ROLES AND RESPONSIBILITY OF SITE ENGINEERS

QUALITY ISSUES IN EMRS, GENERAL MISTAKES & THEIR PREVENTION

SITE ENGINEER

ROLES & RESPONSIBILITIES

1. Understand local regulations, environmental factors, and community dynamics.
2. Communicate effectively with all stakeholders.
3. Interpret MLP, architectural & structural drawings.
4. Review contract agreements & item nomenclature.
5. Prepare a list of available and required materials & compile estimates for technical requirements.
6. Develop work activity and resource schedules for materials, manpower, and equipment and adjust as needed to meet deadlines.

SITE ENGINEER

ROLES & RESPONSIBILITIES

7. Verify building layouts, excavation, shuttering, and steel framework alignment before concrete placement.
8. Ensure approvals of materials and processes.
9. Oversee laborers and monitor project progress.
10. Conduct water quality and material tests, ensuring structural integrity.
11. Monitor curing processes and document relevant timelines.
12. Maintain accurate project documentation and site registers.
13. Evaluate operations and suggest design changes for efficiency.

SITE ENGINEER

ROLES & RESPONSIBILITIES

14. Recording measurements of works before covering.
15. Collaborate with management to align activities with objectives.
16. Identify and mitigate potential risks and issues during construction.
17. Direct engineering activities, assign tasks, provide training and support.

QUALITY CONSTRUCTION-PARAMETERS

How to meet Quality in Construction?

- **Design & Planning:** Perfect in functionality, & Divyang students friendly
- **Aesthetics construction-Good Looking**
- **Material**: Shall be of high quality**.**
- **Workmanship**: Quality workmanship. Perfect in alignment, line, level & symmetry .
- **Finish:** The final touches, such as paint, flooring, door & window, fixtures etc. should be of high quality and consistent with the design intent.
- **Maintenance**: Ease in maintenance. No issues like leakage, seepage, peeling off plaster & water logging.

QUALITY CONSTRUCTION-PARAMETERS

How to meet Quality in Construction?

- **Structural quality: RCC** Structure should meet standard to resist earthquake.
- **Life Span:** The buildings should have prescribed life span of **75** years for RCC structure.
- **Safety Standards**: Meet safety compliance which includes fire safety measures, emergency exits, and structural safety.
- **Value for money**: Quality product within the budgeted provisions of GoI.

POOR ENGINEERING PRACTICE IN CONSTRUCTION

POOR ENGINEERING PRACTICE IN RCC

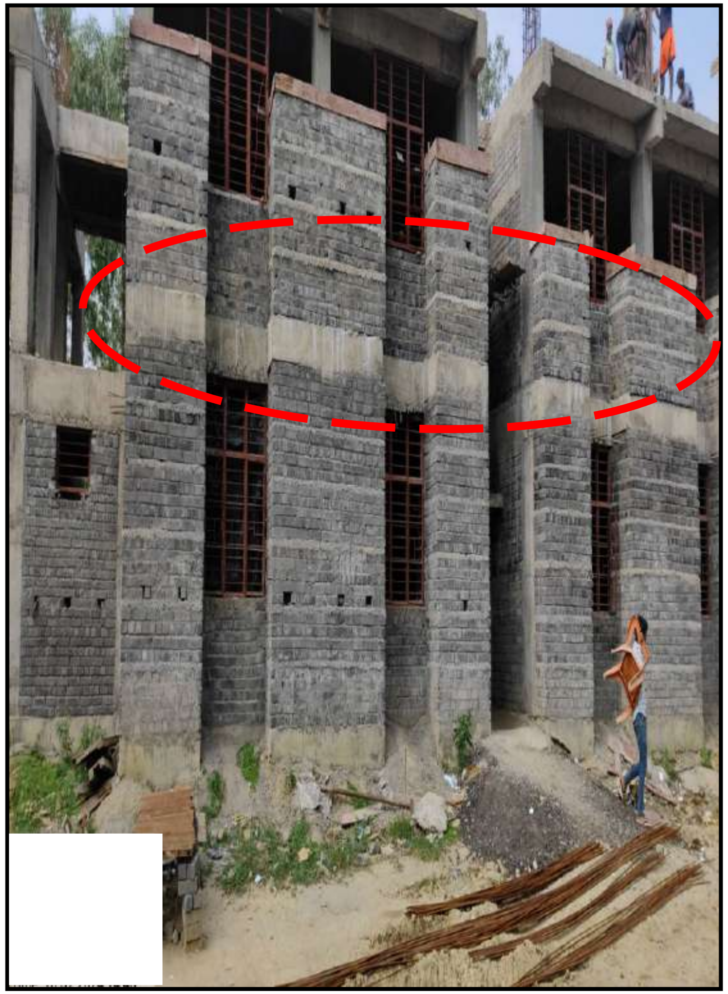
Column is not in alignment

Stair flights not symmetrical

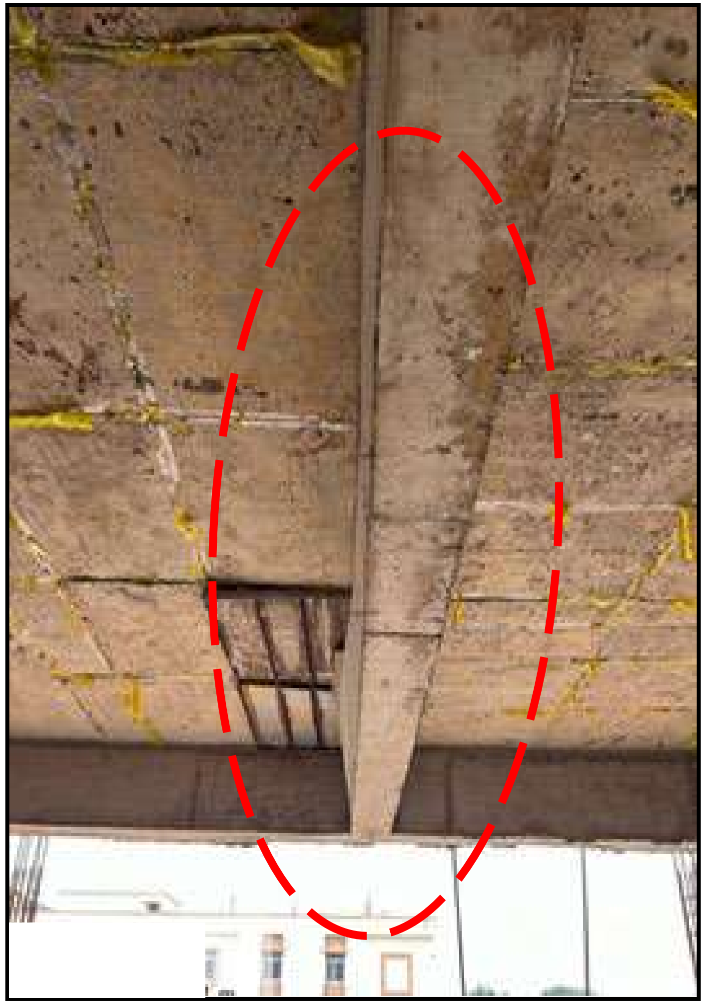
Water pipeline casted in column

POOR ENGINEERING PRACTICE IN RCC

Casting of fins not made integrally with beam



Casting of chhajja not made integrally with beam



Beam is not in alignment

POOR ENGINEERING PRACTICE IN RCC

Column is to be cut for lintel

Mismatch in door opening & Projection

Column not In alignment

RCC WORK

Casting stopped at mid span

- Do not leave construction joint at mid of slab.

DEFECTS IN RCC

Defects mentioned above can be categorize under following heads

1. Alignment issue (Columns & Beams)
2. Honeycombing (Shuttering defects & Workmanship)
3. Bulging (Improper Shuttering)
4. Improper curing
5. Reinforcement issue (Lap in confinement zone, ring placement not proper in confinement zone etc.)
6. Poor strength
7. Joint in beam at column face.
8. Insufficient cover

QUALITY CELL REPORT

S.No.	Issues	Total Issues after 16.05.24 to 15.010.24	% isssues
1	Alignment issue	110	4.5%
2	RCC Size Issues e.g. Size issues, Honeycombing, Bulging, Cover	172	7.03%
3	Issues in Reinforcement	192	7.85%
4	Centering & Shuttering issues	88	3.60%
3	Mandatory Tests not proper	54	2.21%
6	Quality of bricks & Brick Work Issues	133	5.44%
7	Site Lab not well equipped, Site Logistics not maintained	88	3.6%
8	Storage of Cement & Steel not proper	71	2.9%
9	Quality of Cement, Steel & Aggts	29	1.19%
10	Quality of other factory-made items e.g. Steel windows & other materials	95	3.89%
11	Miscellaneous Issues i.e. Issues in Plaster, Flooring, Curing, Plumbing, Painting, Documentation etc	1413	57.79%
	Total	**4670**	**100%**

GOOD WORK: CHHAJJA IN ALIGNMENT

SITE LOGISTICS

SITE REQUIREMENTS

- Well Equipped Lab
- Compression Testing Machine (CTM)
- Field Testing Equipment
- Batching Plant
- Needle/Plate Vibrator
- Earth Compactor
- Design Mix
- Approved Copy Of MLP, Architectural & Structural Drawings.
- CPWD Specification & BOQ

STORAGE OF CEMENT & STEEL

STORAGE OF CEMENT & STEEL

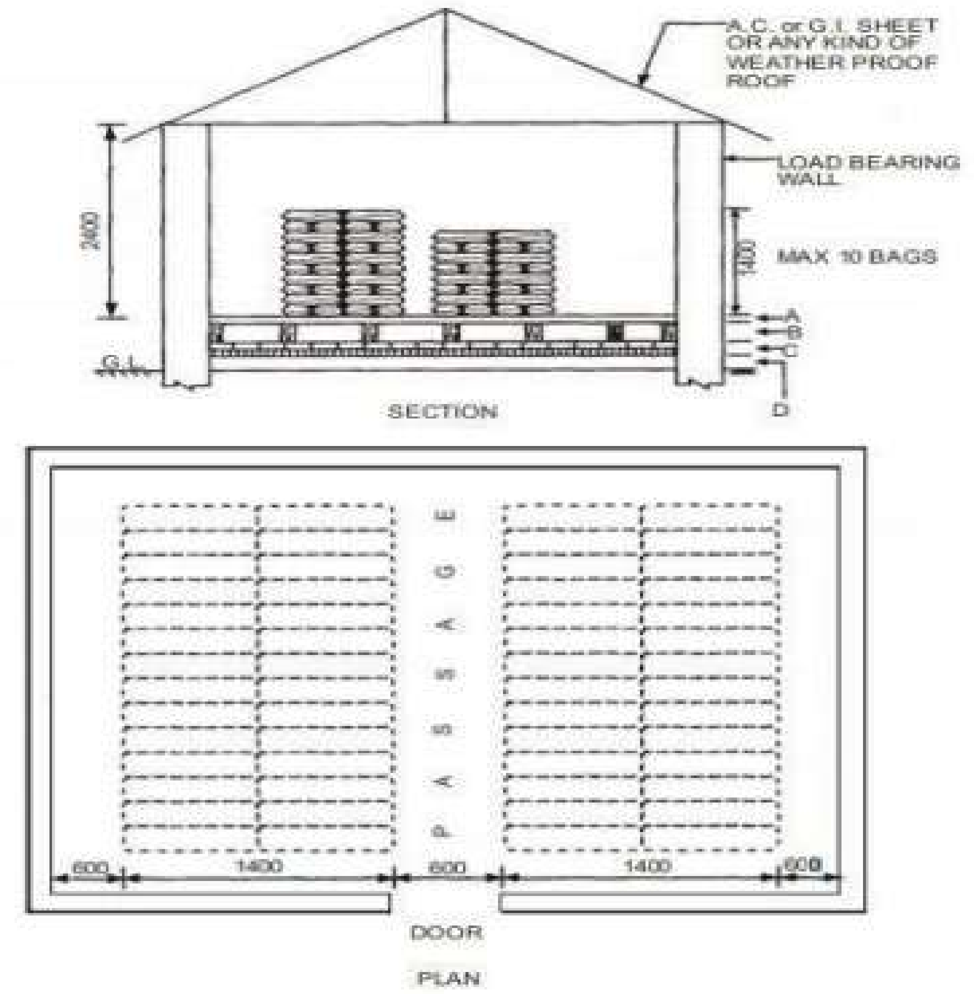
Stacking not proper

Stacking not proper

Stacking of Steel in Low Lying Area

STORAGE OF CEMENT

- Cement brought at site not more than 6 weeks old.
- Stacked at 150 mm above floor on wooden plank.
- Wall clearance: 450 mm,
- Stack gap: 600 mm.
- Height of Stack: Max. 10 bags high..
- For more than 8 bags high, lengthwise & crosswise arrangement in consecutive layers.
- If different type of cements: Separate storage required.



STORAGE OF STEEL

Do's ☑

- On Platform (at least 150 mm above ground)
- Separate storage of each dia.

Don'ts ☒

- Avoid stacking directly on ground.
- Avoid stacking in low lying area.

CEMENT REGARDING

While using PPC & Higher Grade Cement

- PPC requires shuttering for longer time.

- Higher grade cement requires proper curing otherwise cracks may get developed.

- Different types of cement shall not be mixed together.

WHY QUALITY ISSUE IN RCC?

Reasons of Poor Quality in RCC

1. Lack of supervision by the CA.
2. Passing responsibility to lower level.
3. Use of inferior quality water, sand, c/aggts.
4. Sub-standard centring & shuttering.
5. Non compliance of due process in mixing, pouring & compaction.
6. Sub-letting.
7. Unskilled manpower.
8. Negligence in curing
9. No punitive action for defective work.

QUALITY ISSUES IN RCC

How to improve Quality in RCC?

1. Proper Supervision .
2. Periodic inspection by QA Cell of PSU.
3. Use of approved quality of concrete ingredients.
4. Use of Good quality of shuttering materials.
5. Follow due process in mixing, pouring & compaction.
6. Use of proper size & shape of cover blocks.
7. Deploy tested skilled & experienced manpower.
8. Proper attention to curing.
9. Punitive action for defective work

CENTERING & SHUTTERING

CENTERING & SHUTTERING

Use of wooden props

Leakage of slurry due to substandard Shuttering

Avoid Polythene Sheet

CENTERING & SHUTTERING

RCC with poor shuttering

Good Practice:

- Steel shuttering with MS Props & props on steel plate.
- Firmness of shuttering to avoid bulging/ settlement.
- Removal of shuttering: If PPC cement, after 10/7 days of OPC.
- Column de-shuttering after 36 hrs. in case PPC Cement used
- Proper checking of centering & shuttering.
- If honeycombing, attend it while the conc.is still green.
- Date of work to be written to ensure proper curing

CENTERING & SHUTTERING

Stripping time of shuttering Period: Minimum

S.N.	Type of Shuttering	OPC 33 Grade/ OPC 43 Grade	PPC
1	Vertical shuttering to columns, beams & slab	16-24 hrs	24-36 hrs
2	Props to slab < 4.5 m	07 days	10 days
3	Props to slab > 4.5 m	14 days	20 days
4	Props to beams < 6 m	14 days	20 days
5	Props to beams > 6 m	21 days	30 days

PLUMB/ALIGNMENT ISSUES IN COLUMNS, BEAMS & WALLS

COLUMNS WITH PLUMB ISSUES

Zig Zag Column - Twisted bar

COLUMNS WITH PLUMB ISSUES

Column shifted from original position-Eccentric loading

COLUMNS WITH PLUMB ISSUES

Overhung & eccentric columns

ALIGNMENT ISSUE IN BEAMS

Beams not aligned properly

ALIGNMENT ISSUE IN WALLS

WHY PLUMB ISSUES?

Poor Column Starter Quality

Defective Starter

Reasons:

- Mainly workmanship issue
- Improper Layout
- Work done without layout pillars.
- Not checking center line, outer line & diagonals in foundations & at plinth level.
- Poor quality and improper casting of starter.
- Poor quality of Shuttering
- Not maintaining cover at every stage of casting

HOW TO ADDRESS ALIGNMENT ISSUES

Prevention

- Check centerline (Both direction & diagonally) and outer line of columns at every stage of casting(footing level, plinth beam level, floor levels) while casting starter.
- Ensure proper quality of Column Starter.
- Check plumb of Shuttering at every stage of casting of columns.
- Use quality cover block & ensure proper cover.
- No Eccentricity allowed in column.

HONEYCOMBING AND POOR QUALITY IN RCC

RCC HONEYCOMBING

RCC HONEYCOMBING

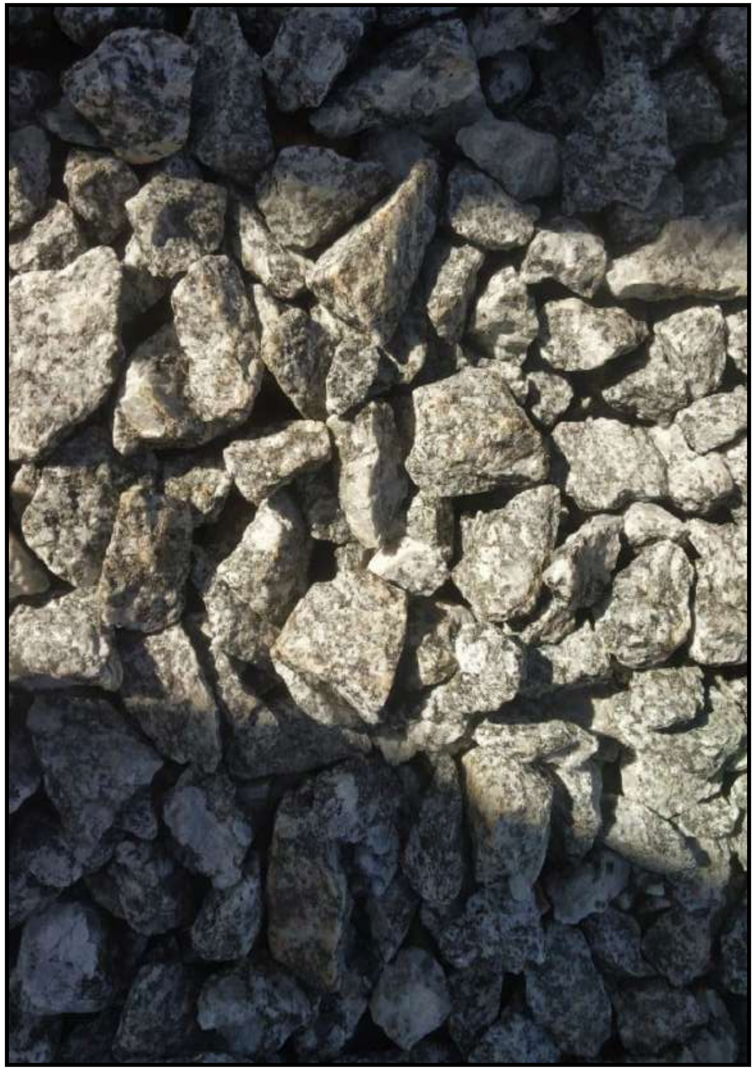
RCC- POOR QUALITY

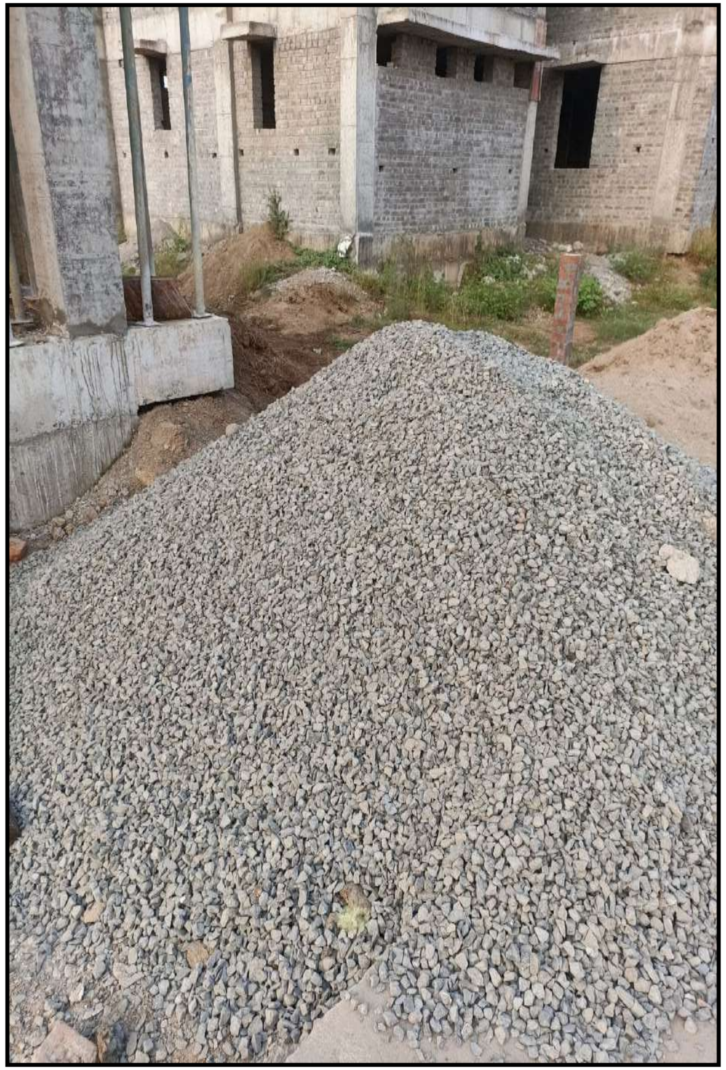
POOR RCC & HONEYCOMBING

WHY HONEYCOMBING IN RCC ?

- No proper water cement ratio
- Lack of proper workability of concrete
- Use of excessive amounts of large-sized aggregate/ Non graded aggregates
- Inadequate formwork that is not rigid and watertight/Defective shuttering gap
- Causal approach in adding/ mixing of aggregate & water
- Batching plant without mix detail printout
- Dropping concrete from a height > 1.5 metre
- Inappropriate bar placement prevents the concrete from flowing easily
- No proper use of vibrator
- No proper compaction

QUALITY ISSUE IN MATERIALS





Poor sand quality & poorly graded chips

BAD MIXING PROCESS

Manual Mixing

- Hand mixing not allowed.
- Mixing without batching plant.
- Mix to be used and compacted within 30 mins of adding water.
- No Manual Mixing

HOW TO ADDRESS HONEYCOMBING & BAD RCC

Prevention

- Maintain proper water cement ratio
- Ensure workability of concrete
- Use of well grade sized aggregate Inadequate
- Firm shuttering (No gap in shuttering)
- Proper mixing of aggregates & water
- Batching plant with mix detail printout
- Pouring concrete not from height
- Proper compaction using vibrator
- Proper curing

COVER ISSUES

WHY COVER ?

Purpose of cover:

To protect the reinforcing steel from corrosion, fire, and other damage

Structural strength

- Adequate concrete cover ensures that the reinforcing steel is well-anchored in the concrete, which allows it to distribute and transfer loads effectively.

Durability

- Concrete cover helps maintain the durability of reinforced concrete elements.

Safety

- Concrete cover is a fundamental aspect of structural design that directly impacts the safety of a structure.

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WHY COVER?

Corrosion protection

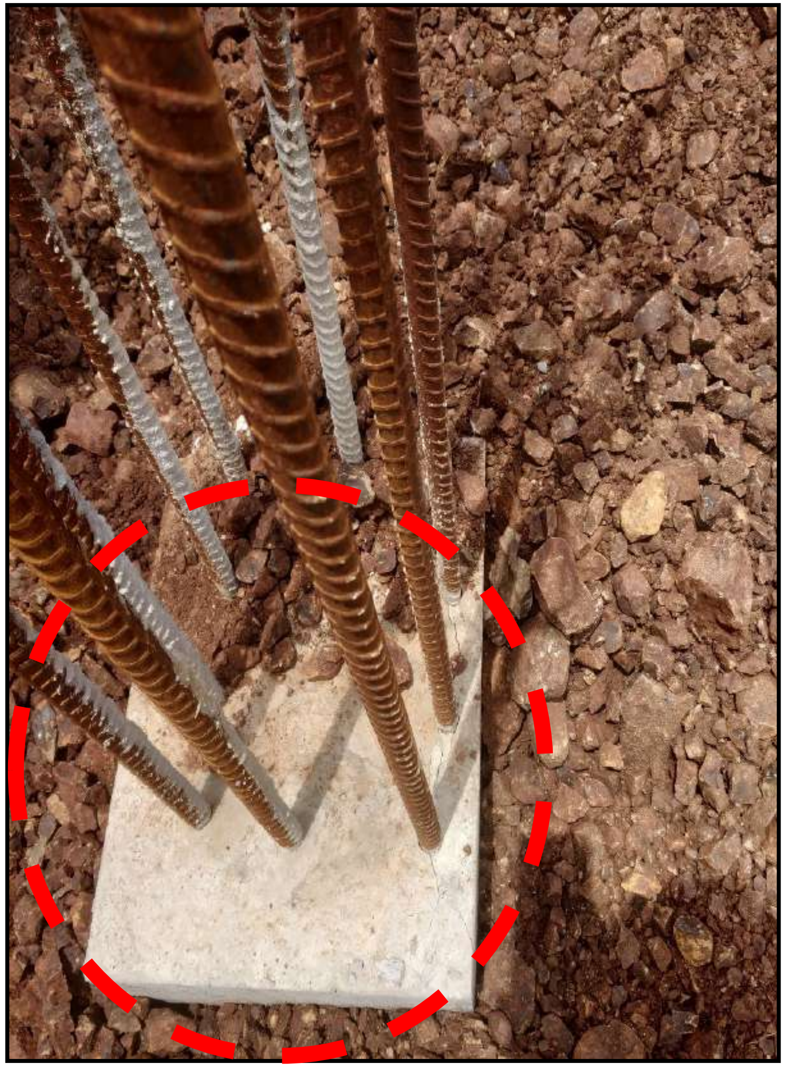
- The high alkalinity of the concrete initially protects the reinforcing steel, but this protection decreases over time due to carbonation.

Longevity

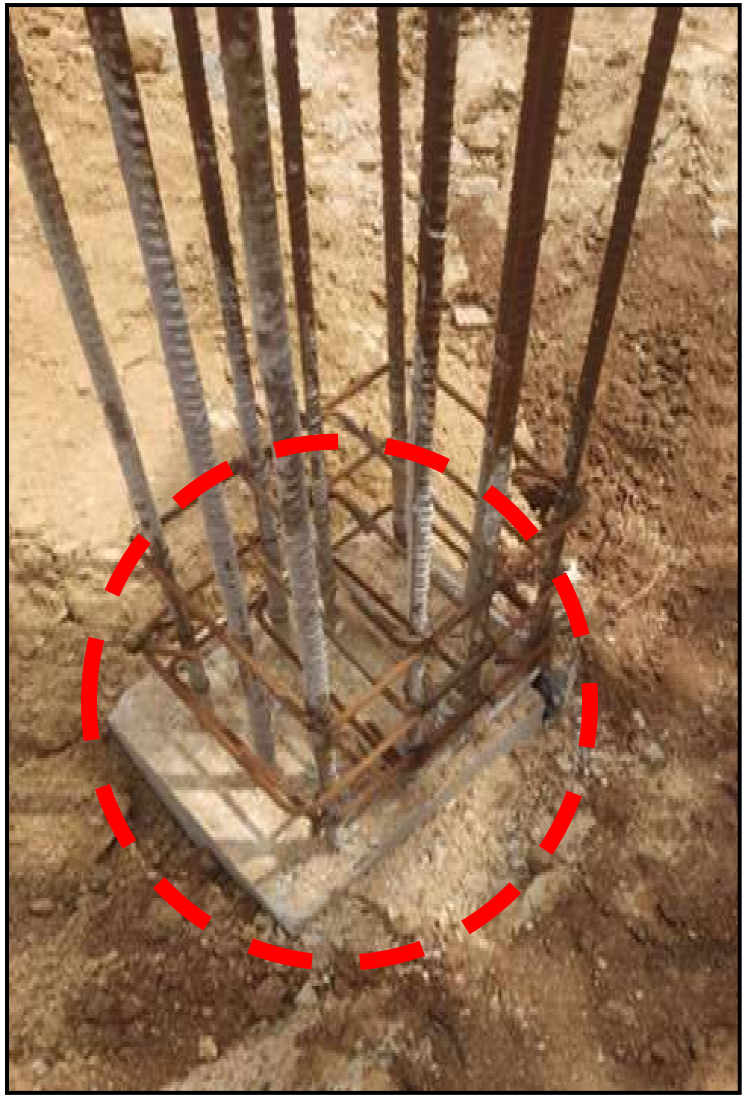
- Concrete cover helps ensure that concrete structures remain intact and serve their intended purpose for many years.

CONSEQUENCES OF INADEQUATE COVER

IMAGES OF IMPROPER COVER



IMAGES OF IMPROPER COVER



COVER GUIDELINES

S.No	Clear Cover For Durability	Cover For 2 Hr. Fire Resistance
1	Slab: 20 mm	Slab: 25 mm
2	Beam: 25 mm	Beam: 30 mm
3	Column: 40 mm	Column: 40 mm
4	Footings: 50 mm	Footings: 50 mm

Specification of cover

Strength

- Design mix >M-25

Numbers

- One for every meter.
- One for every sq.m.

CURING

WHY CURING ?

Purpose of curing:

To maintain proper moisture content & temperature for a specified period for proper setting & gaining required strength.

Strength and durability

- Curing helps concrete to develop its full strength and durability.

Cracking

- Curing helps to prevent cracking.

Hydration

- Curing ensures chemical reaction between cement and water

CURING: BAD PRACTICE

No ponding

Bad Curing:

CURING: GOOD PRACTICE

EXPECTATIONS FROM PMC

Don'ts

- Avoid inferior aggregates.
- Avoid use of old cement
- No use of high silt sand
- No hand mixing
- No use of wooden props at site
- No use of site made cover blocks.
- Don't rest/ place shuttering props directly on soil.
- No unskilled Labour Force

CONCLUSION

- Site engineer is a pivotal key to ensure quality.
- But he alone can’t. Being a team-work, every stake holder must work jointly to deliver quality in construction of building.
- By applying effective supervision and monitoring of an EMRS project, we can definitely ensure quality in construction of building structure.

THANKS

REINFORCEMENT ISSUES

INTRODUCTION

PCC VS RCC

Plain Cement Concrete (PCC):

- Strong under Compression
- Weak in Tension
- Better water resisting member
- Used in Foundation base, Pavement, DPC and Non-Structural Members.

Reinforced Cement Concrete:

- The property of Plain concrete increases when reinforced. The composite member is called reinforced cement concrete.
- The RCC can withstand compressive, bending, shear and tensile forces.
- The RCC is widely in use in construction.

PCC VS RCC

- Reinforcing bar makes excellent bond with the concrete.
- Both Concrete and reinforcement bar behave in similar manner under expansion and contraction because their coefficient of thermal expansion for Steel and Concrete is same.
- No internal stress developed along the bond line of concrete and steel.
- The limiting value of stress up to which this bound can be maintained is called Bond Stress (denoted by tbd)
- The bond strength depends on the grade of concrete and the yield stress of the reinforcing bar.
- The reinforcement shown in the structural drawing are to provided and also to be embedded into the other structure members (Foundation, column and beam) up to the development length to keep the bond strength below the allowable limit.

PCC VS RCC

The site engineer needs to study the issued structural drawing along with the architectural drawing. The site engineers also required to go through the note portion of the issued drawing wherein all the design parameter (Seismic Zone, SBC, Grade of Concrete, Grade of reinforcing bars etc.), as well as important feature (Clear cover to structural member, Lap length, Development length etc.) are specifically mentioned.

Reference Code:

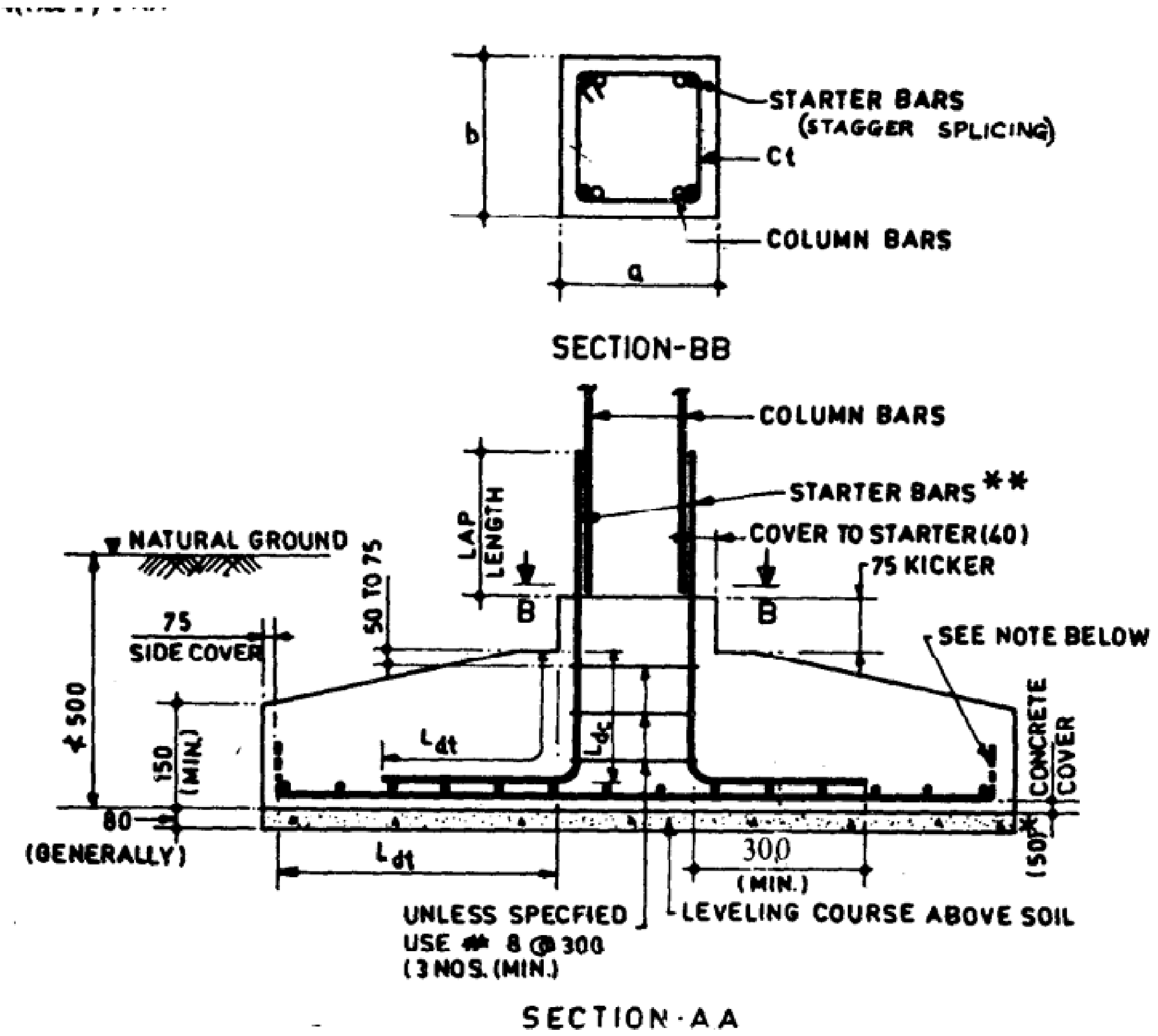
IS SP 34 : Hand Book On Concrete Reinforcement and Detailing
IS 13920:1993 Ductile Detailing of Reinforced Concrete Structure.
IS 456 456(2000) : Plain and Reinforced Concrete

REINFORCEMENT IN FOOTING

FOOTING

Isolated Footing: Placement of main reinforcement in the lower most layer and distribution reinforcement in the transverse direction of main reinforcement in the isolated footing.

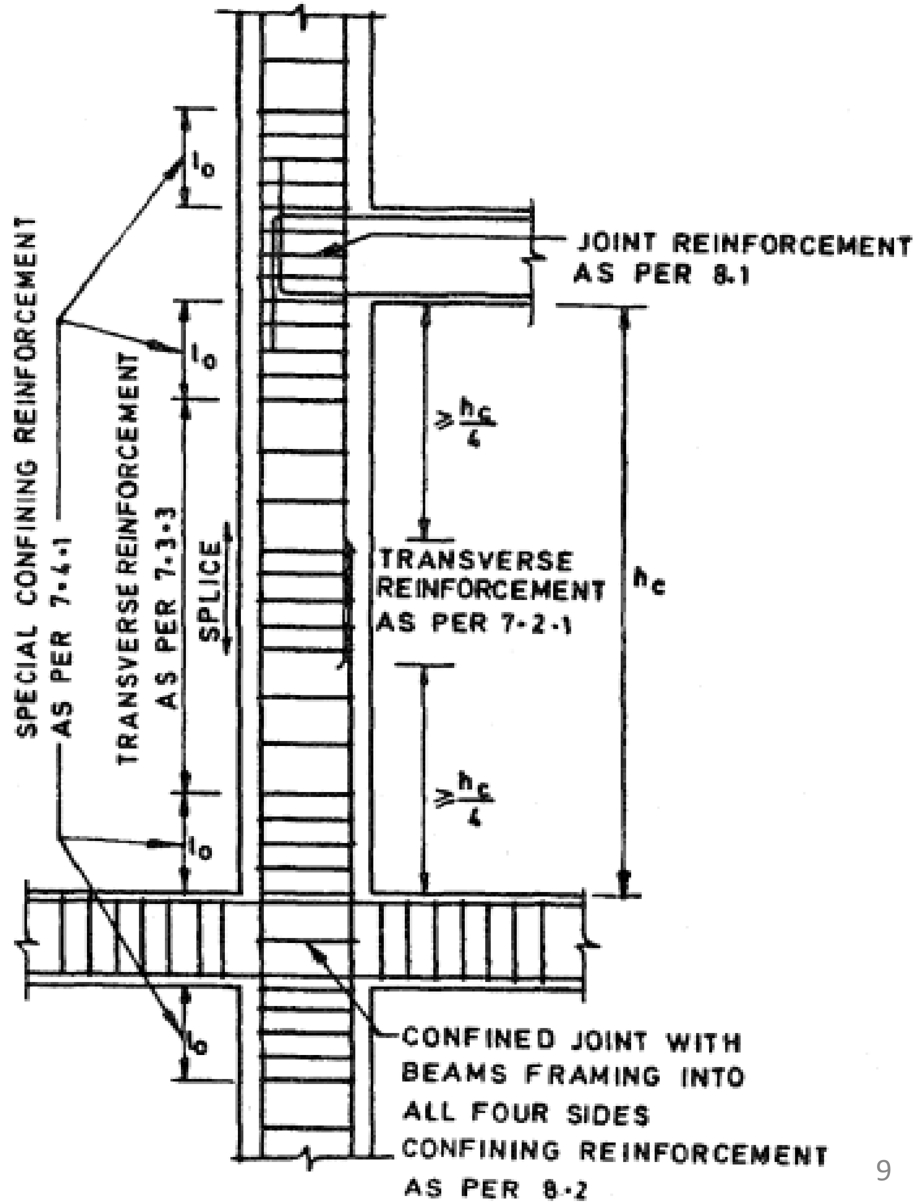
Combined Footing: Maintaining the effective distance between the top layer reinforcement net and bottom layer reinforcement net as per structural drawing by providing sufficient number of chairs.



LAPPING IN COLUMN & BEAM

LAP IN COLUMNS REINFORCEMENT

- Laps are unavoidable in the RCC. However, the lap shall be planned and provided at the location having lesser stress.
- In column the laps are provided in the middle half portion of the column.
- Not more that 50% of the reinforcing bars shall be lapped at one location. The laps shall be provided as staggered.
- The lap length shall be equal to development length the higher dia bar. For M25 grade of concrete and with HYSD 500 bars, the lap length is 50D.

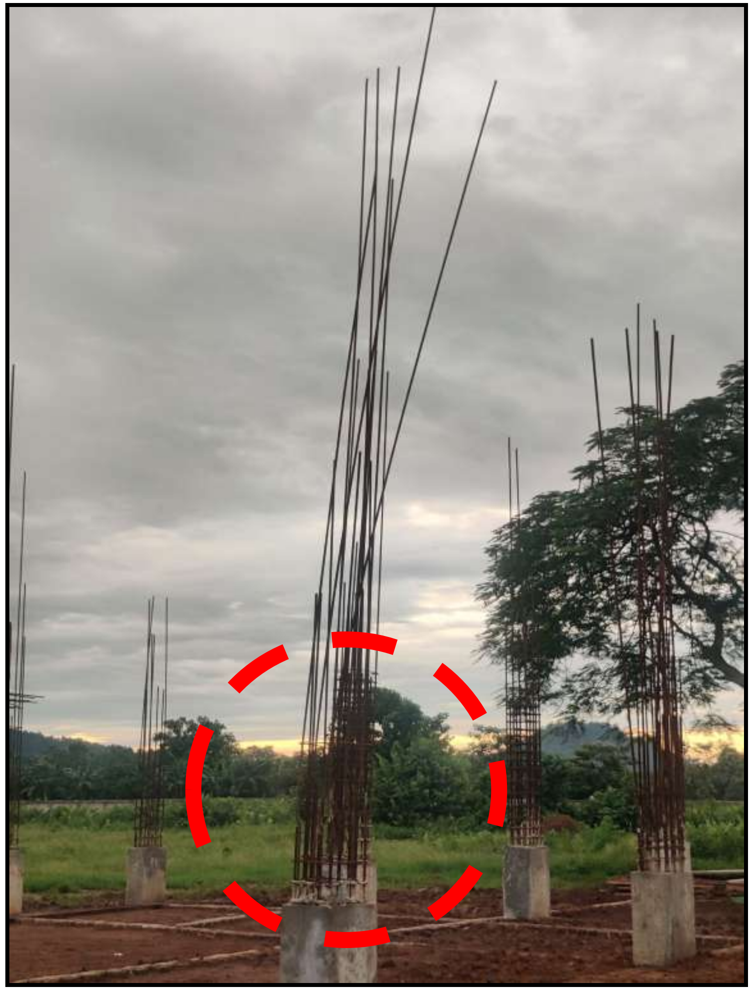


KEY POINTS TO REMEMBER

- The column bars (Dowels) are to be raised from the foundation in such a way that the development length criteria are met up in the vertical portion of foundation depth and the horizontal spread of the footing. (By providing 90 Degree Bend)
- The column reinforcement detailing is divided in to two different zone.
- Confining zone (Ductility requirement): Top and bottom portion of length equal to h/4 from the junction of column beam.
- The spacing of the shear stirrups in the in the confining zone shall be 100mm c/c with first ring to be provided at 50 mm from the edge of the structural member.
- Normal Zone: Middle h/2 portion of the column. The spacing of the shear stirrups in the in the normal zone shall be at higher spacing as specified in the structural drawing.

IMAGES OF LAP IN COLUMNS
(AVOID LAPS IN CONFINEMENT ZONE)

- **Bad Work**



- **Good Work**

KEY POINTS TO REMEMBER

- The spacing of the shear stirrups from foundation up to plinth beam shall be as per confining zone.
- The share reinforcement in column at beam column junction is to be provided.
- The column bar/column not required above terrace level, the column dowels of such column to be embedded into terrace beam/slab by providing development length and not cut at terrace level.

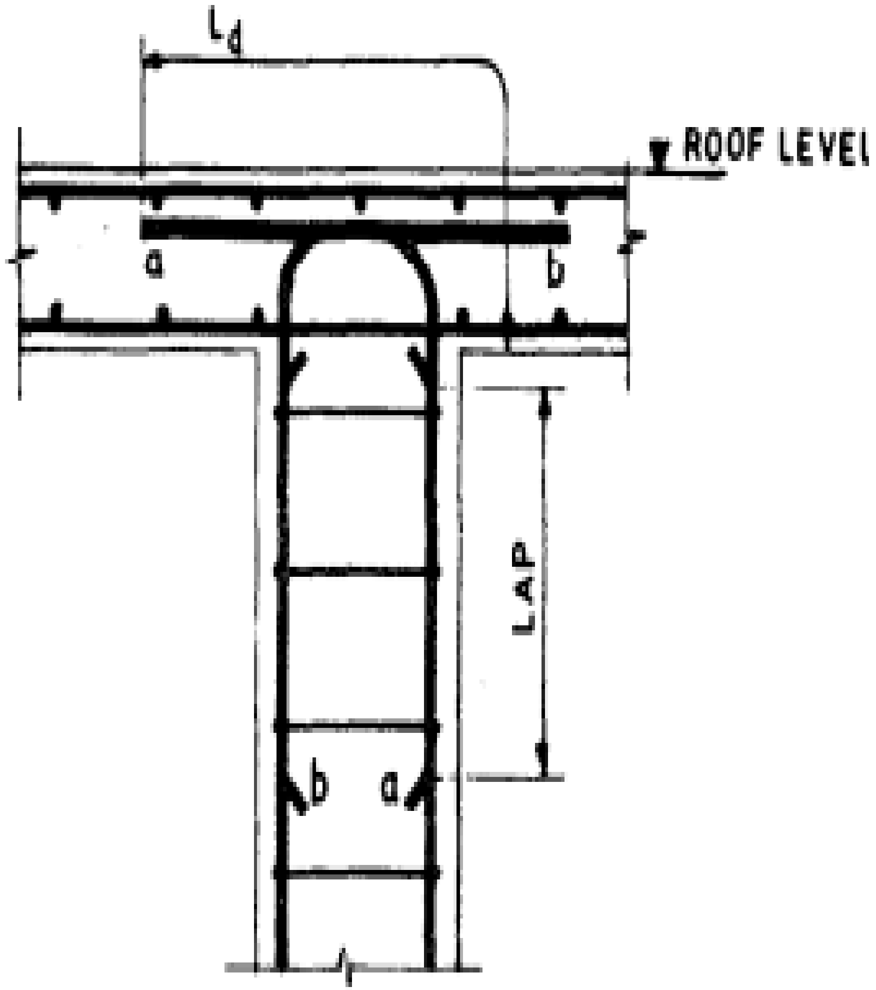
CUTTING OF BARS IN TERMINATING COLUMNS

General Mistakes:

Bars of terminating columns are generally cut at the terrace level without providing proper anchorage.

What to be?

Column bars will be bent into beam/ slab for its anchorage.



Column bars to be bent in beam/slab

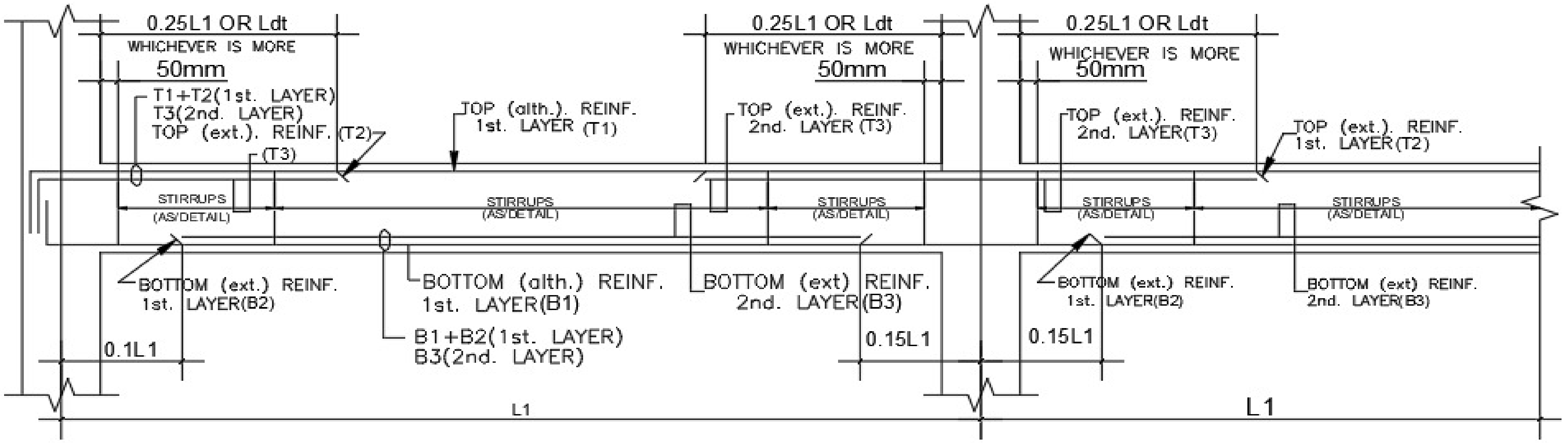
CUTTING OF BARS IN TERMINATING COLUMNS

Bars cut at terrace

Beam Shear Reinfocement

- The extra bottom/top bars shall be provided up to the length mentioned in the structural drawings.
- The shear reinforcement detailing of beam is divided in to two different zone.
- Confining zone (Ductility requirement): L/4 from the junction of column beam.
- The spacing of the shear stirrups in the in the confining zone shall be 100mm c/c with first ring to be provided at 50 mm from the edge of the structural member.

LAP IN BEAMS REINFORCEMENT



TYP. DETAIL SHOWING CURTAILMENT OF REINFORCEMENT

LAP IN BEAMS REINFORCEMENT

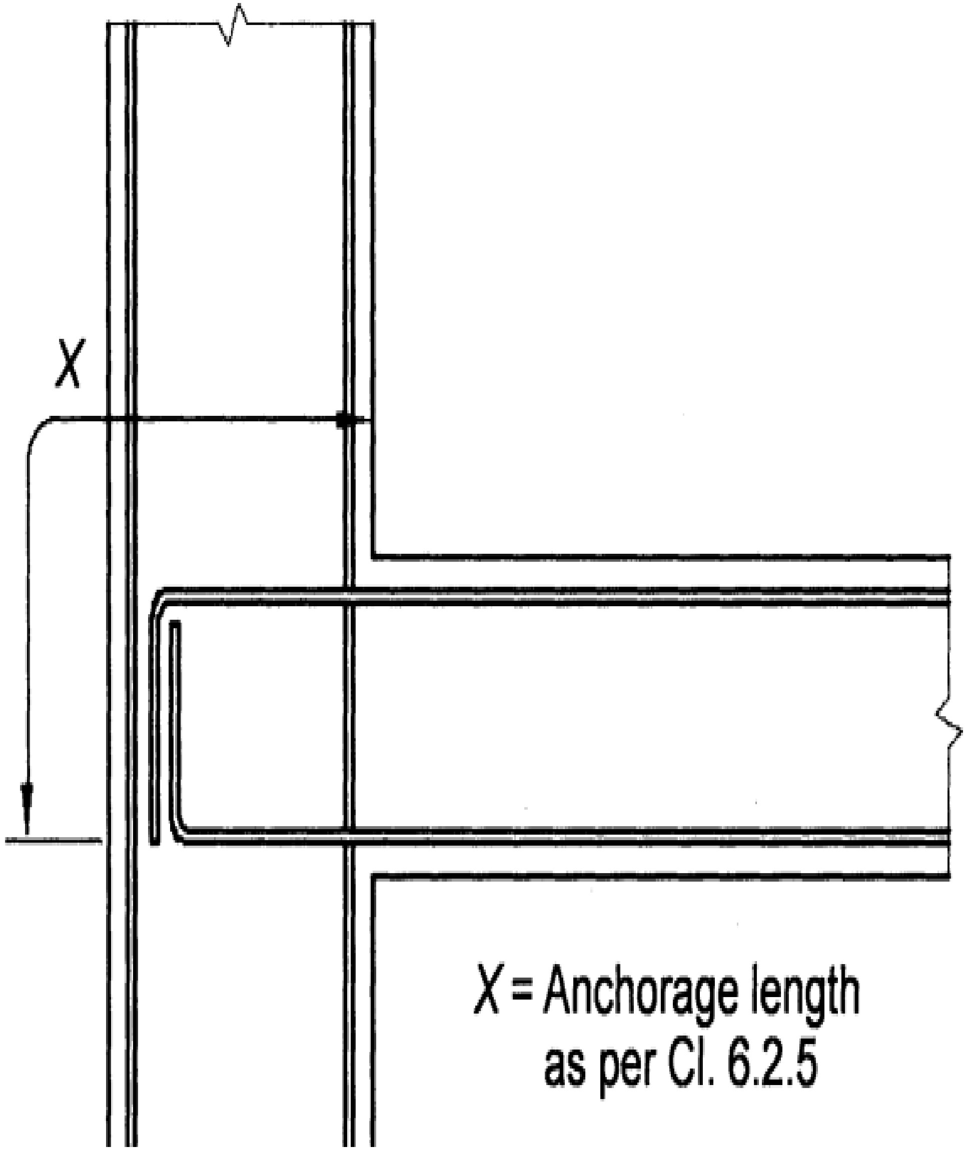
Laps are unavoidable in the RCC. However, the lap shall be planned and provided at the location having lesser stress.

Top Reinforcement: The requirement of top reinforcement in beam is at the support. Therefore, the lap of the top reinforcement in the beam can be planned at the central portion.

Bottom reinforcement: The requirement of bottom reinforcement in beam is at the center of span. Also, the confining zone of the beam is upto L/4 from the support. Therefore, the lap in bottom reinforcement shall be preferred between L/3 to L/4 distance.

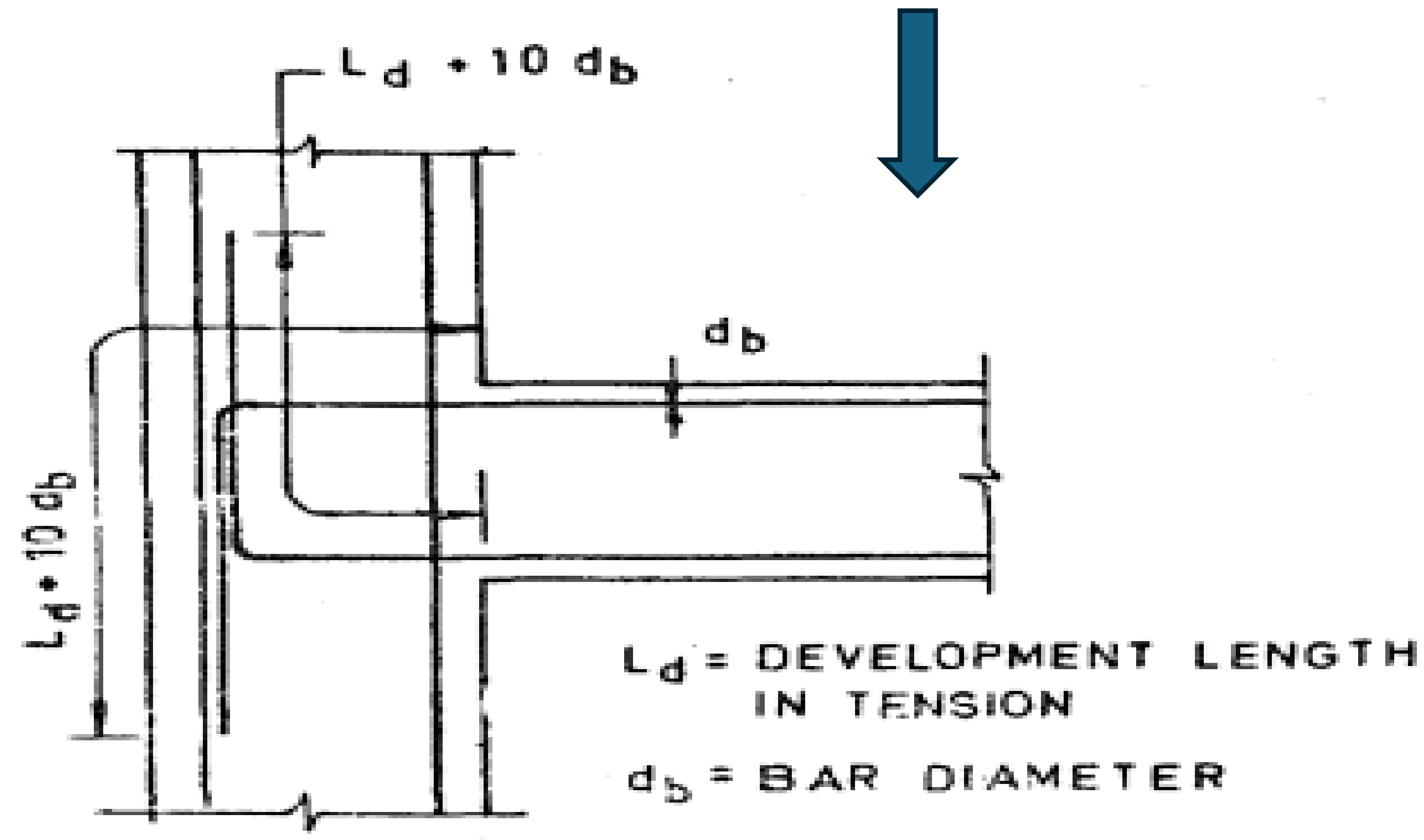
KEY POINTS TO REMEMBER

- The site engineer needs to go through the structural drawing of the beam carefully and specifically marked the location where extra top bars and extra bottom bars shown in the drawing.
- All the extra top bar/ terminating top bar/starting top bars/starting bottom bar/terminating bottom bar are to provide with development length and the same is to be embedded in the column.



REINFORCEMENT ARRANGEMENTS

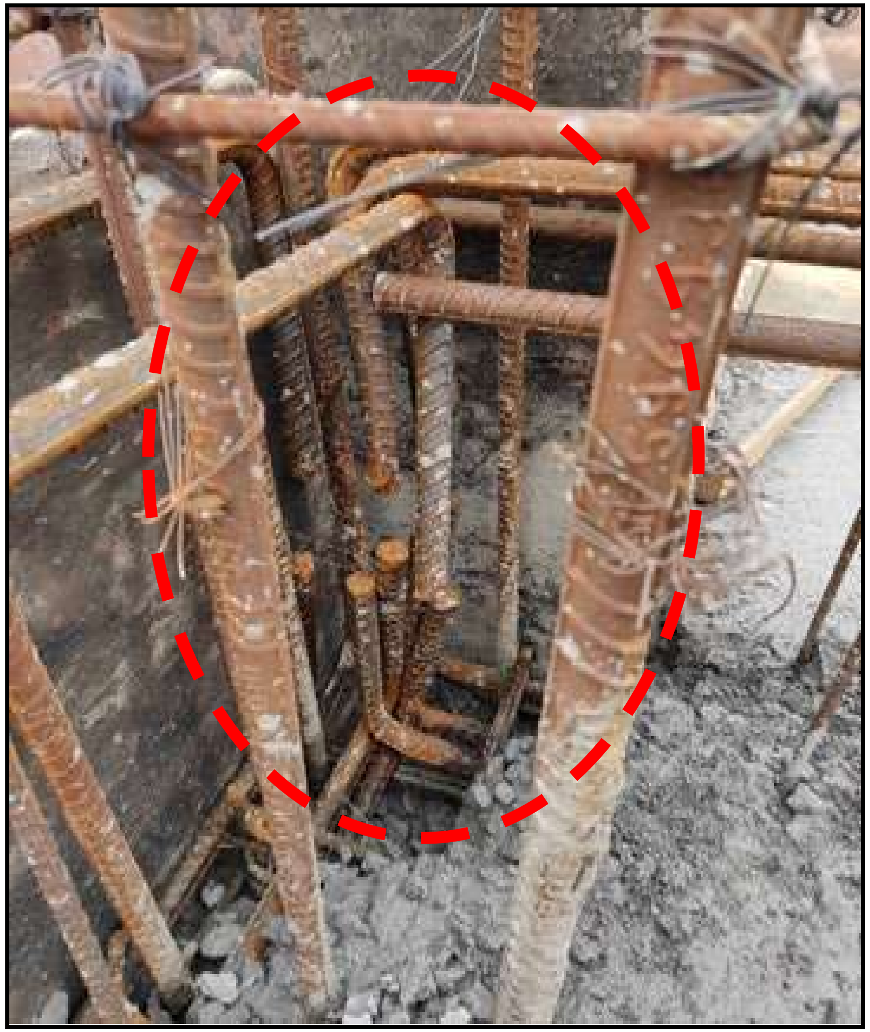
- IN SEISMIC ZONE -V
- Anchorage at ends =Ld+10 x dia of bar



REINFORCEMENT AT COLUMN BEAM JUNCTIONS

REINFORCEMENT ARRANGEMENTS

AT BEAM- COLUMN JUNCTIONS



Extra top at mid depth **Extra top not having “L”**

REINFORCEMENT ARRANGEMENTS

AT COLUMN JUNCTION

Mistake occurred:

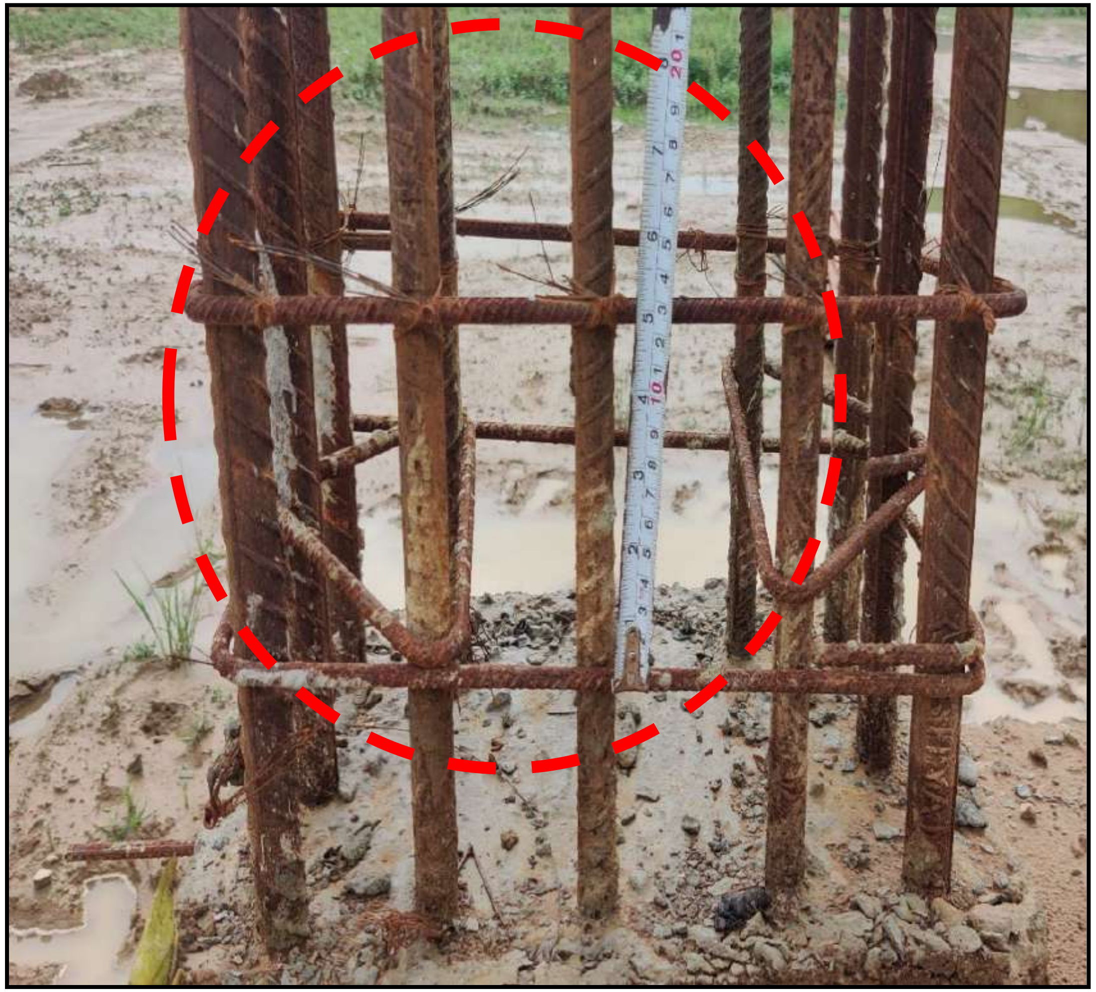
1. Joint left at column face.
2. Extra top missing in beam at column.
3. Stair flight bars do not have “L” .
4. Spacing of ring not proper.

REINFORCEMENT ARRANGEMENTS

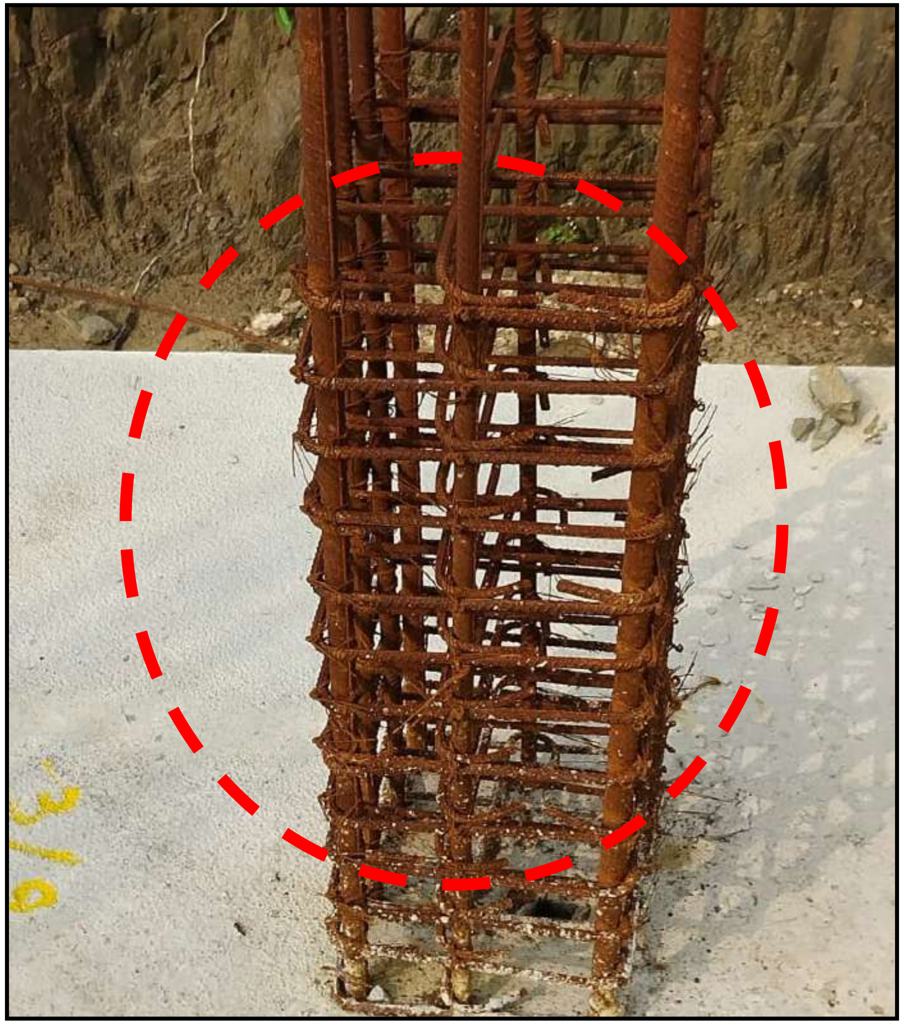
AT COLUMN JUNCTION

- Extra top missing in beam at column.
- Not possible to provide proper ‘Ld’ by debarring at a later date

RINGS/ STIRRUPS IN REINFORCEMENT

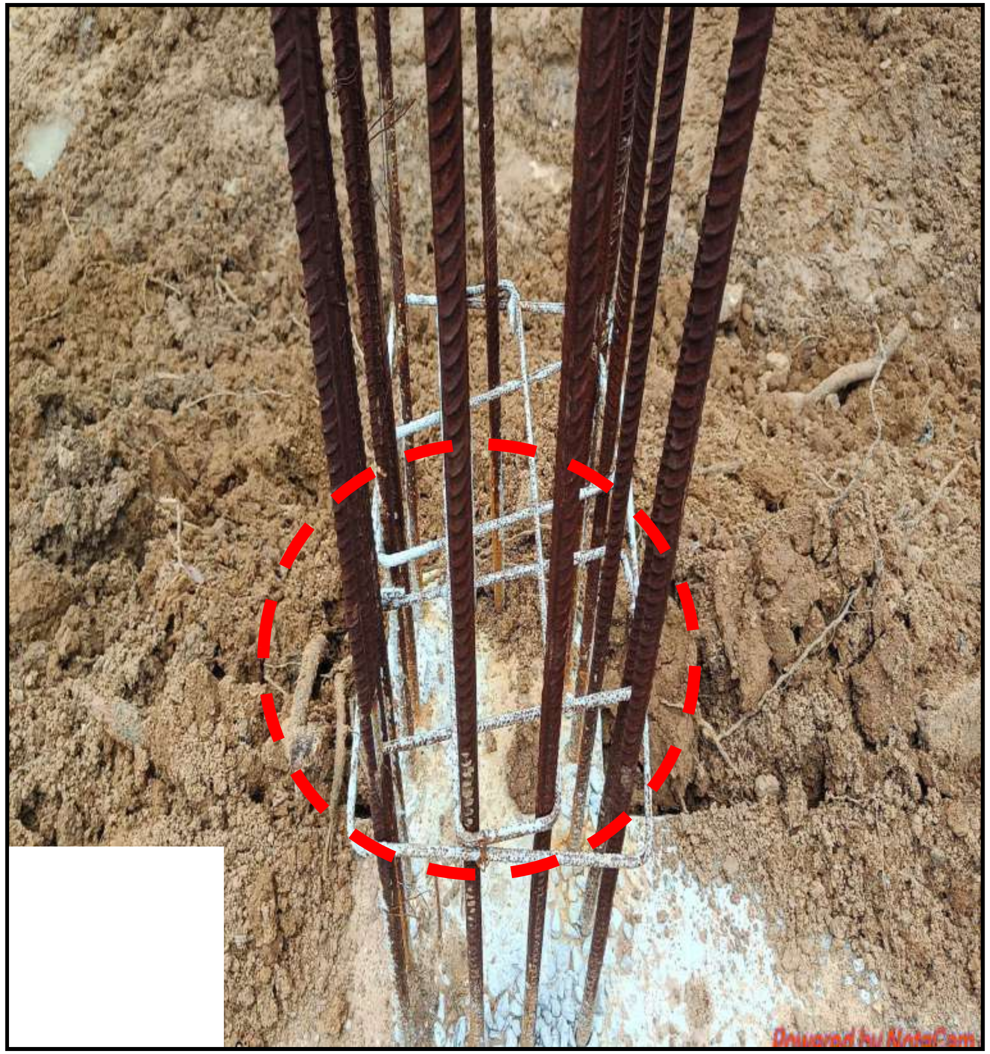


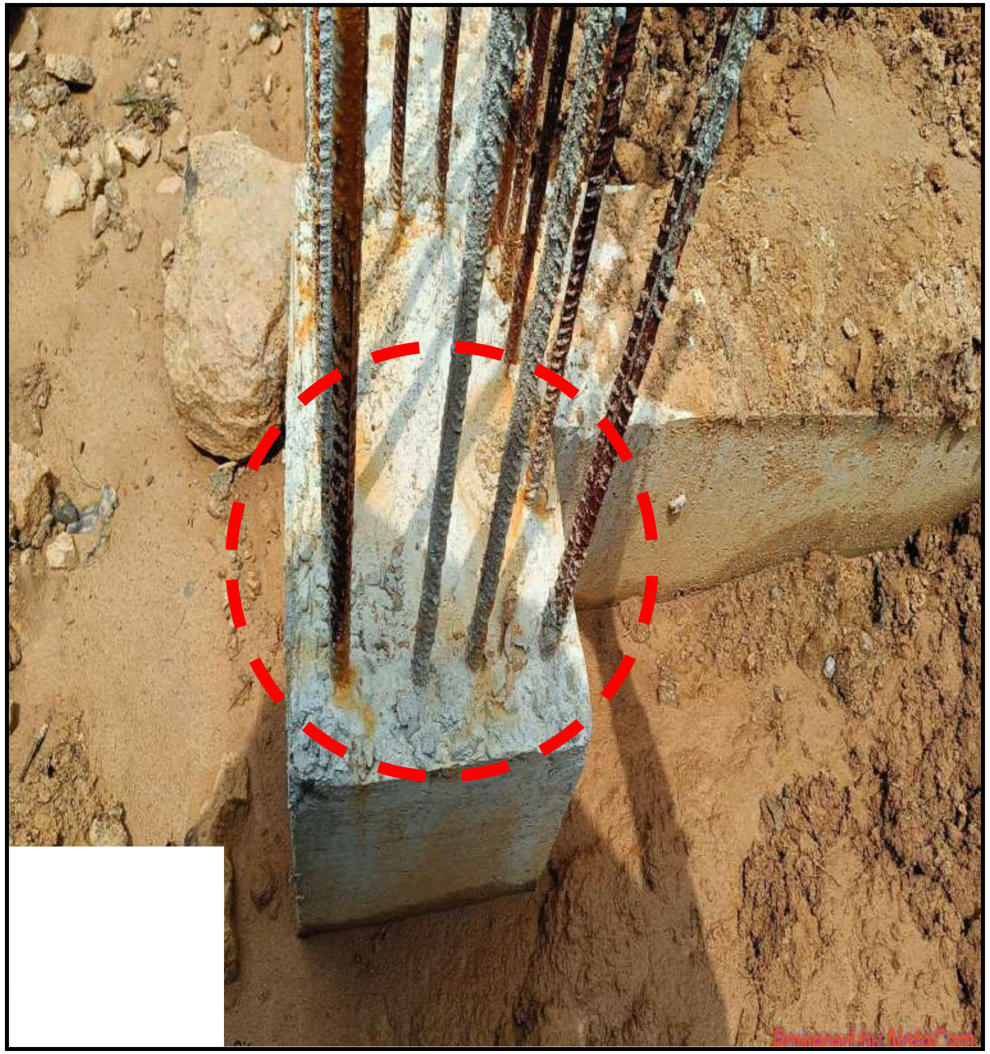
Bad Work



Bad Work

RINGS/ STIRRUPS IN REINFORCEMENT





Master Rings not tied before casting of column below

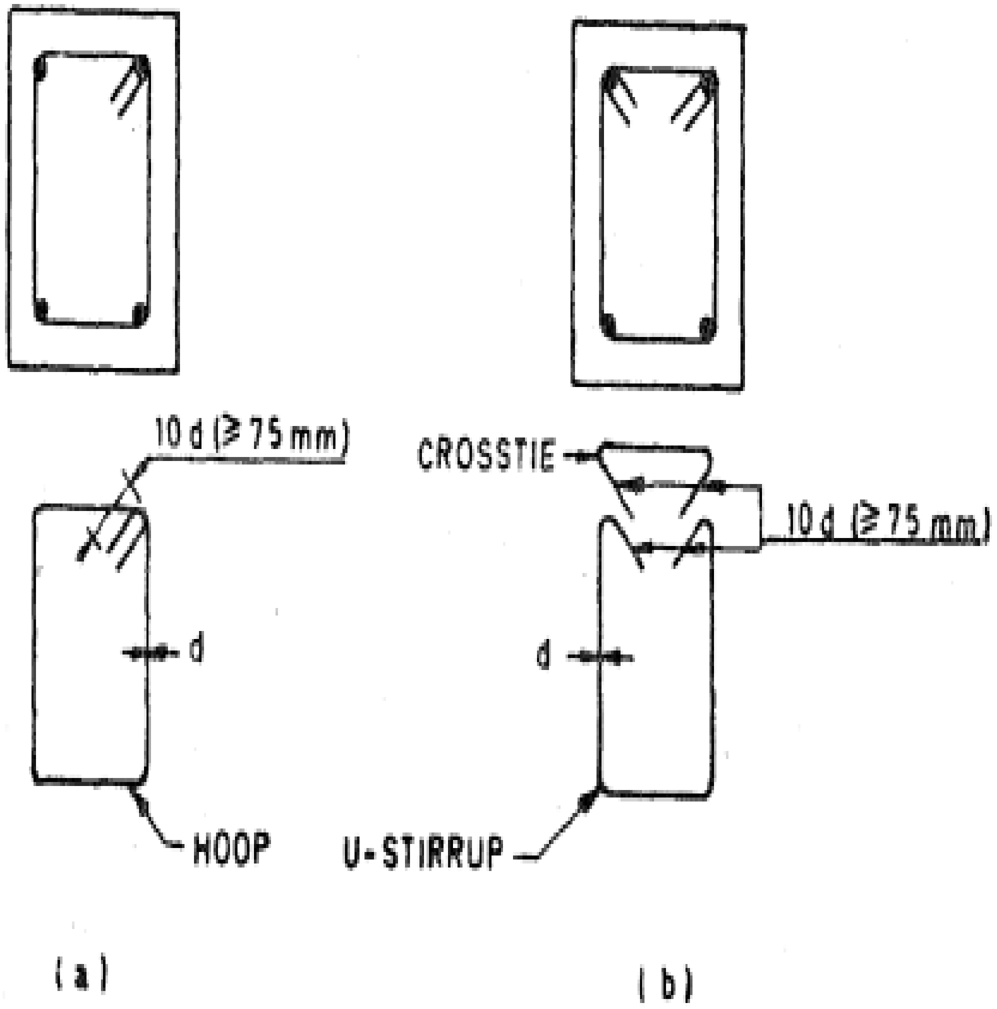
JOINT IN RCC

Wrong Placement of Joint: Avoid where Max. SF

RINGS & STIRRUPS

RINGS/ STIRRUPS IN REINFORCEMENT

- Special care should be taken in spacing of rings in confinement zone 'Lo'.
- First ring in beam to be within 50 mm from face of column.
- Bend hooks to 135 degrees
- Tie master ring in column for holding bars before casting.

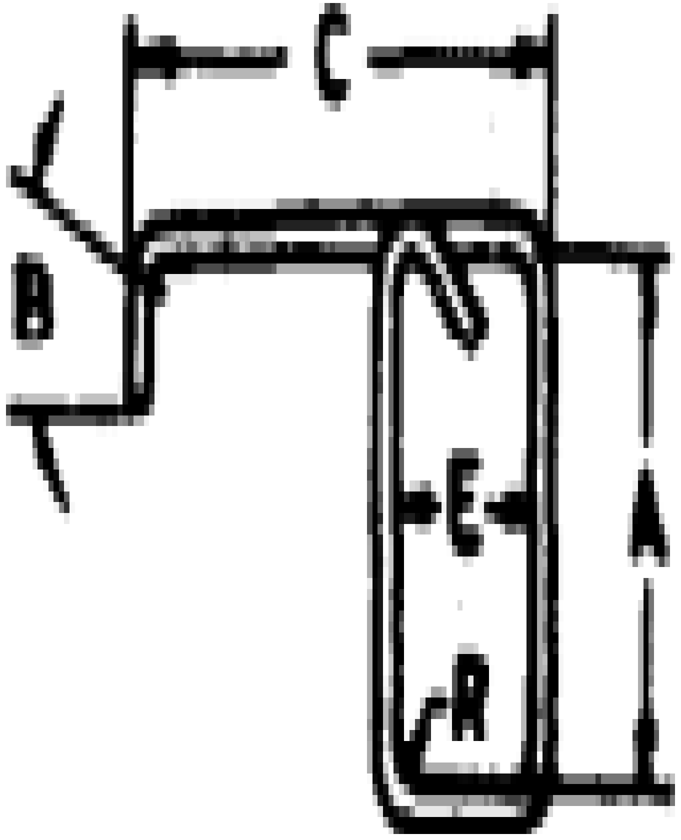


Rings/ Stirrups

REINFORCEMENT IN CHHAJJAS

REINFORCEMENT IN CHHAJJA

- The chajjas act a cantilever.
- The main reinforcement in the chajjas is the top reinforcement. The top reinforcement of the chajjas from the face of the beam is to be embedded into the back slab, if any, or around the lintel if the chajas is projected from the lintel beam.
- Casting of lintel and chajjas shall be done simultaneously.

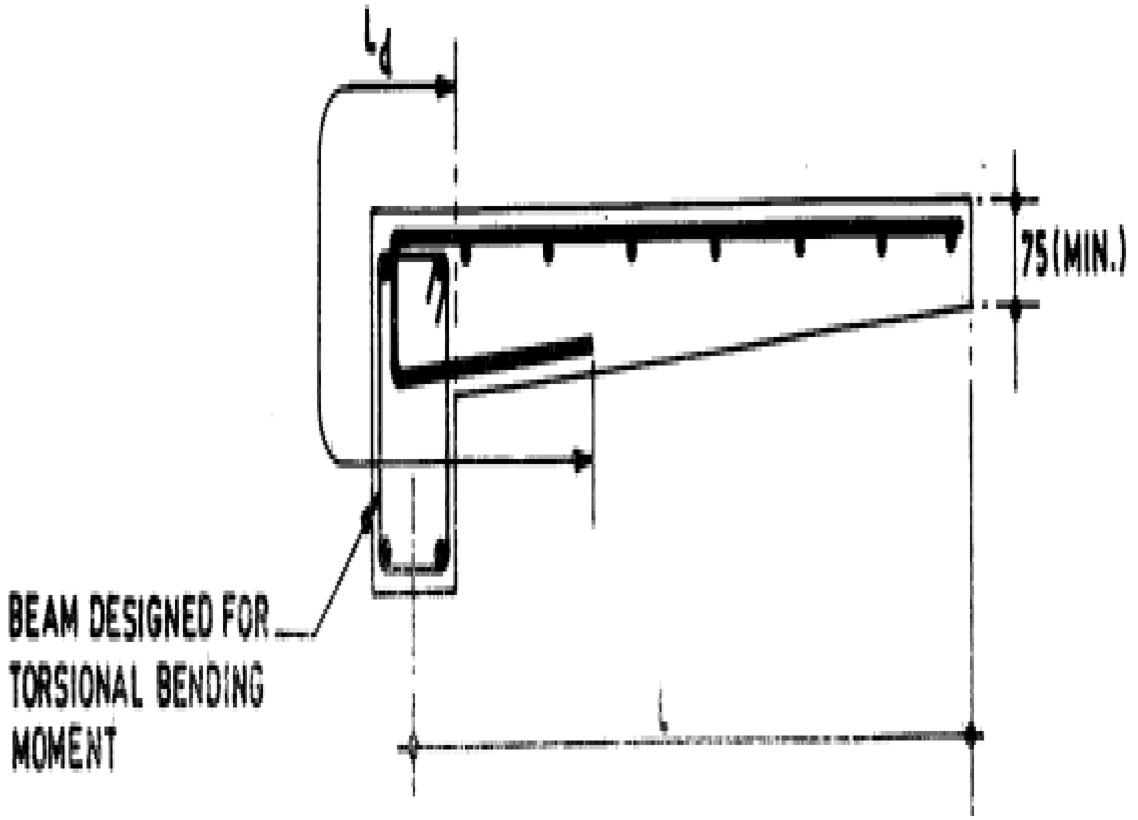


Bars in Chhajja

REINFORCEMENT IN CHHAJJA

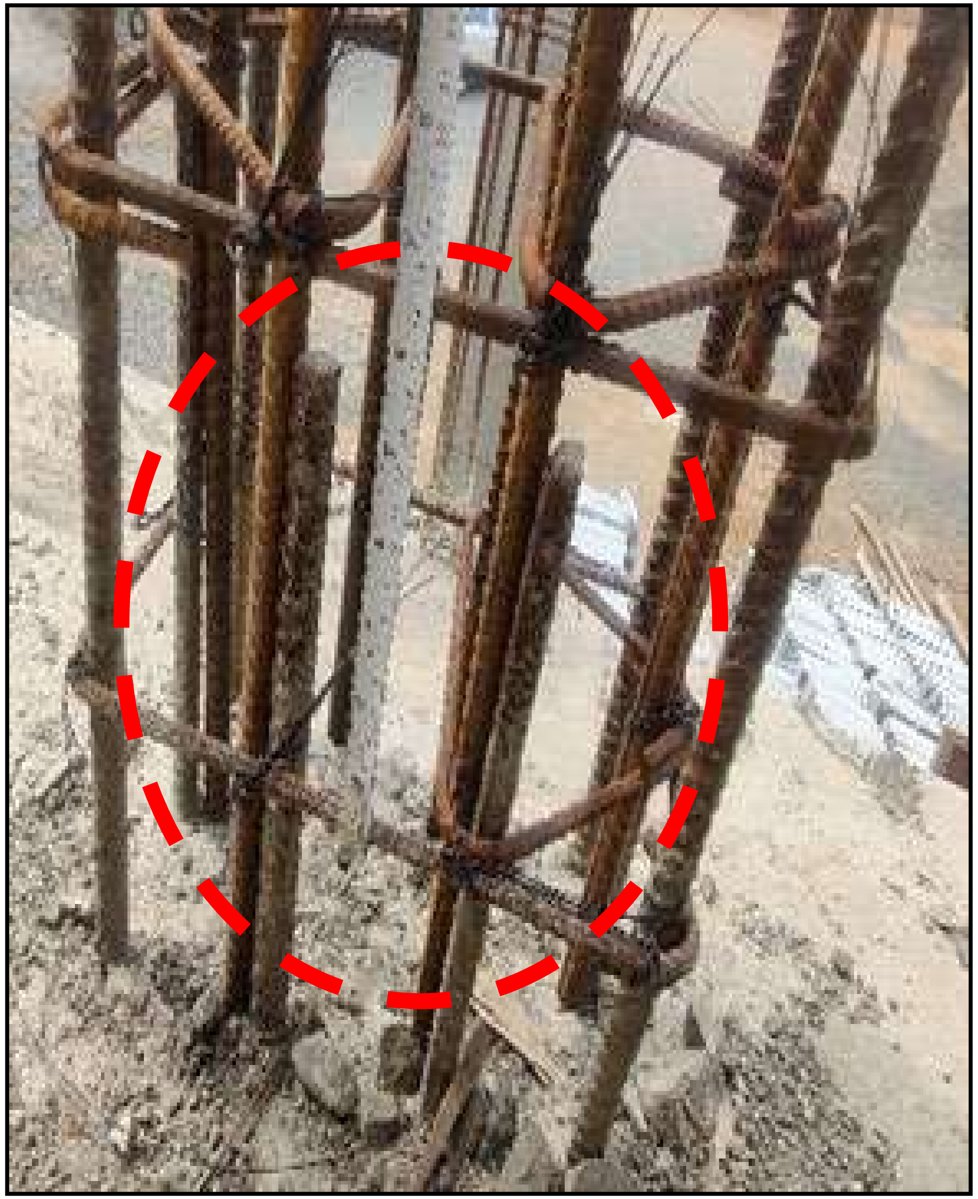
What to be?

- If chhajja bar not coming out of lintel rings, main bar shall have anchorage as shown
- Main bar shall be at top
- Chhajja shuttering not be removed till B/W done & set over



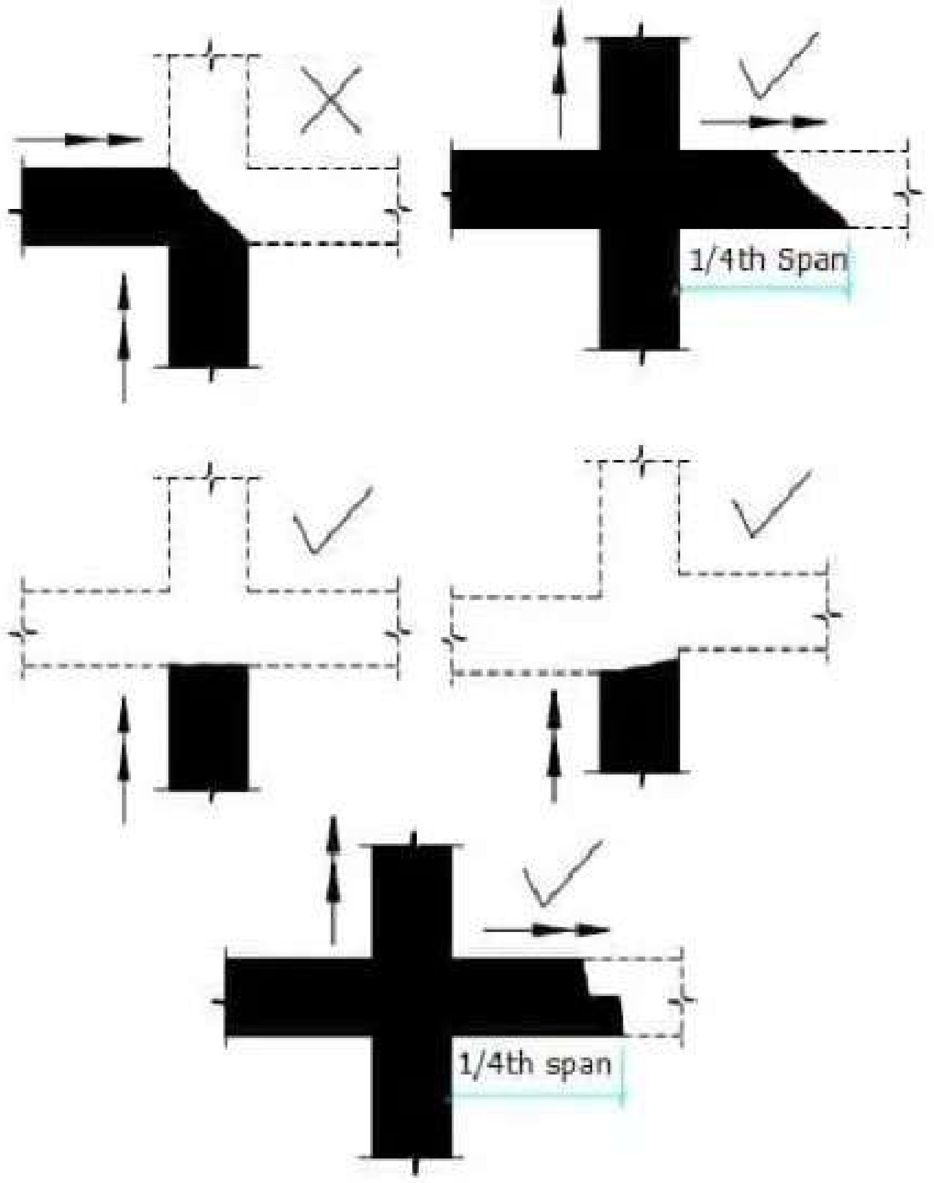
Bars in Chhajja

LAPS IN TERRACE REINFORCEMENT



- If terrace bars shorts in anchorage, proper welding to be done.

JOINT IN RCC



- **Joint in beam/ Column:**

Where to avoid joint:

- Avoid joint at the location where Shear Force (SF) is maximum

Where to provide joint in column:

- Joint in column: approx. 150 to 200 mm below soffit of the beam.
- Joint in beam: at ¼ of the span

THANKS

TESTING OF BUILDING MATERIALS

TESTING OF BUILDING MATERIALS BROUGHT AT SITE

a. Mechanism to see materials brought at site is as per specification- Authority to approve?

b. Documentation regarding the earlier approval of materials used in construction.

c. Visual Inspection followed by Testing of materials as per quality plan & frequency.

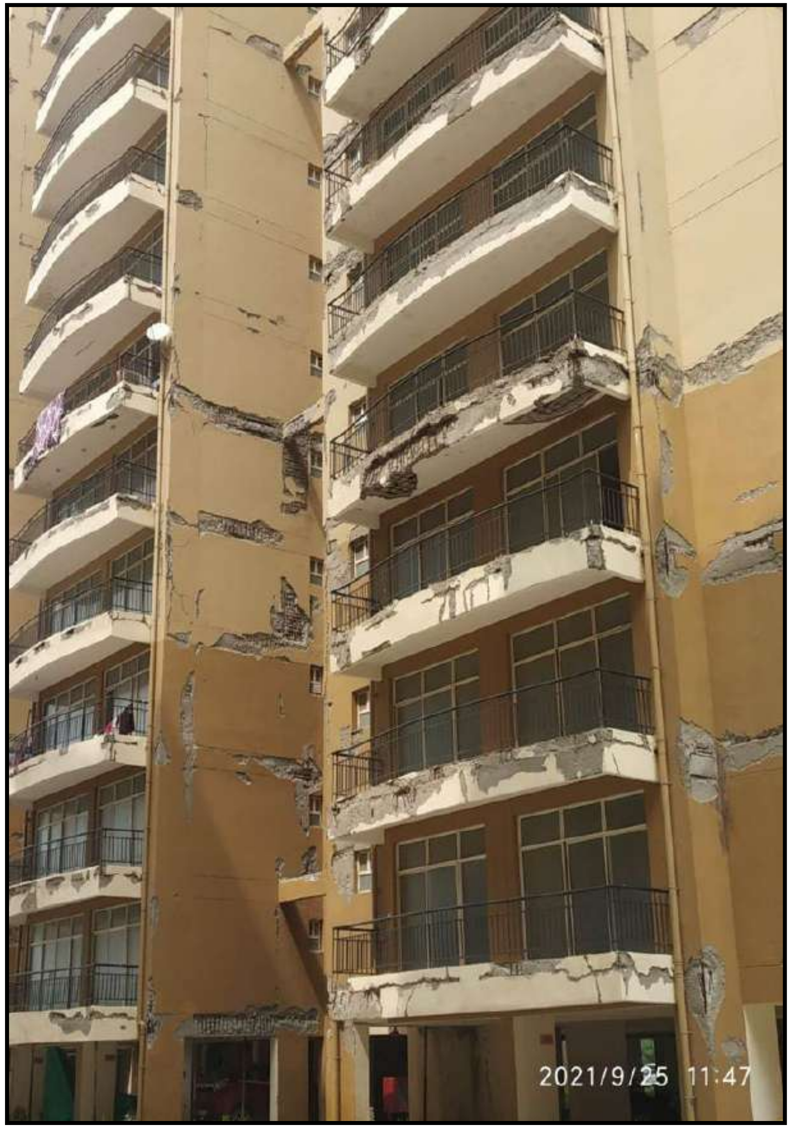
d. Checking & Cross Checking whether materials and finished items brought to sites are as per approved make List.

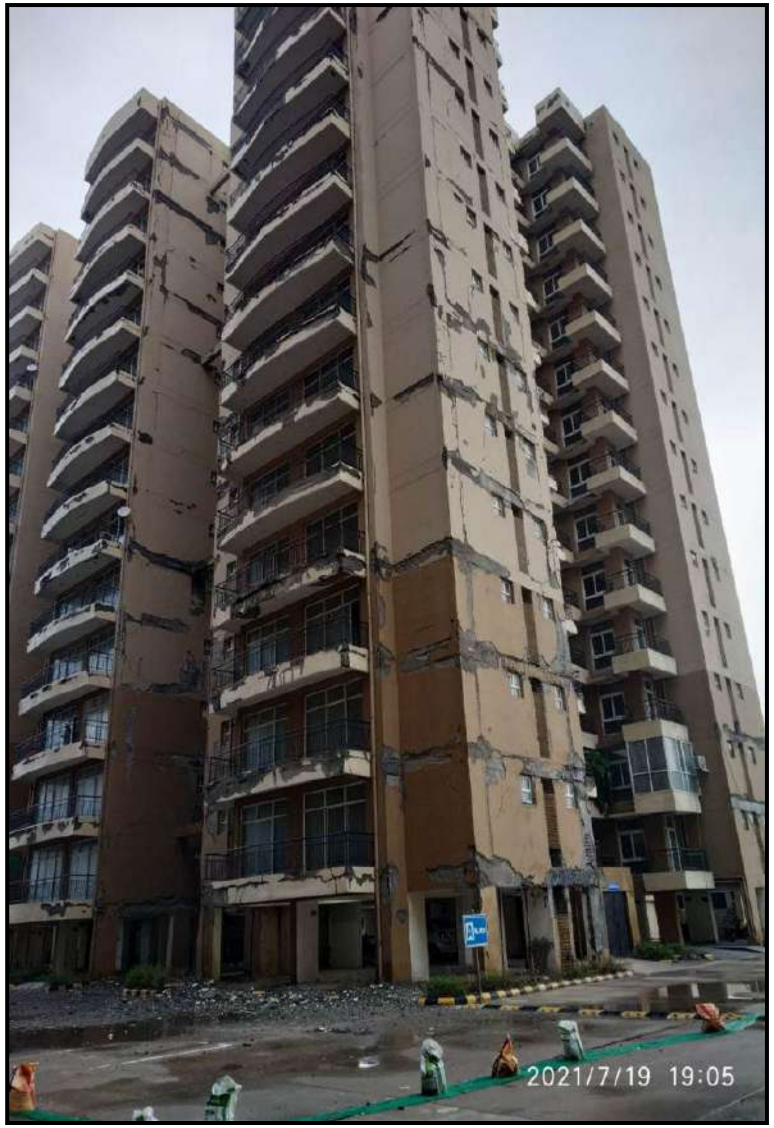
EFFECTS OF CARELESSNESS IN TESTING

REASONS

- Water used is not as per specification
- High chloride concentration in water
- Ph value of water less than 6

HIGH CHLORIDE CONCENTRATION IN WATER

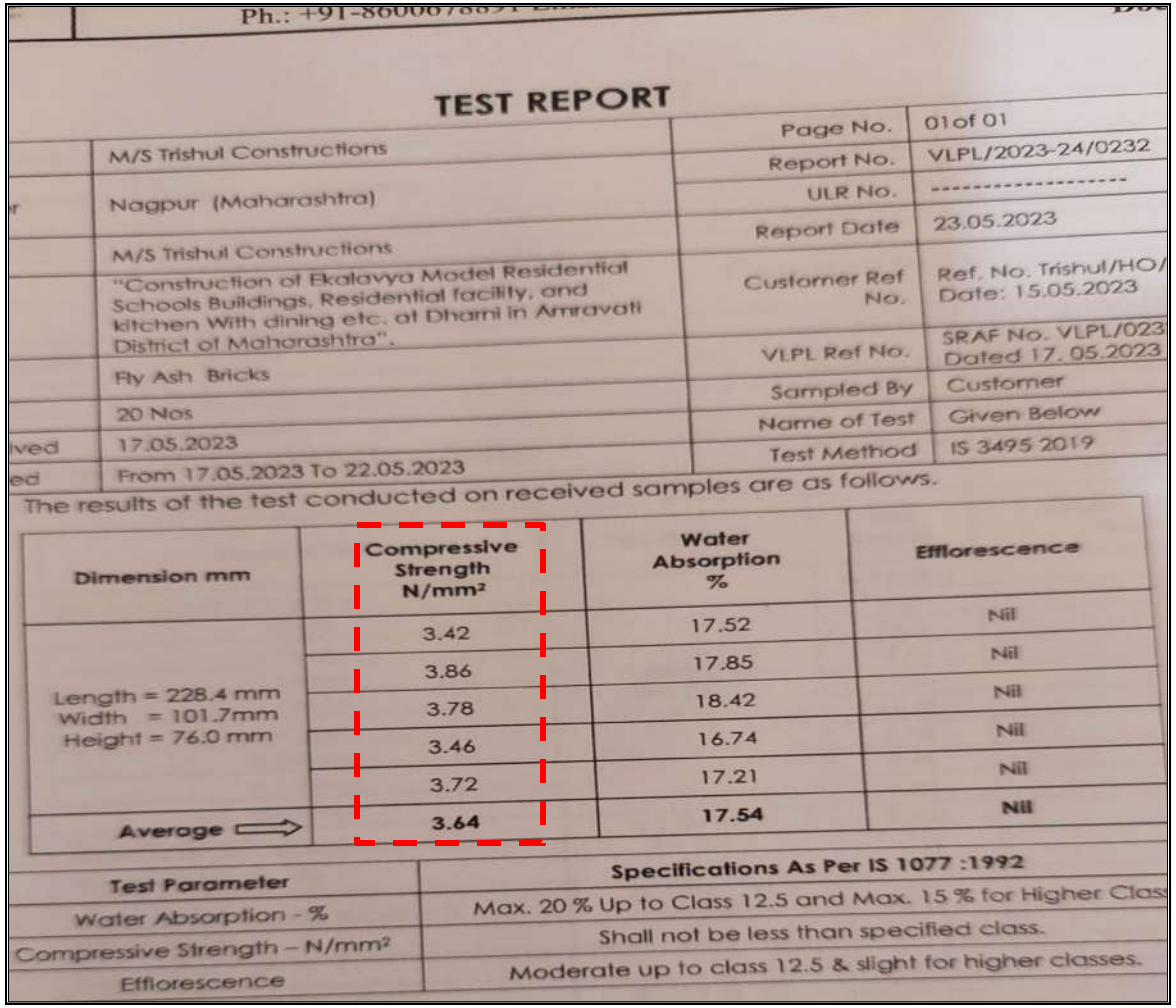




EFFLORESCENCE IN BRICKS

- Effect of Efflorescence on wall and after plaster

STUDY OF TEST REPORT IS MUST



TEST REPORT

	M/S Trishul Constructions	Page No.	01 of 01
		Report No.	VLPL/2023-24/0232
	Nagpur (Maharashtra)	ULR No.	--------------------
		Report Date	23.05.2023
	M/S Trishul Constructions "Construction of Ekalavya Model Residential Schools Buildings, Residential facility, and kitchen With dining etc. at Dhami in Amravati District of Maharashtra".	Customer Ref No.	Ref. No. Trishul/HO/ Date: 15.05.2023
		VLPL Ref No.	SRAF No. VLPL/023 Dated 17. 05.2023
	Fly Ash Bricks	Sampled By	Customer
	20 Nos	Name of Test	Given Below
...ved	17.05.2023	Test Method	IS 3495 2019
...ed	From 17.05.2023 To 22.05.2023		

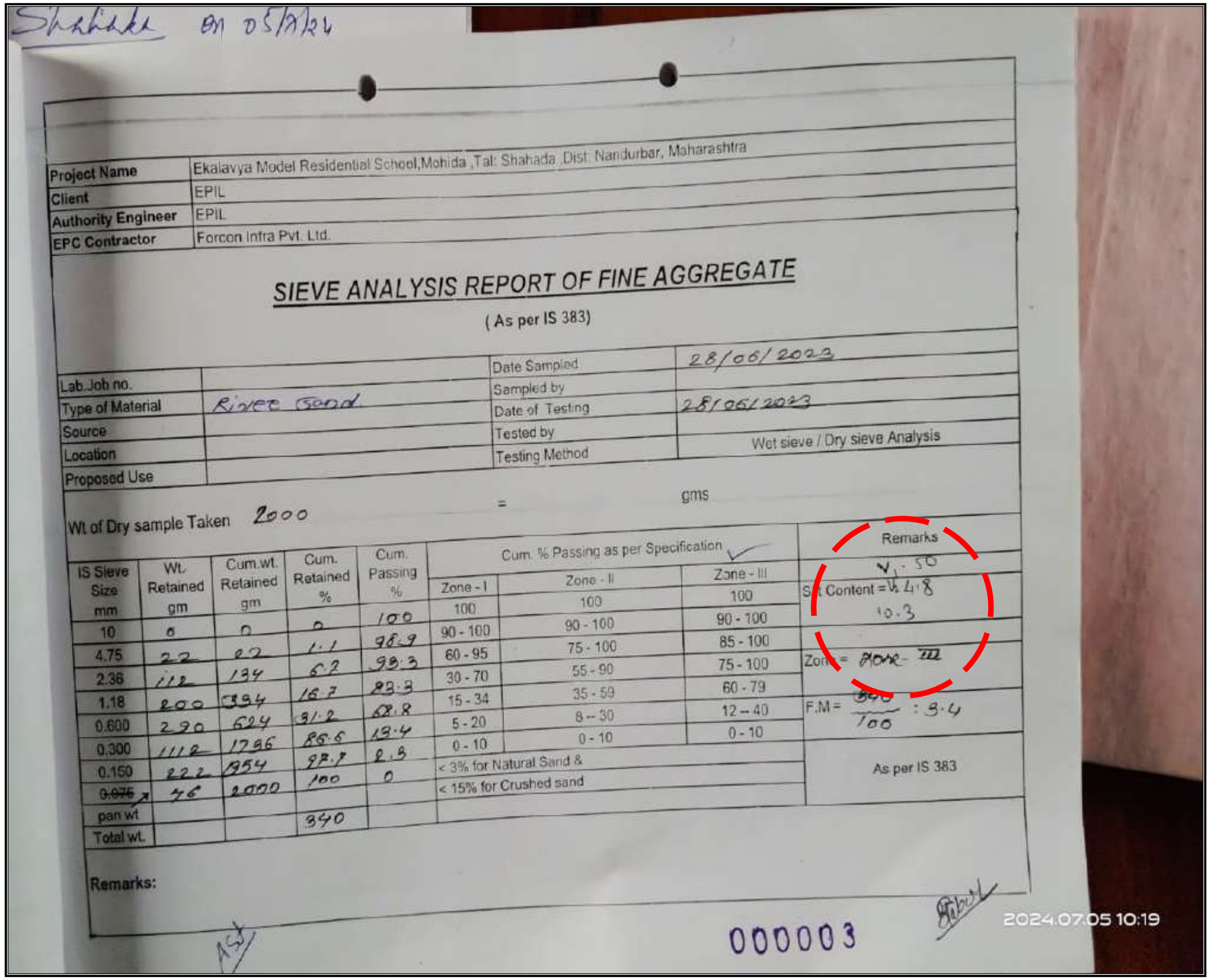
The results of the test conducted on received samples are as follows.

Dimension mm	Compressive Strength N/mm²	Water Absorption %	Efflorescence
Length = 228.4 mm Width = 101.7mm Height = 76.0 mm	3.42	17.52	Nil
	3.86	17.85	Nil
	3.78	18.42	Nil
	3.46	16.74	Nil
	3.72	17.21	Nil
Average ⇨	**3.64**	**17.54**	**Nil**

Test Parameter	Specifications As Per IS 1077 :1992
Water Absorption - %	Max. 20 % Up to Class 12.5 and Max. 15 % for Higher Class
Compressive Strength – N/mm²	Shall not be less than specified class.
Efflorescence	Moderate up to class 12.5 & slight for higher classes.

- It is noticed that the reports of laboratory are not studied .
- Due to this compressive strength of bricks failed but site engineer unaware.
- Study of IS code and specification are must.

AWARENESS OF SPECIFICATIONS IS MUST


Shahada on 05/07/24

Project Name: Ekalavya Model Residential School,Mohida ,Tal: Shahada ,Dist: Nandurbar, Maharashtra
Client: EPIL
Authority Engineer: EPIL
EPC Contractor: Forcon Infra Pvt. Ltd.

SIEVE ANALYSIS REPORT OF FINE AGGREGATE
(As per IS 383)

Lab.Job no.		Date Sampled	28/06/2023
Type of Material	River Sand	Sampled by	
Source		Date of Testing	28/06/2023
Location		Tested by	
Proposed Use		Testing Method	Wet sieve / Dry sieve Analysis

Wt of Dry sample Taken 2000 = gms

IS Sieve Size mm	Wt. Retained gm	Cum.wt. Retained gm	Cum. Retained %	Cum. Passing %	Zone - I	Zone - II	Zone - III
10	0	0	0	100	100	100	100
4.75	22	22	1.1	98.9	90 - 100	90 - 100	90 - 100
2.36	112	134	6.7	93.3	60 - 95	75 - 100	85 - 100
1.18	200	334	16.7	83.3	30 - 70	55 - 90	75 - 100
0.600	290	624	31.2	68.8	15 - 34	35 - 59	60 - 79
0.300	1112	1736	86.8	13.4	5 - 20	8 -- 30	12 -- 40
0.150	222	1954	97.7	2.3	0 - 10	0 - 10	0 - 10
0.075	46	2000	100	0	< 3% for Natural Sand & < 15% for Crushed sand		
pan wt							
Total wt.			340				

Remarks:
V_1 - 50
Silt Content = V_2 4.8
10.3
Zone = Zone - III
F.M = 340/100 : 3.4
As per IS 383

Remarks:

000003

2024.07.05 10:19

- Site engineer has tested silt content and entered in register but due unawareness with the specification could not take any action. Such as removal of material from site.

EFFECT OF HIGH SILT ON CONCRETE SURFACE

- The slab casted with the sand of high silt content.
- Cracks developed on slab after setting of concrete.

EFFECT OF HIGH SILT OF SAND IN PLASTER SURFACE

- The plaster was done with the sand of high silt content.
- Due to this the plaster surface could not gain the strength.

QUALITY PLAN

a. Quality Plan indicating number and frequencies of Testing of materials as per BOQ

b. Field Testing Equipment & Instrument (Annexure-I & II)- set of sieves, Silt Testing Glass, Slump Cone, Cube Moulds.

c. T & P, etc. for Quality Assurance – Batching Plant, Plate & Needle Vibrator, Earth Compactor, Compression Testing Machine, Pulse Velocity, Rebound Hammer for finished RCC work.

d. Mandatory Testing of RCC, Brick, etc. to be done at site by CTM and in outside lab as per required frequencies indicated in Quality Plan

e. Maintenance of preferred list for factory made items.

QUALITY PLAN

- Quality Parameters
  - Materials
    - Visual Inspection
    - Testing in Lab
  - Work Process
    - Testing during work-Field & Lab testing
    - Batching Plant, vibrator,compactor
  - Work Monitoring
    - Workmanship- Line level, finish, honeycombing etc.

VISUAL EXAMINATION

- To see aggregate is not poorly graded.
- Aggregate is not flacky.
- No deleterious material is available.

VISUAL EXAMINATION

- Poorly graded and high silt content of coarse sand.

VISUAL EXAMINATION

Inferior Quality of Brick

Inferior quality of
fly ash bricks

VISUAL EXAMINATION

High silt content in sand

No silt content in sand

AUTOCLAVED AERATED CONCRETE (AAC) BLOCKS

- Item 6.47,DSR 2023

- Providing and laying Autoclaved Aerated concrete (AAC) blocks masonry 100 mm/ 125 mm thick with Grade-I AAC blocks of density 551 to 650 kg/ cum conforming to IS: 2185 (Part 3)

AUTOCLAVED AERATED CONCRETE (AAC) BLOCKS

PHYSICAL PROPERTIES
IS 2185(PART-3)

S.No	Density in oven dry condition(Kg/m3)	Compressive strength ,Minimum(N/mm2)	
		Grade I	Grade 2
i	451 to 550	2	1.5
ii	551 to 650	4	3
iii	651 to 750	5	4
iv	751 to 850	6	5
v	851 to 1000	7	6

TESTING IN LAB

Field Lab (Testing immediately on receipt at Site)

1. Silt Content
2. Sieve Analysis,
3. Dimensions, & weights
4. Compressive strength of bricks and cubes etc

Testing during work progress(At Batching Plant)

Slump, Print of Design mix & Ensure pouring of materials in proper slot

Approved Lab(other than field lab)

1. Water
2. Cement
3. Aggregates

1. RCC Cube
2. Brick/AAC block
3. Reinforcement

TESTING OF WATER

FREQUENCY:EVERY THREE MONTHS

S.No	Name of Test	Field/Lab	Acceptance Criteria
1	pH value	Lab	Not less than 6
2	Limits of acidity	Lab	5 ml
3	Limits of alkalinity	Lab	25 ml
4	chlorides	Lab	2000 mg per litre
5	Suspended matters	Lab	2000 mg per litre
6	Sulphates	Lab	400 mg per litre
7	Inorganic solids	Lab	3000mg per litre
8	Organic solids	Lab	200 mg per litre

TESTING OF CEMENT

FREQUENCY:50 MT OR PART THEREOF

S.No	Name of Test	Field/Lab	Acceptance Criteria
1	Fineness	Lab	not less than 300 m2/kg
2	Soundness	Lab	not more than 10 mm and 0.8%
3	Setting time (initial & final)	Lab	30 minutes(Min) and 600 minutes (Max)
4	Compressive strength	Lab	At 72 +- 1 h =16 Mpa Min At 168 +- 2 h = 22 MPa, Min At 672+-4 hrs = 33 MPa, Min

TESTING OF SAND

FREQUENCY: 20 cum for all except grading for which 40 cum frequency

S.No	Name of Test	Field/ Lab	Acceptance Criteria
1	Silt Content	Field	Maximum 8%
2	Sieve Analysis	Field	As per grading zone specified in IS 2386 part I

TESTING OF BRICKS

FREQUENCY: 50,000 no's

S. No	Name of Test	Field/Lab	Acceptance Criteria
1	Dimension Tests	Field/Lab	4600+-80 L,2200+-40 B,1400+-40 H for 20 bricks
2	Water absorption Test	Lab	not more than 20%
3	Compressive Strength	Field/lab	As per class designation
4	Efflorescence Tests	Field/Lab	Not more than moderate

TESTING OF AGGREGATE

FREQUENCY: 40 cum

S. No	Name of Test	Field/ Lab	Acceptance Criteria
1	Percentage of soft or deleterious materials	Lab	Not more than 2%
2	Particle size distribution,	Field/ Lab	As per IS 383
3	Determination of ten percent fine value	Lab	50 KN
4	Aggregate crushing strength	Lab	30%
5	Aggregate impact value	Lab	45% & 30% for wearing surface

TESTING OF REINFORCEMENT

10 mm & above 45 MT ,for 10 mm & below 25 MT

S.No	Name of Test	Field/ Lab	Acceptance Criteria
1	Bend Test	Lab	No crack
2	Rebend Test	Lab	No crack
3	Percentage Elongation test	Lab	12%
4	Ultimate tensile strength test	Lab	545 N/mm2
5	0.2% proof stress/Yield stress	Lab	500 N per mm2 for Fe 500
6.	Chemical test	Lab	As per IS 1786

WORKABILITY OF CONCRETE

workability of concrete measured in accordance with IS 1199

S.No	Placing Condition	Degree of workability	Slump(mm)
1	Blinding concrete: shallow sections: Pavements using pavers	Very low	determination of compacting factor will be more appropriate than slump (see IS 1199) and a value of compacting factor of 0.75 to 0.80 is suggested.
2	Mass concrete: Lightly reinforced sections in slabs, beams, wall, columns, : floors	low	25-75
3	Hand placed pavements: canal lining; Strip footing	Medium	50-100
4	Slip form work:Pumped concrete	Medium	75-100
5	Trench fill	High	100-150
6.	Tremie concrete	Very high	measurement of workability by determination of flow will be appropriate

REINFORCED CEMENT CONCRETE

Material	Test	Field Test/ Lab Test	Frequency
Reinforced cement concrete (Nominal Mix)	Slump Test (For workability of concrete)	Field	(i) One test for 10 cum of part thereof for columns. (ii) One test for 40 cum or part thereof for other R.C.C work. **Minimum Quantity:-** **(i) 5 cum in case of column.** **(ii) 20 cum for other RCC work**
	(a) Cube Test (For compressive strength of concrete)	Field/Lab	do
(Reinforced cement concrete (Design Mix)	a) Cube Test (For compressive strength of concrete)	Field/Lab Lab	Quantity of concrete Delivered in a day / Lot (cum) Number of samples 1 to 10 1 11 to 30 2 31 to 60 3 61 to 100 4 101 and above 4 plus one additional samples for each additional 50 cum of part thereof Each sample shall be of adequate quantity so that a minimum of 3 specimen cubes can be made. Test of the sample is to be done in accordance with IS 516. **(Minimum Quantity: 10)**

THANKS

PROJECT PLANNING MANPOWER,MATERIAL & MANAGEMENT

OBJECTIVE

- **Project Management Objective** is timely completion of project ensuring quality.

- "Time is the essence of contract"

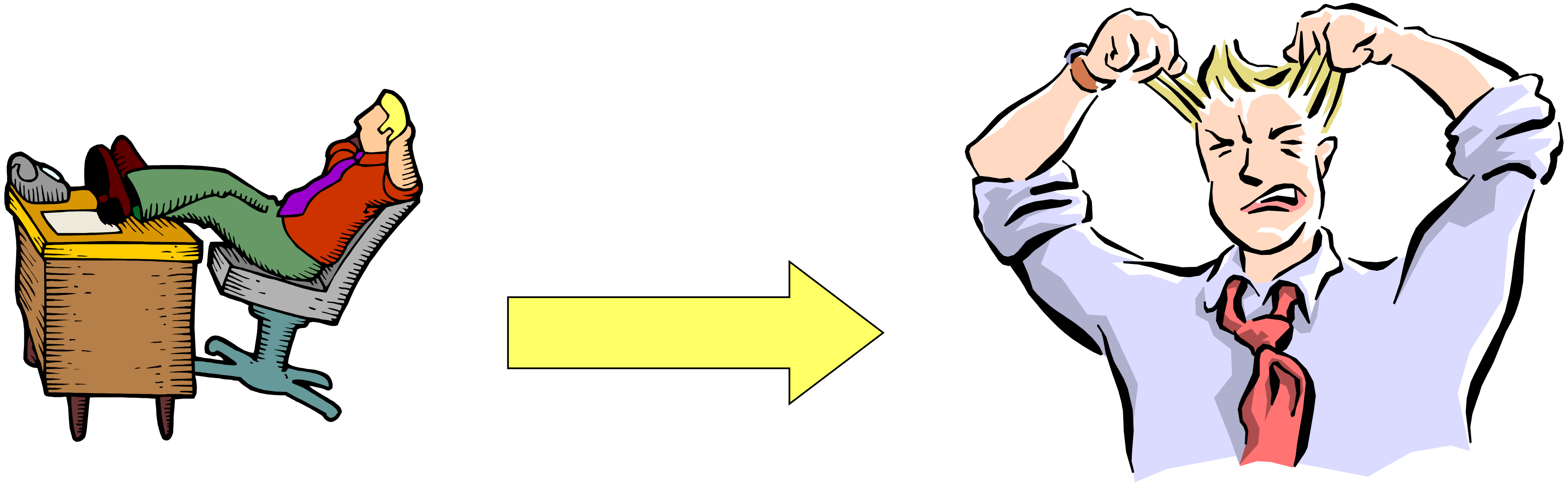
- In EMRS project , the allotted time period is **18** months. So progress @ Av. Rate of **5.5 - 6.0 %** per month needs to be ensured to complete the project within stipulated time.

WHY TIME OVER RUN ?

- No work plan
- Not review of work plan/No follow up with contractor.
- No advance planning for procurement of materials.
- Supply order to factory vendor/dealer without advance payment.
- Keeping on changing the source of ingredients of Design Mix Concrete.
- Poor labour management- Non-deployment of required labours
- Non-availability of required drawings
- Parallel activities are not being taken simultaneously.
- Lack of decision for routine site matters (Money & Decision)
- Causal approach for timely testing of material / Design mix in outside lab.
- No punitive action/notices to contractor for delay.

INADEQUATE PLANNING-CONSEQUENCES

- Inadequate planning leads to frustration towards the end of the project & poor project performance
- Purpose of all stake holders (Owner, PMC & Working contractor) get defeated.



Project Start **Project End**

PROJECT MOBILIZATION

❖ **Site logistics :**

✓ Ensure availability of all approved MLP, Architectural, Structural & Services Drawings (From PMC side)

✓ Site office , Field lab. labour huts, essential T & P (Batching Plant, Vibrator, Earth Compactor , Compression Testing Machine, Silt test Jar, Slump test Cone, Rebound hammer etc during mobilization period. (From contractor side)

❖ **Detailed Work Plan** - Work Plan/Gantt Chart/Pert Chart to be drawn immediately after award of work with contractor with Contractor for each and every activity.

PROJECT MOBILIZATION

- **Approval of work plan-** By Zonal Head

- **Set Deadlines-** Commencement and completion dates for all critical activities using Gantt / Bar chart.

- **Identify parallel activities** to take up simultaneously.

- **Source of supply** -Fix the source of supply of various design mix Ingredients.

WELL BEGUN IS HALF DONE

ILLUSTRATION-

KEY MILESTONES (BUILDING WORK)

- ✓ Foundation work
- ✓ Super structure (RCC)
- ✓ Super structure (Brick work)
- ✓ Internal plaster
- ✓ External Plaster
- ✓ Flooring
- ✓ Terrace water proofing
- ✓ Door, windows grills etc.

- ✓ SS Rail/hand Rail
- ✓ Entrance Alu. work /collapsible shutters
- ✓ Internal Painting
- ✓ External Painting
- ✓ Internal plumbing
- ✓ Elect. wiring ,sheets, switches, MCBs.
- ✓ Sanitary & water supply fixtures
- ✓ Internal Electrical fittings

ILLUSTRATION-
KEY MILESTONES (EXT.DEV.WORK)

Civil Infra. Work

- ✓ Manholes, Septic Tank & Soak Pit.
- ✓ Ext. Sewerage, Drainage & Water Supply.
- ✓ Roads, Pathways.
- ✓ Assembly and flag Hosting.
- ✓ Compound wall.
- ✓ Dressing/Levelling of site and development of sports activities area
- ✓ Entrance Gate incl. Signage.

Electro-Mechanical Infra. Work

- ✓ LT /HT Panel & Associated Work.
- ✓ Transformer.
- ✓ Fire fighting & Allied work.
- ✓ Electrical Poles & Cables.
- ✓ Street Lighting.

ILLUSTRATION OF GANT CHART (ACTIVITY WISE)

BAR/PERT chart of Building works (Activities wise) for all Building wise till completion									
	Name of Building	Status (completed/ in progress)	Time period						
SN.	List of Activities			Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24
1	Foundations and upto plinth level		School						
			Boys Hostel						
			Girls Hostel						
			K&D						
			Staff Qtrs						
			Misc.bldgs.						
2	Superstrucure (RCC Work) including water tanks,momty,ramps etc.		School						
			Boys Hostel						
			Girls Hostel						
			K&D						
			Staff Qtrs						
			Misc.bldgs.						
3	Brick work GF to Mumty, MEP,internal and external plastering, flooring.		School						
			Boys Hostel						
			Girls Hostel						
			K&D						
			Staff Qtrs						
			Misc.bldgs.						

EFFECTIVE PLANNING & SCHEDULING- APPLY THEORY OF 3M'S

1st 'M'

- **Materials** : Materials Procurement

2nd 'M'

- **Manpower:** Manpower Deployment

3rd 'M'

- **Management** – Managing of project Activities as per work plan

1^{ST} 'M'- MATERIALS MANAGEMENT

- **Keep Source /Brand of material fixed** – To avoid loss of time loss in re-testing.

- **Working out Procurements Quantities**– for all key items & activities

- **Stocks in Advance**– Keep 3 month advance stocks of all basic building materials i.e. concrete ingredients, Steel , bricks , find sand etc. (Cement – 06 weeks)

1ST 'M'- MATERIALS MANAGEMENT

- **Align procurement with critical activity**–Give advance order for factory made items well before commencement of respective activities. (Tiles/Doors/Windows/Sanitary fittings/ LT &HT Panels/Transformer/Cables, etc)

- **Project Management Tools**– Use Advance project management tools i.e. MS Project,/Primavera for aligning and tracking progress.

ILLUSTRATION-TENTATIVE LEAD FOR IMPORTANT PROCUREMENTS

Illustration of -Tentative Lead for Procurement				
SN.	Items	Anticipated date of commencement of Activity	Anticipated date of completion of activity	tentative lead for for procurement of materials w.r.t. commencement of
A	**Civil Work**			
1	Flooring & Tiling work Granite work in lab	01.02.2025	31.03.2025	31.12.2024 (**2 months Adv.**)
2	Doors,Windows ,Grills &Railings ,Al work in entrance			4 Month Advance
3	Terrace Water proofing			3 Month Advance
4	Internal Pulumbing			2 month Advance
5	Internal Painting			1 month Advance
6	External painting			2 month Advance
7	Sanitary and water supply fixtures			1 month Advance
8	Electrical Wiring			1 month Advance
9	Electrical fitting, switches,sheets,MCBs			1 month Advance

ILLUSTRATION-TENTATIVE LEAD FOR IMPORTANT PROCUREMENTS

Illustration of -Tentative Lead for Procurement				
SN.	Items	Anticipated date of commencement of Activity	Anticipated date of completion of activity	tentative lead for for procurement of materials w.r.t. commencement of
B	**Electro-Mechnical Infra Work**			
1	LT panels & Associated works			4 month Advances
2	HT panels & Associated works			4 month Advances
3	Transformer			3 month Advance
4	Cable work			3 month Advance
5	Steet Light			3 month Advance
6	Fire fighting & Allied works			3 month Advance
C	**Furniture & kitchen Equipments**			
1	All furniture in School, Hostel and K&D bldgs.			4 month Advance
2	All Kitchen & Dinning equipments			4 month Advance

2^{ND} 'M'- MANPOWER DEPLOYMENT

- **Align Manpower Requirement with Critical Activity**– Work out the requirement of manpower to complete a particular activity in time.

- **Advance talk with Labour gang**– Based on requirement , keep the labour gangs ready for deployment.

- **Keep dedicated team for each activity in every building**– Keep separate dedicated team of labour for each activity in each building .

- **Project Management Tools**– Use Advance project management tools i.e. MS Project/Primavera to align labour requirement with activity commencement.

3RD 'M'- MANAGING ACTIVITIES

Communication with Stakeholders & Regular Review Meetings:

- Work in every buildings simultaneously
- Maintain communication with all stakeholders i.e. NESTS, vendor, Peti-contractor, supplier, transporter (The supply order given to vendor i/c advance payment to be reconfirmed)
- Regular review meeting with contractor (weekly or bi-weekly) to review activity-wise progress, material procurement status, manpower etc.
- Review work plan & follow up with contractor to see work is going as per target fixed for each activity in every building
- Issue notices/punitive action for delay (No EoT for flimsy ground)
- If genuine hinderance adjust timelines and resources as necessary based on progress.

UNWARRANTED GROUNDS FOR DELAY

1. Delay on Personal Grounds.
2. Delay on Wrong supply of materials.
3. Delay on Unavailability of manpower
4. Delay for performing pre-construction activities.
5. Delay on ground of delay on part team of CA(soil investigation, Architects, Structural engineer ETC.).
6. Delay on grounds of payment from NESTS.
7. Delay making NESTS Guidelines as grounds.
8. Delay on grounds of non-supply of materials by vendor.
9. Delay on normal rainy period.
10. Delay due to hinderance in part construction area.

CONCLUSION

By applying "3M" principle effectively, we can ensure effective planning and monitoring of an EMRS project, leading to successful completion on time and within budget.

It is a team work & site engineer alone can not ensure progress. Every stack holders must work jointly.

CONCLUSION

Project Start

Project Completion

THANKS

ISSUES IN DOOR FRAME & SHUTTER

DOOR FRAMES & SHUTTERS

Tee-Iron Door frame:

- Welding: Welding shall generally be done by flush butt or electric arc process as per IS 816 and IS 823.
- **MS tie bar** of **10 mm dia** shall be welded at bottom of the frame. **40mm extra margin** along vertical member shall be kept to burry in floor.
- The size of doors, window and ventilators shall be calculated so as to **allow 12.5 mm clearance on all sides** to allow an easy fitting in opening.
- The **actual size** of doors, windows and ventilator **shall not vary by more than +/- 2 mm** than those shown in the drawings.
- The T Sections shall be **mitre joined and continuously butt welded** all along.

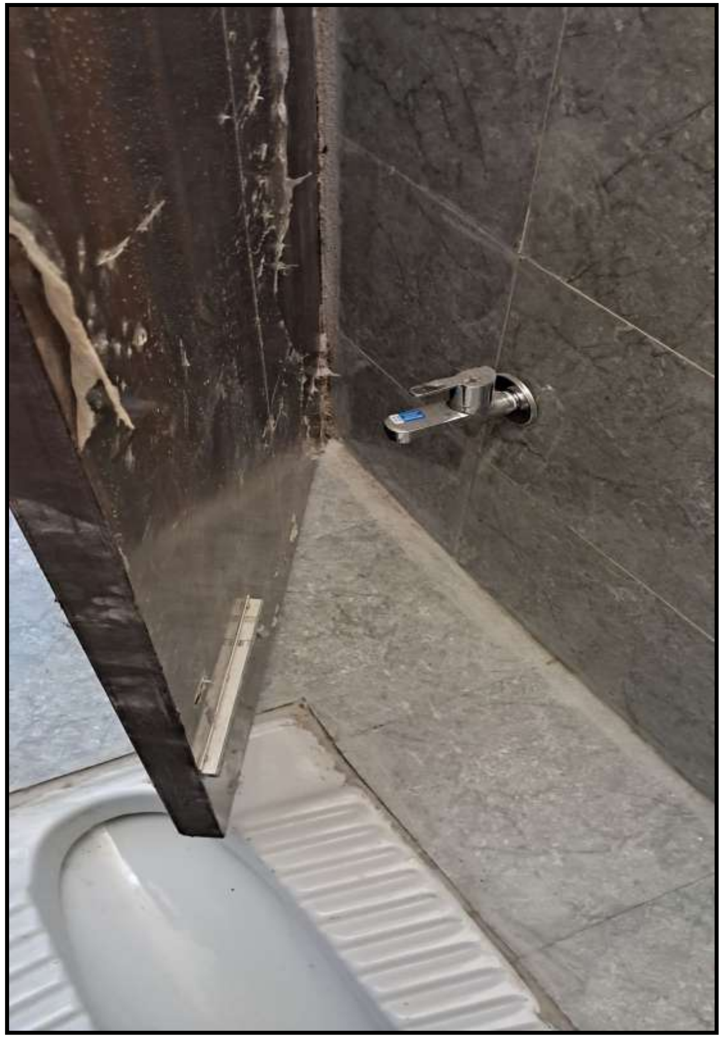
DOOR FRAMES & SHUTTERS

Frame not flush welded

Frame not fitted properly & splashed with mortar

DOOR FRAMES & SHUTTERS

Tower Bolts: Fixing not proper

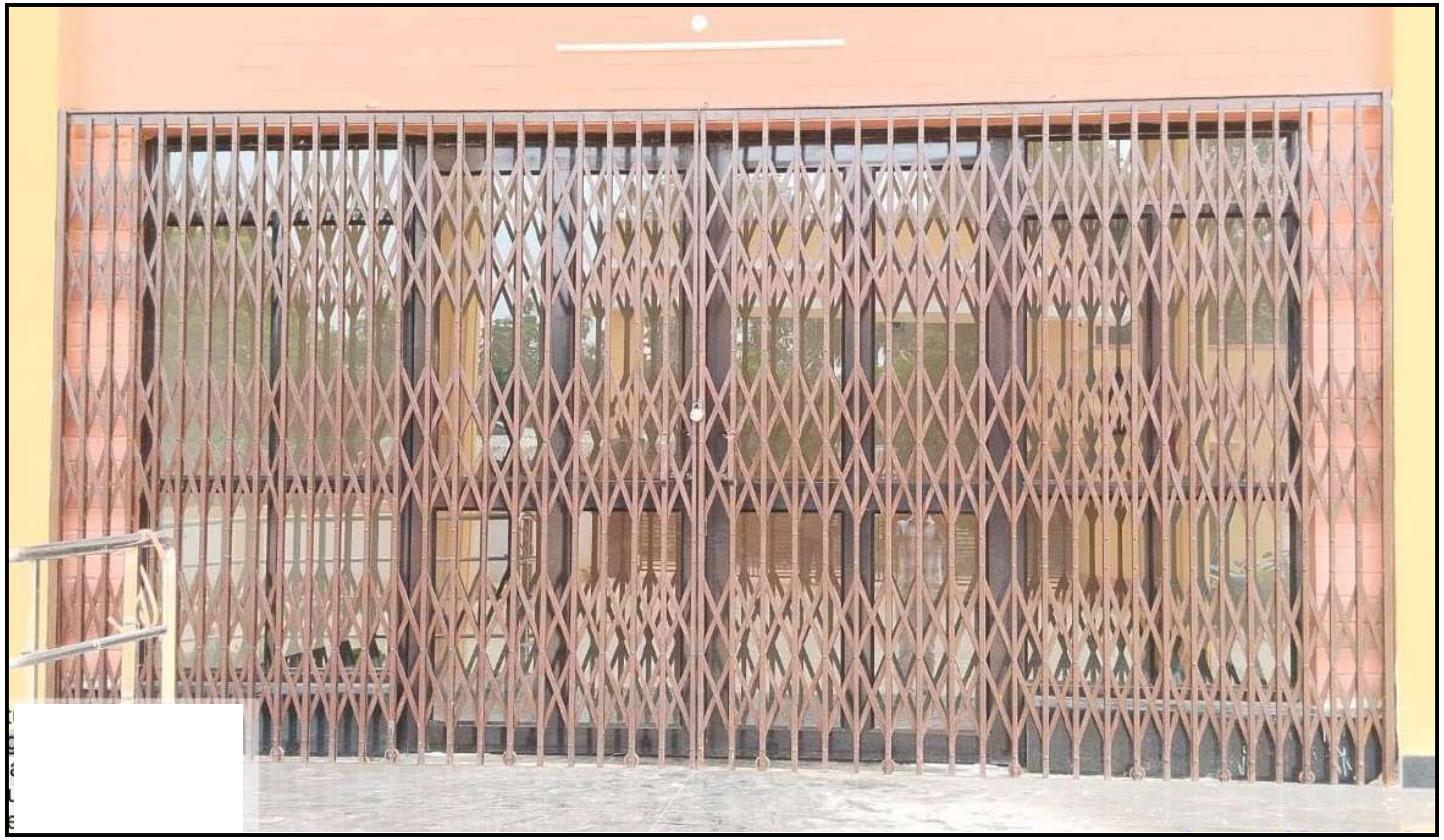


Wrong direction & 60mm masonry offset missing

Correct way of fixing door fittings

DOOR FRAMES & SHUTTERS

Improper way of fixing



Correct fixing of Collapsible gate

DOOR FRAMES & SHUTTERS

Aluminium door

Aluminium Main Doors:

- Aluminum Section to be of suitable size with thickness 2.5 mm
- Glass to be of 5 mm thick
- Door Sliding Door bolts: 300 mm
- Door Tower bolts (300 mm + shutter ht. in excess of 2.15 m)
- Doors shall have floor spring

DOOR FRAMES & SHUTTERS

Aluminium door joints not mitred properly

Correct way of fixing aluminium door

ISSUES IN STEEL WINDOWS

Steel Window:

- Welding: The process of welding adopted shall be **flush butt welding** and should be **factory made**.
- The **hinges** shall be of projecting type with **thickness not less than 3.15 mm** and **length not less than 65 mm & width** not more than **25 mm**.
- The **diameter of hinge pins** shall not be less than **6mm**.
- The handle shall have a two-point nose which shall engage **with a brass or aluminium alloy striking plate on the fixed frame**.

Process

Flush butt welding

STEEL WINDOWS

Joints not flush welded

Flash butt welding

Window as per specs.

STEEL WINDOWS

Window without flush butt welding

Window Hinge 35 mm against 65 mm

Flingy window shutter.

DOOR FRAMES, SHUTTERS & FITTINGS

Steel Window:

- The **height of the handle plate** in each type of standards windows will be as specified, otherwise it **shall be at a height of 3/8 of the height of shutter**, from its bottom.
- **Glazing** shall be provided **on the outside of the frame** unless otherwise specified.
- **Four glazing clips** may be provided **per glass pane** for a size larger than **30 cm x 60 cm** for all types, where the glass panes size **exceed 80 cm x 200 cm**, **6 glazing clips** shall be used.

Window as per specs.

ROOFING & WATERPROOFING

Khurra

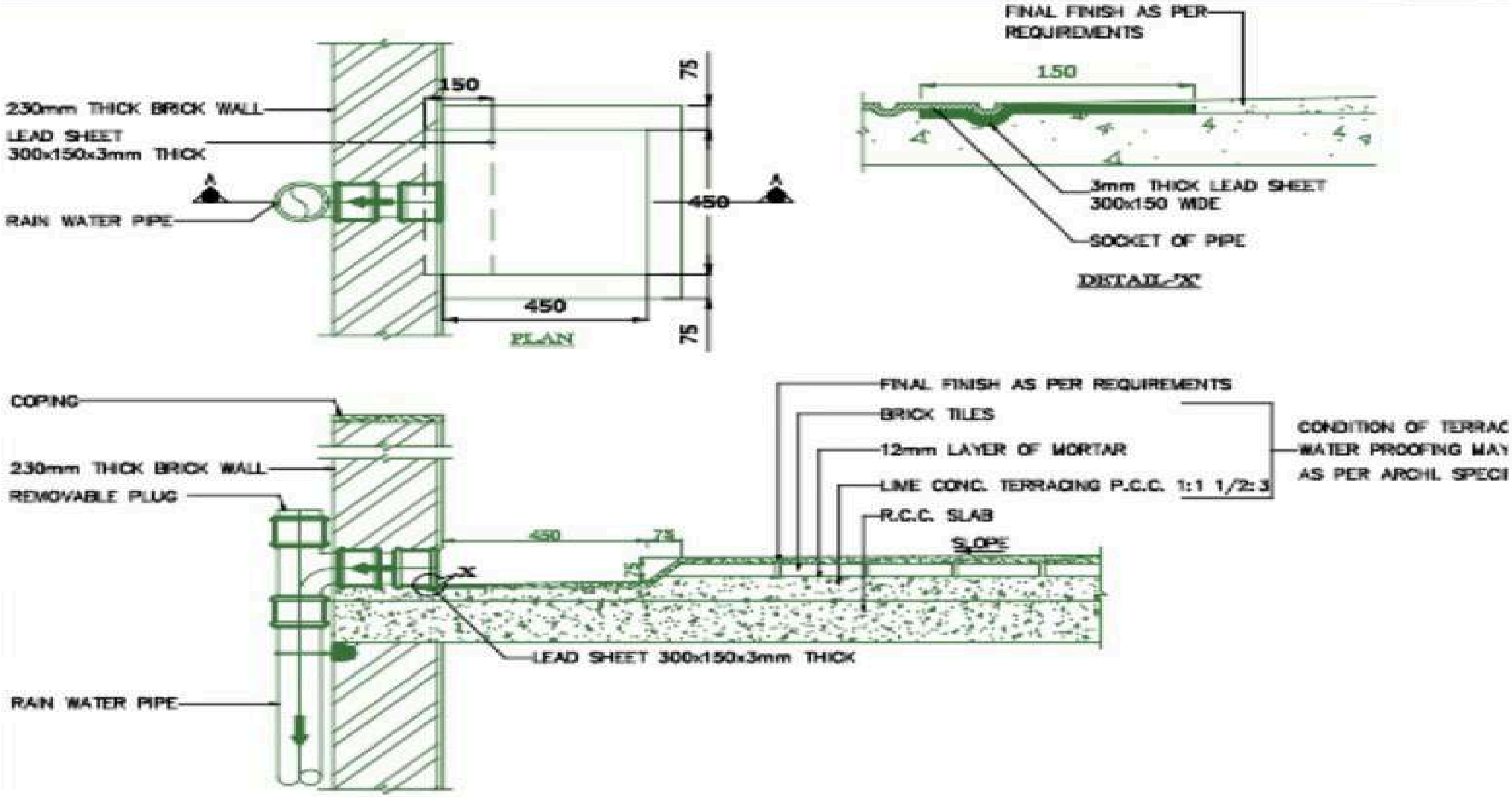
- Khurras **shall be constructed before the brick masonry work** in parapet wall is taken up.
- It shall be of **size 45 cm x 45 cm** and shall be made of cement concrete 1:2:4 mix
- A **PVC sheet** of **size 1 m x 1 m x 400 micron** (alternatively, aluminium foil of 32 SWG) shall be **laid under the khurra**.
- Then **CC** shall be laid over it to average thickness of **50 mm** with **its top surface lower than the level of adjoining roof surface by not less than 50 mm.**
- The **CC shall be laid to a size greater than** the stipulated **size of the khurra** in such a way that the adjoining terracing shall **overlap the concrete on its three edges by not less than 7.5 cm**.

ROOFING

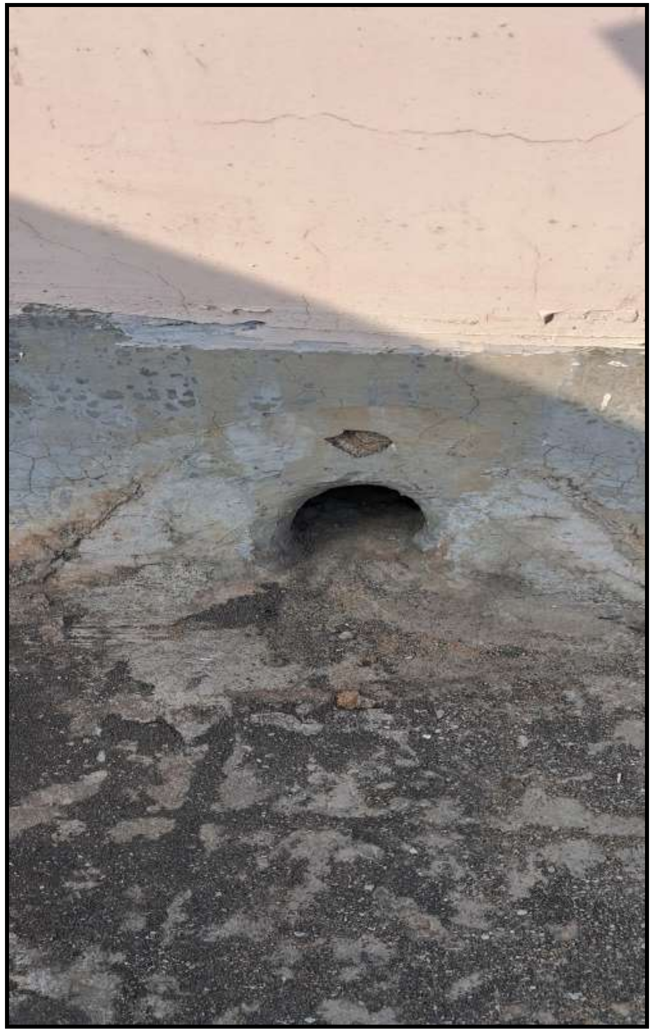
Khurra…

- The **concrete will slope uniformly from the edges to the outlet**, the slope being as much as possible and **in no case less than 20 mm cement concrete at the outlet**. The **concrete** shall be **continued at the same slope through the width of the wall** into the outlet opening to ensure a water tight joint.
- The khurras and the **sides of the outlet shall then be rendered with 12 mm coat of cement plaster** 1:3 mix (1 cement : 3 coarse sand). This shall be done **when the concrete is still green** and shall be finished.
- The sides of the khurras and sides of the outlet opening shall be well rounded. The **size of the finished outlet opening shall be 10 cm wide and by 20 cm high.**
- **Iron gratings**, shall be of overall size 20 × 25 cm. with an outer frame of 15 × 3 mm M.S. flat to which 4 Nos M.S. bars of 10 mm dia shall be welded in a vertical direction keeping equal clear spacing of 2.5 cm.

ROOFING


FINAL FINISH AS PER REQUIREMENTS
150
3mm THICK LEAD SHEET 300x150 WIDE
SOCKET OF PIPE
DETAIL-'X'
230mm THICK BRICK WALL
LEAD SHEET 300x150x3mm THICK
RAIN WATER PIPE
150
75
450
450
75
PLAN
COPING
230mm THICK BRICK WALL
REMOVABLE PLUG
RAIN WATER PIPE
FINAL FINISH AS PER REQUIREMENTS
BRICK TILES
12mm LAYER OF MORTAR
LIME CONC. TERRACING P.C.C. 1:1 1/2:3
R.C.C. SLAB
SLOPE
450
75
LEAD SHEET 300x150x3mm THICK

ROOFING



Khurra not proper

Grating is not as per specification

WATERPROOFING

For Terrace

Terrace drainage plan must be in hand and shall be executed by a specialised agency (10 year warranty bond shall be taken).

- **Cleaning the RCC slab**
- Applying **2.75 kg/sqm** of cement admixed with water proofing compound (over the RCC slab including **adjoining walls up to 300 mm height**)
- **Laying base coat with 20 mm thick** layer of cement mortar of **mix 1:5** (1 cement :5 coarse sand) admixed with water proofing compound.
- **Fixing ridges line** for **making required gradient / slope by laying broken bricks /brick bats** (*of size 25 mm to 115 mm out of **well burnt bricks** shall be used*) for gradient / slope **with mortar with 50% of cement mortar 1:5** admixed with water proofing compound. (***The brick bats shall be properly dampened for six hours before laying***)

WATERPROOFING

For Terrace…

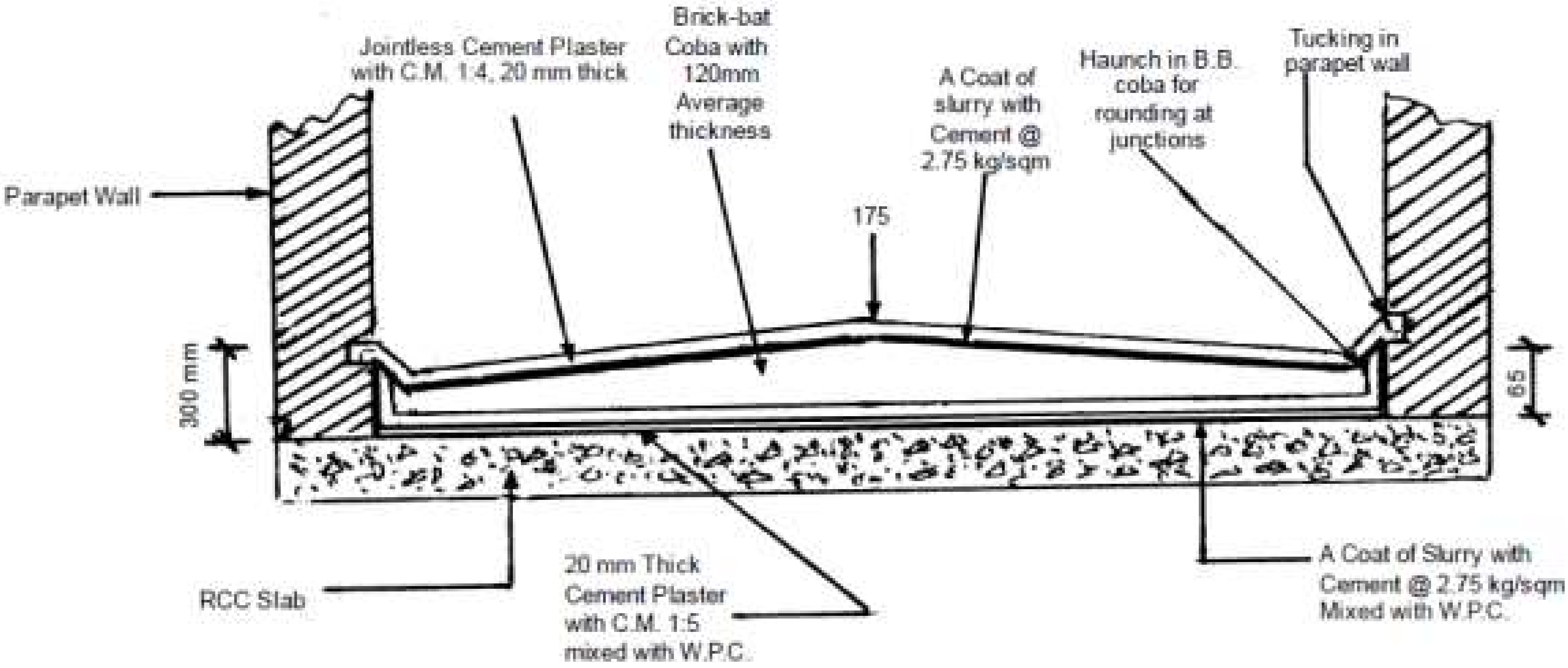
- **Brick bats shall be laid to required slope/gradient** over the base coat of mortar leaving **15-25 mm gap between two bats**.
- **The haunches/gola at the junction of parapet wall and the roof shall be formed only with brick bat coba.**
- **After two days** of proper **curing** applying **a second coat of cement slurry** using 2.75 kg/ sqm of cement admixed with water proofing compound ***(only that much quantity of slurry shall be prepared which can be used within half an hour of preparation i.e. before the initial setting time of cement.)***
- **Laying glass fibre cloth** of approved quality in top layer of plaster (Note: The **slurry shall be applied** evenly on the **entire surface covered with fibre glass cloth so that a layer of 1.50 mm thickness** of slurry is formed.)

WATERPROOFING

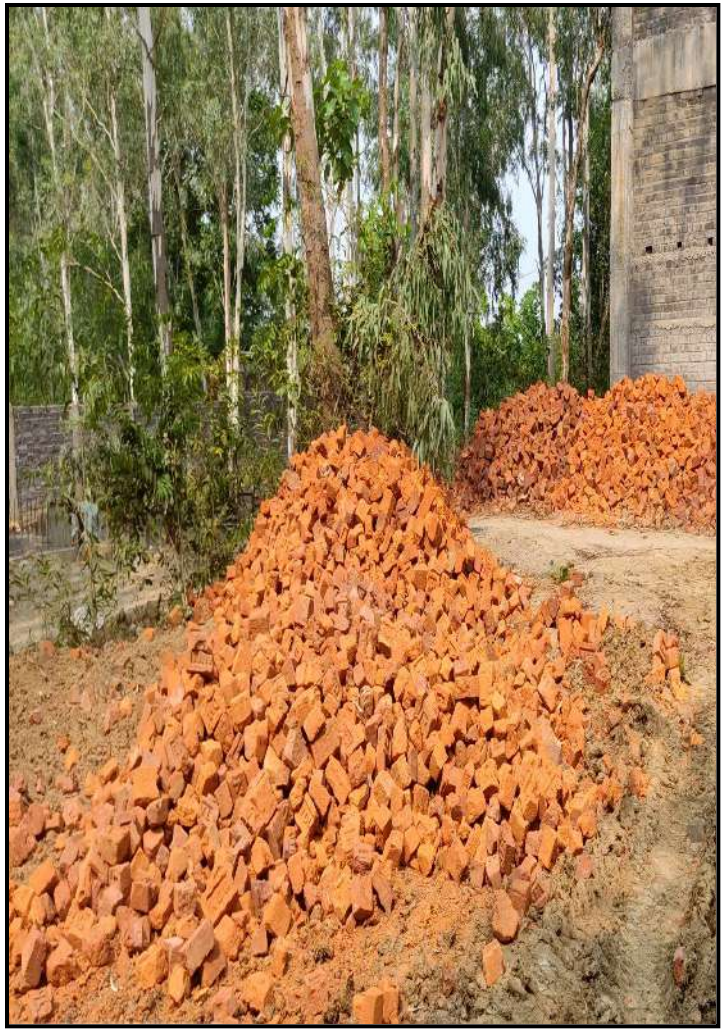
For Terrace…

- Finishing the surface with 20 mm thick jointless cement mortar of **mix 1:4** (1 cement :4 coarse sand) admixed with water proofing compound.
- Finally finishing the surface with trowel with neat cement slurry and **making pattern of 300x300 mm square 3 mm deep**.
- The **whole terrace** so finished shall be **flooded with water** for a **minimum period of two weeks** for **curing** and for **final test.**

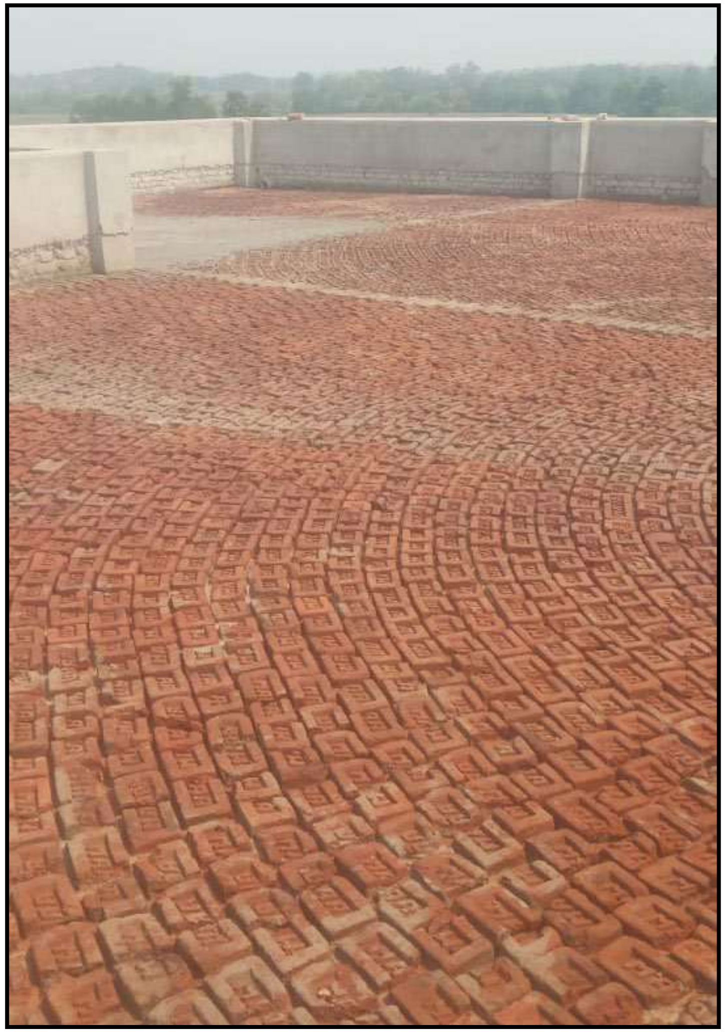
WATERPROOFING



WATERPROOFING



Inferior quality brick bats not to be used



Laying of brick bats

WATERPROOFING

Cracks in waterproofing

Good quality final finish

Pond curing of terrace

WATERPROOFING

For toilet sunken floor

- Before the water proofing treatment, the **internal plaster of ceiling and walls of WC block leaving the portion for dado/skirting should be completed**.
- **Grooving / chasing for doing the concealed work of GI/CI pipes/Electrical conduits should be completed.**
- **Cleaning the depressed/sunken portion of WC of all debris, extra mortar sticking to the vertical and horizontal surface etc. Necessary holes for 'P' trap /Nahani trap/Water escape pipe etc should be completed.**
- **Before the water proofing treatment work, proper key in the concrete surface should be provided.**

WATERPROOFING

For toilet sunken floor

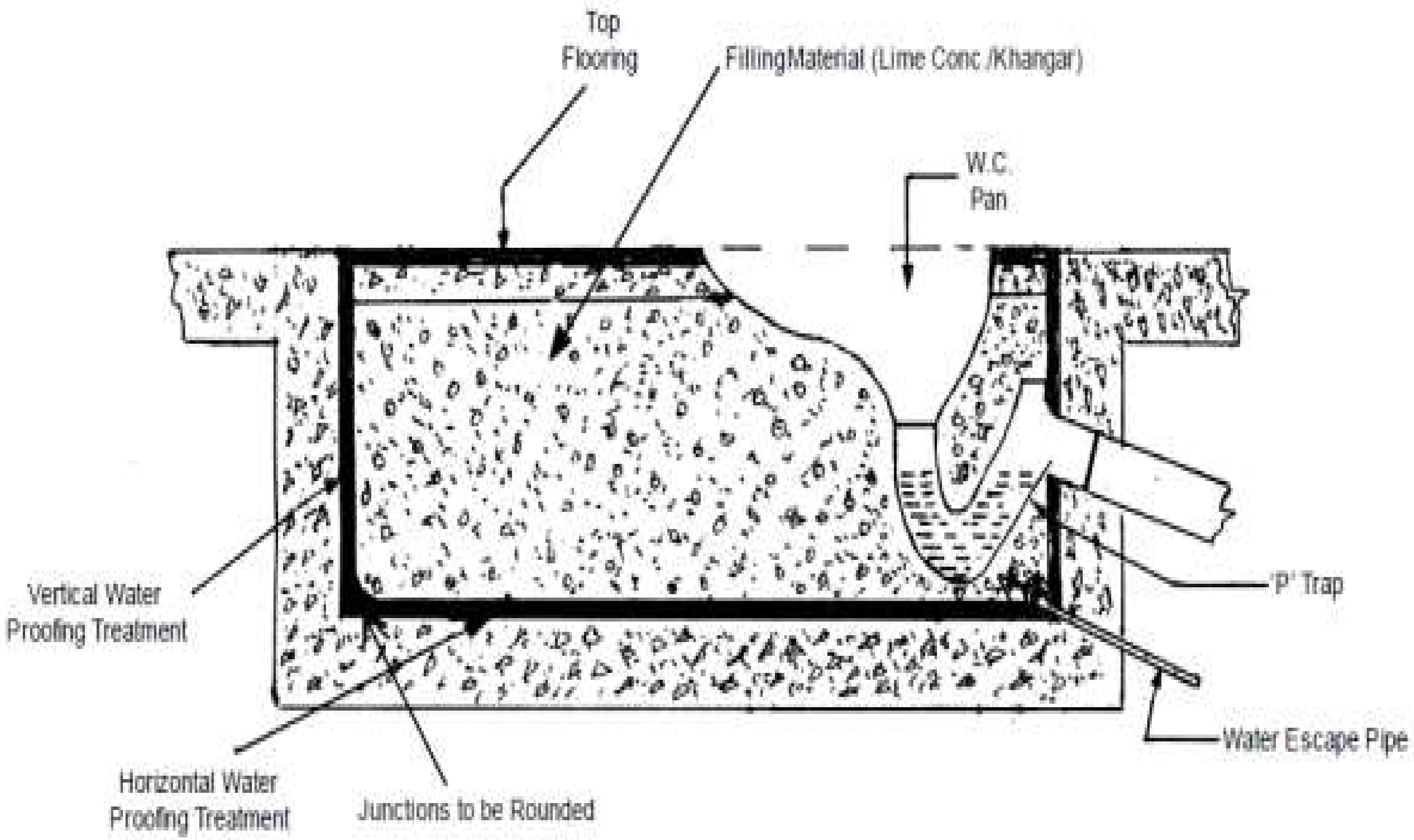
- **The depressed/sunken portion (horizontal) should be hacked by a hacking tool, after the concrete slab is cast and when this concrete is still green.**
- **The vertical surfaces of the depressed /sunken portion should be hacked with a hacking tool just after the shuttering is removed.**
- Fixing ***the 'P' trap in position and all other pipes work*** including the ***water escape pipe*** shall be fixed properly and the **holes should be plugged carefully** before taking up the water proofing work.
- **Ist course of applying cement slurry @ 4.4 kg/sqm mixed with water proofing compound** conforming to IS 2645 in recommended proportions including rounding off junction of vertical and horizontal surface.

WATERPROOFING

For toilet sunken floor

- **IInd course of 20 mm cement plaster 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound** in recommended proportion including rounding off junction of vertical and horizontal surface.
- **IIIrd course** of applying blown or **residual bitumen applied hot at 1.7 kg. per sqm of area**.
- **IVth course of 400 micron thick PVC sheet.** (Overlaps at joints of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 kg/sqm).
- **The projections of pipes and 'P' trap outlet etc.** inside the depressed/sunken portion of WC **shall also be cladded with water proofing treatment layer up to a height of 150 mm, using a coat of bitumen with PVC sheet complete.**

WATERPROOFING



WATERPROOFING

1. Down slab of 450 mm is mandatorily required in the toilet block & 200 mm in Kitchen for laying pipes for drainage.
2. Piercing of beam to be avoided pre & post concreting.

THANKS

QUALITY ISSUES IN EARTH WORK, BRICK WORK & PLASTER

EXCAVATION

Avoid Mass Excavation

Why unnecessary excavation of the already compacted ground

Excavation

- Excavation as per approved Drg./ excavation plan.
- Avoid Mass excavation. Unnecessary excavation of the compacted ground lead the possibility of settlement in future.
- Barricading of the area required.
- Surplus earth is utilized for site levelling.
- Excess excavation beyond drg./ approved plan to be made good at the cost of contractor.

BACKFILLING

Backfilling : Wrong Practice

Backfilling in bulk

Backfilling not compacted

Filling with black cotton soil

Backfilling: How to do?

- Filling to be done in layers (in thickness of 200 mm).
- Lumps/ clods (greater than 8 cm) is broken. Grass roots etc to be removed.
- Each layer to be watered & compacted with ½ T steel rammer.
- Every 3rd & top layer with 8T roller.
- Vibratory Power Roller required, if depth of filling > 1.5m.
- Better to use Earth Compactor.

ISSUES IN BRICK WORK

BRICKS & BRICK MASONARY

Joints not filled with mortar

Joints are thicker

Joints not raked

BRICKS & BRICK MASONARY

No brickwork below plinth beam

Joints not filled properly

Thicker Joints

BRICKS & BRICK MASONARY

General:

- Brick work in **English Bond**.
- B/W in **uniform layers, in plumb & alignment**.
- B/W in a day, **maximum height 1 m**.
- **Tooth end**, if wall to be extended in future.
- Joints, fully filled with mortar. Mortar to be used within **30 minutes**.
- Cutting of column for holdfasts to be avoided. Brick pillar may be provided.
- **B/W on edge**: Top course of B/W for coping, plinth beam, floor beam etc.
- Joints are filled with mortar & **raked** out up to 1.5 cm while mortar in joints is still green.
- **Date of work** be written to ensure proper curing.

BRICKS & BRICK MASONARY

Good brick work

ISSUES IN HALF BRICK WORK

HALF BRICK MASONARY: DEFECTS

Bars not provided in every 3rd Layer

HALF BRICK MASONARY

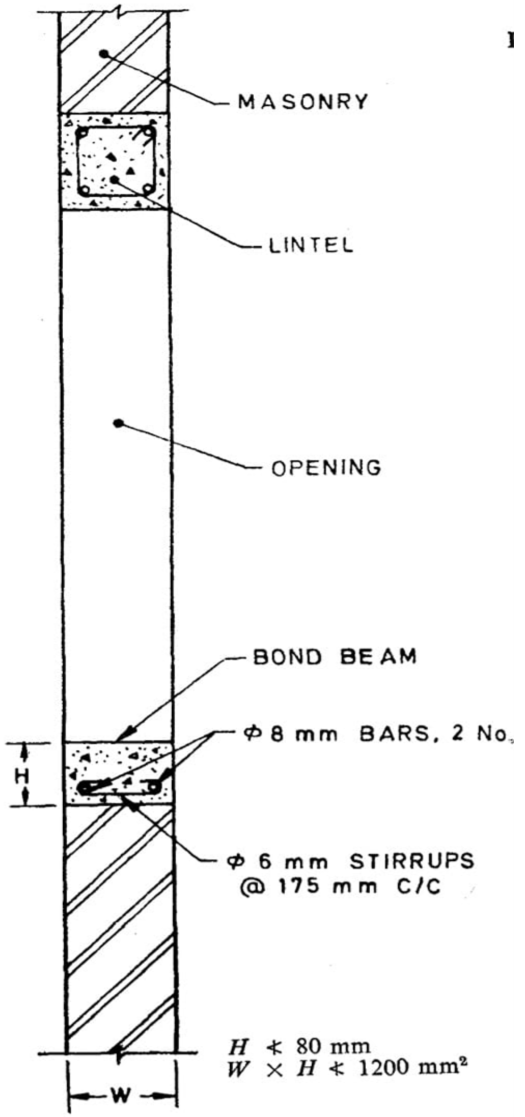
WHAT TO DO?

- Half brick work shall be reinforced with **2 nos. MS bars** of 6 m dia. at every 3rd course.
- Bars shall be securely anchored at their end.
- Half brick wall shall end in full brick pillar at unsupported ends.
- Overlaps in bars required 300 mm

AAC BLOCK MASONARY

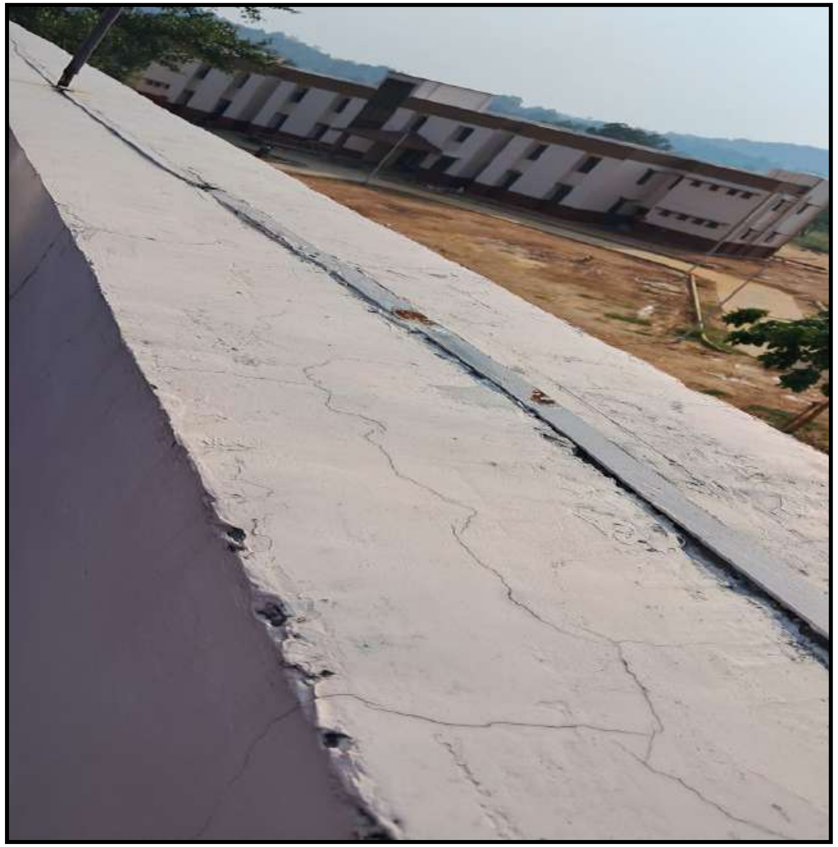
WHAT TO DO?

- AAC Blocks to be light & of reqd. strength
- RCC band required at **sill & lintel level** throughout the wall.
- **Not used in foundations & below DPC**.
- In heavy rainfall area, external plaster consists of two coats.
- Blocks need not be wetted for masonry.
- Only top & sides of the blocks may be lightly moistened to prevent absorption of water from mortar & development of required bond in masonry.



EXTERNAL PLASTER

CRACKS IN PLASTER



Cracks in coping

Cracks in Parapet Wall

- Top course of B/W to be on edge & slightly tilted inward
- Exp. joint to be provided @ 4.5 m & diagonally at corner

EXTERNAl PLASTER

Undercoat plaster not done properly on External Wall

EXTERNAL PLASTER

WHAT TO DO?

18 mm Plaster:

- In two coats, 12 mm undercoat & 6 mm finishing coat.
- To have even thickness & plaster in true surface, plaster beading of 15x 15 cm are made @ 2.0 m vertically & horizontally.
- Coarse sand in under coat & fine sand in finishing coat.
- Under coat shall be roughened.
- Groove required between RCC & Brick work.
- Finishing coat after under coat has sufficiently set but not dried
- Finishing coat within 48 hrs of under coat.
- Conduit laying to be done & checked before plastering.
- Curing for 7 days.

COPING

COPING

WHAT TO DO?

- Top course of Brick work to be on edge slightly tilted inward
- Groove to be provided between RCC column and the masonary work.
- Groove required between CC of coping & the B/W.

EXPANSION JOINT

DEFECTIVE EXPANSION JOINTS

Beam casted continuous on expansion joint

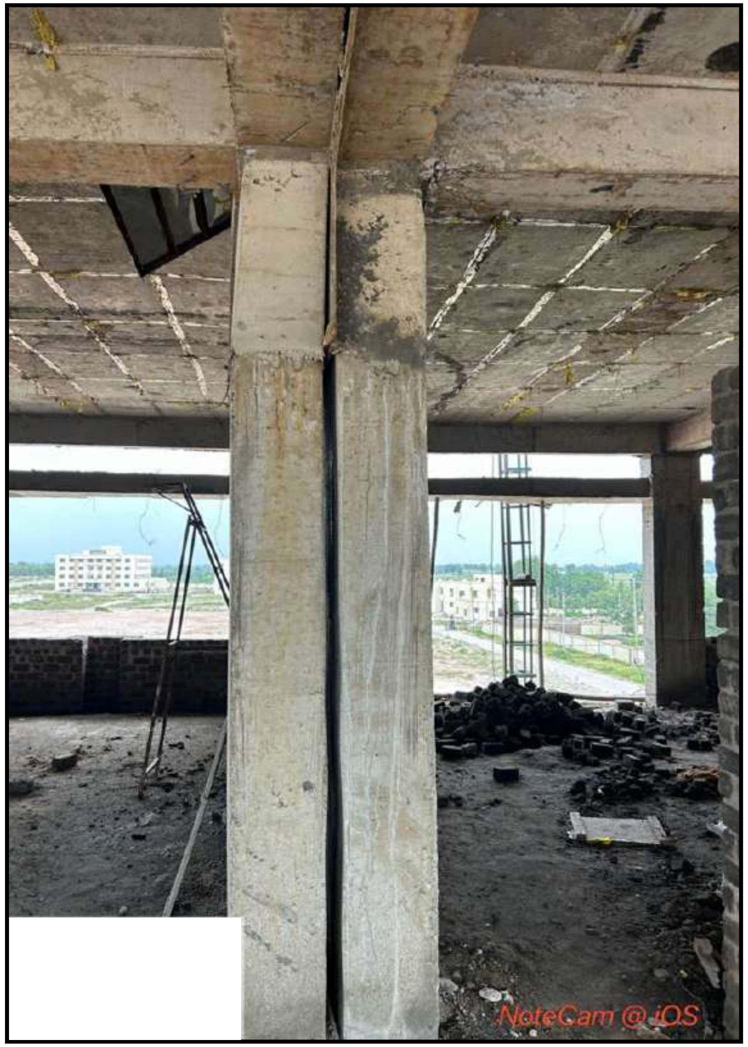
Flooring done over the expansion joint

Expansion joint > 50 mm

DEFECTIVE EXPANSION JOINTS

Dampness near expansion joint

DEFECTIVE EXPANSION JOINTS

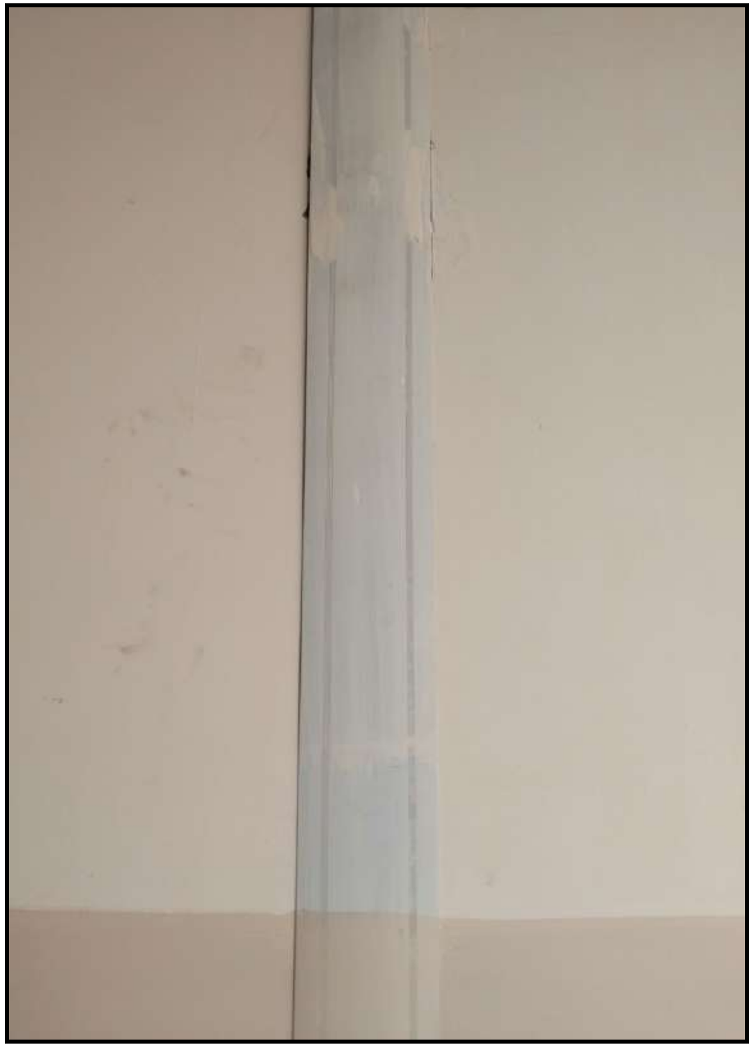


Uneven expansion Joint

Expansion Joint filled with mortar

Expansion Joint missing in floor

EXPANSION JOINTS



Exp. Joint Cover Plate

Expansion joint in floor

What to be?

- Expansion joint to be maintained throughout i.e. in floor & walls
- Holes in cover plate to have plays at one side to allow free movement at the joint.

EXPANSION JOINT TO BE PROVIDED

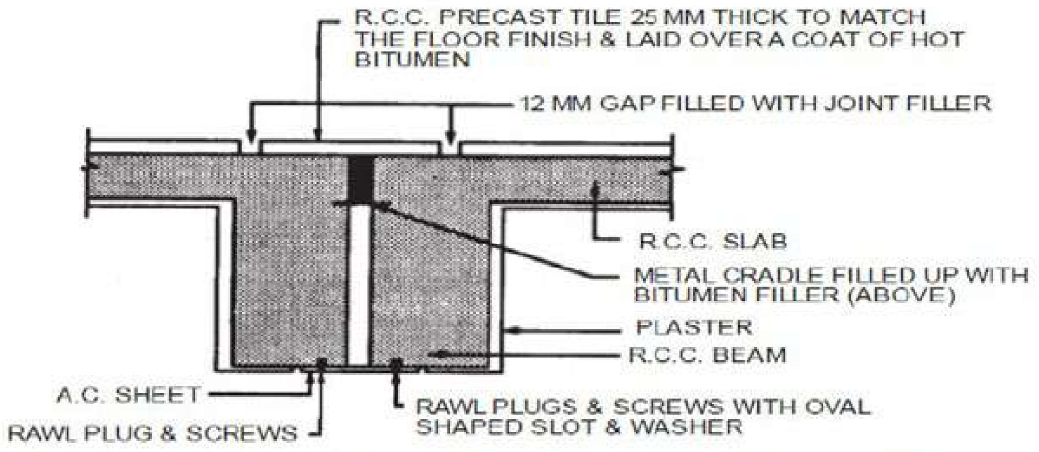


Fig. 5.12 : Typical Details of Expansion Joint at Floor

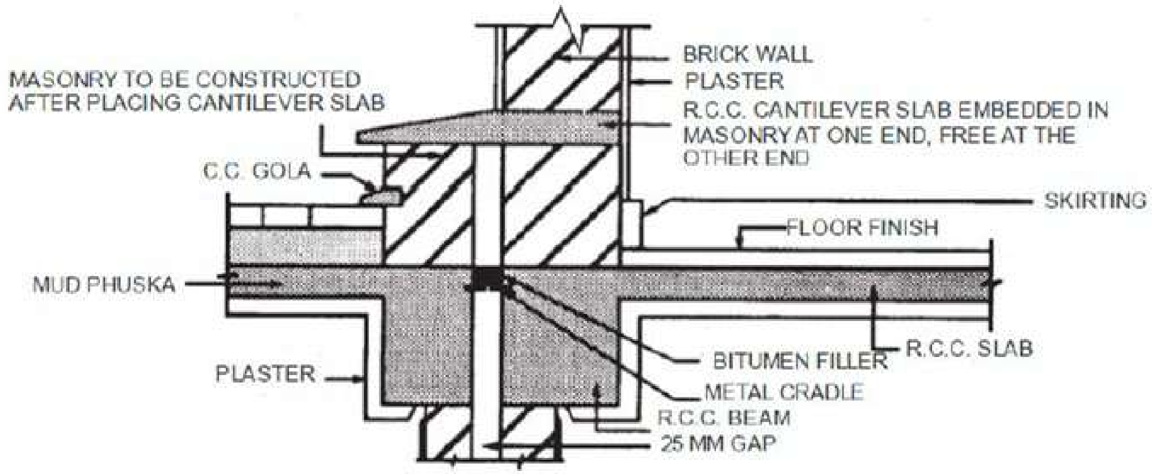


Fig. 5.14 : Typical Details of Expansion Joint at Roof & Floor Junction

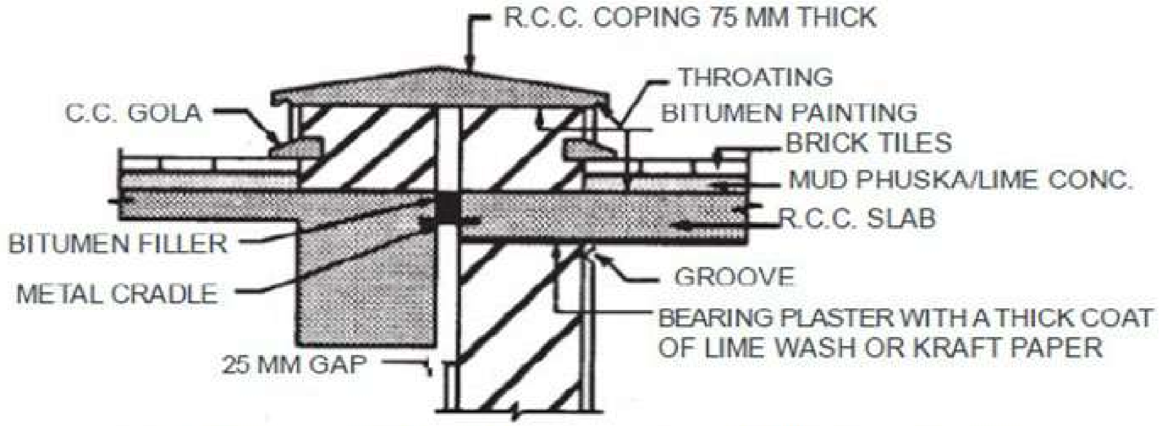


Fig. 5.13 : Typical Details of Expansion Joint at Wall & Beam Junction

- Expansion joint at terrace to be provided before construction of mumty wall

STEEL JOISTS IN ROOF COVERING FIXED AT BOTH ENDS

What to do?

- Higher end of steel joists will be fixed.
- Lower end shall have facility of movement horizontally.

THANKS

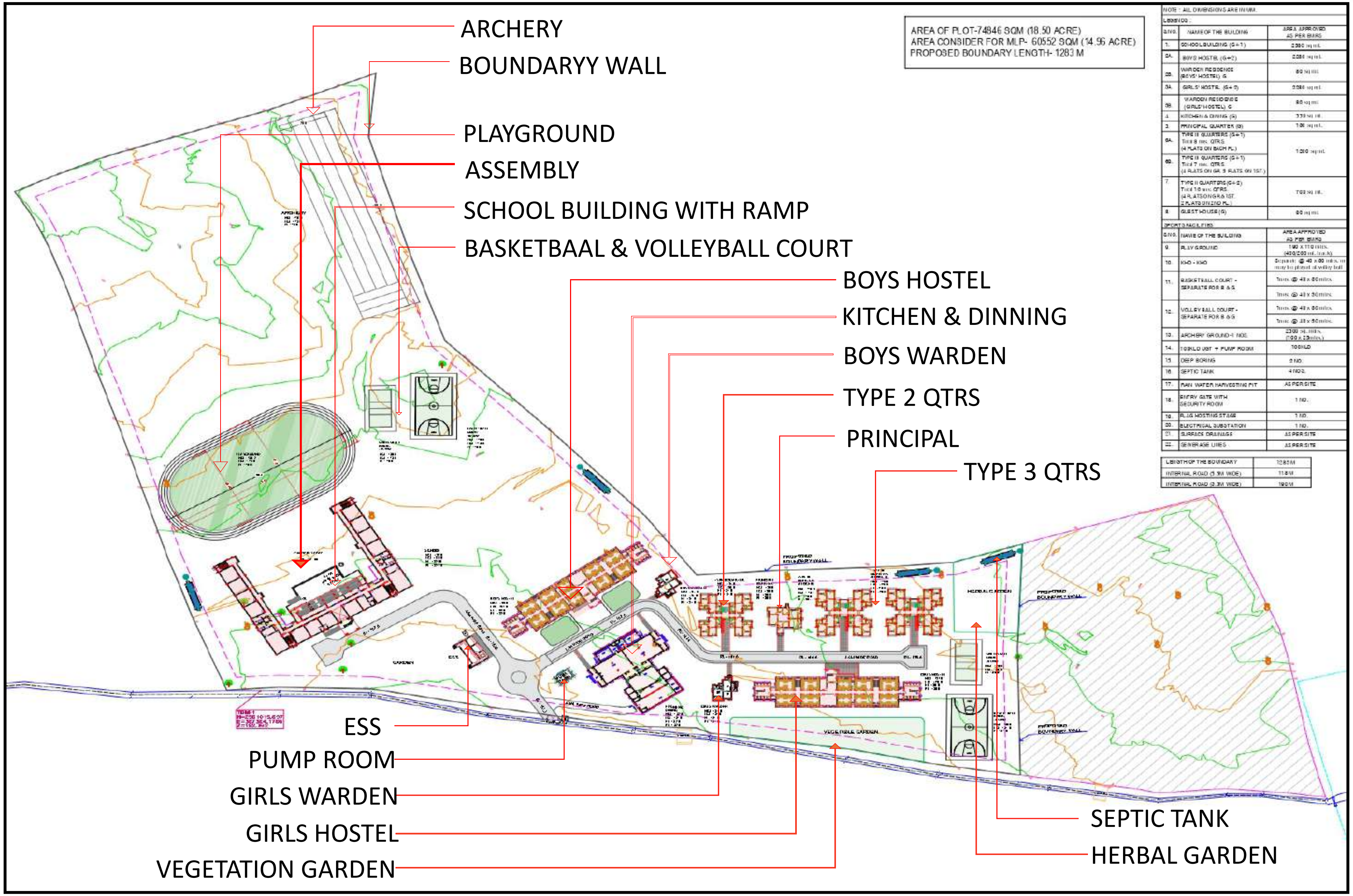
SITE LAYOUT & ARCHITECTURAL POINTS

CONTENT

- MASTER LAYOUT PLAN
- LAYOUT OF BUILDINGS
- ARCHITECTURE PRESENTATION
- DIVYANGJAN ACCESS

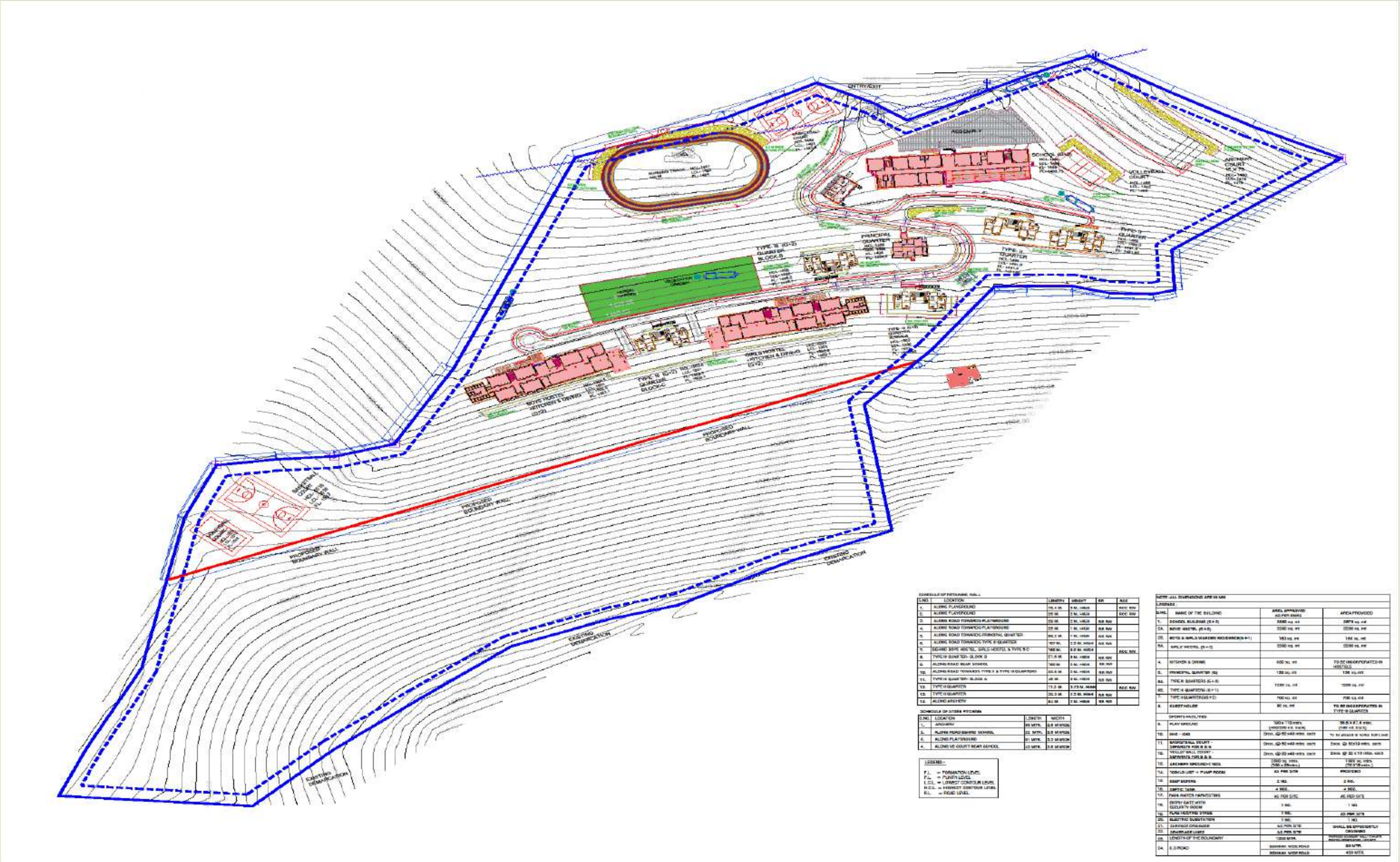
MASTER LAYOUT PLAN

MAJOR COMPONENETS OF A MLP



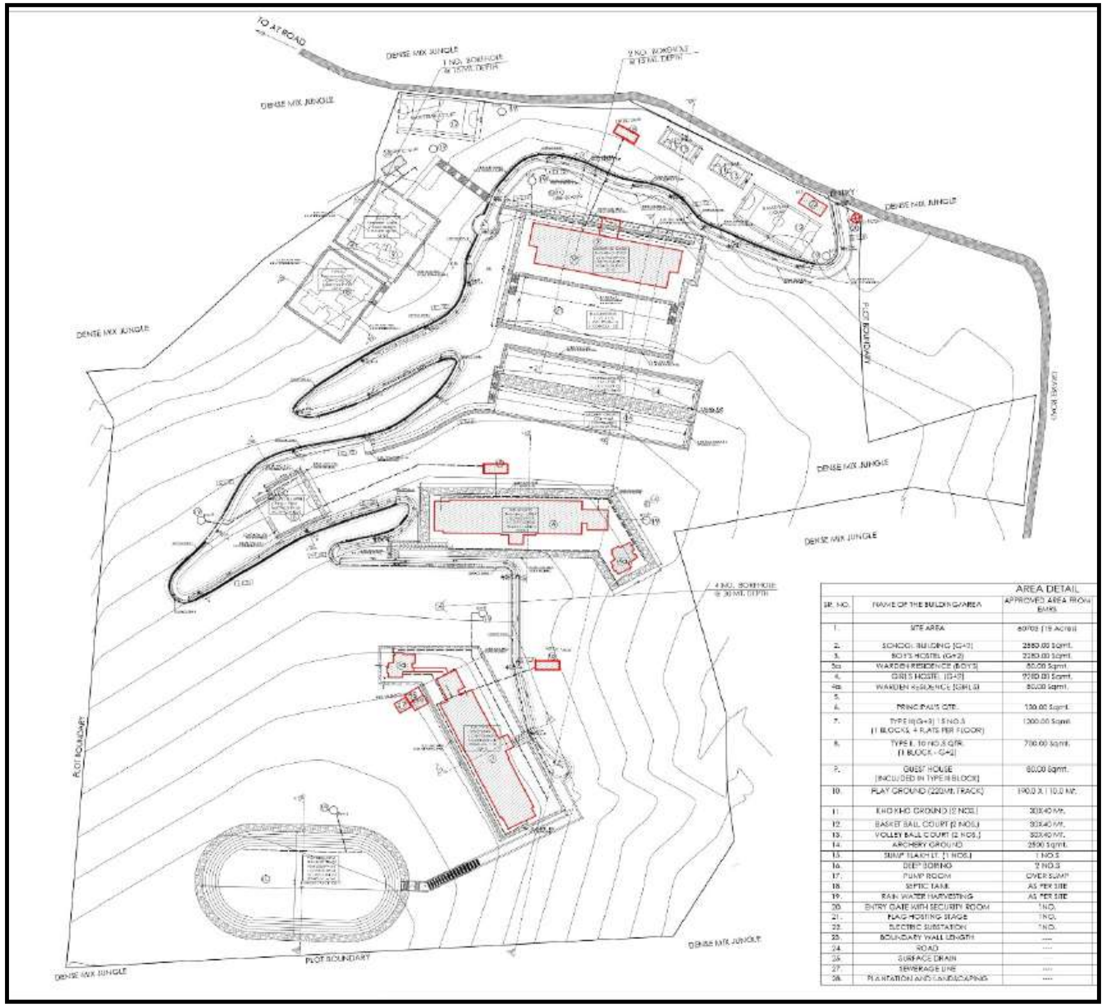
NORTH

MATCH MLP AREA WITH DEMARCATION OF LAND PROVIDED BY STATE



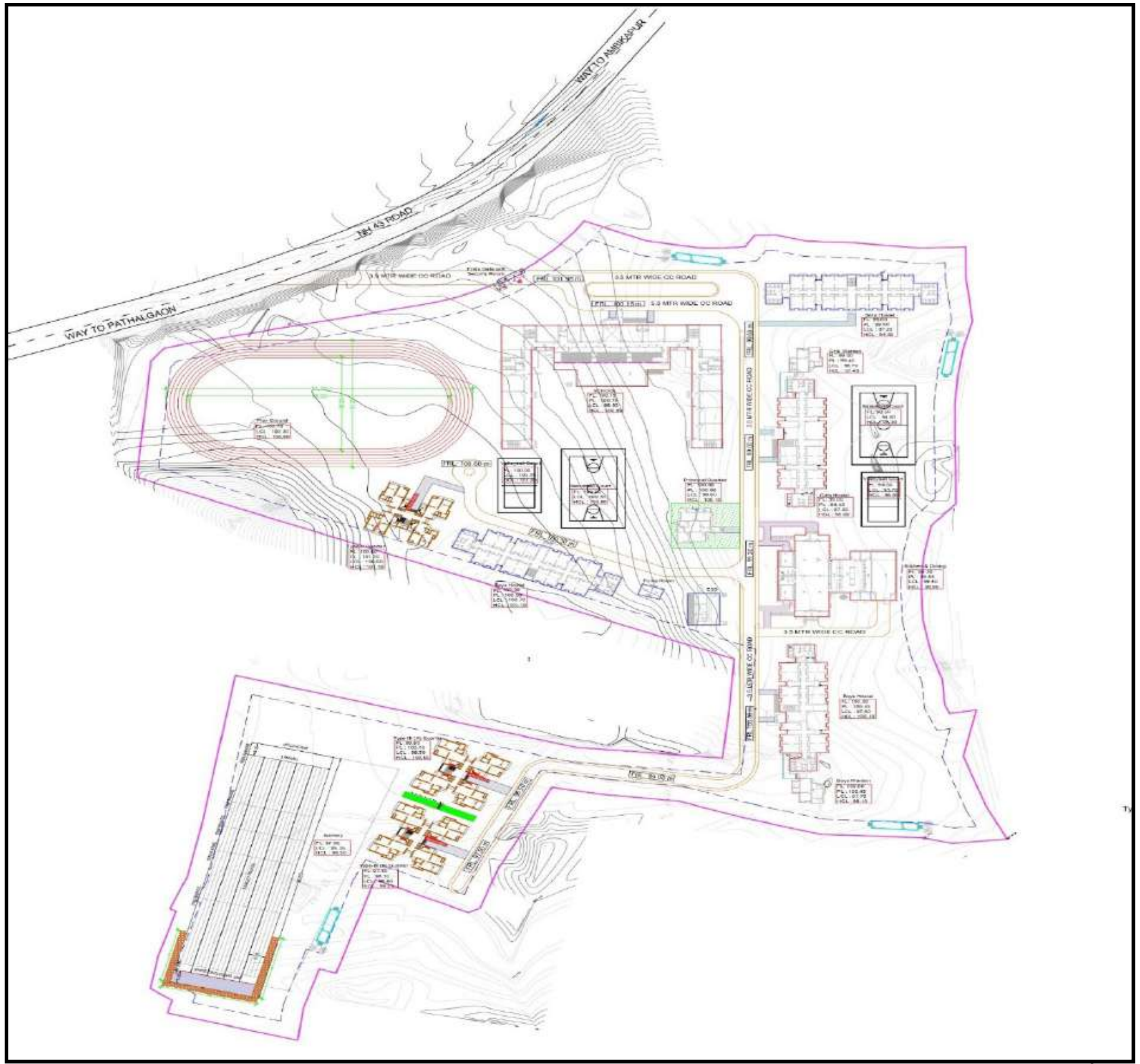
NORTH

MISMATCH OF MLP & SITE NGL/CONTOURS



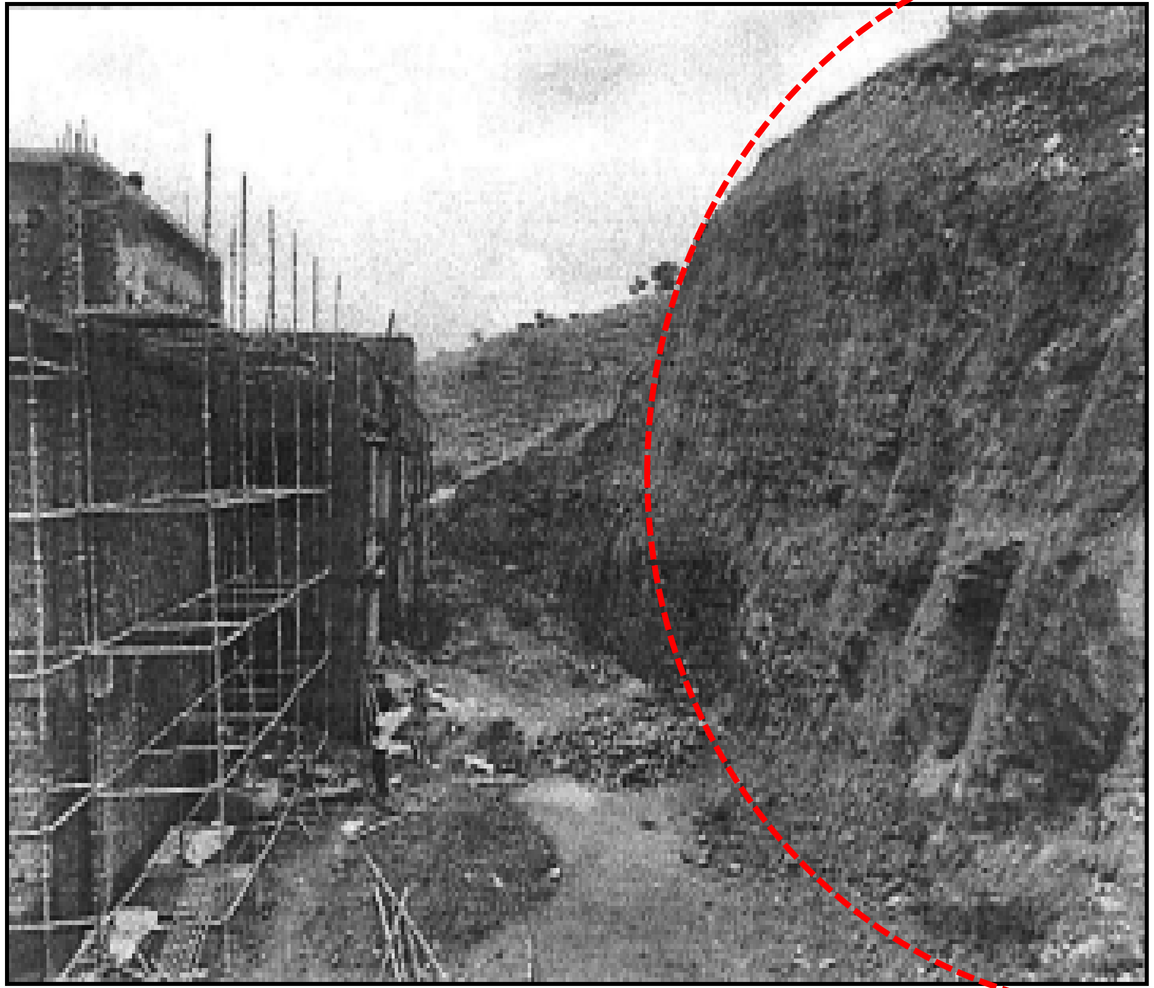
- Site jungle/ shrubs cleaning before contour survey
- Level in MLP shall be verified with actual NGL

PLACE BUILDING/SERVICES COMPONENT AS PER MLP



MANDATORY OFFSET

AVOID HUGE CUTTING/FILLING



BUILDING IN DITCH/ LOWER AREA

SUSTAINING CUTTING FILLING BY RCC RW

SLOPE RETENTION BY PITCHING/VEGETATION

Stone pitching supporting Road

Vegetation/Landscaping used to retain the slope

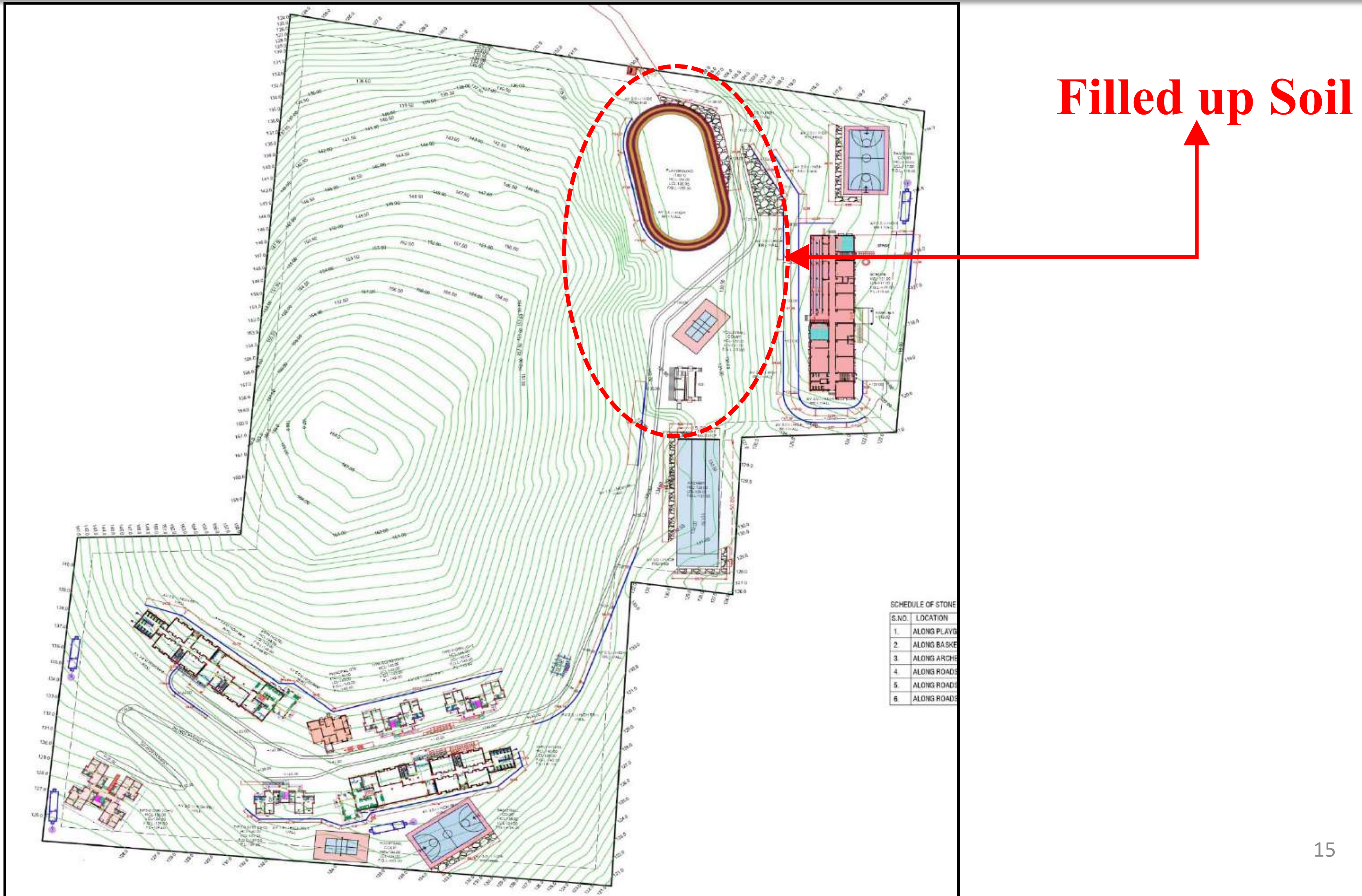
USE RETAINING STRUCTURES JUDICIOUSLY

Unnecessary retaining wall

Use pitching

LEVEL DIFFERENCE IN PHASE II HOSTEL

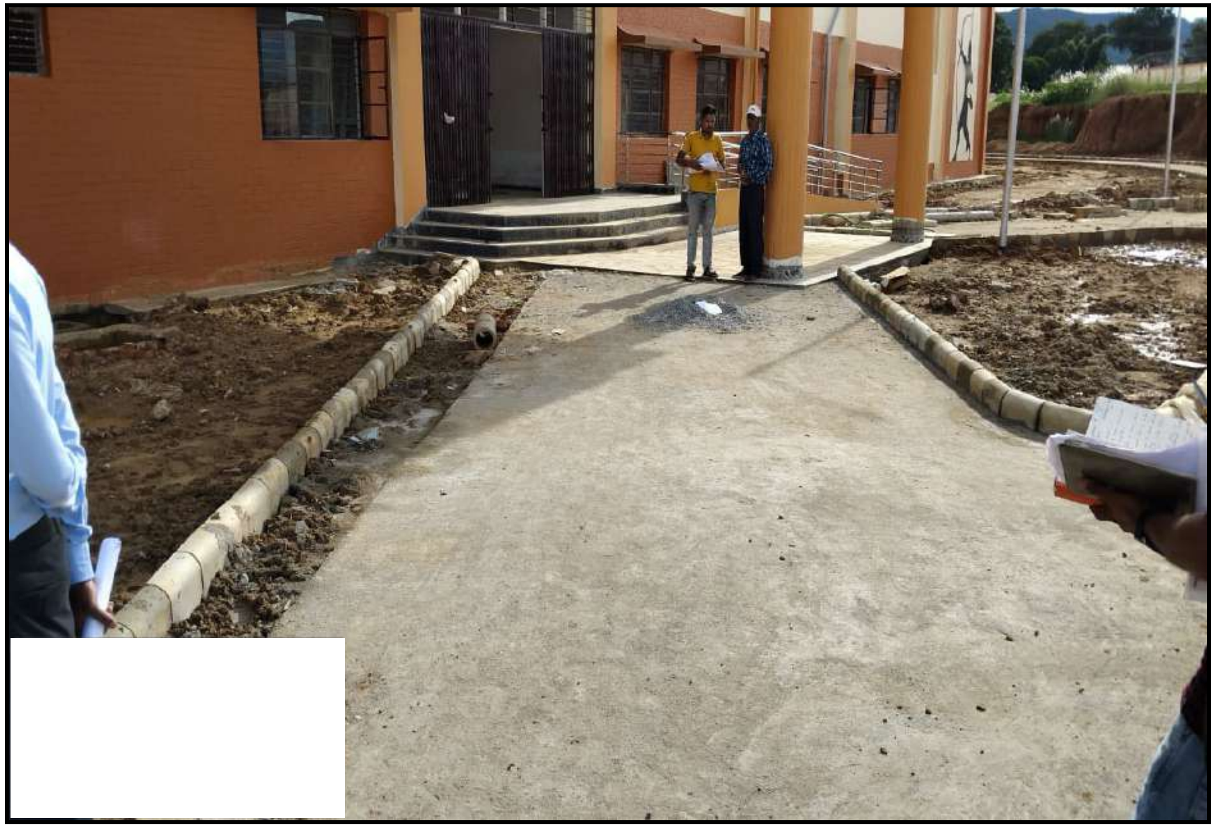
NO BUILDING ON FILLED UP SOIL



KEEP PUMP ROOM AT HIGHER NGL. HILL REGION PLAN PUMP ROOM FOR GRAVITY FLOW

Pump Room at Low Level

FAULTY PRACTICES



Approach to Porch Blocked

IN GENERAL SCHOOL BUILDING PL 750 MM & OTHERS 600 MM ABOVE FL

Low Plinth Level of Buildings

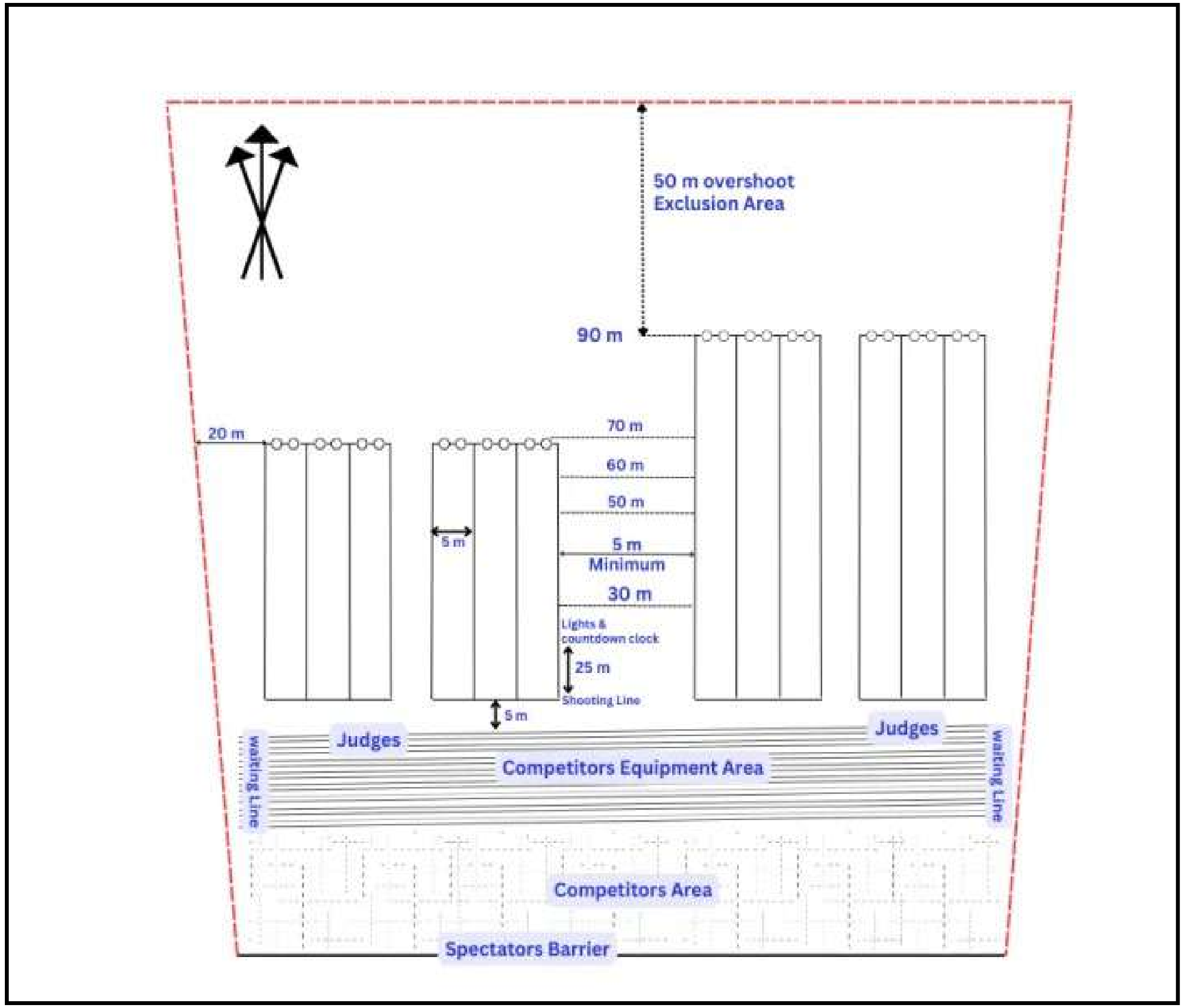
Faulty Access to Plinth of Building

OTHER ASPECTS

Drainage not Planned

ESS kept abnormally High Level

PROVIDE REFUSE AREA FOR ARCHERY



POINTS TO REMEMBER

Don't Adopt the levels of MLP if actual NGL differs

Plinth Level of all buildings/ ESS/Pump Room/invert level of Septic tank to be finalized in one go at the time of layout.

Provide connecting pathways to all bldg. & service components

Don't Keep surface drainage planning for last stage

Septic tank at lower level from bldg plinth

Don't Place septic tank near borewell/RWH pit

RWH pit near borewell

LAYOUT OF BUILDINGS

FALLOUT FAULTY LAYOUT

Creation of Extra Torsion at Column Beam Joints

Eccentricity in axial loading

Misalignment of Grid

Wrong position of column

Actual sizes of Functional Areas will alter

Beam may loose straight line

CENTER LINE BURJI

LAYOUT WITHOUT BURJI & REFERENCE BENCH MARK

Difficulty noticed:

- Verification of Centre Line becomes difficult

- More chances of column out of line

FAULTY LAYOUTS

Do’s	Don'ts
➢ Use Total station for plotting layout	➢ No Work without burji
➢ Check alignment manually by center line & diagonally	
➢ Benchmark burji for each bldg. block	
➢ Centre-line burji on both side of gridline	

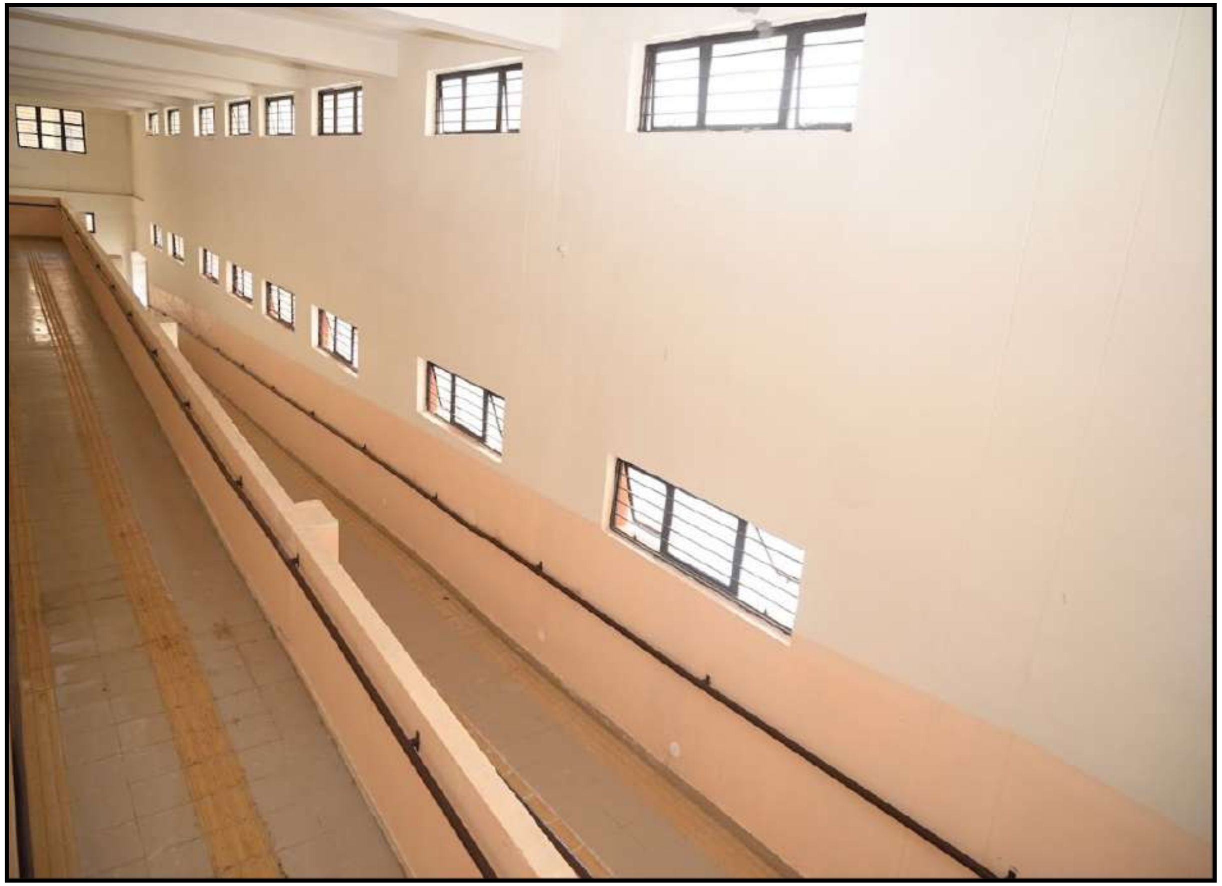
ARCHITECTURE PRESENTATION

SCHOOL FAÇADE (FRONT)

G+1

G+2

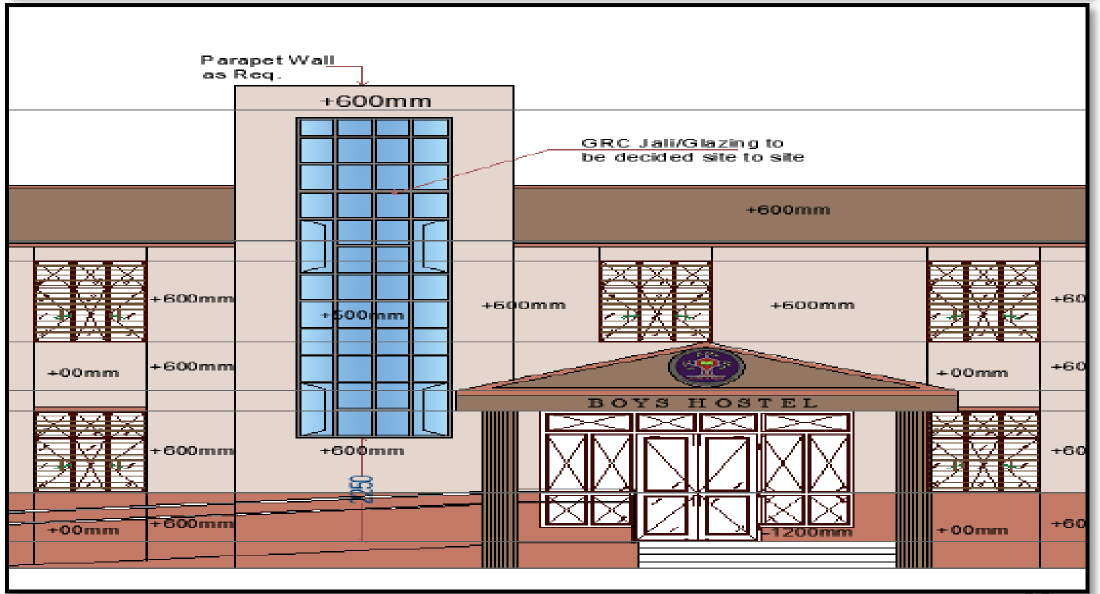
RAMP VENTILATION



BOYS HOSTEL FAÇADE (FRONT)

KITCHEN FAÇADE (SIDE)

HOSTEL FAÇADE



Bad Façade

Façade as per drawing

EKLAVYA LOGO

Eklavya logo

Entrance gate

CAMPUS ENTRANCE GATE

No
Notice Board

Horizontal groove

Detail missing

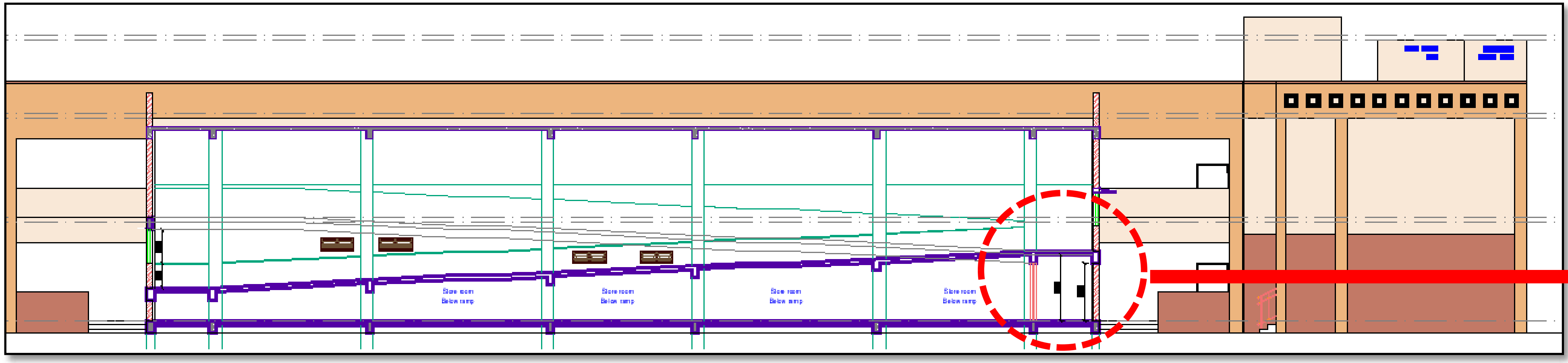
No grill

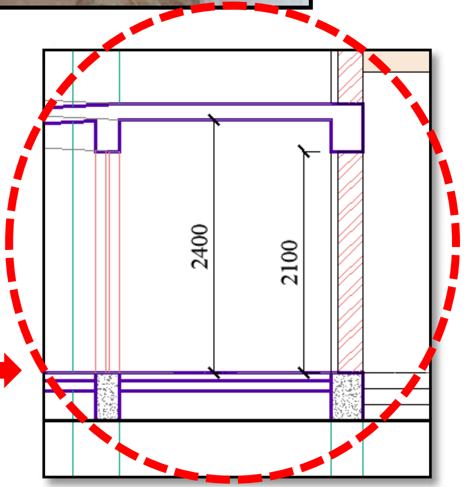
Faults at Entrance Gate

CEILING HEIGHTS BUILDING COMPONENTS

SNO.	BUILDING BLOCK NAME	HEIGHT
1.	SCHOOL BUILDING	3.60 M
2.	HOSTEL (GIRL/BOYS)	3.30 M
3.	KITCHEN & DINNING	3.30 M
4.	PRINCIPAL	3.15 M
5.	TYPE 3 QUARTER	3.15 M
6.	TYPE 2 QUARTER	3.15 M
7.	WARDEN (GIRLS/BOYS)	3.15 M

CORRIDOR TO RAMP : MIND CLEAR HEADWAY



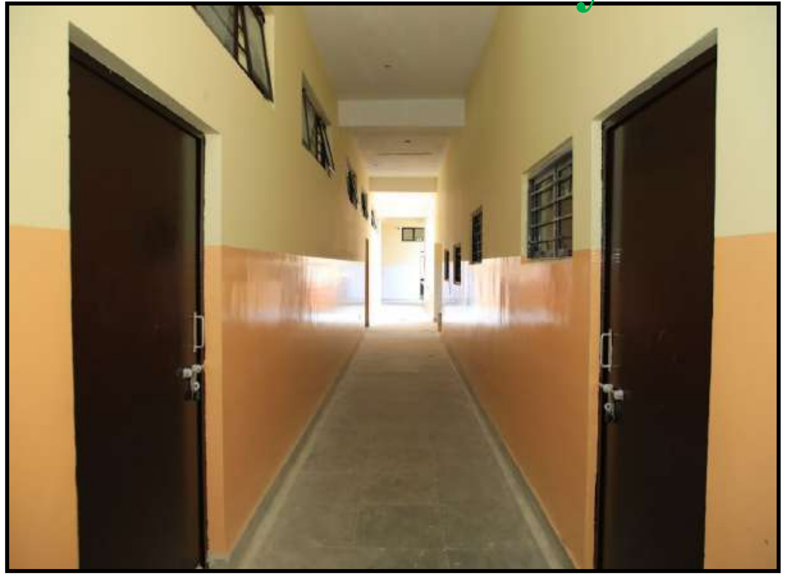


FLOORING PATTERN/ ENAMEL PAINT/ CORRIDOR

Library

Dormitory

Classroom



Corridor

Low Plinth Level

Proper Plinth Level

SCHOOL PORCH

Flutes/Grooves not provided on columns

Flutes/Grooves provided on columns

KITCHEN & DINNING

Down Kitchen courtyard & Wash Area by 300 mm

1500 mm Partition wall between boys & girls dinning hall

Proper ventilation as per the Architectural drawing.

Proper Slope of truss & profile sheet.

STAGE & FLAG HOISTING

Flag hoisting point violates Flag Code of India

Flag hoisting point as per Flag Code of India

ESS

Perforated rolling shutter

ESS front Road of Lock in Tiles

ESS front Road of RCC

INTERNAL ROADS

Side shoulders on Road not provided

1.0 M side shoulders on Road provided

CORRIDOR FINS

Missing Corridor Fins

Corridor Fins Provided

SKIRTING

Extra Thick Skirting

Corridor down by 0.5”

DIVYANGJAN ACCESS

SCHOOL BUILDING

HOSTEL BUILDING

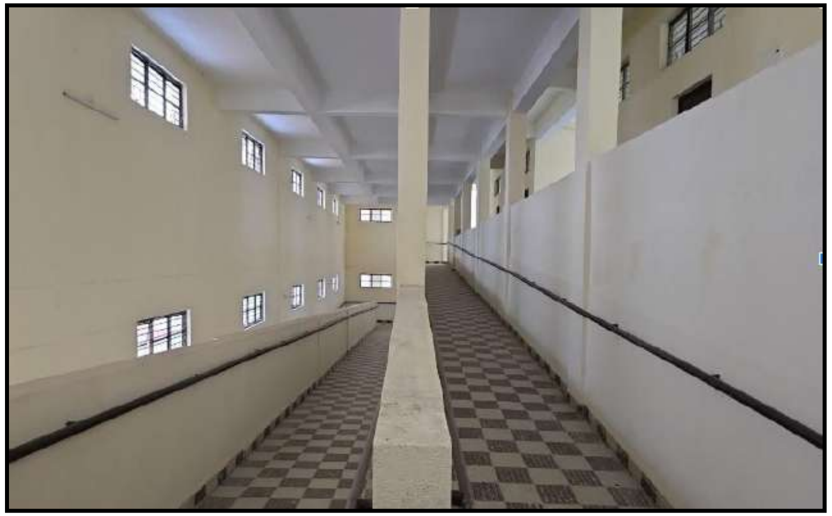
KITCHEN & DINNING

REQUIREMENT FOR RAMP

Requirements for Ramp

Sl No. (1)	Level Difference (2)	Maximum Gradient of Ramp (3)	Ramp Width mm (4)	Handrail on Both Sides (5)	Other Requirements (6)
i)	150 mm to 300 mm	1:12	1 200	√	—
ii)	301 mm to 750 mm	1:12	1 500	√	Landings after every 5 m of ramp run
iii)	751 mm to 3 000mm	1:15	1 800	√	Landings after every 9 m of ramp run
iv)	More than 3 000 mm	1:20	1 800	√	Landings after every 9 m of ramp run

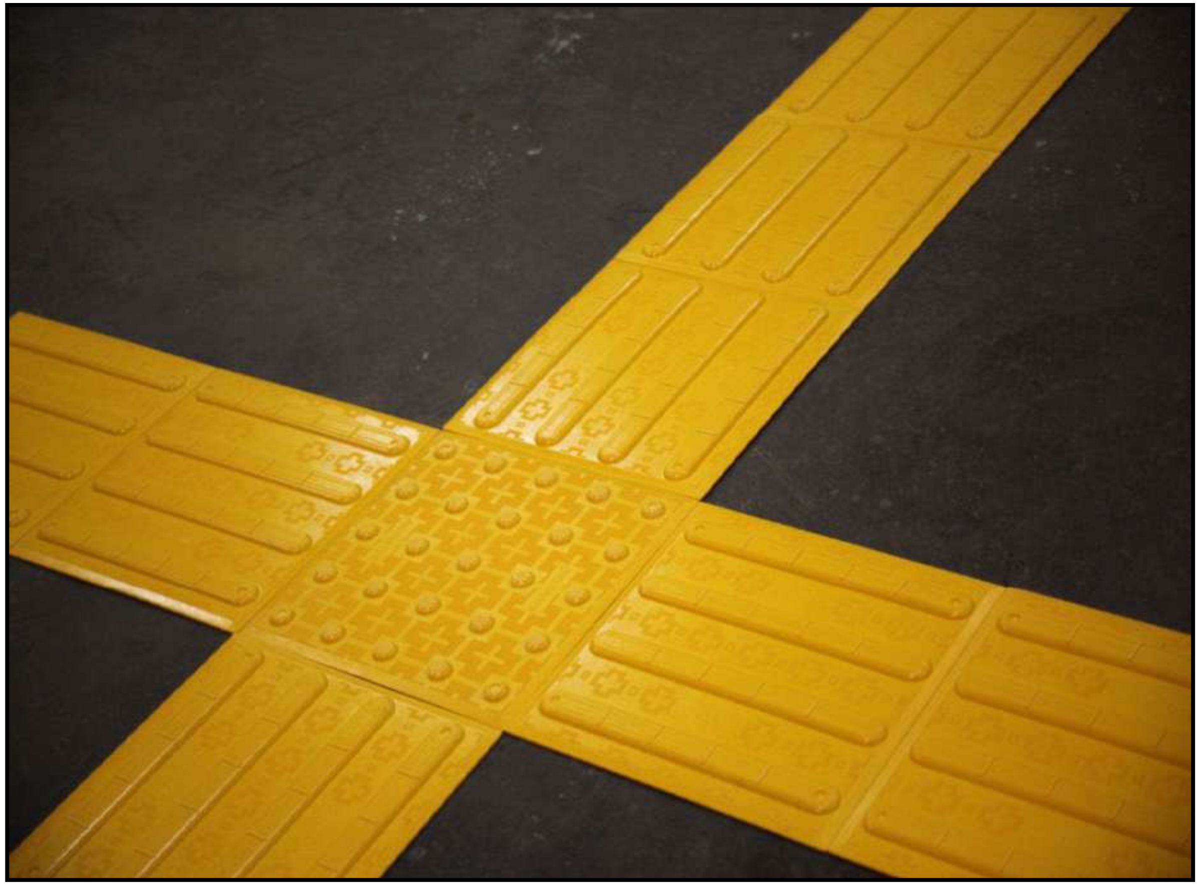
RAMPS



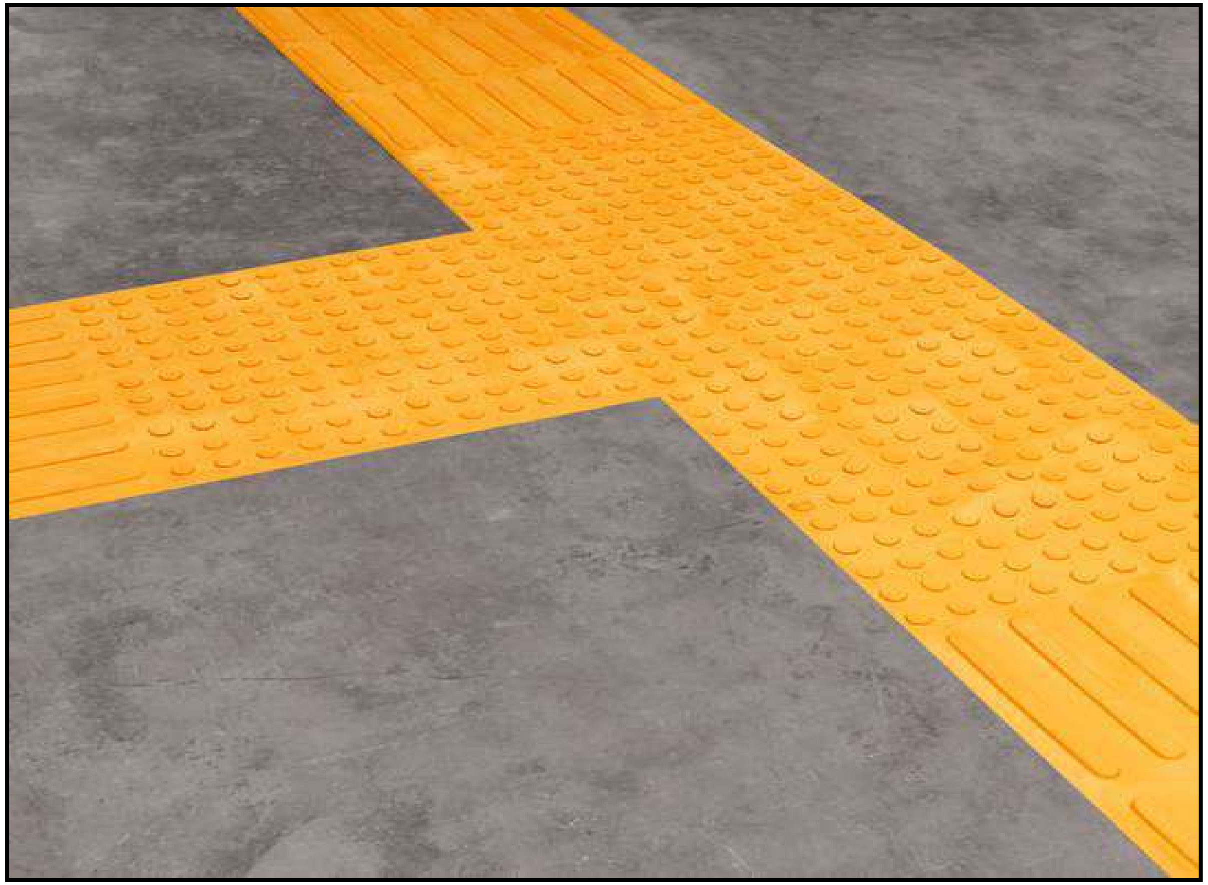
Antiskid & Tactile flooring in ramps Missing

Tactile flooring in ramps Provided

TACTILE FLOORING GUIDANCE



Tactile-Example 4 Side



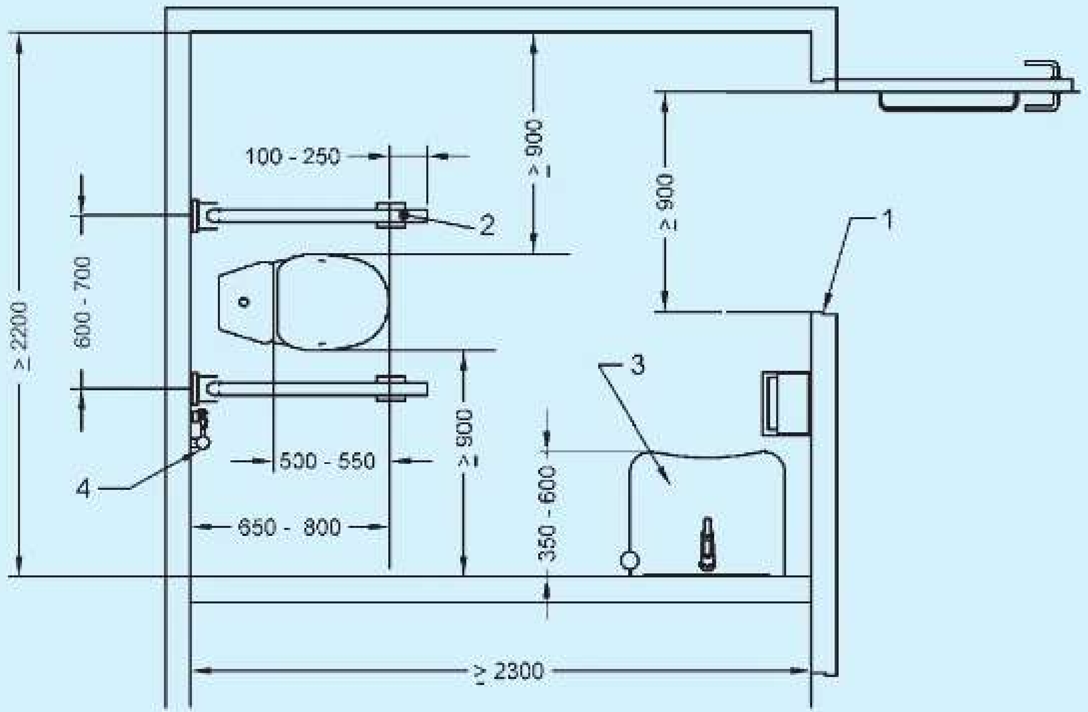
Tactile Flooring 3 Side

DIVYANGJAN TOILET

Grab bars not as per the NBC norms

Grab bars as per the NBC norms

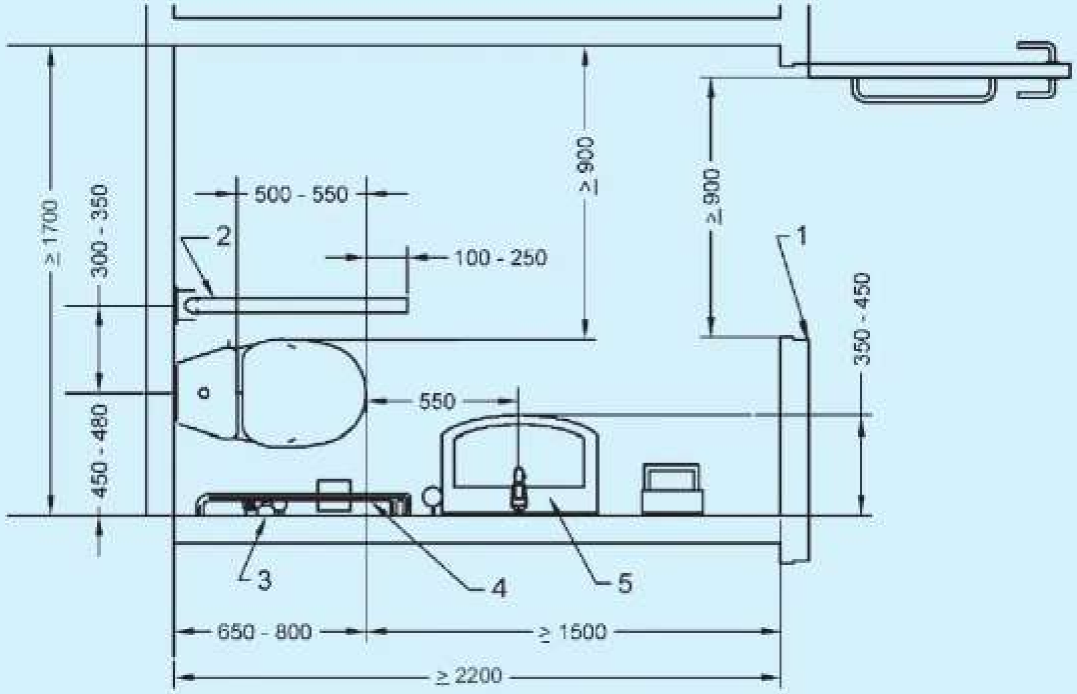
NBC NORMS



Key
1 Minimum 900 mm
2 Foldable grab bars, both sides
3 Washbasin
4 Independent water supply

All dimensions in millimetres.

EXAMPLE OF TYPE A TOILET ROOM — LATERAL TRANSFER FROM BOTH SIDES



Key
1 Minimum 900 mm
2 Foldable grab bar
3 Independent water supply
4 Grab bar on wall
5 Washbasin

All dimensions in millimetres.

EXAMPLE OF TYPE B CORNER TOILET ROOM — LATERAL TRANSFER FROM ONE SIDE ONLY

The position of grab bars shall be as per the NBC norms.

THANKS

ELECTRO-MECHANICAL SERVICES

ELECTRO-MECHANICAL SERVICES

PVC Conduit Wiring System, E.I., Fans & Fittings

L.V. Works (CCTV, Telephone, Data)

Water Pumps

External Lighting

Fire Fighting Work (First Aid Hose Reel System)

Electrical Sub-station (Transformer & MV Panels)

25 KVA D.G. Set

Lighting Conductor

ELECTRICAL INSTALLATION,FANS & FITTINGS

- No Conduit less than **20 mm in diameter** to be used.
- Separate Conduits for Light/Power/Circuit/UPS/Submain Wiring. No mixing.
- Use of inspection boxes shall not present a shabby look. These can be provided 5mm above plaster level, covered with plaster of Paris with their marking.
- Generally, no conduits for wiring in floor slabs. When it is unavoidable, special precaution to be taken to provide floor channels, compartmentalized Adaptable trunking for power and Data cables with provision for safety and maintenance.
- All floor openings shall be suitably sealed after installation.
- Passing of wiring cables through a wall shall be taken through a protection (steel/ PVC) pipe or porcelain tube of suitable size.

USE OF INSPECTION BOX DURING SLAB CASTING

Bad Work

Good Work :- Use of Inspection Box

ELECTRICAL INSTALLATION , FANS & FITTINGS

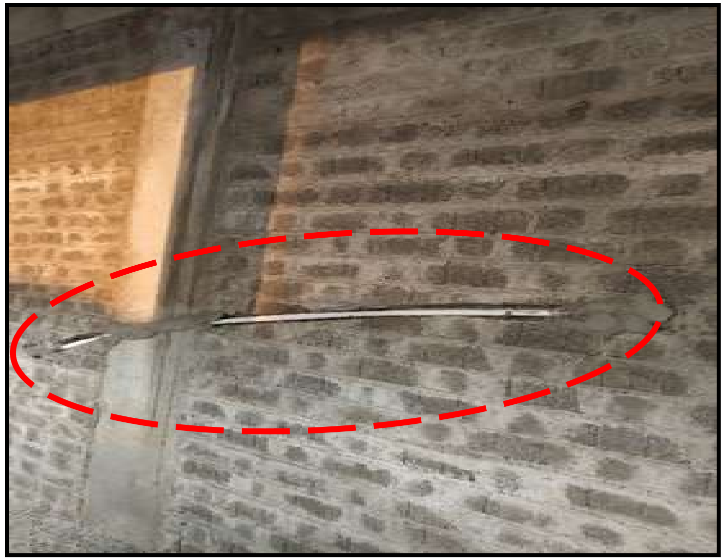
- Colour Coding :

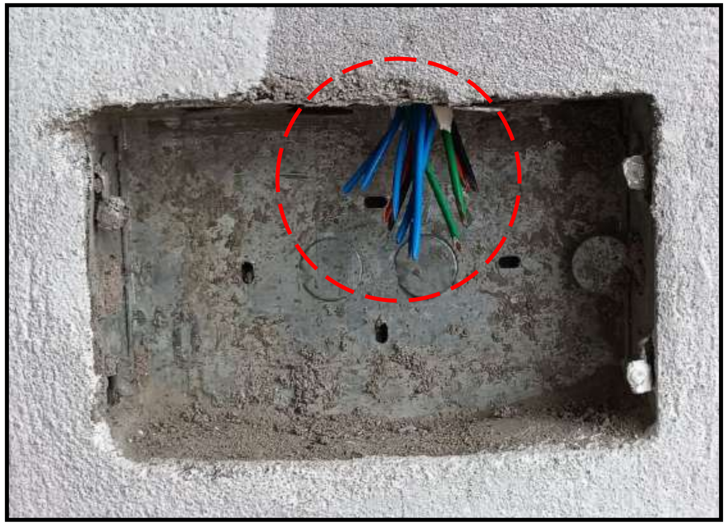
  In Single phase wiring: **Live**– Red, **Neutral**– Black, **Earth**– Green

  In Three phase wiring: **Live**– Red/ Yellow/Blue.

- Minimum Size of Wiring : **Light Wiring**– 1.5 sq.mm., **Power Wiring**– 4.00 sq. mm.
- In wiring, **no joints are permitted**. There should be no break in neutral wire. If length of ckt./submain wiring is more than a standard coil, mechanical connectors to be used.
- Phase/Live conductors are looped at switch boards. No switch board will have more than one source of incoming supply.
- Group wiring light points – School, Kitchen & Dining, Corridors of bldgs.
- Power/ Light/ Essential/ UPS DBs shall be marked **'P','L','E'& 'UPS'** respectively.

USE OF INSPECTION BOX DURING SLAB CASTING



Joints in Wiring

Improper Conduit laying

ELECTRICAL INSTALLATION , FANS & FITTINGS

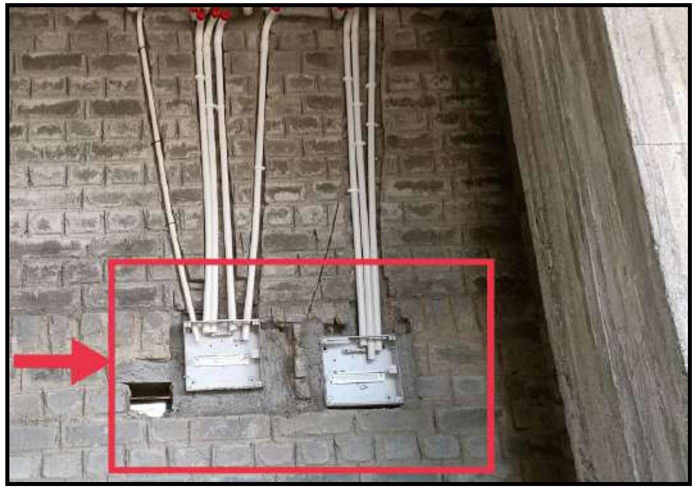
- Mounting of **Switch Board** : -- Its bottom shall be **1.25 m** from floor level. The switch shall be **"ON"** when knob is down.
- Installation of **C/ fan** : -- **2.75 m** from floor level.
- Installation of **Fitting**: -- **2.40 m** from floor level.
- Installation of **6A/16A Socket Outlet**:-- **23 cms/110 cms** from floor level.
- **In Kitchen**:-- Installation of 6A/16A Socket Outlet:-- **23 cms** above working platform.

ELECTRICAL INSTALLATION , FANS & FITTINGS

- **For Geyser**:-- Installation of Socket Outlet at min. **2.0 m** floor level with 16A MCB at **110 cms** from floor level and at least 60 cms away from shower head adjacent to geyser.
- For fixing of exhaust fan, a circular opening in the wall to suit the size of frame of ex. Fan shall be provided.
- Only 3 pin / 6 pin socket outlets will be permitted.

INSTALLATION OF MCB DBS AND SWITCH BOARDS

Bad Work



Improper Leveling

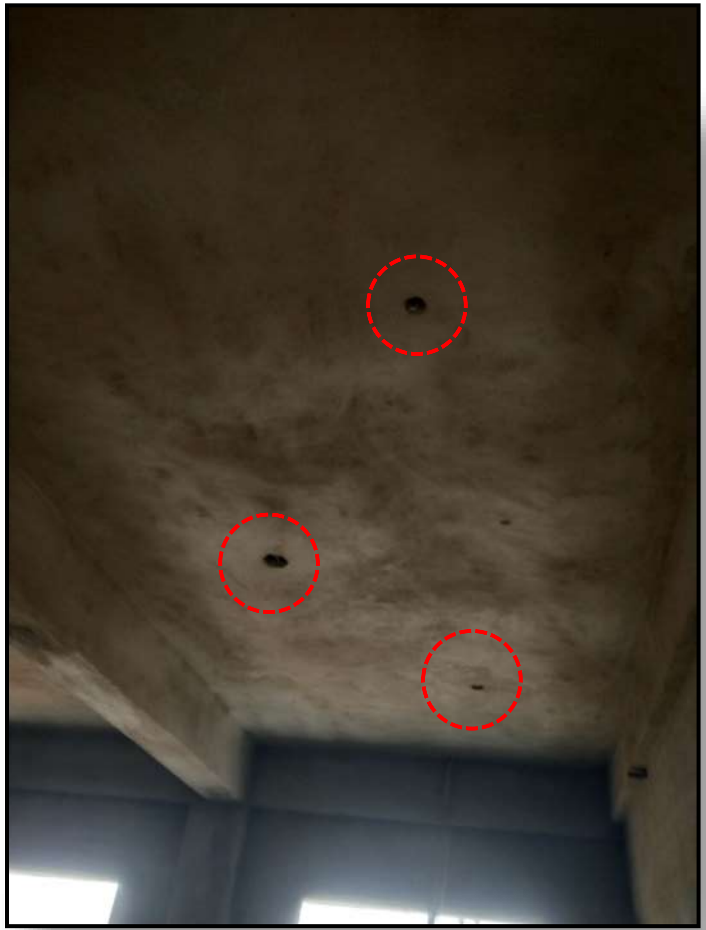
Saddles are not Fixed

Improper Finishing

Good Work

Proper Leveling & Finishing

FIXING OF FANS & LIGHT FITTINGS



Improper Alignment during Slab Casting

Proper Alignment

Improper Ex. Fan Installation

Proper Ventilating Fan Installation

ELECTRICAL SUBSTATION

- A sub-station work comprises of HV/MV/APFC/Emergency panels/ Transformer, Cables, Earthing System.
- The ideal location for an ESS with oil-filled equipment's would be at the load centre and shall be located on the ground floor in a separate building.
- Minimum distance between the adjoining buildings and sub-station shall be **6 mtr.** such that fire tender is able to pass between these.
- For installation of Transformer, necessary support channels shall be grouted in flooring. It shall be moved to its location and shall be correctly positioned.
- For a single transformer Sub-station, the total number of earth electrodes shall be **4** (02 for neutral and 02 for body earthing).

ELECTRICAL SUBSTATION

- The M.V. panel shall be compartmentalized, dust and vermin proof, floor mounted, free standing, totally enclosed & extensible type. Fabrication with CRCA sheet not less than 2mm for load bearing members and 1.6 mm for doors.
- A panel shall have necessary instrumentation i.e. CTs, PTs, Ammeters, Voltmeters(or multifunctional meter) LED indication lamps, fuses/MCB etc.
- In panels, operating handle of highest unit shall be at a height not more than **1.7 m**. Overall height of Panel shall not exceed **2.4 m.**
- Clear space of Electrical Panel :**1.0 meter** in the front and shall be either less than **20 cms** or more than **75 cms** behind the panel.

ELECTRICAL SUBSTATION

- Removable bland plate to be provided for each cable entry.
- Incomer and bus bar section panel shall be separate and independent.
- A common earth bar shall be run inside at the back of LT panel connecting all the sections for connection to the earth system.
- Clearance between M.V. Busbars Minimum
  - Phase to Earth **26mm**
  - Phase to Phase **32mm**
  - **(Note : Not for strip connections from busbars to switchgears)**

MV PANELS

Improper Transformer Cable Connections

No M.S. Duct Covers

M.S. duct covers

ELECTRICAL SUBSTATION

- Genset should not be installed on loose sand or clay.
- A PCC (1:2:4, M-20 grade) foundation for DG Sets installed outside in open area should be **300 mm high** above the ground level. The length and breadth of foundation should be at least **250 mm** more on all sides than the size of enclosure.
- If DG Set is installed inside or near to the substation, for body-earthing of DG set, AMF Panel, Essential Panel, earth bus provided for sub-station shall be used.
- For DG Set : **02** for neutral and **02** for body earthing).
- **Power Factor Management** :- Low power factor results in higher current resulting in higher voltage drop & system losses. In order to have control, power factor of not less than **0.97 lag** to be maintained.

CABLE LAYING

- In EMRSs, provision of XLPE cables is taken as high in strength, heat and moisture resistant, cracks, scratch and water proof, good in extreme weather conditions. Size by considering voltage drop and current carrying capacity.
- Before cable laying, shortest possible route shall be decided.
- 3m of surplus cable shall be left on each terminal in the form of a loop.
- Pipes for LV, MV and HV cables shall be independent ones. Pipes for cable entries to the bldg. shall slope downwards from bldg. and shall be suitably sealed to avoid water.
- Manholes with sufficient working space at suitable intervals shall be provided to facilitate feeding/ drawing of cables.
- Cable route markers shall be provided at intervals not exceeding 100 m.

CABLE LAYING

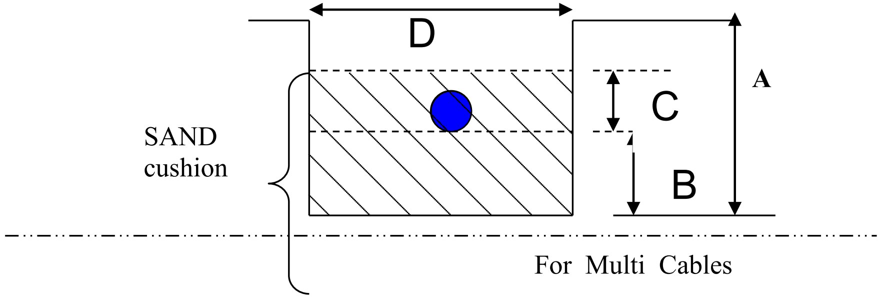
Sand Cushioning not provided

Right procedure

CABLE LAYING (M.V & H.T) IN GROUND

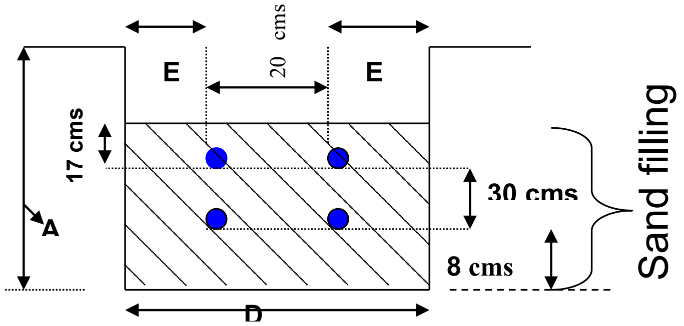
For single cable: -

	Upto **1.1** kV (M.V Cables)	Exceeding **1.1** kV (H.T. Cables)
A	75 cms	120 cms
B	8 cms	8 cms
C	17 cms	17 cms
D	35 cms	35 cms



For Multi Cables

	Upto 1.1 kV (M.V Cables) in cms	Exceeding 1.1 kV (H.T. Cables) in cms
A	**75 + (N_1 x 30)**	**120 + (N_1 x 30)**
D	**30 + (N_2 x 20)**	**30 + (N_2 x 20)**
E	**15**	**15**



N1 = No. of additional cables in vertical formation.
N2 = No. of additional cables in horizontal formation.

EARTHING

- Without proper earthing, elect. Current may not have a safe path to flow in the event of fault, leading to risk of elect. shock and individuals who come into contact with elect. appliance/ equipment.
- Normally the location of an earth electrode will be such that soil has a reasonable chance of remaining moist as far as possible.
- By watering the earth pits, the resistance can be lowered.
- Normally an earth electrode shall not be situated less than **1.5 m** from any building.
- As far as possible, entrances, pavements and road ways, are to be definitely avoided for locating the earth electrode. Earth sets should be minimum **2 mts** apart.

EARTHING

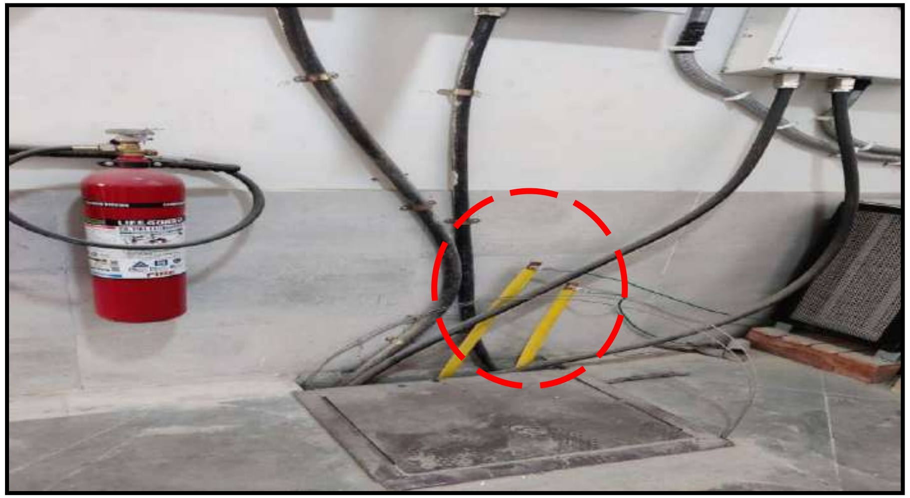
- Allowable earth Values **(Not to exceed)**
  - Power earth- **5 ohms** (In rocky soils up to **8 ohms**)
  - Lightning Conductor- **10 ohms**
- **Pipe earth**:- Salt **5 Kgs.** Charcoal **64 kgs.** or coke **160 kgs.**
  - Pipe Medium class **40 mm Dia. 4.5 mts long** (Without Joint).
  - Holes **12 mm Dia.** each & spaced **75 mm** from each other.
  - **Holes to be drilled from bottom end of pipe up to 2mts.**
- **Plate earth**:- Salt **5 Kgs.** Charcoal **96 kgs.** or coke **240 kgs.**
  - G I Plate **600 x 600 x 6 mm** }
  - Copper Plate **600 x 600 x 3 mm** }

  buried in ground with its top edge 3 mts below ground level
  - Water pipe medium class **20 mm Dia. 2.7 mts** Long.

EARTHING

Funnel & Wire Mesh not fixed to Watering Pipe

Earth Pits on Loose Earth



Earth Strip not connected to DBs

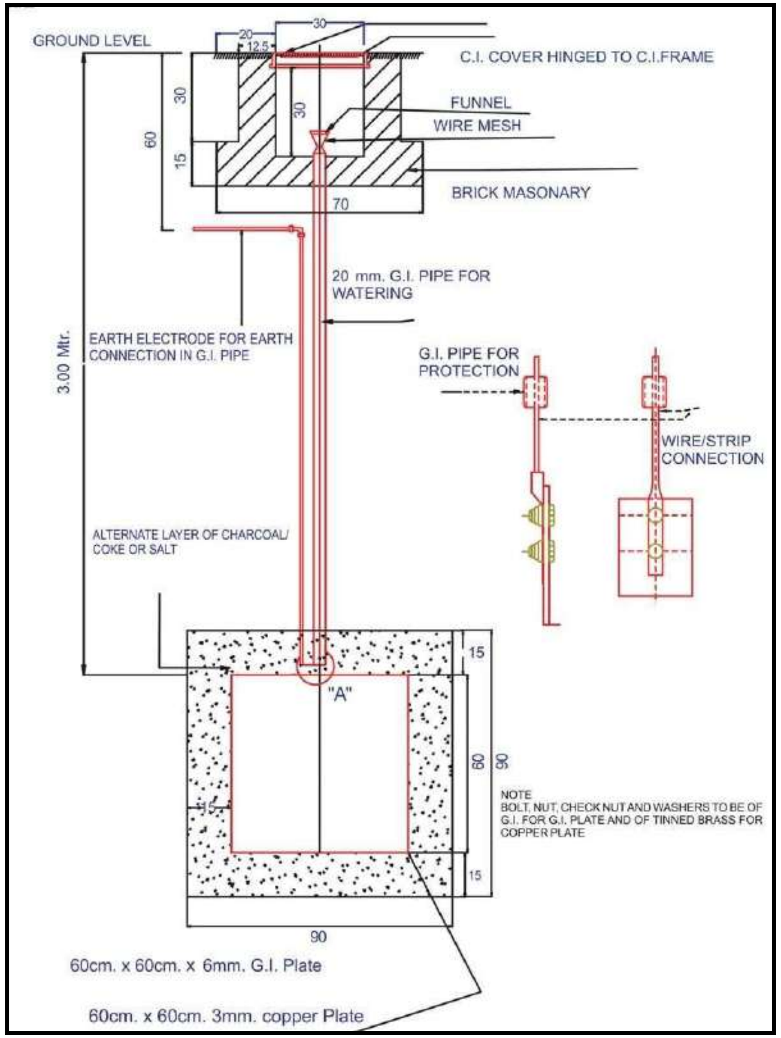
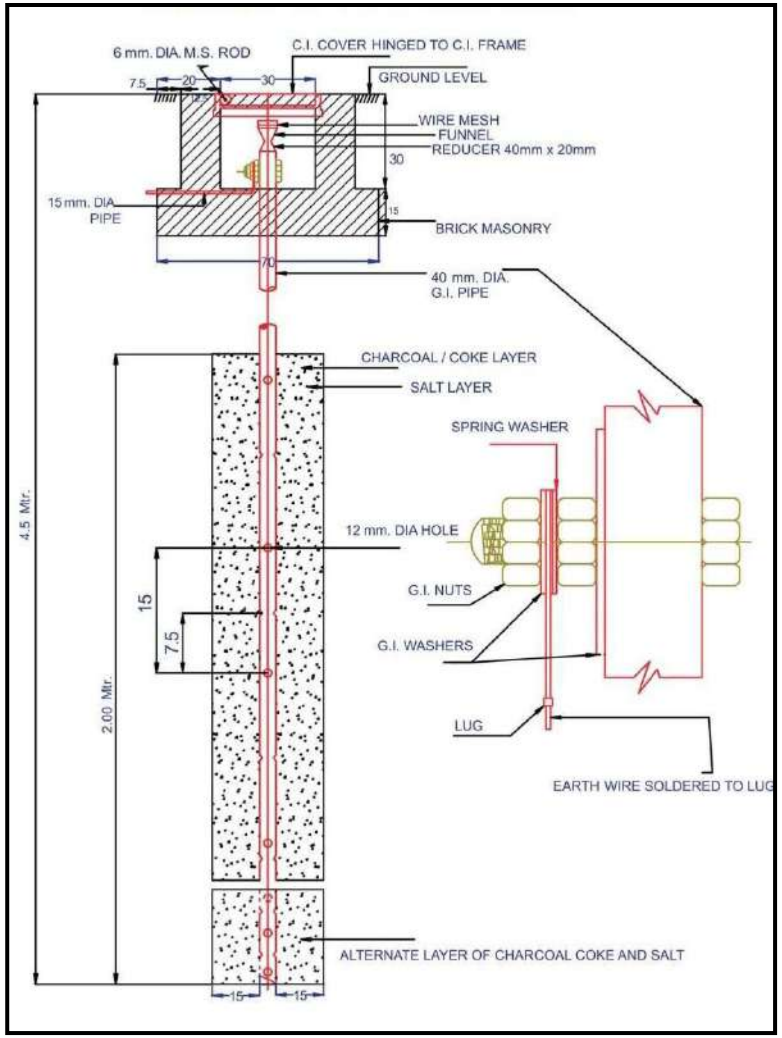


Plate Earthing



Pipe Earthing

EXTERNAL LIGHTING

- LED street lighting along Internal Roads and Boundary.
- Pole height in EMRS – 6 meter
- Minimum distance between two poles shall be **2.5 – 3** times of height of the pole. Minimum distance between two poles at roads and boundary is kept **15-20 m** and **40-45 m** respectively.
- The location of the light pole along the road/pavement outside Kerb stone.
- At least 40% - 50% of external lighting system shall be connected to alternative supply in case of power failure.
- Each street light pole should be suitably earthed.
- Every third pole shall have Solar Light fitting.
- There should not be any exposed wiring in outdoor fittings.
- Outdoor fitting shall have suitable IP (IP 65 OR IP 66) Protection.

EXTERNAL LIGHTING

Bad Work

Earthing not provided

Wrong fixing, No J.Box & Corroded Bracket

Good Work

Proper Fixing

Earthing is provided

FIRE FIGHTING WORK (FIRST AID HOSE REEL SYSTEM)

Following number of First Aid Hose Reels to be provided in EMRS:

- School Block: **4 Nos.** for G+1 configuration & **2 Nos.** for G+2 configuration in each floor
- Hostel Block: **2 Nos.** for both Boys & Girls in each floor.

Pump motor and entire metal work above ground level shall be painted with approved red colour.

The suction pipelines of pump shall be **100 mm** from terrace tank and delivery pipelines shall be **80 mm** and **65 mm** dia. for downcomer as per BOQ.

All down comer pipes shall be interconnected at the terrace level.

Normally one riser is provided for every **1000 sq.m** of plinth area or part thereof. However, the number of risers can be suitably increased to meet the given situation.

Terrace Pump :

Discharge : 450 lpm, Head : 20m + 6% of max. length of pipe from pump to any hydrant.

A NRV on delivery side.

Independent Electric supply

Automatic Starting of pump.

FIRE FIGHTING WORK (FIRST AID HOSE REEL SYSTEM)

Internal Hydrant:

- Easily accessible.
- Not in a lockable room.
- Min. clear space in front of hydrant for operation – 1.5 m.
- Marked as 'Fire Hose Cabinet".

Piping installation shall not create undue hinderance at terrace. It should be installed along parapet wall with the support of clamps etc.

FIRST AID HOSE REEL mounted on a wall bracket shall not obstruct public movement and swinging **180 degrees**.

The location of Fire Hose Cabinet shall be such that it does not form any obstruction in passage.

One no. Fire extinguisher shall be provided for every **300 sq. mtr.** floor area. Its installation shall be such that its bottom is **1000 mm** above the floor level. Minimum distance between fire extinguishers shall not be more than **15 mtrs.**

Please remember that the bldg. will be issued N.O.C. for occupation only when safety provisions of Fire fighting work are complete to the satisfaction of Chief Fire Officer.

FIRE FIGHTING WORKS

Wrong Placement of Fire Tank at Terrace

Obstruction in passage due to Hose Reel Cabinet

Fire tank shall be at Higher Level

Wrong Location

Ideal Location

FIRE FIGHTING WORKS

Fire Pipeline creating undue hinderance

Wrong placement of Fire Extinguishers

Fire Pipe installation is supported by clamps at Parapet Wall

LIGHTING CONDUCTOR,CCTVSYSTEMS,UPS

LIGHTING CONDUCTOR

A lightning protective system should have as few joints as possible.

Earth resistance for down conductor earth set shall be not more than **10 ohms**.

CCTV SYSTEM

The DVR & monitor shall be placed in Server Room/ Principal Room of School Block, Warden Rooms of Hostels and in Electrical Panel Room/ Dining Hall of Kitchen Block.

The cameras shall be provided in corridors, entrance of School, Hostels & in Dining Hall in Kitchen Block, Main Entrance of EMRS.

10 KVA UPS

The 10 KVA UPS shall be placed in Server Room of School Block.

All the DATA points shall be connected to 10 KVA UPS.

Only conduit is to be laid in class rooms for Data points in School Bldg. No LAN wiring with CAT 6 cable is to be done.

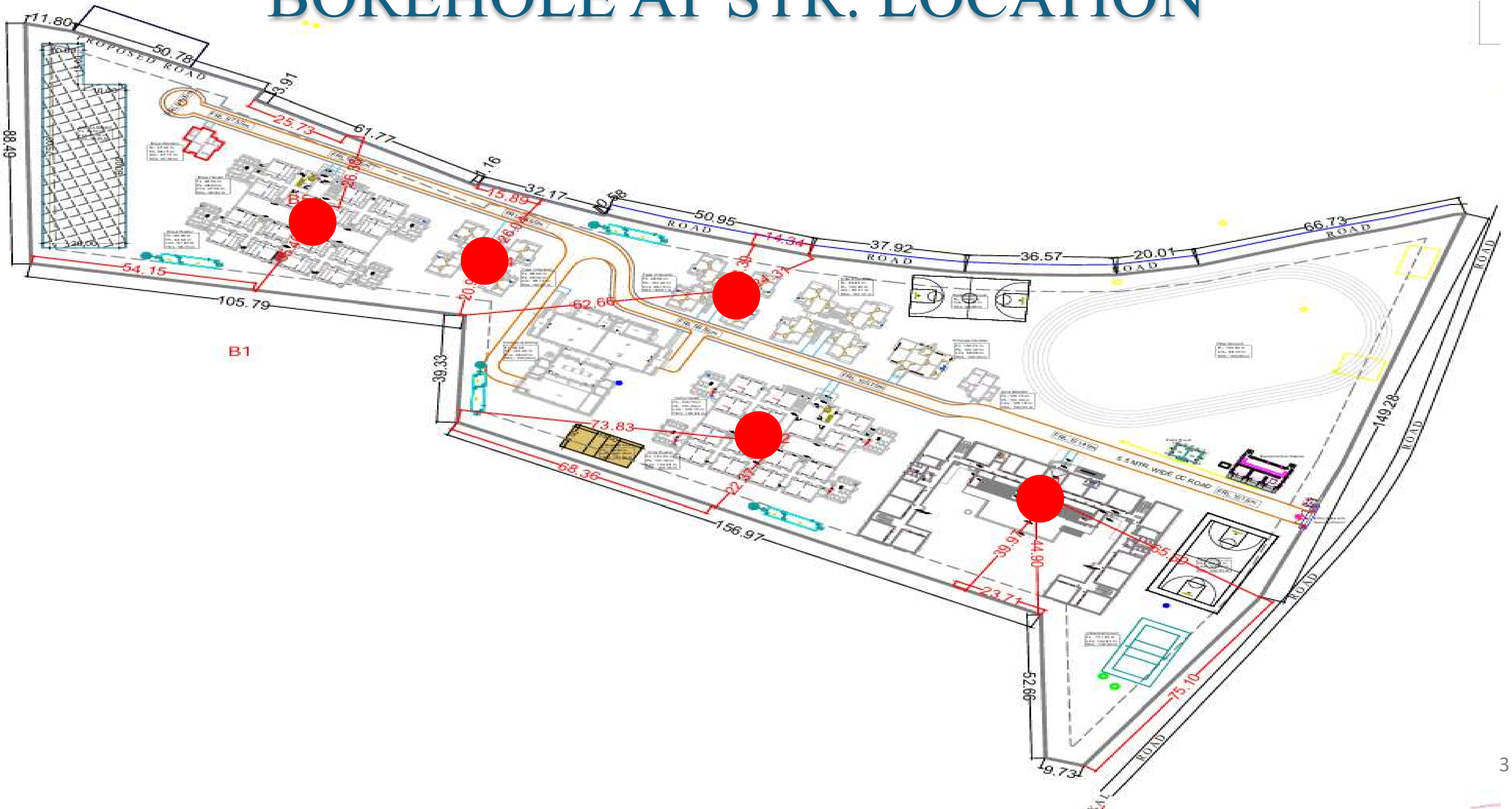
THANKS

EXTERNAL DEVELOPMENT,SEWERAGE & WATER SUPPLY

GEO-TECHNICAL INVESTIGATION

GEO-TECHNICAL INVESTIGATION

BOREHOLE AT STR. LOCATION



GEO-TECHNICAL INVESTIGATION

- Soil investigation is basis of foundation design.
- Geotechnical Investigation:-Minimum 08-10 bore holes, at least 01 for each major building, bore hole location to be indicated in MLP.
- SPT ‘N’ value at every 0.5 metre up to 3.0 metre , thereafter at every 1.0 metre till 10 metre.

GEO-TECHNICAL INVESTIGATION

- Soil Report shall indicate type of Soil strata, water level and SPT value and recommended safe bearing capacity at every depth.
- SBC shall be calculated for shear and settlement analysis, least of the two shall be the SBC.

GEO-TECHNICAL INVESTIGATION

- If water table is within 1 m of the base of footing, soil shall be checked for Liquefaction potential (Sudden loss of soil strength under cyclic loading).
- If black cotton soil at site, extent of depth and area covered to be reported.
- At the time of excavation, Soil Strata needs to be confirmed with soil report, in case of variation appropriate action is needed.

WATER-SUPPLY & SANITARY INSTALLATIONS

EXTERNAL WATER SUPPLY

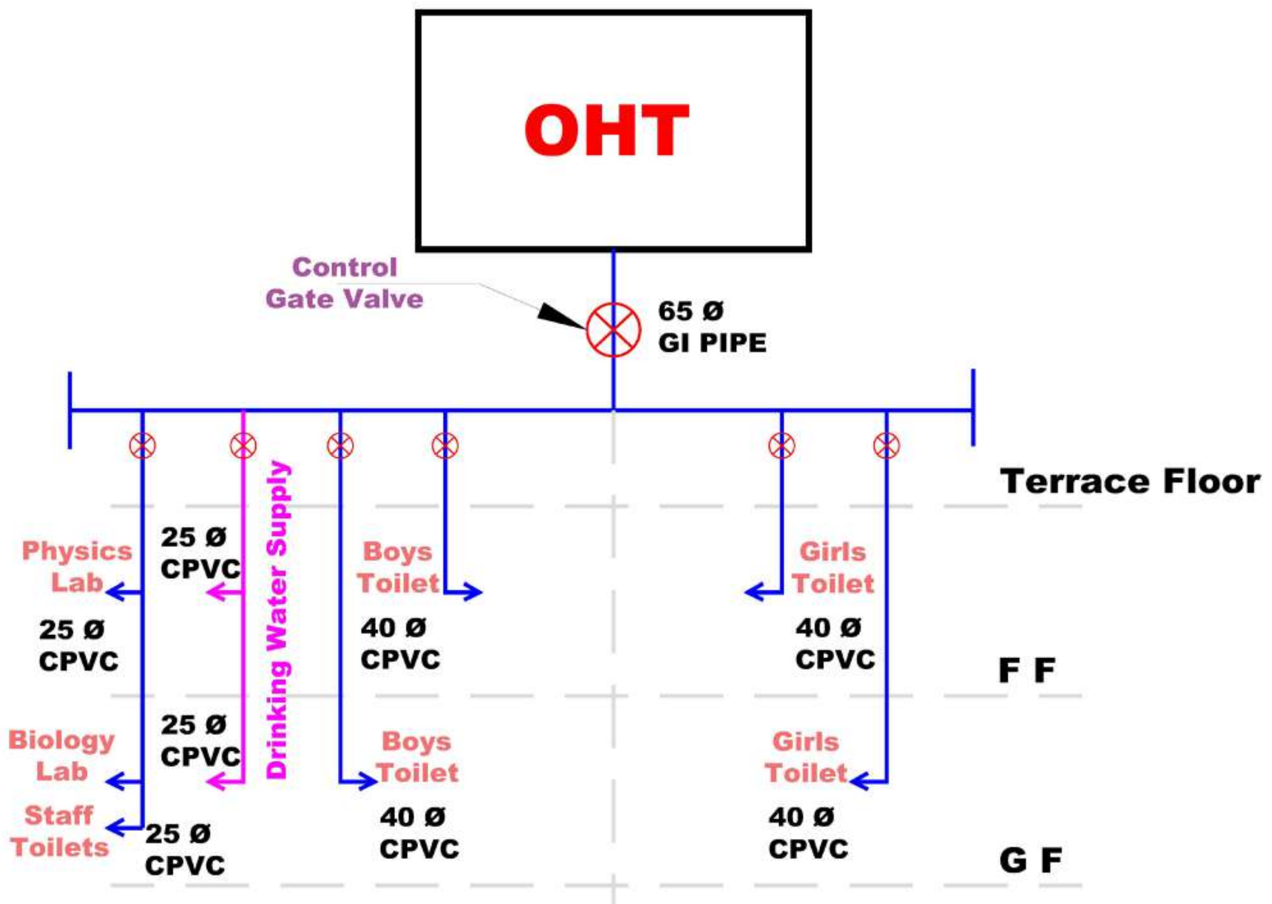
FROM PUMP ROOM TO OH TANK

EXTERNAL WATER SUPPLY

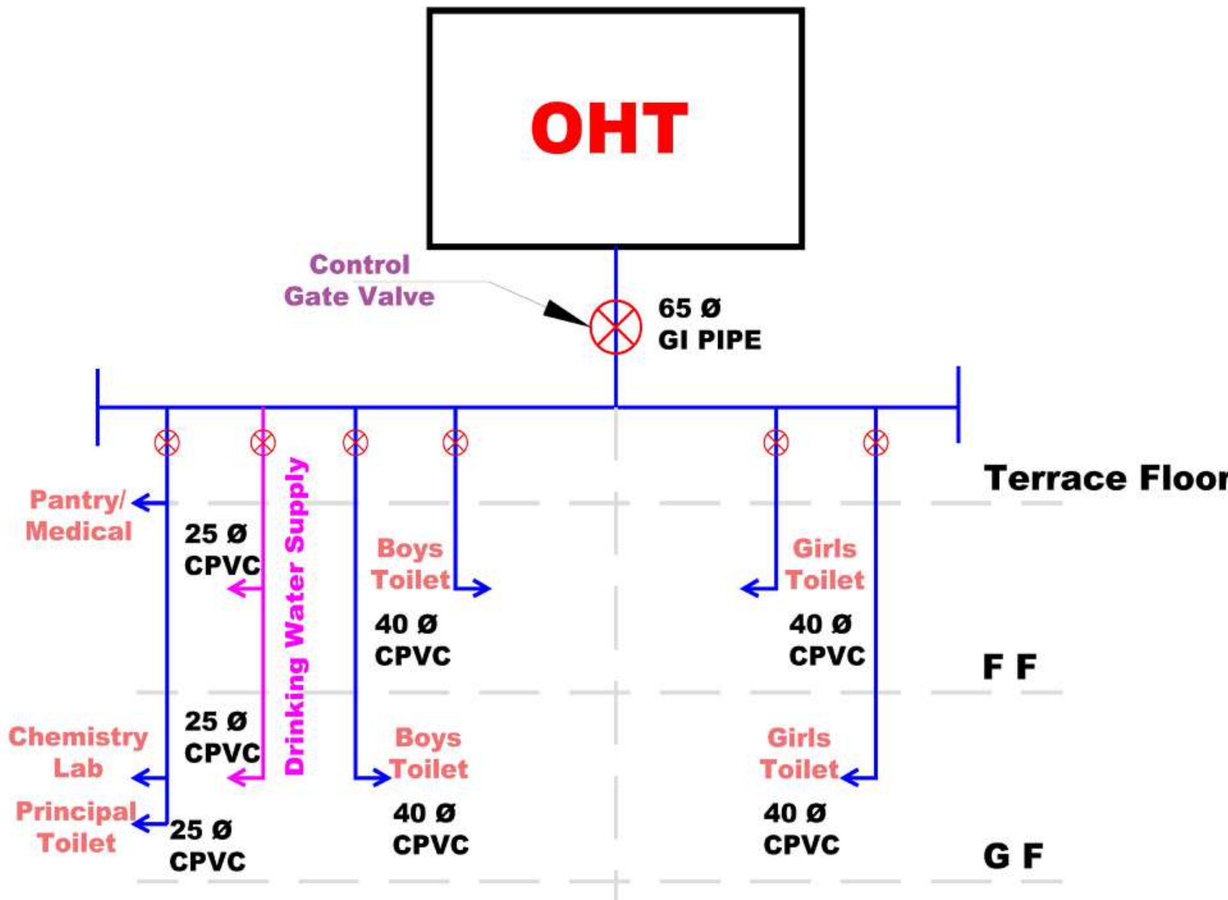
FROM PUMP ROOM TO OH TANK

- Pump Room to be at the top of Sump.
- Minimum Two bore-wells with suitable submersible pumps.
- Two mono-submersible Pumps, one operation at a time.
- First outlet from Sump: 80 mm Dia GI, 1st branching in 65 mm, 2nd 50mm, 3rd 40 mm, 4th 32 mm, 5th 25 mm, all judiciously.
- All OH tanks filling pipe to be by 32/25 mm Dia GI pipe (vertical).

TYPICAL SINGLE LINE DIAGRAM FOR SCHOOL BUILDING (G+1)



Single Line Diagram for Distribution Network Left Side School Building (G+1)



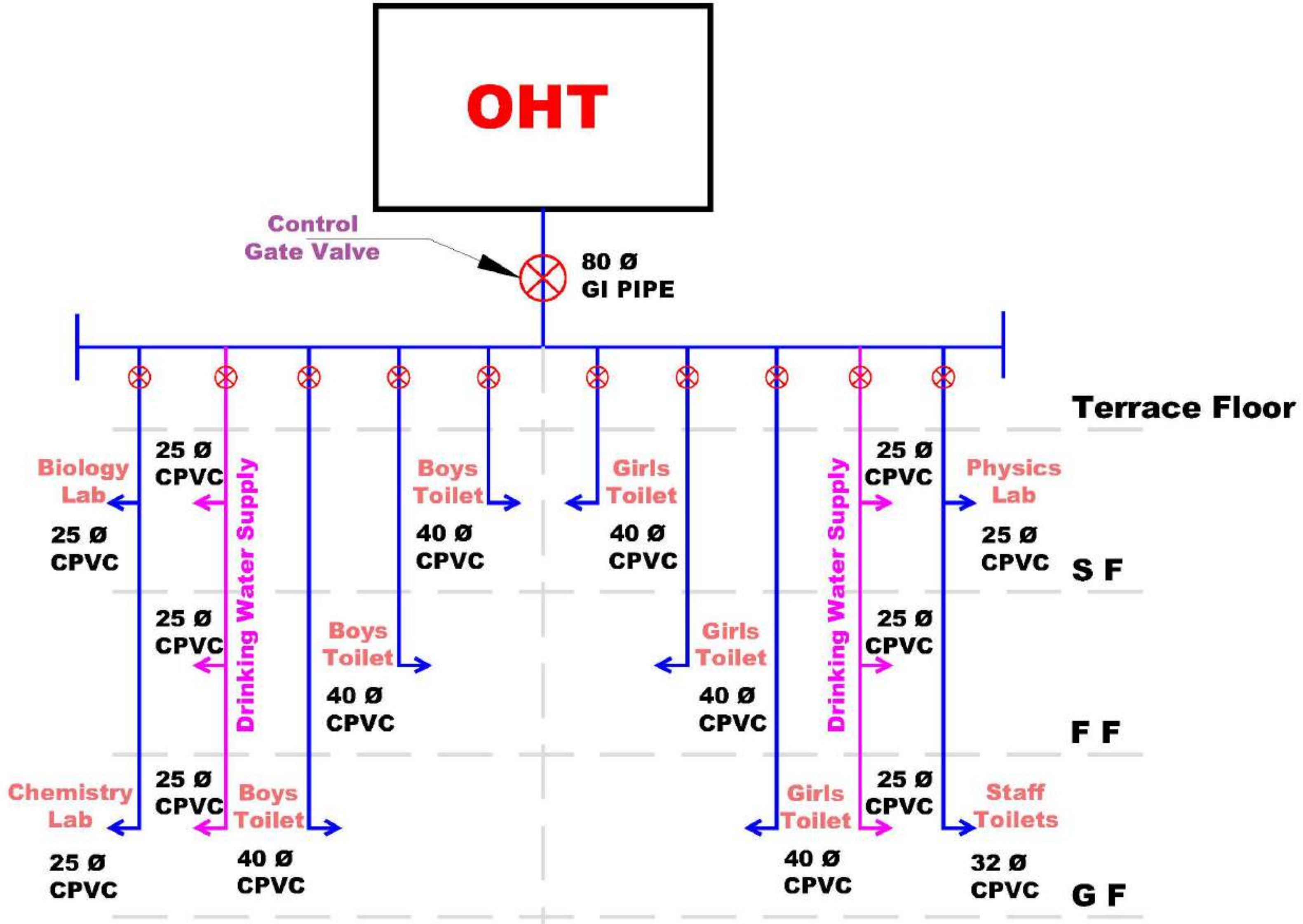
Single Line Diagram for Distribution Network Right Side School Building (G+1)

EXTERNAL WATER SUPPLY

FROM OH TANK TO BUILDINGS

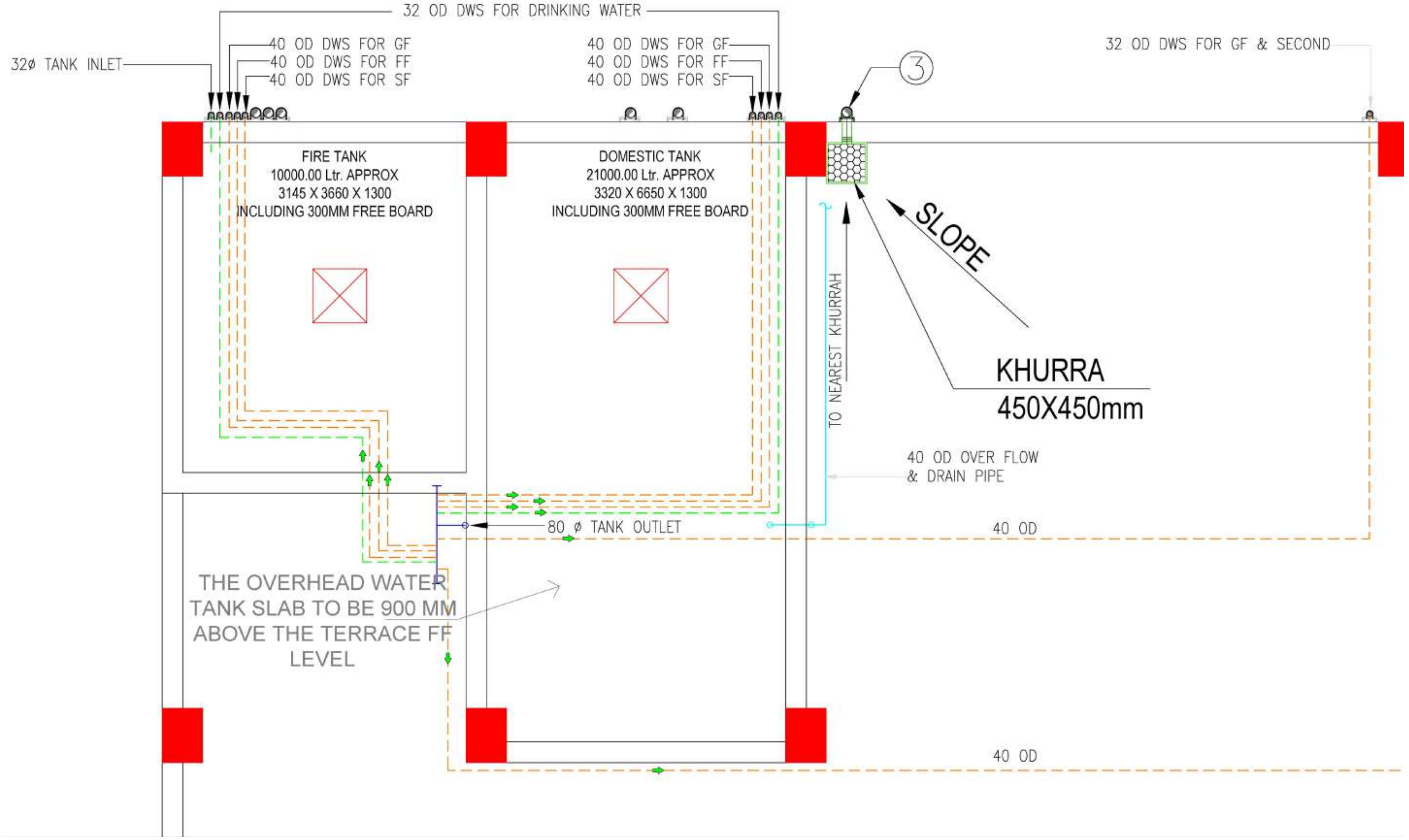
- **For school & hostel;** Take 1 no. 80/65 dia GI pipe and branch it (flute-connection) into required no. of 40 dia CPVC pipe with necessary gate valves for toilets, labs, staff toilets. & 2 no. of 32 dia CPVC pipe for drinking water (separate).
- **For kitchen & dinning;** Take 1 no. 50 dia GI connection and make grid of 50 dia GI pipe on terrace and draw 40/32 delivery connection downward.

TYPICAL SINGLE LINE DIAGRAM FOR SCHOOL BUILDING (G+2)



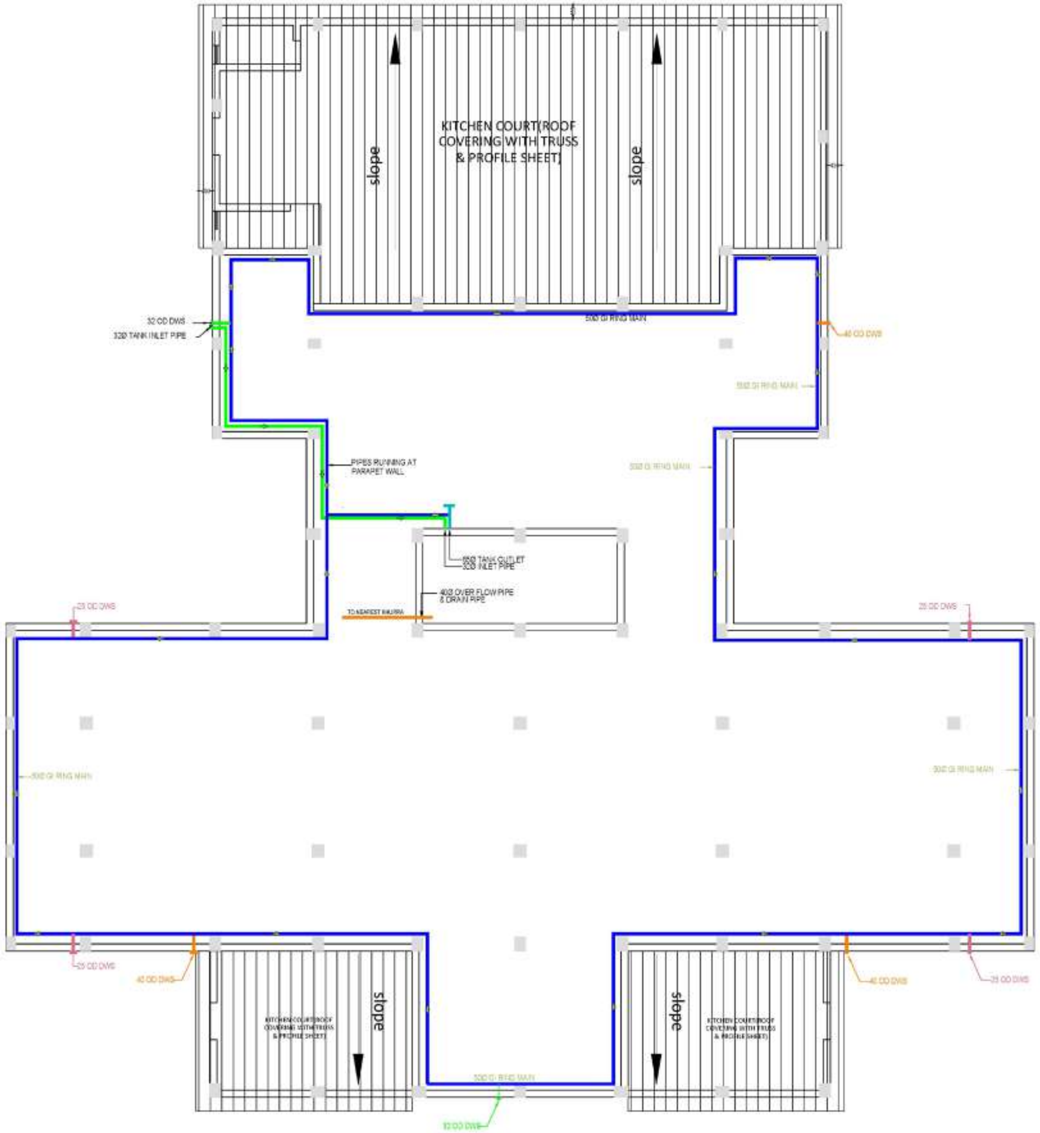
SCHOOL TYPICAL WATER SUPPLY NETWORK

FROM OH TANK TO TOILETS



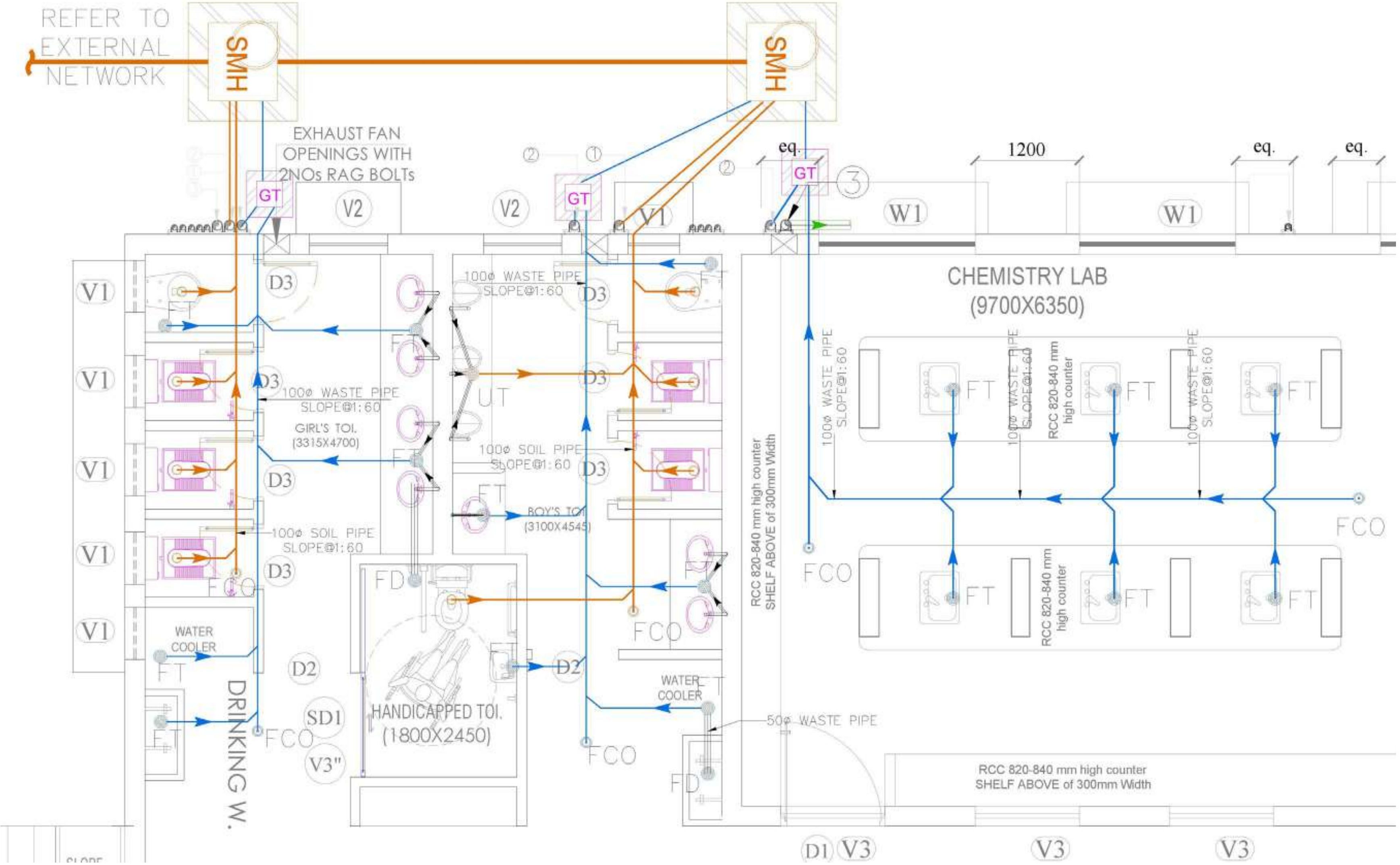
K & D TYPICAL WATER SUPPLY NETWORK

FROM OH TANK TO TOILETS

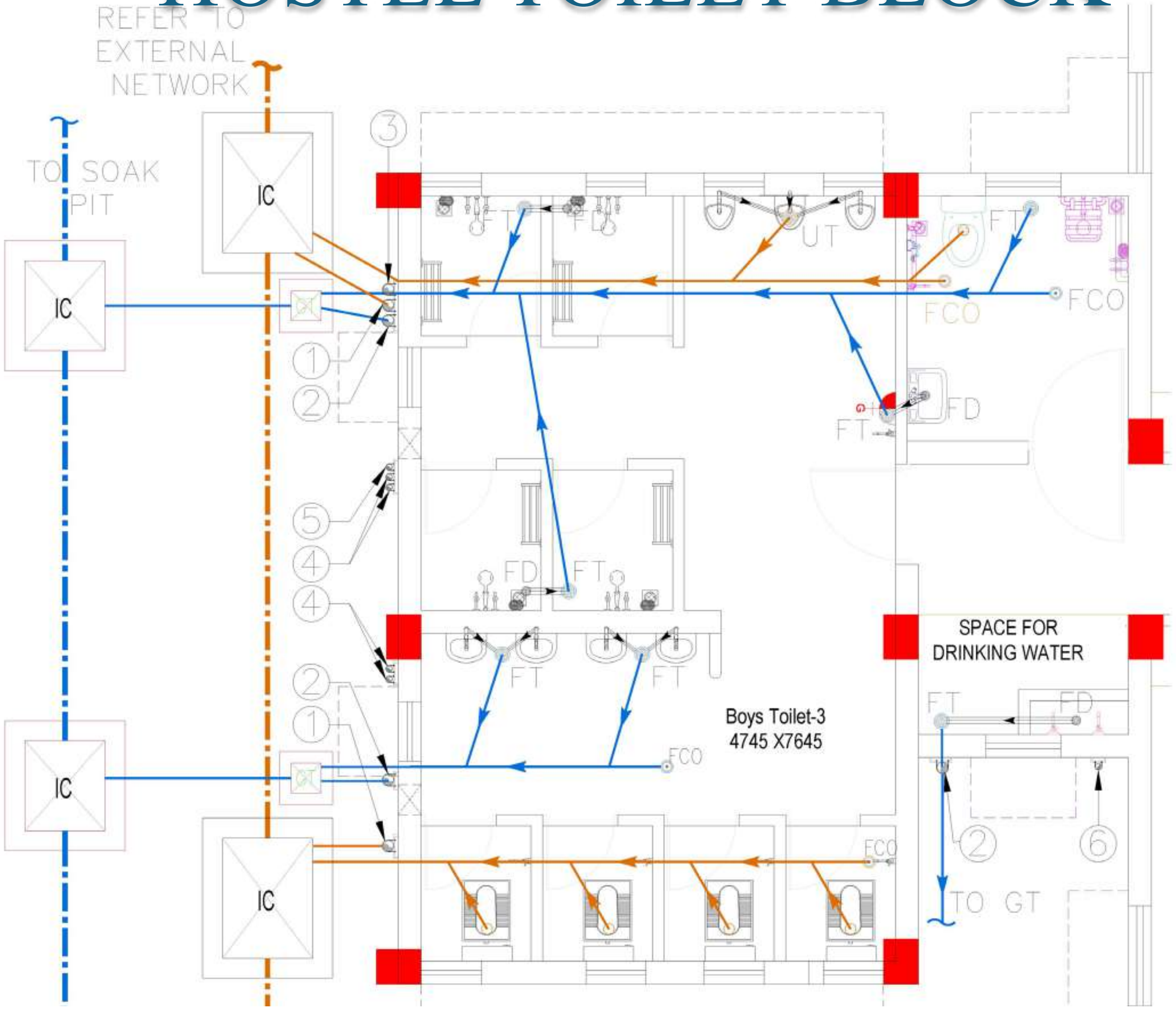


INTERNAL SEWERAGE & DRAINAGE

TYPICAL DRAIN OUT OF SEWERAGE- SCHOOL TOILET BLOCK



TYPICAL DRAIN OUT OF SEWERAGE- HOSTEL TOILET BLOCK



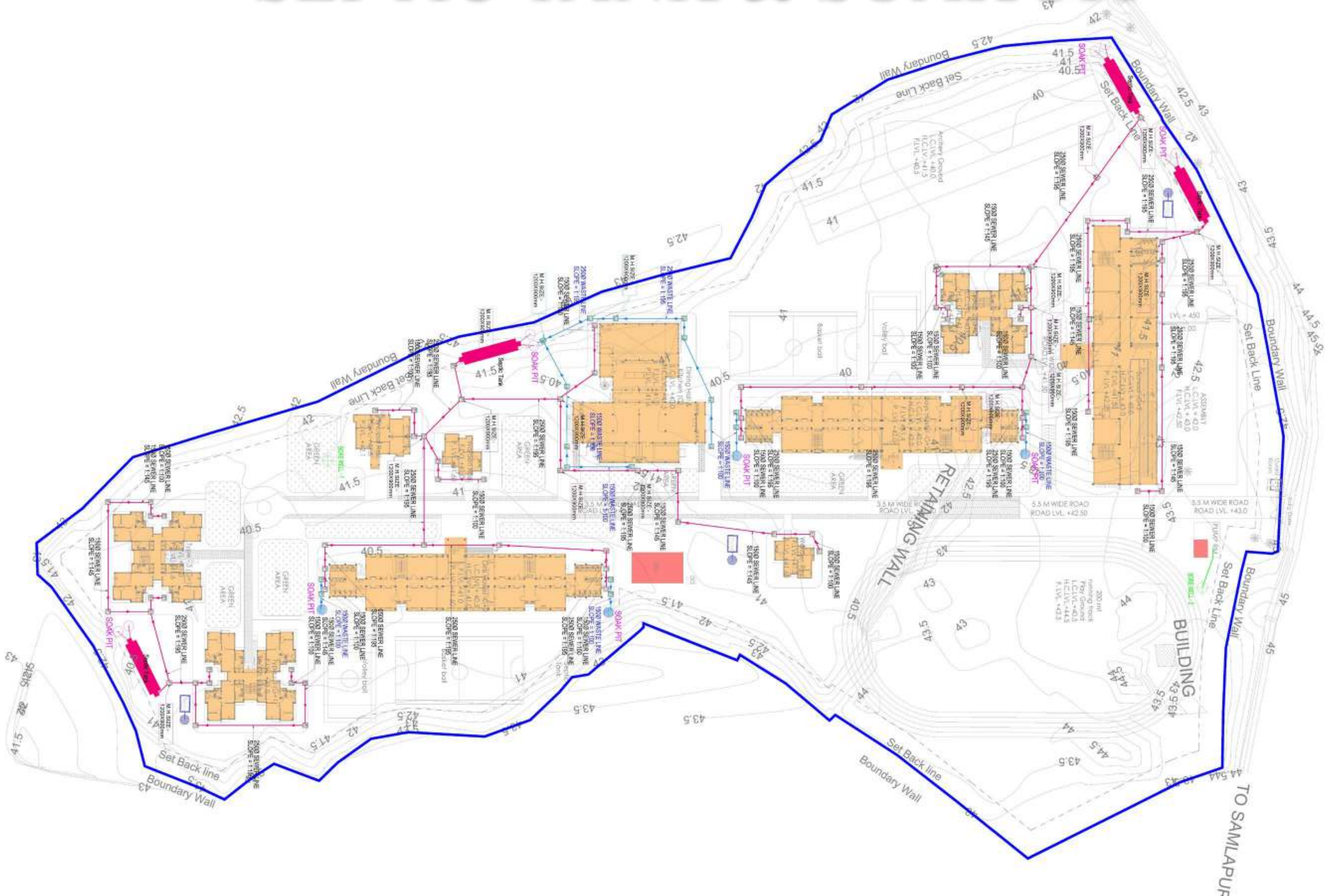
DISPOSAL OF SEWERAGE

- **Single point disposal :** School bldg. and quarters (T-II, T-III, Principal Qtr, Warden Residence)

- **Double point disposal:** Hostels & KD

DISPOSAL OF SEWERAGE

SEPTIC TANK & SOAK PIT



SANITARY INSTALLATIONS

Urinal Partition & Floor trap not proper

What to be?

- One urinal to be at lower height to facilitate students of lower height.
- For waste in urinal, pipe to be laid concealed in wall & then connected to a single floor trap.
- Partition to be of approved size & well fixed in wall.

SANITARY INSTALLATIONS

Floor Spout: A nitch of 150x150 mm 20 mm deep required at floor spout

Trough: At least 2 nos waste holes required in trough

COMMON MISTAKES

DISPOSAL OF WASTE WATER

Good work: minimum trap

Bad work: too many trap

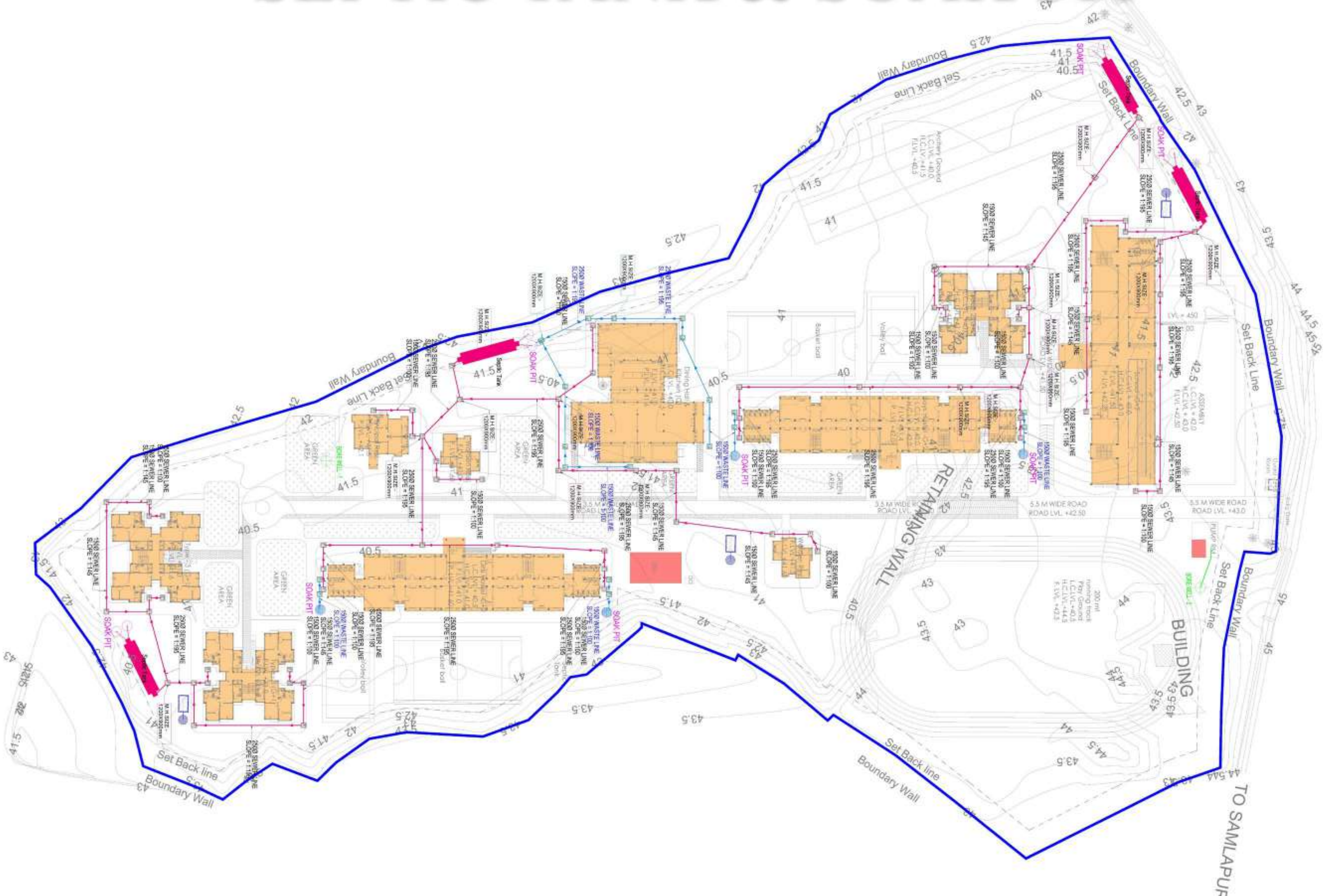
COMMON MISTAKES

Cutting of Beam is highly objectionable

EXTERNAL SEWERAGE & DRAINAGE

EXTERNAL SEWERAGE DISPOSAL

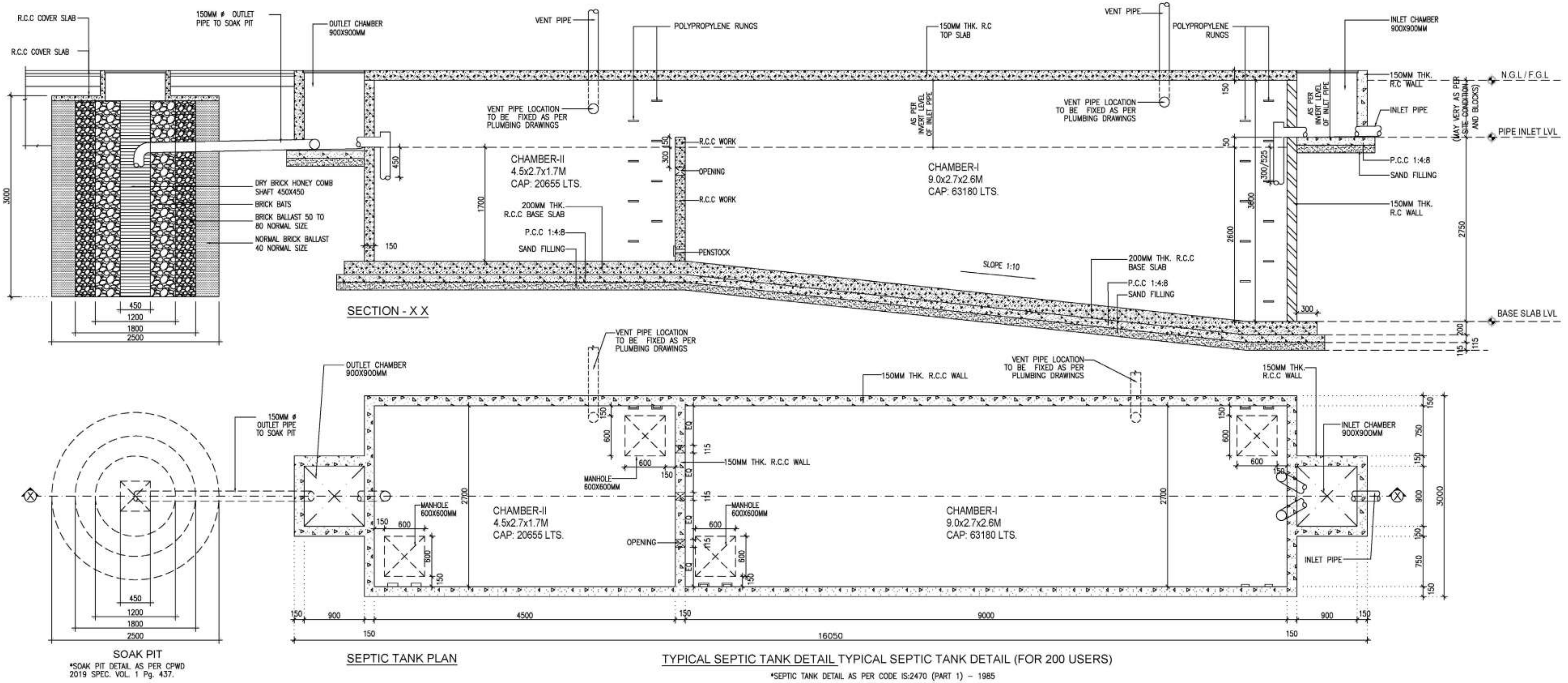
SEPTIC TANK & SOAK PIT



GENERAL CONSIDERATIONS WHILE PLANNING FOR SEWERAGE & DRAINAGE

- Slope for 150 mm Dia sewer: 1 in 100 & for 250mm Dia sewer: 1 in 190.
- Minimum Dia of pipe for sewerage 100 mm. Direction of flow at junction with manhole not more > 45°.
- Invert level of septic tank to be decided based on topography of plot & Building Plinth level.
- Ventilation Pipe at Septic tank: Min Dia 50 mm, height 2 m above the nearby bldg. if bldg. is within 15 m radius.
- Location of Septic Tank/ Soak pit shall be more than 18 m from any source of drinking water.

TYPICAL SEPTIC TANK WITH SOAK PIT



TYPICAL SEPTIC TANK DETAIL TYPICAL SEPTIC TANK DETAIL (FOR 200 USERS)

*SEPTIC TANK DETAIL AS PER CODE IS:2470 (PART 1) – 1985

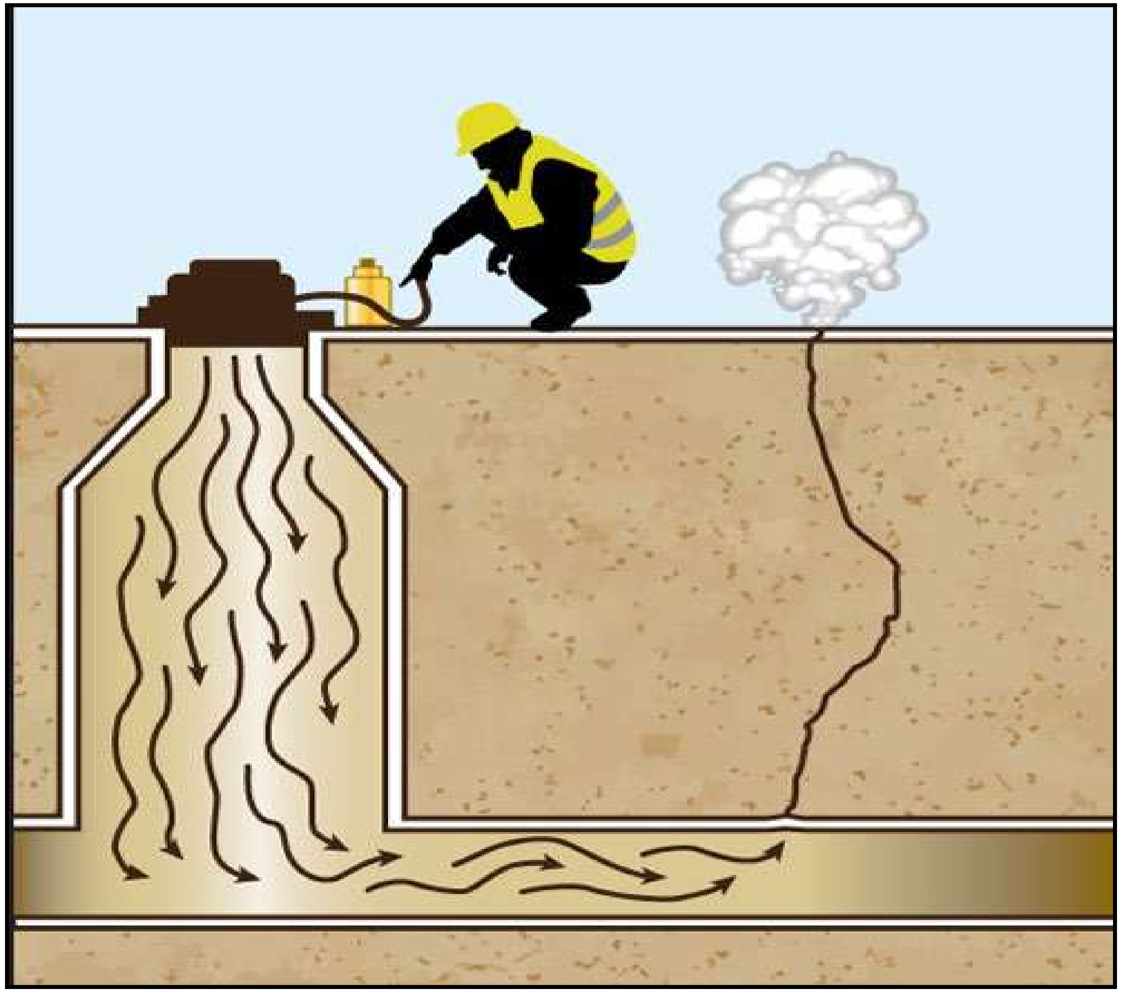
SEPTIC TANK

Good work: Inlet/outlet chamber

Bad work: Inlet/outlet chamber missing

SMOKE TEST

- All soil pipes, waste pipes, and vent pipes and all other pipes when above ground shall be approved gas-tight after all trap seals have been filled with water. The smoke is produced by burning oily waste or tar paper or similar material in the combustion chamber of a smoke machine. Chemical smokes are not satisfactory.



COMMON MISTAKES

Top of MH/GT not to expose more than slab thickness

COMMON MISTAKES

No proper planning:
Top of MH/GT not to expose more than slab thickness

EXTERNAL SEWERAGE INSTALLATIONS

RAINWATER PIPE

- SWR pipe: UPVC PIPES
- Type A – ventilation & rain water applications 110 mm dia
- The recommended slopes -flat roofs with smooth finish 1:150 to 1:133.
- The effective strainer area should preferably be 1.5 to 2 times the area of pipe to enhance the capacity of rainwater pipes.

RAINWATER PIPE

Table 23 Sizing of Rainwater Pipes for Roof Drainage in mm/h
(*Clause* 4.5.11.6.8)

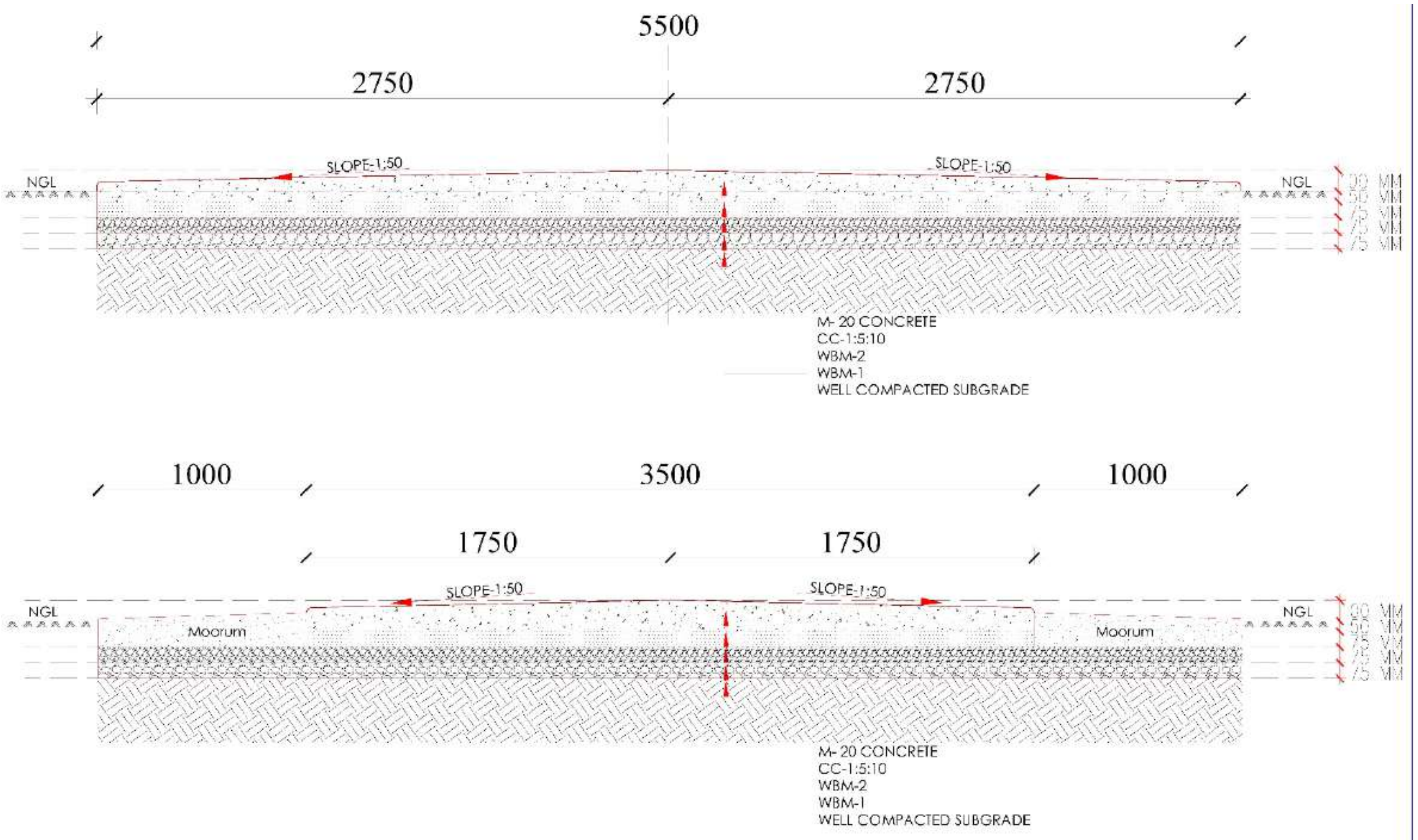
Sl No.	Dia of Pipe mm	Roof Area, in m² for Average Rate of Rainfall in mm/h					
		50	75	100	125	150	200
(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)
i)	50	29.70	19.80	14.85	11.88	9.90	7.42
ii)	65	57.23	38.15	28.61	22.89	19.08	14.31
iii)	75	81.84	54.56	40.92	32.74	27.28	20.46
iv)	100	168.00	112.00	84.00	67.20	56.00	42.00
v)	125	293.48	195.66	146.74	117.39	97.83	73.37
vi)	150	462.95	308.64	231.48	185.18	154.32	115.74

NOTE — For rainwater pipes of other materials, the roof areas shall be multiplied by (0.013/coefficient of roughness of surface of that material). For example, for rainwater pipes of PVC (coefficient of roughness = 0.009), the above values of roof area shall be multiplied by 0.013/0.009 = 1.44.

ROAD & PAVEMENT

CEMENT CONCRETE ROAD

- 5.50 meter wide- main entrance to School Porch area.
- 3.50 meter wide with 1.00 mtr. shoulder on both side- rest of Buildings
- 2.00 meter wide precast paver block pavement for approach.
- M20 grade Cement Concrete road 150 mm thick



WBM-1= 63-45 MM AGG.+MOORUM

WBM-2= 53-22 MM AGG.+MOORUM

CEMENT CONCRETE ROAD

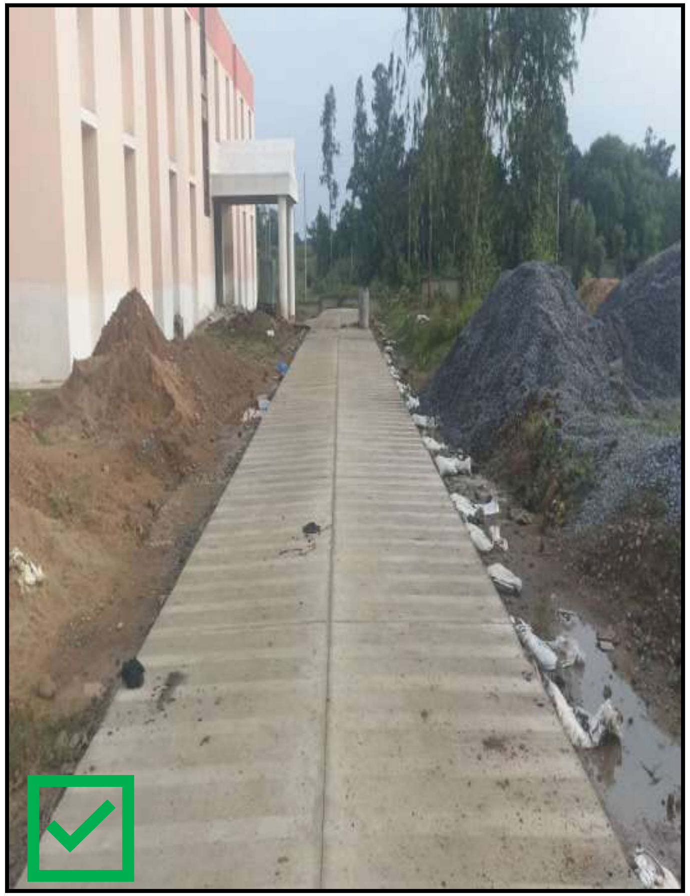
- Formwork - of steel & firm.
- Smooth curve to be provided at Turning.
- Expansion/ Contraction joint to be provided preferably @ 4.50 m.
- Finally belting & brooming is done.
- Curing for 21 days.
- When dry, joint filling with bitumen.

Road not provided at curve

CEMENT CONCRETE ROAD

Road Expansion Joints not proper

Smooth curve at turn



Good Work

MISC

Bad work: Plinth Protection Damaged

MISC

OH Tank wall casting not continuous

Water Tank cover not proper

WATER TANK COVER

What to be done?

- Water Tank cover to be given attention
- Casting of water tank walls to be continuous
- Cover to be proper.

THANKS

MEASUREMENTS & VARIATIONS

MEASUREMENTS

SIGNIFICANCE & CONSEQUENCES

- Correct Measurements -Prime responsibilities of site Engineer .
- It is the basis of making payments to the contractor for work done.
- Very important records of project , preserve carefully for long time and can be produced in a court of law, if required.

- Casual approach in measurements / Over-measurement/ Excess Payment → Undue benefit to Contractor

↓

Unrealistic Cost Inflation

↓

Misuse of Public Money

↓

Invitation to Trouble

BASIC REQUIREMENTS

- ❖ Measurements methodology ⟹ As per CPWD specification/ BIS Codes

- ❖ Availability of Hard copy of CPWD **Specification & BoQ at site -** For ready reference.
- ❖ Acquainted With **Nomenclature** of items, its **operations** and prescribed **methodology of measurements**.
- ❖ Measurements of hidden items i/c test check before covering

x Measuring from drawing while sitting in office ⟹ **Wrong practice.**

✓ Measurements after checking & verifying at site ⟹ **Right Practice.**

COMMON MISTAKES: EARTHWORK 1/2

Do's

- ✓ Maintain level books & record all natural ground levels/contours.
- ✓ Pick Correct item for excavation i.e. over areas & trenches.
- ✓ Pick correct item for 'site levelling using surplus excavated earth' i.e. item 2.36
- ✓ For isolated footing: max permitted working space is 30 cms. & 75 cms. for footing depth up to & above 1.5 mtrs. respectively.
- ✓ Measuring net area of excavation with due care for overlapping area.
- ✓ Ensuring correct classification of soil for measuring excavation and apply due deduction for voids in case of excavation in rocks areas.
- ✓ Keep import of soil for filling to minimum after correctly working out availability of soil at site.

COMMON MISTAKES: EARTHWORK 2/2

Don’t Do.

- x Paying mass excavation against isolated footing.
- x Considering hard/dense soil as ordinary rock and all weather rock as hard rocks for measurement in excavation.
- x Making import of earth as common practice under extra items.
- x Not referring basic item while paying extra lift.

COMMON MISTAKES: RCC & BRICKWORK 1/2

Do's

- ✓ Measuring shuttering under correct item.
- ✓ Apply deduction for hooks /bends in working out stirrups cut length.
- ✓ Measure actual weight of each dia. of reinforcement bars for payment.
- ✓ Measure chairs quantities as per actually provided.
- ✓ Check and verify each and every bar at site w.r.t. vetted drawing before measurement.
- ✓ Correct application of below plinth level work in compound wall i.e. -up to 1.2 mtrs above NGL paid under “up to plinth level item”-
- ✓ While paying extra cement over minimum specified in design mix concrete ,Refer correction slip no. 20 of CPWD 16.02.2021

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निर्माण भवन, नई दिल्ली | दिनांक: 16 /02/2021

कार्यालय ज्ञापन

Sub:- Correction Slip No. 20 of SH:5 (Reinforced Cement Concrete) of Delhi Analysis of Rates 2019.

According to decision taken in the meeting of the Technical Committee held on 28.01.2021 under the chairmanship of Director General CPWD, the following correction slip to DAR 2019 is issued.

Existing Provision		Modified Provision	
5.33	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using coarse aggregate as well as fine aggregate derived from natural sources and cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge. (Note :- Cement content considered in this item is @ 330 kg/cum. Excess / less cement used as per design mix is payable / recoverable separately).	5.33	Providing and laying in position ready mixed or site batched design mix cement concrete for reinforced cement concrete work, using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana / Ordinary Portland /Portland Slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads; but excluding the cost of centering, shuttering, finishing and reinforcement as per direction of the engineer-in-charge; for the following grades of concrete. **Note:** Extra cement up to 10% of the minimum specified cement content in design mix shall be payable separately. In case the cement content in design mix is more than 110% of the specified minimum cement content, the contractor shall have discretion to either re-design the mix or bear the cost of extra cement.

COMMON MISTAKES: RCC & BRICKWORK 2/2

Don't Do.

- x Paying reinforcement on standard weight as a practice.
- x Taking chairs quantities and their length on lump sump basis.
- x In half brick AAC block wall, paying 2 bars -6 mm dia bars after every third course as separate item like in brick work.
- x Paying extra cement ditto as per design report.

COMMON MISTAKES: STEEL/ALUMINIUM & FINISHING WORK 1/2

Do's

- ✓ Measure steel windows/ventilators work & aluminium work on actual section weight basis after ensuring that sections sizes are in conformity to items nomenclature/ approved drawing/ approved guidelines .
- ✓ Keep sample of each section in records.
- ✓ Measure steel work under correct items **i.e. single section , built up, tubular, z- section.**
- ✓ Plastering Measurement : RCC surface- under 6 mm **(Unless otherwise specified)**
  Brick surface-under 12/15/18 mm plaster.
- ✓ Correct application of multiplying coefficient in painting items.

COMMON MISTAKES: STEEL/ALUMINIUM & FINISHING WORK 2/2

Don't Do

- x Measuring steel work/ aluminium work on lump sump area coefficient basis.
- x Not referring specification / DAR to clear doubts on un-payable components of items.
- x Not keeping weighing samples in records.
- x Measuring glass work /painting work in steel windows, Ventilators, door frames, grills etc. on lump sump area coefficient basis

VARIATION

VARIATION 1/2

<u>"Be careful -Don't take Variation for granted"</u>

- Variation due to exceptional /unforeseen site specific reasons.-(Acceptable)

- Variation due to deviation from approved Drawings/ Guidelines or due to change in scope of work without prior approval of owner or due to lapses on part of CA in discharging their obligation as PMC. -(Not Acceptable)

VARIATION 2/2

To Curb Variation:

- ✓ Do Proper technical scrutiny of site conditions, site topography ,layout & sub-soil Investigation.
- ✓ Verify final layout with demarcated position of building vis-à-vis approved MLP. Good MLP should avoid excessive cutting/filling.
- ✓ Verify quantities of RCC, Reinforcement & Brick work from vetted/approved drawings before execution.
- ✓ Vigilant supervision & regular watch/ control on quantities of important Items.
- ✓ Keep approved project cost in mind while allowing Extra / Substitute items.
- ✓ Take every step to optimize cost-Levelling, Cutting/ Filling, Retaining Structures, Drainage, system etc .

Even if the variation establish , take appropriate action as per MoU.

THANKS