



**GUJARAT INDUSTRIES POWER COMPANY LIMITED  
SURAT LIGNITE POWER PLANT (SLPP)**

**VOLUME II — Civil — Technical Specification (Package A, B & C)**

Design, Engineering, Supply, and Construction of Package A, B, C & D  
**New Lignite Feeding System, Associated Works, Contingency Feeding Arrangement &  
Dismantling**

**Tender No.: GIPCL/SLPP/R&M/LHS/FB-RE/LOCATION/EPC/2026**

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**Gujarat Industries Power Company Limited**

Surat Lignite Power Plant (SLPP), Village: Nani Naroli, Taluka: Mangrol, Dist.: Surat, Gujarat



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## **SECTION 2.1 GENERAL**

1. This specification is to cover the design, preparation of general arrangement, construction drawings, supply of all labour as well as materials and construction of all civil, structural as well as architectural work on EPC basis for the proposed New Lignite Feeding system at Plant end of Surat lignite Power plant, at Village; Nani Naroli, Dist.: Surat in the state of Gujarat, India promoted by M/s. Gujarat Industries Power Company Limited.
2. Description of various items of work under this specification and nature of work in detail are given hereinafter. The complete work under this scope is referred to as CIVIL WORKS. The detailed scope of works covered under civil works are given in Section 2.2.
3. The work to be performed under this specification consists of design, engineering as well as providing all labour, materials, consumables, equipment, temporary works, temporary labour and staff colony, constructional plant, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion and proper functioning of the plant, all in strict accordance with the specifications, including revisions and amendments thereto as may be required during the execution of the work.
4. All materials including cement, reinforcement steel and Construction material shall be arranged by the BIDDER.
5. The scope shall also include setting up by the BIDDER a complete testing laboratory in the field to carry out all relevant tests required for the civil works for the project. Please refer to table no 1.0 in section 2.5 as Standard list of laboratory equipment's.
6. The work shall be carried out according to the design/drawings to be developed by the BIDDER and approved by the CONSULTANT/OWNER. For all buildings and structures, foundations, etc., necessary layout and details are to be developed by the BIDDER, keeping in view the statutory & functional requirements of the plant and facilities and providing enough space and access for operation, use and maintenance. Certain minimum requirements are indicated in this specification for guidance purposes only. However, the Bidder's offer shall cover the complete requirements as per the best prevailing practices and to the complete satisfaction of the OWNER.
7. BIDDER shall inspect the site, examine and obtain all information required and satisfy himself regarding matters and things such as access to site, communications, transport, right of way, the type and number of equipment and facilities required for the work, availability of local labour, materials and their rates, local working conditions, weather, tidal / flood levels, subsoil conditions, natural drainage, etc. Ignorance of the site conditions shall not be accepted by the Owner as basis for any claim for compensation or extension of time. The submission of a bid by the BIDDER will be construed as evidence that such an examination was made and any later claims / disputes in regard to price quoted shall not be entertained or considered by the OWNER on account of ignorance of prevailing site conditions.
8. BIDDER shall provide automatic concrete batching plant with required office facility of sufficient capacity (minimum 30 M3/hr, Minimum 1 Nos Batching Plant to be installed)



with transit mixtures and concrete pumps/Boom placer. No manual/electric/diesel operated mixer machine is allowed.

## **9. STATUTORY REQUIREMENT**

BIDDER shall comply with all the applicable statutory rules pertaining to BOCW act, Factory act, Fire safety rule of Loss prevention association, Water act for Pollution control, Explosives act etc. Provisions of Safety, health and welfare according to Factories act / BOCW act shall also be complied with. Statutory clearances and norms of State Pollution Control Board shall be followed. Statutory body /Act requirements shall be fulfilled by the BIDDER and in case any modifications /additions to the building /Structures are to be made as per the above, shall be carried out by the BIDDER at no extra cost to the owner.

### **SECTION 2.1A – GENERAL OBLIGATIONS OF THE BIDDER**

#### **1. GENERAL OBLIGATIONS**

The Bidder shall execute the Works on a Single Point Responsibility, Lump Sum Turnkey EPC basis and shall be fully responsible for complete Design, Engineering, Procurement, Supply, Transportation, Storage, Construction, Testing, Commissioning and Handing Over of all Civil, Structural and Architectural Works required for successful operation of the New Lignite Feeding System. The Bidder shall be deemed to have included in his scope all permanent works, temporary works, incidental works and miscellaneous items necessary for completion of the Project in accordance with good engineering practice, irrespective of whether such items are specifically mentioned in this Specification. No claim for additional payment or extension of time shall be entertained for any omission which is reasonably required for satisfactory completion, safe operation, maintainability and statutory compliance of the Project.

#### **2. DESIGN RESPONSIBILITY**

The Bidder shall remain solely responsible for the adequacy, safety, serviceability, stability, durability and correctness of all designs, calculations, drawings and engineering prepared under the Contract. Review, comments or approval by the Owner or Consultant shall not relieve the Bidder of his contractual responsibility for design adequacy or performance of the completed works. Any modification required due to deficiencies in design, detailing or engineering shall be carried out by the Bidder at his own cost without any impact on Contract Price or Completion Schedule.

#### **3. CONSTRUCTION PLANNING AND METHODOLOGY**

The Bidder shall prepare and submit detailed construction methodology, resource deployment plan, equipment deployment schedule, temporary works methodology, construction sequencing, traffic management plan, monsoon protection plan, lifting methodology, risk assessment and project execution schedule for approval prior to commencement of work. The methodology shall clearly demonstrate uninterrupted operation of the existing plant and safe execution of all activities.



#### **4. TEMPORARY WORKS**

The Bidder shall be entirely responsible for design, construction, maintenance and removal of all temporary works necessary for execution of the Project including, but not limited to, temporary roads, working platforms, excavation support systems, shoring, sheet piling, dewatering arrangements, temporary drainage, barricading, fencing, temporary lighting, construction power distribution, construction water distribution, storage yards, fabrication yards, crane pads, labour facilities and traffic diversions. No separate payment shall be made for temporary works irrespective of whether specifically identified in this Specification.

#### **5. INTERFACE COORDINATION**

The Bidder shall coordinate all Civil Works with Mechanical, Electrical, Instrumentation, Fire Protection, IT, Communication and other associated systems. The scope shall include all embedded parts, inserts, sleeves, block-outs, anchor bolts, pedestals, grouting pockets, trenches, supports and miscellaneous Civil Works necessary for installation, commissioning and future maintenance of all equipment. Any omission resulting from inadequate coordination shall be rectified by the Bidder without additional cost.

#### **6. QUALITY ASSURANCE AND DOCUMENT CONTROL**

The Bidder shall establish a Project Quality Management System covering inspection, testing, material traceability, calibration of equipment, document control and construction records. Project Quality Plan (PQP), Inspection & Test Plans (ITP), Method Statements and Material Approval Schedule shall be submitted prior to commencement of work. Only approved revisions of drawings and documents shall be used for construction. The Bidder shall maintain complete records of inspections, test reports, calibration certificates and quality documentation throughout the Contract Period.

#### **7. SURVEY CONTROL AND SETTING OUT**

The Bidder shall establish permanent Benchmarks, Grid Reference Points and Survey Control Stations based on approved coordinates before commencement of construction. These reference points shall be adequately protected throughout the execution period. Any disturbance or damage to survey control points shall be restored by the Bidder at his own cost. All setting out shall be checked and certified prior to commencement of foundation works.

#### **8. PROTECTION OF EXISTING FACILITIES**

The Bidder shall take all necessary precautions to protect existing buildings, roads, drains, underground utilities, pipelines, electrical cables, communication cables, structures, equipment and operating facilities during execution of the Works. Any damage caused due to construction activities shall be immediately repaired or replaced by the Bidder at his own cost to the satisfaction of the Owner. The Bidder shall carry out joint verification of existing facilities before commencement of work.

## **9. ENVIRONMENTAL MANAGEMENT**

The Bidder shall implement suitable measures for dust suppression, noise control, waste management, spill prevention, storm water management, housekeeping and protection of existing vegetation. Construction debris, excavated materials and other waste generated during execution shall be disposed of strictly in accordance with statutory requirements and directions of the Owner. The Project site shall be maintained in a clean, safe and environmentally acceptable condition throughout the execution period.

## **10. DIGITAL ENGINEERING DELIVERABLES**

All engineering deliverables shall be submitted in both hard copy and editable electronic format. Design calculations, drawings, survey data, quantity statements, reinforcement schedules, structural analysis files, AutoCAD drawings, Revit models (where applicable), GIS/DGPS survey data and As-Built drawings shall become the property of the Owner upon completion of the Project.

## **11. COMPLETION RESPONSIBILITY**

Completion of Civil Works shall mean complete readiness of all facilities for installation, testing, commissioning, operation and maintenance of Mechanical, Electrical and Instrumentation systems. Any Civil Works found incomplete, deficient or unsuitable during erection, commissioning, performance testing or Defect Liability Period shall be rectified by the Bidder without additional cost to the Owner.

## **12. PERFORMANCE AND DURABILITY REQUIREMENTS**

All Civil, Structural and Architectural Works shall be designed and constructed to achieve the intended service life, durability and functional performance under the prevailing site conditions. The Bidder shall ensure that the completed facilities remain structurally sound, serviceable and fit for their intended purpose throughout the specified design life, considering environmental exposure, operational loads, vibration, abrasion, corrosion, thermal effects and maintenance requirements. Selection of materials, detailing and construction practices shall ensure minimum life-cycle maintenance and long-term reliability.

## **SECTION 2.2 SCOPE OF WORK**

1. The works covered in this section consists of collection of all site related data, conducting soil investigations, Topography survey & area drainage study, design, preparation of all construction drawings, supply of all materials, construction, fabrication, erection and testing where necessary, of all structures required for housing all equipment and civil works for all services required for the New Lignite Feeding system at Plant end defined in the specification document. The Civil Works shall include all activities required for complete engineering, procurement, construction, testing, commissioning support, statutory compliance, successful installation of equipment, operation, maintainability and final handing over of the New Lignite Feeding System. The Bidder shall have single-point



responsibility for successful completion of all Civil, Structural and Architectural Works covered under this Specification. The Scope will cover but not limited to the following buildings / structures / systems / facilities.

2. Site related investigations, and studies For Packages (A, B & C) to finalize design parameters related to:
  - a) Topographical Surveying
  - b) Geotechnical Investigation
  - c) Area Drainage study.
  - d) The Bidder shall carry out any additional survey, investigation, field testing, utility mapping, geotechnical investigation or engineering study that may be required during detailed engineering for safe and complete design of the facilities. No additional payment shall be made on this account.
3. Site development works for packages (A, B & C), consisting of:
  - a) Site clearance.
  - b) Site grading.
  - c) Dismantling /Demolition of Existing weigh bridges foundation, RCC ramp both side of weighbridge & Operator cabins, Street light poles & CCTV's poles and foundations, and associated ancillaries and foundations.
  - d) The scope shall also include dismantling, segregation, loading, transportation, disposal of unusable material and stacking of reusable/salvageable material at locations identified by the Owner. Disposal outside the Plant premises shall be carried out only after obtaining necessary statutory permissions wherever applicable.
4. Construction enabling works:
  - a) Construction Water
  - b) Temporary Site Building
  - c) Temporary Workshop and Garage
  - d) Fabrication Yard
  - e) Quality control laboratory
  - f) Fuel Storage Area
  - g) Staff welfare facility

### **Constructability Review**

The Bidder shall carry out a comprehensive constructability review before commencement of construction to ensure compatibility of design with site conditions, construction methodology, plant operation and equipment installation. Any discrepancy identified shall be resolved during detailed engineering without impact on project schedule.

### **Protection of Existing Operating Facilities**

The Bidder shall execute the Works in a manner that prevents damage to existing buildings, roads, utilities, conveyors, equipment and operating facilities. Any damage

caused shall be repaired or replaced by the Bidder at his own cost to the satisfaction of the Owner.

### **Future Maintainability**

The layout and Civil Works shall ensure adequate accessibility for operation, inspection, maintenance and replacement of all equipment throughout the service life of the Project. Necessary maintenance clearances, access routes and working spaces shall be incorporated during detailed engineering.

### **Restoration and Reinstatement**

Upon completion of the Works, all temporary facilities, diversions, construction areas and disturbed surfaces shall be removed and restored to their original or improved condition, including roads, drains, fencing, pavements, landscaping and utility corridors, to the satisfaction of the Owner.

## **5. SCOPE OF WORK: PACKAGE A**

Package A covers Design, Engineering, Procurement, Supply, Fabrication, Erection, Testing, Pre-commissioning, Commissioning, and Handing Over of the New Lignite Feeding System at the Plant End (Feeder Breaker Relocation), on a complete Turnkey EPC basis.

- a) New RCC Ramp with RCC Platform at dump level, RCC Retaining wall & RCC counterforts for platform area & side slope Rubble pitching of Ramp: suitable for 1 Feeder Breaker and trucks.
- b) RCC paving around connecting approach to existing ramp area, new ramp area and round-about for fleet movement. (refer sketch)
- c) All equipment foundations like Feeder Breaker, conveyor trestle, take-up structure, Tail pulley, over ground Hopper, Junction tower / transfer structure etc, The scope shall include anchor bolt templates, embedded plates, inserts, sleeves, block-outs, grouting pockets, cable openings, drainage openings, maintenance platforms and all miscellaneous Civil provisions required for successful installation and commissioning of equipment.
- d) Over ground Hopper & Conveyor gallery structure with GI sheet cladding; conveyor trestle/support structures. The scope shall include all access platforms, staircases, walkways, maintenance platforms, handrails, toe plates, drainage arrangements, cable supports and miscellaneous steel works required for safe operation and maintenance.
- e) Junction tower / transfer structure at interface with Phase-I receiving conveyor.

- f) MCC Room (Ground + 1 story): RCC framed Structure Building work incl finishing work like; flooring, roofing, AC, ventilation, cable trenches/racks, fire detection etc. The scope shall also include cable basement (where applicable), pipe sleeves, equipment openings, maintenance access, waterproofing, architectural finishes, roof insulation, rainwater disposal system, lightning protection provisions and miscellaneous embedded items.
- g) Cable trenches (covered with RCC/MS grating covers); man-holes; inspection pits.
- h) Roads and drainage around ramp, hopper area, JNT and conveyor; levelling and site development. The scope shall include road furniture, kerbs, road markings, crash barriers wherever required, speed breakers, traffic signage, pavement markings and miscellaneous traffic safety arrangements.
- i) Cable rack foundation & structure from MCC to Feeder breaker & Feeder to Transfer point
- j) Area development near JNT-13 & Existing Nallah diversion.
- k) Foundation & Structure work for Cross over (New MCC to Proposed MCC).

## **6. SCOPE OF WORK: PACKAGE B**

**Weigh bridge complex shall be designed and configured during detailing only. Following details are indicative for bidding purpose.**

### **6.1. Weigh Bridge**

- a) Total seven no's of the weigh bridge foundation with operator cabin along with ramp both side of weigh bridge shall be constructed. Weigh bridge shall be procured, supplied, install and commissioning by the bidder. System configuration and arrangement shall be decided during detailing. Newly procured and supplied weigh bridge shall be fully automatic electronic cell arrangement pit-less-type weighbridges of 80–100 MT Gross Vehicle Weight (GVW) capacity with digital compression load. Refer, specification of the weigh bridge. Capacity and dimension of the weigh bridge shall be decided during detailing.
- b) Surrounding of the weighbridge area shall be developed with RCC paving on both side of the weigh bridge (entry/exit).- Estimated plan area is 3600 sq.m (Plan area). It may vary and will be based system configuration/layout.
- c) RFID loop interface at weigh bridge entry and exit; SCADA connectivity.
- d) All associated civil works:, drainage, washroom, toilet, water cooler etc
- e) RCC foundation with foundation bolt for high mast, lighting, IT work, Fire network etc.



- f) The weighbridge foundation shall be designed considering permissible total and differential settlement limits recommended by the weighbridge manufacturer.

## **6.2. Approach Road**

- a) Construction of new RCC approach road Minimum 10 m wide (two-way traffic) from existing lignite transportation route to weigh bridge.
- b) Construction of new RCC approach road Minimum 10 m wide (two-way traffic) from weigh bridge to existing stockpile road.
- c) Construction of new RCC approach road Minimum 10 m wide (two-way traffic) from weigh bridge to dumper hopper ramp.
- d) Construction of new RCC approach road Minimum 10 m wide (two-way traffic) from dumper hopper ramp to existing lignite transport route.
- e) It is envisaged that the total length of above-mentioned road is shall be estimated 700 meters. The length of the road is indicative and for bidding only. Actual length and width shall be as per system layout and configuration. Bidder shall design for loaded truck axle loads. (considering upto 40MT payload capacity) total weight of the vehicle shall be upto 100MT)
- f) Final pavement composition, pavement thickness, sub-grade improvement, DLC/PQC thickness, reinforcement (where applicable), joints and drainage arrangements shall be based on detailed pavement design carried out by the Bidder.
- g) Extension of RCC road in lignite stockpile area for truck movement. (200 meter in length & 7 meter wide)
- h) RCC box type Culvert (Minimum size L12 m × W10 m × D 2.5 m) designed for truck axle loads 100MT. The size/details are indicative may vary based on requirement. Hydraulic capacity, waterway, scour protection, return period and structural design shall be finalized during detailed engineering based on hydrological studies.
- i) Hume pipe culvert- Minimum 20Meter in Length. The length is indicative may vary based on requirement.
- j) Chain-link fencing (200 m in length)
- k) Porta cabins-04 Number
- l) Lignite Stockpile development. The scope shall include grading, compaction, storm water drainage, erosion protection, surface runoff management and all associated Civil Works.
- m) Restoration of all existing roads, pathways, and drainage systems disturbed during construction. Restoration shall include matching existing pavement thickness, strength, finish and riding quality.
- n) Seamless interconnection of the all the approach of the stockpile, existing and new lignite feeding system ramp start point, round-off for crisscrossing of the fleets etc.
- o) Any diversion/temporary/dismantling for the development of the system. The scope shall include planning, design, construction, maintenance and removal of all



temporary diversions, temporary roads, utility diversions, barricading, signage, illumination and traffic management arrangements required during execution without affecting existing plant operation.

- p) RCC foundation with foundation bolt for high mast, lighting, IT work, Fire network etc.
- q) Rest room for workers
- r) Transformer room

## **7. SCOPE OF WORK: PACKAGE C**

- a) Construction of the tail pulley foundation of the BCN-M1A by using existing Stacker reclaimer foundation.
- b) RCC foundation for surface feeder.
- c) RCC paving in surrounding area of the surface feeder for dozer/front-end loader operation
- d) The scope shall include all associated foundations, Earthen Ramp, paving, drainage, cable trenches, maintenance access, retaining structures, equipment supports, embedded items and miscellaneous Civil Works required for complete commissioning of the package.

This specification covers entire civil engineering work including design, supply and construction for all buildings, equipment foundations, technological structures and facilities for all production, auxiliary units, foundations for all buildings, structures and equipment's, roads, ramps, paving, parking areas, storm water drainage and sewers and all other miscellaneous civil engineering work as will be necessary for completing packages A.B & C on a turnkey basis.

It is not the intent to specify herein all the works in the scope of this contract. The scope also includes all other buildings, structures and works necessary, which are not specifically mentioned here but required, for construction, operation and maintenance of the New Lignite feeding system at Plant end are deemed to be included in the scope of the BIDDER. All works shall conform to the specification. The works shall conform to high standards of design, engineering and workmanship. Design and construction shall conform in every respect to all local and state regulations governing such works and to stipulations of Indian Standards unless stipulated otherwise in detail specification.



## **SECTION 2.3 DOCUMENTS TO BE SUBMITTED BY BIDDER WITH EPC BID PERTAINING TO CIVIL WORKS**

1. Suggested Plot Plan indicating all proposed and existing buildings, structures, conveyor systems, equipment foundations, roads, culverts, drainage network, grading contours, retaining structures, utility corridors, underground and overhead services, temporary construction facilities, construction access roads, site offices, storage areas, fabrication yards, parking areas, future expansion provisions, north direction, grid coordinates and finished floor levels. The Plot Plan shall clearly indicate all dimensions, offsets and interface with existing facilities.
2. A Write-up on De-watering System proposed at the time of construction.
3. General Arrangement and Architectural Drawings for all buildings and structures showing plans, elevations, sections, dimensions, levels, structural framing concept, foundation arrangement, expansion joints, construction joints, architectural finishes, roofing system, waterproofing system, drainage arrangement, access provisions, maintenance facilities, materials proposed and construction methodology.
4. General Arrangement and Floor Plan of MCC Building indicating location of all major equipment, cable routing, cable trenches, equipment maintenance clearances, emergency exits, ventilation arrangement, fire escape routes, access doors, operating corridors and future equipment provisions.
5. Detailed Design Basis Report covering design philosophy, design life, applicable codes and standards, loading criteria, seismic parameters, wind loading, vibration criteria, durability requirements, design assumptions, exposure conditions, material specifications, foundation philosophy, pavement design basis, drainage design basis, construction loads and all other engineering assumptions proposed for detailed design.
6. List of software proposed to be used in various areas for analysis, design, drafting as well as project monitoring along with their sources and validation report for software.
7. Details of the proposed Quality Control Laboratory including layout, staffing, testing equipment, calibration certificates, testing frequency, quality procedures, NABL association, and methodology for field and laboratory quality control.
8. BIDDER shall indicate requirements to the OWNER, well in advance, the List of Equipment to be maintained for Quality Control purposes.

## **SECTION 2.4 DOCUMENTS TO BE SUBMITTED BY BIDDER AFTER AWARD OF CONTRACT**

The following list represents the minimum engineering deliverables to be submitted by the Bidder. The Bidder shall also submit all additional calculations, drawings, reports, analyses, models, procedures and documents necessary for complete review, approval, construction, commissioning and operation of the Project, irrespective of whether specifically listed herein. Submission of these documents shall not relieve the Bidder of responsibility for the adequacy, correctness or completeness of the design.

1. General layout drawing with coordinates of roads, Ramp, buildings and facilities, Toile block, Weigh bridge, stockpile, piping / cable corridors, pipe and cable trestles, diversion roads and drains, equipment lay down areas etc.
2. Drawing showing underground facilities with coordinates of these facilities like buried pipes, buried cables, trenches, ducts, sewer, drains, sumps pits, culverts, foundations etc.
3. Storm water drainage study and details of drains, culverts etc. for storm water drainage system. Area drainage study of the proposed power plant with the surrounding areas for possible flooding of the plant, high flood level of the area and schemes for preventing the flooding by diversion drains, rainfall intensity of the area, rainwater disposal points etc.
4. Study Note on disposal of sewage and other effluent from the plant to satisfy the statutory requirement.
5. Design Basis Memorandum for all buildings, facilities, services and structures.
6. Architectural floor plans, elevations, cross sections and perspective view in colour of all buildings. BIDDER shall use 3D tool such as REVIT to generate 3D model for building which include MEP services. Construction drawings shall be in 2D generated from 3D model.
7. Design calculations and drawings for foundations / substructure and superstructure of all buildings including MCC and other structures.
8. Design calculations including dynamic analysis and drawings for all foundations subjected to dynamic loads For vibrating like foundations. Design and drawing of vibration isolation system shall also be furnished. Furthermore, OWNER / OWNER's Consultant shall arrange for review of the same including any correction in the QA plan to be submitted by the BIDDER.
9. Design calculations and drawings for all facilities and services like Junction tower ,conveyor, Hopper foundation, Roads, Ramp ,Weighbridge foundation, Operator cabin, Platform culverts, paving, road drainage, MCC (if required), drains, sewers, trenches, ducts etc.



- 10.** Drawings of all architectural works including finishing schedule, colour schemes (both internal and external), doors & windows, waterproofing, flooring and false ceiling, etc.
- 11.** Design calculations and drawings for plumbing and building drainage.
- 12.** All other designs, details / drawings or any other submissions as indicated elsewhere in this specification and as required by the OWNER.
- 13.** Details of corrosion protection measures for all structures (Below ground and above ground structures).
- 14.** Total quantity of concrete (grade wise), reinforcement steel (diameter wise) and structural steel (section wise) shall be indicated in all construction drawings. Furthermore, BIDDER shall provide a break-up of quantities up to plinth of buildings and further in the Construction Drawings that will be submitted.
- 15.** Shop drawings / fabrications of all structural steel works and design calculations for important and critical joint connections.
- 16.** Construction and erection procedure for all major structures with specific reference to MCC building, Operator cabin, Ramp & platform construction, transfer towers, conveyor galleries, etc.
- 17.** Write up on various statutory requirements and their compliance for various buildings and facilities.
- 18.** Quality assurance and Quality Control procedures.
- 19.** Copies of all reports on investigation and studies carried out by the BIDDER as per the scope.
- 20.** Fabrication drawings of important structures, such as, typical gallery, typical trestle & typical Junction tower for Lignite Handling system, or any other structure specifically called for by OWNER.
- 21.** BIDDER shall submit drawings showing group classification, fire zones and kind of fire protection measures to be adopted for structural members as per stipulations of IS 1641, 1642 & IS 800 prior to start of detail engineering for OWNER's approval.
- 22.** BIDDER shall provide "As built drawings" after completion and successful running of plant.



## **SECTION 2.5 DESCRIPTION OF BUILDING, STRUCTURE, FACILITIES**

### **SCOPE**

The BIDDER shall perform all the Civil works specified herein below or necessary to complete the New lignite feeding system at Plant end & associate works in accordance with this specification. Further, the BIDDER'S performance of the works under the CONTRACT shall be in accordance with good engineering and construction practices, notwithstanding the fact that every item involved may not be specifically mentioned below, or the item mentioned may be inadequate for its intended purpose. Details and items which are not specifically mentioned below shall also be adequately and properly performed by the BIDDER at no extra cost if such details and / or items are reasonably necessary to meet the system requirement.

### **DESCRIPTION OF BUILDINGS, STRUCTURES AND FACILITIES**

Following structures / buildings / areas / facilities are to be included in the contract. The description against each building / system is indicative only and not exhaustive. Although most of the systems are covered here in, any other system (Civil and Architectural) required for successful completion of the works shall form a part of this contract and shall be deemed to be included in the scope of works.

#### **1. SITE RELATED INVESTIGATION**

##### **1.1 Topographical Surveying (for Package A, B & C)**

- 1) The scope of work shall include mobilisation of all necessary equipment, providing necessary experienced and qualified land surveyors, supervisors and technical personnel, skilled, unskilled labour and such other services as required to carry out all field work, analysis and interpretation of all the collected data, preparation & submission of survey drawings and detailed report on the work done.
- 2) Only SI System shall be followed.
- 3) The BIDDER shall conduct topography survey to –
  - a) To demarcate the acquired property and fix Boundary Pillars at site in co-ordination with the OWNER / ENGINEER as well as representatives of other agencies as applicable. Lengths and bearings with respect to the Magnetic North of each Boundary line shall be determined.

To establish a baseline within the area being surveyed at location indicated by the Engineer and determination of its bearings with respect to the True North as well as the Magnetic North.

- b) To establish and Construct permanent Benchmarks (3 Nos.) on site at locations to be indicated by OWNER/ENGINEER. These shall be tied to nearest authenticated GTS / Survey of India Benchmark/GIPCL benchmark already established at site and can be used for verification.



- c) To determine Latitude and Longitude of one of the horizontal ground control points, decided in coordination with OWNER / ENGINEER.
  - d) To survey and determine the ground levels and map (incorporating contour and topographic details) the entire site including land 50m beyond the boundaries or to the opposite edge of adjoining roads or as directed by the OWNER / ENGINEER.
  - e) To obtain Highest High Flood Levels and Lowest Low Water Levels of normal streams and Monsoon streams; overflow levels and lowest levels of ponds and lakes; tidal levels etc. if applicable.
  - f) To identify and mark on the Survey Drawings places of worship, tombs, relics of archaeological importance, trees with girth more than 300mm at 1m above ground level, transmission lines and towers, telephone /telegraph lines and poles, power and lighting poles, trenches, identified underground services and any other structure, etc.
  - g) To suitably collate all the Survey details and represent the same on drawings drawn to scales as specified.
- 4) The BIDDER shall mobilize and use appropriate and adequate number of precision instruments and equipment required for the successful execution of the work. These shall include but not be limited to Differential Global Positioning System (DGPS), Drone , levels, ranging rods with least count of at least 5mm, level staves, calibrated tapes, survey umbrellas, etc.
- 5) All necessary Reduced Levels (RL) as entered in the field book have to be submitted along with pre-contour layout of the total site.
- 6) The reference pillars shall be labelled permanently with their respective coordinates and reduced levels for future use. The Benchmarks and reference pillars shall be shown on the survey drawings.
- 7) Pillars shall be 300 x 300mm size founded below 500mm below NGL on 100 thick, M 25 grade RCC Pillars shall use, marking RL on top and shall project minimum 300mm above FGL. The top of pillars shall have MS plate with galvanized embedded in concrete for engraving necessary details as specified.
- 8) Positions, both in plan and elevation, of all natural and artificial features of the area like waterways, railway tracks, trees, cultivation, houses, fences, any other permanent and temporary structure, permanent (pucca) and temporary (kutchha) roads including culverts and crossings, foot tracks, other permanent objects like telephone posts and transmission towers etc. are to be established and subsequently shown on survey maps by means of conventional symbols (preferably, symbols of survey of India Maps). All hills and valleys within the site are to be surveyed and plotted on maps by contours. Necessary levelling work of the entire area/areas are to be surveyed and plotted on maps by establishing horizontal location so that location and sketching of contours for the site can be done at specified intervals and in specified scales on maps. Method of survey, contour intervals etc. shall be decided by OWNER /ENGINEER on site in case of steep slopes etc. where grading is not



possible. Any unusual condition or formations on the ground, locations of rock outcrops (if visible on the surface) and spring/falls, sand heap/dune, possible aggregate deposits etc. shall also be noted and plotted on the maps. The grids for the survey work shall be established in N-S & E-W direction (Corresponding to Magnetic North) or the Plant North as directed by the/ENGINEER.

- 9) The spot levels shall be taken at nodes of grid 10 m side. The grid shall essentially be perpendicular and parallel to established baseline. Finer grids may be adopted for representing local features. The Contour Maps shall show contours at 0.5m interval. Smaller contour intervals shall be adopted to indicate local mounds, field bunds, dykes, Monsoon stream, rivers, lakes, ponds, wells etc. Presence of any well and/ or tube well in the site or adjoining areas and water level in them shall be in the documents. Details of earlier uses of the site i.e. mining, quarrying, agriculture etc., existing drainage pattern of the site, possibility of water logging and high flood level of the area shall also be captured in the documents.
- 10) Levels shall also be taken on all traverse stations and on salient points located at random over the area (ground points). Contours are to be interpolated at 0.5 M intervals after the above points are plotted.
- 11) The contours shall not be just interpolated but properly surveyed on the ground so that features falling between the two successive levels are also picked up. Sufficient points shall be properly distributed over the entire area and levels shall be taken so that accurate contouring can be done at places of sharp curvature or abrupt change in direction and elevation, points selected shall be close to each other.
- 12) Salient points on ridge lines and valley lines shall also be measured. Transfer of levels shall always start from Main/Subsidiary stations whose levels are based on bench mark established in the survey area.
- 13) The BIDDER shall initially produce check prints of all Drawings for review and comments of the OWNER / ENGINEER prior to proceeding with the final copies at no extra cost to the OWNER. All comments of the OWNER/ ENGINEER shall be incorporated onto the final Drawings.
- 14) The BIDDER shall submit the following drawings:
  - a) Site location plan drawn to a scale of 1:20000.
  - b) One drawing, showing the complete plot and prominent features in and around it, drawn to a scale of 1:1000.
  - c) Detailed Survey Drawing drawn to a scale of 1:500.
  - d) Contour Map drawn to a scale of 1:500 with Contour Interval of 500mm. The contours shall be drawn in 3-Dimensions such that all the spot levels indicated on the drawings bear all the three co-ordinates viz. X, Y and Z - co-ordinates.
  - e) Longitudinal profile of the railway lines, pipelines etc. as specified, drawn to a horizontal scale of 1:2000 and a vertical scale of 1:10. Plan shall be drawn along the profile, with scale normal to the alignment at 1:1000.
- 15) The Detailed Survey Drawing shall identify and depict all prominent features and details with their sizes, elevations / depths, bearings and co-ordinates.



- 16) It shall be noted that all Drawings, Maps, Records etc. produced by the BIDDER shall be the sole property of the OWNER and the BIDDER shall not use any of the details for any other work without the written approval of the OWNER.
- 17) All the maps should be prepared in digitized forms using computer software like AutoCAD or as directed by OWNER / ENGINEER. The block of name plate of all the drawings should be as per standard defined by OWNER.
- 18) BIDDER shall submit all data pertaining to the survey in original to the OWNER / ENGINEER including all levels & co-ordinates in X-Y-Z format for the area on Pen drive
- 19) The survey shall be conducted through DGPS/DRONE only.

## **1.2 Geotechnical Investigations (for Package A,B & C)**

Geotechnical investigation shall be carried out by the BIDDER on award of work. Based on the plot plan developed, the BIDDER shall identify proposed borehole location and obtain the approval of OWNER prior to commencing the investigation. Boreholes shall be spread judiciously to cover all major building as well as equipment foundations. Bidder shall be ensured that the boreholes are located within the boundary of all major structures.

- 1) Following field tests shall be conducted:
  - a) Bore Holes
  - b) Static Plate load tests/ Cyclic Plate load tests
  - c) Cross hole Seismic Tests
  - d) Electrical Resistivity Tests
  - e) Field Permeability tests
  - f) Field Density tests
  - g) Static Cone Penetration tests/ Dynamic Cone Penetration tests
  - h) Field CBR tests for roads.
  - i) Making trial pits of specified sizes through soil/ boulder and weathered rock.
  - j) Any other test required for design and Engineering purpose.
- 2) During boring, the level at which ground water is struck shall be carefully noted. Ground water samples shall be collected for chemical analysis. Boring shall be carried out without the use of water or drilling mud up to the depth of ground water table.
- 3) All necessary laboratory tests required to fix the design parameters shall be conducted
- 4) The geo technical investigation report shall necessarily include but not be limited to the following information:
  - a) Recommended types of foundation. (Along with bearing capacity w.r.t depth and size of foundation)



- b) Allowable safe bearing capacities and settlement values in different strata for shallow foundations indicating relevant design criteria adopted, method of analysis adopted etc.
- c) If Pile Foundation is necessary, type of pile recommended with reasons for the same, length, diameter, allowable capacity (lateral, pullout and vertical) of individual and groups of piles, negative skin friction if any and magnitude of estimated negative skin friction.
- d) Recommendations for values for modulus of sub grade reaction for foundation design by elastic method.
- e) Type of cement to be used for concrete with reference to the chemical nature of subsoil and ground water.
- f) Recommendations regarding excavations (shallow and deep), embankment, covering safe side slopes for excavation and embankment, dewatering, site drainage, etc.
- g) Recommendations for values for coefficient of elastic uniform compression ( $C_u$ ) for dynamic foundation design.
- h) Any other parameters required for design and Engineering purpose.

## **2. SITE DEVELOPMENT WORK**

### **2.1 Site Clearance**

- 1) The site shall be cleared of all trees, shrubs or other vegetation, rubbish, concrete debris, slush stumps, roots etc. and other objectionable matters. Any unwanted material lying in the area including soil, debris, etc. shall be removed up to natural GL / grade level and disposed off to suitable locations. If any roots or stumps of trees are met during excavation, they shall also be removed. Where earth fill is intended, the area shall be stripped of all loose / soft patches or topsoil containing objectionable matter before fill commence. Any structure or services existing at the site required to be removed / rerouted shall be removed / rerouted by the BIDDER with the permission of the Owner at no extra cost. Existing wells, pits, marshy areas etc. shall be filled up with sand /PCC as directed by the ENGINEER.
- 2) The BIDDER shall be deemed to have visited and carefully examined the site and surroundings to have satisfied himself about the nature of the existing structures, underground services, general site conditions, the site for disposal of surplus materials, debris etc. and all other materials affecting the work. Claims due to ignorance of site condition will not be considered after submission of Bid.

## 2.2 Site Grading

- 1) Site grading work shall be carried out within the plant so that the cutting and filling are approximately equal. However, the final grade level of each area shall be decided during detailed engineering and based on hydrology study of area with the highest flood level (HFL) determined from area drainage study report. The finish grade level shall be situated minimum 0.3M above the high flood level or NGL, whichever is higher.
- 2) Fills shall normally be made up of CNS material capable of being compacted up to 95% Modified Proctor density. Filling may also be made using sand in which case a relative density of 85% shall be achieved. In case earth has to be borrowed from outside the plant boundary, the same shall be arranged by the BIDDER himself at no extra cost. Earth from Swamps, marshy as well as lagoons, expansive type of clays, peats, organic material, material susceptible for combustion, material which will react with other material already used in work shall not be used as borrow material. A minimum side slope of 1 vertical: 2 horizontals shall be maintained at all slopes.

CNS (Cohesive non-swelling) material shall conform the requirements given below:

| Sr. No. | Property                                                                                                                                                                                                 | Specification Range                                      |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 1       | Grain size analysis<br><br>i) Clay<br>ii) Silt<br>iii) Sand<br>iv) Gravel                                                                                                                                | <br><br>15-25%<br>35-50%<br>30-40%<br>Less than 10%.     |
| 2       | Consistency limits<br><br>i) Liquid limit<br>ii) Plastic limit<br>iii) Plasticity limit<br>iv) Shrinkage limit                                                                                           | <br><br>30-50%<br>20-25%<br>10-25%<br>15% and above.     |
| 3       | a) Swelling pressure when compacted to maximum dry density corresponding to standard proctor compaction with zero initial compaction moisture content for no volume change condition.                    | Less than 0.1 kg/cm <sup>2</sup> (5 kN/m <sup>2</sup> )  |
|         | b) Swelling pressure when compacted to maximum dry density corresponding to standard proctor compaction and initial compaction corresponding to optimum moisture content for no volume change condition. | Less than 0.05 kg/cm <sup>2</sup> (5 kN/m <sup>2</sup> ) |

- 3) Slopes shall be provided with proper protection like stone pitching, etc. to prevent erosion

### **3. CONSTRUCTION ENABLING WORKS**

#### **3.1 Construction Water**

Construction water shall be provided by Owner on free of charge basis at one point within the plant boundary and the bidder shall make his own arrangements for further distribution. The bidder shall make alternate arrangement in case of non-availability of construction water from Owner at his own cost.

#### **3.2 Temporary Site Building**

Land will be allotted free of charge for the purpose of site office, stores, site fabrication and site lab. The BIDDER shall provide at his cost the following building facilities for proper execution and quality control of the job, while meeting the provision stipulated by Factory Rules regarding staff welfare facilities. All these building shall have brick cladding, Colour coated sheet roofing over steel roof truss with cement concrete flooring.

#### **3.3 Site office**

The BIDDER shall establish a site office at the area allotted by the Owner.

#### **3.4 Stores**

A covered store shall be provided with brick cladding and. G.I. / colour coated sheeting to store at least one-month requirement of cement. Cement in bags shall be stored on a raised floor well away from outer walls and insulated from the floor to avoid moisture. Not more than 15 bags shall be stacked in any tier. Each consignment of cement shall be stored separately and consumed in its order of receipt.

- 1) Covered storage area may also be provided to store other construction material, which will be affected on exposure to wind, sun and rain.
- 2) Reinforcement shall be stacked on top of timber sleepers to avoid contact with ground /water.
- 3) Storage yard paved or unpaved shall be provided within the stores complex for storage of other material.
- 4) Proper fencing and security arrangement shall be provided for the stores complex.
- 5) Proper welfare facilities for Staff and work men of BIDDER shall be arranged by the BIDDER.
- 6) Closed Material Storage House (of adequate nos for keeping all C&I items, Electrical Items, Mechanical Items, chemical and additives etc.) & Material Storage yard for storage of various plant & equipment (mechanical, electrical, instrumentation & control) with approach roads & drainage arrangement. AC Storage sheds wherever deemed to be necessary is to be provided as per the OEM/ Manufacturer's requirement
- 7) Development of Open Storage yard along with surface treatment, grid approach road, drains for storage of plant equipment's & materials.

### 3.5 Temporary Workshop and Garage

The BIDDER shall provide a temporary workshop and garage to attend to routine maintenance and repair of the construction equipment's as well as his fleet of vehicles used for construction activities.

### 3.6 Fabrication Yard

Depending on the extent of fabrication envisaged at site, the BIDDER should establish a full-fledged structural fabrication yard with adequate handling facility during and after the fabrication. Radiography, ultrasonic, dye penetration, magnetic particle test arrangement shall be ensured for fabrication to ensure strict quality control.

### 3.7 Quality Control Laboratory

A fully equipped quality control laboratory shall be established at site with qualified personnel to conduct acceptance test on all construction materials, weldments, concrete cubes, soil and rock samples etc. This laboratory shall be housed in a covered building with A/C facility as required by the testing facility. All testing equipment like Owen, Electrical operated cube testing machine, Sieves for grading of sand & aggregates, flakiness and elongation index testing sieve, Density of Aggregate, Electrically operated vibratory aggregate sieve, jars for sand testing, Abrasion testing equipment, Impact testing equipment, Sufficient size cube tank with partition, Cube moulds, Slump cones, Vicat apparatus, Moisture meter, Soil testing equipment's, Small mixer machine for trial mixes shall be arranged for laboratory.

All testing equipment shall be periodically calibrated to the satisfaction of the OWNER. It is the responsibility of BIDDER to carry out NDT tests as and when demanded by client and BIDDER has to arrange for such test from reputed NABL/Govt approved agency at his own expense.

**Table 1.0 Standard list of laboratories equipment's**

| Sr | Name of Equipment's                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Pan Balance – Capacity 10 Kg, Accuracy- 1gm                                                                                          |
| 2  | Platform balance - capacity 100 Kg, Accuracy – 50gm                                                                                  |
| 3  | Concrete cube moulds (54)nos with tamping rod size –(150x150)mm                                                                      |
| 4  | Vicat Apparatus                                                                                                                      |
| 5  | Mortar cube moulds 06 nos, with base plates size: - (70.6x70.6) mm                                                                   |
| 6  | Aggregate Impact Test apparatus                                                                                                      |
| 7  | Aggregate crushing Test apparatus – 150 mm dia                                                                                       |
| 8  | Measuring Cylinder – 100 ml, 500 ml, 1000 ml.                                                                                        |
| 9  | Flakiness index gauge                                                                                                                |
| 10 | Slump cone apparatus with measuring rod: - Minimum Three Nos.                                                                        |
| 11 | Sieves for Coarse Aggregates – G I 18" dia<br>(63mm,50mm,40mm,31.5mm,25mm,16mm,12.5mm,10mm,8mm,6.3mm<br>4.75mm,2.36mm)-02 sets of 13 |

|    |                                                                                                                               |
|----|-------------------------------------------------------------------------------------------------------------------------------|
| 12 | Sieves for Fine Aggregates – Brass Sieve (4.75mm,2.36mm,1.18mm,600microns,300microns, 150micron,75micron, Lid & Pan)-set of 8 |
| 13 | Pycnometer bottle                                                                                                             |
| 14 | Electric oven O/S M.S &I/S Aluminium- size – 18"x18"                                                                          |
| 15 | Electrically operated Digital Cube testing Machine- capacity 200 MT                                                           |
| 16 | Thermometers electronic insertion type                                                                                        |
| 17 | G I Trays – 45 cmx45cm-03 sets                                                                                                |
| 18 | G I Trays – 45cmx60cm-03 sets                                                                                                 |
| 19 | Core cutter with dolly & rammer – 06 nos                                                                                      |
| 20 | Only core cutters-03 nos.                                                                                                     |
| 21 | Proctor compaction mould with light rammer of 2.4 kg.                                                                         |
| 22 | Vernier calliper - 200 mm x .02mm-02 nos                                                                                      |
| 23 | Wire gauge                                                                                                                    |
| 24 | Le-Chetlier's mould,                                                                                                          |
| 25 | Vibrating machine for cement cube moulds                                                                                      |
| 26 | 90-micron sieve for cement cube moulds                                                                                        |
| 27 | Rapid moisture meter for Soil test: - Minimum Three Nos.                                                                      |
| 28 | 0.25 m <sup>3</sup> capacity mixer machine for trial mix.                                                                     |

**Note:** Any other equipment required during execution if found necessary shall be brought at site.

Safety Training Centre & Workmen Training centre for Quality and safety Aspects.

### 3.8 Fuel Storage Area

BIDDER shall obtain necessary permission from competent authorities and establish and operate a POL outlet with proper storage, dispensing and adequate firefighting facility. Such outlets for petroleum product are required only if no regular petrol bunk is available in the near vicinity.

### 3.9 Staff Welfare Facility

- 1) OWNER shall identify sufficient area outside the plant boundary to the BIDDER to locate his staff and labour colony. But construction and maintenance of the staff and labour colony to satisfy all statutory requirement is the sole responsibility of BIDDER.
- 2) BIDDER shall provide adequate facility for his staff inside the plant boundary such as toilets for both gents and ladies, canteen, drinking water facility, First Aid Centre, rest places, crèches etc.
- 3) Necessary approach roads to the construction facility complex and internal roads within the complex as well as proper drainage of the area shall be the BIDDER's responsibility. He shall also provide for proper disposal of sewage and other wastewater to meet with the requirement of Pollution Control Board.

#### 4. DETAILED SCOPE OF WORK Package A

##### 4.1 FEEDER BREAKER WITH APPROACH RAMP

###### a) RCC Ramp — Design and Construction

| Parameter                                | Specification / Requirement                                                                                                                    |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Ramp Type, RCC Platform, Retaining wall  | Well compacted RCC Ramp with RCC wall for retaining earth, Approach road in Ramp & Platform Shall be of RCC. please refer detail spec Below.   |
| Ramp Width                               | Suitable for 1 no. Feeder Breaker + service access + truck manoeuvring (indicative: ~30-35 m or wider); finalized by structural design         |
| Ramp height at Dump level                | Approximate 9.0 M at Dump level                                                                                                                |
| Ramp Gradient (Loaded Trucks)            | 1:20 for loaded trucks; confirmed by truck approach study                                                                                      |
| Concrete Grade — Ramp & Main Foundations | Minimum M25 (all structural elements).                                                                                                         |
| Concrete Grade — Minor Structures        | Minimum M25                                                                                                                                    |
| Reinforcement                            | Fe-550D CRS TMT bars per IS:1786;                                                                                                              |
| Ramp Surface                             | Concrete pavement with expansion joints; slope for drainage; non-slip surface                                                                  |
| Hopper Sheds                             | 1 no. structural steel framed shed above Feeder Breaker hopper; GI galvalume cladding (0.8 mm min.); open on truck entry side                  |
| Underground structure Treatment          | Pl refer clause 12 of General requirements                                                                                                     |
| Drainage                                 | Surface drainage channels around ramp; consider 110 mm/hrs rainfall intensity for design. connected to plant drainage/Existing nearby network. |

###### b) Detail specification of FEEDER BREAKER WITH APPROACH RAMP AND RCC PAVING

The Feeder Breaker Foundation shall be designed considering static loads, dynamic loads, impact loads, fatigue effects, vibration criteria, equipment manufacturer's data, operating and maintenance loads, seismic forces, wind loads (where applicable), temperature effects and differential settlement and as per geotechnical reports. The foundation shall include all anchor bolts, embedded plates, sleeves, inserts, cable

openings, drainage provisions, grouting pockets and miscellaneous embedded items required for complete installation and commissioning of the equipment.

BIDDER shall provide well-compacted RCC M25 ramp (Ramp height Approximate 9.0 meter at Dump level) with suitable gradient and necessary RCC retaining wall to retain earth. The stability of the ramp and retaining wall shall be established by detailed geotechnical analysis considering global stability, sliding, overturning, bearing capacity, settlement and seismic effects wherever applicable. Suitable drainage arrangements including filter media, perforated drain pipes, weep holes and geotextile separators shall be provided behind retaining walls to prevent build-up of hydrostatic pressure. Feeder breaker foundation shall be isolated from retaining wall foundation. Approach road, in the ramp portion and sufficient size platform at dump level shall be of RCC M25 (VDF with nonmetallic hardener) construction. Side slopes of the ramp shall be provided at 1 vertical to 2 horizontal (1:2) and shall be protected with 230 thick rubble stone pitching and pointing with cement mortar (1:2) for protection of slope. Construction and expansion joints in the slab shall be as per IS / IRC codes. Crash barrier / parapet wall and toe drain shall be provided.

The RCC road on ramp shall be minimum 200mm thick and shall be executed with vacuum dewatering process with top and bottom reinforcement and minimum grade of concrete shall be M25. and shall be designed as an pavement as per IRC recommendations. RCC Parapet wall in platforms area (as per requirements). CNS filling well compacted approved borrowed earth suitable for filling to be done. (Proctor density > 95%).

Filling shall be carried out in layers not exceeding 250 mm compacted thickness at Optimum Moisture Content. Each layer shall be compacted to not less than 95% of Maximum Dry Density as determined by the Modified Proctor Test and verified through field density tests at specified frequencies.

RCC paving shall be provided for the truck's movement considering the existing ramp's entry area, round-about(as per bid drawing) for fleet movement vide crisscross movement of the trucks "to and from" both the ramps. The whole area shall be developed and provided by RCC paving for the fleet movement. Sufficient entry and exit areas for the trucks shall also be considered for the paving works. The works shall be designed based on the logistics of the working of the dump yard. RCC paving shall be of heavy duty for supporting trucks for the wheel loads anticipated. Proper drainage system around the paving area shall be provided. The pavement shall be designed in accordance with the latest IRC guidelines considering anticipated axle loads, wheel loads, traffic intensity (MSA), tyre pressure, braking forces, turning movements and operational loading. Pavement design shall include sub-grade improvement, Dry Lean Concrete (DLC) where required, dowel bars, tie bars, joint sealants, expansion joints, contraction joints, load transfer arrangements and surface tolerances.

The layout shall be designed considering turning radius, swept path analysis, queue length, simultaneous truck movement, parking requirements and safe manoeuvring of all anticipated vehicle configurations.

Foundations for high mast lighting towers and lighting poles shall be provided as per



requirements. Foundations for High Mast Lighting Towers and Lighting Poles shall be designed considering wind loads, soil parameters, equipment manufacturer's recommendations, anchor bolt assemblies, earthing provisions, cable entry arrangements and maintenance requirements.

The entire ramp, retaining walls, RCC pavement, foundations and associated Civil Works shall be designed for long-term durability considering abrasion due to heavy truck movement, repeated impact loading, environmental exposure, drainage conditions, differential settlement and ease of maintenance throughout the design life of the facility.

All construction joints, expansion joints, contraction joints, reinforcement detailing, concrete cover, crack control measures, curing methodology and finishing tolerances shall conform to the latest applicable IRC, IS and MoRTH Specifications.

Suitable impact protection measures including sacrificial wearing surfaces, abrasion-resistant concrete, steel edge protection or other approved arrangements shall be provided at locations subjected to repeated impact of lignite and heavy truck operation.

The proposed scheme given is minimum and tentative and shall be finalized during the details engineering stage.

#### **4.2 All equipment foundations like Feeder Breaker, conveyor trestle, take-up structure, Tail pulley, Over ground Hopper, Junction tower / transfer structure etc,**

All equipment foundations including Feeder Breaker, Conveyor Trestles, Take-up Structures, Tail Pulley, Overground Hopper, Junction Towers/Transfer Structures, Head Pulley, Drive Stations, Intermediate Trestles, MCC Building equipment foundations, High Mast Lighting foundations and all other associated equipment foundations shall form part of the BIDDER's scope. The BIDDER shall be fully responsible for carrying out detailed geotechnical investigation, for the complete design, engineering and construction of all foundations based on the approved Geotechnical Investigation Report, equipment manufacturer's data, applicable Indian Standards and site-specific conditions. The BIDDER shall submit detailed design calculations, structural analysis, foundation drawings, reinforcement detailing and construction drawings for approval of the OWNER/ENGINEER prior to commencement of construction. Such approval shall not relieve the BIDDER of the responsibility for the adequacy, safety, stability, serviceability and performance of the foundations.

The foundations shall be designed considering all applicable loads including dead load, equipment operating and maintenance loads, dynamic and impact loads, fatigue effects, wind loads, seismic forces, temperature effects, earth pressure, hydrostatic pressure, construction loads and all relevant load combinations in accordance with applicable IS Codes. The design shall also consider allowable bearing capacity, total and differential settlement, groundwater conditions, uplift, sliding, overturning, durability and long-term serviceability. Foundations supporting



vibrating or rotating equipment shall be designed based on equipment manufacturer's recommendations and detailed dynamic analysis to ensure that the natural frequency of the foundation system remains adequately separated from the operating frequency of the equipment so as to avoid resonance and excessive vibration.

scope shall include all anchor bolt assemblies, templates, embedded plates, inserts, sleeves, block-outs, cable openings, earthing inserts, grouting pockets, non-shrink grouting, drainage provisions and all miscellaneous embedded items required for complete installation, alignment and commissioning of the equipment. No foundation shall be permitted to rest directly on uncontrolled backfill, expansive soil or any unsuitable founding strata. Where unsuitable soil is encountered, the BIDDER shall adopt suitable ground improvement measures or revise the foundation system based on geotechnical recommendations, subject to the approval of the OWNER/ENGINEER.

The final founding level shall be established based on the approved geotechnical investigation report, detailed foundation design and approval of the OWNER/ENGINEER. The top of all structural pedestals shall generally be maintained at 600 mm above Finished Ground Level (FGL) unless otherwise specified or required by the equipment layout. The top surface of pedestals shall be provided with suitable slope and chamfer to prevent accumulation of dust and water around structural columns. Concrete grade, reinforcement detailing, concrete cover, crack-width control, construction joints, durability requirements, curing, construction tolerances and workmanship shall comply with the latest applicable IS Codes, relevant project specifications and good engineering practice. The completed foundations shall be fully ready for installation, alignment, grouting and commissioning of equipment without requiring any modification during erection.

#### **4.3 MCC ROOM (G+1) (Electrical and C&I Building)**

- 1) The MCC Building shall be designed as a G+1 RCC framed structure founded on RCC foundations designed based on the approved Geotechnical Investigation Report and detailed structural analysis. The size of the building shall be finalized during detailed engineering based on the approved system configuration, equipment layout, statutory requirements, operational requirements, future expansion provisions, maintenance clearances, cable routing and accessibility. The building shall be designed considering all applicable dead loads, live loads, equipment loads, crane/lifting loads (where applicable), wind loads, seismic forces, temperature effects and all other relevant load combinations in accordance with the latest applicable IS Codes. Foundations shall be designed considering allowable bearing capacity, differential settlement, groundwater conditions, durability and long-term serviceability.
- 2) The Ground Floor shall accommodate cable vault/basement, cable trenches, staircases and other service utilities, while the First Floor shall accommodate the Switchgear Room, PLC Room, VFD Room, Charger Room, Battery Room and associated electrical and control equipment. The building layout shall ensure adequate maintenance clearances, equipment handling space, emergency escape routes and future equipment additions. An Auxiliary Transformer Yard complete with RCC foundations, oil soak pit, cable trenches, PVC-coated chain-link fencing, gates, drainage system and all associated civil works shall be provided adjacent to the building. External walls shall generally be of Red brick masonry, and the wall facing



- the transformer yard shall be designed with the required fire resistance rating in accordance with applicable statutory requirements, relevant IS Codes and Loss Prevention Association (LPA) guidelines.
- 3) The staircase enclosure shall be designed to satisfy the applicable fire-resistance requirements and shall provide safe emergency egress. The main access door to the Switchgear Room shall be a heavy-duty steel sliding door of adequate dimensions to facilitate movement, installation and replacement of switchgear panels. In addition, the Switchgear Room shall be provided with at least two fire-rated steel doors for emergency exit. Other external and internal doors shall be anodized aluminium glazed doors or flush steel doors as specified in the approved architectural finishing schedule. Windows shall be anodized aluminium sliding type fitted with 6 mm wired/toughened safety glass and insect-proof screens wherever required. A heavy-duty GI rolling shutter with suitable loading platform shall be provided for handling equipment at the First Floor level. Suspended grid-type powder-coated metal acoustic false ceiling shall be provided in the PLC, VFD and Charger Rooms. Adequate under-deck thermal insulation and vapour barrier shall be provided above the false ceiling to minimise heat gain and condensation. The building shall also be provided with all necessary sleeves, inserts, embedded conduits, cable openings, ventilation openings and equipment access openings required for Electrical, HVAC, Fire Protection and Instrumentation services.
  - 4) Access to the roof shall be provided through an RCC staircase with suitable handrails. Another RCC staircase require upto First floor level. The roof shall also be provided with an adequately sized equipment hatch complete with structural lifting beam, lifting hooks and all necessary provisions for safe handling, installation, replacement and maintenance of electrical equipment. Roof access and lifting arrangements shall comply with applicable safety requirements.
  - 5) The RCC roof slab shall be provided with a minimum slope of 1 in 100 towards designated rainwater collection points away from the transformer yard. The roof shall be treated with a high-performance waterproofing system complete with protective screed, fillets and flashings in accordance with the project specifications. Adequately sized heavy-duty Schedule 80 UPVC rainwater downpipes complete with fittings, brackets and cleanouts shall be provided to ensure efficient disposal of roof runoff. RCC garland drains, plinth protection, apron paving and proper surface drainage shall be provided around the building to prevent water stagnation and ingress into the structure.
  - 6) The Auxiliary Transformer Yard shall be enclosed with PVC-coated chain-link fencing complete with lockable gates. Where multiple transformers are installed, RCC firewalls shall be provided between adjacent transformers in accordance with statutory requirements and applicable fire safety standards. Oil soak pits shall be designed considering the full oil capacity of the transformer along with firefighting water and shall be connected to the oily water drainage system through an approved oil-water separation arrangement wherever applicable. The transformer yard shall be provided with PCC/RCC paving over properly compacted subgrade and rubble soling, suitable drainage arrangements, cable trenches, earthing provisions, maintenance access and all associated civil works necessary for safe operation and maintenance.

All architectural finishes including flooring, wall finishes, ceiling finishes, waterproofing, painting, doors, windows, false ceiling and external finishes shall conform to the approved Architectural Finishing Schedule. Suitable RCC steps and/or barrier-free access ramps with non-slip finish shall be provided at all entrances in

accordance with applicable accessibility requirements. All staircases, ramps, platforms and landings shall be provided with hot-dip galvanized steel handrails conforming to the project specifications. The completed building shall be fully functional, weatherproof, fire-safe, durable and ready for installation, testing, commissioning and long-term operation of all Electrical and C&I equipment.

#### **4.4 STORM WATER DRAINAGE**

The storm water drainage (Trapezoidal section with RR PITCHING) shall be planned as per outcome of area drainage study. It is recommended that the drainage for the system shall be designed keeping the natural flow of water to the nearest exit point. A comprehensive drainage system comprising catch water drains, longitudinal drains, cross drains, toe drains and discharge arrangements shall be provided to ensure rapid disposal of storm water and to prevent erosion, ponding and weakening of pavement or embankment.

#### **4.5 WORK FOR BALANCE OF PLANT of Package A: FIREFIGHTING AND PIPING**

- 1) The BIDDER shall carry out complete design, engineering and construction of all Civil and Structural Works associated with the Fire Fighting System, Plain Water Dust Suppression System, Water Supply System, Street Lighting System, RFID System and all other Balance of Plant (BOP) facilities required for successful operation of the New Lignite Feeding System. The scope shall include RCC foundations, pedestals, pipe supports, sleepers, thrust blocks, anchor blocks, equipment foundations, valve chambers, inspection chambers, cable trenches, pipe trenches, crossing arrangements, road crossings, sleeves, embedded items, ducts, pits, catch basins, paving, fencing, access platforms, maintenance walkways, drainage arrangements, earthing pits, lighting pole foundations, High Mast foundations (where applicable), RFID pole foundations, Fire Hydrant foundations, Fire Monitor foundations and all miscellaneous Civil Works required for complete installation, testing, commissioning and operation of the systems.
- 2) The BIDDER shall be responsible for carrying out detailed engineering and shall execute all Civil Works required based on the approved Plot Plan, equipment layout, piping layout, cable routing, statutory requirements and actual site conditions. The scope shall include excavation, backfilling, compaction, dewatering, temporary works, protection and diversion of existing utilities, reinstatement of disturbed roads and paved areas, restoration of landscaping, disposal of surplus excavated material and all incidental works necessary for successful completion of the Project. All foundations, supports and underground structures shall be designed based on the approved Geotechnical Investigation Report and relevant Indian Standards, considering dead loads, operating loads, wind loads, seismic forces, hydrostatic pressure, earth pressure and all other applicable load combinations.

#### **4.6 Cable rack foundation & structure from MCC to Feeder breaker & Feeder to Transfer point**

The BIDDER shall be fully responsible for carrying out detailed geotechnical investigation, for the complete design, engineering and construction of all foundations based on the approved Geotechnical Investigation Report, equipment manufacturer's

data, applicable Indian Standards and site-specific conditions. The BIDDER shall submit detailed design calculations, structural analysis, foundation drawings, reinforcement detailing and construction drawings for approval of the OWNER/ENGINEER prior to commencement of construction. Such approval shall not relieve the BIDDER of the responsibility for the adequacy, safety, stability, serviceability and performance of the foundations.

The foundations shall be designed considering all applicable loads including dead load, equipment operating and maintenance loads, dynamic and impact loads, fatigue effects, wind loads, seismic forces, temperature effects, earth pressure, hydrostatic pressure, construction loads and all relevant load combinations in accordance with applicable IS Codes. The design shall also consider allowable bearing capacity, total and differential settlement, groundwater conditions, uplift, sliding, overturning, durability and long-term serviceability. Foundations supporting vibrating or rotating equipment shall be designed based on equipment manufacturer's recommendations and detailed dynamic analysis to ensure that the natural frequency of the foundation system remains adequately separated from the operating frequency of the equipment so as to avoid resonance and excessive vibration.

scope shall include all anchor bolt assemblies, templates, embedded plates, inserts, sleeves, block-outs, cable openings, earthing inserts, grouting pockets, non-shrink grouting, drainage provisions and all miscellaneous embedded items required for complete installation, alignment and commissioning of the equipment. No foundation shall be permitted to rest directly on uncontrolled backfill, expansive soil or any unsuitable founding strata. Where unsuitable soil is encountered, the BIDDER shall adopt suitable ground improvement measures or revise the foundation system based on geotechnical recommendations, subject to the approval of the OWNER/ENGINEER.

The final founding level shall be established based on the approved geotechnical investigation report, detailed foundation design and approval of the OWNER/ENGINEER. The top of all structural pedestals shall generally be maintained at 600 mm above Finished Ground Level (FGL) unless otherwise specified or required by the equipment layout. The top surface of pedestals shall be provided with suitable slope and chamfer to prevent accumulation of dust and water around structural columns. Concrete grade, reinforcement detailing, concrete cover, crack-width control, construction joints, durability requirements, curing, construction tolerances and workmanship shall comply with the latest applicable IS Codes, relevant project specifications and good engineering practice. The completed foundations shall be fully ready for installation, alignment, grouting and commissioning of equipment without requiring any modification during erection.

#### **4.7 Area development near JNT-13 & Existing Nallah diversion.**

Levelling & Grading of Area near JNT-13. Work also include Diversion of existing drain.

#### **4.8 Pipe rack Foundation & Structure work for cable laying from New MCC to Proposed MCC.**

For foundation Detail refer clause 4.5 above.

## **5. DETAILED SCOPE OF WORK: PACKAGE B**

### **General requirements of Package B:**

- a. Package-B comprises all Civil, Structural, Architectural and associated infrastructure works required for successful implementation, operation and maintainability of the New Lignite Feeding System under Package-A. The works under Package-B shall be fully integrated with Package-A and shall be completed within 12 (Twelve) months from the Effective Date of the Contract or within the overall project completion schedule, whichever is applicable.
- b. Package-B shall be read in conjunction with Package-A and all related Tender Documents. The BIDDER shall carry out detailed engineering considering both packages simultaneously so that the overall layout, grading, drainage, traffic circulation, utility corridors, equipment locations and area development are fully coordinated and optimized. The design shall ensure safe, efficient and uninterrupted operation of the complete lignite handling system without conflict between existing and proposed facilities.
- c. The scope of Package-B shall include all infrastructure required for smooth movement of lignite transportation fleets from the existing transportation route to the stockpile through the weighbridge, movement from the stockpile to both the existing and proposed feeder breaker/dump hopper facilities, fleet tracking arrangements, queue management, safe turning radii, cross-over arrangements, entry and exit lanes, parking/holding areas (where required), emergency access, maintenance access and return movement of vehicles to the existing transportation network. The complete traffic circulation system shall be developed based on detailed traffic engineering, swept-path analysis, expected vehicle configuration, axle loads, traffic volume, turning requirements, operational safety and future expansion requirements.
- d. The BIDDER shall develop the entire area holistically, including RCC roads, ramps, paving, culverts, retaining structures, storm water drainage, grading, slope protection, road furniture, crash barriers, guard rails, kerbs, road markings, traffic signage, illumination, safety barriers, fencing, utility crossings, landscaping restoration and all associated Civil Works necessary for safe, reliable and efficient operation of the lignite feeding system. The layout shall provide adequate manoeuvring space, maintenance access, visibility at intersections, safe pedestrian movement where applicable and compliance with all relevant statutory requirements and applicable Indian Standards.
- e. The quantities, dimensions and arrangements indicated in the Tender Drawings and Specifications are minimum and indicative and are intended only to establish the overall scope of work. During detailed engineering, the BIDDER shall optimize and finalize the layout, dimensions, pavement design, drainage system, infrastructure facilities and associated Civil Works based on detailed surveys, geotechnical investigation, traffic studies, operational requirements, equipment layouts and approved engineering calculations. Any additional Civil, Structural or Architectural Works, whether specifically mentioned or otherwise, that are required for completeness, safety, durability, maintainability, statutory compliance and successful operation of the New Lignite Feeding System shall be deemed to be included within the BIDDER's scope without any additional cost or extension of time to the OWNER.

## **5.1 Weigh Bridge foundation with both side ramp & operator cabin**

### **System Requirements**

Automatic Fully Electronic cell arrangement pit-less-type weighbridges of 80–100 MT Gross Vehicle Weight (GVW) capacity with digital compression load, Weighbridges shall be provided at the designated entry and exit locations of the stockpile/lignite storage area to facilitate automatic weighing of all trucks transporting lignite. Every truck delivering lignite to the stockpile, existing dump hopper, apron feeder area, new feeder breaker/dump hopper or any other designated unloading point shall pass through the weighbridge for recording of gross weight at entry and tare weight at exit, enabling automatic calculation of net material weight. The system shall be integrated with RFID-based vehicle identification, fleet management, automation and data acquisition systems. The BIDDER shall provide all Civil and Structural Works required for complete installation, operation and maintenance of the weighbridge system, including foundations, approach ramps, operator cabin, drainage, cable trenches, pipe crossings, earthing pits, utility ducts, protective barriers, lighting pole foundations and all associated infrastructure.

### **A. Foundations for Seven New Weighbridges (Three number of size 16 m × 3 m & 04 Number for 12 m x3 m size)**

The BIDDER shall carry out complete design, engineering and construction of the weighbridge foundations in accordance with the approved Geotechnical Investigation Report, OEM recommendations and applicable Indian Standards. The design shall consider dead loads, live loads, axle loads, impact loads, braking forces, equipment loads, dynamic effects, wind loads, seismic forces, temperature effects, differential settlement, groundwater conditions and all other applicable load combinations. The foundation shall include anchor bolt assemblies, templates, embedded plates, sleeves, cable trenches, earthing provisions, grouting pockets, drainage arrangements and all miscellaneous Civil Works necessary for complete installation and commissioning. The completed foundation drawings and design calculations shall be submitted for approval of the OWNER/ENGINEER and the Weighbridge OEM before commencement of construction. The finished top level of the weighbridge deck shall generally be maintained at +600 mm above Finished Ground Level (FGL) unless otherwise approved.

### **B. RCC Approach Ramps**

RCC approach ramps shall be provided on both sides of each weighbridge. The pavement shall be designed in accordance with the latest IRC recommendations considering the anticipated axle loads, wheel loads, traffic intensity, braking forces and turning movements of the design vehicles. Unless governed by detailed pavement design, the ramp shall comprise 150 mm thick RCC (minimum M25 grade) pavement executed using Vacuum Dewatering Finish (VDF) with bottom reinforcement of 10 mm diameter bars at 150 mm c/c over 75 mm thick PCC, 230 mm thick rubble soling and 600 mm thick compacted approved borrow earth/CNS filling compacted in layers to not less than 95% Modified Proctor Density. The

pavement shall incorporate contraction joints, expansion joints, dowel bars, tie bars and joint sealing compound as per IRC specifications. RCC guard beams, wheel guides/crash barriers and edge protection shall be provided on both sides of the ramp wherever required. Adequate longitudinal and cross slopes shall be provided to prevent water stagnation and suitable drainage arrangements shall be made around the weighbridge and ramp.

The RCC approach pavement shall be designed in accordance with the latest applicable IRC Guidelines considering the design axle loads, wheel loads, tyre pressure, traffic intensity (MSA), braking forces, turning movements and anticipated operational loading of heavy dump trucks. The pavement thickness indicated in this specification shall be considered as the minimum requirement and the final pavement composition, thickness, reinforcement, sub-base and joint detailing shall be finalized by the BIDDER based on detailed pavement design. Unless otherwise justified by design calculations and approved by the OWNER/ENGINEER, the RCC pavement shall be of minimum M25 grade concrete executed using the Vacuum Dewatering Finish (VDF) process with suitable abrasion-resistant surface finish for heavy-duty industrial applications

### **C. Operator Cabin**

A reinforced cement concrete Operator Cabin having a minimum carpet area of 16 m<sup>2</sup> shall be provided adjacent to each weighbridge. The building shall be designed based on the approved Geotechnical Investigation Report and relevant IS Codes. The cabin shall have RCC framed construction with Red brick masonry walls, RCC roof slab, waterproofing treatment, plinth protection, storm water drainage, heavy-duty Schedule-80 UPVC rainwater downpipes, aluminium doors and windows, adequate ventilation, electrical and communication cable entry provisions and all associated Civil Works. The Finished Floor Level shall be maintained at +600 mm above Finished Ground Level. Internal partitions shall be partly glazed and partly laminated aluminium partitions complete with all necessary fittings and hardware. Suitable provisions shall be made for installation of weighing terminals, computers, printers, UPS, communication equipment, air-conditioning, lighting and other operator facilities. Access to the building shall be provided through RCC steps and/or barrier-free ramps complete with hot-dip galvanized steel handrails. Bidder shall provide one table, one chair & one big size almirah for Each operator cabin.

### **Painting and Finishing**

Internal walls shall receive 12 mm cement plaster finished with two coats of premium acrylic emulsion paint over approved primer. External walls shall receive 20 mm cement plaster incorporating waterproofing compound and finished with weather-resistant exterior acrylic paint. Flooring shall consist of anti-skid vitrified tiles of 600 mm × 600 mm or approved equivalent. The floor construction shall comprise 150 mm RCC slab over 50 mm PCC, 230 mm rubble soling and 600 mm compacted approved fill/CNS unless otherwise governed by structural design. All architectural finishes shall conform to the approved Architectural Finishing Schedule. The completed weighbridge installation shall include all Civil, Structural and Architectural Works necessary for safe operation, maintenance, durability and successful commissioning of the weighing system.

**D. General requirement of weighbridge complex**

The weighbridge foundations and all associated Civil and Structural Works shall be designed in accordance with the recommendations of the approved Geotechnical Investigation Report, applicable Indian Standards and the respective Weighbridge Manufacturer's (OEM) requirements. The completed foundation drawings, design calculations and anchor bolt layouts shall be reviewed and approved by the Weighbridge OEM prior to commencement of construction. Approval by the OWNER/ENGINEER and/or OEM shall not relieve the BIDDER of the responsibility for the adequacy, safety and performance of the foundations.

Suitable RCC wheel guides, crash barriers/guard beams and edge protection arrangements shall be provided along both sides of the weighbridge approaches and deck to protect the weighbridge structure from accidental vehicle impact and to ensure proper vehicle alignment during weighing operations.

The BIDDER shall provide all necessary RCC cable trenches, utility ducts, sleeves, inspection chambers and crossing arrangements between the weighbridge and the operator cabin for routing of power cables, control cables, communication cables, optical fibre cables, earthing conductors and all associated utility services. All underground services shall be suitably protected against mechanical damage and water ingress.

A comprehensive surface and sub-surface drainage system shall be provided around the weighbridge, approach ramps and operator cabin comprising longitudinal drains, catch pits, cross drains and suitable outfall arrangements to prevent water accumulation, erosion, weakening of the pavement foundation and differential settlement of the weighbridge structure.

Separate earthing pits, lightning protection interfaces, cable earthing arrangements and equipment bonding provisions shall be provided for the weighbridge, operator cabin, RFID system and all associated electrical and instrumentation equipment in accordance with the applicable IS Standards and project specifications.

The overall layout shall ensure adequate access for inspection, calibration, maintenance, repair and future replacement of the weighbridge platform, load cells, junction boxes, instrumentation, operator cabin equipment and associated utilities. Sufficient working space shall be maintained around the weighbridge to facilitate maintenance activities without affecting normal truck movement or plant operations.

The completed weighbridge installation, including foundations, approach pavements, operator cabin and all associated Civil Works, shall be designed and constructed to ensure long-term durability under repeated heavy vehicular loading, adverse environmental conditions and continuous industrial operation throughout the design life of the Project. Any Civil Works required for successful installation, operation, calibration, maintenance and future replacement of the weighbridge system, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.



## **5.2 Toilet block with drinking water facilities:**

The BIDDER shall design, engineer and construct complete Toilet Blocks with Drinking Water Facilities at the locations indicated in the approved Plot Plan or as directed by the OWNER/ENGINEER. The Toilet Block shall be a reinforced cement concrete (RCC) framed structure with Red brick masonry walls, designed based on the approved Geotechnical Investigation Report and relevant Indian Standards. The building shall be complete with RCC foundations, superstructure, roofing, architectural finishes, sanitary fixtures, plumbing, electrical works, ventilation, drainage, water supply, septic system, rainwater disposal and all associated Civil Works required for complete and satisfactory operation.

Toilet Block shall be provided with two Water Closets (WC), two urinals, two wash basins, mirrors, liquid soap dispensers, towel holders, coat hooks, waste bins and all necessary sanitary accessories of approved make, colour and quality. Suitable drinking water facilities complete with wash basin, stainless steel drinking water tap, bottle filling provision and all associated plumbing shall also be provided adjacent to or within the Toilet Block.

A minimum 1000-litre UV-stabilized polyethylene overhead water storage tank conforming to IS 12701 shall be provided for each Toilet Block. Where a common overhead tank serves more than one Toilet Block, the capacity shall be designed to meet a minimum of 8 hours water requirement, considering not less than 25 users per Toilet Block, or as determined by detailed engineering. The tank shall be complete with float valve, ball valve, overflow pipe, vent pipe, scour arrangement, access ladder, manhole cover and all necessary fittings.

Water supply piping from the nearest designated source (New PCH or other approved point identified by GIPCL) to the overhead water tank shall be provided using minimum 25 mm (1 inch) Schedule-80 heavy-duty UPVC pipes or larger size as required by hydraulic calculations. Internal water supply piping shall be of heavy-duty CPVC conforming to relevant IS Standards and capable of withstanding a minimum hydrostatic test pressure of 4 kg/cm<sup>2</sup>. Routing of all pipelines shall be finalized during detailed engineering. Wherever pipelines cross roads, drains or other utilities, suitable protective sleeves, encasement, underground crossings or pipe supports shall be provided. All exposed piping shall be adequately supported and protected against mechanical damage and ultraviolet exposure.

All sanitary fixtures, CP fittings, valves and plumbing accessories shall be of approved make and shall conform to the relevant Indian Standards. Suitable floor traps, cleanouts, vent pipes, inspection chambers and manholes shall be provided to ensure efficient operation and maintenance of the sanitary system.

The toilet floor shall be finished with anti-skid vitrified tiles, while walls shall be provided with full-height vitrified wall tiles for ease of cleaning and hygiene. Internal walls shall receive smooth plaster and premium acrylic emulsion paint wherever tiles are not provided. External walls shall receive 20 mm cement plaster incorporating waterproofing compound and finished with premium weather-resistant exterior acrylic paint. The RCC roof shall be provided with approved waterproofing treatment complete with protective screed, fillets and flashings in accordance with the project



specifications. Adequately sized Schedule-80 heavy-duty UPVC rainwater downpipes shall be provided for disposal of roof runoff.

Doors shall be fabricated from heavy-duty painted steel sections complete with approved hardware, locking arrangements and door closers. Windows and ventilators shall be fabricated from minimum 3.0 mm thick anodized aluminium sections fitted with suitable glass and insect-proof screens wherever required. Adequate natural ventilation, exhaust ventilation and daylight shall be provided in accordance with applicable standards.

The Finished Floor Level (FFL) of the Toilet Block shall be maintained at +600 mm above Natural Ground Level (NGL) unless otherwise approved. The floor construction shall comprise 150 mm RCC slab over 50 mm PCC, 230 mm thick rubble soling and 600 mm thick approved compacted borrow earth/CNS filling compacted to not less than 95% Modified Proctor Density, unless otherwise governed by structural design. RCC plinth protection, garland drain and proper surface drainage shall be provided all around the building to prevent water accumulation and deterioration of the foundation.

A suitably designed septic tank and soak pit of adequate capacity shall be provided based on the anticipated occupancy and applicable standards. Complete underground sanitary piping, inspection chambers, manholes, vent pipes and connections between the Toilet Block and septic tank shall form part of the BIDDER's scope. The septic system shall comply with all applicable statutory requirements and shall permit easy inspection, desludging and maintenance.

Barrier-free RCC access ramps and/or steps with non-slip finish shall be provided at all entrances. All ramps, steps and landings shall be provided with hot-dip galvanized steel handrails conforming to the project specifications. Suitable external paving, approach pathway, lighting, drainage and all associated Civil Works required for safe access and maintenance shall also be provided.

The completed Toilet Block shall be fully functional, weatherproof, hygienic, durable and ready for continuous operation. Any Civil, Structural, Architectural, Plumbing or Electrical Works required for complete functionality, statutory compliance, operation and maintenance of the facility, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

### **5.3 Approach Roads**

The BIDDER shall carry out the complete design, engineering and construction of heavy-duty RCC approach roads for uninterrupted two-way movement of lignite transportation vehicles. The minimum carriageway width shall be 10.0 metres unless otherwise required by detailed engineering. The scope shall include construction of RCC approach roads from the existing lignite transportation route to the Weighbridge, from the Weighbridge to the existing stockpile road, from the Weighbridge to the Feeder Breaker/Dump Hopper ramp and from the Dump Hopper ramp back to the existing lignite transportation route, complete with road shoulders, drainage, culverts, road furniture, road markings, crash barriers, signage and all associated Civil Works.



The total length of the above roads is approximately 700 metres and is indicative only for bidding purposes. The actual alignment, length and width shall be finalized during detailed engineering based on the approved plot plan, equipment layout, traffic circulation study and operational requirements. No additional claim shall be entertained on account of variation in road length or alignment within the overall project scope.

The RCC pavement shall be designed in accordance with the latest applicable IRC Guidelines considering the design traffic, cumulative traffic loading (MSA), axle loads, wheel loads, tyre pressure, braking forces, turning movements, impact effects and anticipated operational loading. The road shall be designed for heavy-duty lignite transportation vehicles carrying up to 40 MT payload with a maximum Gross Vehicle Weight (GVW) of 100 MT. The pavement thickness specified herein shall be treated as the minimum requirement, and the BIDDER shall increase the pavement thickness, reinforcement or pavement composition wherever required by the detailed pavement design without any additional cost to the OWNER.

Unless otherwise governed by the approved pavement design, the RCC pavement shall comprise minimum 200 mm thick M25 grade reinforced cement concrete pavement with abrasion-resistant non-metallic floor hardener, executed using the Vacuum Dewatering Finish (VDF) process. Reinforcement shall consist of 10 mm diameter bars at 150 mm centre-to-centre in the bottom layer or as required by design. The pavement shall be laid over 75 mm thick PCC, 230 mm thick rubble soling and 600 mm thick approved borrow earth/CNS filling compacted in layers to not less than 95% Modified Proctor Density. Construction joints, contraction joints, expansion joints, dowel bars, tie bars, joint sealing compound, reinforcement detailing and finishing tolerances shall conform to the latest applicable IRC, MoRTH and IS Specifications.

Adequate camber and longitudinal gradient shall be provided to ensure rapid drainage of surface water. A comprehensive storm water drainage system comprising longitudinal drains, catch pits, cross drains, culverts and suitable outfall arrangements shall be provided to prevent water stagnation, erosion and deterioration of the pavement foundation.

#### Road Shoulders

Road shoulders shall be provided on both sides of the carriageway with a minimum width as per the approved road design. The shoulders shall be constructed using approved compacted earth filling, Granular Sub-Base (GSB) and other pavement layers as required. The finished shoulder shall be maintained at a cross fall of 1 in 30 towards the drainage side to facilitate surface runoff. Suitable edge protection, turfing or stone pitching shall be provided wherever required to prevent erosion of the shoulder. Necessary road edge markings, delineators, reflectors and guardrails/crash barriers shall be provided at curves, embankments, culverts, intersections and other hazardous locations in accordance with applicable IRC standards.

The completed road network shall provide safe, smooth and uninterrupted movement



of heavy vehicles under all operating conditions. Adequate turning radii, visibility at intersections, maintenance access, utility crossings, road lighting interfaces and provisions for future expansion shall be considered during detailed engineering. Any Civil Works required for the completeness, safety, durability, operation and maintenance of the road system, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

#### **5.4 Extension of road to lignite stockpile area for truck movement. (200 meter in length & 7 meter wide)**

The BIDDER shall design, engineer and construct an extension of the heavy-duty RCC road from the proposed approach road to the lignite stockpile area for movement of loaded and unloaded lignite transportation vehicles. The proposed road shall be approximately 200 metres in length and 7.0 metres wide. The indicated dimensions are tentative and for bidding purposes only. The final alignment, length and width shall be finalized during detailed engineering based on the approved plot plan, traffic circulation study and operational requirements without any additional cost to the OWNER.

The road shall be designed in accordance with the latest applicable IRC Guidelines considering the design traffic, cumulative traffic loading (MSA), axle loads, wheel loads, tyre pressure, braking forces and turning movements of heavy-duty dump trucks carrying up to 40 MT payload with a maximum Gross Vehicle Weight (GVW) of 100 MT. The pavement thickness specified herein shall be treated as the minimum requirement, and the BIDDER shall revise the pavement composition, reinforcement and thickness wherever required based on the approved pavement design.

Unless otherwise governed by the approved pavement design, the RCC pavement shall comprise minimum 200 mm thick M25 grade reinforced cement concrete with abrasion-resistant non-metallic floor hardener, executed using the Vacuum Dewatering Finish (VDF) process. Reinforcement shall consist of 10 mm diameter bars at 150 mm centre-to-centre in the bottom layer or as required by design. The pavement shall be laid over 75 mm thick PCC, 230 mm thick rubble soling and 600 mm thick approved borrow earth/CNS filling compacted in layers to not less than 95% Modified Proctor Density. Construction joints, contraction joints, expansion joints, dowel bars, tie bars and joint sealing shall conform to the latest applicable IRC, MoRTH and IS Specifications.

Adequate camber, longitudinal slope and cross fall shall be provided for proper drainage. Longitudinal drains, catch pits and suitable storm water disposal arrangements shall be provided to prevent water stagnation and deterioration of the pavement. Road shoulders, edge protection, road markings, delineators and traffic signage shall be provided wherever required for safe vehicle movement. The completed road shall provide safe, smooth and uninterrupted movement of heavy lignite transportation vehicles under all operating conditions and shall include all incidental Civil Works required for its satisfactory operation, maintenance and long-term durability.



**5.5 RCC box type Culvert (Minimum size L12 m × W10 m × D 2.5 m) -01 Nos designed for truck axle loads 100MT. The size/details are indicative may vary based on requirement.**

The BIDDER shall design, engineer and construct one (01) RCC Box Culvert of minimum clear size 12.0 m (Length) × 10.0 m (Width) × 2.5 m (Depth) or as required by the approved hydraulic and structural design. The dimensions indicated herein are minimum and tentative for bidding purposes only. The final size, number of cells, barrel dimensions, foundation levels and overall configuration shall be finalized during detailed engineering based on the approved drainage study, hydrological analysis, site conditions and operational requirements without any additional cost to the OWNER.

The RCC Box Culvert shall be designed for IRC Class AA Tracked/Wheeled Loading, and shall also be checked for IRC Class A Loading in accordance with the latest applicable IRC Codes. In addition, the culvert shall be designed considering the movement of heavy industrial vehicles having maximum Gross Vehicle Weight (GVW) of 100 MT, impact factors, braking forces, surcharge loading, construction loading and any other operational loads anticipated during the design life of the Project. Structural design of all RCC components shall conform to the latest applicable IS 456, IRC 6, IRC 21, IRC 112, IRC 78, IS 1893 and other relevant Indian Standards.

The design shall consider dead loads, live loads, earth pressure, hydrostatic pressure, groundwater pressure, uplift, differential settlement, seismic forces, temperature effects, load combinations, durability requirements and all other applicable design criteria. The thickness of the base slab, top slab, side walls and other structural components shall be determined based on detailed hydraulic calculations, structural analysis, geotechnical recommendations and the approved design standards.

The culvert foundation shall be designed based on the approved Geotechnical Investigation Report considering allowable bearing capacity, settlement, groundwater conditions and long-term stability. Where unsuitable founding strata are encountered, suitable ground improvement measures shall be adopted subject to the approval of the OWNER/ENGINEER.

The culvert shall be provided complete with approach slabs, wing walls, return walls, curtain walls, toe walls, cutoff walls, headwalls, crash barriers/parapets, kerbs, expansion joints, construction joints, waterproofing treatment, drainage spouts, filter media, weep holes (where applicable), erosion protection, stone pitching, guardrails and all associated Civil Works necessary for safe operation and long-term durability.

Adequate inlet and outlet protection works, energy dissipation arrangements, scour protection, pitching, apron protection and channel training works shall be provided to prevent erosion and ensure uninterrupted flow of storm water. The culvert shall be hydraulically designed to safely convey the design storm runoff without overtopping the roadway or causing upstream flooding.



The completed RCC Box Culvert shall provide safe, durable and uninterrupted passage of heavy-duty lignite transportation vehicles throughout the design life of the Project. Any Civil, Structural or Hydraulic Works required for completeness, safety, durability, maintainability and statutory compliance, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

The top slab of the culvert shall be integrated with the RCC road pavement, and the pavement reinforcement, joints and wearing surface shall be detailed to ensure smooth vehicular movement without differential settlement at the culvert-road interface.

**5.6 Hume pipe culvert- Minimum 20Meter in Length The length are indicative may vary based on requirement.**

The BIDDER shall design, engineer and construct RCC Hume Pipe Culverts complete with all associated Civil Works at the locations indicated in the approved plot plan or as required during detailed engineering. The minimum length of each culvert shall be 20 metres. The indicated length is tentative and for bidding purposes only. The final length, number of pipes, pipe diameter, invert level and overall configuration shall be finalized during detailed engineering based on the approved drainage study, hydrological calculations, road geometry and site requirements without any additional cost to the OWNER.

Unless otherwise required by hydraulic design, the culvert shall comprise 900 mm internal diameter Heavy Duty RCC Hume Pipes (NP4 Class) conforming to the latest applicable IS Codes, complete with RCC collars, jointing in Cement Mortar (1:2) or approved rubber ring joints, as applicable. The BIDDER shall carry out excavation, dewatering (where required), bedding preparation, laying, alignment, jointing, testing, backfilling, compaction and all associated works necessary for complete installation.

The culvert shall be hydraulically designed considering the design rainfall, catchment area, peak runoff, upstream and downstream drainage conditions and shall safely convey the design storm discharge without overtopping of the roadway. The pipe bedding, cradle, haunching, backfilling and compaction shall be designed in accordance with the applicable IS and IRC Standards considering the anticipated loading conditions.

The culvert shall be designed to safely withstand IRC Class AA Loading together with the movement of heavy industrial vehicles having a maximum Gross Vehicle Weight (GVW) of 100 MT. Structural design shall consider earth cover, surcharge loading, impact factors, differential settlement, groundwater conditions and all applicable load combinations in accordance with the latest IRC and IS Codes.

The scope shall include all excavation, PCC bedding, RCC cradle/encasement (where required by design), granular bedding, approved backfilling, compaction to not less than 95% Modified Proctor Density, headwalls, wing walls, cutoff walls, toe walls, apron slabs, inlet and outlet protection, stone pitching, energy dissipation arrangements, erosion protection, filter media, drainage improvements and all miscellaneous Civil Works required for complete, safe and durable installation.



All exposed concrete surfaces shall be finished in accordance with the project specifications. The completed culvert shall provide safe, uninterrupted drainage and shall ensure smooth movement of heavy lignite transportation vehicles without settlement or damage to the roadway. Any Civil, Structural or Hydraulic Works required for completeness, durability, safety, operation and maintenance of the culvert, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

The road pavement over the culvert shall be designed as an integral system with the culvert, and suitable earth cushion, pavement layers, compaction and transition zones shall be provided to prevent differential settlement and ensure smooth movement of heavy vehicles throughout the design life of the Project.

### **5.7 Chain-link fencing (200 m in length)**

The BIDDER shall design, engineer, supply and construct complete chain link fencing around the designated project area as indicated in the approved plot plan. The total length of fencing is approximately 200 metres, which is indicative only for bidding purposes. The final alignment and quantity shall be finalized during detailed engineering without any additional cost to the OWNER.

The fencing shall comprise 1.80 m high PVC-coated chain link fencing fabricated from 10-gauge galvanized steel wire with 8-gauge PVC coating, having a mesh size of 75 mm × 75 mm. The fencing shall be provided with three rows of galvanized barbed wire (Type-B, Tata or equivalent approved make) fixed on inclined extensions projecting 600 mm above the chain-link fence. In addition, three horizontal rows of 12-gauge high-tensile galvanized spring steel wires shall be provided over the full length of the fencing to maintain proper tension and prevent sagging of the chain-link mesh.

The chain-link mesh shall be securely fixed to the fence posts using 50 mm × 6 mm hot-dip galvanized (minimum 126-micron coating) MS flats provided at every fifth post, complete with galvanized nuts, bolts and washers. Suitable tension bars, binding wires, tensioning devices and all fixing accessories required for proper installation shall form part of the BIDDER's scope.

Fence posts shall be fabricated from 65 mm × 65 mm × 6 mm hot-dip galvanized MS angle sections having a minimum galvanization thickness of 126 microns. Posts shall generally be spaced at 2.5 metre centres unless otherwise required by design. End posts, corner posts, gate posts and straining posts shall be suitably strengthened with galvanized stay members. One transverse stay post shall be provided at every fifth post, while corner posts shall be provided with two stay posts. Additional stays shall be provided at changes in direction, level differences and other locations where necessary to maintain the rigidity of the fencing system. Expansion joints shall be provided at intervals not exceeding 60 metres.

Each fence post shall be embedded in an RCC foundation/pile of minimum 300 mm diameter and 1.0 metre depth below Finished Ground Level (FGL) or deeper if required by the Geotechnical Investigation Report. Concrete shall be of minimum



M25 grade. The top of the concrete pedestal shall project at least 200 mm above Finished Ground Level with suitable slope to prevent water accumulation. The exposed concrete pedestal shall be finished with two coats of approved protective epoxy/bituminous coating.

The fencing system shall be designed to withstand the applicable design wind loads and all anticipated service conditions without excessive deflection or permanent deformation. All components shall be properly aligned, tensioned and securely fixed to ensure a neat appearance, structural stability and long-term durability.

Where fencing intersects roads, drains, culverts, pipelines, cable trenches or other utilities, the BIDDER shall provide all necessary modifications, supports, sleeves, offset arrangements and associated Civil Works without affecting the integrity of the fencing system.

Suitable galvanized gates, gate posts, locking arrangements, warning sign boards, identification boards and all miscellaneous accessories required for complete and functional fencing shall be provided wherever indicated in the approved layout drawings.

The completed fencing system shall be rigid, properly tensioned, corrosion-resistant and maintenance-friendly. Any materials, fittings, accessories or Civil Works required for the completeness, safety, durability and satisfactory performance of the fencing system, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

The fencing alignment indicated in the Tender Drawings is tentative and shall be finalized during detailed engineering. The BIDDER shall coordinate the fencing layout with roads, drainage, underground utilities, lighting poles, fire-fighting facilities, equipment foundations and future expansion requirements. Any modification required to achieve an integrated and obstruction-free layout shall be carried out without any additional cost to the OWNER.

## **5.8 Porta cabin (For IT network) : 04 No's**

The BIDDER shall design, supply, transport, install and commission four (04) numbers of weatherproof prefabricated Porta Cabins for IT Network equipment at locations indicated in the approved plot plan or as directed by the OWNER/ENGINEER. Each Porta Cabin shall have a minimum external size of 3.0 m × 3.0 m, unless otherwise required during detailed engineering. The cabins shall be complete in all respects, including RCC foundations, anchoring arrangements, flooring, insulation, electrical works, Network points, earthing, lighting, ventilation, cable entry provisions and all associated Civil Works required for satisfactory operation.

Each Porta Cabin shall be of factory-fabricated modular construction comprising structural steel framework with corrosion-resistant treatment, insulated wall panels, insulated roof panels and heavy-duty flooring suitable for industrial applications. The cabin shall be designed to withstand the applicable wind and seismic loads at the



project site and shall be suitable for continuous outdoor service under the prevailing environmental conditions.

The Porta Cabin shall be mounted on suitably designed RCC foundations based on the approved Geotechnical Investigation Report. The cabin shall be securely anchored to the foundation with approved anchor bolts and hold-down arrangements. The finished floor level of the cabin shall generally be maintained at +600 mm above Finished Ground Level (FGL) unless otherwise approved. RCC plinth protection, external paving and proper surface drainage shall be provided around the cabin to prevent water accumulation.

Each cabin shall be provided with a lockable insulated steel door, aluminium windows with safety glass and insect-proof screens, suitable ventilators, internal wall and ceiling finishes, anti-skid flooring, weatherproof roof, thermal insulation and complete waterproofing to ensure protection against heat, rain and dust ingress.

The electrical scope shall include complete internal wiring, LED lighting fixtures, illumination switchboards, socket outlets, distribution board, earthing system, lightning protection interface (where applicable), cable trays, cable glands and all accessories required for operation of IT equipment. Adequate cable entry sleeves, cable trenches/ducts and utility interfaces shall be provided for incoming power, communication and optical fibre cables. All electrical installations shall comply with the applicable IS Standards and project specifications.

Suitable provisions shall be made for installation of network racks, communication equipment, UPS, switches and associated IT infrastructure. The cabin shall provide adequate working space for inspection, maintenance and future equipment replacement. Natural ventilation and/or mechanical ventilation shall be provided to maintain satisfactory operating conditions for the installed equipment.

Access to each Porta Cabin shall be provided through RCC steps and/or barrier-free access ramps complete with hot-dip galvanized steel handrails. The completed installation shall include all Civil, Structural, Architectural and Electrical Works necessary for safe operation, durability and long-term serviceability. Any materials, fittings, accessories or miscellaneous works required for the completeness and satisfactory performance of the Porta Cabin installation, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

## **5.9 Lignite Stockpile development by Filling fly ash in 150 x150 m AREA**

The BIDDER shall carry out complete design, engineering and development of the proposed lignite stockpile area by filling, spreading, watering, compaction, grading and dressing using fly ash and/or bed ash over an area of approximately 150 m × 150 m. The indicated area is tentative and for bidding purposes only. The final area, filling height, formation levels, slopes and grading shall be finalized during detailed engineering based on the approved plot plan, geotechnical recommendations and operational requirements without any additional cost to the OWNER.



Fly ash and/or bed ash shall be issued free of cost by GIPCL from the designated ash silos. The BIDDER shall arrange collection, transportation in covered/closed vehicles, unloading, handling, spreading, watering, compaction and dressing of the material at the designated stockpile area. Fly ash issue slips shall be issued by GIPCL in duplicate, and one duly signed and stamped copy shall be returned to GIPCL as acknowledgement of receipt.

The filling material shall be spread uniformly in suitable horizontal layers of thickness compatible with the compaction equipment, wetted to the Optimum Moisture Content (OMC) and compacted using suitable rollers to achieve a minimum 95% Modified Proctor Density or higher, as specified by the approved Geotechnical Investigation Report. The layer thickness, moisture content, compaction methodology and number of roller passes shall be established through field trials and shall be subject to approval by the OWNER/ENGINEER.

The completed formation shall be finished to the required line, level, cross-fall and longitudinal slope to ensure proper surface drainage and shall be free from soft pockets, rutting, differential settlement and loose material. The BIDDER shall carry out all necessary field density tests, moisture content tests, level surveys and quality control tests to demonstrate compliance with the approved specifications.

The stockpile area shall be provided with suitable grading, peripheral storm water drains, catch drains, toe drains, erosion protection and all associated drainage arrangements to prevent water accumulation, erosion and deterioration of the filled area. Wherever required, suitable retaining measures, slope protection, turfing or stone pitching shall be provided to maintain long-term stability of the embankment.

During transportation, unloading and spreading of fly ash, the BIDDER shall implement adequate dust suppression measures, including water sprinkling and covering of transport vehicles, to prevent environmental pollution and nuisance. All operations shall comply with the applicable environmental regulations and project safety requirements.

The BIDDER shall be responsible for monitoring settlement of the filled area during construction and shall carry out any regrading, recompaction or rectification required to achieve the specified formation levels prior to handing over the completed works. Any Civil Works, quality control measures, environmental protection arrangements or miscellaneous works required for complete, safe, durable and satisfactory development of the lignite stockpile area, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

- 5.10** The BIDDER shall be responsible for restoration of all existing roads, RCC pavements, pathways, culverts, drains, storm water drainage systems, cable trenches, utility corridors, fencing, landscaping and any other infrastructure disturbed, damaged or dismantled during execution of the works. Restoration shall be carried out to the original condition or better, matching the existing specifications, alignment, levels, strength and finish, to the satisfaction of the OWNER/ENGINEER. Any temporary reinstatement required for maintaining uninterrupted plant operation



during construction shall also form part of the BIDDER's scope. No additional payment shall be made for restoration works.

- 5.11** The BIDDER shall carry out complete design, engineering and construction of all approach roads, transition zones, intersections, cross-over arrangements, turning circles, roundabouts, merging lanes and connecting infrastructure required for seamless integration of the existing lignite transportation system, stockpile area, existing dump hopper, proposed feeder breaker/dump hopper, weighbridge facilities and all associated roads. The layout shall be developed based on detailed traffic engineering and swept-path analysis considering heavy-duty dump trucks having a maximum Gross Vehicle Weight (GVW) of 100 MT. Adequate turning radii, vehicle stacking areas, visibility, safety clearances, road markings, traffic signage, crash barriers and drainage arrangements shall be provided to ensure safe, smooth and uninterrupted fleet movement under all operating conditions.
- 5.12** The BIDDER shall design, construct, maintain and subsequently remove all temporary works required for execution of the Project, including temporary roads, traffic diversions, bypass arrangements, temporary drainage, utility diversions, temporary fencing, barricading, protection works, excavation support systems, dewatering arrangements and all other temporary facilities necessary for safe construction. Any dismantling, shifting, relocation or protection of existing Civil, Structural, Electrical, Mechanical, Instrumentation or utility facilities required for execution of the works shall form part of the BIDDER's scope. Upon completion of the works, all temporary facilities shall be dismantled and the affected areas restored to their original condition or better, to the satisfaction of the OWNER/ENGINEER, without any additional cost to the OWNER.
- 5.13** The BIDDER shall carry out complete design, engineering and construction of all RCC foundations, pedestals and associated Civil Works required for High Mast Lighting Towers, Lighting Poles, CCTV poles, RFID poles, IT Network equipment, communication systems, Fire Fighting System, hydrants, monitors, piping supports, electrical kiosks, junction boxes, cable trays, earthing pits and all other miscellaneous utilities included under the Project. Foundations shall be designed based on the approved Geotechnical Investigation Report, manufacturer's recommendations, applicable Indian Standards and site-specific wind, seismic and operational loading conditions. The scope shall include excavation, dewatering, PCC, RCC, anchor bolts, templates, embedded plates, cable entry sleeves, earthing provisions, grouting, backfilling, compaction, finishing and all incidental Civil Works required for complete installation, testing and commissioning of the respective systems. Any additional foundations or pedestals required during detailed engineering for successful completion of the Project shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.
- 5.14 REST ROOM FOR WORKERS**
- 1) **Scope of Work**
- The scope includes design, construction, finishing, plumbing, electrical works, of Rest Rooms for Workers. The Bidder shall provide all materials, labour, equipment, supervision, and tools necessary for completion as per specifications and drawings.



2) **Location**

The rest room shall be constructed at designated location within the project site as approved by the Engineer-in-Charge.

3) **Design Requirements**

- a) Rest rooms shall be designed to accommodate minimum 50 workers at a time.
- b) Minimum floor area: 2.0 sq.m per person.
- c) Adequate ventilation and natural lighting must be provided.
- d) Separate male and female rest areas.
- e) Provision of drinking water and sanitation facilities nearby.

4) **Civil Construction**

**1 . Foundation**

- a) Foundation shall be RCC foundation design as per soil investigation report.
- b) Minimum concrete grade: M25.

**2 Structure**

- a) Roof shall be with colour coated sheet 0.8 mm. Above plinth column of structural steel.
- b) Red Brick masonry walls Upto cill level (230 mm thick) in cement mortar 1:6.
- c) Plinth height: minimum 600 mm above ground level.

**3 Flooring**

- a) Flooring with IPS flooring.
- b) Minimum thickness: 20–25 mm.
- c) Proper slope for cleaning.

**Floor Construction**

Floor build-up below finished floor is :

- a) 150 mm RCC slab
- b) 100 mm PCC
- c) 230 mm rubble soling
- d) 600 mm good soil (CNS)

**5 Internal Facilities**

The rest rooms shall include:

- a) Benches
- b) Ceiling or wall fans
- c) Adequate LED lighting fixtures
- d) Charging points in sufficient numbers for mobile phones
- e) Dustbins



## 6 Electrical Works

Electrical works shall include:

- a) LED lighting fixtures
- b) Ceiling fans
- c) Exhaust fans if any
- d) Switch boards
- e) Earthing
- f) Wiring using FRLS three core armoured cables

All electrical works shall comply with Indian Electricity Rules and as per relevant section 15 of Electrical system

## 7 Painting & Finishing

- a) Internal walls: 12 mm thick plaster & 2 coats acrylic emulsion paint
- b) External walls: 20 mm thick plaster with water proofing compound & weather resistant exterior paint
- c) Garland drain as well as plinth protection shall be given around the building.

## 8 Other requirements

- a) Fire Protection System shall be complied with latest applicable Indian / American standards / codes, i.e. NBC-2016 (National Building Code Volume 1, Part 4).
- b) Adequate Qty. And capacity Water cooler shall be provided as per requirement with all accessories, like piping, valves, filters.
- c) Waste water and sludge disposal system shall be provided as per applicable guideline.
- d) Nearest One tapping for water shall be provided and all other network shall be done by Bidder.

### 5.15 Transformer room

In to in Dimension of Transformer building shall be 3.6(L)x3.0(W)x3.0(H) meter and near to weighbridge. This shall be RCC structure designed suitably on based on soil report. This Cabin shall be provided with Red brick cladding and RCC roof slab. Plinth protection, storm water RCC drain, Adequate dia. Sch 80 UPVC Heavy duty industrial rain water pipe shall be provided. Roof shall be of insitu RCC Construction and waterproofing treatment as per specifications. Anodized aluminum Door, window & ventilation shall be provided. Bidder shall provide. Main door shall be of M.S 2.0 x 2.4 meter for panel entry. FFL of Transformer room shall be +600mm above FGL. Bidder shall provide pipe sleeves for cable entry /exit & sealing of same shall be with roxtec.



## **Painting & Finishing**

- a) Internal walls: 12 mm thick plaster & 2 coats acrylic emulsion paint
- b) External walls: 20 mm thick plaster with water proofing compound & weather resistant exterior paint

## **Flooring & dado**

Flooring with Anti skid Vitrified tiles (600\*600mm).

## **Floor Construction**

Floor build-up below finished floor is :

- a) 150 mm RCC slab
- b) 50 mm PCC
- c) 230 mm rubble soling
- d) 600 mm good soil (CNS)

Ramp/step shall be provided to entry of building or as per requirements. GI handrail shall provide to all ramp/steps.

## **6. DETAILED SCOPE OF WORK: PACKAGE C**

- 6.1** The BIDDER shall carry out complete design, engineering and construction of the RCC foundation for the Surface Feeder, including pedestals, anchor bolt assemblies, embedded plates, grouting pockets, cable trenches, drainage arrangements, Ramp and all associated Civil Works required for complete installation, testing and commissioning of the equipment.

The foundation shall be designed based on the approved Geotechnical Investigation Report, the Surface Feeder Manufacturer's (OEM) data, applicable Indian Standards and all relevant statutory requirements. The design shall consider dead loads, operating loads, equipment static loads, machine dynamic loads, impact loads, vibration characteristics, fatigue effects, wind loads, seismic forces, temperature effects, erection loads, maintenance loads and all other applicable load combinations.

The dynamic analysis and design of the foundation shall be carried out in accordance with the latest edition of **IS 2974 (Relevant Part)** and other applicable Indian Standards to ensure that the foundation is free from resonance and satisfies the permissible limits of vibration, displacement and rotation under all operating conditions. The natural frequency of the foundation system shall be adequately separated from the operating frequency of the equipment as recommended by the OEM and relevant design standards.

The foundation shall be designed considering allowable bearing capacity, settlement, groundwater conditions, differential settlement and long-term durability. No foundation shall rest on uncontrolled fill, loose soil or expansive soil. Where unsuitable strata are encountered, suitable ground improvement measures shall be adopted after obtaining approval from the OWNER/ENGINEER.



The **top of all RCC pedestals shall be maintained at a minimum elevation of +600 mm above Finished Ground Level (FGL)** unless otherwise approved. The exposed pedestal surfaces shall be provided with suitable slopes/chamfers to prevent accumulation of dust and water. Non-shrink, non-metallic grout shall be provided beneath the equipment base plates in accordance with the OEM recommendations.

The completed foundation shall include all embedded conduits, sleeves, cable entries, earthing inserts, anchor bolts, templates, embedded plates, drainage arrangements, Ramp and miscellaneous items required for successful installation and future maintenance of the Surface Feeder. Design calculations, detailed construction drawings and anchor bolt layouts shall be submitted to the OWNER/ENGINEER for approval prior to commencement of construction. Approval of the drawings shall not relieve the BIDDER of the responsibility for the adequacy, safety and performance of the foundation.

Any Civil, Structural or miscellaneous works required for completeness, durability, safe operation, vibration control, maintenance and successful commissioning of the Surface Feeder, whether specifically mentioned herein or otherwise, shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

- 6.2** The BIDDER shall design, engineer and construct heavy-duty RCC paving around the Surface Feeder to facilitate safe and efficient operation of dozers, front-end loaders, excavators, maintenance vehicles and other plant equipment. The extent and layout of the paving indicated in the Tender Drawings are minimum and indicative only. The final dimensions, configuration and levels shall be finalized during detailed engineering based on equipment layout, operational requirements, maintenance access, traffic movement and the approved plot plan without any additional cost to the OWNER.

The RCC paving shall be designed considering the maximum wheel loads, track loads (where applicable), static loads, dynamic loads, braking forces, turning movements and impact loads generated by dozers, front-end loaders and other heavy equipment anticipated during operation and maintenance. The pavement design shall conform to the latest applicable IRC, IS and MoRTH specifications. The pavement thickness specified under Package-B Road and RCC Paving Specifications shall be considered as the minimum requirement, and the BIDDER shall suitably revise the pavement thickness, reinforcement and pavement composition wherever required based on detailed design calculations.

The RCC paving shall be executed using minimum M25 grade reinforced cement concrete with abrasion-resistant non-metallic floor hardener, Vacuum Dewatering Finish (VDF), reinforcement, joints, dowel bars, tie bars and joint sealing in accordance with the approved pavement design and the detailed specifications of Package-B. The completed paving shall be capable of withstanding repeated heavy-duty industrial loading throughout the design life of the Project without excessive settlement, cracking or surface deterioration.

Adequate surface slopes shall be provided to ensure positive drainage away from the equipment foundations. Suitable surface drains, catch pits and storm water disposal arrangements shall be provided to prevent water stagnation around the Surface Feeder foundation and paved area. The paving shall be integrated with adjoining

roads, ramps, equipment foundations and drainage systems to provide smooth and obstruction-free movement of equipment and maintenance personnel.

The completed RCC paving shall include all excavation, filling, compaction, PCC, RCC, reinforcement, joints, edge beams, drainage, finishing and all incidental Civil Works necessary for safe operation, maintenance and long-term durability. Any additional paving required during detailed engineering for complete functionality, equipment access or operational safety shall be deemed to be included within the BIDDER's scope without any additional cost to the OWNER.

The BIDDER shall also construct a properly designed **earthen ramp** of adequate width, length, bearing capacity and gradient for loading and unloading of lignite using dozers and other heavy earth-moving equipment. The ramp shall be designed considering equipment operating requirements, safe manoeuvring, drainage and erosion protection.

Unless specifically modified herein, all materials, construction methodology, pavement design criteria, reinforcement, concrete grade, joints, quality control requirements and acceptance criteria shall be as specified under the RCC Road and Paving Specifications of Package-B.

### **6.3 Tail pulley foundation:**

The BIDDER shall be responsible for the complete design, engineering, construction, testing and commissioning support of the RCC foundation for the Tail Pulley, including all civil, structural and allied works required for the complete installation and satisfactory operation of the equipment.

The scope shall include, but not be limited to, the following:

1. Detailed assessment of the existing Stacker Reclaimer foundation, including verification of its structural adequacy through analysis and field investigation wherever required before carrying out modification works.
2. Chipping, cutting and dismantling of the existing RCC foundation at required locations without causing damage to the remaining structure. The extent of chipping shall be adequate to expose sound concrete and reinforcement for proper structural integration.
3. Preparation of existing concrete surfaces, including roughening, cleaning, removal of loose concrete, laitance, dust, oil, grease and all deleterious materials to achieve proper bonding between existing and new concrete.
4. Drilling, fixing and anchoring of reinforcement bars into the existing RCC foundation using approved chemical anchoring systems of Hilti/Fischer/Fosroc or equivalent make. Reinforcement shall be designed to achieve full structural continuity between the existing and new RCC works.
5. Application of approved epoxy bonding agent (Nitobond EP or equivalent) at the interface of old and new concrete prior to concreting, strictly in accordance with the manufacturer's recommendations.

Construction of RCC pedestal(s), foundation block(s), tie beams (where required), anchor bolt pockets, embedded plates, inserts, cable sleeves, conduits, drainage



arrangements, non-shrink grout, housekeeping concrete, finishing works and all associated civil works necessary for complete installation of the Tail Pulley.

6. Supply, fabrication and installation of anchor bolt assemblies, templates, embedded steel plates, inserts and fixtures as per OEM requirements. Proper alignment and positioning shall be ensured before concreting.
7. Non-shrink, high-strength cementitious grout shall be provided beneath equipment base plates and around anchor bolts after alignment of equipment, using approved non-shrink grout conforming to the project specifications.
8. The BIDDER shall provide all necessary drainage arrangements, including drain channels, drain pipes, slopes, weep holes and disposal arrangements to prevent accumulation of water around the foundation.
9. All excavation, backfilling, compaction, dewatering (if required), PCC, shuttering, reinforcement, concreting, curing, finishing, testing and protection works shall be included in the scope.

The foundation shall be designed, analysed and detailed considering, but not limited to, the following:

- a) Existing Stacker Reclaimer foundation design and its load-carrying capacity.
- b) Geotechnical Investigation Report.
- c) OEM equipment data and loading details.
- d) Dead loads.
- e) Operating loads.
- f) Belt pull and belt tension forces.
- g) Starting, stopping and braking loads.
- h) Impact and dynamic loads.
- i) Rotating equipment vibration.
- j) Fatigue loading.
- k) Wind loads.
- l) Seismic forces.
- m) Thermal effects.
- n) Erection and maintenance loads.
- o) Accidental load cases.
- p) Load combinations in accordance with applicable IS Codes and relevant international standards.

The foundation shall be designed to ensure strength, stability, durability, serviceability and vibration performance throughout the design life of the Project.

The top level of the RCC pedestal shall be as per requirements of system. It will be decided during detailing.

The BIDDER shall submit detailed design calculations, structural analysis, reinforcement drawings, bar bending schedules, anchor bolt layout, construction methodology and design verification for review and approval before commencement of the work.

Unless otherwise specified herein, all requirements specified under Section 4.2 – Equipment Foundations shall be fully applicable to the Tail Pulley Foundation.

## **(SECTION 2.6.A) LOADS AND LOAD COMBINATIONS**

### **1. GENERAL**

All structures shall be designed for the most critical combinations of dead loads, imposed loads, equipment loads, crane loads, piping loads (static, friction & dynamic) , wind loads, seismic loads, earth pressure and surcharge loads, Hydro static and Hydro dynamic loads, temperature loads. In addition, erection loads, loads and forces developed due to differential settlement shall also be considered.

### **2. DEAD LOADS**

- 1) Dead loads consist of the weights of the complete structure with finishes, fixtures, partitions, wall panels and all equipment of semi-permanent nature including tanks, partitions, roofing, piping, cable trays, bus ducts etc. The content of tanks, etc. shall be measured at full capacity for this purpose.
- 2) The piping loads, cable tray loads and the contents of the tanks, silos, bins and hoppers shall be listed separately so that they can be excluded from dead load when dead loads are acting as stabilising load for uplift.
- 3) The following unit weight of material shall be considered for computation of loads. Loads given in IS: 875 (part-I) shall be made use of for material not listed below. If the adopted /procured material whose unit density is higher than minimum specified below, actual higher density shall be considered.

| <b>Materials</b>                     | <b>:</b> | <b>Unit weight</b> |
|--------------------------------------|----------|--------------------|
| Plain cement concrete                | :        | 24.0 kN /cum       |
| Reinforced cement concrete           | :        | 25.0 kN /cum       |
| Structural steel                     | :        | 78.5 kN /cum       |
| Brick work                           | :        | 19.0 kN /cum       |
| Cement plaster                       | :        | 21.0 kN /cum       |
| Roof Treatment (7 course bituminous) | :        | 0.30 kN /cum       |
| Roof Treatment (9 course bituminous) | :        | 0.40 kN /cum       |
| Floor Finish                         | :        | 24.0 kN /cum       |
| Lignite                              | :        | 12.0 kN /cum       |
| Fly Ash                              | :        | 16.0 kN /cum       |
| Bottom Ash                           | :        | 16.0 kN /cum       |
| Coal                                 | :        | 11.0 kN /cum       |
| Hollow concrete block work           | :        | 15.0 kN /cum       |
| Solid concrete block work            | :        | 18.0 kN /cum       |
| Aerated Concrete Block               | :        | 11.0 kN /cum       |
| Sandwiched colour coated sheeting    | :        | 0.20 kN/sq.m       |
| Colour coated single skin sheeting   | :        | 0.07 kN/sq.m       |

### **3. IMPOSED LOADS**

- 1) Imposed loads in different areas shall include live loads, dust loads, minor equipment loads, cable trays, small pipe racks / hangers, erection loads, operation/ maintenance



loads, etc. The loads considered shall not be less than that specified in IS:875 (Part II). The loads listed hereunder are the minimum loads for the areas involved. Special use areas shall be investigated and loads revised upward as necessary. Floors and supporting members which may be subjected to heavy equipment live loads shall be designed on the basis of the weight of equipment or specifically defined live loads, whichever is greater.

2) The specific minimum floor live loads are listed below

1. Roofs:

- |                |                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| a) Flat Roof   | : 1.5 kN/sqm for accessible roofs<br>: 0.75 kN/sqm for non-accessible roofs<br>: 5.0 kN/sqm for accessible roofs with HVAC equipment etc. |
| b) Sloped Roof | : As per IS:875                                                                                                                           |

3) Main control room/ electrical buildings

- |                      |             |
|----------------------|-------------|
| a) MCC Room          | : 15 kN/sqm |
| c) Cable vault Floor | : 5 kN/sqm  |
| d) Battery Rooms     | : 20 kN/sqm |
| e) Switchgear room   | : 15 KN/sqm |

4) Other Areas

- |                                                            |                                                                                        |
|------------------------------------------------------------|----------------------------------------------------------------------------------------|
| a) For building floors where equipments are located        | : 5.0 kN/m <sup>2</sup> or equipment load (when placed elsewhere) whichever is higher  |
| b) For building floors where equipment are not located     | : 5.0 kN/m <sup>2</sup>                                                                |
| c) Cable rack                                              | : Load due to cables / cable trays – 1.5 kN/m on platform supporting beam              |
| d) Culverts and their allied structures including RC pipes | : As per IRC standard for Class 'AA' loading                                           |
| e) Staircases                                              | : 5.0 kN/m <sup>2</sup> or equipment load whichever is higher.                         |
| f) Toilet blocks                                           | : 2.0 kN/m <sup>2</sup>                                                                |
| g) Precast trench covers                                   | : 5.0 kN/m <sup>2</sup> inside buildings and 10.0 kN/m <sup>2</sup> outside buildings. |



Culverts and allied structures including RCC pipes shall be designed for Class “AA” loading and checked for Class “A” loading as per IRC standards for two lane road and above.

- 5) Covers for trenches & channels, which are not exposed to vehicular traffic, shall be designed for live load of adjoining area or 2 t/sqm whichever is higher. Where channels are likely to be exposed to vehicular traffic, the requirements of code of practice for road bridges shall be adhered to.
- 6) Ponding effects due to framing deflections for roofs, if any shall be considered.
- 7) In addition to the live loads, a minimum of 0.50 kN/sqm shall be considered as Hung loads for electrical, ventilation & air conditioning. Load of 1.0 kN/sqm shall be considered as Hung loads for piping unless otherwise mentioned.
- 8) Live load reduction shall be in accordance with the provisions of IS:875 and IS:1893 in case of seismic analysis.

#### **4. EARTH PRESSURE LOADS**

- 1) Earth pressure for all underground structures shall be calculated using coefficients of earth pressure at rest, coefficient of active or passive earth pressure (whichever is applicable).
- 2) In addition to earth pressure and ground water pressure, etc. a minimum surcharge load of 20kN/m<sup>2</sup> shall also be considered for the design of all underground structures including channels, sumps, cable and pipe trenches, etc. to take into account the vehicular traffic in the vicinity of the structure.
- 3)

#### **5. WIND LOAD**

- 1) Wind load on structures shall be calculated as per provisions of IS:875 (part 3). The basic wind speed shall be considered as 50m/sec. The wind shall be assumed to blow in any direction and most unfavourable condition shall be considered for design.
- 2) In design of structures, wind force on equipments supported on frame including all fixtures, piping, staircases, ladders, handrails, etc. shall also be considered.
- 3) Wind loading as per is: 15498 shall be considered for wind governing tall structures in case of coastal areas.

#### **6. SEISMIC LOADS**

- 1) Criteria for design shall be as governed by Part-1 and part-4 of IS: 1893.
- 2) For all the structures fall under category 2 and 3 as per Table-6 of IS : 1893 Part-4, if the project is located in seismic Zone III, IV and V, site specific design spectrum shall be arrived at based on site specific earth quake parameter studies.

- 3) Importance factor for all structures shall be taken as per IS 1893: Part 4.
- 4) Detailed dynamic analysis shall be performed using Time History method or Response spectrum method. Analysis shall be performed using design spectrum specified in above clause 6.2. and earthquake design forces shall be arrived as per IS1893 part 1 and part 4 appropriately depending on the type of structures.

## **7. TEMPERATURE LOAD**

- 1) Expansion and contraction due to changes of temperatures of materials of a structure shall be considered and adequate provisions shall be made for the effects produced (as per provision in relevant IS codes). Suitable expansion joints shall be provided in the longitudinal direction wherever necessary with provision of twin columns. The maximum distance of the expansion joint shall be as per the provisions of IS:800 and IS:456 for steel and concrete structures respectively.
- 2) Analysis shall be carried out for ambient temperature variation. The temperature variation shall be considered as 2/3 of average maximum annual variation in temperature. The average maximum annual variation in temperature for this purpose shall be taken as the difference between the mean of the daily minimum temperature during the coldest month of the year and mean of daily maximum temperature during the hottest month of the year. The structure shall be designed to withstand thermal stresses due to 50% of the temperature variation.
- 3) Coefficient of thermal expansion of steel shall be taken as per IS:800. Coefficient for thermal expansion for concrete shall be taken as per IS:456.

## **8. EQUIPMENT LOADS**

- 1) Static and dynamic loads of major equipments. shall be based on the manufacturer's data of the specified equipments and shall be considered in design in addition to the live load. However, where the uniform floor live load adequately accounts for the equipment moving weight, the weight of such equipment as a dead load shall not be considered e.g. switchgear and control room floors are usually designed for a live load that includes the equipment weight.
- 2) All equipment, tanks and piping design loading shall include hydraulic test loading. Weight of equipment, ducts, tanks, pipes, conduits, etc. supported by structure shall include maximum possible loading conditions i.e. flooded conditions and associated impacts, test loading, anchorages and constraint effects.
- 3) Air and gas duct loads shall include weight of insulation, duct attachments, dust accumulation loads, seismic, wind and other loads applicable.

## 9. OTHER LOADS

- 1) Stresses imparted to structures due to differential settlements, variation of water table, erection and maintenance loads, creep and shrinkage shall also be considered in design of all structures.
- 2) In order to allow for unusual loading during steel member erection or during the construction period, all beams on major column lines acting as column struts or ties shall be designed to withstand an axial force of 45t in combination with the dead load of the beam. End connections on these beams are designed to transfer its axial load. Minimum of 12mm thick connection angle shall be provided unless thicker angles are required by design.

## 10. BASIC LOAD CASES

The following basic load cases shall be considered for the analysis:

|       |                                    |   |     |
|-------|------------------------------------|---|-----|
| i)    | Dead load                          | : | D   |
| ii)   | Self Weight of permanent equipment | : | EL  |
| iii)  | Live load on floor/walkway         | : | L   |
| iv)   | Live load on roof                  | : | LR  |
| v)    | Crane load with lift               | : | CR1 |
| vi)   | Crane load without lift            | : | CR2 |
| vii)  | Wind load                          | : | WL  |
| viii) | Seismic load                       | : | SL  |
| ix)   | Load due to soil pressure          | : | SP  |
| x)    | Load due to surcharge              | : | SCL |
| xi)   | Load due to hydrostatic pressure   | : | HP  |
| xii)  | Load due to temperature            | : | TL  |
| xiii) | Special loads                      | : | SPL |

## 11. LOAD COMBINATIONS

- 1) The individual members of the frame shall be designed for worst combination of forces such as bending moment, axial force, shear force and torsion. Permissible stresses for different load combinations shall be taken as per IS:875 (Part-V) and other relevant IS codes. Wind and seismic forces shall not be considered to act simultaneously.
- 2) Criticality of erection / maintenance loads shall also be checked separately in combination with other simultaneously occurring loads for possible design loading.
- 3) For design of main plant structures during seismic conditions, the deareator feed water tank shall be considered full, up to operating level. However for other load combinations flooded condition shall be assumed.
- 4) "Lifted load" of crane shall not be considered during seismic condition.
- 5) In case more than one crane is provided and Tandem operation is not envisaged, the load shall be taken as one crane fully loaded and second crane without lifted load but standing idle adjacent to first crane.



## **(SECTION 2.6-B) GENERAL REQUIREMENTS**

### **1. GENERAL**

- 1) Design and construction of buildings, structures etc. shall consider requirements for operation and **maintenance** of all equipment and its users. The buildings shall have good architectural features. The surrounding areas shall be properly micro levelled and graded.
- 2) **Architectural Concept for Buildings**

The architectural design concept of buildings shall be evolved considering the functional, technical and other requirements for efficient operation, ensuring proper lighting and ventilation for comfortable working environment for personnel, satisfying the aesthetic requirements. Special care shall be taken to provide elegance and aesthetics, with effective use of appropriate treatment, materials, fittings and finishes. To achieve above objective BIDDER shall employ a qualified architect/architectural firm to carry out all designs and hold all other architectural responsibilities for the project.

The BIDDER shall obtain and be conversant with all laws, by-laws and regulations of local and Statutory Bodies as applicable to the project. The architectural concept evolved should also take care of these requirements. The BIDDER shall provide the drawings and documents for such statutory approvals.

### **2. ROOF ACCESS**

All roofs shall be provided with Two access one with staircase of RCC/Structure & second is with cage ladder.

### **3. PLATFORMS AND WALKWAYS**

- 1) Platforms shall be provided to all equipment wherever necessary, which are not directly accessible from the floors, for maintenance. Platforms and connecting walkways shall have a minimum width of 750 mm. Platforms in front of the entry shall be at least 1200 mm wide. Platforms located close to each other shall be connected with walkways.
- 2) All steel platforms above grade level shall be constructed with kick plates at edge of the platform to prevent tools or materials from falling off. It shall consist of minimum 8 mm thick steel plate projecting 100 mm above the platform surface.
- 3) Continuous walkway, at least 1000 mm wide shall be provided along the crane girder level with handrails on both sides of the building. Approach to EOT crane shall be ensured by staircase.

### **4. STAIRS AND LADDERS**

#### **1) Steel Stairs**

All steel staircases shall normally have minimum clear width (back to back of stringer) of 1200 mm and maximum inclination with horizontal of  $35.75^{\circ}$ . However, in case of space restriction, minimum clear width upto 750 mm and slope upto  $45^{\circ}$  may be provided. The vertical height between successive landings shall not exceed 3 m.



Treads shall be minimum 250 mm wide of grating, with suitable nosing, and spaced equally so as to restrict the rise to maximum 180 mm (200 mm in exceptional cases).

## **2) Stair Treads And Nosing**

Solid stair treads and risers for the two main access stairs shall be minimum 750 mm wide raised pattern chequered plate, 8 mm thickness. The treads and riser shall be formed in one piece and supported on and bolted with countersunk bolts to angle brackets welded to stringers. Solid stair treads shall be shop painted.

- 3) Grating stair treads shall be rectangular type electro forged grating as described above. Treads shall have two 1.5mm holes at each end for securing treads to stair stringer with 10 mm machine bolts and nuts.
- 4) Each grating tread shall be provided with an applied cast iron nosing, which is minimum of 32 mm wide, and with abrasive granules.

## **5) Steel Ladders**

Ladders shall be provided to platforms, walkways, instruments and equipment, which do not require frequent access. Ladders shall preferably be vertical and its angle with vertical shall not exceed 5°. Ladders shall be of minimum 450 mm clear width with 20 mm diameter MS rungs spaced at 300 mm (maximum).

Ladders shall be provided with a safety cage of minimum 750 diameter clear when the top of ladder is more than 4.5 m above the landing level. Safety cages shall start at 2.5 m above the lower landing level.

## **6) RCC Stairs**

All stairs shall have maximum riser of 180 mm and a minimum tread of 250 mm. However, for public buildings riser shall be limited to 150 mm and tread width of 300 mm. Minimum width of stairs shall be 1200 mm generally. All stairs normally shall have not more than 15 risers in one flight. Aluminium angle nosing with minimum 50X25X3 angle shall be provided for edge protection of RCC stairs.

## **5. HANDRAILS & GRATINGS**

- 1) All handrails shall be of 32mm nominal bore medium class GI pipes. Handrails for platforms, walkways and projections shall be a two-rail system with the top rail 1000mm above the walkways surface and the intermediate rail 450mm below the top rail. Handrail post spacing shall be limited to 1500mm as far as possible but can be proportioned to the length of the protected horizontal opening. In such a case spacing shall not exceed 1850mm centre to centre of posts.
- 2) All handrails shall be constructed with kick plates at bottom. It shall consist of 100 mm wide minimum 8mm thick steel plate. Handrails shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Each length is to be



joined by internal ferrules or by butt-welds and all joints shall be neatly finished by the removal of all burrs, and grinding flush with the tube surfaces.

- 3) For RCC stairs, handrails with 20 mm square MS bar balustrade with suitable MS flat & PVC handrail shall be provided, unless specifically mentioned otherwise.
- 4) Floor grating
- 5) All gratings shall be electro-forged GI grating, manufactured in accordance with applicable Indian standard. Specification for electro forged GI grating for floors, platforms, stair landings and other locations shall be as given under:
  - a. Load Bearing Bar: 30x5 mm, Plain C/C 30 mm.
  - b. Cross Bar: Square twisted bar 6mm, Across C/C 100 mm.
  - c. Frame Bar: 30x6 mm Plain.
  - d. Finish: Hot dip galvanized (150 micron)

All walkways, approach areas, and platforms—whether using gratings or chequered plates—must be designed with a robust support system to prevent sagging or bending. The following minimum structural requirements apply:

- 1.0 Primary Support: Direct support members must be provided at a maximum interval of 1.0 meter, utilizing a minimum section of ISMB 150. Secondary Bracing: At least one ISA 75 x 75 x 8 mm cross-brace must be installed between the ISMB members within every 1-meter span.
  - 2.0 Direct Contact: These primary supports and secondary cross-braces must directly support the underside of the grating or chequered plate.
  - 3.0 These requirements are specifically intended to ensure the local stiffness of the flooring and are in addition to any structural members required for overall stability or global load distribution
- 6) Cross bar shall be press welded into un punched bearing bar by electro forged method. Welding of frame bar to bearing bar shall be done full at all four corners and at every fourth bearing bar.
  - 7) Floor grating shall be neatly cut and banded around all openings. Unless Otherwise indicated, banding will form 00 mm high curb. Grating at head of stair runs shall have an applied cast iron abrasive surfaced nosing similar to that specified for stair treads.
  - 8) Grating panel shall be removable and will have the bars of adjacent panels aligned.
  - 9) Grating shall be anchored to supports with bend clip fasteners secured to threaded studs field welded to the supporting members. Two clips at each end of each panel and clip (staggered) at each intermediate support will be provided.
  - 10) Penetrations through grating and floor plates that are not shop fabricated (generally openings under 500 mm in nominal size pipes and for conduits etc.) are to be cut in the field as required. Such openings shall be neatly trimmed concentric with the penetration or as required to provide for movements. Generally,



50 mm clear will be left for insulation and 25 mm clear at bare metal. Openings may be ganged where accepted by the PURCHASER/Consultant.

- 11) Openings under 150mm in maximum dimension may be squared off. All grating openings shall be kick plated for bender to match the shop fabricated work.

## **6. EDGE PROTECTION**

- 1) Wherever possible around floor openings an RCC kerb of 100 mm wide 250 mm high shall be provided from the finish floor level. All concrete edges, where breakage of concrete corner is expected, shall be provided with angles at least L75x75x6 with lugs for edge protection e.g. all round the cut-outs/openings in floor slab, edges of drains supporting grating covers, edges of RCC cable/pipe trenches supporting covers, edges of manholes supporting covers and supporting edges of precast covers etc.

## **7. ANCHOR BOLTS AND INSERT PLATES**

- 1) Anchor bolts shall be designed for working stress, in tension and shear, for embedded length of the anchor bolts and pipe sleeves. Shear and crushing strength of concrete shall also be checked. Increase in allowable stress for loading including seismic and wind loads shall not be permitted in design of anchor bolts.
- 2) Insert plates shall be designed/checked for shear and bending moment. All lugs shall be checked for tension. Bond strength of concrete shall also be checked. Lugs using steel bars shall preferably be fillet welded to the plate to transfer full strength of the lug.

## **8. VERTICAL HEADROOM**

- 1) All accessible areas shall be provided with a minimum clear headroom as follows, unless otherwise specified:

|                                                                  |   |         |
|------------------------------------------------------------------|---|---------|
| Doors, Walkways, Platforms, Stairs etc.                          | : | 2100 mm |
| Safety cage for ladders                                          | : | 2500 mm |
| Main road crossings & crane access                               | : | 8000 mm |
| Other plant roads and truck access                               | : | 7000 mm |
| Cable & Pipe rack                                                | : | 3000 mm |
| (Except Road crossings) and designated areas for crane movement) |   |         |

## **9. EXPANSION / CONSTRUCTION JOINTS**

- 1) Expansion and construction joints shall be provided wherever required. All expansion and construction joints of water retaining structures in RCC shall be made watertight using PVC ribbed water stops with central bulb. However, kicker type (externally placed) PVC water stops may be used for the base slabs and in other areas where it is required to facilitate concreting. The minimum thickness of PVC water stops shall



be 6 mm and minimum width shall be 225 mm. At other joints these shall be 150 mm wide.

- 2) Two-part polyurethane sealant conforming to IS: 12118 shall be used for sealing of joints in contact with water. Minimum 25mm thickness of Sil Flex Pre-moulded Compressible Filler Board in black colour, manufactured by The Supreme Industries Limited (or equivalent), conforming to M.O.R.T.H\* specification (clause 1015), having minimum density 95 Kg/Cu.Mt, Non Staining with less than 1% water absorption & compression recovery of 93% minimum shall be used as joint filler..

## **10. BRICK MASONRY AND PARAPET WALL**

- 1) All masonry works shall be designed in accordance with IS: 1597, IS: 1905, IS: 2212, IS: 4326 and other relevant IS codes as applicable. Structural design of load bearing and non-load bearing walls constructed with Red bricks satisfying the requirements of IS 1077.
- 2) All walls shall be non load bearing infill panel walls. External walls of all buildings shall be at least one brick thick. All internal walls shall be at least one brick thick except for internal partition walls for office area, change rooms, first aid rooms and toilets, which may be half brick thick.
- 3) 50 mm thick DPC (1:1.5:3) with water proofing admixture shall be provided at plinth level top of DPC shall be applied 2 coats of bitumen @ 1.8 Kg/Sqm before starting masonry work.
- 4) Average 50 kg/sq.cm compressive strength brick shall be used for super structure brickwork. Cement sand mortar 1:5 for one brick thick wall and 1:4 for half brick thick wall shall be used. Half brick walls shall be constructed as per technical specifications.
- 5) Type, thickness and height of external wall, facing the transformer yard to take care of fire accidents in transformer yard shall be according to the requirements of LPA.
- 6) Even where metal cladding is specified, for initial 3 m height from the ground level, minimum one brick thick masonry wall shall be provided.
- 7) All up stands and parapet walls on roof shall be of RCC construction, minimum height of parapet walls shall be 1000 mm and thickness minimum 125 mm.

## **11. DRAINAGE**

### **1) Floor drainage**

- a) For all buildings and areas, suitable arrangement for draining out water collected from equipment blow downs, leakage, floor washing, fire fighting, etc. shall be provided on each floor. Gully traps, inspection pits, collecting pits etc. shall be located suitably and designed considering flow volume, easy access, maintenance and safety. All the intermediate floors shall be provided with proper drainage. These floors shall be checked for leakage of water before application of floor finish and if at all any leakage is observed, any leakage of water shall be prevented by grouting.



Catch pit with C.I grills shall be provided near the internal column in a regular pattern and the floor shall be sloped towards the catch pit by varying the thickness of the bedding concrete for the floor finish. Catch pits shall be at the same co-ordinates for all floor levels. GI pipe of adequate size shall be provided to carry the drainage down from each intermediate floors.

- b) All pits inside the building, drains shall have heavy duty minimum 40 thick grating covers. In areas where heavy equipment loads would be coming, precast RCC covers shall be provided in place steel grating. These drains shall lead the water to drain sump.
- c) RCC Garland drains shall be provided around all buildings to receive the drainage water from roof and intermediate floor and lead them to the plant storm water drainage system.

## 2) Roof drainage

- a) Roof drainage system shall be provided for quick and efficient draining of rainwater from roof to avoid seepage and damage to roof. The runoff gradient for the roof shall not be less than 1 in 100. Roof drainage system shall consist of roof drain heads, rainwater down take pipes and fixtures. System shall be designed to handle design requirements for the specific site and shall be in accordance to stipulations of IS: 1742 and IS: 2527. Roof drains shall conduct water to storm drains through down take pipes.
- b) Rain water down take pipes shall be Sch 80 UPVC (heavy duty industrial grade) pipe of adequate size and number.

## 12. WATERPROOFING OF UNDERGROUND STRUCTURES

All underground structures like foundations, pedestals, plinth beam, tie beam, basements, sumps, pits, trenches etc. shall have plasticiser cum waterproofing cement additives conforming to IS: 9103. In addition, limits on permeability as given in IS: 2545 shall also be met with. The concrete surface of these structures in contact with soil shall be provided with minimum two coats of bituminous painting of grade 85/25 conforming to IS: 702 @ 1.7 kg/sq.m (minimum) for water / damp proofing. Also provision shall be made on the inner surface of walls and base slab, so that water proofing grouting can be injected later in case of leakage.

## 13. ANTI TERMITE TREATMENT

Pre-constructional anti-termite treatment shall be given to all vulnerable areas susceptible to termite attack and shall include column pits, wall trenches, foundations, filling bellow the floors etc. as per IS: 6313 and as per the General specifications such as but not limited to MCC room, toilet block etc.



#### **14. PLINTH LEVEL**

Finished floor level (plinth level) of all buildings shall be +600 mm above FGL. The ground floor of all the buildings shall be provided with 150mm thick RCC slab on 50 mm thick PCC over 230mm thick rubble soling with below 600mm compacted CNS filling. RCC Garland drain as well as plinth protection shall be given around the all buildings.

#### **15. STATUTORY REQUIREMENTS**

- 1) All the applicable statutory rules pertaining to Indian Factories act, Factory rules of state government, Fire safety rules of LPA, Water act of Pollution Control Boards, Explosives act etc. and stipulations of other relevant statutory authorities shall be taken into consideration at the time of design.
- 2) Provisions of safety, health and welfare according to Factories act shall be complied with design stage. These shall include provision of continuous walkway (minimum 1000 mm wide) along crane-girder at crane girder level on both sides of the building, comfortable approach to EOT crane cabin, railings, fire escape, locker room for workmen, pantry, toilets, rest room etc.
- 3) Adequate number of fire escapes shall be provided in a building. Fireproof doors, number of staircases, fire separation walls, lath plastering on structural steel member (in fire prone areas) shall be made according to the recommendation of LPA. For fire safety requirements of buildings IS: 1641 and IS: 1642 shall be followed in addition to TAC requirements. All masonry firewalls shall be minimum 345 mm thick and RCC firewall shall be minimum 200 mm thick.

#### **4) QUALITY CONTROL**

Bidder shall establish fully equipped quality control laboratory at site to conduct all acceptance test on all construction materials, concrete cube test, compaction of soil testing. This shall be housed with covered buildings. All testing equipment like Owen, Electric operated cube testing equipment, sieves for grading of sand and aggregates, flakiness and elongation index testing sieve, density of aggregates, abrasion testing equipment, impact testing equipment, bitumen testing equipment like thermometer, Marshall test apparatus. Other apparatus like cube moulds, sump cones. Vicat apparatus, moisture meter, dry film thickness gauge meter.

- a) Bidder shall arrange for design mix of concrete for each grade of concrete from GIPCL approved laboratory or NABL (National accreditation board for testing and calibration laboratories)
- b) Bidder shall arrange for gradation mix for road works-Murram, granular subbase, Wet mix macadam, Water Bound macadam, dense bitumen macadam, bituminous coarse etc.
- c) All testing equipment's shall be periodically calibrated to the satisfaction of owner and as per manufacturer manual and instruction.
- d) Bidder shall submit & get approval from OWNER for field quality plan for all construction material & all civil activity (concrete, excavation, backfilling, masonry, plaster, Road work etc) as per relevant IS Code.

## **(SECTION 2.6-C) REINFORCED CONCRETE STRUCTURES AND FOUNDATIONS**

### **1. GENERAL**

All structures, building foundations, machines / equipment foundation, water retaining structures, trenches, pits, etc. shall be designed as per latest relevant IS codes in general. Construction in general shall follow provisions of IS: 456 and IS:3370 for normal and water retaining structures.

### **2. DESIGN METHODOLOGY**

#### **2.1. General**

1. All designs of RCC structures shall be carried out by limit state method as per IS: 456 unless use of working stress method is specifically mentioned. Design strength of materials and design loads shall be calculated using appropriate partial safety factors over characteristic strength and characteristic loads as per IS: 456.
2. For reinforcement detailing IS:5525 and SP:34 shall be followed.
3. The walls shall be provided with reinforcement on both faces for sections 150 mm or more, even if not required from design consideration.

#### **2.2. Foundation and Underground Structures**

##### **General**

1. Type of foundation system, i.e. isolated, strip, raft or pile shall be decided based on the loading arrangement, load intensity and soil strata. Design of foundations at various levels shall be dependent upon the soil bearing capacity at that level.
2. Foundation system adopted shall ensure that settlement / relative settlement is as per provision of IS:1904 and other Indian Standards. However, the settlement shall be restricted to a lower value, if necessary as per the system requirement.
3. As per the Geotech investigation recommendations, soil and ground water is aggressive in chloride content and all foundations and underground structures coming in contact with soil shall be provided with two coats of bitumen painting. The bitumen painting shall be minimum 600 microns thick and shall extend 150mm above the finish ground level. Clear cover to foundations and underground structures in contact with soil shall be minimum 50mm. Corrosion Resistant steel shall be used as per recommendations. Minimum thickness of blinding concrete shall be 100mm of grade M15.
4. All foundation including machine / equipment foundations shall be of RCC construction. All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian standards IS: 2974 and IS:456. Raft foundations shall be designed as per IS:2950. All underground cable trenches and pits shall be water proof.



5. For design of underground structures, subsoil water level shall be assumed at the grade level. All underground pits, tunnels, basements, cable and pipe trenches, etc. shall be designed as leak proof RCC structure, where depth of ground water table so warrants. Effects of uplift and reduction in bearing capacity due to underground water table shall also be considered.

### **2.3. Machine Foundations**

The design of machine / equipment foundation shall be as per IS:456 and IS:2974. The provisions of DIN 4024 shall also be followed for machine foundations.

1. All machine / equipment foundations and structures subject to vibrations shall be suitably proportioned so that amplitude and frequency of the foundation / structures are within permissible limits.
2. All block foundations resting on soil or piles shall be designed using the elastic half space theory. The mass of the RCC block shall not be less than three times mass of the machine. Dynamic analysis shall be carried out to calculate natural frequencies in all modes including coupled modes and to calculate vibration amplitudes. Frequency and amplitude criteria as laid down by the relevant codes or machine manufacturers shall be satisfied. Minimum reinforcement shall be governed by IS: 2974 and IS:456.
3. For the foundations supporting minor equipment weighing less than one ton or if the mass of the rotating parts is less than one hundredth of the mass of the foundation, no dynamic analysis is necessary. However, if such minor equipment is to be supported on building structures, floors, etc. suitable vibration isolation shall be provided by means of springs, neoprene pads, etc. and such vibration isolation system shall be designed suitably.

### **2.4. General Requirements**

#### **2.5. Increase in Stresses**

1. Where stresses due to wind (or seismic) and temperature are combined with those due to other loads, the allowable stresses in concrete and reinforcement steel shall be increased by 33.33% in case of working stress design.
2. Bearing capacity of the soil/ pile shall be allowed to be increased by 25 % under seismic/ wind load condition.

### **3. Stability of Structures**

- 3.1. All building sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combination of loads. Factor of safety for these cases shall be taken as mentioned in IS: 456 and other latest relevant IS codes. However following minimum factor of safety shall be followed:



- a) Factor of safety against overturning due to wind, seismic or other lateral load shall be 1.5 minimum
- b) Factor of safety against sliding shall be 1.5 minimum
- c) Factor of safety against uplift due to hydrostatic forces shall be 1.2 and due to any other loads shall be 1.5.

**3.2.** Stability of the structure shall also be investigated for loading conditions during construction, repair or other temporary measures. Lower factor of safety may be used for such loading conditions as per relevant IS codes.

**3.3.** In cases where dead load provides the restoring force, only 0.90 times characteristic dead load shall be considered. Imposed loads shall not be considered as restoring force.

#### **4. MINIMUM THICKNESS OF CONCRETE STRUCTURAL ELEMENTS**

**4.1.** The following minimum thickness shall be followed:

- a) Suspended floor / slab / walkways /canopy slabs, etc. : 125mm
- b) Ground floor slab (non-suspended) :150mm
- c) Water Retaining slabs / walls :200mm
- d) Cable/pipe trenches/underground pits/  
Launder walls and base slab : 125mm
- e) All footings (including raft foundations) : 300mm
- f) Parapets : 125mm
- g) Sunshades : 75mm at edge
- h) Precast louvers / fins : 50mm
- i) Precast trench cover slabs / floor slabs / louvers : 75mm
- j) Paving : 100mm
- k) pile cap : 500mm
- l) Basement walls and base slab : 200mm
- m) Underground sumps ,pits
  - i. Below ground water table : 200mm
  - ii.Above ground water table : 150mm
- n) Silo / bin walls : 200mm

**4.2.** From fire resistance point of view minimum thickness of reinforced concrete members shall be as per fig.1 or Table 16A of IS: 456.

#### **5. MINIMUM HEIGHTS FOR PEDESTALS OF STEEL COLUMNS**

**5.1.** Pedestals to Steel Columns for building structures:

Top of RCC foundations (pedestals) shall normally be kept at a lower level so that the column base plates together with gussets and stiffeners remain below finished floor level (FFL) unless specified otherwise. Foundation levels for columns shall be decided to accommodate underground services, pits, trenches, etc.

**5.2.** Stair and ladder pedestal shall be kept 200 mm above the finished floor level.

**5.3.** Pedestals to Steel Columns for Equipment structures:

- |    |                                             |                                                               |
|----|---------------------------------------------|---------------------------------------------------------------|
| a) | Equipment in open area                      | : as required (600mm min)                                     |
| b) | Equipment in covered area                   | : as required (600mm min)                                     |
| c) | Structures and equipment supplied by vendor | : as per vendor's data subject to minimum as specified above. |

## **6. MINIMUM HEIGHTS FOR ENCASEMENT OF STEEL COLUMNS**

In case the top of pedestal is kept at a lower level so that the column base plate together with gussets and stiffeners remain below finished floor level (FFL) the column bases as well as the column sections shall be encased in concrete above FFL as per following:

- |    |              |                             |
|----|--------------|-----------------------------|
| a) | Open area    | : Minimum 600 mm above FFL. |
| b) | Covered area | : Minimum 600 mm above FFL. |

## **7. CONCRETE MIX**

**7.1.** Ordinary Portland Cement (OPC) shall be used. Grade of cement shall be 53 grade conforming to IS 8112, unless the chemical nature of the soil warrants special cement for structures below ground level. The following minimum grades of concrete as per IS:456 shall generally be used for the type of structures noted against each grade.

**7.2.** The proportions for nominal mix of concrete shall be as per Table 9 of IS: 456. The concrete grade used for different structures shall be as follows.

- |     |   |                                                                                                                                                                                              |
|-----|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M5  | : | Fill concrete                                                                                                                                                                                |
| M10 | : | Foundation below brick wall, RR masonry walls.                                                                                                                                               |
| M15 | : | Blinding layer below foundations, trenches and under ground structures, Pavement around buildings including plinth protection work, damp proof course below brick masonry work. etc.         |
| M20 | : | Base plate encasement, encasement of structural steel work, screed concrete, etc.                                                                                                            |
| M25 | : | All RCC structure, super structure, grade beams, columns, roof slabs, grade slabs, area paving, RCC road and all underground RCC structures, cable and pipe rack foundation, pedestals, etc. |

**7.3.** Minimum grade of concrete for all reinforced concrete work shall be M25 unless specified otherwise.

- 7.4.** Minimum cement content, maximum water cement ratio and minimum grade of concrete shall be considered as per IS: 456 for moderate exposure condition. However minimum cement content for various grade of concrete shall be as under :-

| Grade of Concrete                  | Minimum Cement Content (Kgs/M <sup>3</sup> ) |
|------------------------------------|----------------------------------------------|
| M20 (with Admixture)               | 320                                          |
| M20 (without Admixtures)           | 345                                          |
| M25 (with Admixture)               | 360                                          |
| M25 (without Admixtures)           | 390                                          |
| M30 (with Admixture)               | 400                                          |
| M30 (without Admixtures)           | 415                                          |
| M35 (with Admixture)               | 420                                          |
| M35 (without Admixtures)           | 440                                          |
| M40 and above (with Admixture)     | 450                                          |
| M40 and above (without Admixtures) | 450                                          |

- 7.5.** Minimum fire rating of 2 hours shall be considered where fire hazard is expected (LHS area) and accordingly minimum cover shall be taken as per Table 16A of IS: 456. For structures below ground level which are exposed to sulphate attack, requirement of cement shall be as per Table 4 of IS: 456.
- 7.6.** However, higher grade of concrete may also be used than the minimum specified to satisfy the design requirement.
- 7.7.** All Grade slabs & RCC Roads shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum processing, floating and towelling as per equipment manufacturer's recommendations.
- 7.8.** The Ground floor (zero meter) of each building shall be provided with 150mm thick RCC slab on 50mm thk. PCC, 230mm thick rubble soling over 600mm well compacted CNS filling.
- 7.9.** Inter mixing of different grade of concrete in the same structure shall not be allowed normally.



## **8. REINFORCEMENT**

**8.1.** Reinforcement bars (FE 550D CRS) shall be as per the following codes:

|                                   |                     |
|-----------------------------------|---------------------|
| High Yield Strength Deformed bars | : IS:1786           |
| Mild steel bars                   | : Grade I of IS:432 |
| Welded wire fabric                | : IS:1566           |

**8.2.** Intermixing of different grades of rebars or rebars of different material composition in same structure shall not be allowed. Use of rerolled steel is strictly prohibited.

## **9. GROUTING**

**9.1.** Non-shrink ready mixed flowable grout shall be used for under pinning work below base plate of columns. For grouting of base of machine foundation high strength ready mixed non-shrink flowable grout shall be used. The high strength ready mix shall be from Fosroc or Sika or approved make shall be used.

**9.2.** Non-shrink cum plasticiser admixture shall be added in the grout shall be used for grouting of base plate column of equipment foundations and structural foundations including all other required foundations for system. Crushing strength of the non-shrink grout shall generally be one grade higher than the base concrete.

**9.3.** Nominal thickness of grouting shall be at least 50mm for building columns and pedestals of major equipment. For secondary posts, stair and ladder base, etc. grouting shall not be less than 25mm thick.

## **10. MINIMUM COVER TO FOUNDATION BOLTS**

Minimum distance from the centre line of foundation / anchor bolt to edge of pedestal shall be the maximum of the following:

- a) Clear distance from the edge of base plate / base frames to the outer edge of the pedestal shall be minimum 50mm.
- b) Clear distance from the face of pocket to the outer edge of pedestal shall be 100 mm.
- c) Clear distance from the edge of sleeve or anchor plate of anchor bolt to the edge of pedestal shall be 200 mm or as per codal requirements considering the anchor bolt size.

## **11. MISCELLANEOUS REQUIREMENT**

**11.1.** Plywood formwork shall be used for all over ground concrete works. Plywood formwork shall be used for all intermediate & roof slab, beam & column, RCC wall and foundation work above ground level. Maximum 08 repetition of plywood form shall be allowed. For other areas like pile cap, footing work etc. For other areas steel / plywood formwork shall be used. However good quality and proper steel formwork only allowed to be used.



**11.2.** Unless specified 20 mm and downgraded aggregates shall be used for all structural concrete works. However 40mm and downgraded aggregates may also be used under special conditions for foundation on approval of OWNER/ENGINEERS

**11.3.** Tolerance for formed and concrete dimension shall be as per IS:456.

## **12. MAJOR EQUIPMENT FOUNDATIONS**

Special requirements for concreting of major equipment foundations shall be as given below:

### **12.1. Coarse Aggregates**

Sound and durable crushed blue granite aggregates shall be used. All aggregates shall be tested for alkali aggregate reaction. Materials, which contain high percentage of reactive silica, shall not be used. In exceptional cases of high percentage of reactive silica content, aggregate may be allowed where low alkali cement shall be used.

### **12.2. Temperature Control of Concrete**

The temperature of fresh concrete shall not exceed 25<sup>0</sup> C when placed. For maintaining the temperature of 25<sup>0</sup> C in the machine foundations, any other foundations where mass concreting is involved, crushed ice shall be used in mixing water. Shall be governed by applicable IS code for mass concreting.

### **12.3. Admixture**

Plasticizer cum retarder type admixture of approved make as per standard list shall generally be added to the concrete for promoting workability in addition to retarding setting time for mass concreting work. The slump of concrete shall generally be in the range given below:

|                  |                  |
|------------------|------------------|
| Block foundation | : 100mm to 150mm |
| Column / Slab    | : 100mm to 150mm |

### **12.4. Form work**

Plywood formwork shall be used for the all work above ground level.

### **12.5. Scheme for Concreting**

All the concrete work shall be from automatic batching plant of minimum capacity 30 cum/ hour with printer facility and printout of all the batches shall be submitted to client in regular basis. Arrangements for stand-by Plant and Equipment's shall also be made.

### **12.6. Placing of Concrete**

Base mat /column as well as top deck of machine Foundations shall be cast in a single pour.

## **(SECTION 2.6-D) FINISHES**

The minimum quality of finishes used for various building areas are furnished in this section. The bidder is at liberty to use superior finishes provided all specific requirements for the finish specified herein below are satisfied.

### **1) Vitrified Colour Tiles**

Vitrified Colour Tiles (first quality) of 600mm x 600mm x (8 to 10mm) / of approved size, Nitco or approved make Shall be provided in buildings for location refer Finishing schedule-Annexure-1 & 2. The vitrified tile flooring shall be laid on bed of 20 mm. thick cement mortar 1:3 (1 cement : 3 fine sand) finished with flush pointing in color epoxy grout of approved shade.

### **2) Heavy Duty Ceramic Tiles**

Heavy duty ceramic tiles with anti skid / matt finish conforming to IS: 13711 / 13712 shall be used in toilets, The tiles shall be 600 x 600 x 10 mm / of approved size of approved shade brand and colour.

### **3) Acid / Alkali Resisting Tiles**

Battery rooms and such other areas coming into contact with acid / alkali vapours or fumes shall be given acid / alkali resistant tiles 25 mm thick, jointed with acid / alkali resistant cement mortar. Bedding shall comprise of potassium silicate mortar conforming to IS:4832 (Part-I) and resin based mortar like epoxy for jointing. Total thickness of flooring shall be 50 mm. Ceramic unglazed vitreous tiles conforming to IS:4457 with minimum thickness of 25 mm may also be used as acid / alkali resistant tile.

## **MATERIALS**

The ceramic unglazed vitreous acid resisting tiles shall conform to the requirements of IS:4457. Acid resistant bricks shall conform to the requirements of IS:4860.

The finished tile when fractured shall appear fine grained in texture, dense and homogeneous. Tile shall be sound, true to shape, flat, free from flaws and any manufacturing defects affecting their utility. Tolerance in the dimensions shall be within the limits specified in the respective IS.

The tiles shall be bedded and jointed using chemical resistant mortar of the resin type conforming to IS:4832 (Part II). Method of usage shall generally be as per the requirements of IS:4443.

## **WORKMANSHIP**

The size and thickness of tiles/size for use in the flooring/skirting/dado shall be as specified. The resin shall have viscosity for readily mixing with the filler by manual methods. The filler shall have graded particles which permit joint thickness of 1.5 mm.

The base concrete surface shall be free from dirt and thoroughly dried. The surface shall be applied with a coat of bitumen primer conforming to IS:3384. The primed surface shall then be applied with a uniform coat of bitumen conforming to IS:1530.

Tiles shall be laid directly without the application of bitumen, if epoxy or polyester resin is used for the mortar.

Just adequate quantity of mortar which can be applied within the pot life as specified by the manufacturer shall be prepared at one time for bedding and jointing. Rigid PVC/Stainless steel/chromium plated tools shall be used for mixing and laying.

For laying the floor 6 to 8 mm thick mortar shall be spread on the back of the tile. Two adjacent sides of the tile shall be smeared with 4 to 6 mm thick mortar. Tile shall be pressed into the bed and pushed against the floor and with the adjacent tile, until the joint in each case is 2 to 3 mm thick. Excess mortar shall then be trimmed off and allowed to harden fully. Similar procedure shall be adopted for the work on walls by pressing the tile against the prepared wall surfaces and only one course shall be laid at a time until the initial setting period.

The mortar joints shall be cured for a minimum period of 72 hours with 20 to 25% hydrochloric acid or 30 to 40% sulphuric acid. After acid curing, the joints shall be washed with water and allowed to thoroughly dry. The joints shall then be filled with mortar to make them smooth and plane. Acid curing is not required to be carried out if epoxy or polyester resin is used for the mortar.

Resin mortars are normally self curing. The area tiled shall not be put to use before 48 hours in case epoxy, polyester and furane type of resin is used for the mortar. If phenolic or cashewnut shell liquid resin is used for the mortar, the area tiled shall not be put to use for 7 to 28 days respectively, without heat treatment. This period shall be 2 to 6 days respectively if heat treatment is given with infrared lamp.

**4) Integral Floor Finish**

For MCC floor finish integral to the concrete base shall be provided as per IS:2571.

**5) Finish for stair cases**

Risers and treads of staircases shall be provided with Kotastone (single piece) except service building or wherever specifically mentioned in tender. Total thickness of the finish shall be maximum 50 mm. 3 Nos groove to be provided in tread. Half round moulding to be provided in tread.

**6) Miscellaneous**

- a. Angles 75x75x6 mm (minimum) with MS lugs shall be provided for edge protection of cut outs / openings in floor slabs, edge of drains covering gratings, edge of R.C.C cable / pipe trenches of any other place where breakage of edges / corners is expected.
- b. Floors of switchgear rooms shall have embedded steel channel suitable for easy movement of breaker panel.

## **2. SKIRTING / DADO**

- 1) Minimum 100 mm skirting matching with floor finish shall be provided in all areas unless specified otherwise elsewhere.
- 2) Toilets and locker rooms shall be provided with dado up to the bottom of the ceiling with colour /design glazed tiles of minimum 7.5 mm thickness generally as per IS:777. BIDDER shall provide the same after shed, make and quality approval from the client.
- 3) For battery room and other areas coming in contact with acid / alkali spillage / fume, dado of acid / alkali resistant tiling 25 mm thick as per IS:4457 shall be provided to a height of 2100 mm set in potassium silicate mortar and joints pointed with resin bonded mortar.
- 4) Entrance lobby, Poarch and up to lift area in Service building shall be provided with vitrified tile dado to a height up to false ceiling level.

## **3. METAL CLADDING**

### **1) Permanent Colour Coated (non-insulated) Metal Cladding System**

Cladding shall be single skin pre-coated metal sheets of 0.8mm thickness, trough type, zinc aluminium alloy coated (zinc aluminium coating not less than 150g/sqm), MS high tensile sheet having minimum yield strength of 550Mpa including silicon modified polyester (SMP) coating of DFT 20 microns over 5 microns primer on exposed surface of sheeting and SMP coating of DFT 20 microns over 5 micron primer on internal surface of sheeting.

### **2) Flashings, Cap, Trim Closures etc.**

All flashings, trim closures, caps etc. required for the metal cladding system shall be made out of plain sheets having same material and coating specification as mentioned above for the outer face of the sandwiched metal cladding.

## **4. PLASTERING**

- 1) Details furnished below does not include special types of plaster / plaster finishes which may be provided to enhance the architectural appeal. BIDDER may propose such superior plaster finish in his Bid.
- 2) Unless otherwise mentioned External face of all walls shall be provided with 20 mm thick cement mortar plastering with an under layer 12 mm thick in CM 1:4 and top 8 mm thick layer in CM 1:4 with approved water proofing compound. Water proofing admixture shall conform to the requirement of IS: 2645 and shall be of approved manufacture.
- 3) For internal walls 18 thick plaster in CM 1:6 shall be provided on the uneven side of the wall and 12 mm thick plaster in CM 1:4 on the even side of the wall.
- 4) Inside surfaces of walls shall be provided with 2mm thick plaster of paris punning over the plastered surfaces in office areas, entrance lobby, corridor, control equipment room and all other air conditioned rooms.



- 5) Ceiling of all buildings except in cable vaults and over false ceilings shall be given 6mm thick cement sand plaster 1:3.
- 6) The quality and grading of sand for plastering shall conform to IS: 1542.
- 7) 200 mm wide Steel wire fabric (24G) shall be provided (External and internal faces of the building/structure) at the junction of brick masonry and concrete to overcome reasonably the differential drying shrinkage/thermal movement.
- 8) The proportions of the cement mortar for plastering shall be 1:4 (one part of cement to four parts of sand) unless otherwise specified under the respective item of work. Cement and sand shall be mixed thoroughly in dry condition and then water added to obtain a workable consistency. The quality of water and cement shall be as per relevant IS. The quality and grading of sand for plastering shall conform to IS:1542. The mixing shall be done thoroughly in a mechanical mixer unless hand mixing is specifically permitted by the ENGINEER. If so desired by the ENGINEER sand shall be screened and washed to meet the specification requirements. The mortar thus mixed shall be used as soon as possible preferably within 30 minutes from the time water is added to cement. In case the mortar has stiffened due to evaporation of water this may be re-tempered by adding water as required to restore consistency but this will be permitted only upto 30 minutes from the time of initial mixing of water to cement. Any mortar which is partially set shall be rejected and removed forthwith from the site. Droppings of plaster shall not be re-used under any circumstances.
- 9) Preparation of surfaces and application of plaster finishes shall generally conform to the requirements specified in IS:1661 and IS:2402.
- 10) Plastering operations shall not be commenced until installation of all fittings and fixtures such as door/window panels, pipes, conduits etc. are completed.
- 11) All joints in masonry shall be raked as the work proceeds to a depth of 10mm/20mm for brick/stone masonry respectively with a tool made for the purpose when the mortar is still green. The masonry surface to be rendered shall be washed with clean-water to remove all dirt, loose materials, etc., Concrete surfaces to be rendered shall be roughened suitably by hacking or bush hammering for proper adhesion of plaster and the surface shall be evenly wetted to provide the correct suction. The masonry surfaces should not be too wet but only damp at the time of plastering. The dampness shall be uniform to get uniform bond between the plaster and the masonry surface.
- 12) Interior plain faced plaster - This plaster shall be laid in a single coat of 12 mm thickness on even side and 18 mm on uneven side. The mortar shall be dashed against the prepared surface with a trowel. The dashing of the coat shall be done using a strong whipping motion at right angles to the face of the wall or it may be applied with a plaster machine. The coat shall be trowelled hard and tight forcing it to surface depressions to obtain a permanent bond and finished to smooth surface. Interior plaster shall be carried out on jambs, lintel and sill faces, etc. as shown in the drawing and as directed by the ENGINEER. Rate quoted for plaster work shall be deemed to include for plastering of all these surfaces.



- 13) Plain Faced Ceiling plaster - This plaster shall be applied in a single coat of 6mm thickness. Application of mortar shall be as stipulated in clause 4.5.
- 14) Exterior plain faced plaster - This plaster shall be applied in 2 coats with waterproofing compound in second coat. The first coat or the rendering coat shall be approximately 14mm thick. The rendering coat shall be applied as stipulated in clause 4.9 except finishing it to a true and even surface and then lightly roughened by cross scratch lines to provide bond for the finishing coat. The rendering coat shall be cured for atleast two days and then allowed to dry. The second coat or finishing coat shall be 6 mm thick. Before application of the second coat, the rendering coat shall be evenly damped. The second coat shall be applied from top to bottom in one operation without joints and shall be finished leaving an even and uniform surface. The mortar proportions for the coats shall be as specified in the respective item of work. The finished plastering work shall be cured for atleast 7 days.
- 15) Interior plain faced plaster 20mm thick if specified for uneven faces of brick walls or for random/coursed rubble masonry walls shall be executed in 2 coats similar to the procedure stipulated.
- 16) Exterior Sand Faced Plaster - This plaster shall be applied in 2 coats. The first coat shall be 14mm thick and the second coat shall be 6mm thick. These coats shall be applied as stipulated earlier. However, only approved quality white sand shall be used for the second coat and for the finishing work. Sand for the finishing work shall be coarse and of even size and shall be dashed against the surface and sponged. The mortar proportions for the first and second coats shall be as specified in the respective items of work. Water proofing admixture has to added for all the exterior plaster mortar. For first coat mortar is CM (1:4) and for second coat CM (1:3).
- 17) Wherever more than 20mm thick plaster has been specified, which is intended for purposes of providing beading, bands, etc. this work shall be carried out in two or three coats as directed by the ENGINEER duly satisfying the requirements of curing each coat (rendering/floating) for a minimum period of 2 days and curing the finished work for atleast 7 days.
- 18) In the case of pebble faced finish plaster, pebbles of approved size and quality shall be dashed against the final coat while it is still green to obtain as far as possible a uniform pattern all as directed by the ENGINEER.
- 19) Where specified in the drawings, rectangular grooves of the dimensions indicated shall be provided in external plaster by means of timber battens when the plaster is still in green condition. Battens shall be carefully removed after the initial set of plaster and the broken edges and corners made good. All grooves shall be uniform in width and depth and shall be true to the lines and levels as per the drawings.
- 20) Curing of plaster shall be started as soon as the applied plaster has hardened sufficiently so as not to be damaged when watered. Curing shall be done by continuously applying water in a fine spray and shall be carried out for atleast 7 days.
- 21) When the specification items of work calls for waterproofing plaster the BIDDER shall provide the waterproofing compound as specified while preparing the cement mortar.



- 22) For external plaster, the plastering operations shall be commenced from the top floor and carried downwards. For internal plaster, the plastering operations for the walls shall commence at the top and carried downwards. Plastering shall be carried out to the full length of the wall or to natural breaking points like doors/windows etc. Ceiling plaster shall be completed first before commencing wall plastering.
- 23) Double scaffolding to be used shall be as specified.
- 24) The finished plaster surface shall not show any deviation more than 4mm when checked with a straight edge of 2m length placed against the surface.
- 25) To overcome the possibility of development of cracks in the plastering work following measures shall be adapted.
- 26) Plastering work shall be deferred as much as possible so that fairly complete drying shrinkage in concrete and masonry works takes place.
- 27) Steel wire fabric shall be provided at the junction of brick masonry and concrete to overcome reasonably the differential drying shrinkage/thermal movement.
- 28) Ceiling plaster shall be done, with a trowel cut at its junction with wall plaster. Similarly trowel cut shall be adopted between adjacent surfaces where discontinuity of the background exists.

## **5. DECORATIVE PAINTING**

- 1) Details furnished here in below are the minimum acceptable standard for painting. Superior finish if any required by BIDDER to enhance overall appearance will be permitted if such finish meet with the technical requirements.
- 2) Weather Proof Exterior Emulsion paint as per IS:5410 shall be provided on external faces of walls, sunshades, etc. Minimum three finish coats shall be apply over a coat of primer.
- 3) Inside surfaces shall be provided with luxury Emulsion as per IS:5411 Part I for all Control rooms, Control equipment rooms, all air conditioned areas and all other areas and above dado in buildings like time office, canteen, first aid centre, toilets etc.
- 4) Inside surfaces shall be provided with Premium Acrylic Emulsion Paint (as per approved make) as per IS:428 for all plant buildings except mentioned buildings in above clause 5.3.
- 5) Walls in D.M.Plant and Chlorination Plant shall be provided with chlorinated rubber based paint as per IS : 9862 over walls. Walls above Dado in battery rooms shall also be provided with similar painting. The Chlorination room shall be provided with epoxy flooring.
- 6) All plastered ceilings shall provided with oil bound distemper.



- 7) External surface of Silo, Fan, Crusher, TG Deck Column & side, IDCT shall be painted with Anti carbonation paint.
- 8) All ceiling shall be properly cleaned and remove loose concrete slurry and level the surface. Apply POP (in case of No Plaster) & Putty or Birla white putty (Plaster area) for making uniform & smooth surface before application and apply Paints Primer @ 8-10% dilution with water or turpentine (depends on manufacturer recommendation) of three coats of oil bound distemper over a coat of primer.
- 9) Oil resistant paint as per IS:161 shall be provided for oil canal and oil equipment room.
- 10) All wood work shall be provided with fire resistant transparent paint as per IS162 over French polish as per IS:348 or flat oil paint as per IS:137.
- 11) Painting for structural steel has been specified else where in this document.
- 12) Following general instructions for painting shall be followed.
  - i. For painting on concrete, masonry and plastered surfaces IS:2395 Parts I and II shall be followed.
  - ii. For painting on wood work IS:2338 Parts I & II shall be followed.
  - iii. All paints shall be of brand and make to the approval of OWNER.
  - iv. A minimum of three finishing coats of paint over a primer shall be provided to give a smooth uniform finish for the painted surface.
  - v. All painting on masonry or concrete surfaces shall preferably be applied by rollers.
  - vi. Thinner shall not be used with textured paint (sandtex matt etc) finish.
  - vii. All fire exits shall be painted in Post office red colour shade which shall not be used any where except to indicate emergency or safety measure.
  - viii. Battery room shall be painted with minimum three coats of acid-resistant paint over one coat of primer.
  - ix. The epoxy resin and hardener formulation for laying of joint-less lining work in floors and walls of concrete tanks / trenches etc. shall be as per the requirement of IS 9197.
- 13) Painting colours for all the buildings / rooms / super structures shall be decided by the OWNER during detailed engineering stage. The paint shall be of premier quality.

## **6. ROOF**

- 1) Roof of all buildings having R.C.C. framework shall have cast in situ R.C.C. slab with conventional shuttering.
- 2) Roof of conveyor galleries and steam generator shall be of permanently colour coated galvanized M.S. trough metal sheet of approved profile. Total coat thickness of roof shall be 0.8 mm (18 gauge). The zinc coating shall be confirming to IS 277 Class II Grade-600. The external face shall have permanent colour coating of PVF2 paint of minimum DFT of 20 microns and inner surface shall be coated with silicon modified polyester paint with DFT of 20 microns

## **7. ROOF DRAINAGE AND WATER PROOFING**

- 1) For efficient drainage of rainwater, roof concrete shall be given a gradient of a minimum of 1 in 100. The gradient shall preferably be provided by sloping the structural framing system itself. Gradient may also be provided using screed concrete of grade M20 using 12.5 mm downgraded aggregate. But the average thickness of such screed concrete shall be restricted to about 50 mm. In the case of metal roofing system the roof slope shall be 1 vertical: 4 horizontal.

### **2) Roof Waterproofing Specification (PU Elastomeric System)**

Roof shall be provided with a high-performance waterproofing system using a high solid content, liquid-applied, two-component Polyurethane (PU) elastomeric membrane, conforming to ASTM C836 and ASTM C898, with a total Dry Film Thickness (DFT) of 1500 microns.

#### **Surface Preparation**

- a. Surface preparation shall be carried out as per IS 3067.
- b. All laitance, dust, oil, grease, and loose materials shall be removed by mechanical means.
- c. Cracks, honeycombs, and leakage points shall be treated by cementitious injection grouting (where required).
- d. Construction joints shall be sealed using cement slurry modified with expansive grout admixture.
- e. Floor-wall junctions shall be treated with polymer-modified vatta (fillet).
- f. Annular gaps around rainwater outlets shall be sealed using non-shrink cementitious grout.

#### **Primer Application**

- a. A compatible PU primer coat shall be applied uniformly over the prepared surface to enhance adhesion.
- b. Primer consumption shall be as per manufacturer's recommendation.
- c. The primer shall be allowed to dry/tack-free prior to application of the membrane.

#### **PU Elastomeric Membrane Application**

- a. The waterproofing membrane shall be applied in two coats, each of 750 microns DFT, achieving a total DFT of 1500 microns.
- b. Application shall be by brush, roller, or squeegee.
- c. The second coat shall be applied perpendicular to the first coat to ensure uniform coverage.
- d. A minimum 150 GSM non-woven polyester geotextile shall be embedded within the membrane system with minimum 100 mm overlaps.
- e. The membrane shall be extended over vertical surfaces and taken up the parapet wall, terminating in a groove minimum 300 mm on the external face.

## **Curing**

The applied membrane shall be allowed to cure for a minimum of 24 hours or as per manufacturer's specification before further works.

## **Flood Testing**

Prior to screed application, a ponding test shall be conducted by flooding the terrace with minimum 50 mm water depth for 24 hours to check watertightness.

## **Protective Screed**

- a. A 75 mm thick M20 grade screed concrete (using 12.5 mm aggregate) shall be laid with proper slope towards drainage points.
- b. Adequate care shall be taken to avoid damage to the waterproofing layer during screed placement.

## **UV Protective Coating (Parapet Area)**

- a. Over exposed vertical areas (parapet), a two-component aliphatic PU protective coating shall be applied in two coats (80 microns WFT total).
- b. The coating shall provide UV resistance, chemical resistance, and long-term durability.

## **General**

- a. All materials shall be from an approved manufacturer.
- b. Application methodology, coverage, curing time, and safety practices shall strictly follow manufacturer's specifications.
- c. Workmanship shall ensure a continuous, seamless, and defect-free membrane system.

Laying procedure shall be as per approved manufacture specification. Adequate number of rain water down take pipe shall be provided using Sch 80 UPVC (heavy duty industrial grade) pipe of adequate size with coupling.

- 3) Number and size of rainwater down take pipe shall be decided based on the provisions of IS: 1742 and IS: 2527. However minimum one rain water pipe shall be provided at each RCC/Structure column for proper drainage of the water. The pipes shall be UPVC(SCH80) (heavy duty industrial grade) of adequate size for all the building including pipes for Turbine building, Service building and other auxiliary buildings. Bunker building, Boiler building. It is recommended that the minimum diameter of the pipe be kept as per design and there shall be a minimum of two pipes provided on each gutter. The down comer pipes shall be suitably concealed with masonry work, cement concrete or sheeting to match with the exterior finish.

## **8. FALSE CEILING AND UNDER DECK INSULATION**

- 1) MCC Building shall be provided by Armstrong or equivalent make colour quoted metal square type false ceiling. Additional hangers and height adjustment clips shall be provided for return air grills, supply air diffusers, light fixtures, AC ducts etc. The installation of false ceiling shall be carried out by the specialist agency and shall be strictly as per manufacturer's instructions
- 2) Armstrong or equivalent make colour coated metal Grid type false ceiling (acoustic) system shall consist of 600x600x12.5 mm gypboard with one coat of primer and two or more coats of acrylic emulsion paint. The suspension system shall consist of 6 mm diameter galvanised steel rods suspended from ceiling supporting aluminium grid of 38x25x1.5 mm and crosstie of 25x25x1.5 mm and aluminium angle of 25x25x1.5 mm.
- 3) Suitable M.S channel (minimum ISMC100) grid shall be provided above false ceiling for movement of personnel to facilitate maintenance of lighting fixtures, AC ducts etc.
- 4) BIDDER shall prepare a layout of the false ceiling system incorporating light fixtures, supply air diffuser, return air grills, fire detectors, fire protection sprinklers etc. such that the ceiling looks aesthetically pleasing. Work shall commence only after the OWNER approves the layout.
- 5) Under deck insulation shall comprise of 50 mm thick resin bonded mineral wool insulation mat conforming to IS:8183. This mat shall be backed with 0.05 mm thick aluminium foil and 24 Gx25 mm wire mesh netting. These shall be fixed to ceiling or wall as the case may be with 100x50x6 mm slotted mild steel plate welded to M.S. plate inserts embedded at the soffit of the slab at 600 mm c/c and 14 G steel wire drawn through slots and fixed to wire netting.

## **9. DOORS & WINDOWS**

- 1) Unless specified all doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings and windows/ventilators provided on the outer face of all buildings shall have, electro colour coated (anodised) aluminium framework with glazing. The fixtures and hardware shall be of best quality and shall be provided as detailed in the technical specifications.
- 2) Entrance of the main control room and control equipment room shall be provided with air-locked lobby with provision of double doors of anodized aluminium framework with glazing & RFID/Biometric Lock. Doors shall be of sliding type.
- 3) For common control building, double glazed wall panels (DGU) with anodized aluminium frame shall be provided between air-conditioned and non air-conditioned areas and on the side of control room and control equipment room(s) facing the operating floor to have a clear view.
- 4) Single glazed panels with anodized aluminium framework shall be provided as partition between two air-conditioned areas wherever clear view is necessary.

- 5) Lignite conveyor galleries shall have Anodized aluminium windows or ventilators.
- 6) All steel doors shall consist of double plate flush door shutters. The door shutter shall be 45 mm thick with two outer sheets of 18 G rigidly connected with continuous vertical 20 G stiffeners at the rate of 150 mm centre to centre. Side, top and bottom edges of shutters shall be reinforced by continuous pressed steel channel with minimum 18 G. The door shall be sound deadened by filling the inside void with mineral wool. Doors shall be provided with all hardware and fixtures like door closer, tower bolts, handles, stoppers, aldrops, etc.
- 7) Wherever functionally required GI rolling shutters with suitable operating arrangement manual / Electric shall be provided to facilitate smooth operations. Rolling shutters shall conform to IS: 6248.

The type of rolling shutter viz., self-coiling type (manual) for clear area up to 12 sq m, gear operated type (mechanical) for clear area up to 35 sq m and electrically operated type for area up to 50 sq m shall be provided. Mechanical type of rolling shutter shall be suitable for operations from both inside and outside with the crank handle or chain gear operating mechanism duly considering the size of wall / column. Electrical type of rolling shutter shall also be provided with the emergency mechanical operation

- 8) Fireproof doors shall be provided at all fire exit points as per the recommendations of LPA. These doors shall generally be as per IS: 3614 (Part I and Part II). Fire rating of the doors shall be as per LPA requirements. However minimum rating shall be 2 hours. These doors shall be double cover plated type with mineral wool insulation. Panic bar is to be provided as per design and functional requirement.
- 9) Hollow extruded section of minimum 3 mm wall thickness as manufactured by INDAL or equivalent shall be used for all anodized aluminium doors, windows and ventilators.
- 10) Hardware fittings for doors and windows :

Fittings for steel door

| SI No                                 | Nos. for Single leaf | Nos. for double leaf |
|---------------------------------------|----------------------|----------------------|
| 1) M S Aldrop                         | 1                    | 1                    |
| 2) M S Tower bolt for top             | 1                    | 2                    |
| 3) M S Hinge                          | 3                    | 6                    |
| 4) M S Door handle (one on each face) | 2                    | 4                    |

Fittings for Doors in anodized aluminium frame work.

| SI No                       | Nos. for Single leaf | Nos. for double leaf |
|-----------------------------|----------------------|----------------------|
| 1) Tower bolt 300mm for top | 1                    | 2                    |

|                                                                           |   |   |
|---------------------------------------------------------------------------|---|---|
|                                                                           |   |   |
| 2) Tower bolt 150mm for bottom                                            | 1 | 1 |
| 3) Aldrop 300mm long with 16mm sliding bolt                               | 1 | 1 |
| 4) Door handles with continuous plate 150x38x12 mm rod                    | 1 | 2 |
| 5) Butt hinge (125x63x4mm) with cadmium plated M.S screws                 | 4 | 8 |
| 6) Butt hinge (75x45x3.2mm) for door cleat with cadmium plated M.S Screws | 1 | 2 |

All doors for officers cubicles as well as all anodized aluminium doors will have hydraulic door closers, door stopper (heavy type) and mortice lock (4 levers) with handle.

All openable steel windows will be provided with brass handles and brass peg stays.

## 10. Aluminum Doors, windows, ventilators and partitions

- 1) Aluminum alloy used in the manufacture of extruded sections for the fabrication of doors, windows, ventilation shall conform to designation HE9-WP of IS 733.
- 2) All aluminium units shall be supplied with anodised finish. The minimum anodic film thickness shall be 0.015 mm. (AC 15 Grade)
- 3) The frame work of the partitions with mullions and transoms shall be with anodised aluminium box sections. Anodised aluminium bar sections shall be in-filled with timber of class 3 (silver oak or equivalent) as per IS: 4021. The thickness of aluminium section shall not be less than 3mm.
- 4) IS: 1948 and IS: 1949 refers to incorporates the sizes, shapes, thickness and weight per running metre of extruded sections for the various component of the units.
- 5) Builder's hardware of fitting and fixtures shall be of the best quality from approved manufacturer.

## 11. Glazing

- 1) All ventilators and windows on external face of turbine building, bunker bay, compressor house, fire escape staircase and fuel oil pressurizing pump house , ESP Control room and all the buildings covered in the scope except the service building shall be provided with wired glass of minimum 6 mm thickness conforming to IS: 5437. For the Service building the glazing shall be float glass of 6 mm thickness. (Tinted glass).



- 2) Where specified, double glazing shall consist of two 6 mm thick clear toughened safety glass conforming to IS: 2553, hermetically sealed and separated by 12 mm thick gap for thermal insulation.
- 3) For single glazed aluminium partitions and doors, Float glass of minimum 6 mm thickness shall be used.
- 4) Ground glass / frosted glass of minimum 6 mm thickness shall be used for all windows / ventilators in toilets.
- 5) Unless specified otherwise in this specification minimum thickness of plain sheet glass used for windows/ventilators shall be 6 mm.
- 6) Float glass or flat transparent sheet glass shall conform to IS: 2835.
- 7) All glazing work shall conform to IS: 1083 and IS: 3548.

## **12. WATER SUPPLY AND SANITATION**

- 1) Roof water tank of minimum 1000 litres capacity shall be provided for each building toilet. Where number of toilets are to be served by the same tank the tank shall have capacity to cater to 8 hours requirement considering minimum 25 persons per toilet block Polyethylene water storage tank conforming to IS: 12701 shall be used. The tank shall be complete with all fittings including float valve, stop cock, vent pipes etc.
- 2) Water tanks shall not be provided directly on the roofs. A separate RCC platform of 1m high shall be provided with separate water drainage arrangement in case of leakage/overflow shall be provided CPVC (SCH 80) (heavy duty industrial grade) pipe of adequate size shall be used for internal piping works for potable water supply. For concealed pipes the pipes shall be of heavy class.
- 3) UPVC (heavy duty industrial grade) pipe of adequate size shall be used for sanitary works above ground level. The pipes shall be capable of withstanding minimum test pressure of 4 KSC.

## **13. MISCELLANEOUS REQUIREMENTS**

- 1) Doors and windows on external walls of buildings shall be provided with RCC sunshade over the openings with 300 mm projection on either side of the opening. Projection of sunshade from the wall shall be minimum 600 mm over window openings and 750 mm over door openings.
- 2) Doors and windows on the external walls of buildings with metal cladding shall be fixed by creating recesses in the cladding system.
- 3) Duct banks consisting of MS/PVC conduits for cables shall be provided with proper sealing arrangement consisting of fire retardant sealing compound.



- 4) All floor openings for cables below electrical panel shall be sealed with fire sealing compound after cables are laid.
- 5) All openings in external walls provided for pipes, cables, ducts etc. shall be effectively sealed to prevent water seepage, after the routing of the services are over.

#### **14. NATURAL LIGHTING & VENTILATION**

- 1) The area of windows shall be a minimum 15% of the floor area to ensure adequate natural lighting.
- 2) Fans & AC facility shall be provided in general office area as per standard norms.
- 3) Sewerage system shall be provided with adequate ventilation for the pipe work as well as manhole.

#### **15. EXPANSION JOINT AND JOINT SEALING COMPOUND**

##### **1) MATERIALS**

25 mm /50 mm thick Pre-moulded joint filler shall be provided for Expansion joint at every 30mtr. length. Pre-moulded joint filler shall be Sil Flox pre-moulded compressible Filler Board in black colour of manufactured by the Supremo industries or equivalent having minimum density 95 kg/Cu. Mt, Non staining with less than 1% water absorption & compression recovery of 92% minimum. In an expansion joint pre-moulded joint filler (like SIL FLEX) can be fixed in position to substrate using either a double sided adhesive form tape or synthetic rubber based adhesive.

##### **2) Expansion Joint Treatment :-**

- a. Top 25X25 / 50x 25 mm top of the expansion joint shall be seal using cold applied, polyurethan based, high performance fuel resistant sealant like colpor 200 of M/s Fosroc make or equivalent as per manufacture recommendation and application procedure.
- b. Sealing compound for filling the joints above the preformed bitumen filler shall conform to Grade 'A' as per IS:1834.

##### **3) WORKMANSHIP**

- a. The thickness of the Pre-moulded joint filler shall be as specified in the respective items of work. BIDDER shall procure the strips of the desired thickness and width in lengths as manufactured. Assembly of small pieces/thicknesses of strips to make up the specified size shall not be permitted.
- b. Sealing compound shall be heated to a pouring consistency for enabling it to run molten in a uniform manner into the construction joint or cut concrete surface of

Road. Before pouring the sealing compound, the vertical faces of the concrete joint shall be applied hot with a coat of bitumen primer conforming to IS:3384 in order to improve the adhesive quality of the sealing compound.

- c. Expansion joints between beams/slabs shall be provided with 100mm wide x 4mm thick mild steel plate at the soffit of RCC beams/slabs to support and prevent the Pre-moulded joint filler from dislodging. This plate shall be welded to an edge angle of ISA 50 x 50 x 6mm provided at the bottom corner, adjacent to the expansion joint of one of the beams/slabs, by intermittent fillet welding. All structural steel work shall be provided with painting as per section 2.6-D1 Clause. No 10).

## **16. FLASHING**

### **1) MATERIALS**

- a. Anodised aluminium sheets shall be 1.00mm thick with anodic film thickness of 0.025 mm.
- b. Galvanised mild steel sheets shall be 1.00mm thick with zinc coating of 800 gms/sq.m.
- c. Bitumen felt shall be either Hessian base self finished bitumen felt Type-3 Grade I conforming to IS:1322 or glass fibre base self finished felt Type-2 Grade I conforming to IS:7193.

### **2) WORKMANSHIP**

- a. The type of the flashing and method of fixing shall be as specified in the respective items of work.
- b. Flashing shall be of the correct shape and size as indicated in the construction drawings and they shall be properly fixed to ensure their effectiveness.
- c. Flashing shall be of long lengths so as to provide minimum number of joints. The minimum overlap at joints shall be 100mm.
- d. Fixing of the flashing shall be either by bolting with bitumen washers or by tucking into the groove 75 mm wide X 65 mm deep in masonry/concrete along with cement mortar 1:4 filleting as indicated in the drawings. Curing of the mortar shall be carried out for a minimum period of 4 days.
- e. Bitumen felt flashing of the type as specified shall be provided with 2 coats of bituminous paint at the rate of 0.10 litre/sq.m after the installation.

## **17. STONE PITCHING**

Stone pitching for thickness of 23 cms with stones of about 15-23 cms in size in mortar of cement and sand in proportion of 1:8 to required thickness including necessary trimming of slopes. All stones shall be laid full in mortar both in bed of 25 mm and in vertical joints and settled carefully in place with a wooden mallet immediately on placement so that it is firmly bedded in, before the same has set. Clean chips and spalls shall be wedged in to the mortar joints and beds wherever necessary to avoid thick beds or joints of mortar. No dry or hollow space shall be left anywhere in the pitching and each stone shall be left anywhere in the pitching and each stone shall have all the embedded faces completely covered with mortar. Vertical joints shall be staggered. No joints shall be more than 35 mm thick. Green work shall be protected from rain with suitable covering. Stone pitching shall be neatly pointed with cement mortar proportion 1: 2 (1 part sand and 2 part cement) including racking out joints, curing, watering, trimming, dressing, and complete the base with proper compaction by suitable mechanical means to required slope in line and level for all



necessary leads and lifts utilizing surplus earth in filling as directed by Engineer- in- charge including providing protective measures for under water concrete condition if required for the execution. Weep holes shall be provided of 110 mm dia PVC Pipe(Type-B) @ 2 mt c/c

**1) MATERIALS:**

**A. Sand:**

Sand to be used in the work shall conform to IS 2116-1980 and the gradation limits given below :-

| IS Sieve designation | Percentage by weight passing IS Sieve. |
|----------------------|----------------------------------------|
| 4.75 mm              | 100                                    |
| 2.36 mm              | 90-100                                 |
| 1.18 mm              | 70-100                                 |
| 600 Micron           | 40-100                                 |
| 300 Micron           | 5-70                                   |
| 150 Micron           | 0-15                                   |

Before collecting the sand required for work, the BIDDER shall ensure that the samples of sand proposed to be used are supplied to the project laboratory for determining the mechanical analysis of gravel. The gravel shall be well graded of 40 mm.

**B. Rubble Stones:**

Stones shall be hard, sound, free from cracks, decay and weathering. Stone shall be used from surplus usable excavated rubble or from the approved quarries, if required. Stones with round surface shall not be used. Stones when immersed in water for 24 hours, shall not absorb water by more than 5 per cent of their dry weight when tested in accordance with IS 1125-1974. the length of stone shall not exceed three times its height and the breadth on base shall not be greater than three fourth of the thickness of pitching and in any case not less than 150 mm.. Minimum crushing strength of stone shall not be less than 105 kg./Cm<sup>2</sup> .

**C. Material for Pitching:**

The pitching material shall consist of the most durable rock fragments of approved quality selected for the purposes. Stone shall be used from the surplus usable excavated rubble or from the approved quarries, if required, and shall be subject to thorough inspection and approval by the Engineer-in-Charge. The quality of individual stones shall be dense, sound and resistant to abrasion and shall be free from cracks, seams shale partings, conglomerate, bands and other defects that would tend to increase unduly their susceptibility to destruction by water and weathering action. The shape of the individual stones shall be angular. Stones having thickness less than 50% of their maximum dimensions shall not be used for pitching.

**D. Size of Stone:**

No stone shall be less than 0.02 m<sup>3</sup> in size. At least 15% of stones to be used for pitching shall have depth equal to the thickness of pitching i.e. 230 mm. All stones to be used shall have a minimum depth of 23 cm. No stones shall have any dimension less than 15 cm.

## **(SECTION 2.6-E) FINISHES SCHEDULE**

| No. | Space Type                          | Finishing Schedule                                                                       |                                                                                                   |                                                                                      |                                                     |
|-----|-------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------|
|     |                                     | Floor                                                                                    | Skirting (H=100mm)                                                                                | Wall                                                                                 | Ceiling                                             |
| 1   | PLC/VFD Room                        | Vitrified Tiles                                                                          | Vitrified Tiles                                                                                   | Three coats of Acrylic Emulsion Paint with 1 coat of Primer over 2mm thk POP Punning | Lineal/Tile shaped Metal Ceiling of 600*600 Tiles   |
| 2   | Switch Gear Room (LT/HT)            | IPS Floor with non Metallic Hardener Topping                                             | 100mm high 25mm thk IPS Skirting                                                                  | Three coats of Acrylic Emulsion Paint with 1 coat of Primer over 2mm thk POP Punning | Three coats of Oil Bound Distemper                  |
| 3   | Battery Room                        | Concrete Floor with Acid Alkali resisting tiles over a bed of potassium silicate mortar. | Acid Alkali resisting tiles over a bed of potassium silicate mortar upto 2100mm above floor level | Chemical Resistant paint (Chlorinated Rubber Based)                                  | Chemical Resistant paint (Chlorinated Rubber Based) |
| 4   | Operator cabin Room                 | Vitrified Tiles                                                                          | Vitrified Tiles (For dado)                                                                        | Three coats of Acrylic Emulsion Paint with 1 coat of Primer over 2mm thk POP Punning | Three coats of Oil Bound Distemper                  |
| 5   | Toilets, changing room, shower area | Anti skid ceramic Tile                                                                   | Ceramic Tile for full wall height                                                                 | -                                                                                    | Lineal/Tile shaped Metal Ceiling of 600*600 Tiles   |
| 6   | Staircase                           | Kota stone/ Granite 25mm thk slab                                                        | Kota stone/ Granite                                                                               | Three coats of Acrylic Emulsion Paint with 1 coat of Primer over 2mm thk POP Punning | Three coats of Oil Bound Distemper                  |



## **SECTION 2.6-F LIST OF APPROVED MANUFACTURERS**

### **LIST OF MATERIALS OF APPROVED BRAND AND/OR MANUFACTURERS**

Unless otherwise specifically mentioned in the Schedule of Items, BIDDER has to use materials of only these brand names/Company's names, which are mentioned in the approved list for civil, water supply and sanitary items, as listed below, thereon.

### **LIST OF APPROVED MAKES OF FOLLOWING MATERIALS (CIVIL Works)**

#### **Annexure-3**

| <b>Material /</b>                                       | <b>Approved</b>                                                                                               |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>CIVIL WORKS</b>                                      |                                                                                                               |
| AAC Blocks                                              | Xtralite from Ultratech, Aerocon from HIL, ECOREX, BILTECH                                                    |
| AAC block joining mortar                                | Fixoblock xtralite from Ultratech, Smartfix from Aerocon, MYK Laticrete, Ardex Endura                         |
| Anchor bars                                             | Bright bars                                                                                                   |
| Acoustic Insulation (Mineral Wool)                      | Lloyd, Ecophone from Saint Gobain, U.P. Twiga Ltd, Rockwool India, Anuton, Knauf,                             |
| Acoustic Wooden Door                                    | Pacific, Navair, Tesco                                                                                        |
| Acoustic Seal                                           | Lorient, Raven, Dorma, Kelargo, Reddiplex                                                                     |
| Acoustical Ceiling / Wall Panelling                     | Anutone, Ecophon - Saint Gobain, USG Boral, Armstrong, Parmepho, Acoustics India, Knauf                       |
| Access panel in False ceiling                           | Saint Gobain, USG Boral, Knauf Denoline,                                                                      |
| Adhesive For Wood Work                                  | Ardex Endura, Laticrete, Pidilite, Vamicol                                                                    |
| False flooring                                          | United insulations(unitile), Delhi, Advance business Consultants, Mumbai                                      |
| Air transfer grills                                     | Trox, Ruskin Titus, Systemair India                                                                           |
| Aluminium Accessories                                   | Classic/ Argen/ Oxford/ Nulite/ Crown/ EBCO                                                                   |
| Aluminium composite panel                               | Alucobond, Alstone, Alubond, Eurobond, Aludecor, Alstrong                                                     |
| Aluminium sheets                                        | Indal, Jindal, Hindalco, Vedanta.                                                                             |
| Aluminium Sections                                      | Hindalco, Jindal, Indalco,                                                                                    |
| Aluminium Systems Glazing/ Curtain wall (Façade system) | Domal, Technal, Schuco, SAPA Building Systems, Reyners, Kawneer, NCL Alltek & Seccolar Plectra VS1 F1 Bhoruka |
| Aluminium D/W hardware                                  | Godrej, Dorma, Everite                                                                                        |
| Aluminium Louvers                                       | Hunter Douglas, Armstrong, Luxalon                                                                            |
| Anti-Termite Pesticides - (Chloropyrifos)               | DE - Nocil, Bayer, Biflex-TC from FMC, Hilban from                                                            |
| Automatic Sliding doors/ Revolving Doors                | Dorma, Geze, Hafele                                                                                           |
| Backer Road                                             | Supreme, Fosroc                                                                                               |
| Bricks                                                  | Approved make by Owner                                                                                        |
| Calcium Silicate Board                                  | Hilux, Aerolite, Pamtech, Promatech                                                                           |

|                                                                                                            |                                                                                  |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Cement OPC 53 Grade                                                                                        | Ultratech, ACC, Lafarge, Ambuja, Sanghi, Sidhi, JK LAKSHMI, ADANI.               |
| Cement - White                                                                                             | Birla, JK                                                                        |
| Cement Fiber Board                                                                                         | Everest, NCL Industries (Bison Panel), Shera Board, Visaka Industries (V- Next). |
| Tiles/ Stone Adhesive                                                                                      | Pidilite, MYK- Latricrete, Ardex Endura, KeraKoll, Ultratech                     |
| Chemical Admixtures & Additives                                                                            | Pidilite, Sika, Fosroc                                                           |
| Anchor Fastener, Rebar, Chemical/Mechanical fastener, Core - cutting, Dry stone cladding clamp, Expandable | Hilti, Fischer                                                                   |
| Commercial ply & Board                                                                                     | Greenply, Archidply, Century, Duroply, Uniply, Kitply, National                  |
| Crystalline Integral Waterproofing                                                                         | Pidilite, Fosroc, Sika                                                           |
| Door Closer                                                                                                | Dorma (XLC), Hafele, Yale, Geze, Everite,                                        |

| Material /                                             | Approved                                                                |
|--------------------------------------------------------|-------------------------------------------------------------------------|
| Door Locks, Access Control Lock                        | Dorma (XLC), Geze, Kich, Hafele, Assa Abloy                             |
| Door Hardware (other than Floor spring, Closer, Locks) | Dorma (XLC), Kich, Hafele, Assa Abloy (Yale), Dorset.                   |
| Door Seal – Wool pile Weather Strip                    | Reddiplex, Osaka rubber, Enviro Sealz, Anand                            |
| Double Side Tape, Decorative Tape                      | 3M                                                                      |
| EPDM Gaskets                                           | Anand, Osaka Rubber, Roop, Bohra, Hanu, Maharashtra polymer             |
| Epoxy Grout/ Cementitious Grout for Flooring           | Ardex Endura, MYK Latricrete, Kerakoll, Pidilite                        |
| External Paving Tiles (Cement based)                   | Pavit, Basant baton, Vyara, Ultra, Eurocon,                             |
| Expansion Joint System                                 | 3R, Kantaflex, sandfield, Deevin, Vexcolt                               |
| Expansion Filler board - Premoulded                    | Supreme (Capcell HD100), Shalitex -STP                                  |
| Fabric (Acoustic and fire rated)                       | Atmosphere, Palette, D'décor Fabric, Response                           |
| Fire Doors                                             | Tata Pravesh, Shakti Horman, Pacific, Navier, iCLEAN - IHMS, Promat.    |
| Fire Rated Hardware                                    | Dorma, Hafele, Geze, Horman, Assa Abloy                                 |
| Fire Seal, Fire smoke Seal                             | 3M, Hilti, Dorma, Sealz, Lorient, Kelargo, Raven                        |
| Fire rated Glass                                       | Vetrotech Saint-Gobain, Pyroguard, Glaverbel, Schott - Pyran, Pyroswiss |
| Fittings - Brass Fittings                              | Leader Engineering Jalandhar; L & K Mathura,                            |
| Fittings -C.P. Fittings                                | Jaquar-continental series, Roca /Parrayware /Cera                       |
| Fire rated Glass fixing gasket, tape                   | Karfani, 3M                                                             |
| Floor Springs                                          | Dorma (XLC), GEZE, Haffle, Assa Abloy (Yale)                            |
| Floor hardening compound                               | Endura, Fosroc, Sika, Pidilite                                          |
| Flush Door Shutter (Factory pressed)                   | Godrej, Century, Greenply, Duroply, Kitply,                             |
| Furniture Hardware                                     | Hettich, Hafele                                                         |
| MS Expanded metal mesh (Powder Coated)                 | Tata, Asian Streck Metal                                                |

|                                                               |                                                                                                                               |
|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Glass, Tinted Glass, High Performance Glass, Reflective Glass | Saint Gobain, AIS, Modiguard (Gujarat Guardian), Pilkington, Asahi                                                            |
| Glass Processing                                              | GlassTech, FG, Fuso, Asahi, Nishu Glass Processor, GSC Toughened, Saint Gobain                                                |
| Ceramic Fritting on Glass                                     | Art & Glass, GSC Glass, Ashai                                                                                                 |
| Wired Glass                                                   | From Locally approved glass manufacturer                                                                                      |
| W.C. Pan Wash Basin, Urinals Sink Low down.                   | Parryware, Hindustan Sanitaryware, Cera,                                                                                      |
| E.W.C. Seats                                                  | Parryware, Hindustan Sanitaryware, Cera                                                                                       |
| Flushing Cistern                                              | Parryware Hindustan Sanitaryware industries Ltd., New Delhi, Cera                                                             |
| Stainless Steel Sink with drain board                         | Nirali, or equivalent                                                                                                         |
| Mirrors                                                       | Philco, Atul Glass Works, Vallabh Glass Works, Goldenfish                                                                     |
| Glass Doors (Motorised systems / sliding)                     | Autodoor Industries, DORMA, Manusa, Haffle,                                                                                   |
| Glass Fibre Acoustical Tiles                                  | ECOPHON, Armstrong, Anutone, AMF                                                                                              |
| Gypsum ceiling board                                          | Saint Gobain, Armstrong, Gyptech                                                                                              |
| Gypsum plaster                                                | Stain Gobain, Perma board approved equivalent, India Gypsum                                                                   |
| GI Rolling Shutters                                           | Standard, Swastik, Diana, Hercules, Prabhat, Vinayaga, Rani shutters-Pondy, Royal fabricators, Vinayaga-Chennai or Equivalent |
| Honey Comb Panels                                             | Sarey approved equivalent                                                                                                     |
| Laminates                                                     | Century, Greenlam, Formica, Sunmica,                                                                                          |
| Laminated Shuttering Ply                                      | Green Ply , Century Ply, Archidply                                                                                            |
| Masking Tapes                                                 | 3M, Sun Control, Wonder Polymer. Essentra                                                                                     |
| Metal Ceilings                                                | Luxalon, Armstrong, Techno Ceiling Product, Saint Gobain, Hunter Douglas, Dexune, USG                                         |

| <b>Material /</b>                                                          | <b>Approved</b>                                                           |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Metal Doors (Non Fire rated)                                               | Shakti Horman, Naviar, Ahlada, Metaflex,                                  |
| Mineral Fibre Grid Ceilings                                                | Armstrong, Saint Gobain (Ecophon), Anutone, USG Boral, Knauf, AMF, Dexune |
| Mirrors                                                                    | Saint Gobain, Modi Guard (Gujarat Guardian). Asahi. HNG. Pilkington       |
| Non shrink cementious precision (anchoring)                                | Fosroc, Sika, Endura,                                                     |
| Patch Fitting                                                              | Dorma (XLC), Haffle, Geze, Hettich, Kinlong                               |
| PAINT - Cement Based                                                       | ICI , Ultratech, Berger Paints, Asian,                                    |
| Paint - Acrylic, Synthetic Enamel, Acrylic emulsion- interior and exterior | Asian Paints, Akzo Nobel (Dulux), Berger, Jotun                           |
| Concrete Cover Blocks                                                      | Astra, Ramtec or approved equivalent. For exposed                         |
| Paint - Texture Paints (Interior, Exterior)                                | Asian, Jotun, ICI , Berger, Ultratech,                                    |
| Paint - Anti microbial paint                                               | Asian, Berger, Jotun                                                      |
| Paint - Anti carbonation paint                                             | Asian, Berger, Jotun, Krishna Conchem.                                    |
| Paint - Fire Retardant paint                                               | Jotun, Akzo Nobel, Viper-Nullfire, Asian                                  |
| Paint - High Albedo paint/ Solar reflective                                | Jotun, Sika, Fosroc, Pidilite, Ecmas                                      |

|                                                                              |                                                                                                                                                                                         |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Paint - Oil Bound Distemper & Dry Distemper                                  | Asian Paints, AkzoNobel (ICI Dulux), Berger, Ultratech                                                                                                                                  |
| Paint - Acid /Alkali Resisting                                               | Asian, Berger                                                                                                                                                                           |
| Paint - PU paint, epoxy paint and primer                                     | Asian, Nippon, ICI, Berger, Jotun                                                                                                                                                       |
| Polycarbonate Sheets & Panel system                                          | Tuflite, Gallina India, Dan Pal (Dpi daylighting), Lexan, Polygal, GE                                                                                                                   |
| Polish for wooden work                                                       | MRF, Asian                                                                                                                                                                              |
| Polysulphide Sealant                                                         | Pidilite, Fosroc, Dow corning, Sika, MC-                                                                                                                                                |
| Polyurethane Concrete Flooring, Epoxy flooring, Self Levelling compound      | Fosroc, Ardex Endura, MYK Schomburg, Sika                                                                                                                                               |
| Polyurethane overdeck insulation foam                                        | Pidilite, Ecmas, Lloyd Insulations                                                                                                                                                      |
| Polyster Powder coating/ PVDF Coating                                        | Jotun, Akzo nobel (Interpon), Valspar, Asian                                                                                                                                            |
| Precast panels for Façade                                                    | Fuji -Silvertech, Elematic                                                                                                                                                              |
| Precast concrete tiles, Interlocking Paving, Brick paver, Grass/ Grid Pavers | Vyara, Basant betons, Super Decorative floorings, Ultra Tiles, Unistone, Nimco                                                                                                          |
| Pre cast Concrete Landscape elements, gratings, kerb, Drain cover            | Vyara, Basant betons, Super Decorative floorings, KK Manholes & Gratings, Nimco                                                                                                         |
| Precoated Galvanised Sheets                                                  | Tata-Blue scope, Jindal, Everest, Interarch,                                                                                                                                            |
| Plasticiser/Admixture                                                        | Fosroc, Sika,                                                                                                                                                                           |
| PVB/ SGP Laminate Film, Sentry film                                          | Dupont, Saflex, Eastman , Saint Gobain, XDS                                                                                                                                             |
| PVC continuous fillet for periphery Packing of Glazings/ Curtain Wall        | Roop, Anand, Forex Plastic or approved equivalent                                                                                                                                       |
| PVC trims                                                                    | Sanjay Polymer, Tubes & Tubings                                                                                                                                                         |
| P.V.C Pipes                                                                  | Finolex / Supreme/ Astral                                                                                                                                                               |
| Reinforcement steel Fe 550D CRS HYSD/TMT BARS                                | SAIL, TATA (TISCO), RINL, JSW steel                                                                                                                                                     |
| Pipe-RCC                                                                     | Indian Hume Pipe Company, Delhi/ Allahabad/ Chandigarh/ Lucknow. Hindustan Pressure Pipes, Kolhapur, Dhare Concrete Products, Pune or any other approved manufacturer conforming B.I.S. |
| Rock wool Insulation                                                         | UP Twiga, Rockwool India, Lloyd, Ecophone,                                                                                                                                              |
| Retro Plate System (Concrete Floor)                                          | JBA, Impact flooring approved equivalent                                                                                                                                                |
| Signage vinyl sticker                                                        | Claude Neon, Prolite 3M                                                                                                                                                                 |
| Silicon Gaskets                                                              | Sree Gaurav, Roop                                                                                                                                                                       |
| Silicone Sealant                                                             | Wacker, Dow Corning, GE momentive, MC-bauchemie. Pidilite                                                                                                                               |

| Material /                                                       | Approved                                       |
|------------------------------------------------------------------|------------------------------------------------|
| Spider Fittings/ WCP profiles                                    | Dorma, Hefele, Hettich, Dline, Geze            |
| Stainless Steel                                                  | SAIL, Jindal, Salem steel                      |
| Stainless Steel Bolts, Washers and Nuts, Pressure plates, screws | Kundan, Puja, Atu, GKW, knettlefoldl           |
| Stainless Steel Friction Stay                                    | Giesse, Securistyle, Cotswold, Hefele          |
| Structural Silicon sealant, Weather Silicone                     | Dow Corning, Momentive (GE)                    |
| Structure Steel & Hallow Section Producers only                  | SAIL, TATA (TISCO), RINL, Jindal steel & Power |

|                                                                         |                                                                                                                               |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Suspended ceiling system                                                | Armstrong, Saint Gobain, USG Boral, Knauf,                                                                                    |
| Tensile Fabric Roofing                                                  | Ferrari, Saint Gobain, Melher, Sattler                                                                                        |
| Tactile Guiding & Warning flooring                                      | Johnson, Pelican ceramics, Maiara                                                                                             |
| Welding electrodes                                                      | Advani Oerlekon ,D&H ,Essab                                                                                                   |
| HSFG Bolts                                                              | GKW ,TVS, Unbrako                                                                                                             |
| Gratings                                                                | TUFF Grate,Indiana                                                                                                            |
| Veneer - Natural                                                        | GreenLam, Century, Kitply                                                                                                     |
| Valve-Gun Metal Valves          Copper Alloy                            | Leader Engineering Works, Jalandhar                                                                                           |
| Valve-Sluice Valves, Check Valves etc.                                  | Leader Engineering Works, Jalandhar; Kirloskar Bros. Limited, Pune; Indian Valve, Calcutta; Geeta Iron & Brass Works, Baroda. |
| Ceramic Tiles                                                           | Kajaria, RAK, Restile, Somany, Johnson, Asian                                                                                 |
| Vitrified Tiles                                                         | Kajaria, RAK, Restile, Somany, Johnson, Asian,                                                                                |
| White cement based putty                                                | Birla, Asian, Berger JK, utsav putty                                                                                          |
| Water Proofing compound                                                 | Fosroc, Sika, , Ecmas, Pidilite, Shalimar Tar Products (STP), CICO                                                            |
| Water proofing membrane/ coating (PU/ Elastomeric cementitious coating) | SIKA, Fosroc, Pidilite,                                                                                                       |
| Water Stops - Hydrophilic Swellable rubber                              | Sika, Ecmas,, Fosroc, Hydrotile, Penetron                                                                                     |
| Wood Wool board                                                         | Anutone, Armstrong, AMF, Himalaya Acoustic                                                                                    |
| Wooden Ceilings/ Wall panelling                                         | Anutone, Armstrong                                                                                                            |
| Wooden flooring - Engineered                                            | Armstrong, Pergo, Mikasa, Junkers, Haro, Tarkett, Hawwoods                                                                    |
| Wool Pile with Silent Film                                              | Schlegel or approved equivalent                                                                                               |

## **SECTION 2.7 CODES, STANDARDS AND REFERENCES**

### **1. IS CODES AND REFERENCES**

- 1) All the Indian Standards referred to shall be the latest revision (including all amendments issued thereto) on the date of opening of the price bid. The codes and standards mentioned in the various specifications and requirements specified in the enquiry document shall be latest as on the day of execution of the works unless otherwise specified. The revisions in the relevant codes and standards after the date of award of contract shall be informed by the BIDDER to the Consultant/ Owner within 30 days of the issue of such revision of the code/ standard. Consultant/ Owner may approve use of the earlier code/ standard if the revisions do not materially affect the statutory requirements of the project or does not impact safety practices. Any cost impact arising out of such revisions shall be mutually agreed.
- 2) Reference to only some of the codes in this document and various clauses of design criteria shall not limit or restrict the scope or applicability of other relevant codes. It shall be ensured that all other codes relevant to a specific job, in addition to those already mentioned, are followed wherever applicable.
- 3) Where British / American / DIN or other codes and standards are referred to in this document, equivalent Indian Standards may be substituted if available.
- 4) In case of any deviation / conflict between provisions of IS codes and the design criteria, the provisions that are more stringent shall be followed unless specifically directed otherwise.
- 5) The Codes and Standards listed below are applicable for the design and construction of structures and buildings in general. Codes and Standards applicable for specific design and construction are listed elsewhere in reference sections.
- 6) Specifications for materials supplied from India shall follow the Indian Standard Specifications.
- 7) Field and laboratory testing procedures for materials follow Indian Standard Specifications.
- 8) Working stress design can be used as alternative but the approval of OWNER is a prerequisite.
- 9) The list of codes shall also be read in conjunction with the list of codes given in the respective detailed technical specifications.

## **2. LOADS**

- IS: 875      Code of Practice for design loads (other than earthquake) for Buildings and structure (All parts)
- IS: 1911     Schedule of unit weights of building materials
- IS: 1893     Criteria for earthquake resistant design of structure
- IS: 15498    Guidelines for improving the Cyclonic Resistance of low rise houses and other buildings/ structures.

## **3. FOUNDATIONS**

- IS: 1080      Code of Practice for design and construction of shallow foundations on soils (other than raft, ring and shell)
- IS: 1904      Code of Practice for design and construction of foundations in soils general requirement
- IS: 2911      Code of Practice for design and construction of pile foundations: (All parts)
- IS: 2950      Code of Practice for design and construction of raft foundations
- IS: 2974      Code of Practice for design and construction of machine foundations (all parts)
- IS:4091      Code of Practice for design and construction of foundations for transmission line towers and poles.
- IS: 8009      Code of Practice for calculation of settlement of foundations: (All parts)
- IS:9556      Code of Practice for design and construction of diaphragm walls
- IS: 11089     Code of Practice for design and construction of ring foundation
- IS: 13301     Guidelines for vibration isolation for machine foundations

## **4. RCC**

- IS: 456      Plain and Reinforced Concrete-Code of Practice
- IS: 458      Specification for precast concrete pipes
- IS: 3370      Code of Practice for concrete structures for the storage of liquids: (All Part)
- IS: 3414      Code of Practice for design and installation of joints in buildings
- IS: 3935      Code of Practice for composite construction

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| IS: 4326  | Code of Practice for earthquake resistant design and construction of buildings                            |
| IS: 4995  | Criteria for design of reinforced concrete bins for storage of granular (all parts) and powdery materials |
| IS:4998   | Criteria for design of reinforced concrete chimneys:2015                                                  |
| IS: 5525  | Recommendation for detailing of reinforced concrete works                                                 |
| IS: 1786  | Specification for high strength deformed steel bars and wires for concrete reinforcement                  |
| IS: 10262 | Recommended guidelines for concrete mix design                                                            |
| IS: 11384 | Code of Practice for composite construction in structural steel and concrete                              |
| IS:11504  | Criteria for structural design of Reinforced concrete Natural Draft Cooling Tower                         |
| IS:11682  | Criteria for design of RCC staging for overhead water tanks                                               |
| IS: 13920 | Code of Practice for ductile detailing of reinforced concrete structures subjected to seismic forces.     |

## **5. STRUCTURAL STEEL**

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| IS: 800  | General construction in steel- Code of Practice                                                |
| IS:802   | Code of Practice for use of structural steel in overhead transmission line towers: (All parts) |
| IS: 806  | Code of Practice for use of steel tubes in general building construction                       |
| IS: 808  | Dimensions for hot rolled steel beam, column channel and angle section                         |
| IS: 813  | Scheme of symbols for welding                                                                  |
| IS 814   | Covered electrodes for manual metal arc                                                        |
| IS: 816  | Code of Practice for use of metal arc welding for general construction in mild steel           |
| IS: 1024 | Code of Practice for use of welding in bridges and structures subjected to dynamic loading     |
| IS: 1161 | Steel tubes for structural purposes                                                            |
| IS1599   | Method of Bend Test.                                                                           |

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| IS 1608   | Method of Tensile Testing of Steel Products.                                  |
| IS: 2062  | Structural steel (fusion welding quality)                                     |
| IS: 4000  | High Strength bolts in steel structures – Code of Practice                    |
| IS: 7215  | Tolerances for fabrication of steel structures                                |
| IS: 8640  | Recommendations for dimensional parameters for industrial building            |
| IS: 9178  | Criteria for design of steel bins for storage of bulk material<br>(All parts) |
| IS: 9595  | Recommendation for Metal arc welding of carbon and carbon manganese steel     |
| IS: 12843 | Tolerances for erection of steel structures                                   |

## 6. MISCELLANEOUS

|            |                                                                                                                     |
|------------|---------------------------------------------------------------------------------------------------------------------|
| IS: 1038   | Specification for steel doors, windows and ventilators                                                              |
| IS: 1172   | Code of basic requirements for water supply, drainage and sanitation                                                |
| IS: 1346   | Code of Practice for water proofing of roofs with bitumen felts                                                     |
| IS: 1742   | Code of Practice for building drainage                                                                              |
| IS: 1905   | Code of Practice for structural use of unreinforced masonry                                                         |
| IS: 2210   | Criteria for design of reinforced concrete shell structures and folded plates                                       |
| IS: 2470   | Code of Practice for installation of septic tank:                                                                   |
| ( part 1 ) | Design criteria and construction                                                                                    |
| ( part 2 ) | Secondary treatment and disposal of septic tank effluent                                                            |
| IS: 3067   | Code of Practice for general design details and preparatory works for damp proofing and water proofing of buildings |
| IS: 10440  | Code of Practice for construction of reinforced brick and reinforced brick concrete floors and roofs                |
| SP: 6      | Handbook for structural engineers (all parts)                                                                       |
| SP: 7      | National Building Code of India                                                                                     |
| SP: 16     | Design Aids for reinforced concrete to IS: 456-2000                                                                 |

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| SP: 20                  | Handbook on masonry design and construction                                                |
| SP: 22                  | Explanatory handbook on codes for earthquake engineering (IS: 1982-2015 and IS: 4326-2013) |
| SP: 24                  | Explanatory handbook on Indian Standard code of Practice for plain and reinforced concrete |
| SP: 25                  | Handbook on causes and prevention of cracks in buildings                                   |
| SP: 32                  | Handbook on functional requirements of industrial buildings                                |
| SP: 34                  | Handbook of concrete reinforcement and detailing (SCIP)                                    |
| IRC: 37                 | Guidelines for design of flexible pavements                                                |
| IS 383                  | Specification for coarse & fine aggregates from natural sources for concrete.              |
| IS 3182                 | Specification for broken brick (burnt clay) fine aggregate for use in lime mortar.         |
| IS 6925                 | Method of test for determination of Water Soluble Chlorides in concrete admixtures.        |
| IS 5624                 | Foundation bolts.                                                                          |
| IS1363<br>(Part I to 3) | Hexagon Head bolts, screws, nuts.                                                          |
| IS 2016                 | Plain washers.                                                                             |
| IS 2614                 | Method for sampling of fasteners.                                                          |
| IS 1077                 | Specification for common burnt clay building bricks.                                       |
| IS3495<br>(Part I to 4) | Method of Test for burnt clay building bricks.                                             |
| IS 3620                 | Specification for Rubble stone block for masonry.                                          |
| IS 1121                 | Method of test for determination of strength properties of natural building stone.         |
| IS 1125                 | Method of test for determination of weathering of natural building stones.                 |
| IS 1126                 | Method of test for determination of durability of building stone.                          |
| IS 1127                 | Recommendation for dimensions and workmanship of natural building stones for masonry work. |

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| IS 460<br>(Part I to 3) | Specification for Test Sieves.                                                        |
| IS 1129                 | Recommendation for dressing of natural building stone.                                |
| IS 1130                 | Specification for Marble (blocks, slabs and tiles).                                   |
| IS1008<br>(Part-2)      | Specification for timber panelled & glazed shutters, windows and ventilator shutters. |
| IS 6315                 | Specification for floor springs (hydraulically regulated) for heavy doors.            |
| IS 3828                 | Specification for ventilator chains.                                                  |
| IS 1917                 | Structural steel (ordinary quality).                                                  |
| IS 1148                 | Specification for hot rolled rivet bars for structural purposes.                      |
| IS 101<br>(Part I to 8) | Method of sampling and test for paints, Varnishes and related products.               |
| IS 73                   | Paving Bitumen.                                                                       |
| IS 217                  | Cut Back Bitumen.                                                                     |
| IS 454                  | Specification for cutback bitumen.                                                    |
| IS 5467                 | Specification for shellac Wax                                                         |
| IS 3037                 | Specification for Bitumen mastic for use in water proofing of roofs.                  |
| IS 782                  | Specification for caulking lead.                                                      |
| IS405<br>(Part 1&2)     | Lead sheet and strips.                                                                |
| IS 5134                 | Bitumen impregnated paper.                                                            |
| IS 2849                 | Specification for non load bearing gypsum partition blocks.                           |
| IS 2095                 | Specification for gypsum plaster boards.                                              |
| IS 77                   | Specification for linseed oil, boiled for paints.                                     |
| IS 533                  | Gum Spirit of turpentine (oil of Turpentine).                                         |
| IS 8273                 | Specification for gypsum plaster for use in the manufacture of fibrous plaster board. |
| IS5871<br>1987          | - Specification for bitumen mastic for tanking and damp proofing.                     |

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| IS651<br>1992            | - Specification for salt glazed stoneware pipe and fittings.                                                  |
| IS1729<br>1979           | - Sand cast iron spigot and socket soil pipe.                                                                 |
| IS 1230                  | Cast iron rain water pipes and fittings.                                                                      |
| IS 774                   | Flushing cisterns for water closets and urinals.                                                              |
| IS2548<br>(Part 1&2)     | Specification for plastic seats and cover for water closet.                                                   |
| IS 1726                  | Specification for cast iron manhole cover and frames.                                                         |
| IS 4984                  | Specification for high density polyethylene pipes for potable water supplies Sewage and industrial effluents. |
| IS 7328                  | High density polyethylene materials.                                                                          |
| IS 3076                  | specification for low density polyethylene pipe for potable water supplies.                                   |
| IS 9762                  | Specification for polyethylene floats for ball valve.                                                         |
| IS 3395                  | Code of practice for fire safety of industrial buildings.                                                     |
| IS7834<br>(Part I to 8)  | Specification for injection moulded PVC fittings with solvent cement joint for water supplies.                |
| IS8008<br>(Part I to 7)  | Specification for injection moulded HDPE fittings for potable water supplies.                                 |
| IS8360<br>(Part 1 to 3)  | Specification for fabricated high density polyethylene fittings for potable water.                            |
| IS 784                   | Specification for prestressed concrete pipe                                                                   |
| IS 1703                  | Specification for copper alloy float valves (horizontal plunger type) for water supply fittings.              |
| IS 12234                 | Specification for plastic equilibrium float valve for old water services.                                     |
| IS 1536                  | Centrifugally cast (spun) iron pressure pipes.                                                                |
| IS 1537                  | Vertically cast iron pressure pipes for water, gas and sewage.                                                |
| IS1538<br>(Part I to 23) | sand cast iron spigot and socket soil, waste and ventilating pipes fittings and accessories.                  |

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| IS 3589                 | Electrically welded steel pipes for water, gas and sewage.                                   |
| IS 781                  | Specification for cast copper alloy screw down bib taps and stop valves for water services.  |
| IS 1795                 | Specification for pillar taps for water supply purposes.                                     |
| IS 2016                 | Plain washers.                                                                               |
| IRC 19                  | Standard specification and code of practice for water Bound macadam.                         |
| IRC 29                  | Tentative specification for 4 cm Asphaltic concrete surface course.                          |
| IRC 15                  | Standard specification and code of practice for construction of concrete roads.              |
| IS 1054                 | Dieldrin emulsifiable concentrates.                                                          |
| IS 1308                 | Aldrin dusting powders.                                                                      |
| IS 6439                 | Hepta chlor emulsifiable concentrates.                                                       |
| IS 2632                 | Crotonaldehyde.                                                                              |
| IS 1343                 | Code of practice for prestressed concrete.                                                   |
| IS1785<br>(Part 1&2)    | Specification for plane hard drawn steel wires for prestressed concrete.                     |
| IS 1635                 | Code of practice for field slaking of building lime.                                         |
| IS 737                  | Wrought aluminium and aluminium alloys, sheet and strips ( for general engineering purposes) |
| IS 3316                 | Specification for structural granite.                                                        |
| IS 1196                 | Code of practice for laying bitumen mastic flooring.                                         |
| IS 1195                 | Specification for bitumen mastic for flooring.                                               |
| IS 1198                 | Code of practice for laying fixing and maintenance of linoleum floor.                        |
| IS7634<br>(Part I to 3) | Code of practice for plastic pipes.                                                          |
| IS .3114                | Code of practice for laying of cast iron pipes.                                              |
| IRC-SPII                | Hand book of quality control for construction of roads and runways.                          |
| IRC-63                  | Tentative guidelines for use of low grade aggregates and soil                                |

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|              | aggregate mixtures in road pavement construction.                                                                     |
| IRC-60       | Tentative guidelines for use of Lime Fly Ash Concrete as pavement base or sub-base.                                   |
| IRC-74       | Tentative guidelines for use of Lean Cement Concrete and lean concrete Fly Ash Concrete as pavement base or sub-base. |
| IS 6509      | Code of practice for installation of joints in concrete pavement.                                                     |
| IRC-43       | Recommended practice for Tools, Equipment and appliances for concrete pavement construction.                          |
| IRC-15       | Standard specifications and code of practice for construction of concrete road.                                       |
| IS 1609      | Code of practice for laying damp proofing treatment using bitumen felt.                                               |
| IS 4365      | Code of practice for application of bitumen mastic for waterproofing of roofs.                                        |
| IS 278       | specification for Galvanized barbed wire for fencing.                                                                 |
| IS 2721      | Specification for Galvanized steel chain link fabric.                                                                 |
| IS 4826      | Specification for hot dipped galvanized coating on round steel wires.                                                 |
| IS 5916      | specification for cast iron gratings for drainage purposes.                                                           |
| IS 4130      | Safety Code for demolition of building.                                                                               |
| IS 5121      | Safety code for piling.                                                                                               |
| IS 7293      | Safety code for working with construction machinery.                                                                  |
| IS 7205      | Safety code for erection of structural steel works.                                                                   |
| IS 9918      | Code of practice for in-situ water proofing and damp proofing treatments with glass fibre tissues reinforced bitumen. |
| BS:4485      | Structural design of Cooling Towers (part 4).                                                                         |
| AWWA-C - 210 | Liquid-Epoxy coatings and lining for steel water pipe and fittings.                                                   |

## **ATTACHMENTS**

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|--------------|--------------------------------------------------|
| ATTACHMENT-1 | EARTHWORK IN EXCAVATION, GRADING AND BACKFILLING |
| ATTACHMENT-2 | DE-WATERING                                      |
| ATTACHMENT-3 | ANTI TERMITE TREATMENT                           |
| ATTACHMENT-4 | CONCRETE AND ALLIED WORKS                        |
| ATTACHMENT-5 | GENERAL BUILDING WORKS                           |
| ATTACHMENT-6 | WATER SUPPLY & SANITARY WORKS                    |
| ATTACHMENT-7 | ROAD                                             |