;
- (c) Licence for use of explosives;
- (d) Permission of the State Government for drawing water from river/reservoir;
- (e) Licence from inspector of factories or other competent Authority for setting up batching plant;
- (f) Clearance of Pollution Control Board for setting up batching plant;
- (g) Clearance of Village Panchayats and Pollution Control Board for setting up asphalt plant;
- (h) Permission of Village Panchayats and State Government for borrow earth; and
- (i) Any other permits or clearances required under Applicable Laws.

Annexure – VI : Provisional Certificate

- 1 I/We, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for construction of the section (km to km) in the State of in- BSTP (the "**BSTP Project**") on Bill of Quantity (BOQ) basis through (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been undertaken to determine compliance of the BSTP Project with the provisions of the Agreement.
- 2 Certain minor works are incomplete and these are not likely to cause material inconvenience to the Users of the BSTP Project or affect their safety or the movement of rail traffic in any manner. These works have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement.
- 3 In view of the foregoing, I/We am/are satisfied that the BSTP Project from km to km can be safely and reliably placed in service of the Authority for railway freight and passenger traffic, subject to authorization by the Commissioner of Railway Safety in accordance with Applicable Laws. In terms of the Agreement, the BSRP Project is hereby provisionally declared fit for entry into operation on this the day of 20.....

ACCEPTED, SIGNED, SEALED
AND DELIVERED

For and on behalf of
CONTRACTOR by:
(Signature)

(Signature)

SIGNED, SEALED AND
DELIVERED

For and on behalf of
AUTHORITY's ENGINEER by:

Annexure – VII : Completion Certificate

- ii. I/We, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for construction of thesection (km to km) of in the State of in- BSTP (the "**BSTP Project**") on through (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been successfully undertaken to determine compliance of the BSTP Project with the provisions of the Agreement, and the authorisation by the Commissioner for Railway Safety under Applicable Laws has been obtained.
- iii. It is certified that, in terms of the aforesaid Agreement, all works forming part of Railway Project have been completed, and the BSTP Project is hereby declared fit for entry into operation on this the day of 20.....
- i. The test on completion of civil works shall also include the integrated testing. The objective of the contract is the Design and construction, testing and commissioning of the permanent works, construction and removal of the Temporary Works and the rectification of defects appearing in Permanent Works by the contractor in the manner stipulated by the Contract..
- ii. The completion certificate is as per railway standard format. Please refer Cl.30.6 at page 161, para 12 and para 2 . The format can be altered as per the contract conditions. The tender conditions prevails.

SIGNED, SEALED AND DELIVERED
 For and on behalf of the Authority's Engineer by:
 (Signature)
 (Name)
 (Designation)
 (Address)