BHILAI STEEL PLANT

AUGMENTATION OF FUEL & FLUX CRUSHING FACILITIES
(PACKAGE NO. 064)
AT BHILAI, CHHATTISGARH

DESIGN CRITERIA
FOR
CIVIL WORKS

APPROVED
WITHOUT PREJUDICE TO
CONTRACTUAL OBLIGATION & LIABILITIES

SIGNATURE

NAME

DATE

MECON LIMITED

ENGINEERING PROJECTS (INDIA) LTD.
(UNDER CONSTRUCTION)

PACKAGE DESCRIPTION
AUGMENTATION OF FUEL & FLUX CRUSHING
FACILITIES (PACKAGE NO. 064)

DESIGN
BR
DRAWN
CHECKED
APPROVED
DATE

REVISION
NO OF SHEETS

EPI-064-05 - BD - 06001
16
16
1. **PROJECT INFORMATION**

- **Owner**: BHILAI STEEL PLANT  
  Steel Authority Of India Ltd (SAIL)

- **Consultants**: MECON LIMITED, RANCHI

- **Project Title**: Augmentation of Fuel & Flux Facilities (PKG-064) of Bhilai Steel Plant

- **Location**: Bhilai, District- Chhatisgarh.

- **Ambient Temperature**: 48°C (Maximum)  
  9°C (Minimum)

- **Relative Humidity**: 25% to 100%

- **Rainfall**: 1288.8 mm (Average Annual)  
  100 mm/hr (Design rainfall intensity)

- **Wind data**: Basic wind speed 39 m/s

- **Seismic Zone**: Zone II as per IS:1893 (Part-1) : 2002

- **Plant Levels**: For Finished ground /floor level refer to the Respective structural / civil drawings

2. **SCOPE OF WORK**

This document covers Design Basis for all Civil work related to the following (but not limited to the same):

**A. COAL HANDLING PLANT:-**

- RCC mixing bins (Silos), 5 Nos. each of 500t storage capacity in 3rd row.

- Additional reversible hammer mills, 2 Nos. each of capacity 350t/h in existing row of hammer mills after extending the existing crushing station.

- Up rating & modification of existing collecting conveyors Y7-12 & Y7-13 to 1000t/hr. capacity in the existing location with minimum shutdown.

- Connecting conveyor stream, connecting new coal tower no. 7 with existing Coal Handling Plant.

- Connecting conveyors for new silos & new crushers to the existing Coal Handling Plant
B. COKE SORTING PLANT:-

- Coke crushing station
- Coke screening station
- Coke breeze bunkers
- Emergency coke storage yard
- Coke dedusting unit
- Junction houses
- Travelling tripper gallery
- Galleries and associated mechanical, civil, structural, electrical works of COBP# 11

C. AUGMENTATION IN FLUX- FUEL PREPARATION AND PLANT RETURN FINES HANDLING FOR SP III FACILITIES:-

- Connecting existing Blast furnace return fines C line conveyor with new BF#8 return fines conveyor.
- Up gradation / Addition of coke crushing and screening and grinding facilities.
- Up gradation/ Addition of Flux crushing & screening facilities.
- Dismantling of C-line conveyors & Junction houses (including foundation of Junction houses & trestle of conveyors with an undulation of about +500mm) & Re-routing of existing sinter fines conveyors (C-lines)

3. CIVIL WORK

3.1 Codes and Standards:

The work shall be carried out as per the following standards but need not be limited to the same. Other standards, if relevant, shall also be followed.

3.1.1 Loads:

IS 875 (Part II & III, 1987) : Code of Practice for design live & wind loads (other than earthquake) for buildings and structure

IS 1893 (part-I, 2002) & part-IV, 2005 : Criteria for earthquake resistant design of structure
3.1.2 Foundations:

IS : 1080 : Code of Practice for design and construction of shallow foundations in soils (other than raft, ring and shell)

IS : 1904 : Code of Practice for design and construction of foundations in soils: General requirement loads (other than earthquake) for buildings and structure

IS : 2950 : Code of practice for design and construction of raft foundations; Part-1 : Design

IS : 2974 (Part 1) : Code of Practice for design and construction of machine foundations for Reciprocating Type Machine

IS : 8009 (Part 1) : Code of Practice for calculation of settlement of foundations: Shallow foundations subject to symmetrical static vertical loads

IS : 8009 (Part 2) : Code of Practice for Deep foundations subjected to symmetrical static vertical loading

IS : 11089 : Code of Practice for design and construction of ring foundations

IS 13301 : Guidelines for vibration isolation for machine foundations.

3.1.3 Reinforced Cement Concrete:

IS : 456 : Code of Practice for Plain and Reinforced Concrete

IS : 3370 : Code of Practice for Concrete Structures for the storage of liquids

IS : 3414 : Code of Practice for design and installation of joints in buildings

IS : 4326 : Code of Practice for earthquake resistant design and construction of buildings

IS : 4998 : Criteria for design of RCC chimneys

IS : 5525 : Recommendation for detailing of Reinforcement in reinforced concrete works

IS : 13920 : Code of Practice for Ductile Detailing of RCC structures subjected to Seismic Forces

SP-7 : National Building Code of India

SP-16 : Design Aids for reinforced concrete to IS : 456
3.2 Design Criteria for Buildings:

3.2.1 Loads:

Design loads shall comply with the requirements of IS: 875 & IS: 1893 (relevant parts), as a minimum, unless more stringent requirements are specified herein. The following types of loads shall be considered in general for the analysis and design of structures and foundations.

3.2.1.1 Dead Loads (DL):

Dead loads shall include the weight of all structural/architectural components, equipment of a permanent or semi-permanent nature including tanks, wall panels, partitions, roofing, piping, drains, electrical trays, bus-ducts etc. Self-weight of materials may be calculated on the basis of unit weights given in IS: 875 (Part-1).

3.2.1.2 Live Loads (LL):

Live loads shall consist of uniform live loads. Uniform live loads are unit loads, which are sufficient to provide for movable and transitory loads, such as the weight of people, portable equipment and tools, equipment, or parts, which may be moved over or placed on floors during maintenance operations. These uniform live loads shall not be considered on floor area, which are permanently covered with equipment.

Plant loads shall be obtained from the manufacturer and due allowance shall be made for any dynamic or impact effects. Foundations and fixing arrangements for items of equipment, which generates vibration, shall be designed to prevent transfer of such vibrations to the adjoining structures.

Equipment live loads are calculated loads based upon the actual weight and size of the equipment and parts to be placed on floors during dismantling and maintenance or to be temporarily placed on or moved over floors during installation. Floors and supporting members, which are subject to heavy equipment loads shall be designed on the basis of the weight of the equipment, in addition to a uniform load of 5.0 KN/sq.m or specifically defined live loads whichever is greater. Each member in the floor which carry these loads shall be designed for the heaviest piece or pieces of equipment arranged in the most critical position. For loads caused by moving equipment over the floor for installation, consideration shall be given to the propping of beams and floor, from floors below.
100% of roof live load shall be considered in columns. In case floor live load is greater than 5.0 KN/sq.m, columns shall be designed with reduced live load from floor as per Cl.3.3 of IS: 875 (Part 2). In case floor live load is 5.0 KN/sq.m or less than that, there will be no reduction in live load from floors to the columns. In any case total live load reduction from all floors for a member shall not exceed 20% of total live load irrespective of codal provision.

The live loads on floor shall be taken as per IS: 875 (Part-2) but in no case less than the following:

A) All Buildings and structures (Unless noted otherwise) :

Roof (accessible) : 1.50 KN/m² + hung load, if any + Dust load (0.50 KN/m²)
Roof (inaccessible) : 0.75 KN/m² + hung load, if any + Dust load (0.50 KN/m²)
Platforms and stairs : 5 KN/m²
Corridors : 5 KN/m²
On ladders : 1.2 KN/m² at centre of rung
On removable covers over trenches : 15KN/m² & manholes in Switchgear & control room.

B) Miscellaneous Plant :

C) Underground Structure :

A surcharge of 20 KN/m² in addition to other loads e.g. earth and water pressure etc. for all underground structures located at a place affected by vehicular traffic. For other places a surcharge pressure of 10KN/m² shall be considered. Earth pressure shall be calculated using co-efficient of earth pressure at rest, co-efficient of active or passive earth pressure (whichever is applicable).

3.2.1.3 Wind Loads (WL):

Wind loading shall be in accordance with Indian Standard Code IS: 875(Part-3) for a basic wind speed of 39 m/sec.

The building classification shall be with risk co-efficient of 1.0 and topography factor of 1.05 and terrain category-2.

3.2.1.4 Earthquake Loads (EL):

The lateral forces will be established in accordance with the recommendations of IS-1893. The site falls in Zone-II, as identified in the map of IS 1893 (Part-1):2002. Importance factor (I) shall be taken as per Table 2 of IS 1893 (Part-4):2002. Under earthquake condition, the whole frame except roof shall be assumed loaded with 50% design live load. No further reduction in column live loads shall be considered.
3.2.1.5 Impact Allowance for elevators and hoists:

Impact factor:

a) Elevators - 100% of Lifted Load

b) Monorails & Crane Girders:
   i) Vertical Impact - 25% of maximum static wheel load
   ii) Transverse Surge 10% of total moving load
   iii) Longitudinal Surge 5% of wheel load

3.2.1.6 Equipment Loads:

Major equipment loads shall be specifically obtained from manufacturers.

3.2.1.7 Test Loads:

The test load shall be defined as the gravity load imposed, if necessary, for testing supporting system for vessels, tanks, equipment or piping.

3.2.1.8 Estimated Loads:

Loadings imposed by equipment shall be specifically determined or estimated before detailed structural design. Estimated loadings shall be noted as such in hand calculations or computer input and verified before detail design. The loading due to future extension of units and installation of additional equipment, where necessary, in future in the unit are to be considered for design.

3.2.1.9 Temperature Loads

Members subjected to temperature variations shall be designed to withstand the stresses arising out of such temperature variations. The maximum distance of the expansion joint will be as per provisions of IS : 456.

3.2.1.10 Dynamic Loads:

Structures shall be designed to withstand the effects of vibration and impact to which it may be subjected. Each structure and foundation supporting a compressor if any, pump or other machinery having significant dynamic imbalance shall be designed to resist the peak loads specified by the manufacturer. Vibration amplitudes of the supporting structure or foundation shall be kept within acceptable limits for dynamic forces that occur during normal machine operation. In the case of a tall and slender structure, the dynamic effects due to wind gusts shall be investigated if required.
3.2.2 Load Combinations:

3.2.2.1 For Limit State Design of R.C.C. Structures:

i) \(1.5\text{DL} + 1.5\text{LL}\)

ii) \(1.5\text{DL} + 1.5\text{WL1}\)

iii) \(1.5\text{DL} + 1.5\text{WL2}\)

iv) \(1.5\text{DL} + 1.5\text{EL}\)

v) \(1.2\text{DL} + 1.2\text{LL} + 1.2\text{WL1}\)

vi) \(1.2\text{DL} + 1.2\text{LL} + 1.2\text{WL2}\)

vii) \(1.2\text{DL} + 0.6\text{LL} + 1.2\text{EL}\)

viii) \(0.9\text{DL} + \text{WL1}\)

ix) \(0.9\text{DL} + \text{WL2}\)

x) \(0.9 \text{DL} + \text{EL}\)

xi) \(0.9\text{DL} + 1.5\text{WL}\)

xii) \(0.9\text{DL} + 1.5\text{EL}\)

Nomenclature

\(\text{DL} \): Dead load (comprising dead weight of concrete & reinforcement and of structural, members, side cladding including equipment loads)

\(\text{LL} \): Live load (i.e. imposed load)

\(\text{EL} \): Earthquake load

\(\text{WL1} \): Wind load with internal suction as per IS:875 Part-3

\(\text{WL2} \): Wind load with internal pressure as per IS:875 Part-3

Notes:

1. Equipment loads shall not be considered as a part of DL for checking the stability of the structure.

2. Under seismic condition live loads are reduced by factor 0.5.

3. Weight of equipment, ducts, tanks, pipes, conduits etc. supported by structure shall be considered for maximum possible loading, i.e. flooded material contents and associated impacts, test loadings, anchorage and constraint effects.
4. Wind load and Earthquake load shall not be assumed to act simultaneously. The effect of both the forces shall be considered separately.

5. "Lifted load" of crane shall not be considered in seismic condition.

6. In case two cranes are provided and tandem operation is envisaged for some bays, then the load shall be taken for both the cranes fully loaded and standing side by side for these bays. For other bays, load shall be taken as one crane fully loaded and second crane without lifted load but standing idle adjacent to first crane.

3.2.3 Methodology of Analysis

Analysis of building / structure shall be carried out by 3D (Space frame method) or by 2D depending on the type of structure and load details.

For analysis of structures, STAAD Pro computer program will be used. For design of various structural elements like footings, columns, beams, slabs etc. in-house developed software or STAAD Pro will be used as applicable.

3.2.4 Water Table:

Water Table shall be considered at finished ground level for the purpose of design of underground structures.

3.3 Design Criteria for Liquid Retaining Structures:

Liquid Retaining Structures shall be designed as uncracked section in accordance with IS:3370 and roof beams and slab will be designed on cracked basis as per IS: 456.

Liquid Retaining Structures shall be checked for two loading conditions.

i) With water inside up to operating level and no earth fill, surcharge or ground water outside. In case two compartments are provided in the same structure, then water in one compartment and no water in the other.

ii) With earth outside, surcharge pressure and ground water at FGL and no water inside.

The walls shall be designed for a surcharge load as applicable.

The structure shall also be checked for stability and factor of safety shall not be less than those specified under Clause 20 of IS:456 against overturning and sliding. Factor of safety against uplift due to buoyancy caused by ground water (considering empty condition inside and ignoring superimposed loadings) and shall be at least 1.20 as per Clause 4.2 (b) (1) IS:3370. (Part-1).
3.4 Design Criteria for Cable Trenches:

The cable trench walls shall be designed for the following loads:

i) Minimum dead load of 1.50 KN/m length of cable tray or as per actuals whichever is higher.

ii) Applicable earth pressure, ground water pressure, as also uniform surcharge pressure due to ground loading.

iii) Cable trench covers shall be designed for self-weight of top slab and a minimum uniformly distributed load of 4.0 KN/m² on each panel or vehicular load as per IRC standards, wherever applicable.

iv) Cable trench/tunnel crossing the road shall be designed for class AA loading of IRC/relevant IS code and should also be checked for Class A loading.

Permissible stress:

The permissible stresses will be as per relevant IS Code. Appropriate increase in allowable stresses as per applicable IS Codes shall be considered, under wind/seismic loading, if design is carried out by Elastic/Working Stress method (ANNEX- B 2.3 of IS: 456, in case of RCC structures).

If Limit State method of design is used, partial safety factors/load factors shall be applied to the loads as per relevant IS Codes. (Table 12 of IS: 456, in case of RCC structure).

3.5 Deflection Criteria

3.6 For RCC Structures

The following deflection criteria shall be considered in sizing of structures as per IS:456.

i) The final deflection due to all loads including effects of temperature, creep, shrinkage and measured from as-cast level of the supports of floors, roofs & all other horizontal members shall not normally exceed span/250.

ii) The deflection including effects of temperature, creep & shrinkage occurring after erection of partitions and the application of finishes shall not normally exceed span/350 or 20 mm whichever is less. Under transient wind load, the lateral sway at the top of column shall not exceed H/500, H being the total height of the column (ref. Cl. 20.5 of IS 456).

3.7 Stability of Structures

The minimum factor of safety against overturning, sliding and hydrostatic uplift shall be as per relevant IS Codes.

Foundations: Factor or safety of foundation/structure during and after construction shall be as under and shall satisfy the requirements of relevant Code IS : 456.
a) Sliding and Overturning: ‘1.5’ considering entire dead weight of structures together with weight of backfilled soil.

b) Uplift due to hydrostatic forces: ‘1.25’ considering entire dead weight of structures together with weight of backfilled soil.

3.8 Foundation System:

For design of foundations, net allowable bearing capacity in different strata shall be considered based on the soil investigation report.

The minimum depth at which foundation may be placed shall be 1.0 m below natural ground level. However, lightly loaded structures with foundation load intensities less than or equal to 50KN/m² may be supported on open/shallow foundation placed at minimum 750mm below natural ground level.

Based on Soil Investigation Report, the following parameters shall be adopted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBC</td>
<td>Refer Soil Report</td>
</tr>
<tr>
<td>Density of soil</td>
<td>Refer Soil Report (From Laboratory Tests)</td>
</tr>
<tr>
<td>Φ</td>
<td>Refer Soil Report (From Laboratory Tests)</td>
</tr>
<tr>
<td>C</td>
<td>Refer Soil report (From Laboratory Tests)</td>
</tr>
</tbody>
</table>

The foundation shall be designed for the most critical combination of forces and moments, resulting from all the possible combinations of the various loading from the structural system.

In view of presence of hard soil strata at site, loss of contact of foundations with soil may be allowed, provided the maximum calculated bearing pressure in the modified pressure diagram remains within the specified limit and stability is ensured.

In case the resultant force on the foundation is not laying within middle third of the plan area, the partial loss of contact of raft with soil shall be allowed. However, maximum loss of contact shall be limited 1/6 of the width of raft.

Design Criteria:

Foundation for structure and equipment shall be designed for the worst conditions of loading and be designed as per IS: 1904.

The maximum base pressure shall be within the net allowable bearing capacity of the soil. Generally, the foundation shall be taken down to at least 1.0 m below original ground level in case of soil and 0.3 m in case of rocky strata.

Foundations of equipment subjected to dynamic loading shall be isolated from adjoining floors/foundations to prevent propagation of vibration.
Permissible settlements of Foundations:

For open foundations, the total permissible settlement and differential settlement will be governed by IS:1904/ IS:13063 respectively and from functional requirements whichever is more stringent.

3.9 Design Details:

3.9.1 Concrete Structures:

Design Mix concrete shall be used in all concrete works for all areas. Design mix shall be carried out as per IS:10262.

The following grades of concrete as per IS: 456 shall be provided for the type of structures noted against each:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Grade of conc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>i) Mudmat</td>
<td>M10</td>
</tr>
<tr>
<td></td>
<td>ii) Levelling Course</td>
<td>M7.5</td>
</tr>
<tr>
<td>2.</td>
<td>i) Reinforced concrete for super structure</td>
<td>M25</td>
</tr>
<tr>
<td></td>
<td>ii) Reinforced concrete for foundation</td>
<td>M25</td>
</tr>
<tr>
<td></td>
<td>iii) Reinforced concrete for water retaining structures</td>
<td>M25</td>
</tr>
<tr>
<td></td>
<td>iii) Ground floor slabs inside buildings</td>
<td>M20</td>
</tr>
<tr>
<td>3.</td>
<td>Paving slab in outdoor areas</td>
<td>M20</td>
</tr>
<tr>
<td>4.</td>
<td>Pre-cast concrete units</td>
<td>M25</td>
</tr>
<tr>
<td>5.</td>
<td>Grouting</td>
<td>1:1:2</td>
</tr>
</tbody>
</table>

Concrete tanks/ water-retaining structures shall be designed in accordance with the recommendations of IS:3370.

Design of all other RCC structures including foundations shall be done by limit state method/working stress method as per the procedures of IS:456-2000.

For reinforcement, high strength deformed steel bars conforming to Grade Fe415/Fe500 of IS:1786, or equivalent TMT bars, are to be used.

Portland Slag cement conforming to IS 455 or Portland Pozzolana cement conforming to IS 1489 and other type of cements as per requirement shall be used.

The increase in permissible stresses will be considered as under:

Where stresses due to wind (or seismic) load 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. For limit state method the partial safety factor for loads shall be reduced to 1.2 as per IS 456-2000.
Bearing capacity of the soil/pile shall be allowed to be increased by 25% under seismic/wind load condition.

Clear cover to reinforcement shall be as per IS: 456 for moderate exposure condition. However, the minimum concrete cover shall not be less than the following (considering moderate exposure and fire resistance of a minimum of 2 hrs):

a) Slabs: 25 mm or dia of bar whichever is greater
b) Beams: 40 mm or dia of bar whichever is greater
c) Beams in contact with earth: 40 mm
c) Columns & Pedestal: 40 mm
d) Footings: 50 mm
e) Walls: 30 mm
f) Chajja: 15 mm
g) Underground Tunnel, Reclaim Hopper etc.
   i) Face in contact with earth = 50 mm
   ii) Free Face = 30 mm
   iii) Trench & Drain = 20 mm

Ground Floor of Buildings:

Ground floor of various buildings shall have 150 mm thick RCC (M20) with 8 dia. bars @ 200 c/c (both ways single mesh) over 50 mm thick. PCC (M10) laid over 250 mm thick boulder soling over well compacted earth.

Plinth Protection:

Minimum 1000 mm wide PCC apron in slope around the building with concrete side drains, sump pits etc. shall be provided. Top of Apron shall be finished with 15 mm thick cement mortar (1:4) with neat cement finish.

Waterproofing and Damp proofing:

All underground structures like basements, tunnels, sumps, pits, etc. shall be made of concrete added with water-proofing admixtures or plasticiser-cum-waterproofing cement additive conforming to IS: 9103. The concrete surface of these structures in contact with soil shall be provided with minimum two coats of acrylic polymer modified cementacious paint.

R.C.C roof of building shall be waterproofed using acrylic polymer modified cementacious slurry coatings 2 coats with fibreglass cloth in between covered with protective screed 1:2:4 in 1:80 slope as per manufacturers specifications.

All ground floor walls shall be provided with damp proofing course.
Grouting and Anchor Bolts:

Non-shrink flowable grout shall be used under base plate of columns. Non-shrink cum plasticizer admixture shall be added in the grout. For grouting of base of machine foundation high strength ready mixed non-shrink flowable grout shall be used. Nominal thickness of grouting shall be 50mm for building columns and pedestals of major equipment.

Anchor Bolts, in general, shall be of property class 4.6 conforming to of IS: 5624.

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 100mm.
b) Clear distance from the face of pocket to the outer edge of pedestal shall be minimum 75mm.
c) Clear distance from the edge of sleeve or anchor plate to the edge of pedestal shall be minimum 75mm.

Minimum Thickness of Structural Concrete Elements:-

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): 250mm
f) Parapets: 125mm
g) Sunshades: 75mm at edge
h) Pre-cast louver / fins: 50mm
i) Pre-cast trench cover slabs / floor slabs / louver: 75mm
j) Paving: 100mm
k) Basement walls and base slab: 200mm
l) Underground sumps .pits
   i. Below ground water table: 200mm
   ii. Above ground water table: 150mm
m) Fire resistance wall: 200 mm
MISCELLANEOUS ITEMS:

Brickwork:

Fly ash bricks shall be used as available locally. Mortar for fly ash brickwork shall be as under:

<table>
<thead>
<tr>
<th>Wall Thickness</th>
<th>Mortar (Cement : Sand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>230mm and above</td>
<td>1 : 6</td>
</tr>
<tr>
<td>115mm or below</td>
<td>1 : 4</td>
</tr>
</tbody>
</table>

Roads:

The main plant approach road shall be double lane and the branch approach approach roads shall be single lane. The roads shall have berms on either side with maximum width of 2 m. The road surface of double lane shall be 7.0 m wide and that for single lane shall be 4.0 m wide. The roads shall have camber of 1 in 60. Camber on top of water bound macadam surface shall be 1 in 40. The bituminous concrete road shall be formed as follows:

Sub-base: Sub-base shall consist of granular material of 200 mm thickness minimum as per specification.

Base: The base course shall consist of water bound macadam having consolidated thickness of 150 mm.

Bituminous Macadam Course: Open penetration bituminous macadam 50 mm thick and 25 mm thk. Premix bituminous + seal coat.

Berms: 2.0 m wide berm to be considered on both sides for all roads (100 mm moorum over 75 mm WBM).

Drains:

All roadside drains shall be made of RCC provided with precast RCC covers with lifting arrangements wherever required. For crossing of drains under roads RCC box culvert or pipe culvert shall be provided. Garland drains around buildings shall be of brick masonry.

3.10 Miscellaneous Details:

i) For all concreting work cement & reinforcement steel to be used shall be as specified in General Technical specification (GTS) vol. II of SAIL / MECON under clause 2.6 & 3.1 respectively.

ii) All edges of openings for R.C floor with or without provision for covering by precast/ steel members shall have edge protection with M.S angle. The size of angle shall be 50 X 50 X 6 mm minimum with M.S flat lugs of minimum size 25 X 6 mm of sufficient length and spacing not exceeding 300 mm center to center.

iii) All insert plates supporting various fixtures shall be minimum 10 mm thick conforming to IS: 2062. Lugs required for anchorage in concrete shall be of flat iron of thickness not less than 6.0 mm.
iv) Slab on grade in open areas shall generally be constructed with concrete of grade M25 of minimum thickness of 150 mm laid over PCC and compacted soling stone base of 250 mm thickness. Grade slab shall be provided with reinforcement both ways, top and bottom with minimum 8 mm dia. Tor steel at 250 mm c/c (maximum).

v) All cable trench bed shall have slope of 1/500 along the run and 1/250 perpendicular to the run.

vi) All trenches within buildings shall be covered with chequered plates. In other areas, outside buildings, precast concrete covers with edge protection angle shall be provided.

vii) The storage beds shall be given 300mm thick Moorum filling over levelled ground.

viii) The painting/finishing shall be as per annexure-iii contract agreement.