

SPECIAL CONDITIONS OF CONTRACT (SCC)**1.0 PREAMBLE AND GENERAL**

1.1 These Special Conditions of Contract (SCC) are issued to define the **specific technical, operational, and contractual requirements** for Providing of Subway for passing of pedestrian/ 2-wheeler vehicles at multiple trespassing locations between Jaipur- Rewari section, of Jaipur Division, North Western Railway

1.2 Construction of such Subway for facilitating the movement of the Pedestrian, 2 wheelers across the tracks has been considered to be taken up over entire Indian Railways, as at many locations Private public is compelled to cross the tracks to reach out to the other side of tracks and face huge risk of life and safety.

1.3 Indian Railways has identified numerous such locations and Railway has seriously and compensatory considered providing of Subway with Adequate opening (2.75m -3m wide) and vertical opening i.e. 2.65m. The Subway shall have approach of Adequate Ramp with Proper Covering and Safety, Aesthetic features.

1.4 NWR has been entrusted with Construction of Subways at 16 such locations between Jaipur- Rewari section of Jaipur Division as Pilot Project. The idea is to construct the Subway with various methods and Schemes wrt to different site conditions, site constraints, approachability, accessibility, site feasibility etc, and work out most feasible, effective and long term sustainable solution for passing of the Pedestrian, 2 wheelers across the tracks

1.5 The Particular tender is for Pilot project and Indian Railway eventually plans to take up all such trespassing locations across Indian Railways on mass scale, based on the learning, experience gathered from the Pilot Project.

1.6 The intent of this contract is to ensure:

- Rapid construction through **Precast technology**
- Minimal interference with Railway operations
- Long-term durability and user safety Planning,
- Execution and maintenance of **precast RCC subway works**
- Effective Water Proofing and all junctions, joints
- Provide pleasant user experience for subway users.

1.7 Targeted locations under this pilot project:

Loc no.	Block Section	Chng (KM)
Loc-1	Karnawas- Bawal	12/8-9
Loc-2	Karnawas- Bawal	13/4-5
Loc-3	Bawal- Ajarka	21/3-4
Loc-4	Khairthal- Harsauli	42/5-7
Loc-5	Alwar- Parisal	71/1-2
Loc-6	Rajgarh- Baswa	112/7-8
Loc-7	Baswa-Bandikui	132/2-3
Loc-8	Bhankri-Dausa	171/34-36
Loc-9	Jhir-Bassi	KM 205/22-24
Loc-10	Khatipura Yard	Km 223/19-17
Loc-11	GetorJagatpura- Khatipura Yard	LC 212- 600m
Loc-12	GetorJagatpura-Khatipura	KM 226/7-9, LC 213
Loc-13	GetorJagatpura- khatipura	KM 228/34-36, ROB 211A
Loc-14	Jaipur- Gandhinagar Jaipur	232/29-31
Loc-15	Gandhinagar Jaipur- Jagatpura	KM 233/23-25

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HUM
SE/IV/1/JP

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Dy. CE/C-3/JP

Loc-16	Bais Godam yard	Km 239/2-6
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1.8 Subway is to be constructed fully functional at the above identified Trespassing locations within 72 hrs. The exact execution of 72 hrs window shall start with commencement of the traffic block as per approved TAD.

Phase	Steps	Time (Hrs)	Activity Description	Dependencies	Integrated Features
Phase 1	Step 1	00:00 - 08:00	Main RCC Box Launching: Positioning and launching of the main underpass structure using a crawler crane/ Pulling arrangement, in single Cut & Cover Block, Track fit after completion of block	Availability of all required precast elements, Machinery, excavators, earth moving machines, Prefab elements with adequate working agencies (as approved by engineer in charge). Approved	Main RCC box, Crystalline admixture in design mix of self-Compacting concrete/ high slump concrete with single pour, duly done with waterproofing pre-works. High-Capacity Crawler crane/ Pulling arrangement.
	Step 2	00:00 - 18:00	Approach U-Wall, L- type retaining wall Launching/ Placement concurrently and continuing after the RCC box launch, overall, 10-12 hours after commencement of Block	TAD, Speed restriction at site and sheet piling, lighting arrangement etc.	Monolithic pre-cast approach U-type segments. Tongue and groove arrangement with rubber gaskets for built-in water barrier.
	Step 3	18:00 - 42:00	Waterproofing: Application of waterproofing treatments to all segment joints across both the main junction and the approach U-walls, work of Wearing course, Art Work, signages, safety works	Correct alignment of all joints, elements, fittings, fixtures and agencies of all sub works at site	External and internal joint water sealing using Thermoplastic Olefin (TPO) sheets. Flexible joint system for high-vibration environment.
Phase 2	Step 4	18:00 - 42:00	MEP & Utility Installation: Installation of electrical lighting, water level sensors, and Occupancy sensors. Complete integration and connection to the localized solar power pack.	Requires completion of all step 1 and 2 structural segments.	Solar-powered motion sensors and lighting system for user safety and convenience.
	Step 5	42:00 - 66:00	Roofing & Solar Panels: Installation of the self-supporting roof sheets over the approach architectural stone elements, height gauges, boundary wall, paver blocks, signages etc followed by the mounting of solar panels over the roof.	Requires completion of Phase 1 and step 4 MEP installations.	Mounting of solar panels to feed the off-grid MEP systems, required testing of the electric system, pumping systems, sensor system etc.
Phase 3	Step 6	66:00 - 72:00	Finishing & Handover: Installation of necessary traffic and safety signages, followed by a comprehensive cleaning and clearing of the site.	Requires completion of Phase 2 roofing and overhead work.	Site clearing and final integration of safety features and commissioning of the Subway fully fit for movement of pedestrians, 2 wheelers in day/ night time. Proper documentation, short video.

1.9 As per the Board Planning made by Railways based on Site Visits and pre-discussions, the Location no.1 (12/8-9), Location no.4(42/5-7), Location no.8(171/34-36), Location no.12 (226/7-9), Location no.14 (232/29-31) (5 no) are exclusively identified for construction of precast segment of 14m length for the double line track and placement/launching of same in single traffic block using Crawler Crane/ Pulling pushing method (as per approved TAD) without use of any relieving girder/ Protection Plate. The segments of approaches shall also be precast and launched in continuation and entire construction of the subway complete in all respect including Water Proofing, height gauge, roof coverings, paver blocks, reconstruction of Boundary walls, signages, electric fitting,

sensors, marking, artwork, safety work. 100% precast/ Pre factory made elements shall be ready at site with respective fixing agencies. Subway shall be commissioned fit for passing of the pedestrians, two Wheelers within 72 hrs of commencement of the Traffic block.

1.10 At balance 11 sites, 4 nos of sites have been tentatively planned with use of Ultra High-Performance Fibre Reinforced Concrete (UHPFRC) precast box culvert technology, The Precast segments of 7 m length with opening size 2.8m X 2.65m in Grade of M150. The approaches shall be in width of 2.8 driveway in M70 with proper loading/ unloading/ launching arrangements. The segments shall be precast in the UHPFRC casting yard in highly controlled manner with utmost quality control and Monitoring System and transported to site through Road and Railway Wagons. The Locations no 5,6,7,11 total (4no) shall be planned and executed with (UHPFRC) segments subjected to approval from Railway Board.

1.11 Further the Scheme of Casting and Transportation of Precast segment in centralised casting yard shall also be explored and considered for execution scheme based on site feasibility and constraints.

1.12 Agency shall visit each site and submit methodology/ execution plan for the execution of work at each site along with method statement of each item/ element/ constituent of the subway, the active involvement of the Contractor for construction of the Subway through different scheme and documentation thereof in audio visual format is also integral part of the Project.

2.0 DEFINITIONS AND INTERPRETATION

2.1 "Subway" shall mean a **precast RCC box structure including approaches, ramps, stairs, drainage, and ancillary works**, enabling safe passage for pedestrians and/or two-wheelers.

2.2 "Launching/Placement" shall mean the **placement/insertion of precast Subway elements beneath/ besides running railway track during approved traffic block.**

2.3 "Casting site" shall mean the **facility established within Railway premises, sites for production of precast units.**

2.4 These provisions shall be read in conjunction with and shall form part of the Contract Agreement along with:

- Indian Railways General Conditions of Contract (GCC) – Latest Edition
- Indian Railways Works Manual and Engineering Code
- IRS Bridge Code and relevant Railway Board circulars
- Unified Standard Specifications (USSOR), CPWD DSR
- Relevant Indian Standards (IS Codes), IRS codes for track related items, PCE safety circular and RDSO guidelines wherever applicable

2.5 In case of any discrepancy, the following order of precedence shall apply:
(i) **Railway Board Guidelines** → (ii) **SCC** → (iii) **Special Specifications** → (iv) **GCC** → (v) **IS Codes**

3.0 NATURE AND CHARACTER OF CONTRACT

3.1 This is an **Item Rate Contract**, wherein payment shall be governed strictly by:

- Measured quantities of executed work
- Accepted rates in the Bill of Quantities (BOQ)

3.2 The contract is **performance-oriented**, requiring the contractor to:

- Mobilize resources across multiple sites
- Maintain synchronization between casting, transport, and launching

3.3 Quantities indicated are **indicative only**. No claim shall arise due to variation.

4.0 SCOPE OF WORK – DETAILED DESCRIPTION

4.1 The scope shall include design (will be provided by Railways as per items in the schedule), engineering, Planning, methodologies, procurement, construction, testing, commissioning, safety compliances and handing over of subway structures.

4.2 The works shall broadly comprise:

4.2.1 Precast Production Works

- All precast segments to be Cast at Sites/ Casting yard with latest technology RMC or mobile RMC essentially.

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- Site surveys, markings, GAD validations, Site clearance, working site preparation
- Site approachability, access roads, Mobilisations
- Shifting/ securing of utilities, TRD foundations, other impediment, including local shifting
- Fabrication and use of well design Shuttering/ Mould to facilitate single pour casting of Box, approach segments
- Fabrication of Reinforcement cages with cover blocks
- Casting of Beds, reaction frames for pulling/ pushing, making of bed for Crawler cranes etc
- Casting of RCC boxes, slabs, approach segments in single pour casting methodologies
- Controlled curing, testing, acceptance, finishes and storage
- Use of premixed Single pour using Self Compacting Concrete (SCC).

4.2.2 Civil and Structural Works

- Excavation, storage and disposal of Materials, earth
- Sheet piling, bank protection, track barricades, safety boards, Caution Boards
- Foundation preparation and rolling, levelling, Compaction
- Construction of approach embankments with due compaction.
- Backfilling and compaction
- Effective and efficient water proofing

4.2.3 Launching and Track Works

- Track cutting and removal of ballast and refixing of Track, welding works, local distressing
- Feasibility of launching/ placement of the precast segments, TAD, Block planning
- Insertion/Launching of 2-3 nos of full 14 m length RCC precast BOX using Crawler mounted cranes with Standby crane of equal capacity.
- Insertion/Launching of 2-3 nos of full 14 m length RCC precast BOX using Pulling/ Pushing arrangement.
- Insertion/Launching of 11 nos of 14 m length RCC (7m RCC Box with joint in between) precast BOX using suitable capacity cranes (Crawler/ Tyre mounted) or with Pulling/ Pushing arrangement.
- Track restoration, packing, and alignment
- Launching of Precast approach sections (L-Type and U-type), installation of precast drainage arrangements, Fabrication and installation of prefab PEB sheds at approaches.
- Launching of precast toe walls, paver blocks, Boundary wall connecting approaches to Railway boundary.

4.2.4 Ancillary Works

- Drainage system (longitudinal and cross drains)
- Speed Breakers, paint marking, signages
- Retaining/return walls, levelling of earth, Wearing course.
- PEB Cover sheds and protective elements (as per site Conditions)
- Concrete/PEB Stairs/ steps as directed by Engineer-in-Charge
- Height gauges, Water sump system, Signages, Safety elements

4.2.5 Finishing and User Amenities

- Waterproofing systems of overall Concrete and at Joints
- Architectural finishes, stone work and artwork
- Lighting provisions, Occupancy sensor, Water level sensor
- Anti-skid flooring and safety provisions
- Automatic pumps and solar panels.
- Site cleaning, removal of left over items, elements

4.3 Agency shall make all required arrangement for ensure accessibility of the site wherever required, approach road shall be constructed as required at site. The cost of construction of Road shall be paid separately. Agency shall independently carry out the survey and verify/ validate the GADs as provided by Railways.

4.4 Agency shall submit the Environment Management Plan before taking up any activity at site.

4.5 Agency shall submit the methodology/ execution plan for the execution of Subway work at each site along with method statement, quality plan of each item/ element/ constituent of the subway, to Cast, procure, arrangement of all machinery, equipment, execution agencies, labour etc and for commissioning of entire subway

within 72 hrs of commencement of the Traffic block at each site. The QAP, QC, Time line program of the overall project shall be submitted by Agency as detailed in the tender document.

4.6 Agency shall submit the TAD of the Subway for execution plan within the Traffic block, as well as execution plan for launching/placement without Traffic block. All the Prerequisites for availing the traffic block and completing the subway work within 72 hrs of commencement of the traffic block shall be completed and arranged at site. Agency shall submit the details of such pre-works, arrangements, machinery, equipment, labours, resources, pretesting to be done/ deployed at site, and approved by Engineer in charge. The Traffic block shall be availed only after all such approved arrangement; deployment is made by the agency well in advance.

4.7 Site shall be thoroughly protected with use of Barricade towards/ along the track as well at any other location as instructed by Engineer in charge, and as per approved drawing as provided by Engineer in charge. All relevant guidelines as detailed in tender document shall be ensured at site, with no short cut/ compromises what so ever. Adequate sheet piling shall be done near track, along track, along general ground to protect the general ground before taking up any excavation/ preexcitation activities can be taken up after required barricade, sheet piling, competency certificate to operator, supervisors and following other required safety Norms, guidelines as specified and instructed by Engineer In charge. Agency shall depute Safety Personnel at site and also get the Safety audits conducted by professional agencies.

4.8 Agency to deploy adequate nos. of high-capacity Excavators and earth moving units/ dumpers shall be deployed to ensure excavation during traffic block is done in minimum time frame, the earth to be reused/ refill shall be stacked properly, while disposal of extra earth can be disposed outside railway Boundary with specific approval of Engineer In charge.

4.9 Agency shall ensure exclusive documentation, video recordings, drone Photography of each site for appreciation and record keeping of the work done at each site. Site shall be installed with required video camera for live verification at site during execution phase. Agency shall hire proper agencies to make good quality set of photographs as well as short video, presentation professionally made to reveal the entire execution, preparation, block work and commissioning of the Subway in all respect.

5.0 CASTING, PRODUCTION INFRASTRUCTURE AND FORMWORK REQUIREMENTS

5.1 The Contractor will cast all precast elements at site using self-compacting concrete (SCC)/ High Slump Concrete of specified grade for main RCC Box as well as Approach segment, in single go i.e., single pour. The casting work shall be taken up only after complete prerequisites, adequate TMs, Trireme arrangements, adequate labours, vibrators are arranged at site to facilitate single pour casting of the RCC Box and other segments, as per approved methodology, at a location approved by the Engineer. Proper curing shall be ensured without failure. In case, Box is planned for placement with pulling/ pushing system, Box shall be casted at required level with required bed, features required for Pulling/ pushing arrangement. In case of launching with Crane, required arrangement of Hook/ Lifting beam shall be provided.

- Precast segment must have very smooth and defined surface finally, segments with gross surface, defects like Honey combing, segregated finish shall not be accepted. Proper alignment and dimensional tolerances of high standards shall be operated.

Further, Concrete shall be designed to act as water barrier too and required admixtures as approved by Engineer in charge shall be used in Concrete. Further, for additives like Fly ash, silica fumes etc shall be used as approved by Engineer in charge for production of SCC/ High Slump Concrete.

Agency shall ensure proper Production, transportation, placement etc for production of concrete segments with self-compacting concrete (SCC)/ High Slump Concrete of high Quality and standards as per good industry Practice. Further, it is to mention that

5.1 The design drawings of RCC Box and Approach segments will be provided by railways. Other drawings shall be provided by agency for approval of Railways.

5.1.1 Durability requirements:

- M45 and M35 grade concrete (as per approved drawing)
- Adequate cover to reinforcement
- Self-Compacting Concrete (SCC) with Low permeability.

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The precast RCC boxes and associated structural components shall be manufactured and installed to ensure **high durability and resistance to ingress of water**, considering their underground application and exposure conditions. The concrete used in precast elements shall be of **dense, low-permeability quality**, achieved through:

- Controlled and optimized water-cement ratio
- Use of suitable admixtures conforming to relevant IS Codes
- Proper batching through RMC plant
- Adequate compaction using mechanical vibrators
- Controlled and continuous curing practices, use of Curing Compound

Agency shall submit method statement for the Concrete work before taking up the Casting work, same shall be approved by engineer in charge.

5.1.2 TESTING FOR PERMEABILITY- The Contractor shall carry out **water permeability / water penetration tests** on concrete samples in accordance with:

- **IS 3085 – Method of Test for Permeability of Cement Mortar and Concrete**, or any other equivalent standard approved by the Engineer.

5.2 MANDATORY INFRASTRUCTURE

The casting purpose, agency shall arrange but not be limited to, following facilities

- **Mobile RMC Plant of minimum 30 Cum/hour capacity**, with automatic batching, controlled mixing
- Transit mixers, concrete pumps, vibrators, and allied equipment
- Reinforcement fabrication yard with cutting and bending machines
- Adequate storage space for raw materials and finished precast units
- Controlled curing arrangements (curing compound as approved)
- approach roads and handling arrangements for movement of heavy precast units

5.4 QUALITY CONTROL AND ACCEPTANCE OF CONCRETE

For the test specified in relevant IS Codes and Railway specifications as detailed in Tender Document, specifications, special conditions, fully equipped **Quality Control Laboratory** shall be established at least two locations/ sites. The requirements for each laboratory as elaborated in the tender Document shall be applicable. Further for Concrete quality, tests as specified in IS 516: 2021 and other relevant codes of testing including NDT shall also be performed regularly on each site, mainly Core Cutting Test, USFD, Rebound hammer test and record of same shall also be maintained. Documentation of the Quality control, assurance system must be ensured by the Agency.

6.0 FORMWORK (SHUTTERING/ MOULD) REQUIREMENTS

6.1 The Contractor shall provide and maintain adequate number of **formwork/shuttering systems (steel moulds or equivalent rigid formwork)** to ensure uninterrupted and time-bound production of precast RCC units.

6.2 It shall be **mandatory** that the Contractor deploys formwork sufficient for casting **not less than one-third (1/4) of the total number of precast RCC elements proposed under the contract**, at any given time.

6.3 This requirement shall be treated as the **minimum mandatory deployment**, and the Contractor shall augment the number of moulds as necessary to achieve the stipulated construction schedule and milestones. After completion of casting, **formwork/shuttering systems (steel moulds or equivalent rigid formwork)** will be **handed over to Railways in good condition and it will not be a property of contractor**.

6.4 The formwork system shall conform to the following requirements:

- Fabricated from prefabricated steel or other approved rigid material
- Capable of repeated use without distortion or loss of dimensional accuracy

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- Designed to withstand vibration and casting loads
- Ensuring leak-proof joints to prevent loss of cement slurry
- Capable of producing smooth and uniform surface finish
- Use of Liners/**Controlled Permeability Formwork (CPF)** liners for smooth finish.

6.5 The Contractor shall ensure that:

- Dimensional tolerances of precast units are maintained within specified limits
- Formwork alignment and rigidity are checked before each casting cycle
- Proper release agents/Props are used to facilitate demoulding without damage

6.6 The adequacy and condition of formwork deployment shall be subject to review by the Engineer. In case of any shortfall or deficiency affecting production rate or quality, the Contractor shall immediately augment or rectify the same at no additional cost to Railway.

7 PRODUCTION CONTROL AND OUTPUT REQUIREMENTS

7.1 The Contractor shall organize the casting operations in such a manner as to ensure **continuous production cycles**, synchronized with transportation and launching schedules.

7.2 The production planning shall consider:

- Number of locations to be executed simultaneously
- Traffic block schedules
- Availability of transportation and launching equipment

7.3 The Contractor shall submit a **detailed production plan and casting schedule** indicating:

- Number of moulds deployed
- Daily/weekly casting targets
- Stock of precast units

Agency shall necessarily submit Plan of Casting activities for each and all site for main RCC Box as well as approach segments and take up simultaneous activities, The Time line of the plan shall be approved by Engineer in charge and agency shall ensure execution as per approved casting plan and in no case any failure shall be accepted.

8.0 CONSTRUCTION OF SUBWAY WITH UHPFRC

Construction of Subway with Ultra High-Performance Fibre Reinforced Concrete (UHPFRC) precast box culvert technology is also envisaged and respective items, specifications, special conditions, payment schedule are also included in the tender Schedule as a separate schedule.

8.1 The Size of Box is planned to be with opening size 2.8m X 2.65m in Grade of M150. The approaches shall be in width of 2.8m driveway in M70 with proper loading/ unloading/ launching arrangements.

8.2 The segments of Box as well the approaches shall be precast in the UHPFRC casting yard in highly controlled manner with utmost quality control and Monitoring System as per the approved QAP, Mould design and methodology, as submitted by the approved Fabricator of Concrete and approved by Engineer in charge. The Precast segments should invariable be planned with proper scheme of water proofing.

8.3 Subway segments shall be transported to the designated Railhead through Loading, transportation, unloading through Trailers of required dimensions. The segments shall be suitably placed over required wooden battens/ base material and secured properly. Route of the Loaded Trailers shall be mindfully decided as per required moving dimensions, ODCs, movements over horizontal/ vertical curves.

8.4 The segments shall then be loaded over Rail Wagons (BRN/ BLLA/ BLCA/ BLCB) and secured very properly.

8.5 It shall be ensured that no damage is caused during loading/ unloading and transportation of the segments. The repairs if any shall be carried out by the agency at its own cost.

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8.6 The Unloading of the segments shall be done at the respective location of the Subway in traffic Block. There shall be about 10-12 segments for each location. The required machineries shall be arranged at site. The weight of the Box shall vary from 30-50 MT.

8.7 Contractor shall submit the scheme for unloading of the segments from the Railway wagon, Engineer in charge shall approve the scheme before taking up the work at site.

8.8 The further Works of Launching (as per approved launching Scheme), working in the Traffic Block (as per approved TWO) shall be taken up for execution, completion, commissioning of the specific Subway as per requirements laid in the Tender Document.

8.9 Contractor may note that planning and execution of the Subways with Ultra High-Performance Fibre Reinforced Concrete (UHPFRC) precast box culvert technology is under deliberation and final decision with Railway Board. Contractor is permitted to plan and take-up the subway with use of UHPFRC precast segments only after written letter from Engineer in Charge in this regard. The Locations to be taken up with UHPFRC precast segments shall be decided in consultation and approval of Engineer in charge.

Till such time, Contractor is not permitted to plan any subway with UHPFRC precast segments.

9.0 CONSTRUCTION WITH PREFABRICATED CONCRETE UNITS (IN CASTING YARD)

The scheme of things hugely promotes use of prefabricated Concrete units (cast in centralised Casting Yard). Contractor shall plan few identified Subway with use of prefabricated Concrete units (cast in centralised Casting Yard). The respective items, specifications, special conditions, payment schedule are also included in the tender Schedule as a separate schedule.

9.1 The Size of Box is planned to be with opening size 2.73m X 2.65m in Grade of M45-M55 or higher. The approaches shall be in width of 2.75 driveway in M35- M45 or higher with proper loading/ unloading/ launching arrangements. The Precast segments should invariable be planned with proper scheme of water proofing.

9.2 The segments of Box as well the approaches shall be precast in the casting yard in highly controlled manner with utmost quality control and Monitoring System as per the approved QAP, Mould design and methodology, as submitted by the approved Fabricator of Concrete and approved by Engineer in charge.

9.3 Subway segments shall be transported to the designated Railhead through Loading, transportation, unloading through Trailers of required dimensions. The segments shall be suitably placed over required wooden battens/ base material and secured properly. Route of the Loaded Trailers shall be mindfully decided as per required moving dimensions, ODCs, movements over horizontal/ vertical curves.

9.4 The segments shall then be loaded over Rail Wagons (BRN/ BLLA/ BLCA/ BLCB) and secured very properly. Contractor can also plan to Transport the Segments up to the subway Location in case same is approachable to the loaded trailers.

9.5 It shall be ensured that no damage is caused during loading/ unloading and transportation of the segments. The repairs if any shall be carried out by the agency at its own cost.

9.6 The Unloading of the segments shall be done at the respective location of the Subway in traffic Block. There shall be about 10-12 segments for each location. The required machineries shall be arranged at site. The weight of the Box shall vary from 30-50 MT.

9.7 Contractor shall submit the scheme for unloading of the segments from the Railway wagon, Engineer in charge shall approve the scheme before taking up the work at site.

9.8 The further Works of Launching (as per approved launching Scheme), working in the Traffic Block (as per approved TWO) shall be taken up for execution, completion, commissioning of the specific Subway as per requirements laid in the Tender Document.

9.9 Contractor shall submit detailed scheme and methodology with particulars of the identified Subway Location to be planned with Precast segments from casting yard and shall take up any work only after approval of the Engineer in charge.

10.0 LAUNCHING/PLACEMENT METHODOLOGY AND EXECUTION

10.1 The contractor shall submit a detailed launching/ placement scheme of each site based on the approaches, land availability, site feasibility. The TAD shall be submitted to Engineer in charge at least 1.5 months earlier to the tentative date of launching/ placement. The breakup of sub activities for entire period of Traffic block including activities pertaining to TRD, telecom disconnection/ lowering during block, the required speed restriction time frame shall also be specified. Deployment of Standby Crane of equivalent capacity crane is mandatory at site.

Separate TAD shall also be submitted for the Launching/ placement activities for the Approach segment involving Crane deployment nearby/ adjacent to track, but not requiring Traffic Block.

In addition, agency shall submit detailed method statement/ scheme to tackle and execute the entire Subway work with all sub works/ elements within 72 hrs of commencement of the traffic Block.

Each TAD shall mandatorily include detailed Method statement, Equipment/ machinery deployment, Risk assessment, safety compliances, manpower/ execution agency deployment and all other details. Work shall be taken up only after approval of the schemes by engineer in charge.

10.2 Launching of main RCC Box shall be executed during approved traffic block (approx. 6-8 hours) for double line track, single block without relieving Girder using Crawler Crane mainly at the specified 2-3 location out of 5 locations. At other 11 locations, suitable planning/ scheme with RCC box (preferable 14 m but not less than 7 m) shall be proposed by agency shall be approved by Engineer in charge.

10.3 Agency shall submit the scheme/ Methodology for Pulling/ Pushing of the 14 m RCC Box duly designed by approved/ Competent agency for mainly at the specified 2-3 location out of 5 locations. At other 11 locations, suitable planning/ scheme for placement of the RCC box (preferable 14 m but not less than 7 m) shall be proposed by agency and shall be approved by Engineer in charge. The required machineries, Jacks, Winches, built up sections etc as per approved design shall be arranged by agency and Bed/ slabs RCC box shall be casted with required elements/ features to facilitate the pulling/ pushing activity.

10.4 Equipment requirements for the taking launching of RCC box and completing subway in 72 hrs, is as listed, but not limited to, are mandatory:

- Minimum 600 MT capacity crane (Crawler Mounted) OR adequate no of Tyre mounted Cranes of suitable capacity with standby Suitable for 14 m RCC Box, as per approved launching scheme, at specified locations.
- All cranes, trailers required for assembling and disassembling of the Crawler Crane/ Tyre Mounted Crane.
- All required machineries, Jacks, Winches, built up sections, ropes etc of suitable capacity with standby for pulling/ pushing of 14 m RCC Box, as per approved scheme.
- At other 11 locations, required Cranes/ Pulling arrangement, relieving girder as per approved scheme
- Load testing, Calibration, validation/ certification of load taking systems
- Excavators/Machineries for speedy Excavation (big Jib, long reach), Hywa, 150 MI cranes etc.
- Arrangement all required Materials, Track Elements, small track Machinery, Resources at site
- Hydraulic jacks, rollers, excavators, hydra and support systems
- Two Double Acting Prestressing Jacks plus one spare jack (200 MT capacity with total 600 mm stroke length or as per approved design)
- One Mild Steel Spreader Beam – Box type (as per approved drawing)
- Three Mild Steel Buffer Beams (as per approved drawing)
- Grader and roller for making base/ Ramp, WBM, coarse materials etc
- Backfilling soil, self-compacting soil, Gunny bags filled with sand adequate no
- Crane set up for launching of approach segments, prefab Sump, Roofing system, height gauge etc.
- Approved materials, fitting, fixtures, sensor system ready with fixing/ execution agencies
- All Prefab elements like PEB members for covering, height gauge, Sump, self-supporting roof sheets, paver blocks, prefab Boundary wall etc.
- Water proofing/ sealant elements for joints, approaches with fixing/ execution agencies
- Arrangement for Documentary, short video, drone, photography etc.

List is indicative, detailed list as per site wise scheme, methodology, TAD, TWO shall be submitted by Agency and approved by engineer in Charge. Suitable checklist shall be maintained to ensure availability of required machineries and pre works to certify readiness for availing the block, and completing work within 72 Hrs.

10.5 The contractor shall ensure:

- Pre-block readiness (all resources mobilized)
- Post-launch track restoration to safe running condition followed by Welding work, tamping, local distressing for relaxation of Speed.

10.6 Planning should be made to avail Blocks every 7-10 days in continuation and even to tackle two sites as shadow block. All arrangements to be made in parallel in case two site are executed as approved Engineer in charge, as per approved TWO.

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9.7 Suitable dewatering arrangement, lighting facilities be ensured as required at site.

11.0 WATERPROOFING AND DURABILITY

11.1 The subway is designed as all-weather unit and all precast segments to launched/ placed under track, natural ground level needs to be highly water tight and intact. The RUB is fully cover on approaches.

11.2 Tender documents specified the various waterproofing agents, sheets, dimple boards over concrete surface as well as to seal the joints to avoid any seepage/leakage.

11.3 Waterproofing elements and executing agencies shall be highly reliable, renowned with **proven systems from reputed manufacturers (Sika, Pidilite, Berger or equivalent)**.

11.4 Supplier/ source shall be got approved from Engineer in charge and detailed methodology for application/ execution of the waterproofing scheme shall be submitted. The application shall also be done with expert applicator and application systems, Tools, equipment only. Work shall be taken up only after approval of scheme.

11.2 The system shall ensure Resistance to water ingress, Long-term durability of subway as a whole

11.3 The (back-to-back) warranty of the water proofing system from the Water Proofing Agency for **minimum 15-year for water proofing/ water intactness** shall be provided by Contractor. The final payment of the Water Proofing items shall be (10% of cost of Water proofing system on each subway) shall be released only after submission of such certificate

12.0 ARCHITECTURAL TREATMENT, ART WORK, LIGHTING AND VENTILATION

12.1 The Contractor shall provide comprehensive **architectural treatment** to all subway structures including **precast RCC boxes, approach boxes, ramps, and staircases**, with the objective of creating delightful, aesthetically pleasing, and user-friendly environment. Agency will also use liners in the mould to make engraved patterns on the concrete surfaces.

Agency will also use liners in the mould to make engraved patterns on the concrete surfaces.

12.2 All subway boxes and approach portions shall be provided with **artwork**, preferably reflecting **local culture, heritage, and regional identity**, duly approved by the Engineer prior to execution. Entire work shall be executed with utmost neatness and clarity. Agency will also use liners in the mould to make engraved patterns on the concrete surfaces.

12.3 The artwork shall:

- Be executed using **durable, weather-resistant, anti-graffiti coatings/paints**
- Be resistant to moisture, abrasion, and vandalism
- Maintain colour stability and finish over the design life

13.0 Lighting, System, MEPF work

13.1 The Contractor shall integrate **embedded lighting systems** within the subway boxes and approaches, with planning, scheme that no wires, cables are concealed/ embedded. Agency shall engage competent MEP Engineer to plan and integrate the required Lights, systems, cables etc in the precast elements, sub structures itself. Overall, the subway must be provided with

- Uniform illumination throughout the subway
- Adequate lighting levels for safe pedestrian and two-wheeler movement
- Use of energy-efficient lighting fixtures (LED-based or equivalent)
- Concealed wiring integrated within precast elements wherever feasible.
- Solar lighting with occupancy sensors
- Automatic water level indicators, pumping arrangements etc.
- Battery backup duly covered
- Locking/ anti-theft arrangement to be provided as and where required

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12.5 The lighting system shall be designed to:

- Avoid glare and dark zones
- Ensure ease of maintenance
- Provide protection against water ingress and vandalism, theft and sabotage

12.6 Adequate **ventilation provisions** shall be incorporated in the design and execution of subway boxes, including:

- Natural ventilation through openings, ducts, or gratings
- Provision of ventilation shafts/openings in approach structures where required
- Ensuring proper air circulation to avoid accumulation of moisture and foul air

12.8 The Contractor shall ensure that all architectural, lighting, and ventilation works are:

- Fully functional at the time of commissioning
- Durable and suitable for long-term Railway usage conditions

Agency shall engage BIM agency for making integrated planning of structure and MEP elements. The detailed BIM program shall be submitted by agency for approval of Engineer in charge.

13.0 QUALITY ASSURANCE AND CONTROL

13.1 A comprehensive **Quality Assurance Plan (QAP)** shall be submitted.

13.2 Inspection stages:

- Pre-casting
- During casting
- Post-casting
- Pre-launching

13.3 Third-party inspection/tests may be enforced. (as required or directed by Engineer-in charge). No separate payment will be made for Third party inspection/test. Contractor shall engage outside agencies for Quality Audits too.

14.0 MEASUREMENT AND PAYMENT

14.1 Measurement shall be carried out as per:

- GCC, Special Conditions of Contract.
- USSOR provisions

14.2 Payment shall be made for:

- Accepted quantities of work
- Stage payment as per item

14.3 The rates shall include:

- All labour, materials, equipment
- Casting yard and RMC plant
- Transportation and launching
- Temporary works and safety measures

14.4 No separate payment shall be made for:

- Mobilization
- Idle resources
- Incidental works

15.0 TIME SCHEDULE AND PROGRAMME

1. COMPLETION PERIOD:

Time is the essence of contract and the entire work should be completed within the specified completion period from the date of issue of acceptance letter including monsoon, the 'the completion period of the contract' is 12 months, while the 5 no Subways at the defined locations *Location no.1 (12/8-9), Location*

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no.4 (42/5-7), Location no.8 (171/34-36), Location no.12 (226/7-9), Location no.14 (232/29-31) (5 no) are to be completed and commissioned within 6 months of the date of issue of acceptance letter including monsoon. The Given milestones are to be adhered strictly as below-

15.2 Milestones

15.2.1 Milestone 1: - (Works of Milestone-1 shall be completed within 45 days from the date of issue of letter of acceptance. Total value of items of milestone 1 is 10% of the contract value for consideration of clause 17B of GCC)

1. Providing of 5 no GADs of the Subway at Trespassing *Location no.1 (12/8-9), Location no.4 (42/5-7), Location no.8 (171/34-36), Location no.12 (226/7-9), Location no.14 (232/29-31) (5 no)*
2. Setup of site office, site lab, Site Engineers, Site Survey, Validation/ Verification of GADs of 5 locations.
3. Approval of concrete mix design and Source approval for RMC plant,
4. Submission of Design of Mould and Source/ Vendor Approval for the Mould and CPF lining
5. Site survey by Cranes, Approval of agency/ Pulling agency, Submission of launching/ placement TAD for the 5 locations with design calculations, scheme/ methodology
6. Submission of Programme, QAP, Scheme/Methodology to complete and commission the subways within 72 hrs of commencement of traffic block at each of the 5 locations.
7. Submission of scheme for waterproofing as per items of tender and approval of Source/ Vendor for water proofing.
8. Approval of Source/ Vendor for electric installations, sensor-based systems, arrangements
9. Design and Approval of agency for fabrication of Relieving Girder for work at balance 11 locations
10. Other works necessary to complete entire work of the contract as per accepted program of works, for balance 11 locations.

15.2.2 Milestone-2:

11. Works of Milestone-2 shall be completed within 4 months from the date of issue of letter of acceptance. Total value of items of milestone 2 is 25% of the contract value for consideration of clause 17B of SGCC. Works /targets of milestone-2 are listed below:
12. Casting of Main Box in single segment in Single Pour at all 5 locations
13. Fabrication of Relieving Girder (3 no)
14. Mobilisation and site preparation for Traffic Block, mainly sheet piling for protection of earth
15. Casting of segments for Approaches in Single Pour at all 5 locations
16. Other works necessary to complete entire work of the contract as per accepted program of works, for balance 11 locations.
17. Financial progress: Total cumulative payment 20 % of the contract price

15.2.3 Milestone-3:

Works of Milestone-3 shall be completed within 6 months from the date of issue of letter of acceptance. Total value of items of milestone 3 is 30% of the contract value for consideration of clause 17B of SGCC. Works /targets of milestone-3 are listed below:

1. Mobilisation of all Machineries, Resources for launching/ placement activities at the 5 locations
2. Availability of all Precast elements, Prefabricated elements, sheeting's, boundary wall, electric installations, height gauges, Ornaments elements and arrangement of all prerequisite elements at site 7 days before taking up the traffic block
3. Availability of all machineries, vehicles, excavators, stand by arrangements and agencies, systems at site 3 days before taking up the traffic block
4. Launching/ placement of RCC box at site under traffic block
5. Launching/ Placement of the Precast Elements of approaches, Water proofing, Electric installations, Road work, Boards, Speed breaker, statuary sign boards/ markings, establishing the systems, Boundary walls, height gauge etc including removal of debris/ left out materials within 72 hrs of the commencement of the Traffic block at all 5 locations.

6. Submission of the Documentary, short video, drone recording and documented record of the entire work at each of 5 sites.
7. Other works necessary to complete entire work of the contract as per accepted program of works, at balance 11 locations.
8. Financial progress: Total cumulative payment 60 % of the contract price.

15.2.4 (Final) Milestone-4:

Works of Milestone-4 shall be completed within the defined Contract completion period from the date of issue of letter of acceptance. Total value of items of milestone 4 is 90% of the contract value for consideration of clause 17B of SGCC.

In (Final) Milestone-4, Contractor shall fully and finally complete entire work of the contract at all the 16 locations (including the works not completed in milestone 1,2 & 3 above) within the 'period of completion of the contract' from the date of issue of acceptance letter.

15.3 The contractor shall submit Weekly Progress report as per the approved Programme as detailed CPM/PERT chart. Monthly progress review shall be held at the level of Engineer in charge, detailed presentation, progress documentation shall be presented by agency. Any failure shall attract suitable penalty, damages as detailed in the tender document. PMIS shall also be implemented in the Contract, the PMIS system to be submitted and approved by Engineer in charge.

16.0 MAINTENANCE PERIOD

The maintenance period for the Contract is 1 year from the date of issue of completion Certificate. Same be read along with the relevant clause of the tender document and GCC with latest update.

17.0 PENALTIES/ Incentives AND PERFORMANCE GUARANTEE

17.1 Delay in completion shall attract **Liquidated Damages as per GCC.**

17.2 The scope of work necessarily includes the completion and commissioning of the subway within 72 hr of the commencement of Traffic block at all 5 locations, the works shall be completed in all respect and Subway shall be commissioned within 72 hrs of the commencement of the Traffic block at all locations. In case agency fails to commission the Subway even within the 80 hrs, penalty amounting to 0.05% of the Cost of Subway shall be levied.

17.3 In case, agency completes all required works and commissions the Subway within 48Hrs of the commencement of Traffic block, an incentive amounting to amounting to 0.05% of the Cost of Subway shall be payable, in addition to the incentive already mentioned in the Agreement.

17.4 The entire subway is envisaged to be water intact and the methodology, materials, workmanship has to be ensured and no water seepage should occur, the (back-to-back) warranty of the water proofing system from the Water Proofing Agency for next 15 years is primary requirement of the agreement. In case of any instance of reported water seepage/ leakage within 5 years of the completion of the project, a penalty of Rs 1,00,000 shall be levied to the agency for each such instance.

The Seepage/ leakage shall be got rectified by the Agency at its own Cost, in case agency fails to respond/attend the site, the same shall be got rectified by Railways and double the cost of the actual rectification work shall be recovered from the Agency. For the assurance of the waterproofing system, additional Surety Bond/ bank guarantee equivalent to the overall cost of the waterproofing work, shall be submitted by agency, as per the formats defined in STD, NWR with latest update, with validity of minimum 5 years from the completion of the project, extended for next 5 years subsequently.

17.5 The Concrete Quality shall be maintained with huge Quality Control and Assurance measures as per approved methodology, in case any element comes out with surface defect (measuring 200mm in any direction), a penalty of Rs 1,00,000 shall be levied to the agency for each such instance.



17.6 The Contractor shall provide a centralised Accommodation (total min. area approx. 140 Sqm.) for the executive, supervisor team with work desks and other required furniture as directed by Engineer-in-charge. The entire required furniture, furnishing for effective and efficient working of the site office shall be provided by the contractor, as per layout approved by Engineer in charge, maintained by the contractor during the currency of the contract.

- (a) Offices shall be accessible only from a corridor within the building. The corridor and reception area entrances shall be provided with an external double door.
- (b) Materials for the construction shall be new, robust and durable. The building shall be weatherproof, vermin proof, well insulated thermally and acoustically. Internal walls shall be soundproofed. Electrical power and lighting, including all fixtures and fittings, power, telecoms and internet sockets with LAN/wifi internet availability shall be provided to each room, including air conditioning to maintain the internal temperature within the range of 20 to 24 degrees Celsius at all times. A standby generator shall also be provided and installed with an automatic switchover if load shedding or power outages are a regular phenomenon at the Site Accommodation. The meeting hall and room of project manager shall be provided with LED smart TV of 55 inches respectively.
- (c) Internal doors shall be flush, fitted with door closets, mortise locks with keys and lever handles.
- (d) External doors shall be a pair of solid core doors, external quality, hung on heavy duty hinges, one leaf fitted with barrel bolts top and bottom and the other leaf fitted with a Yale or similar lock.
- (e) Windows, of area not less than 10% of the floor area, shall be provided to all rooms, securely barred, fitted with blinds and having opening sections fitted with locks and mosquito screens.
- (f) The building shall be provided with a continuous water supply, Filter drinking water and drainage to Kitchen, Washroom and Toilets. The Toilets shall be equipped with low level suites and be adequately ventilated through the ceiling.
- (g) The Kitchen shall be fitted out with a 2-drainer stainless steel double sink unit, hot water heater, worktop with cupboards under, tiling above the sink and worktop and wall mounted cupboards. The Contractor shall provide necessary equipment, service and consumables required for running of the kitchen.
- (h) Fire and Safety regulations shall be complied with and fire-fighting equipment shall be provided in accordance with the recommendations of the relevant local authority/agencies.
- (i). The Contractor shall arrange for upkeep, office boy, service and security of the offices and compound. These to be thoroughly cleaned and rubbish and waste to be removed at least once per day.
- (k). The Contractor shall provide and maintain furniture, communication equipment etc. as described below and will be property of the contractor after work is completed.



Site office required to be furnished as described below during currency of contract: -

S.No	Description	Quantity	Configuration
1.	Desktops Computer/Laptop with pre-loaded latest configuration Operation System.	05	Original Window/Mac OS,16 GB DDR5 ram, 1 TB SSD with wireless Keyboard and Mouse, with Graphics, latest intel/amd/snapdragon processors loaded with Office 2021 with updated version, AUTOCAD, and any other software required for viewing the drawings, designs and/or other BIM outputs with 24" display.
1.	Handheld device/tablets with pencils/allied accessories	4	Latest IOS/Android/Windows OS tablets with 512GB memory latest processor
2.	Printer Laser with scanner, Photocopiers	04	02 No Colour each of (A4 + A3) Wireless Laser Printer, WiFi-Direct Canon / HP or any other good brand

The Specifications of computers, tablets and printers are indicative and may be advised accordingly during currency of the contract with the approval of engineer In charge.







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Additional Special conditions & conditions of NS items

- **RCC Work in main box, junction box and U type approach segments.**

- Special conditions for 024010 in addition to USSOR specifications:

- The specifications detailed in the Agreement and specification laid down in CPWD DSR as well as USSOR, relevant IS codes and approved guidelines for concrete work shall be followed for production, transportation, placement, curing, testing and overall concrete work shall be followed.
- In addition, the concrete for the particular work is specifically designed for the continuous, monolithic casting of RCC box segments (with size and design as directed by Engineer-in-charge) as well as approach segments in a single, uninterrupted pour as per approved methodology.
- Concrete shall be placed as per approved methodology and strictly ensure the free-fall of concrete does not exceed 1.5m, in accordance with IS 456:2000.
- Plasticiser/Superplasticizer shall invariably be used in approved proportions (as per IS:9103) to increase workability, modify viscosity for tremie pouring, and extend slump retention time to ensure the entire volume remains plastic throughout the single-pour duration as per approved Design mix.
- A permeability-reducing crystalline admixture shall be incorporated directly into the design mix. The concrete shall be designed and constructed to ensure water penetration remains strictly less than 20mm, as tested per DIN 1048 (Part V).
- The contractor must ensure adequate backup batching capacity, transit mixers, and concrete boom pumps etc. simultaneously to guarantee the uninterrupted supply of concrete required for the single pour.
- Proper curing with curing compound, wet burlaps and polymer sheets should be ensured or as approved by the Engineer-in-charge.
- Testing, sampling and acceptance criteria will follow but not be limited to relevant provisions IS 516:1959, IS 1199:1959 and IS 456:2000 and as per approved QAP.
- Honeycombing/local surface defects identified as per relevant IS codes shall be rectified by the contractor immediately and penal provisions as decided by TAA may also be imposed.
- Pozzolanic material used in Design mix shall conform to IS 1727:1967.

- Special conditions for Self-compacting concrete/ high slump Concrete:

- The QAP for production, placement and finishing of Self compacting concrete shall be approved by the Engineer-in-charge prior to execution.

- **Additional special conditions for shuttering with specifications:**

- The Shuttering shall be designed so as to facilitate monolithic pouring and casting of the Box segments as per approved shuttering design/drawing.
- Suitable sealing arrangements like rubber seals, geotextile layers etc. shall be used in the interior of shuttering plates to ensure smooth finish.
- The shuttering shall be designed with framework, support system and same shall be designed to handle loads during placement of Reinforcement, pouring and loads after casting of the segments.
- The shuttering arrangement shall be designed to be deliver concrete segment of surface finish as per approved QAP and tolerance criteria in relevant IS codes.

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- The structural integrity of the mould under continuous hydrostatic pressure must comply with IS 14687:1999 (Guidelines for Falsework for Concrete Structures).
- The interior steel surfaces of the mould shall be perfectly milled and treated with a high-grade form release agent and shall be combined preferably with Controlled Permeability Formwork liners (CPF liners)/ Geotextile/ liners.
- QAP, WPSS, Fabricator etc shall be approved by Engineer-in-charge before fabrication of moulds is taken up.
- Structural design and arrangement of mould while shuttering and de-shuttering shall be approved by the Engineer-in-charge.

• **Water proofing and seepage proof:**

Item code: NS-1 to 6 (Waterproofing for horizontal Surface of box & approach)

Description:- Waterproofing of below Raft / Grade slab / Base slab: Providing and applying a fully bonded, pre-applied, thermoplastic polyolefin (ref to IS 16471:-2017 requirements of UG water proofing structures, requirements to provide Type A of IS 16471:2017 & BS 8102: 2009 fully bonded protection of UG waterproofing structures, protection of below ground structures against water from the ground of table 3, CE marked in accordance with EN 13967) based composite sheet membrane waterproofing system min thickness 1.0 mm and bare membrane thickness min. 0.8 mm for underground structures. The membrane should have strong chemical and physical bonding property between hybrid cementitious bonding layer and fresh concrete in underground structures to prevent lateral water migration between membrane and the structural concrete of underground structure. Chemical base of membrane: a) Membrane layer- Thermoplastic polyolefin (TPO), The overlaps of min. 80 mm width shall be thermally jointed with self propelled hot air welding machine as per suppliers' recommendations. Flexible polyolefin membrane, 0.8 mm thick, fully bonded to the structural concrete. The membrane must have i. Tensile strength 8-9 mpa according to ASTM D412, ii. elongation 600% according to ASTM D412, iii. Impact resistance 400 mm according to EN 12691, iv. joint shear resistance 100 N/50mm according to EN 12317-2; v. resistance to lateral water migration of 70 m according to ASTM D 5385 mod, vi. should pass durability tests of water tightness against ageing and chemicals according to EN 1928B, vii. Peel adhesion to concrete 1200 N/m as per ASTM D903, lap peel adhesion 1000 N/m as per ASTM D1876, viii Foldability at low temperatures and shall show no cracking at -29 deg cel. As per ASTM D1970, x. Membrane shall be laid below the RCC and continued over the side of raft, vertical portion of retaining wall.

Item code: NS-2 (Dimple board on exterior of boxes and approach segments)

Description: Construction joint Treatment: Supply & installation of swellable, acrylic profile, rectangular 20 x 10mm according to the following standards: Providing and applying rectangular 20 x10 mm acrylic swellable sealing profile (Bentonite free) using polyurethane based hydrophilic swelling adhesive on construction joints. The swellable profile should have MPA NRW: German approval for construction joints and meets WISSBAU: Function test for application in construction joints, must produce swelling pressure 16 bar after 3 days stored in tap water and swelling capacity of 100 % in demineralised water after 3 days and 200 % in demineralised water after 14 days. The polyurethane hydrophilic sealant must have low swelling capacity of < 25 % in 1 day in tap water and < 100 % in 7 days in tap water according to EN 14406. The swellable system must have a BBA certificate for durability and resistance to water pressure. Both swellable water stop and sealant must be supplied by same manufacturer. The supplier must have their own manufacturing facility, should not be private label product or sourced from third party. The manufacturer must be an ISO 9001 & 14001 certified and valid certificates must be produced as proof. Product requirements: Density: 1.33 kg/ltr;

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change of volume < 25% (exposed 1 day to tap water) and > 100% (exposed 7 days to tap water); shore A hardness (exposed 7 days to tap water) > 10.

Item code: NS-3 (Joint treatment Fully Bonded at approach to Box)

Description: Joint treatment: Epoxy adhesive base layer: Providing and applying 50mm wide epoxy adhesive, a solvent free, moisture tolerant, 2part thixotropic epoxy adhesive for FPO tape system on both sides of the joint. The epoxy adhesive must be capable of bonding with concrete and metal. The compressive strength must be 45 N/mm² in 1 day according to ASTM C 579 and bond strength of > 1.5 N/mm² according to ISO 4624 for both concrete and metal substrates. The consumption of adhesive for base coat must not be less than 0.7 kg/rm.

Item code: NS-4 (Joint treatment Fully Bonded at approach to Box)

Description: Epoxy adhesive top layer Providing and applying adhesive a solvent free, moisture tolerant, 2part thixotropic epoxy adhesive on top of FPO tape from both sides with an overlap of minimum 10mm from both the sides of the joint. The epoxy adhesive must be capable of bonding with concrete and metal. The compressive strength must be 45 N/mm² in 1 day according to ASTM C 579 and bond strength of > 1.5 N/mm² according to ISO 4624 for both concrete and metal substrates. The consumption of adhesive for top coat must not be less than 0.7 kg/rm.

Item code: NS-5 (Box Joint treatment)

Description: Membrane protection in Vertical Wall: Supply and apply a HDPE drainage and protection board as per approved make list on base of premium grade high density polyethylene (HDPE) with dimples 8mm with the help of double side tape. The drain protection board should have high drainage capacity, High mechanical resistance, Resistant to root penetration, Resistant to all natural aggressive mediums in ground water and soil, Suitable for contact with soft water (aggressive to concrete). Can be installed on damp and wet substrates The backfilling shall be done within 2-3 days of fixing drainage boards. All systems to be installed as per manufacturers recommendation etc., complete with all lead and lift for all materials and labour and as directed by Engineer in charge.

Item code: NS-6 Waterproofing joint tape for expansion joint:

Description: Waterproofing joint tape for expansion joint: Providing and applying FPO tape 2mm with desired width, a modified plasticizer free flexible FPO based drinking water compatible, root resistant membrane with advanced adhesion. The tape system must be capable of Water Tightness Pass (Method B, 24 hours / 60 kPa) as per EN 1928; tensile strength > 12 N/mm² according to EN 12311-2; tear strength > 28 N/mm according to EN 12310-2; elongation > 650 % according to EN 12311-2; seam strength > 300 N/5cm according to EN 12317-2; chemically resistant to several chemicals; passes low temperature foldability at -40°C according to EN 495-5; passes artificial weathering 7500 hrs according to EN ISO 4892-2. The tape must be capable of servicing a wide range of temperature of -40 °C to +60 °C. The tape system must have drinking water approvals from WRAS and KTW. The tape, adhesive and repair mortar must be provided by same manufacturer for full compatibility. The supplier must have their own manufacturing facility, should not be private label product sourced from third party. The manufacturer must be an ISO 9001 & 14001 certified and valid certificates must be produced as proof.

NS/7 -: Supplying and fixing Galvanized Steel / Galvalume self-supporting sheet in roofing made from Mild steel having thickness minimum 0.80BMT (Base Metal Thickness) having coating of Zinc/Aluminium +Zinc including cutting to size and shape including fixing. The rates shall include

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all cost of materials, taxes, labour, tools, plants, fixture etc. complete and fixing as per direction of Engineer in Charge at site.

Note: -

- (1) Contractor will have to submit the design of the roofing duly proof checked from Govt. Engg. College / IIT / NIT for approval of the Railway. Roofing shall be provided only after getting it approved from the Railway. (No separate payment shall be made).
- (2) In design, CBE, NWR drawing No. CBE- 1017/RUB/ 2018/Roof Covering/RI and CBE- 1017/RUB/2018/Roof Covering/Sheet No. 1 maybe referred for guidance purpose.
- (3) Approved GAD of RUB will be guiding factor in deciding span and other dimension of roofing.
- (4) In case of any dispute regarding interpretation of any of the above clauses, decision of the Chief Engineer/VI/Construction NW Railway, Jaipur shall be final and binding on the contractors subject to relevant provisions of the GCC and SCC.
- (5) This item shall be used for RUB to be constructed in Urban area.

NS/8- AS PER DESCRIPTION OF ITEM

NS/9 (A&B) of Schedule C - Placement of pre cast reinforced cement concrete components (RCC box/U-Type segments of retaining walls) with the help of suitable capacity road crane at desired location during traffic block of short duration with contractor's labour, tools, material, cranes, machinery, preparation of surface including cost of filling of joints by epoxy mortar, cutting of lifting hooks by gas cutting, all lead, lift, taxes etc. complete in all respect.

1. RCC box/U-type/L-type segments requiring traffic block.
 2. RCC box/U-type/L-type segments not requiring traffic block or in closed sections.
- This item consists of placement of precast reinforced cement concrete box segments and RCC Box/U- type/L- Type segments with the help of suitable capacity tyre-mounted cranes at desired location during traffic block for RCC box launching work.
 - U-Type retaining wall will be launched with or without traffic block with all contractor's labour, material, tools and machinery, cranes etc., including filling of joints by epoxy mortar including supply of epoxy and silica sand or filler material approved by railway, with all lead, lift etc. complete as per approved railway scheme.
 - Launching of RCC Box, segments, slabs etc. will be as per approved methodology/TADs from Railways.
 - Contractor should arrange all tools, plants & machinery at site in working condition with operator and sufficient skilled & un-skilled man power to assist the machinery during traffic block for smooth & safe working as directed by the Engineer-in-charge.
 - Following tools, machinery, labour is indicative in nature for launching of RCC box/U/L segments with/without traffic block per site. However actual requirement will be decided by Engineer-in-charge as per site requirement. Nothing extra shall be paid for using such additional machinery & labour.

S.N	Description	Qty
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1	Hydraulic Cranes of minimum 300MT capacity as per RCC Box size with operator & 10skilled laborers.	2 nos.+ SPARE (as per approved TAD/Launching scheme)
2	Excavator Tata Hitachi or similar with operator (PC 400 or higher)	3 nos.
3	JCB with tools & operator.	3nos.
4	Dumper with Hydraulic lifts system.	6 nos.
5	Gas cutting equipment.	2 nos.+ 1 spare
6	Auto level instruments	2 nos.
7.	Jack hammer mounted excavator along with compressor (where rock is likely to be encountered as per Soil investigation)	2 nos.
8	Labour*	40 As per requirement

*Skilled & unskilled labour required for crane working, excavation of earth, sand filling, placement of slabs and RCC box segments, sand bag placement, back filling & P.Way working.

- Night block working may be required depending upon traffic block availability. If block is sanctioned during night, contractor will arrange required capacity generator with halogens for lighting purpose as mentioned below or as per site requirement as decided by Engineer-in-charge at site.

S.No.	Description	Qty
1	Electric Generator of 10KV	2 no. + 1 spare
2	500 watt. halogen & Elec. Wire etc.	15 no. Halogen & Electric wire for connection.
3	Electrician & Helper	As per requirement

- Deployment of 3 Nos. men round the clock per LHS site for protection of track from date & time of taking traffic block for launching of RCC box segments till the time track is made fit for 45Kmph at the contractor own cost.
- Erecting the Retro-reflective type caution & Speed indicator boards as per P Way manual at specified distance from the time of taking traffic block for launching of RCC box segments & slabs till relaxing the speed to normal at the contractor own cost.
- Rates In this item the payment shall be made as per the weight of RCC box/U type retaining wall segments in MT calculated as per drawing. The rates are inclusive of all labour, material, tools and plants, machinery, cranes etc. loading, unloading, transporting, stacking, deployment of men for track protection & other activities, fixing of caution & Speed indicator boards, taxes, royalty etc.

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- Measurement: The payment shall be made for weight of RCC box segments and U/L type retaining wall segments as per site measurements/actual work done. No additional payment will be made if extra work beyond the scope of approved drawing is done.

Launching of RCC box and approach segments using Crawler crane:

Item code: NS-10

Description -Launching, handling and placement of precast jointless RCC box (single jointless box under track) with all related junction box, slabs, approach segments, lifting arrangement etc. as directed by Engineer-in-charge at fixed locations (decided by Engineer-in-charge) using crawler crane (TPI certified by competent authority) of suitable capacity along with arrangement of equivalent capacity standby crane, complete in all respects.

The work shall include providing all crane labour, supervisors, operators, riggers, tools & plants, cranes, machinery, lifting tackles, slings (of required capacity and tested by TPI), wire ropes, D-shackles, lifting frames, consumables and all accessories necessary for safe lifting, shifting, handling, launching and accurate placement of RCC components to the required line, level and position.

The rate includes:

- Mobilization and demobilization of cranes and associated equipment.
- Preparation and strengthening of crane standing area, working platform and access/approach roads.
- Loading, unloading, stacking, positioning, all leads and lifts.
- Trial lifting, balancing, alignment, final adjustment and setting of segments.
- Cutting/removal of lifting hooks, lugs and temporary fixtures after placement by gas cutting.
- Disposal of released steel pieces, debris and unserviceable materials.
- Compliance with Railway safety rules, specifications and instructions of the Engineer-in-Charge.

The rate shall be inclusive of all labour, materials, fuel, lubricants, consumables, temporary works, taxes, insurance, contractor's overheads and profit, and all incidental charges required for completion of the work in accordance with approved drawings, Railway specifications and directions of the Engineer-in-Charge. No additional charges will be paid by Railways.

NS/11 of Schedule "A"- Removing of existing any type of track for insertion of RCC boxes, laying, linking & lifting of any type of track on newly laid RCC box on either side of LHS:

Scope of work.

- (i) Removing of existing any type of track including removing rails, sleepers and ballast up to 20m length on either side of LHS with all contractor's materials, tools, plants and labour. This work is to be carried out during traffic block. This item also includes dismantling of check rail, if any, for which nothing extra shall be paid.
- (ii) After dismantling of track, existing ballast will be retrieved carefully and shall be kept away from the site of work. This shall be screened before putting it back into the track.
- (iii) The contractor is required to lift the ballast from the ballast stacks, lead them to the proposed alignment of the track and spread it uniformly to provide 150mm thick clean ballast bed initially and subsequently to supply and put ballast including dressing & boxing to make

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standard BG ballast profile, as laid down in the IRPWM (Corrected up to date) and as directed by the Engineer-in-charge, after linking of the track with his own labour and T & P. The ballast toe line should be marked with lime on both sides. The cost of supply of extra ballast if required to provide a cushion as 300mm to 350mm depending upon type of route is also included in this item.

Putting of ballast shall be done to achieve the final profile of the track with or without traffic block conditions for which no extra payment shall be made under any circumstance, whatsoever. Excess ballast, if put in the track, has to be removed by the contractor at his own cost.

The contractor will take all safety precautions while leading & spreading of ballast and doing dressing/ boxing or making ballast profile in running traffic condition as per IRPWM provisions. In case contractor fails to complete boxing, dressing as per required profile, or Railways deploy ballast regulator for this work, recovery at the rate of Rs.15/- per running metre of track shall be made.

Contractor shall deploy sufficient labour and T & P to achieve adequate progress of this activity, so that other connected activities may not suffer.

- (iv) Linking and re- laying of new BG track for main line as well as for loop lines has to be done under traffic block on running line. Additional rails, sleepers, P-way fittings etc., if required, shall generally be made available at nearest depot & contractor has to lead / transport the same by his own machinery at his own cost. No extra payment shall be made on this account. The linking shall be done as per the methodology given in IRPWM. If linking is to be done at a location on curves, then the item includes local alignment of curves along with provision of super elevation and correction of curve parameters as per IRPWM relevant provisions. Nothing extra shall be paid on his account.
- (v) Lifting of track shall be done where track is having clear cushion less than 300mm to 350mm. This work is to be carried out under traffic conditions and speed restriction with proper protection of track. Maximum lifting at a time can be 75mm strictly as per provision of IRPWM. Sufficient labour is to be deployed for packing of lifted track so as to keep the track parameter fit by through packing and slack packing for safe passage of train at restricted speed of 20kmph as per directions of Engineer- in- charge. Proper ramping of track on approaches of RUB/LHSs to be provided and maintained for passage of train during the course of work. Lifting work shall be executed as per methodology given in IRPWM.
- (vi) Cutting of rails include all types of rails with mechanically or electrically operated rail cutting machine using hacksaw blades or abrasive rail cutting machine with contractor's own labour, T & P and consumables. Cuts provided shall be square & within specified tolerance in both vertical and horizontal directions. Cuts which are out of square will not be paid. Necessary provisions of IRPWM in this regard are to be followed. The cutting of rail shall be done as per direction of Engineer in charge or his representative. Cut section/ scrap shall be deposited to concerned SSE/P-Way/C in respective station yard/ adjoining station yard as directed by Engineer- in- charge or his representative.
- (vii) The drilling of holes will be done as per requirement of track linking as directed by Engineer or his representative. Drilling of holes in rails of 31.75 mm/ 26.5mm or any similar dia holes in all types of rails with contractor's own tools, plants, equipment, labour etc. The drilling shall be done correctly as per template for standard fish plated joints of corresponding rail sections.

Chamfering of bolt holes shall also be done under this item as per procedure laid down in para 251 (5) of IRPWM) with contractor's own chamfering kit, for which no extra payment will be

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made. Any hole made at incorrect distance will not be paid for. Such rails shall be cut and holes drilled again. No extra payment shall be made for the same.

- (viii) After complete lifting of track & initial through packing another two rounds of through packing are required to be done as per Para 224 and 1408 of IRPWM so as to make the track fit for the speed of 75 Kmph.

The contractor shall arrange adequate labour and T & P in such a way that the packing work is completed well within the laid down time schedule as per IRPWM or as desired by the Engineer in charge.

If even after making two rounds of through packing desired track standards are not achieved, the contractor will have to arrange for additional rounds of packing for which nothing extra will be paid, whatsoever the case may be. For these relevant provisions of IRPWM shall be followed.

- (ix) Distressing of track includes local distressing for adequate length of track which can be newly laid 60 Kg/52 Kg LWR/ CWR track, as per Para 5.7 of de-stressing of LWR Manual of Instructions on Long Welded Rail, 1996, amended up to date or IRPWM relevant provisions.

The work of distressing shall be done under the personal supervision of a SSE/C/P-way. The distressing may be done manually as per direction of Engineer- in- charge.

The work shall be carried out under traffic block. The contractor shall be responsible to take all safety precautions, necessary protection of the track, during block period as per IRPWM provisions.

- (x) AT welding shall conform to IRS specifications No. T-19-2012 & "Manual for fusion welding of rails by SKV Alumino Thermit process-1998 "with latest correction slips/ addendum-corrigendum issued till the date of opening of tender. Only RDSO certified supervisor and welders shall be permitted to carry out the work of AT welding. Tenderer shall submit the welders name & certificate prior to the execution of work. The scope of work includes all consumable items, entire welding equipment and T&P such as generator, Weld trimmer, Profile Grinder of approved quality along with grinding stone/ files as required, all the raw material, skilled/ unskilled labour, welder, supervisor, adjustment of welding gap etc.

Transportation of men & material viz. thermit welding portions and equipment, tools & plants etc. required for welding and transportation of released P-way material will be the responsibility of contractor for which no extra payment will be made for this.

After welding, all the joints shall be USFD tested. USFD teams will be arranged by the contractor at his own cost. If any joint is found defective in USFD testing the same shall be required to be re-welded free of cost by contractor using Railways portion. The cost of railway portion issued as above would be recovered from the contractor.

- (xi) All the activities to be executed under this NS item shall be strictly as per the IRPWM and all work to be carried out in with or without traffic block condition as per the direction of Engineer-in-charge at site. The rates quoted in this item are for complete job and would include all items of work which are incidental to completion of the job. Nothing extra shall be paid to the contractor on any account.

NS/12- AS PER DESCRIPTION OF ITEM

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NS/13- AS PER DESCRIPTION OF ITEM

List of approved makes of materials-

S.No	Material	List of Preferred Make or similar
1.	(i) Ordinary Portland Cement/ Portland Pozzolona Cement.	ACC, Ultratech, Ambuja Cement, Shree cement
	(ii) White Cement	Birla White, J.K. White
2.	Reinforcement Steel (HYSD TMT- FE 500)	SAIL, Tata Steel, Rashtriya Ispat Nigam Ltd. (RINL), and JSW Steel Ltd., Jindal Steel & Power Ltd,
3.	Water Proofing Compounds, Admixtures, Plasticizer, Super Plasticizer, Curing Compounds	Fosroc, ROFF / Dr. Fixit (Pidilite Industries), CICO, Sika, BASF, Ardex Endura (Bal Endura), Scot Chemicals, STP Limited
4.	Integral Water proofing compound with cement (For Plaster & Mortar)	Fosroc, Conplast 421 Dr. Fixit : LW+, Sika : Sikacim, Asian Paints : Smart care vitalia & equivalent product of BASF, CICO, Ardex Endura, Scot Chemicals, STP Limited
5.	Water proofing for bathroom/ toilet/ balcony & other wet areas	Fosroc : Brush Bond, CICO : Tapecrete, Dr. Fixit : Pidifine 2K, Sika : Nito Bond, Asian Paints : Damp Block 2 K & equivalent product of BASF, Ardex Endura, Scot Chemicals, STP Limited
6.	Crystalline water proofing compound	Fosroc : Fosroc Crystalline, Dr Fixit : Dr. Fixit Crystalline, Sika : Sika Crystalline, Asian Paints : Crystalline Quart, & equivalent product of BASF, CICO, ArdexEndura, Pentron, Scot Chemicals, STP Limited
7.	Grouts, Tile Adhesive	Latecrete, Kerokoal, BASF, Ardex Endura, Ferrous Crete, Pidilite, Scot Chemicals, STP Limited
8.	Stone Adhesive	Pidilite - Fevimate excel, BASF, Ardex Endura, MYK Laticrete
9.	Structural Steel	SAIL, Tata Steel, Rashtriya Ispat Nigam Ltd.(RINL), and JSW Steel Ltd., Jindal Steel & Power Ltd,
10.	Polycarbonate Sheet	GE Plastic, LEXAN, Bayers
11.	Profile steel sheet	Ezydeck of TATA, Lloyd Super deck, JSW/ Jindal

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12	Acrylic Smooth Exterior Paint	Asian Paints: Apex/ Professional Premium Exterior Emulsion, Nerolac : XL, Berger : Weather Coat, ICI-Dulux : Weather Shield
13	Premium Acrylic Smooth Exterior Paint with Silicon additive.	Asian Paints : Apex Ultima Nerolac : XL Total Berger : Weather Coat all guard ICI-Dulux : Weather Shield max
14	Synthetic Enamel Paint	Asian : Apcolite Premium gloss enamel, Nerolac : Synthetic Hi gloss Berger : Luxol Hi gloss ICI -Dulux : Gloss Synthetic enamel
15	Cement Primer	Nerolac, BP White (Berger), Decoprime WT(Asian), White primer (ICI)
16	Steel Primer (Red Oxide Zinc Chromate Primer)	Asian Paints, Nerolac, Berger, ICI
17	Epoxy Paint	Asian, Nerolac, Berger, ICI, Kansai Akzo Nobel
18	Fire Paint	Asian Paints, Akzo Nobel Coatings India Ltd., PROMAT, Jotun,
19	G.I. / M.S. Pipe	Tata, Jindal (Hisar)
20	G.I. Fittings	Unik, AVR, Zoloto
21	HDPE Pipes	Reliance, Jain Pipes, ORIPLAST, Supreme
22	DI PIPES	Electrosteel, Jindal, TATA DUCTURA, Kapilansh, Kesoram
23	DI Fittings	Electrosteel, Jindal, TATA DUCTURA, Kapilansh, Kesoram
24	UPVC pipe and Fittings	Astral, Supreme, Ashirwad
25	Centrifugally Cast (spun) Iron Pipes & Fittings	NECO, Kapilansh, SKF
26	C.I. Manhole covers, frames & GI Gratings	NECO, Kapilansh, SKF
27	SFRC Manhole covers & gratings	KK, JAIN, PARGATI

- GUIDE LINES REGARDING SAFETY OF TRACK DURING EXECUTION OF WORK & CORE TEST, PERMEABILITY TEST & NDT TEST IN ADDITION TO CUBE TEST FOR CONCRETE WORKS IN BRIDGES. -

Safety barricading along the running line as per the approved drawing (Drawing No. CTE/4110/1-F/Type Plan/2018) shall be erected during execution of work. These safety barricading's should be kept in place till completion of work.

- CORE TEST, PERMEABILITY TEST & NDT TEST IN ADDITION TO CUBE TEST FOR CONCRETE WORKS IN BRIDGES. - Shall be done as per Railway Board's letter No. No. 2022/19/CE-III/BR/RDSO/1 (E-3422013) dated- 19/05/2026

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भारत सरकार / GOVERNMENT OF INDIA
रेल मंत्रालय / MINISTRY OF RAILWAYS
(रेलवे बोर्ड / RAILWAY BOARD)

No. 2022/19/CE-III/BR/RDSO/1 (E-3422013)

New Delhi, Dated: As Signed

Principle Chief Engineers,
All Zonal Railways.

Chief Administrative Officers,
All Zonal Railways.

Sub: Core Test, Permeability Test & NDT Test in addition to Cube Test for concrete works
in Bridges.

Ref: ED/B&S-II/RDSO's letter No. CBS/Codes/A&C dated 04.05.2026

The quality of structural concrete components of bridges is presently assessed primarily through cube tests, sampled as per Para 8.7.2.2 and tested in accordance with Clause 4.3.1.2 of the Concrete Bridge Code (CBC), based on the quantity of concrete poured at a time. In view of certain issues observed relating to the quality of construction in bridge works, RDSO has recommended the adoption of additional tests for comprehensive assessment of concrete quality.

Based on the recommendations of RDSO, the Competent Authority has decided that, henceforth, in addition to the mandatory cube tests, Core Test, Permeability Test and Ultrasonic Pulse Velocity (UPV) Test shall also be conducted for all works involving construction of Mega and Major Bridges. The frequency and locations for conducting these tests for various structural elements shall be as specified in Annexure-I enclosed herewith.

It has further been decided that the above testing regime shall be implemented with immediate effect for all Mega and Major Bridge works presently under construction.

This issues with the approval of the Competent Authority.

DA: As Above

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(Abhimanyu Lamba)
Director, Civil Engg./B&S-I
Railway Board

Copy to: (i) DG/IRICEN for information please.
(ii) PED/Infra-I & PED/Infra-II for information & necessary action please.

Annexure-I

Schedule of test to be performed on various element of Mega/Major Bridge in addition to cube test.

BRIDGE ELEMENT	CORE TEST	PERMEABILITY TEST	ULTRASONIC PULSE VELOCITY (UPV) TESTING
Foundation (Each)	Minimum 4 cores shall be obtained from: a) different lifts in case of open foundation b) Pile cap by dividing the cap in 4 zones and one core from every zone in case of pile foundation c) Well cap by dividing the cap in 4 zones and one core from every zone in case of well foundation Equivalent cube strength of minimum three Cores: Average core strength $\geq 0.85 f_{ck}$ Individual core strength $\geq 0.75 f_{ck}$	One test per 300 cum of concrete subject to minimum one test. The test should be conducted in accordance with clause 5.4.2 of IRS CBC.	Random 5 spots of 0.6 m x 0.6 m size shall be identified and Ultrasonic Pulse velocity testing shall be carried out in accordance with IS:516 (Part 5/Sec 1). The concrete quality shall be excellent.
Pier/Abutment (Each)	The pier/abutment shall be divided into 4 zones. Minimum one core shall be obtained from each zone. Equivalent cube strength of minimum three Cores: Average core strength $> 0.85 f_{ck}$ Individual core strength $> 0.75 f_{ck}$	One test per 300 cum of concrete subject to minimum one test. The test should be conducted in accordance with clause 5.4.2 of IRS CBC.	Random 5 spots of 0.6 m x 0.6 m size shall be identified and Ultrasonic Pulse velocity testing shall be carried out in accordance with IS:516 (Part 5/Sec 1). The concrete quality shall be excellent.
Piercap/Abutment cap (Each)	Minimum 4 cores shall be obtained from different region of cap Equivalent cube strength of minimum three Cores: Average core strength $> 0.85 f_{ck}$ Individual core strength $> 0.75 f_{ck}$	One test per 300 cum of concrete subject to minimum one test. The test should be conducted in accordance with clause 5.4.2 of IRS CBC.	Random 2 spots of 0.6 m x 0.6 m size shall be identified and Ultrasonic Pulse velocity testing shall be carried out in accordance with IS:516 (Part 5/Sec 1). The concrete quality shall be excellent.
Concrete Super-structure (Slat/Girder), Deck slab of concrete composite Girder	Minimum 4 cores shall be obtained from different region of one span/super-structure and from deck slab Equivalent cube strength of minimum three Cores: Average core strength $> 0.85 f_{ck}$ Individual core strength $> 0.75 f_{ck}$	One test per 300 cum of concrete subject to minimum one test per slab/girder and deck slab. The test should be conducted in accordance with clause 5.4.2 of IRS CBC.	Random 5 spots of 0.6 m x 0.6 m size shall be identified and Ultrasonic Pulse velocity testing shall be carried out in accordance with IS:516 (Part 5/Sec 1). The concrete quality shall be excellent.

Note:

1. Cube Test results shall satisfy the acceptance criteria as per clause 8.7.6 of IRS CBC.
2. Acceptance of core test results shall be based on Annex B of IS 516 (Part-4).
3. Wherever core test is not possible due to any reason at any location/zone, the dispensation shall be given by Chief Engineer/Construction or CBE as the case may be by satisfying personally that extraction of core for testing is not practically possible.
4. The acceptance of any element of bridge shall be based on the results of cube test, core test, permeability test and ultrasonic pulse velocity test. If the concrete is deemed not to comply to requirement mentioned herein, the structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken.

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Special Special condition of NS/8

SCHEDULE - 'A' is CPWD-DSR-2021.

The work should be carried out in accordance with Central Public Works Department -Specifications (Vol. 1) & (Vol. 2)-2021 with up-to-date correction slips.

SCHEDULE - 'B' is NWR-IRUSSOR-2021.

The work should be carried out in accordance with Indian Railways Unified Standard Specification - 2021 with upto date correction slips.

SCHEDULE - 'C'

(A) Activities involved in Item No. NS/8 for W Beam Crash barrier:

- 1) W-Beam-2mm thick- 02 Nos.
- 2) Channel post 150x75x4 @ 2mt. c/c- length 2.70 mt. each.
- 3) Lap in W-Beam- 0.318 mt.
- 4) All fittings and fastenings.
- 5) Labour charges for driven of channel post as per approved drawing.
- 6) Labour charges for Auger drilling for channel post fixing as per approved drawing.
- 7) Concrete in auger drilled bore is not taken in this item. The quantity of concrete will be paid under relevant item of DSR schedule.

(B) Activities involved for additional height of Galvanized channel post (150x75x4mm) and other Galvanized Materials etc:

- 1) During execution & fixing of channel post, if it is required to increase the column height more than 2.70 mt. The additional length will be paid under this item, (by weight).
- 2) In any circumstances it is required to reduce the overall column height less than 2.70mt, the same will be recovered as per rate of this NS item.
- 3) Any elements not described in item No. NS/8 of W beam but required during execution of work will be paid under this NS item.

(I) MATERIAL AND SPECIFICATION

1. All steel members shall be as per specification of approved drawing.
Railing posts and W-beam shall be made of steel of the section, weight and length as per specification of IS code mentioned in the drawing.
2. All complete steel rail elements, terminal sections, posts, bolts, nuts, hardware, "W" beam section and other steel fittings shall be hot dip galvanized as per specified in drawing.

All elements of the railing shall be free from abrasions, rough or sharp edges and shall not be kinked, twisted or bent.

Damaged galvanized surfaces, edges of holes and ends of steel sections cut after galvanizing shall be cleaned and re-galvanized as per instruction of site in charge.

The "W" beam, the posts, spacers and fasteners for steel barriers shall be galvanized by hot dip process (zinc coated, 0.55 kg per square meter; minimum single spot) unless otherwise specified. The galvanizing on all other steel parts shall conform to the relevant IS Specifications. All fittings (bolts, nuts, washers) shall conform to the IS:1367 and IS:1364.

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SSE/WCLB
K. Srinivas
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All galvanizing shall be done after fabrication.

3. The "W" beam type safety barrier shall consist 2mm thick "W" beam as per IS: 5986 grade -205 or The vertical steel channel post section should be 150 mm x 75 mm x 4 mm thick as per IS:5986 grade 355 or equivalent as specified in the approved drawing.

The steel post shall be 1.50 m above the ground level & 1.2 m below the ground level and posts shall be spaced at 2.0 m c/c or lesser as per site requirements and instruction of site in-charge.

The "W" beam barrier shall be fixed as indicated in the approved drawing.

Technical Requirements:

Components of Metal Crash Barriers

W Beams:

W beams should be 2 mm thick as specified in the drawing. Raw material conforming to IS 5986 grade -205 or equivalent. Hot dip galvanized minimum of 550 gm/sq.m thickness on all surfaces as per IS: 4759 as per specification of drawing.

Posts:

Raw material conforming to IS: 5986 grade 355 or equivalent. Hot dip galvanized minimum of 550 gm/sq.m thickness on all surfaces as per IS: 4759.

Fasteners:

M20 and M16 fasteners as per IS 1367 Grade 4.6/8.8 and Hot dip galvanized as per IS: 4759.

QUALITY ASSURANCE:

Materials testing (From NABL approved Lab) should be done at contractor's own cost prior to fabrication as per instruction of Engineer In charge. Galvanization thickness test should be done (From NABL approved Lab) after the process. Railway will not pay any extra cost for testing.

(II) CONSTRUCTION OPERATIONS:

1. The line and grade of railing shall be true to that shown on the drawing. The railing shall be carefully adjusted prior to fixing in place, to ensure proper matching at abutting joints and correct alignment and camber throughout their length. Holes and cuts should not be done at site which may damage the galvanizing.
2. Splices and end connections shall be of the type and designs specified as shown on the drawing and shall be of such strength as to develop full design strength of the rail elements.

(III) INSTALLATION OF POSTS

1. Insertion of post below G.L. may be adopted by the three process as per site feasibility and Approved Drawing i.e.,

By Driven mechanism.

By Hand or mechanical operated Auger of diameter of 0.30 M.

By Open Excavation process.



Note:

(a) The rates for the insertion of posts by the above mentioned three processes are Inclusive in item rates, no any extra payment will made for any other type of insertion activity.

(b) For item 1.3, Concrete and shuttering will be paid extra in the relevant items as per instruction of engineer in-charge.

2. Holes shall be drilled to the depth indicated on the plans.

Posts to be driven by approved methods, equipment and machinery and are to be erected in proper position and should be free from distortion and burring or any other damage.

The diameter of Hand Auger used shall be 0.30 M, after placing of the post in position the hole shall be filled by the M 20 (1:1.5:3 Mix) CC and payment for the same will be made in the relevant item.

Wherever it is not possible to drive the post due to soil condition the same should be erected after making CC foundation M 20(1:1.5:3 Mix) CC or as advised by site engineer for stability of the foundation. The payment for the M 20(1:1.5:3 Mix) CC and the shuttering used shall be paid in the relevant item.

All column rail anchors shall be set and attachments made and placed as indicated on the plans or as directed by the Engineer.

All bolts or clips used for fastening the column rail or fittings to the posts shall be drawn up tightly as per drawing.

Each bolt shall have sufficient length and at least 10 mm beyond the full nut, except where such extensions might interfere with or endanger movement nearby in which case the bolts shall be cut off flush with the nut.

All railings shall be erected, drawn and adjusted so that the longitudinal tension will be uniform throughout the entire length of the rail.

During erection and fixing of column post, if it is required to increase the column height more than 2.70 M to negotiate the natural gradient, the additional length will be paid under relevant NS item. In any circumstances it is required to reduce the overall column height less than 2.70 M the same will be recovered as per rate of Relevant NS item.

The anti-theft arrangement on fittings and fastenings should be provided as per the direction of Engineer in-charge.

3.TOLERANCE:

The railing barrier shall be erected true to line and grade as per specification of approved drawing.

4.MEASUREMENTS FOR PAYMENT:

(a) Metal beam railing barriers will be measured by linear metre of completed length as per plans and accepted in place.

(b) No extra measurement for payment will be made for excavation or backfilling Performed in connection with this construction. All the excavation and backfilling activity is inclusive in the NS item itself.

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(IV) RATE:

The item rate should include with materials, labours, lead, lift, loading, unloading, Tools and plants, all taxes, site cleaning, bush cutting, preparation of approach path, manual carting of materials due to unavoidable site requirement, etc with contractors own materials and labours necessary for doing all the work involved in constructing the metal beam railing barrier complete in place in all respects as per the Specifications. Work will be carried out as per direction and instruction of Engineer in charge of work/ Engineer representative. (No any extra payment shall be paid by Railway).

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ADDITIONAL SPECIAL CONDITIONS OF CONTRACT (SCC)

NS/12

Technical Specifications for UHPC Execution in RUB RCC Boxes

1. Material Specifications and Code Compliance

The Contractor must strictly adhere to the following material standards to ensure the structural integrity and durability of the Ultra High-Performance Concrete (UHPC) matrix. In case of any ambiguity BS 136 of RDSO and decision of Railway will be final.

- **1.1 Cement:** The cement utilized must be capable of achieving the design strength and uniformly blended using mechanized process controls. Approved types include:
 - Ordinary Portland Cement (IS: 269).
 - Rapid Hardening Portland Cement (IS: 8041).
 - Portland Slag Cement (IS: 455).
 - Portland Pozzolana Cement (Fly ash based: IS: 1489-part I; Calcined clay based: IS: 1489-part II).
 - Sulphate Resistant Portland Cement (IS: 12330).
 - Microfine Ordinary Portland Cement (IS: 16993).
- **1.2 Mineral Admixtures:** Essential for refining the pore structure. Permitted admixtures include:
 - Silica Fume (IS: 15388).
 - Ground Granulated Blast Furnace Slag or GGBS (IS: 16714).
 - Fly Ash (IS: 3812).
 - Metakaolin (IS: 16354).
- **1.3 Fine Aggregates:** Coarse aggregates are strictly prohibited. Fine aggregates shall conform to IS: 383, with particle sizes ranging from 150 to 800 μm . Inert materials such as quartz powder with particle sizes between 0.1 and 100 μm shall be used to achieve higher packing densities.
- **1.4 Chemical Admixtures:** High Range Water-Reducing (HRWR) admixtures conforming to IS: 9103 or ASTM C494 are mandatory to attain the required flowability at ultra-low water-to-cementitious material ratios.
- **1.5 Water:** Water for mixing and curing must conform to Clause 5.4 of IS: 456-2000, and testing shall be conducted per IS: 3025.
- **1.6 Steel Fibres:** To provide post-cracking ductility, short, slender steel fibres with a tensile strength between 1000 and 2500 MPa are required. Fibres must conform to EN 14889-1, ASTM A820, or ISO 13270:2013. Lengths typically range from 12mm to 20mm.
- **1.7 Reinforcement (If Applicable):** Any passive or prestressed reinforcement shall conform to:

- High strength deformed/TMT bars (IS: 1786).
- High Strength Deformed Stainless Steel Bars (IS: 16651).
- Prestressing steel: Uncoated stress-relieved strand (IS: 6006) or low relaxation strands (IS: 14268).

2. UHPC Mix Design & Tolerances

- **2.1 Constituent Proportions:** The typical range of constituents for the mix proportion (by weight) shall be: Cement (27-40%), Silica fume (6-12%), Quartz powder (7-14%), Sand (35-45%), Super plasticizer (0.5-3%), Water (4-10%), and Steel fibre (0-8%).
- **2.2 Strength Grades:** The approved design mix must achieve the designated characteristic strength. Standard UHPC grades include M145, M165, M190, M215, M240, and M265 (representing 100mm cube strengths ranging from 145 MPa to 265 MPa).
- **2.3 Chloride Limits:** The chloride content, expressed as a percentage by mass of chloride ions relative to the mass of cement, shall not exceed 0.20% for non-reinforced UHPC with metallic fibres, 0.15% for UHPC members containing prestressing steels, and 0.40% in all other cases.

3. Batching, Mixing, and Temperature Control

- **3.1 High-Energy Equipment:** The Contractor must utilize high-energy mixers, such as Hobart-type mortar mixers or concrete pan mixers.
- **3.2 Mixing Speed Constraints:** To prevent the introduction of increased porosity into the concrete, mixing speeds must be strictly maintained between a minimum of 50 rpm and a maximum of 100 rpm (approximately 60 rpm is typical for pan mixers).
- **3.3 Thermal Regulation:** To mitigate overheating resulting from high-energy mixing and low water content, the Contractor is advised to lower the temperature of the constituents prior to mixing, and partially or fully replace the mix water with ice.

4. Casting, Placement, and Consolidation

- **4.1 Formwork Specifications:** Formwork must be fully watertight, coated to prevent water absorption, and highly resistant to the extreme hydrostatic pressure generated by fresh, flowing UHPC.
- **4.2 Pouring Methodology:** Concrete placement must be rapid and executed entirely without interruption to ensure homogeneity. Pouring shall be done from a single point only to avoid joints.
- **4.3 Cold Joints:** Cold joints in precast elements, whether horizontal or vertical, are strictly forbidden unless explicitly prescribed in the design with approved structural means for force transfer.
- **4.4 Consolidation:** Internal vibration is not recommended as it disrupts fibre dispersion. Limited external form vibration may be applied exclusively to facilitate the release of entrapped air.

5. Curing and Heat Treatment



- **5.1 Impermeable Sealing:** Immediately after casting, any exposed UHPC surface must be sealed with an impermeable layer (e.g., moist covers like sacking/hessian, opaque plastic sheets, or curing compound). The seal must rest flat against the UHPC without leaving space, preventing surface dehydration and cracking.
- **5.2 Accelerated Heat Curing:** To accelerate strength development and ensure precast elements are dimensionally accurate and free from shrinkage stresses, elements shall be subjected to heat treatment at temperatures of 80°C to 90°C for a duration of 1 to 2 days.

6. Quality Assurance & Structural Detailing

- **6.1 Quality Assurance Class:** The Contractor shall enforce an "Extra High Quality Assurance class" for all materials and workmanship to guarantee uniformity and limit variations between production batches.
- **6.2 Structural Detailing:** The minimum clear reinforcement cover and the clear distance between parallel bars shall not be less than 20 mm, or 1.5 times the length of the longest type of fibre reinforcement included in the mix, whichever is greater.
- **6.3 Hardened Concrete Testing (IS: 516 Part 1/Sec 1 modifications):** Given the extreme compressive strength of UHPC, testing procedures require strict modifications:
 - Test cylinders must be end-ground so ends are plane to within 0.05 mm and perpendicular to the axis within 0.5 degrees.
 - Capping compounds and unbonded neoprene pads are strictly prohibited.
 - The load must be applied continuously and without shock at a constant rate of 1.0 ± 0.05 MPa/s.

7. Mode of payment:

- 50% payment will be released on casting of UHPC RCC elements in the casting yard and after all post casting IS tests are cleared at the casting yard.
- 30% payment will be released after transportation of the UHPC RCC elements at launching site in the desired location and orientation.
- 20% payment will be released after launching of RCC UHPC structures.

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IMPORTANT CODAL PROVISIONS**1.0 EARTHWORK****1.1 Earthwork in embankment/ blanketing**

- (a) For Earthwork in formation for Gauge conversion projects RDSO's guide line for Earthwork in Railway projects GE G-1 with latest amendment will be applicable
- (b) For earthwork in formation/ blanketing for New Line and doubling projects guide line & specifications for design of formation for Heavy Axle Load GE-0014 will be applicable.
- (c) As per RDSO letter GE/Gen/ Comments/Formation Layer/185/ part 1 dated 25.07.19 and other instructions, guidelines issued thereafter.

1.2 The soil classification shall be done as per IS: 1498. To formulate the thicknesses of formation layers, various soil groups have been combined together to simplify the classification based on % age fines, in Table-1 below:

Soil Group	Description w.r.t %age Fines (size < 75 micron)	Equivalent soil group as per IS classification
SQ1	Soil containing fines > 50%	CL, ML, CL-ML, CI, MI, CH, MH
SQ2	Soil containing fines from 12% to 50%	GM, GC, SM, SC, GM-GC, SM-SC
SQ3	Soil containing fines < 12%	GW, GP, SW, SP, GW-GM, GW-GC, GPGM, GP-GC, SW-SM, SP-SM, SPSC

1.3 Earthwork in cuttings: For earthwork in cutting RDSO guide line for cutting in Railway formation GE G-2 with latest amendment will be applicable.

1.4 Quality Control of Compacted Earth / Blanket layer

1.4.1 Compacted Earth: Degree of compaction of each layer of compacted soil should be ascertained by measurement of dry density /Relative Density of soil at locations selected in specified pattern. The method of sampling, frequency of tests, method of tests to be conducted and acceptance criteria to be adopted are as under.

(a) **Method of Sampling:** - Various methods of selection of sample points for check of in-situ dry density are in vogue. The sampling adopted has to be such that effectiveness of proper compaction having been done for the entire area under consideration can be judged. For this, the Engineer will lay down in detail the method to be adopted in detail depending on site conditions and accordingly records of checks done are to be properly maintained. However, in absence of such procedure laid down, following method should be adopted.

(b) **Suggested Method of Sampling:** For each layer, a minimum of one sample at a predetermined interval (in compliance with the requirement) along the center line of the alignment, would be taken in a staggered pattern so as to attain a minimum frequency of tests as given in sub para 1.4.1 "b". For subsequent layer, the stagger should be such that the point of sampling does not fall vertically on the earlier sampling points of the layer immediately below. Additional sampling points can be taken, as considered necessary.

1.5 QUALIFYING AND QUALITY ASSURANCE TESTS (Mandatory)

Qualifying tests as part of pre-selection of good earth for track subgrade, embankment fill is required to be carried out. Also, quality of compaction is required to be ensured for good quality construction.

(i) **Selection of soil:** For selection of soil to be used as embankment fill CBR test is required to be conducted on material. CBR test is conducted on ground soil, embankment fill, prepared sub-grade & blanket material to ensure the minimum specified CBR value of these materials to be used in construction. This test is carried out on soil sample in laboratory as

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per procedure given in IS: 2720 (Part 16)-1987 & in field as per IS:2720 (Part 31)- 1969.

(ii) **Quality Assurance Test on Compacted Layer** : Quality Assurance Tests are required to be conducted on part completion stages of formation, prior to clearing for further earthwork, track linking work:

(iii) **Heavy Proctor test** is required to be conducted to determine the Maximum Dry Density of soil as per IS: 2720 (part 8). In-situ density is measured in the field by Sand Replacement Method (IS: 2720 – part 28) or Core Cutter Method (IS: 2720 – part 29) to calculate the degree of compaction. This shall be determined in laboratory as per BIS procedure with the specified frequency of earthwork quantity, as envisaged in 'Guidelines of Earthwork in Railway Projects, GE: G- , 1July, 2003. Brief procedure of these above tests has been given in Annexure-2 of GE0014.

The ground soil/ subsoil strata shall be checked and tested for following criteria's

- i) Undrained Cohesion of soil (C_u) ≥ 25 KPa
- ii) EV_2 (determined from PLT) ≥ 20 MPa
- iii) N (determined from SPT) ≥ 5 Ground improvement is required, if any of the above parameters not complied with.

Ev2 test as per DIN 18134- 2012 shall be conducted at frequency of one test per km over finished earthwork of embankment fill, prepared subgrade, blanket layer. The test procedure is also detailed in RDSO letter GE/Gen/ Comments/Formation Layer/185/ part 1 dated 25.07.19

1.5.1 Frequency of Quality Assurance Tests

- (a) CBR test for selection of formation materials and other tests required for ensuring conformation of the materials (blanket, subgrade) as per specification e.g. size gradation, C_u , C_c , Los Angeles Tests, OMC/MDD etc. shall be conducted at following frequency :

(i) Embankment Fill & prepared subgrade : one set of tests for every 5000 cum.

- (ii) Blanket material : one set of tests for every 500 cum.

- (b) In-situ Degree of Compaction (or In-situ dry density measurement) test shall be conducted on each compacted layers in random pattern at following frequency for the different layers:

- (i) Embankment fill: One density measurement at every 500 sqm surface area of each compacted layers.

- (ii) Blanket and Prepared Subgrade: one density measurement at every 200 sqm surface area of each compacted layers.

- (iii) In case of bank widening, sampling should be done at an interval of minimum 200 Meters on widened side(s) of embankment.

Ev2 test as per DIN 18134- 2012 shall be conducted at frequency of one test per km over finished earthwork of embankment fill, prepared subgrade, blanket layer

1.6 Requirement of Blanket Layer :

- 1.6.1 The provision of blanket layer shall not be needed when formation/ earth fill embankment have

- (i) Rocky beds except those, which are very susceptible to weathering e.g. rocks consisting of shale and other soft rocks, which become muddy after coming into contact with water.

- (ii) Soil of GW, SW, GW-GM, SW-SM type.

- (iii) Soils conforming to specifications given in Para 1.6 below

The provision of separate Blanker layer shall not be necessary when Coarse granular, well graded ($C_u > 7$, C_c between 1 and 3) soil/quarry dust/crushed stones material of 300 mm thickness is laid as top layer.

- 1.6.2 For other conditions, the system of layered construction of embankment consisting of prepared subgrade shall normally be followed. The Prepared sub-grade should normally

- 1.6.3 consist of good quality soils with fines less than 12%
Thickness of prepared sub-grade and blanket layer has been rationalized based on UIC719R calculation for ballast cushion as 350mm. **Prepared subgrade and Blanket Layers: for 25 T axle Load**

S.No	Soil type category in subgrade	Prepared subgrade		Recommended blanket thickness	Remarks
		Soil type	Thickness		
1.	SQ1	SQ1*	-	550	Single layer
2.	SQ1	SQ2	500	400	Two layer
3.	SQ1	SQ3	500	300	Two layer
4.	SQ2	SQ2*	-	400	Single layer
5.	SQ2	SQ3	350	300	Two layer
6.	SQ3	SQ3*	-	300	Single layer

The level of compaction of various layers of formation shall be ensured as defined in guidelines issued by RDSO.

- 1.6.4 Selection of top layers for design of formation as well as for blanket material as given in above Paras and further deviation from these provisions can be finally decided on techno-economic considerations by CAO (Const.) after recording the reasons.

1.7 Specification of Blanket Material :

- 1.7.1 The material for blanket layer over prepared sub-grade should be well graded granular material. The following specifications shall be ensured at the time of laying.

- (i) $C_u > 7$ and C_c between 1 and 3
- (ii) Fines (passing 75 microns) : 3% to 10%
- (iii) Los angles Abrasion Value $< 40\%$
- (iv) Minimum Soaked CBR value ≥ 25 (soil compacted at 100% of MDD in Lab)
- (v) Field Compaction: 100% of MDD* in field trial.
- (vi) Minimum $E_{v2^{**}} = 100\text{MPa}$
- (vii) Size Gradation – within specified range (as tor should lie more or less within specified enveloping curves)
- (viii) Filter criteria should be satisfied with prepared sub-grade layer as given below.
Criteria-1: $D_{15}(\text{blanket}) < 5 \times D_{85}(\text{Prepared sub-grade})$
Criteria-2: $D_{15}(\text{blanket}) > 4 \text{ to } 5 \times D_{15}(\text{Prepared sub-grade})$
Criteria-3: $D_{50}(\text{blanket}) < 25 \times D_{50}(\text{Prepared sub-grade})$

- 1.7.2 The Earthwork shall be conducted as per GE: G-0014 and RDSO letter GE/Gen/ Comments /Formation Layer/185/ part 1 dated 25.07.19.

- 1.8 Method statement & QAP shall be submitted by the successful tenderer as per guide lines issued by RDSO, relevant IS Codes & Manuals and shall be got approved from Engineer in charge.

2.0 Cement Concrete work

- 2.1 IRS code of Practice for plain, reinforced & Pre-stressed concrete and IRS Concrete Bridge Code will be apply for General Bridge construction.

- 2.2 For Road bridges, the construction shall comply with the standard specifications and Codes of Practices for Road Bridges issued by Indian Road Congress.

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- 2.3 For building & other construction works provisions of Plain and Reinforced Concrete Code of Practices IS-456-2000 will be followed.
- 2.4 **MATERIALS**
- 2.4.1 **General** : Water, cement, and fine aggregate shall conform to IS:383:1970 and as specified in Chapter 26 'Mortar' of Unified Standard Specifications for Works & Materials.
- 2.4.2 **Coarse Aggregate** : This shall conform to IS 383:1970 and as specified in Chapter 3 of unified standard specification for works and materials.
- 2.4.3.1 **Construction Joints** : Construction joints for structures other than bridges will be provided as under (based on para 4.4.5 of Indian Railway Unified Standard Specifications (works & materials):-
- (a) Concreting shall be carried out continuously up to the construction joints, the position and details of which shall be as shown in structural drawing as directed by the Engineer. Number of such joints shall be kept minimum. The Joints shall be kept at places where the shear force is the minimum. These shall be straight and shall be at right angles to the direction of main reinforcement
 - (b) In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head. The portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.
 - (c) When stopping the concrete on a vertical plane in slabs and beams an approved stop board shall be placed with necessary slots for reinforcement bars or any other obstruction to pass the bars freely without bending. The construction joints shall be keyed by providing triangular or trapezoidal filler nailed on the stop-board. Inclined or feather joints shall not be permitted. Any concrete flowing through the joints of stop board shall be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.
 - (d) When the work has to be resumed, the joint shall be thoroughly cleaned with wire brush and loose particles removed.
 - (e) Fig. 4.2, in Chapter-4 of Indian Railway Unified Standard Specifications (Works & Materials) may be referred to comply with above details for construction joints.
- 2.4.3.2 Construction Joints shall be avoided as far as possible and in no case the locations of such joints shall be changed or increased from those shown on the drawings, except with express approval of the Engineer. The joints shall be provided in a direction perpendicular to the member axis. Location, preparation of surface and concreting of construction joints shall conform to the additional specifications given in Appendix-A of IRS – Concrete Bridge Code (Clause 8.5.3) which is reproduced below -
- (a) Construction joints should be positioned to minimize the effect of the discontinuity on the durability, structural integrity and appearance of the structure.
 - (b) As far as possible, joints should be positioned in non-aggressive zones, but if aggressive zones cannot be avoided, joints should be sealed.
 - (c) Joints should be positioned where they are readily accessible for preparation and concreting, the preparation of the joints is more likely to be satisfactory where the cross section is relatively small and where reinforcement is not congested.
 - (d) As far as possible, joints for fair faced concrete should be located where they conform to the architectural features of the construction. Unless they are masked in this way, the position of the joints are always obvious, even when the concrete is given a textured finish.
 - (e) If substantial changes in the cross section of a member are necessary, the joints should be formed where they minimize stresses caused by temperature gradients and shrinkage.
 - (f) Joints should be located away from regions of maximum stress caused by loading,

particularly where shear and bond stress are high. Construction joints between slabs and ribs in composite beam should be avoided. As a general rule, joints in column are made as near as possible to the beam hunching, joints in beams and slabs should normally be made at the center or within the middle third of the span.

- (g) The minimum number of joints should be used and their construction should be simple. They should be either horizontal or vertical, because concreting sloping surfaces are usually unsatisfactory.
- (h) Where concrete is placed in vertical members e.g. walls, columns and the like, the lift of concrete shall finish level or at right angles to the axis of the member, the joint line matching the features of the finished work. Concreting shall be carried out continuously up to the construction joint.
- (i) Laitance, both on the horizontal and vertical surfaces of the concrete, should be removed before fresh concrete is cast. The surface should be roughened to promote good adhesion. Various methods for removal can be used but they should not dislodge the coarse aggregate particles. Concrete may be brushed with a stiff brush soon after casting while the concrete is still fresh, and while it has only slightly stiffened
- (j) If the concrete has partially hardened, it may be treated by wire brushing or with a high pressure water jet, followed by drying with an air jet, immediately before the new concrete is placed.
- (k) Fully hardened concrete should be treated with mechanical hand tools or grill blasting, taking care not to split or crack aggregate particles.
- (l) The best time for treating the joint is a matter of judgment because it depends on the rate of setting and hardening (which is itself dependent on the temperature of the concrete). Before further concrete is cast, the surface should be thoroughly cleaned to remove debris and accumulated rubbish, one effective method, being air jet.
- (m) Where there is likely to be a delay before placing the next concrete lift, protruding reinforcement should be protected. Before the next lift is placed, rust, loose mortar or other contamination should be removed from the bars and where conditions are particularly aggressive and there has been a substantial delay between lifts, the concrete should be cut back to expose the bars for a length of about 50mm to ensure that contaminated concrete is removed
- (n) In all cases, when construction joints are made to essential it is to ensure that the joint surface is not contaminated with release agents, dust or curing membrane, and that the reinforcement is fixed firmly in position at the correct cover.
- (o) When the form work is fixed for the next lift, it should be inspected to ensure that no leakage can occur from the fresh concrete. It is a good practice to fix a 6mm thick sponge which seals the gap completely
- (p) The practice of first placing a layer of mortar or grout is not recommended. The old surface should be soaked with water without leaving puddles, immediately before starting concreting, then the new concrete should be thoroughly compacted against it. When fresh concrete is cast against existing mature concrete or masonry, the older surfaces should be thoroughly cleaned and soaked to prevent the absorption of water from the new concrete. Standing water should be removed shortly before the new concrete is placed and the new concrete should be thoroughly vibrated in the region of the joint.

3.0 REINFORCED CEMENT CONCRETE

3.1 GENERAL

Reinforced cement concrete work may be cast-in-situ or pre-cast as may be directed by the Engineer according to the nature of work. Reinforced cement concrete work shall comprise

of the following which may be paid separately or collectively as per the description of the item of work.

- a) Form work (Centering and Shuttering)
- b) Reinforcement
- c) Concreting : (1) Cast-in-situ (2) Pre-cast

3.1.1 Selection and Preparation of Test Sample for steel reinforcement:

This shall be done in accordance with provisions of IS: 1786 and IS 13920 (2016) All test pieces shall be selected by the Engineer or his authorized representative either –

- a) From cutting of bars

Or

- b) If he so desires, from any bar after it has been cut to the required or specified size and the test piece taken from any part of it. In neither case, the test pieces shall be detached from the bar or coil except in the presence of the Engineer or his authorized representative. The test pieces obtained in accordance with above shall be full sections of the bars as rolled and shall be subjected to physical tests without any further modifications. No reduction in size by machining or otherwise shall be permissible except in case of bars of size 28mm and above. No test piece shall be annealed or otherwise subject to heat treatment. Any straightening which a test piece may require shall be done cold.

3.1.2 Retest

Should any one of the test pieces first selected fail to pass any of the tests specified above, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the materials represented by the test samples shall be deemed to comply with the requirement of the particular test. Should the test piece from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with standard.

3.1.3 Guidelines for use of Steel Items in Railway Projects/Contracts.

All Reinforcement Steel (TMT Bars) and Structural Steel shall be procured as per specifications mentioned in BIS's documents – IS: 1786, IS 13920(2016) and IS: 2062 respectively. Independent tests shall be conducted, wherever required, to ensure that the materials procured conform to the Specifications

3.2 FORM WORK (CENTERING AND SHUTTERING)

3.2.1 Removal of Form work (Stripping time)

In normal circumstances and where ordinary Portland cement is used, forms may generally be removed after the expiry of the following periods. (Based on Clause 9.5.1 of IS: 146871999)

Type of Formwork	Minimum Period before striking Form work
(a) Vertical formwork to columns, walls, beams	16 – 24 hours
(b) Soffit formwork to slabs (Props to be re-fixed immediately after removal of formwork)	3 days
(c) Soffit formwork to - beams (Props to be re-fixed immediately after removal of formwork)	7 days
(d) Props to slabs Spanning up to 4.5m Spanning over 4.5 m	7 days 14 days

(e) Props to beams and arches:	
Spanning up to 6m	14 days
Spanning over 6m	21 days

Note: - For other cement and lower temperature, the stripping time Recommended above may be suitably modified.

3.3 SAMPLING AND ACCEPTANCE CRITERIA OF STRENGTH OF DESIGN CONCRETE MIX (Extract from IS: 456-2000)

3.3.1 General:

Samples from fresh concrete shall be taken as per IS: 1199 and cubes shall be made, cured and tested at 28 days in accordance with IS: 516.

3.3.2 Frequency of sampling

3.3.2.1 Sampling Procedure –

A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested that is, the sampling should be spread over the entire period of concreting and cover all mixing units.

3.3.2.2 Frequency

The minimum frequency of sampling of concrete of each grade shall be as shown in para 3.5 below.

3.3.3 Test Specimen

Three test specimens shall be made from each sample for testing at 28 days. Additional samples may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork, or to determine the duration of curing, or to check the testing error. Additional samples may also be required for testing samples cured by accelerated methods as described in IS: 9013. The specimen shall be tested as described in IS: 516.

3.3.4 Test Results of Sample

The test results of the sample shall be the average of the strength of three specimens. The individual variation should not be more than ± 15 percent of the average. If more, the test results of the sample are invalid.

3.4 ACCEPTANCE CRITERIA

3.4.1 Characteristic Compressive Strength Compliance Requirement (Clause 16.1 and 16.3 of IS: 456 with upto date correction slip.)

Specified Grade	Mean of the Group of 4 Non-Overlapping Consecutive Test Results in N/mm^2 Min.	Individual Test Results in N/mm^2 Min.
(1)	(2)	(3)
M 15 and above.	$\geq f_{ck} + 0.825 \times \text{established standard deviation}$ (rounded off to nearest 0.5 N/mm^2) Or $f_{ck} + 3 \text{ N/mm}^2$, whichever is greater	$\geq f_{ck} - 3 \text{ N/mm}^2$

NOTES:-

1. In the absence of established value of standard deviation, the values given in table 8 may be assumed and attempt should be made to obtain results of 30 samples as early as possible to establish the value of standard deviation.
2. For concrete of quantity up to 30 cum (where the number of samples to be taken is less than four as per the frequency of sampling given in 15.2.2) the mean of

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test result of all such samples shall be $f_{ck}+4$ N/mm² minimum and the requirement of minimum individual test results shall be $f_{ck}-2$ N/mm². However, when the number of sample is only one as per 15.2.2, the requirement shall be $f_{ck}+4$ N/mm² minimum

3.4.2 Quantity of Concrete Represented by Strength Test Results

The quantity of concrete represented by a group of 4 consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches. Where the mean rate of sampling is not specified the maximum quantity of concrete that four consecutive test results represent shall be limited to 60cum.

3.4.3 Structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken to the satisfaction of Engineer-in-charge.

3.4.4 Concrete of each grade shall be assessed separately.

3.4.5 Concrete is liable to be rejected if it is porous or honey combed; its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the tolerances specified; or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the Engineer-incharge.

3.5 RECOMMENDED LIST OF TESTS ON MATERIALS AND WORKS

Material	Test	Field/Lab.	Test Procedure	Frequency of Testing (AS per site Requirement)	
				Quantity of concrete in the work (cum) or steel for RCC in MT.	Number of samples
Cement Concrete	(a) Slump Test	Field / Lab	Annexure 3.5 of Chapter-3 of IRUSS.		
	(b) Cube Test	Lab.	IR Concrete Bridge Code	1-5 6-15 16-30 31-50 51 & above	1 2 3 4 4+1 addl. Sample for each additional 50 cum or part thereof
Steel for Reinforce-	High Strength Deformed		IS: 1786:2008,	For Casts/Heats	For Casts/

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ment in RCC	Steel Bars/TM			Below 100 tones	Heats of 100 tones or More
	a)Nominal 1 Mass b)Tensile test c)Bend Test d)Re-bend Test	Lab/Field Lab/Field Lab/Field Lab/field	IS:13920:2016 IS:1608 IS:1599 IS:1786:2008	2 Per Cast	3 Per Cast

4.0 Bridge Works: Super Structure-Concrete

This is additional requirement as mentioned in para 2 & 3

4.1 CONCRETE FOR SUPERSTRUCTURE

4.1.1 Additional Requirements

Concrete shall meet with any other requirements as specified on the drawing or as directed by the Engineer. Additional requirements shall also consist of the following overall limits of deleterious substances in concrete:

- (a) The total chloride content of all constituents of concrete as a percentage of mass of cement in mix shall be limited to values given below:
- Prestressed Concrete : 0.1 per cent
 - Other reinforced concrete construction : 0.3 per cent
- (b) The total sulphuric anhydride (SO₃) content of all the constituents of concrete as a percentage of mass of cement in the mix shall be limited to 4 per cent.

4.1.2 Construction Joints

Construction joint for bridge work will be provided as per para 2.4.3.2

- 4.2 Method statement & QAP shall be submitted by the successful tenderer as per guidelines issued by RDSO, relevant IS Codes & Manuals and shall be got approved from Engineer-in charge.

5.0 Bridge Works: Superstructure-Steel

5.1 FABRICATION OF STEEL WORK

5.1.1 Codes of Specifications:-

The work shall be done in accordance with the following Codes and specifications and any other requirements that may be prescribed in special cases.

(a) Bridge Work

1. IRS Steel Bridge Code
2. IRS Specification No.B-1-2001 for Steel Girder Bridges
3. IRS Specification No P-31 Zinc Chromate red oxide primer.

The fabrication and erection of the steel work shall be in accordance with IRS: B12001 supplemented by relevant provisions of this Specifications.

(b) Iron and steel tanks and staging:-

IRS Specification No.B-3-61 Part 4

5.1.2 Quality of Steel:-

The structural steel will be used as per IS Code 2062 – 2011 as required grade & Quality

- 5.1.3 **HSFG Bolts:** - HSFG Bolts may also be used in lieu of rivets with the approval of Chief Engineer/Const. However RDSO guidelines No.BS-111(Revision-2) Nov-13 shall be strictly followed.

5.1.4 Tolerances :-

Tolerances in dimensions of components of fabricated structural steel work shall be specified on the drawings and shall be subject to the approval of the Engineer before fabrication. A machined bearing surface, where specified by the Engineer, shall be machined within a deviation of 0.25 mm for surfaces that can be inscribed within a square of side 0.5m

5.1.5 Guidelines for procurement of Steel Items in Railway Projects/ Contracts:-

Procurement of steel items in Indian Railway Projects/Contracts for bridge works will be as per Para 3.1.3.

6.0 Bridge Works-Miscellaneous**6.1 POT BEARINGS AS PER RDSO GUIDE LINES (As per Para 22.4 of IRUSS (W&M) Vol.II-2010)****6.1.1 General**

(i) Pot type bearings shall consist of a metal piston supported by a disc or reinforced elastomeric confined within a metal cylinder to take care of rotation. Horizontal movement, if required, shall with a system of sealing rings be provided by sliding surfaces of PTFE pads sliding against stainless steel mating surfaces. The pot bearings shall consist of cast steel assemblies or fabricated structural steel assemblies.

(ii) Provisions of IRC-83 (Part I) shall be applicable for all metallic elements. Provisions of IRC: 83 (Part II) shall be applicable for all elastomeric elements. When any item is not covered by IRC: 83 (Parts I and II), the same shall be as per guidelines given hereunder and BS: 5400 (Sections 9.1 and 9.2), except that no natural rubber shall be permitted. If there is any conflict between BS on the one hand and IRC on the other, the provisions of IRC will be guiding.

6.1.2 Acceptance test on Bearing

- (i) All bearings shall be checked for overall dimensions.
- (ii) All bearings shall be load tested to 1.1 times maximum design capacity including seismic force. Bearing tested at higher loads cannot be used.
- (iii) A pair of bearings selected at random will undergo testing in order to determine the coefficient of friction "....". The coefficient of friction shall be < 0.05 at the design load.
- (iv) Two bearings selected at random shall be tested for permissible rotation.

6.1.3 Installation of POT-cum-PTFE Bearings**(a) General**

- (i) Care shall be taken during installation of the bearings to permit their correct functioning in accordance with the design scheme.
- (ii) To prevent contamination, dismantling of the bearings at site shall not be done.
- (iii) The load shall be transferred on to the bearings only when the bedding material has developed sufficient strength. The props for the form work shall be removed only after lapse of appropriate time. In special cases, this can be ensured by suitable devices like jacks etc. Temporary clamps and shims (introduced to maintain working clearance) shall be removed at an appropriate time, before the bearing is required to permit movement.
- (v) Permitted installation tolerance of the bearing from plane of sliding shall be maintained.
- (vi) Cement based non-shrink grout with air releasing additive and epoxy based grout, whichever is specified, shall be first tried at the site. For the proprietary grout mixes, appropriate instructions from the manufacturer shall be followed especially with regard to the following :



- a) Preparation -concrete cleaning, roughening, pre-soaking etc.
- b) Forms sturdiness, leak proofing, shape, header funnel vents, etc.
- c) Bearing Base - cleaning, etc.
- d) Placement- mixing, consistency, time period, finishing etc.
- e) Protection - curing, ambient temperature, etc.
- (b) **In-situ Casting of Superstructure**
 - (i) Form work around the bearing shall be carefully sealed to prevent leakage.
 - (ii) Sliding plates shall be fully supported and care taken to prevent tilting, displacement or distortion of the bearings under the weight of wet concrete.
 - (iii) Bearings shall be protected during concreting operation. Any mortar contaminating the bearing shall be completely removed before it sets
- (c) **Seating of bearing.**
 - A – Using Template.**
 - (i) Template with required rigidity and matching holes corresponding to the base of the bearing shall be used.
 - (ii) All the anchors shall be fitted to the lower face of the template using the anchor screws but with steel washer replacing the elastomer washers. Separate screws may be used in case of inconvenience in the length of the original anchor screws.
 - (iii) The template assembly shall be located with regard to level and alignment. It shall be ensured that the top of the anchors lie in a horizontal plane at the required elevation. The anchors shall be tied / welded to reinforcements to avoid displacement during concreting.
 - (iv) Concreting of the pedestal / pier cap shall be done to a level leaving a gap of 25-50mm below the template.
 - (v) The template and steel washers shall be removed prior to placement of the bearing assembly with temporary clamps. The bearing assembly shall be fitted to the anchors with the help of anchor screws and elastomer washers. Level at the bearing shall be checked.
 - (vi) The gap below the bearing assembly shall be grouted with cement based grout. Reference may be made to Para 22.4.6 (a) (vi)
 - B - Without Template with Gap.**
 - (i) Pockets commensurate with the sizes of the anchors shall be kept in pedestals during concreting of the same. The pedestal shall be cast approximately 25mm short of the required finished level.
 - (ii) Anchors shall be fitted to the bearing bottom with elastomer washers and anchor screws. The bearing assembly shall be seated in the location on steel chairs / packs. The anchors fitted below the bearing shall go into pockets in the bed block. Level and alignment of the bearing shall be checked. It shall be ensured that the bearing sits in a horizontal plane
 - (iii) The gap below the bearing assembly including anchor pockets shall be grouted with cement based grout
 - C - Without Template without Gap**

Elongated pockets commensurate with the sizes of the anchors shall be kept in pedestals during concreting of the same. The geometry and location of the anchor pockets (with tapered funnel extension, if required) shall be such that after placement of the bearing the pockets can be successfully grouted. The pedestal shall be cast 5mm to 15mm short of the required finished level. The required level shall be achieved by chipping before placement of the bearing. Careful control shall be exercised to cast at the exact finished level or 1mm to 3mm down from the required finished level.

D - Seating of bearings shall be as per manufacturer's instructions.

6.1.4 Inspection and Testing - Where any patents are used, the manufacturer's certificate with test proofs shall be submitted along with the design and got approved by the Engineer before their use in work

6.1.5 Tests and Standards of Acceptance - The materials shall be tested in accordance with these specifications and shall meet the prescribed criteria. The work shall conform to these specifications and shall meet the prescribed standards of acceptance.

6.2 Method statement & QAP shall be submitted by the successful tenderer as per guide lines issued by RDSO, relevant IS Codes & manuals and shall be got Approved from Engineer-in charge.

7.0 SPECIFICATIONS FOR SUPPLYING AND STACKING STONE BALLAST

7.1 MANDATORY CONDITION FOR SUBMISSION OF TENDER

7.1.1 Each tenderer at the time of tendering for supply of ballast shall submit the following:-

(a) Test report of impact value, abrasion value, and water absorption value from reputed laboratory/institution as mentioned below. These shall have to be in accordance with is codes as under:

Aggregate abrasion value test.....S: 2386 Part IV 1963.

Aggregate impact value test S: 2386 Part IV 1963

Water absorption test.....S: 2386 Part III 1963.

It may be noted by tenderer/s that they are required to submit the test report of the stone ballast, along with their offer, issued from the approved laboratory as listed in the tender documents otherwise their offer shall be summarily rejected. The test viz. determination of Abrasion value, Impact value and water absorption should be got done through approved laboratories or Railway's own laboratories.(List given below).

(i) Government Engineering College.

(ii) Government Polytechnic College.

(iii) Engineering Workshop, Bhagat Ki Kothi, Jodhpur/Sabarmati, Ahmadabad / any other Railway Laboratory.

(iv) Laboratory /Test house owned / approved by Central / State Government/NABL approved laboratory.

(b) The tenderer/s shall supply the ballast supply at all times Conforming to the specifications for track ballast as specified by Railway. (applicable to the ballast tenders only)

7.2 SPECIFICATION FOR STONE BALLAST:-

7.2.1 GENERAL:

7.2.1.1 Basic Quality: - Ballast should be hard durable and as far as possible angular along edges/corners, free from weathered portion of parent rock, organic impurities and in organic residues.

7.2.1.2 Particle Shape: - Ballast should be cubical in shape as far as possible, individual pieces should not be flaky and should have generally flat faces with not more than two rounded/sub-rounded faces.

7.2.1.3 Mode of Manufacture: - Ballast shall be machine crushed.

7.2.2 PHYSICAL PROPERTIES:

7.2.2.1 Ballast sample should satisfy the following physical properties in accordance with IS: 2386

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part-IV-1963, when tested as per the procedure given in Annexure-1-2 of specifications for track ballast from RDSO Geo-Technical Engineering Directorate.

Aggregate abrasion value 30% maximum.

Aggregate impact value 20% maximum.

7.2.2.2 The water absorption tested as per IS: 2386 part-III-1963 (when tested as per the procedure given in Annexure-3 of RDSO Geo-Technical Engineering Directorate) should not be more than 1%.

7.3 The track ballast shall be procured confirming to specifications for Track Ballast-IRSGE-I (Jan 2004) issued by RDSO with amendments up to the date of opening of tender.

8.0 **Training of Personnel Railways & Contractors Engineers** (Applicable for Tenders costing above Rs.20 Cr.):

To achieve good quality work, a good working knowledge and experience is required. Practical training in important field of work covering major items included in scope of work in the subject tender (such as concreting, steel fabrication, earthwork as per GE-0014 specification etc.) should be imparted by the contractor at his own cost through trainer duly approved by concerned Chief Engineer/C to all engineers i.e. Contractor's and Railways. What constitutes the major items of the work will be decided by the Engineer in Charge in consultation with the contractor. No extra payment will be made to the contractor on this account.





SAFETY PRECAUTIONS**1.0 MEASURES TO BE ENSURED PRIOR TO START OF WORK**

- 1.1 The contractor shall not start any work without the presence of railway supervisors at site.
- 1.2 The methodology in detail for execution of the work at site shall be approved by engineering in charge of the organization executing the work and copies of the same shall be available with contractor's supervisor, railway supervisor, SSE/P.Way/SSE (Works)/ ADEN /DEN/Sr. DEN of the section in whose jurisdiction the work falls.
- 1.3 Before permitting the execution of certain works like earthwork in formation, bridge work, supply of ballast, transportation of rails, sleepers and other material, track linking, platform/any other civil work close to the running track etc. for new/existing rail lines, gauge conversion, doubling, traffic facility work, ROB/RUB, open lines engineer-in-charge (ADEN/DEN/Sr. DEN) of the section shall ensure that he received the prior intimation/confirmation of the following aspects from Assistant Engineer/Assistant Officer In charge of the work of the executing agency i.e. Construction, S&T, Electrical, Mechanical, Rail Tel, RVNL etc.
- 1.4 Name and address of the contract assigned to execute the work.
- (i) Name of the Contractor's supervisor
 - (ii) Name of the supervisor/assistant engineer/assistant officer of the construction organization/other organizations who are going to be site in charge/in charge of work site.
 - (iii) List of the number(s) of individual vehicle(s)/ machineries, names and license particulars of the driver(s) proposed to be used by contractor.
 - (iv) Information regarding location, duration and timings during which the vehicles/machinery are planned to be plied/worked.
 - (v) The supervisors and operators of the contractor proposed to be deployed at work site which is close to the running track, shall be imparted training by the Railway trainer at contractor own cost about the safety measures to be adopted while working in the vicinity of running track. Further competency certificate to the individual supervisors/operator shall be issued as in Annexure- 'A' by a railway officer not below the rank of Assistant level officer who is in charge of site. No supervisor/operator of the contractor shall work or allowed to work in the vicinity of running track who is not possession of valid competent certificate.
 - (vi) Survey of site by supervisor of contractor and Railways to assess the precautions to be taken at site for working of trains and materials required for protection.
 - (vii) Written advice to sectional ADEN/SE (P.Way) and SE(Works) about the detailed planning of work including protection of track and safety measures proposed to be adopted.
 - (viii) A copy of the approved methodology (to be approved by engineer in charge) proposed to be adapted by the contractor with a view to ensure safety of trains passengers and workers.
 - (ix) Assurance that the methods and arrangements are actually available at site before start of the work and the contractors supervisors and the workers have clearly understood the safety aspects and requirement to be adapted/followed while executing the work.
 - (x) An assurance register has been kept at site duly signed by both Railway supervisor as well as by the contractor supervisor as a token of their having understood the safety precautions to be observed at site.
 - (xi) No work shall which is to be done near running track shall commence unless permitted by sectional ADEN/DEN/Sr. DEN
 - (xii) Supplementary site specific instructions, wherever considered necessary shall be issued by the Engineer in Charge
 - (xiii) Check list given in Annexure-V of Compendium of instructions on Safety at Work Sites 31.03.2014 shall be used to ensure that all the requisite measures have been taken before

for





start of work.

2.0 PLYING OF ROAD VEHICLES AND WORKING OF MACHINERIES CLOSE TO RUNNING TRACKS

- (i) Normally, the road vehicles shall be run or machinery shall be worked so as not to come closer than 6.0m from center line of nearest running track.
- (ii) The land strip adjacent to running tracks, where road vehicle is to ply or machinery is to work, shall be demarcated by lime in advance in consultation with the Railway's Supervisor. Wooden pegs at interval not exceeding 75mts shall be provided along the line marking as permanent marks. The road vehicles shall ply or machinery shall work so as not to infringe the line of demarcation. Demarcation of the land shall be done as per **Annexure II-A**. Compendium of instructions on Safety at Work Sites 31.03.2014.
- (iii) If a road vehicle or machinery is to work closer to 6.0m due to site conditions or requirement of work, following precautions shall be observed.
 - a. In no case the road vehicle shall run or machinery shall work at distance less than 3.5m from center line of track.
 - b. Demarcation of land shall be done by bright colored ribbon/nylon cord suspended on 120 cm high wooden/bamboo posts at distance of 3.5 m from center line of nearest running track. Sensors with horns shall be provided as per **Annexure II-B** of Compendium of instructions on Safety at Work Sites 31.03.2014.
 - c. Presence of an authorized Railway's representative shall be ensured before plying of vehicle or working of machinery.
 - d. Railway's Supervisor shall issue suitable caution order to Drivers of approaching train about road vehicles plying or machineries working close to running tracks. The train drivers shall be advised to whistle freely to warn about the approaching train. Whistle boards shall be provided wherever considered necessary.
 - e. Lookout men shall be posted along the track at a distance of 800m from such locations who will carry red flag and whistles to warn the road vehicle/machinery users about the approaching trains. Lookout man shall be deputed as per Annexure-III-A of Compendium of instructions on Safety at Work Sites 31.03.2014.
 - f. On curves where visibility is poor, additional lookout men shall be posted.
- (iv) **If vehicle/machinery is to be worked closer to 3.5m from running track.** Under unavoidable conditions, if road vehicles is to ply or machinery is to work closer to 3.5m due to site conditions or requirement of work, following precautions shall be observed:
 - a. Plying of vehicles or working of machinery closer to 3.5m of running track shall be done only under protection of track. Traffic block shall be imposed wherever considered necessary. The site shall be protected as per provisions of Para No. 806 & 807 of P-Way Manual as case may be.
 - b. Presence of a Railway's Supervisor shall be ensured at worksite.
 - c. Railway's Supervisor shall issue suitable caution order to Drivers of approaching train about road vehicles plying or machineries working close to running tracks. The train drivers shall be advised to whistle freely to warn about the approaching train.
- (v) **Precaution to be taken while reversing road vehicle alongside the track.** The location where vehicle will take a turn shall be demarcated duly approved by Railway's representative. The road vehicle driver shall always face the Railway track during the course of turning/reversing his vehicle. Presence of an authorized Railway representative shall be ensured at such location.
- (vi) Road vehicle shall not be allowed to run along the track during night hours generally. In unavoidable situations, however, vehicles shall be allowed to work during night hours only

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in the presence of an authorized Railway's representative and where adequate lighting arrangements are made and where adequate precautions as mentioned earlier have been ensured.

- (vii) Road vehicles/machinery/plant etc. when stabled near running tracks shall be properly secured against any possible roll off and always be manned even during off hours.

3.0 EXECUTION OF WORKS CLOSE TO OR ON RUNNING LINES

Any work close to or on running tracks shall be executed under the presence of a Railway's Supervisor only.

- (i) Precaution to be taken to ensure safety of trains while execution of work close to the running line or on running lines.
- (a) Contractor has deputed trained supervisors in required number at worksites duly certified by ADEN/In charge of the works.
- (b) Drivers of vehicle/operators of the machines have been briefed about the safety and precautions to be taken while moving / working close to traffic.
- (c) Contractor shall ply road vehicles/working of machinery only between sunset and sunrise. In case of emergency where it is necessary to work during night hours sufficient lighting shall be ensured in the complete work area for the safety of public and passengers. Also additional staff shall be posted as necessary for night working and taking safety precautions.
- (d) The contractor shall not change the approved vehicle/machinery and driver/operator for working at site. Contractor shall not induct any new vehicle/machinery and driver/operator without prior written approval of Assistant Engineer/Assistant officer and the list of such changes with numbers of individual vehicle, name and license particulars of the driver shall be given to ADEN/DEN/Sr. DEN of the section.
- (e) Contractor shall ensure that road vehicle/machinery ply/work in a way so that these do not infringe the line of demonstration.
- (f) Lookout men with required safety equipment shall be posted where necessary.
- (g) In unusual circumstances, where operator apprehends danger to track while working truck/machinery near running track, following action shall be taken.
 - a. The contractor/supervisor/vehicle operator immediately advice the situation to railway official/officials of the organization executing the work and assist him/them in protecting the track.
 - b. Protection shall be done as done for other emergencies
- (h) Individual vehicle/machinery shall not be left unattended at site of work. If it is unavoidable and becomes necessary to stable the road vehicle/machinery at site near the running track, these shall be properly secured against any possible roll off and always be manned even during non-working hours. In addition the road vehicle / machinery should be stabled parallel to track only so that incase of failure of any securing arrangement, it may not roll towards the track.
- (i) All temporary arrangements required to be made during execution of work shall be made in such a manner that moving dimensions do not infringe. Necessary checks shall be exercised by site in charge from time to time.
- (j) While inspecting the worksite check list given in Annexure VI of Compendium of instructions on Safety at Work Sites 31.03.2014 shall be used to ensure that all the requisite measures have been taken during the execution of work.
- (k) During the hours of night, lamps of temporary indicators which are not of reflective type should be lit at sun-set and kept burning till sun rise, where trains run at night.
- (ii) **Precaution to be taken to ensure safety of electrical/signal/ telephone cables while excavating near tracks.**

- a) Particular care shall be taken to mark the locations of buried electrical/signal/telephone cables on the plans jointly with S & T/Electric supervisor and also at site so that these are not damaged during excavation.
- b) Copy of the cable plan should be given to the contractor's authorized representative before handing over the site to start the work.
- c) Due care shall be taken to ensure that any part of the equipment or machinery or temporary arrangement does not come close to cables while working.
- d) Joint procedure order No. 17/2013 as mentioned in the Annexure-VII of compendium of instructions on safety at work site dated 31.03.2014 issued by PCE Office shall be followed for undertaking digging work in the vicinity of underground signaling, electrical and telecommunication cables.
- (iii) **Precaution to be taken during execution of works requiring traffic blocks.**
 - a) Any work, which infringes the moving dimensions or causes discontinuity in the track any activity making the existing track unsafe for passage of trains etc. Shall be started only after the traffic block has been imposed, railway servant in charge of the work is present at the worksite, engineering signals are exhibited at specified distance and flagmen are posted with necessary equipment to man them etc.
 - b) Before closing the work, the track shall be left with the proper track geometry so that the trains run safely and flagmen are kept in the night with safety and track protection equipment to patrol the stretch and take action to protect the track, if so warranted and inform the railway supervisors.
 - c) After completion of work the released sleeper and fittings should be properly stacked away from the track to be kept clear of moving dimensions.
 - d) Block shall be removed only when all the temporary arrangement, machineries, tools, plants etc. have been kept clear of moving dimensions.
- (iv) **Precaution to be taken during execution of works during night.** The work close to running line, generally, shall be carried out only during day hours. At locations, however, where night working is unavoidable, proper lighting arrangement should be made. The engineering indicator boards shall be lighted during night hours as per the provisions of IRPWM. The staff deputed for night working should have taken adequate rest before deploying them in night shift. We can specify duration of night shift from 20.00 hrs to 04.00 hrs. All other safety precautions applicable for day time work should be strictly observed during night working.
- (v) **Precautions to be taken to ensure safety of workers while working close to running lines**
 - a) Any work close to or on running tracks shall be executed under the presence of a Railway's supervisor only.
 - b) Precaution to be taken to ensure safety of trains while execution of work close to the running line or on running lines.
 - i) Such works shall be planned and necessary drawings particularly with regard to infringement to moving dimensions shall be finalized duly approved by competent authority before execution of work. The work shall be executed only as per approved procedure and drawings.
 - ii) All temporary arrangements required to be made during execution of work shall be made in such a manner that moving dimension do not infringe.
 - iii) Suitable speed restriction shall be imposed or Traffic block shall be ensured as required.
 - iv) The site shall be protected as per provisions of Para No. 806 & 807 of P.Way Manual as case may be.
 - v) Necessary equipment for safety of trains during emergency shall be kept ready at site.

- c) A 'first aid kit' shall always be kept ready at site.
- (vi) **Precaution shall be taken for safety of public or passengers, while executing works at locations, used by passengers and public** - The worksite shall be suitably demarcated to keep public and passengers away from work area. Necessary signage boards such as "Work in progress. Inconvenience is regretted" etc. shall be provided at appropriate locations to warn the public/ passengers. Adequate lighting arrangement of worksite wherever required shall be done to ensure safety of public/passengers during night.
- (vii) **Precaution to be taken before stacking materials alongside the track to ensure that safety of trains is not affected.** The following precautions shall be taken before stacking the materials along the track for stacking of ballast, rails, sleepers etc.
 - a) The sites for material stacking should be selected in advance in such a manner as to ensure that no part of the material to be stacked is infringing the Standard Moving Dimensions. A plan of proposed stacking locations be made and signed jointly by an authorized Railway's representative and contractor's representative.
 - b) The selected locations shall be marked by lime in advance.
 - c) Presence of an authorized Railway's representative while unloading and stacking shall be ensured
 - d) The material shall be stacked in such a height so as to not to infringe SOD in case of accidental roll off.
- (viii) **Precaution for handling of departmental material trains-** Instructions for working of material trains are contained in Chapter XII of IRPWM which should be brought to the notice of the supervisors and other staff working on the material trains. In addition to this, following precautions should be taken:
 - (a) Issue of 'fit to run' certificate. As per Para 1207 before a material train is allowed to work, the complete rake should be examined by the Carriage and Wagon staff and a 'fit to run' certificate issued to the Guard.
 - (b) As per Para 1208 of IRPWM, a qualified Engineering official should be deputed on the train to ensure working of the material train as the Guard is not qualified to carry out such duties like Supervising of loading and unloading of materials.
 - (c) As per Para 1204 of IRPWM, the material train should not be permitted to work during the period of poor visibility due to fog, storm or any other cause except with the permission of the ADEN/DEN. Working of the material trains carrying labour should not be permitted between sunset and sunrise except in an emergency
 - (d) While unloading rail panels by the side of the running track, placement of the panels, clear of the maximum moving dimensions should be ensured.
 - (e) Unloading of rail panels should be done by a team of trained staff under the active supervision of competent Supervisor/Officer.
 - (f) Before unloading of rail panels, site should be prepared by way of leveling/removing extra ballast, if any, from the crib and shoulder with the objective to ensure requisite lateral and vertical clearances so as to prevent slippage of rail panels due to vibration during the passage of trains.
 - (g) Reasonably adequate block should be asked and provided for unloading of the material and the work should be done preferably in day light to avoid shortcut in haste which may infringe the safety requirements.
- (ix) **SAFETY ASPECTS TO BE OBSERVED WHILE WORKING IN OHE AREA**
 - a) No electrical work close to running track shall be carried out without permission of railway representative.
 - b) A minimum distance of 2m has to be maintained between live OHE wire and body part of





- c) worker or tools or metallic supports etc.
- d) No electric connection etc. can be tapped from OHE.
- e) Authorized OHE staff should invariably be present when the relaying work or any major work is carried out.
- f) Power block is correctly taken and 'permit to work' is issued.
- g) The structure bonds, track bonds, cross bonds, longitudinal rail bonds are not disturbed and
- h) If disconnected for the work, they are reconnected properly when the work is completed
- i) The track level is not raised beyond the permissible limit during the work.

4.0 PROTECTION OF TRACK DURING EMERGENCY

- (i) **Action to be taken when a contractor's supervisor or vehicle operator apprehends any unusual circumstances likely to infringe the track and endanger safe running of trains.**
At any time if a contractor's supervisor or vehicle operator observes any unusual circumstances likely to infringe the track and apprehend danger to safe running of track, he shall take immediate steps to advise a Railway official of such danger and assist him in protection of track.

The track shall be protected as under. One person shall immediately plant a red flag (red lamp during night) at the spot and proceed with all haste in the direction of approaching train with a red flag in hand (red lamp during night) and plant a detonator on rail at a distance of 600m from the place of obstruction of BG track (400m for MG track) after which he shall further proceed for not less than 1200m from the place of obstruction from BG track (800m for MG track) and plant three detonators at 10m apart on rails. After this he shall display the red flag (red lamp during night) at a distance of 45m from the detonators.

Attempts shall also be made to send an advice to nearest Railway station about the incident immediately. Protection of the track shall be done as per Annexure-IV of the Compendium of instructions on Safety at Work Sites 31.03.2014

- (ii) **Action to be taken if train is seen approaching to site of danger and there is no time to protect the track as per guidelines mentioned above.** In such a case the detonators shall be planted on rails immediately at distance away from place of danger as far as possible and attention of driver of approaching train shall be invited by whistling, waving the red flag vigorously, gesticulating and shouting.
- (iii) **Action to be taken if more than one track is obstructed.**
 - a) In case of single line protection as above shall be done in both the directions from place of danger.
 - b) In case of double line or multiple lines, if other tracks are also obstructed, the protection as above shall be done for other track also.
 - c) The protection shall be done in that direction and on that track first on which train is likely to arrive first.
 - d) The Contractor's Supervisors, Operators and lookout men shall be properly explained about the direction of trains on running tracks.
- (iv) **Equipment required for protection of track.**
Minimum compliment of protection equipment i.e. 10 detonators, 4 red hand flags, 4 red hand lamps, 4 banner flags and whistles etc. shall always be kept ready at worksites for use in case of emergency. Railway will arrange to provide detonators, whereas Contractor shall arrange other equipment at his own cost.
- (v) **Arrangement of lookout men and competency required for lookout man to warn labour about approaching train.**

- a) Contractor will provide lookout men.
- b) The lookout men shall be properly trained in warning to staff at worksite about approaching train.
- c) Only those lookout men shall be provided at site who have been issued with a competency certificate by the Railway's Supervisor.
- d) In case, it is felt necessary to provide lookout men by Railway, the charges for the same as fixed by Railway Administration shall be recovered from Contractor

5.0 **TRAINING TO SUPERVISORS AND OPERATORS OF CONTRACTOR**

The Supervisors and Operators of the contractor proposed to be deployed at work site, which is close to the running track, shall be imparted mandatory training by the Railway at site free of cost about the safety measures to be adopted while working in the vicinity of running track. Engineer-in charge of the work shall decide the scale, extent & adequacy of training. In case training is imparted at a recognized Railway training institute, the charges for the same, as decided by Railway, shall be recovered from contractor. A competency certificate to this effect to the individual Supervisor/Operator shall be issued as per Annexure-as given below a Railway Officer not below the rank of Assistant Officer. No Supervisor/Operator of the Contractor shall work or allowed to work in the vicinity of running track that is not in possession of valid competency certificate.

All the labour, materials, tools, plants etc. except detonators, required for ensuring safe running of trains shall be provided by Contractor at his own cost. Wherever lookout men are provided by Railway, charges at the rate of Rs. 500/- per man day shall be recovered from Contractor.

6.0 **SPECIAL CONDITIONS FOR WORKING OF ROAD CRANES**

To ensure safe working of road cranes used in works in connection with provision of ROB/RUB/Subways, following items shall invariable be ensured before putting the cranes to use :-

- i) No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered against the weights, dimensions and lift radii of the heaviest and largest loads.
- ii) The contractor shall ensure that a valid Certificate of Fitness is available before use of Road Cranes.
- iii) Contractors should utilize the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories
- iv) The laminated photocopies of fitness certificate issued by competent persons, the operators' photo, manufacturer's load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.
- v) All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability

- 7.0 Contractor shall indemnify Railways against any loss/damage to public property, travelling public, railway or his own staff due to his (contractor's) negligence. In case there is any mishap, a fact finding inquiry will be conducted by Railway. A show cause notice will be issued to the contractor, in case he is prima facie held responsible. Contractor's reply to show cause notice will be considered by the Engineer in Charge before taking final decision. In case contractor is found responsible for the mishap, recovery from him will be affected for only tangible direct losses.

Note: For detailed instructions regarding safe working at works site, the compendium of instructions on safety at work site dated 31-03-2014 issued by PCE office shall be referred which is available in tender document.

Annexure-A

Competency Certificate

Certified that Shri Supervisor/Operator of M/s..... has been trained and examined in safety measures to be followed while working in the vicinity of running railway track for the work..... His knowledge has been found satisfactory and he is capable of supervising the work safely.

This certificate is valid only for the work mentioned in this certificate only.

Signature and designation of the officer

ESTABLISHING SITE OFFICE AND SITE LABORATORY

1.0 SITE OFFICE:-

The Contractor shall establish the camp office at site and keep on the works at all times efficient and competent staff to give the necessary directions to his workmen and to see that they execute their work in sound proper manner and shall employ only such supervisors, workmen & laborers in or about the execution of any of these works as are careful and skilled in the various trades. The Camp office shall be completely equipped for office working with provision of sufficient T&Ps, Office Equipment, accessories including advance version of PCs, printer, Fax, mail, phone etc. and also with facilities like sitting, drinking water etc. The area of the office and facilities required must be sufficient enough to ensure effective office working at site office itself without any difficulties and issues. Suitable site on railway land, if conveniently available, may be allowed to the contractor for setting up the site office, site laboratory, either free of charge or on such terms and conditions that may be prescribed by Railways.

2.0 SITE LABORATORY:-

The site laboratory shall be established and maintained by the contractor as for effective implementation of the QAP and approved method statements of particular activities, all the equipment shall be properly calibrated at all times. The other requirements like water tank, generator etc. shall also be maintained.

2.1 A well-qualified, competent and know ledged Laboratory supervisor shall be deputed at the site laboratory to conduct all the required tests, checks at the specified frequencies and keep proper record, documentation in soft as well as hard registers.

2.2 The equipment required for periodic quality checks and test to be conducted at laboratory and in field shall be maintained in the project. All the required machines, T&Ps, consumables, testing facilities shall be maintained in the site laboratory as required as per relevant Code, Manuals, RDSO guidelines, specification of USSOR, Contract Agreement

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etc. A brief list of the equipment to be kept at the laboratory are listed as under for guidance. however, the Engineer-in-charge is free to maintain any additional equipment, T&Ps as deemed necessary due to site specific requirements

2.2.1 Equipment for Concrete Test in Field Laboratory

S.No.	Equipment name at Lab
1	Vicat apparatus
2	Le _ chateleir apparatus
3	Mould (50mm)
4	Gauging trowel
5	Slump test apparatus
6	Compaction factor apparatus
7	Mould (150mm)
8	Tamping rod.
9	EDI compression testing machine 2000 kn. & CTM
10	Flexure test attachment
11	Mortar mixture capacity 4.75 ltr.
12	High speed stirrer with disperser cap. & baffle
13	Jaw crusher three phase
14	Le _ chateliermould
15	Le _ chatelier flask
16	Extensibility mould
17	Vibrating table
18	Beam mould (100*100*500) (150*150*700)
19	Cylindrical mould (150*300)
20	Cement autoclave
21	Heat of hydration
22	Curing tank for 6/12 mould of 1.50/ 70.6mm
23	Mould steel for 70.6mm cutes
24	Air permeability apparatus
25	Aluminum box (373*273*160)
26	Modular heavy duty table (furniture)
27	Compression testing machine (1000 kn) electrically operated single gauge
28	Rebound hammer
29	Ultrasonic testing instruments
30	Vibration machine with button digital timer
31	Sieve 200mm dia spun brass frame for grading of Fine and Course aggregate
32	Concrete mixer drum type 1 cub feet
33	Longitudinal compresso-meter for modulus of Elasticity
34	Drying shrinkage and moisture movement apparatus
35	Bulk density voids and bulking
36	Density basket
37	Crushing value apparatus
38	Permeability apparatus
39	Alcometer (as required)

2.2.2 Equipment for Earthwork Test in Field Laboratory

S.No.	Description of equipment
1.	IS set of sieves with base & top lid 20 mm, 19mm, 10mm, 4.75mm, 2 mm 600mic, 425 mic, 212 mic, 75mic.
2.	Hand operated sieve shaker for above sieves.
3.	Balance :- i) Pan balance – 10 kg. capacity (with 1.0 gm Least count) ii) Electronic balance – 500 gm capacity (with 0.1 gm east count)
4.	Field density apparatus complete Sand replacement Core cutter with dolly
5.	Modified heavy Proctor density apparatus full unit.
6.	Liquid Limit apparatus hand operated with counter & grooving tools.
7.	Shrinkage limit apparatus
8.	Stainless steel spatula – 25cm long
9.	Porcelain bowl for LL- 15 cm dia
10.	Aluminum dish with lid – 5 cm. dia
11.	Wash bottle – 1 lit. capacity 500 ml capacity
12.	Glass plate 10mm thick 50 x 50 cm.
13.	Ground glass 5mm thick 50 x 50 cm
14.	Enameled trays : 45x 40 cm : 20x 20 cm
15.	Enameled plates : 6 inch dia : 8 inchdia : 10 inch dia.
16.	Frying pans
17.	Stove janta
18.	Straight edge 300 mm long
19.	Grain size analyser of fines Hydrometer Thermometer 0 to 50 c. Glass cylinder 1000 cc capacity with 60mm dia.
20.	Desiccators as IS-6128
21.	Can of 10 litre capacity for distilled water Wooden mortar and pestle.
22.	Specific gravity test apparatus
23.	Density bottle – 50 ml capacity
24.	Glass cylinder 100 cc capacity (for 1 Free Swell index test)
25.	Oven-thermostatically controlled to maintain a temperature 105-110c
26.	Lab. CBR apparatus (set)
27.	Hydraulic sample ejector (complete set)
28.	Speedy moisture meter
29.	Compaction test apparatus
30.	Proctor compaction apparatus
31.	Sand pouring cylinder small
32.	Specific gravity bottle
33.	Standard penetration test (SPT) apparatus
34.	Electronic weighting balance (50kg)
35.	Core cutter equipment assembly
36.	Sand replacement assembly.

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37.	EV2 measurement equipment and assembly
38.	Consumable Item – Sieve brush, Wire Brush, Sodium carbonate, Sodium hexa meta phosphate, Kerosene, Mercury.
39.	Additional Equipment – Hand auger 150mm dia with extension rod. Sampling tube 100mm dia. and 450mm length

3.0 RECORD KEEPING AND DOCUMENTATION -

The following records are to be maintained by the contractor for the works as detailed below. In addition, Engineer-in-charge is free to maintain any additional records as deemed necessary due to site specific requirements. These records with all pages serially numbered should have the basic information like name of work, agreement No. , Agency, Location, etc. on their covers / first page.

Sl.No.	NAME OF THE RECORD	TO BE MAINTAINED FOR
1	Site order book	All works,
2	Daily progress register	
3	Hindrance register	
4	Technical register	
5	Material Passing register	
6	Cement consumption register	all cement involving works
7	Reinforcement steel accountal register	All RCC/PSC works and MCC works with temperature reinforcement
8	Reinforcement steel consumption	
9	Field tests for sand	all cement involving works
10	Field tests for C A	all concrete involving works
11	Field test for cement	all cement involving works
12	Field test for steel	all steel involving works
13	Slump test	all concrete involving works
14	Concrete cube testing register	all concrete involving works
15	Pile passing register	for buildings and structures with pile founds
16	Shuttering passing register	all concrete involving works
17	Permeability of concrete	major bridges
18	Stressing record of PSC girder	PSC girder bridges
19	Record of grouting of cable ducts	PSC girder bridges
20	Level books	Earthwork in formation/projects
21	Soil test reports for fill materials	
22	Soil test reports for blanketing materials	
23	Earthwork compaction register	
24	CBR test reports	Earthwork in formation (for 25t+ axle load only) and road works as per agreement
25	Ballast Register	Ballast supply

26	Stressing Register	PSC work
27	Cable profile Register	
28	Structural Steel Register	Steel Structure Work
29	Rivet, HSFG check register	
30	Camber register	
31	Metalizing and painting Register	
32	Inspection Note and Compliance register	All works

- 4.0** The tests required to be conducted outside the Site established laboratory shall be got done through NABL accredited lab, Central /state govt approved or owned laboratory /Test house / Government Engineering college/Govt. Polytechnic college only. The contractor shall inform regarding the name, details and accreditation documents of the particular laboratory in writing and seek approval of the Engineer in charge of work, well in advance. Engineer in charge shall accord approval of the particular laboratory lab, after ensuring testing equipment, records keeping, competency of staff etc. of the laboratory

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