प्रधान मंत्री आवास योजना-शहरी

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Ministry of Housing and Urban Affairs
Government of India

स्वच्छ भारत
एक कदम स्वच्छता की ओर

LIGHT HOUSE PROJECT AT AGARTALA

GHTC-India Category

Light Gauge Steel Structural System & Pre-engineered Steel Structural System

Technology

Light Gauge Steel Framed (LGSF) System with Pre-engineered Steel Structural System

CONTENTS

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Global Housing Technology Challenge - India (GHTC-I)

Broad Category	***Technologies (Nos.)***
Precast Concrete Construction System - 3D Precast volumetric	4
Precast Concrete Construction System – Precast components assembled at site	8
Light Gauge Steel Structural System & Pre-engineered Steel Structural System	16
Prefabricated Sandwich Panel System	9
Monolithic Concrete Construction	9
Stay In Place Formwork System	8
Total	54

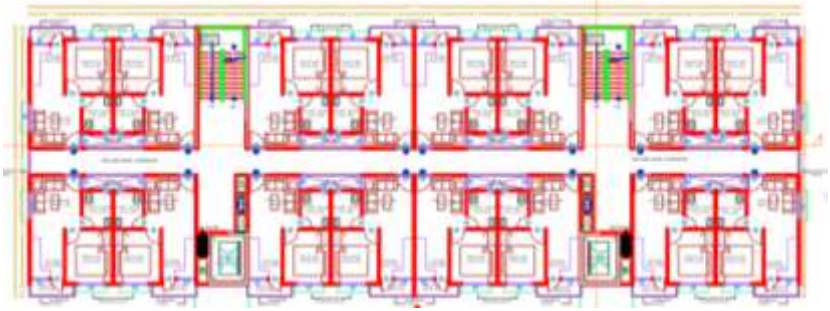
Summary of Six Light House Projects (LHPs)

LHP Location			Chennai (Tamil Nadu)	Rajkot (Gujarat)	Indore (Madhya Pradesh)	Ranchi (Jharkhand)	Agartala (Tripura)	Lucknow (Uttar Pradesh)
Sl. No	**Particulars**	**Units**						
1	Name of Technology	Name	Precast Concrete Construction System-Precast Components	Monolithic Concrete Construction using Tunnel Formwork	Prefabricated Sandwich Panel System	Precast Concrete Construction System – 3D Volumetric	Light Gauge Steel Frame System (LGSF) with Pre-Engineered Steel Structural System	Stay in Place Formwork System
2	No. of Houses	No.	1,152	1,144	1,024	1,008	1,000	1,040
3	No. of Floors	No.	G+5	S+13	S+8	G+8	G+6	G+13
4	Plot Area	Sqm	33,596	39,599	41,920	31,160	24,000	20,000
5	Per House Carpet Area	Sqm	26.58	39.77	29.04	29.85	30.00	34.50
6	Project Cost	INR (in Cr)	116.27	118.90	128.00	134.00	162.50	130.90
7	Per House cost (with infrastructure)	INR (in Lakh)	10.09	10.39	12.50	13.29	16.25	12.58

- Total Plot area is 24168 Sqm.
- Ground coverage of the project is 29% and FAR achieved is 2.43
- Proposed organized green space is 31%.
- The project also includes Anganwadi, Health Centre and community hall of 480 Sqm, 700 Sqm and 500 Sqm respectively in G+1 configuration

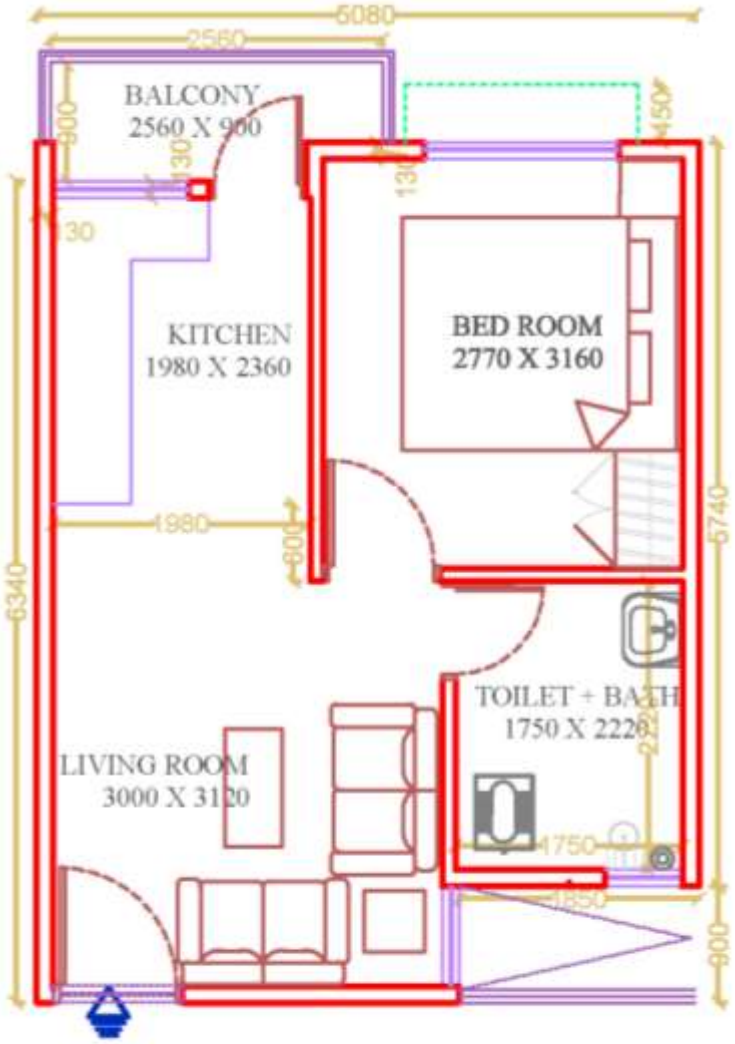
- There are 7 blocks in Ground + 6 configuration with 1000 houses along with basic and social infrastructure.

Typical floor plan



- 16 dwelling units each in A & G Block; 22 Units in B Block; 18 Units in C Block and 24 units each in D,E & F per floor with a provision of lifts and staircase.

- Typical Dwelling Unit plan



TYPICAL UNIT PLAN
(SCALE - 1:20)

Each dwelling unit consists of one living, one bed room, a kitchen, a toilet and a balcony. The carpet area of each unit is 30.03 Sq.mt. The sizes of individual rooms & service areas conform to NBC norms.

Other special features:

- Green rating as per GRIHA
- Use of renewable resources:
  - Rain water harvesting
  - Solar lighting
- Solid waste management
- STP with recycling of waste water
- Fire fighting services as per NBC norms

Prevalent Construction Systems

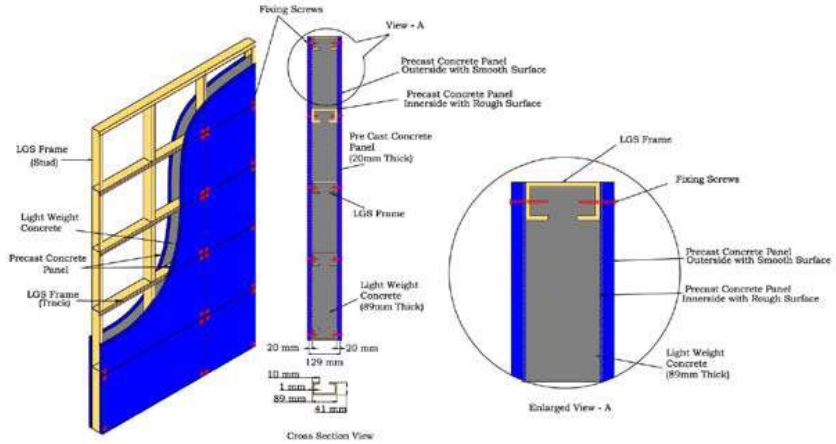
Technology being Used

Load bearing Structure

RCC Framed Structure

Steel Frame Structure

Light Gauge Steel Framed Walling System



Light Gauge Steel Framed System (LGSF) is based on factory made galvanised light gauge steel components. The components/sections are produced by cold forming method and assembled as panels at site forming structural or non structural steel framework of a building of varying sizes of wall and floor.

In order to meet structural requirements, Hybrid system comprising of **Light Gauge Steel Frame System with Pre-Engineered Steel Structural System** has been adopted in the present project.

Structural Elements

- Foundation
- Structural System
- Floor/ Roof Slab
- Wall Panels

Foundation

- Pile Foundation (Bored Cast-in-situ Concrete Piles) as per geo-technical investigations, bearing capacity, soil strata, water table, etc.
- RCC Raft on the Piles and then RCC pedestal on the Raft
- Anchor bolts and Base plate of varying sizes and diameter as per structural design for erecting Pre-Engineered Steel Structure.
- RCC plinth beam and grade slab at plinth level.
- RCC shear walls for staircases and lift on RCC raft and water proofing with kota stone.

Structural system

- Pre-Engineered Building (PEB) system comprising of built-up fabricated I-sections for beams and columns

Floor/ Roof Slab

- The floor/ roof is deck slab which comprises of deck sheet, reinforcement with concrete screed

Structural Elements

Wall Panels – Light Gauge Steel Frame System

- LGSF is a "C" cross-section made of galvanised light gauge steel with built in notch, dimpling, slots, service holes etc. and produced by computerized cold roll forming machine.
- These frames are assembled using self driven metal screws to form into LGSF wall and roof structures of a building.
- Provisions for doors, windows, ventilators and other cut outs as required are incorporated in the LGSF.
- Cement concrete panels are fixed on both side of the wall and then filled with light weight concrete.
- Cement fibre board as an alternative to the above panels are used for cladding with infill of rockwool.

Receiving GI Coils, Inspection and Store

Loading the coils in Decoiler

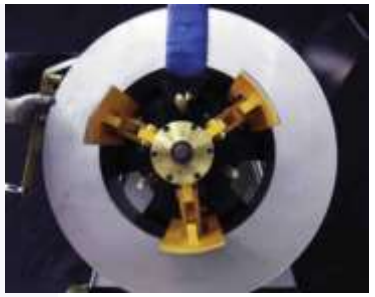
Loading NC files and Operation of computerized Roll forming machine.

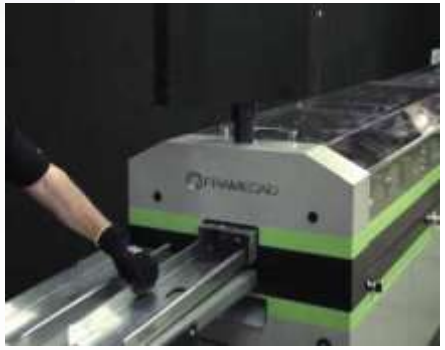
Production of frames, Marketing & Labeling

Inspection of frames.

Packing of frames wall wise Marking & Labeling

Dispatch to construction site.





- Flow Diagram of manufacturing plant for fabrication of Light Gauge Steel Frame System

Light Gauge Steel Frame System

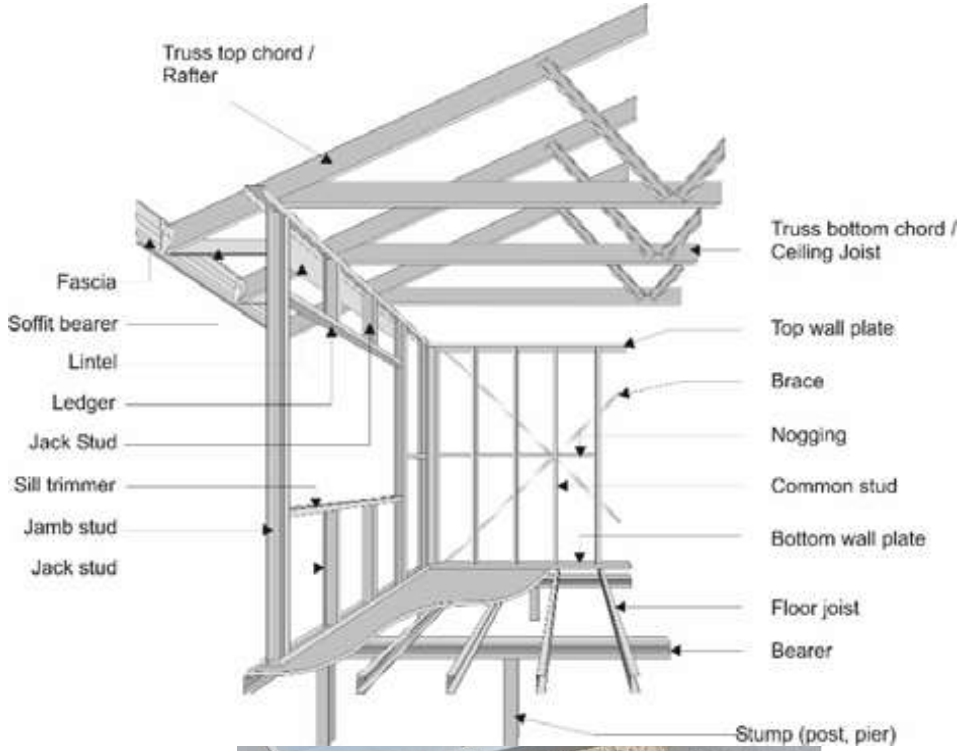
- Photos of manufacturing plant

Wall Frame

- Factory finished custom designed cold form Light Gauge Steel Framed structure comprising of steel wall panel, trusses, purlins etc are manufactured out of minimum 0.75 mm thick steel sheet as per design requirements.
- The steel sheet shall be galvanized (AZ-150 gms Aluminium Zinc Alloy coated steel having yield strength 300- 550 Mpa) conforming to AISI specifications and IBC 2009 for cold formed steel framing and construction.
- IS 800-2007 (Code of practice for general construction in steel) and IS: 801- 1975 (Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members In General Building Construction.

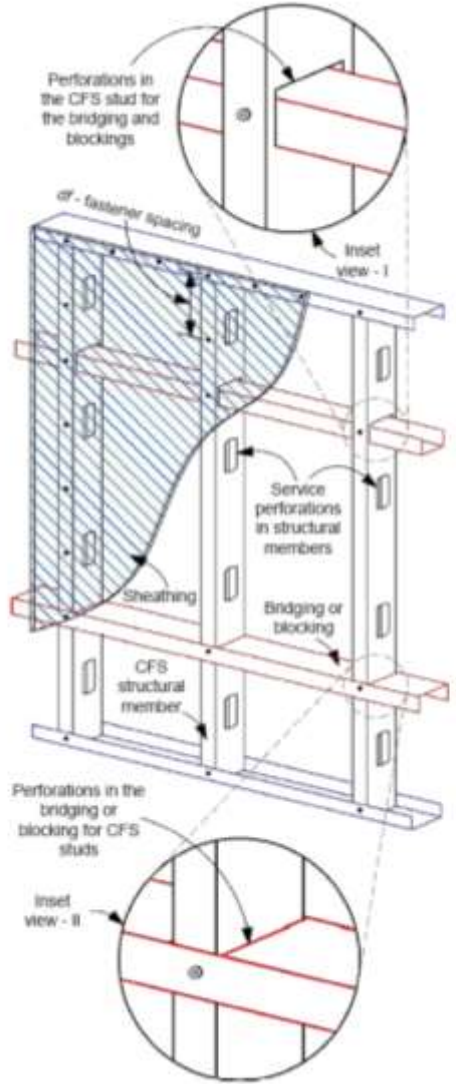
Wall Frame…contd.

- The framing section shall be cold form C-type having minimum web depth 89 mm x 39mm flange x 11mm lip in required length as per structural design
- Duly punched with dimple/slot at required locations as per approved drawings.
- The slots will be along centre line of webs and shall be spaced minimum 250mm away from both ends of the member.
- The frame can be supplied in panel form or knock down condition in specific dimensions and fastened with screws extending through the steel beyond by minimum of three exposed threads.
- All self drilling tapping screws for joining the members shall have a Type II coating in accordance with ASTM B633(13) or equivalent corrosion protection of gauge 10 & 12, TPI 16 & 8 of length 20mm.
- The frames shall be fixed to RCC slab or Tie beam over Neoprene rubber using self expanding carbon steel anchor bolt of dia as per approved drawings, design subject to minimum 12mm diameter and 121mm length conforming to AISI 304 and 316 at 500mm c/c with minimum embedment of 100mm in RCC and located not more than 300mm from corners or termination of bottom tracks complete in all respects.



Wall Frame…contd.

- Fasteners and Connectors
  - ***Frame assembly screws:*** Shall be galvanized steel screws self-drilling type of size 10 x 25 mm having Truss-head and shall be as per ASTM C 1513-10.
  - ***Wall Erection Screws:*** Shall be galvanized steel screws self-drilling type of size 8 x 25 mm having Hex Washer head and shall be as per ASTM C 1513-10.
  - ***Precast Concrete Panels Fixing Screws***: Shall be of galvanized steel screws self-drilling type of size 8 x 50 mm having CS head and shall be as per ASTM C 1513-10.
  - ***Wall and Foundation Anchor Bolt***: Shall be of high tensile galvanized steel of size 10 x 100 mm/ 10 x 150 mm and 12 x 100 mm/ 12 x 150 mm and shall be as per ASTM C 1513-10.



Cold-formed steel structural members with perforations (service openings and opening for continuity members)

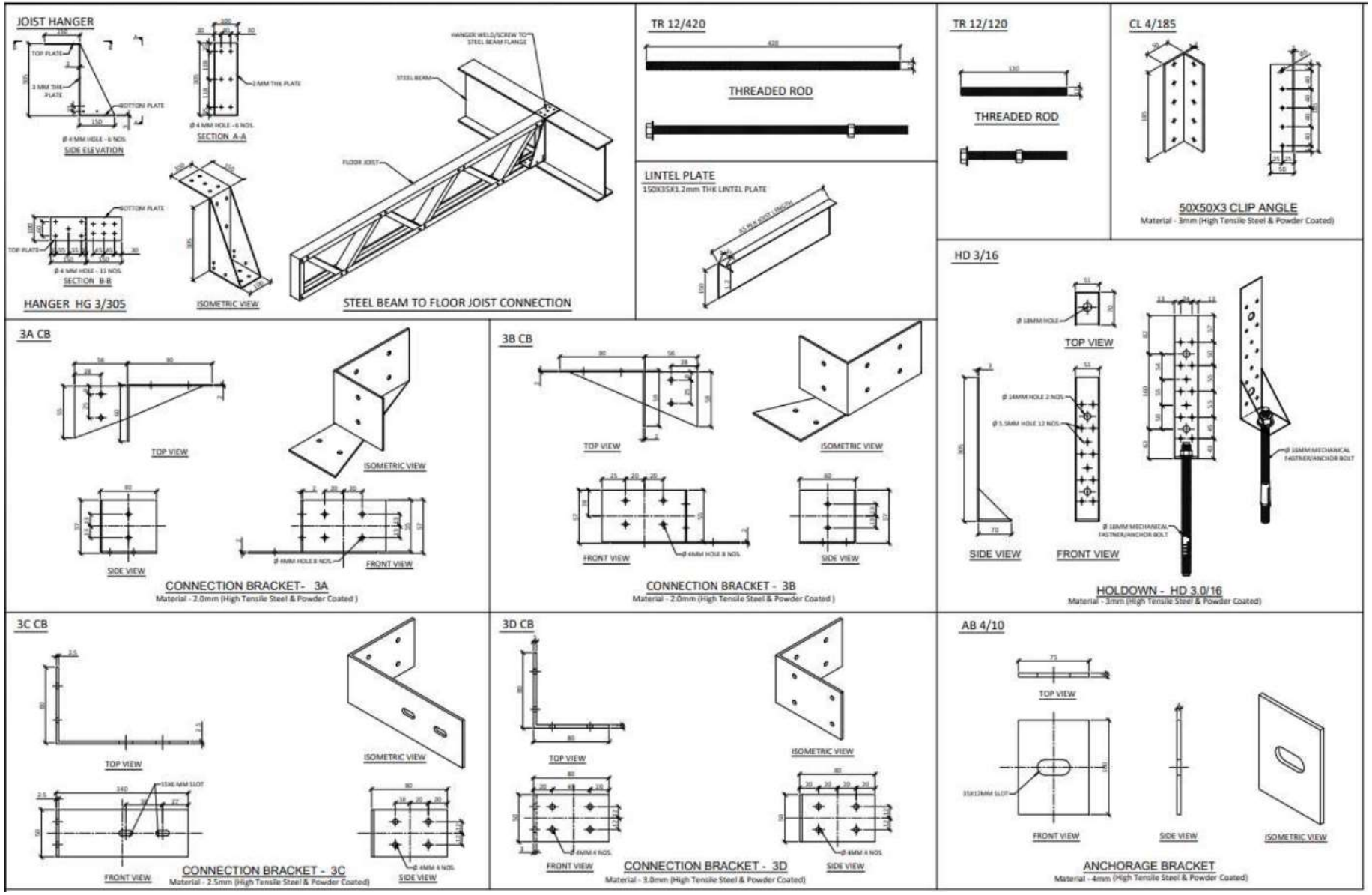
Wall Frame…contd.

- Cladding of LGSF Panels
  - 20mm thick Precast Concrete (M20) Panels (PCP) are used as facing sheets for construction of walls on both sides. Metal moulds, concrete mixing machine and vibration tables are used for manufacturing the panels at onsite or offsite.
  - The panels are designed to withstand the concrete weight pumped in between the gap of the panels without failure and buckling.
  - The steel reinforced precast concrete panels (PCP), has one side rough surface and the other side smooth surface. The PCP's are fixed on either side of Light Gauge Steel Frame Structures (LGSFS) with studs and tracks using mechanical fasteners. While fixing, the rough side of the panels are facing inside and smooth side is facing outside. Each PCP is fixed with 6 screws.
  - Light weight concrete is pumped in to the gap between two PCPs. The concrete bonds with the rough surface of the panels. Thus, the LGSFS and PCPs are firmly joined to make a monolithic steel–concrete structure.

Wall Frame…contd.

- Core of wall panels
  - The concrete used for infill wall is light weight and free flow.
  - The density shall be 1500-1800 Kg/m^3 after adding/mixing foam or EPS beads as per the design mix. The light weight concrete shall be of grade M5 to M10 as required.
  - The light weight concrete shall be mixed and used at site.

- Structural connections of LGSF panels



Advantages

- Due to light weight, significant reduction in design earthquake forces is achieved. Making it safer compared to other structures.
- Fully integrated computerised manufacturing of LGSF sections provide very high precision & accuracy.
- Speedier
- Structure being light, does not require heavy foundation
- Structural elements can be transported to any place including hilly areas/ remote places easily
- Structure can be shifted from one location to other with minimum wastage of materials.
- Steel used can be recycled multiple times
- The system is very useful for post disaster rehabilitation work.

Essential Requirements

- The labours are required to be trained for fabrication/assembly works
- Plumbing & electrical services need to be pre-planned.
- Door and Window position shall not be changed after pouring of light weight concrete.
- Erection of panels shall be under supervision of trained staff.
- Post construction alteration is difficult.
- Proper care should be taken for fixing of tiles on the walls.
- Electrical cables need to be properly insulated with mini circuit breakers.

Being first time mass scale field implementation of new technology

the Light House Project at Agartala is on

Design & Build Basis

Technology Provider and Construction Agency:

M/s Mitsumi Housing Pvt. Ltd., Ahmedabad

Design Basis

- Structural Frame as RC Steel Hybrid structure
  - Sub-structure up to the plinth level in RCC
  - Superstructure is wall using HR Steel built-up I sections with lift and staircase wells in RCC as shear wall
- Vertical Safe Design Load: 70 MT, Lateral Safe Design Load: 2.2MT
- Pile foundation as per IS-2911(Part1):2010
- Raft foundation as per IS-2950 (Part-1)-1981 (reaffirmed 2008)
- Wind speed: Very high damage risk zone with basic wind speed (V_b=55m/sec)
- Design wind speed:

  $V_z=V_b.k_1.k_2.k_3.k_4$

  k_1 (Risk Coefficient)=1

  k_2 (Size factor)=as per height

  k_3 (topography factor)=1

  k_4 (importance factor)=1
- Wind Pressure (P_z) = $0.6.Vz^2$
- Wind pressure is converted into design wind pressure and then distributed at each storey as wind force.

Design Basis

- Earthquake : Zone-V as per Seismic Zoning Map of India IS: 1893 (Part-1):2016
  - Designed as ductile RC structural walls and few special moment resisting frames in structural steel in both direction, as per Table 9 (iv) (d) of IS 1893 (Part I): 2016.
  - Zone factor 0.36 (As per Table 3-IS:1893-2016), Importance factor 1.2 (As per Table 8-IS:1893-2016), Response Reduction Factor 5 (As per Table 7-IS:1893-2016) and Damping Ratio 5%.
  - Design Horizontal Seismic Coefficient (A_h)

$$A_h=(Z/2).(S_a/g).(I/R)$$

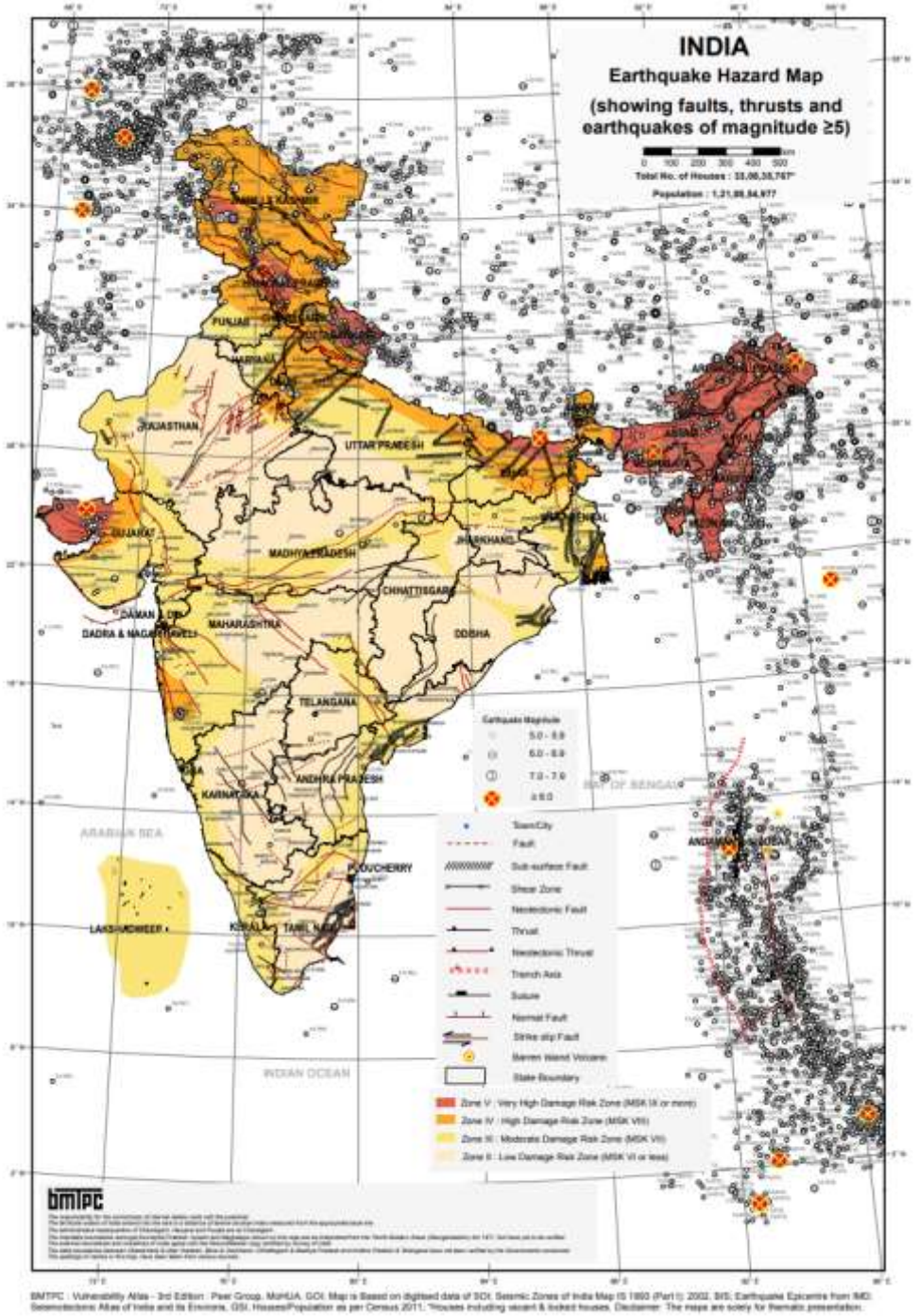
S_a/g is design acceleration coefficient for different soil types corresponding to natural period (T) of building

  - Design Lateral Force (V_B)

$$V_B=A_h.W$$

W is seismic weight of building

  - Linear dynamic analysis has been done to obtain the design lateral forces
  - Steel columns fixed for moment frames and pinned for ordinary frames at top of RC pedestal and support reaction at the location for sub-structure design. Some columns – beams frames as rigid joint frames to cater lateral loads in addition to gravity loads and other as pinned jointed frames to cater gravity loads only.
  - Rigid diaphragms in horizontal direction at floor levels as per Cl.7.6.4 of IS:1893(Part-1):2016.
- Design has been carried out as per IS 456-2000, IS 800-2007 and NBC-2016.



Design Standards

Loads

Is:875 (part-1)-1987 (reaffirmed 2018)	Code of practice for design loads (other than earthquake)for buildings and structures part 1 dead loads - unit weights of building material and stored materials (incorporating is:1911-1967)
Is 875 : part 2 : 1987 (reaffirmed 2018)	Code of practice for design loads (other than earthquake) for buildings and structures: part 2 imposed loads
Is 875 : part 3 : 2015	Design loads (other than earthquake) for buildings and structures - code of practice - part 3 wind loads
Is 1893: part 1 : 2016	Criteria for earthquake resistant design of structures - part 1 : general provisions and buildings

Design Standards

Structural Steel

Is 800 : 2007 (reaffirmed 2017)	General construction in steel - code of practice
Is 801 : 1975 (reaffirmed 2016)	Code of practice for use of cold formed light gauge steel structural members in general building construction
Is 806 : 1968 (reaffirmed 2017)	Code of practice for use of steel tubes in general building construction
Is 808 : 1989 (reaffirmed 2014)	Dimensions for hot rolled steel beam, column, channel and angle sections
Is 813 : 1986	Scheme of symbols for welding
18: 816-1969 (REAFFIRMED 1969)	CODE OF PRACTICE FOR USE OF METAL ARC WELDING FOR GENERAL CONSTRUCTION IN MILD STEEL
Is 1161:2014	Steel tubes for structural purposes
Is 2062:2011	Hot rolled medium and high tensile structural steel
Is 4000 : 1992 (reaffirmed 2017)	Code of practice for high strength bolts in steel structures
Is 4923:2017	Hollow steel sections for structural use — specification (second revision)
Is 11384 : 1985 (reaffirmed 2017)	Code of practice for composite construction in structural steel and concrete

Design Standards

RCC

Is 456 : 2000 (reaffirmed 2016)	Plain and reinforced concrete - code of practice
Is 3370 : part 1 : 2009 (reaffirmed 2019)	Concrete structures for storage of liquids - code of practice - part 1 : general requirements
Is 3370 : part 2 : 2009 (reaffirmed 2019)	Concrete structures for storage of liquids - code of practice - part 2 : reinforced concrete structures
Is 4326 : 2013 (reaffirmed 2018)	Earthquake resistant design and construction of buildings - code of practice
Is 5525 : 1969 (reaffirmed 2018)	Recommendations for detailing of reinforcement in reinforced concrete works
Is 1786 : 2008 (reaffirmed 2018)	High strength deformed steel bars and wires for concrete reinforcement - specification
Is 10262 : 2019	Concrete mix proportioning-guidelines
Is 13920 : 2016	Ductile detailing of reinforced concrete structures subjected to seismic forces - code of practice

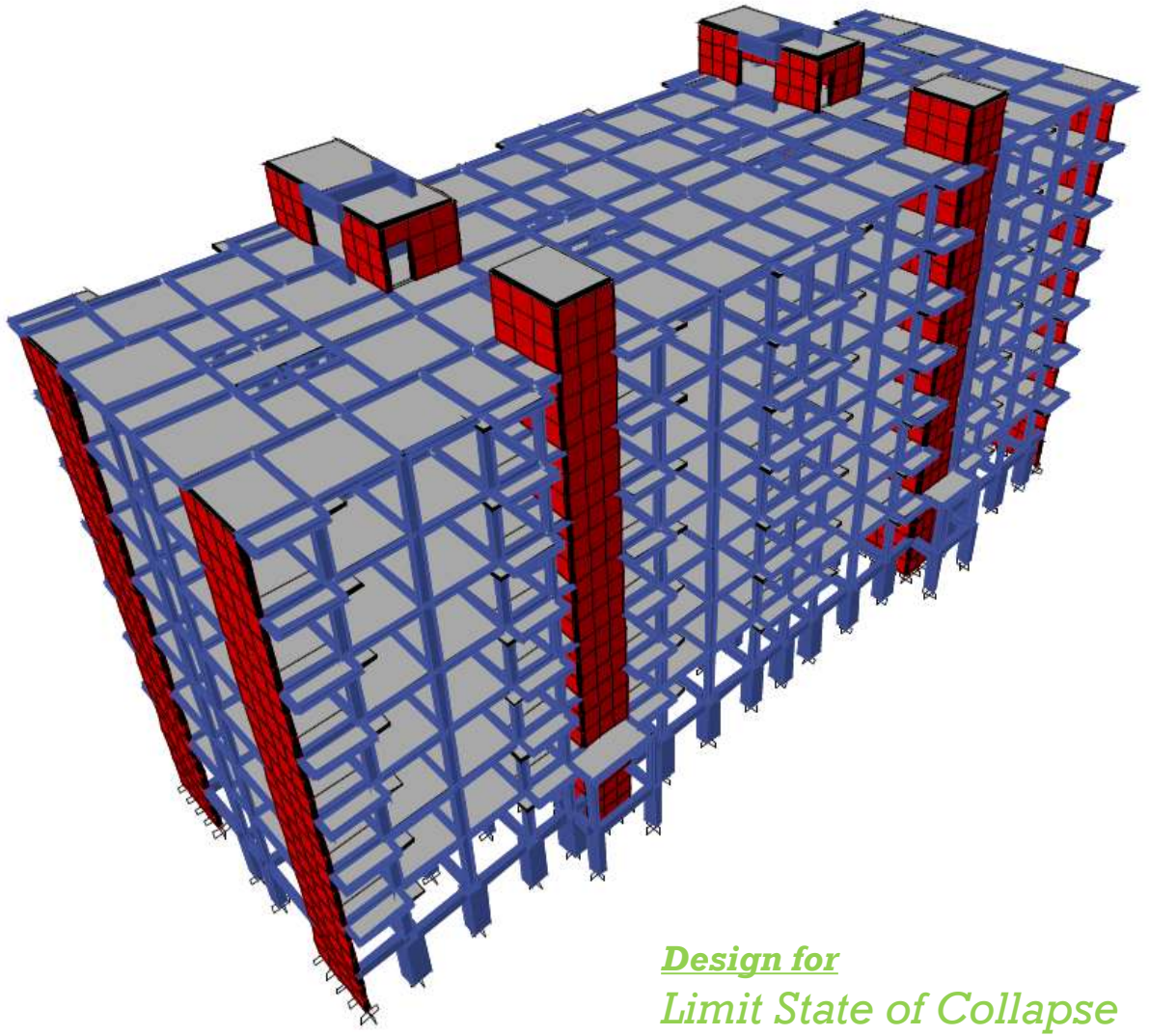
Design Standards

Foundation

Is 1080 : 1985 (reaffirmed 2016)	Code of practice for design and construction of shallow foundations om soils (other than raft, ring and shell)
Is 1904 : 1986 (reaffirmed 2015)	Code of practice for design and construction of foundations in soils: general requirements
Is 2950 : part 1 : 1981 (reaffirmed 2018)	Code of practice for design and construction of raft foundations - part 1 : design
IS 2911 (Part 1& 4) : 2013	Design and construction of pile foundations — code of practice
Is 2974 : part 5 : 1987 (reaffirmed 2018)	Code of practice for design and construction of machine: foundations part 5 foundations for impact machines other than hammers (forging and stamping press, pig breakers, drop crusher and jolter)
Is 8009 : part 2 : 1980 (reaffirmed 2015)	Code of practice for calculation of settlement of foundations: part 2 deep foundations subjected to symmetrical static vertical loading

STRUCTURAL ANALYSIS & DESIGN

- 3D Model of typical tower with PEB Structure



- Load Combinations :
  - 1.5 (DL+LL)
  - 1.2 (DL+LL±EL/WL)
  - 1.5 (DL±EL/WL)
  - 0.9DL ±1.5EL/WL

(EL/WL implies Earthquake/Wind Load in +X, -X, +Y, and –Y, directions . Lateral forces shall be considered acting from all directions but one at a time.)

- Steel structural system can be easily modeled in the CAD software such as STAADPRO, ETABS, SAFE, SAP, ABACAS and others for detailed structural analysis.
- 2D/ 3D Static and dynamic linear and non-linear analysis can be carried out using these softwares.
- The softwares can also be used for structural design as per Indian Standards.
- AUTOCAD for drawings

Design for

Limit State of Collapse

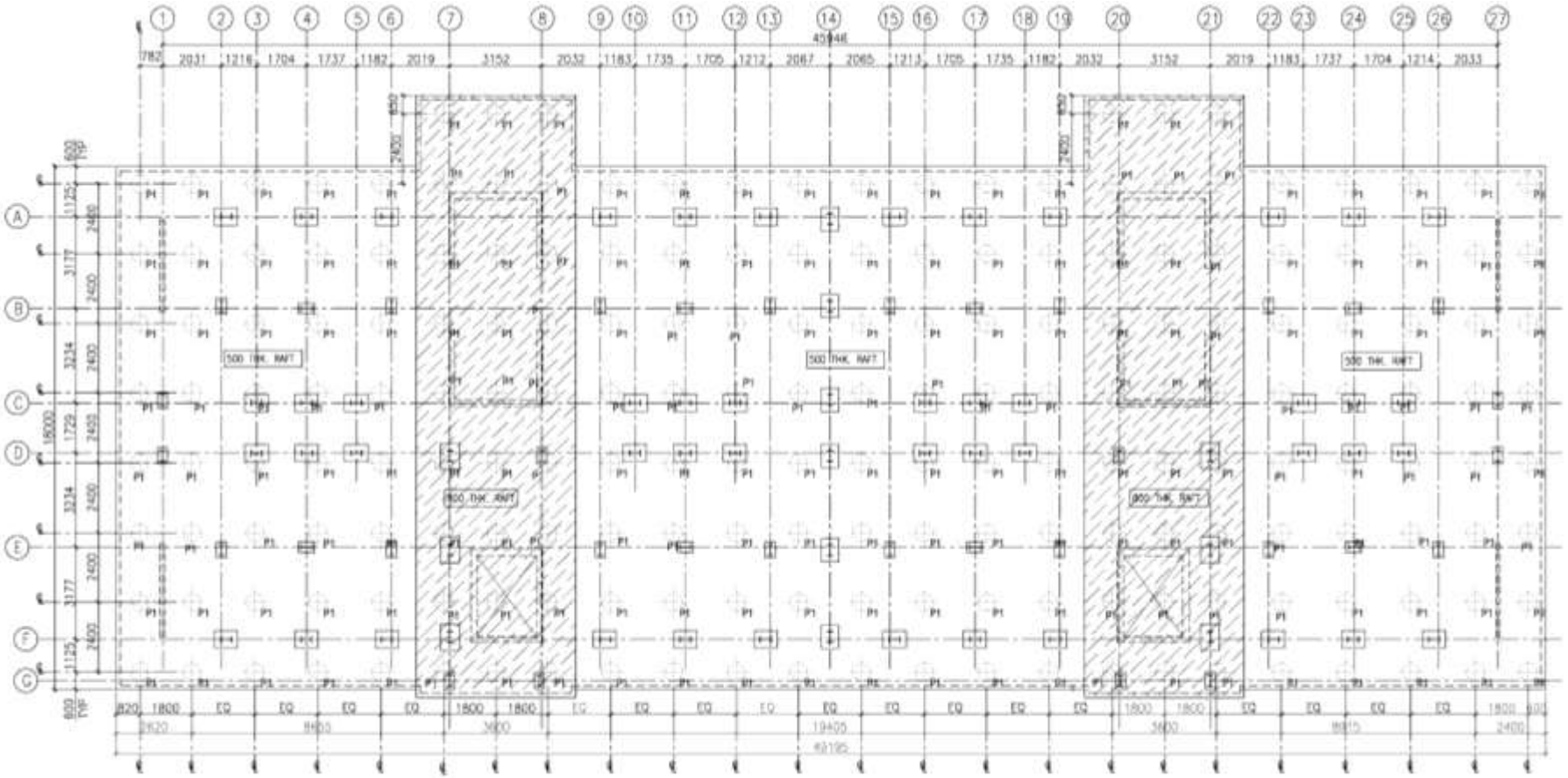
Limit State of Serviceability

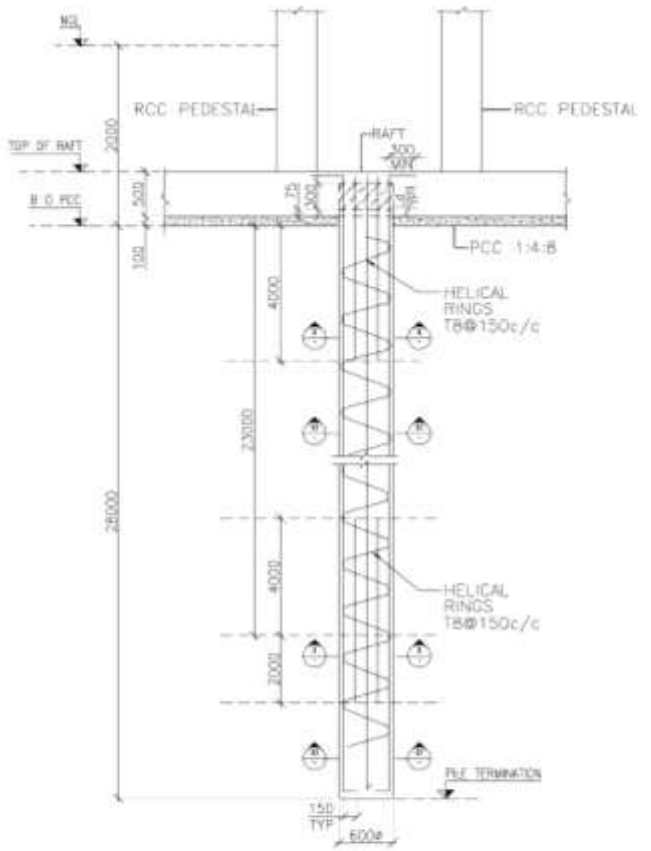
Construction Sequence

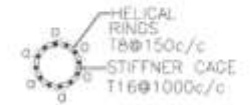
- Sub-Structure: Foundation
- Super-structure: Structural system
  Floors
  Wall Panels
- MEP: Plumbing & Electrical
- Finishing

FOUNDATION

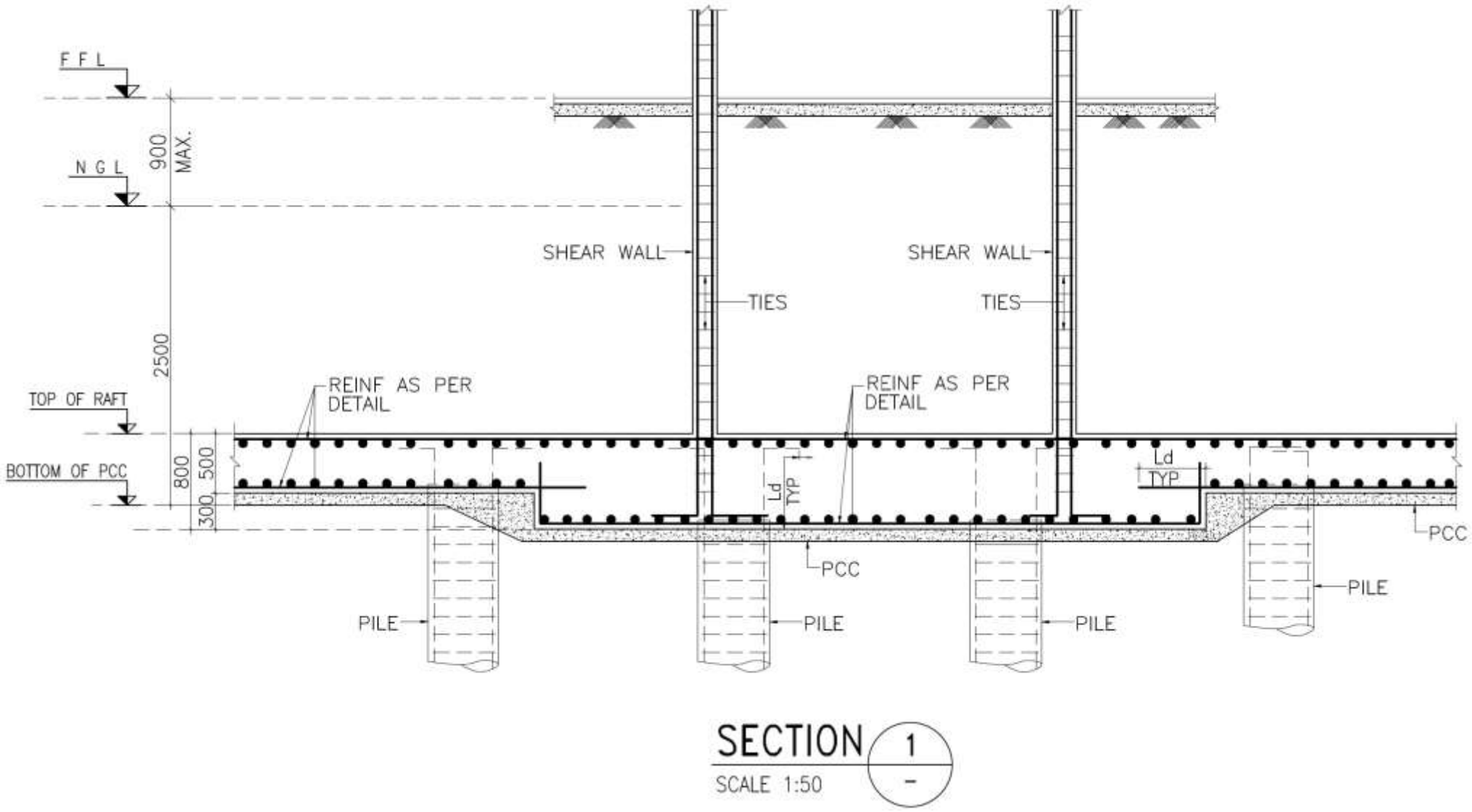
Structural Drawings





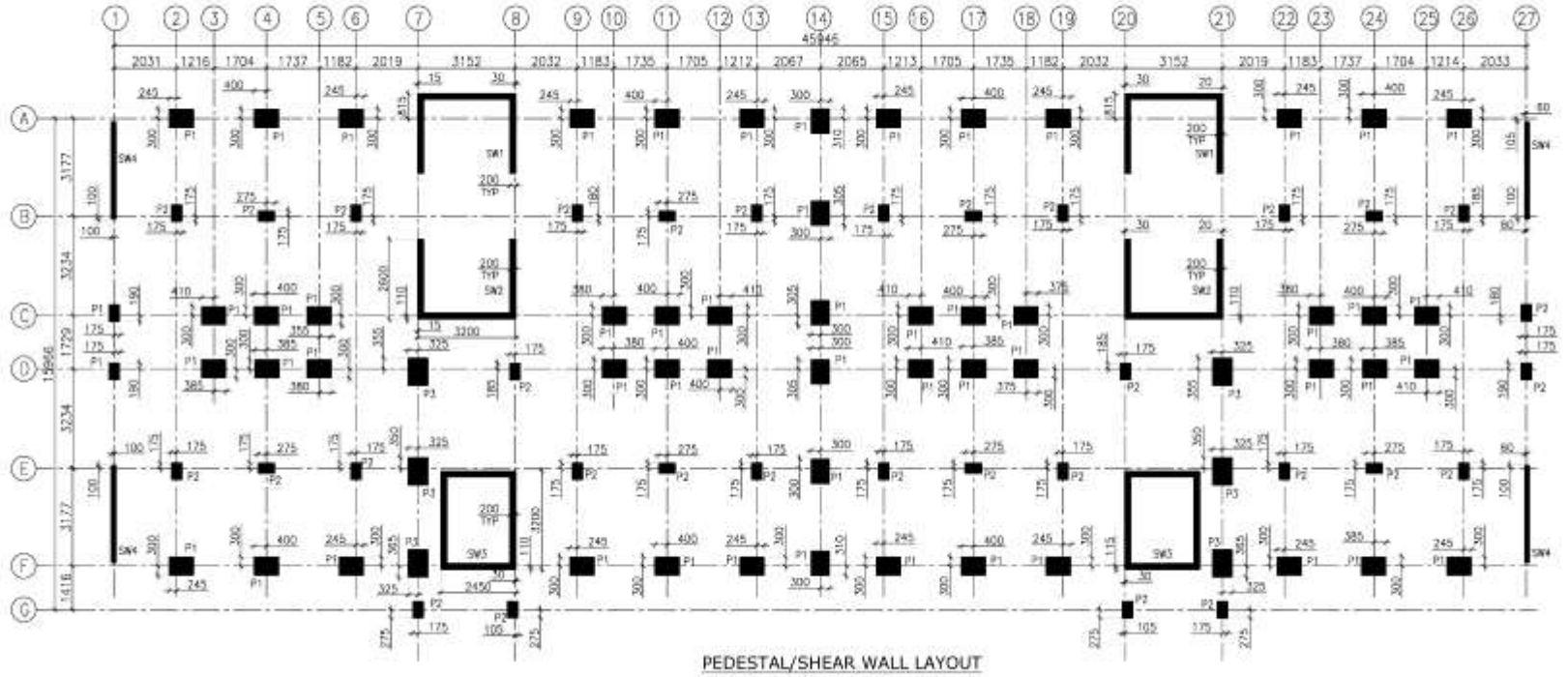


FOUNDATION



- A section showing the placing of raft on the piles.

FOUNDATION



PEDESTAL/SHEAR WALL LAYOUT

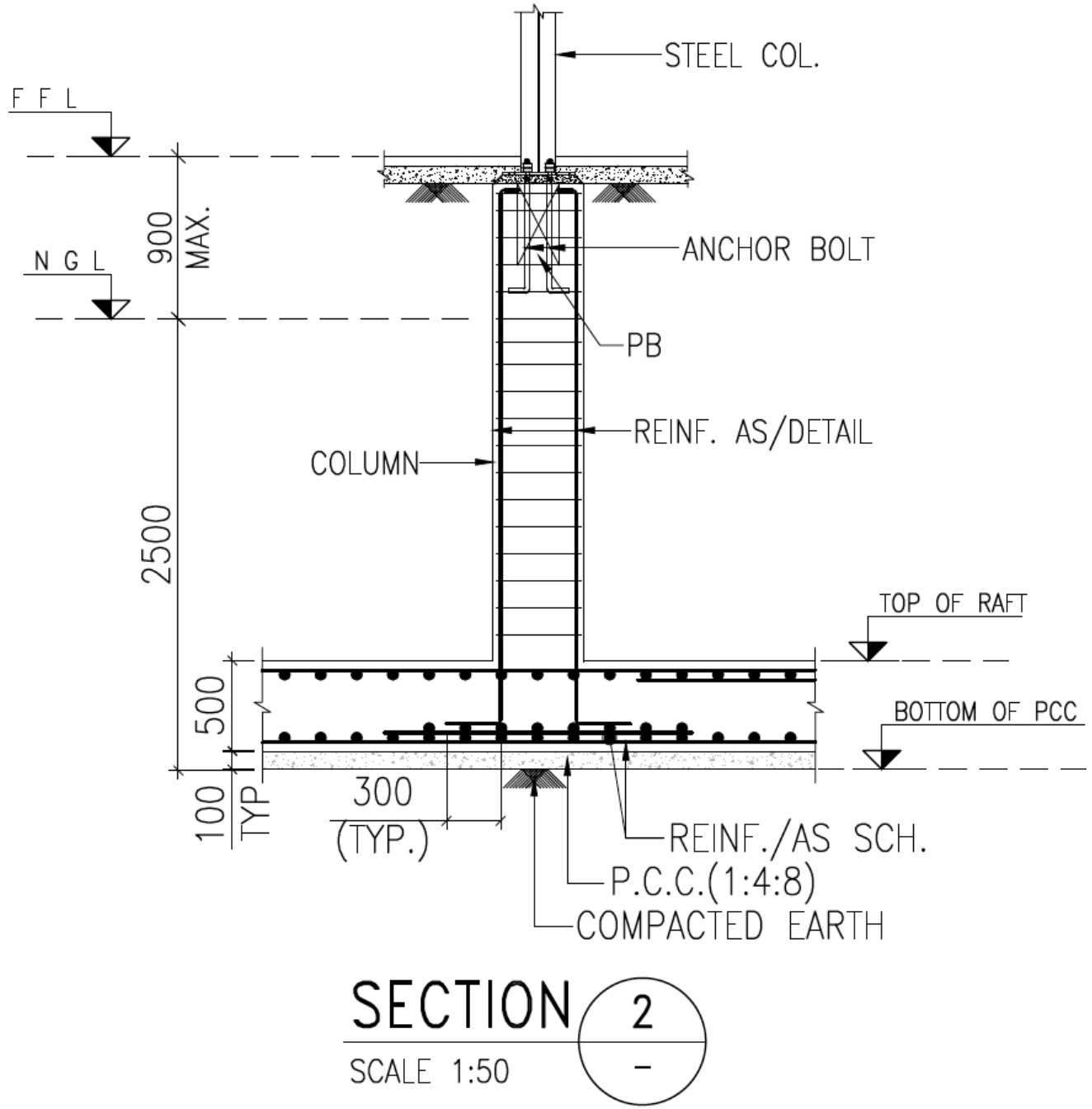
PEDESTAL SCHEDULES

FOUNDATION TO TERMINATION LVL								
	SIZE	(600x600)		(350x550)		(550x900)		
	MAIN REINF	16-T16(c)+ 08-T12		04-T16(c)+ 08-T12		26-T16		
	TIES SET	6/SETS (w+2x+3y)		3/SETS (w+2x+3y)		7/SETS (w+2x+3y+r)		
	TIES SET	①		②		①		
	CONC. MIX	M25		M25		M25		
PEDESTAL MKD.		P1		P2			P3	

TIES SCHEDULE			
		TIE GROUP ①	TIE GROUP ②
ZONE-A	OUTER	T8@75c/c	T8@75c/c
	INNER	T8@75c/c	T8@75c/c
ZONE-B	OUTER	T8@200c/c	T8@175c/c
	INNER	T8@200c/c	T8@175c/c

- The RCC raft is casted on the piles. Then concrete pedestal are casted in M25 concrete.

FOUNDATION



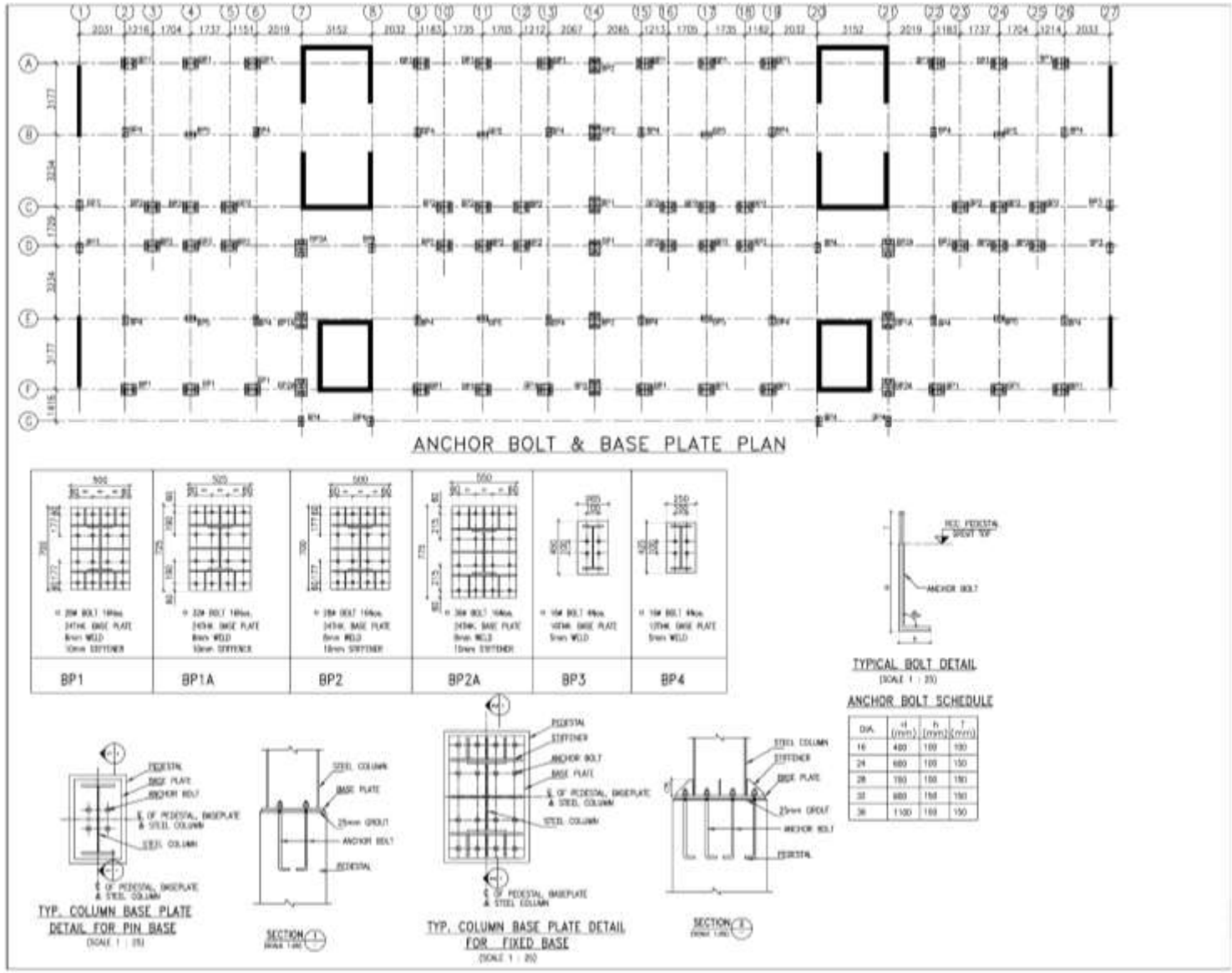
- A section of the foundation showing the raft, concrete pedestal, location of the anchor bolts & base plate and steel column in super-structure.

FOUNDATION

- Fixing of anchor bolts with templates over which factory made built up columns with base plate will be erected.

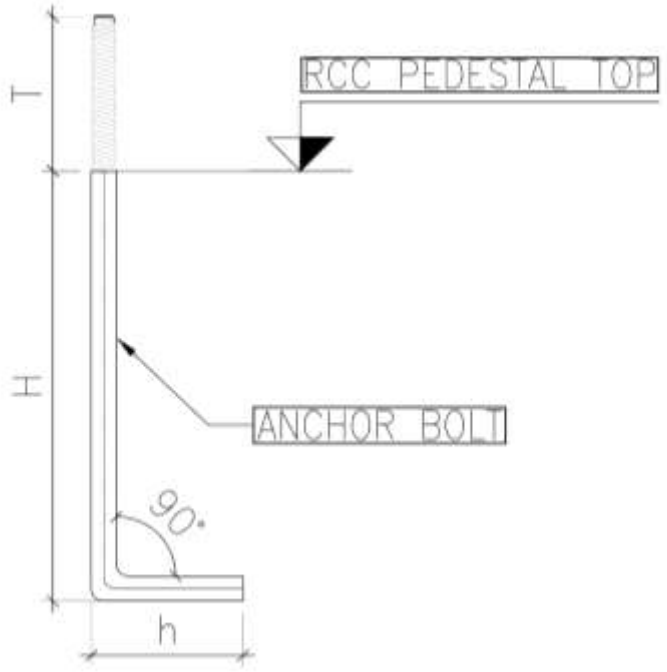
FOUNDATION

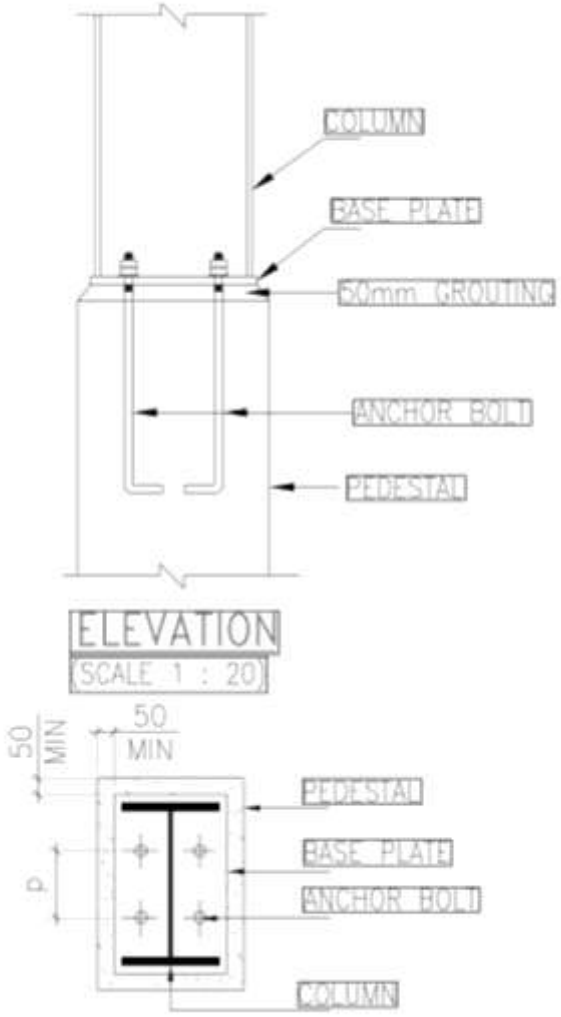
Anchor Bolt & Base Plate Plan



FOUNDATION

- Connection details of built up steel column at plinth level (Stilt) with foundation (plinth beam)





Dia (mm)	H (mm)	h (mm)	T (mm)
16	400	100	100
24	500	100	150
28	700	100	150
32	900	150	150
36	1100	150	150

Anchor bolt schedule

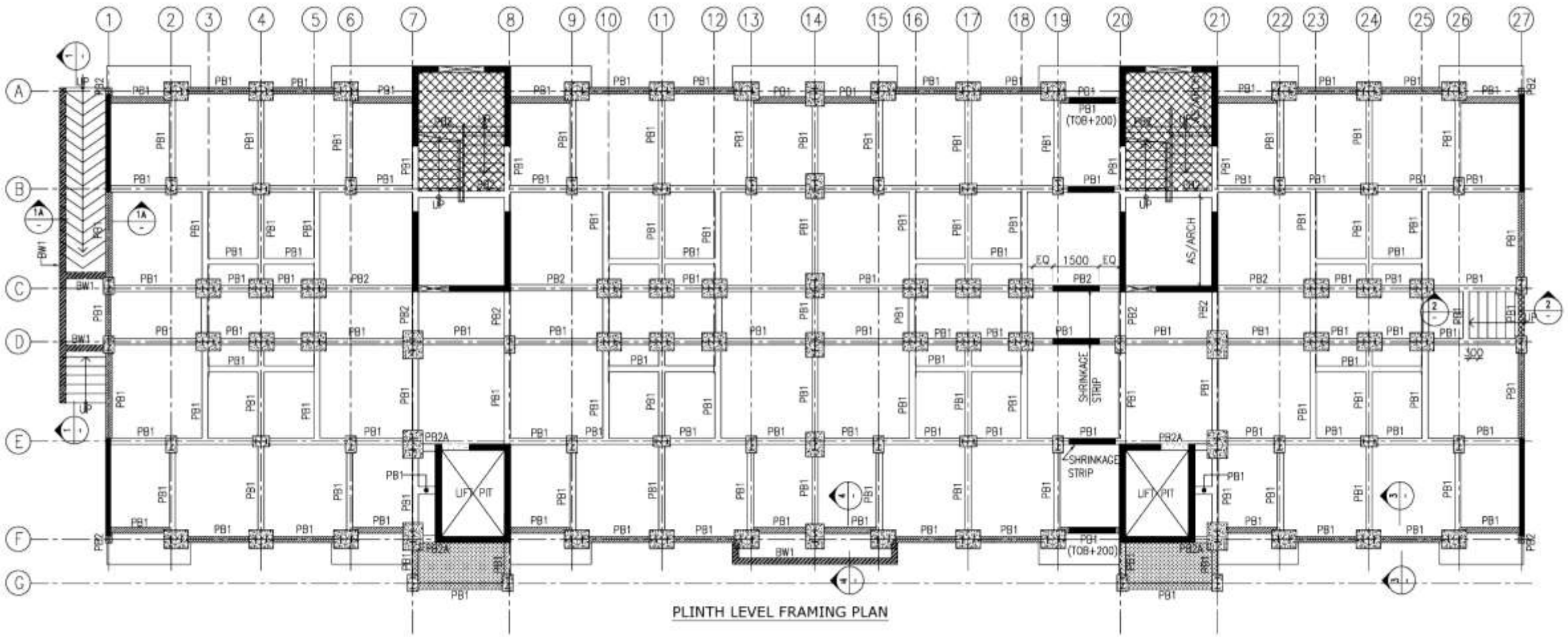
a) Typical anchor bolt detail

Anchor bolt is inserted below plinth level upto height H and projected above plinth up to height T

b) Typical base plate detail

The built up steel I column is being fixed with anchor bolts and base plate

FOUNDATION



PLINTH LEVEL FRAMING PLAN

- On concrete pedestal, plinth beam are casted in M25 concrete and backfilling is done.

FOUNDATION

- The project starts with layout and marking of piles on field.
- After the layout at site, the boring of piles is undertaken with the help of Hydraulic Rigs. The depth of the borehole is 30m from NGL and diameter of pile is 600 mm. Total number of piles in the project is approx. 1750.

FOUNDATION

- Steel Cages with helical reinforcement are prepared at site and inserted in the pile holes.

FOUNDATION

- After flushing of bore hole with bentonite slurry, pouring of M 30 Grade concrete through trimming pipe in piles is undertaken.
- Laying of Raft in M30 concrete as per the structural design with reinforcement is to be completed in concrete above the piles.

FOUNDATION

Filing of concrete in piles

FOUNDATION

Excavation and pile head breaking

FOUNDATION

FOUNDATION

Bending of Reinforcement bars for insertion into raft

FOUNDATION

FOUNDATION

FOUNDATION

Placing of Reinforcement for raft

FOUNDATION

Placing of Reinforcement for raft

FOUNDATION

Reinforcement and casting of stub-columns on raft

FOUNDATION

Reinforcement and casting of stub-columns on raft

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Reinforcement and casting of stub-columns on raft

FOUNDATION

Reinforcement and casting of stub-columns on raft

FOUNDATION

Reinforcement for plinth beam and placing of templates for starting of PEB structure

FOUNDATION

RCC shear wall construction for lift and staircase

FOUNDATION

Fixing of foundation bolts for base plates

FOUNDATION

Concrete & Reinforcement Steel Specifications

Item	Concrete Grade
Piles, raft, shear wall	M30
Plinth beam, Grade slab, Pedestals, Water tank, Sewage Treatment Plant (STP)	M25

- Mix design for concrete and all Concrete work shall conform to IS 456-2000 & Liquid retaining structures shall conform to IS 3370:2009
- Reinforcement Steels being used is TMT bars of Fe 500 as per IS 1786-2008.

Concrete mix design M25 and M30 (IIT Delhi)

Amrit Cement

Concrete Grade	Water	Cement	Fine Aggregate		Coarse Aggregate		Plasticizer	Slump		Comp. Strength	
			Zone-IV	Zone-II	10mm	20mm		Initial	After 1 hour	7 days	28 days
M-30	165	387	217	506.4	434	651	1.25%	170	145	31.63	40.89
M-25	170	347	219.4	512	439	658	1.00%	155	120	24.52	34.52

Dalmia Cement

Concrete Grade	Water	Cement	Fine Aggregate		Coarse Aggregate		Plasticizer	Slump		Comp. Strength	
			Zone-IV	Zone-II	10mm	20mm		Initial	After 1 hour	7 days	28 days
M-30	165	387	217	506.4	434	651	1.25%	175	155	33.63	41.7
M-25	170	347	219.4	512	439	658	1.00%	150	130	23.55	33.93

28 days Target Strength:M30- 38.25MPa
28 days Target Strength: M25- 31.65MPa

Dynamic Load Test

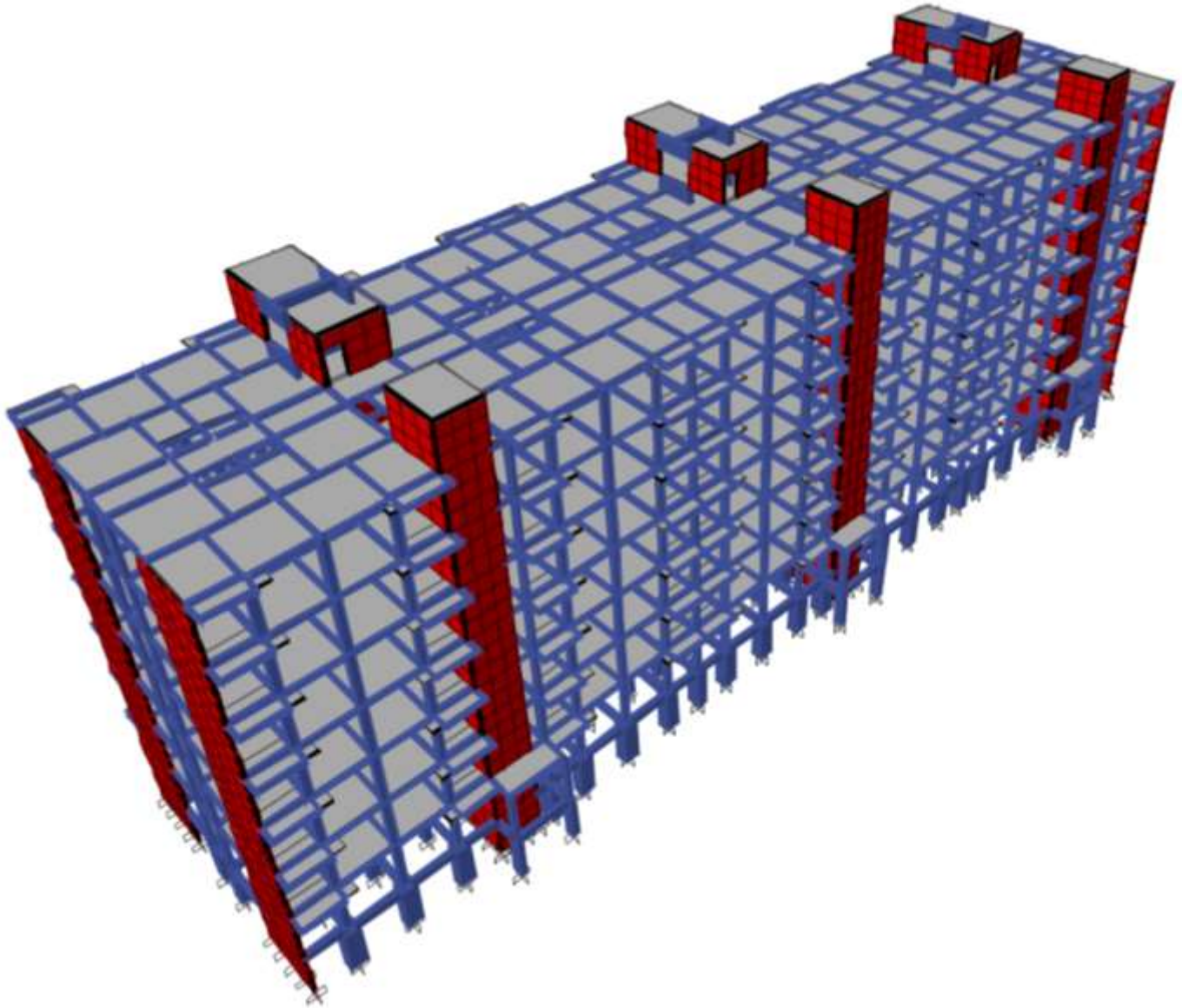
Batching Plant

To bring resource efficiency, optimization of building materials and for quality control, a computerized batching plant has been established at site.

Concrete Testing

Quality control and quality assurance is essential for a project and therefore a quality control lab has been established at site for testing of raw materials and finished products.

STRUCTURAL SYSTEM

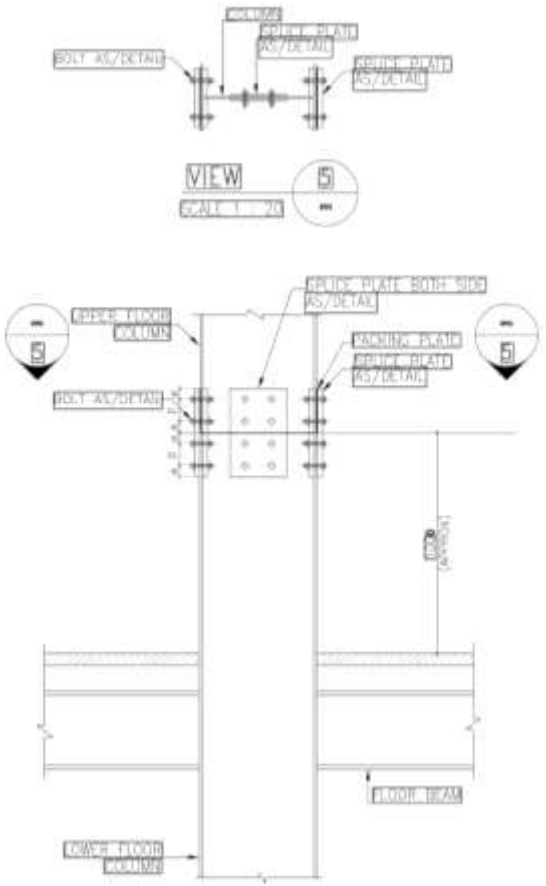


In the present lecture, the structural system and other details are being explained through drawings, sketches and text.

The work on super-structure is yet to start and actual on-ground picture will be covered subsequently.

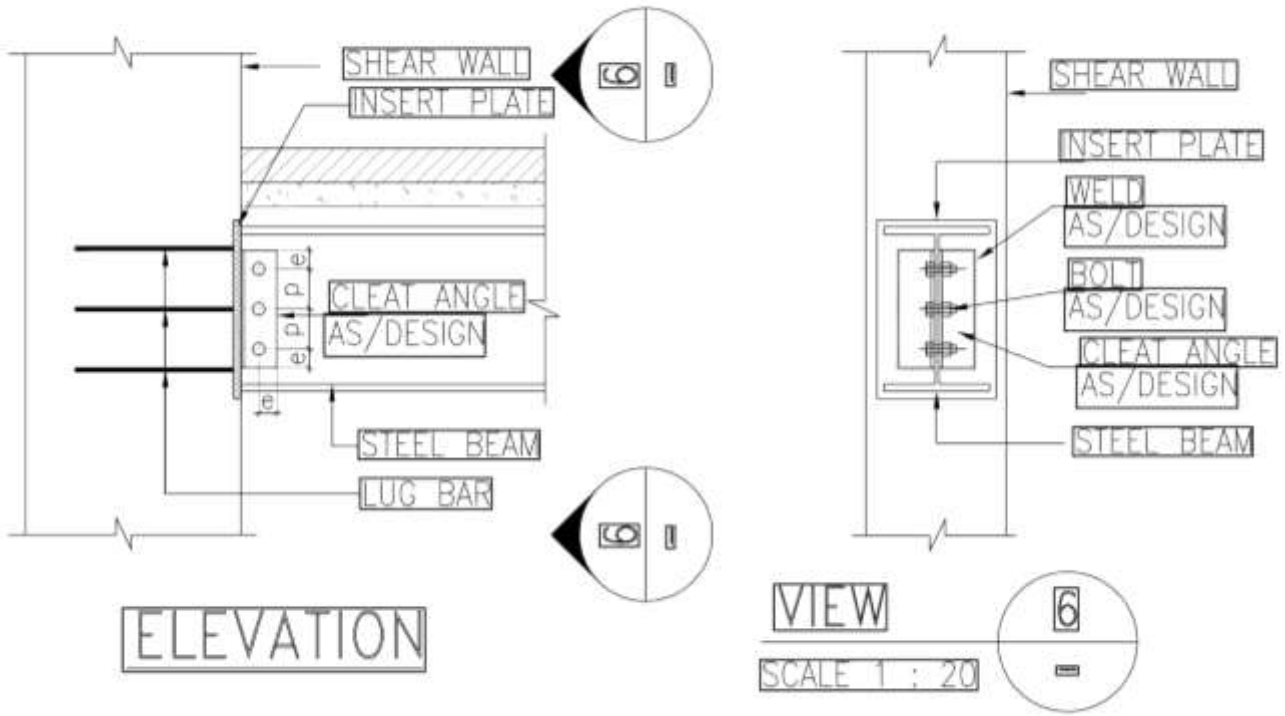
STRUCTURAL SYSTEM

- Column-Column Connections



a) Column Splice detail

Columns are being spliced through nut & bolts connection along with plates both in web and flange portion



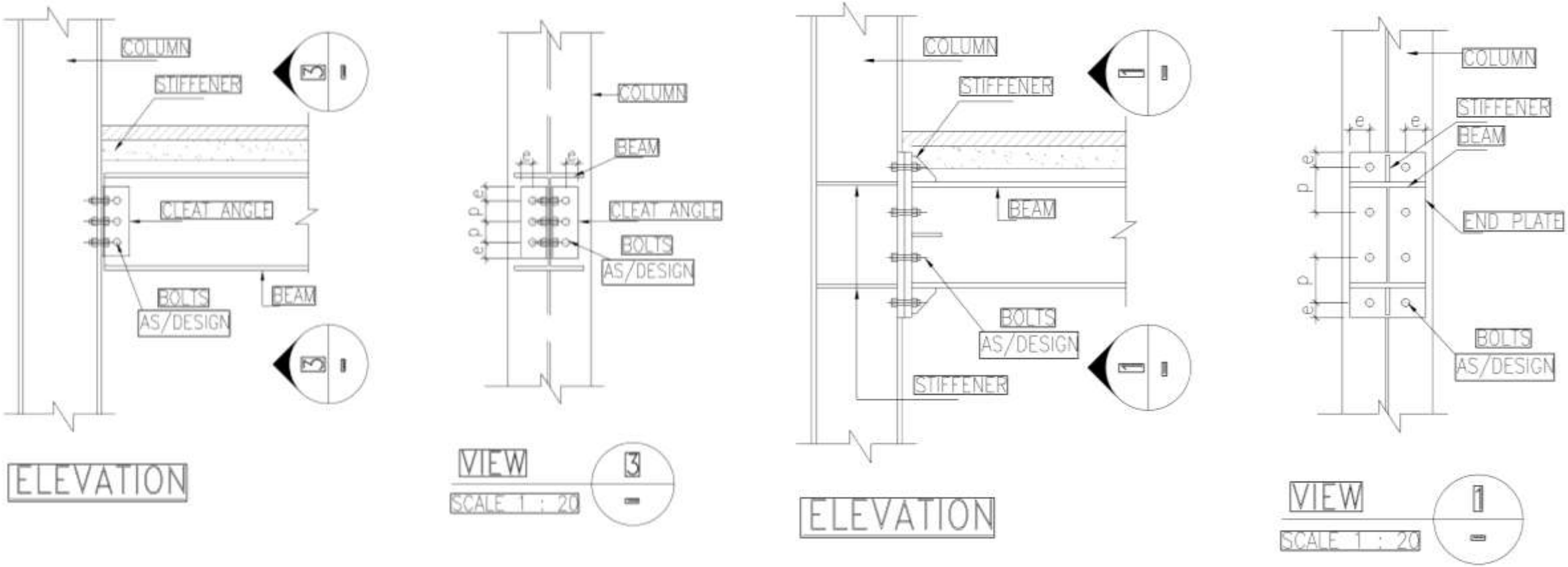
b) Shear wall to steel beam connection

Insert plate along with lug bar are cast during the casting of shear walls and steel beam is connected to the wall with bolted connection through insert plate

A typical length of column being fabricated for the project is of 6m.

STRUCTURAL SYSTEM

- Typical beam column shear and moment connections



a) Typical beam to column flange shear connection

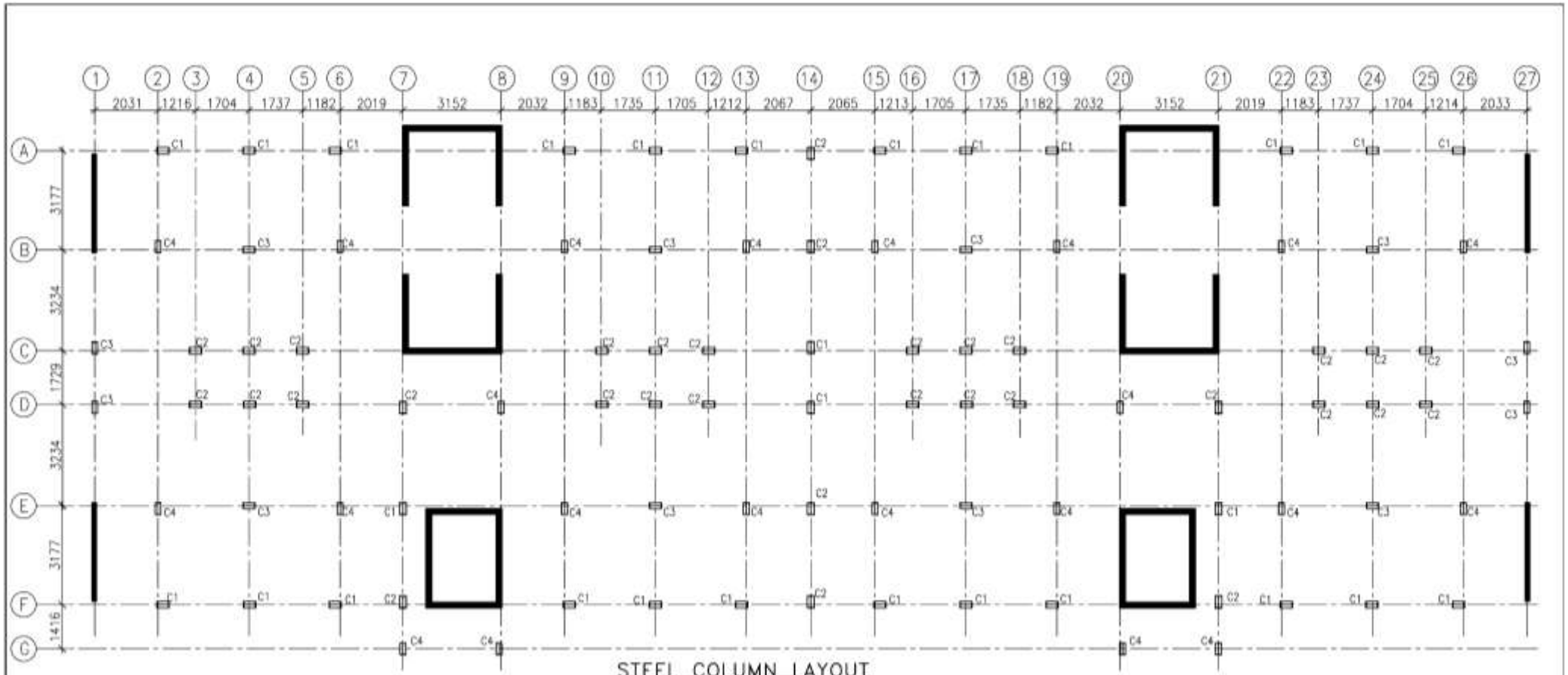
Steel beam is being connected to the column through cleat angle connected to the web portion of beam

b) Typical beam to column flange moment connection

The steel beam is being connected to column through plates on flange & web portion

STRUCTURAL SYSTEM

- Steel column layout in superstructure



STEEL COLUMN LAYOUT

STEEL COLUMN SCHEDULE

COLUMN MKG.	GR TO 2nd FLOOR		2nd TO 4th FLOOR		4TH TO TERMINATION	
	WEB	FLANGE	WEB	FLANGE	WEB	FLANGE
C1	350x10	200x16	350x10	200x16	350x10	200x16
C2	350x10	200x16	350x10	175x16	350x8	175x16
C3	350x8	175x12	350x8	175x10	350x6	175x10
C4	350x8	175x10	350x6	175x10	350x6	175x10

STRUCTURAL SYSTEM

RCC shear wall in super structure

STRUCTURAL SYSTEM

Erection of PEB structure

STRUCTURAL SYSTEM

Erection of steel columns & beams

STRUCTURAL SYSTEM

Erection of steel columns & beams

STRUCTURAL SYSTEM

Erection of LGSF wall panels

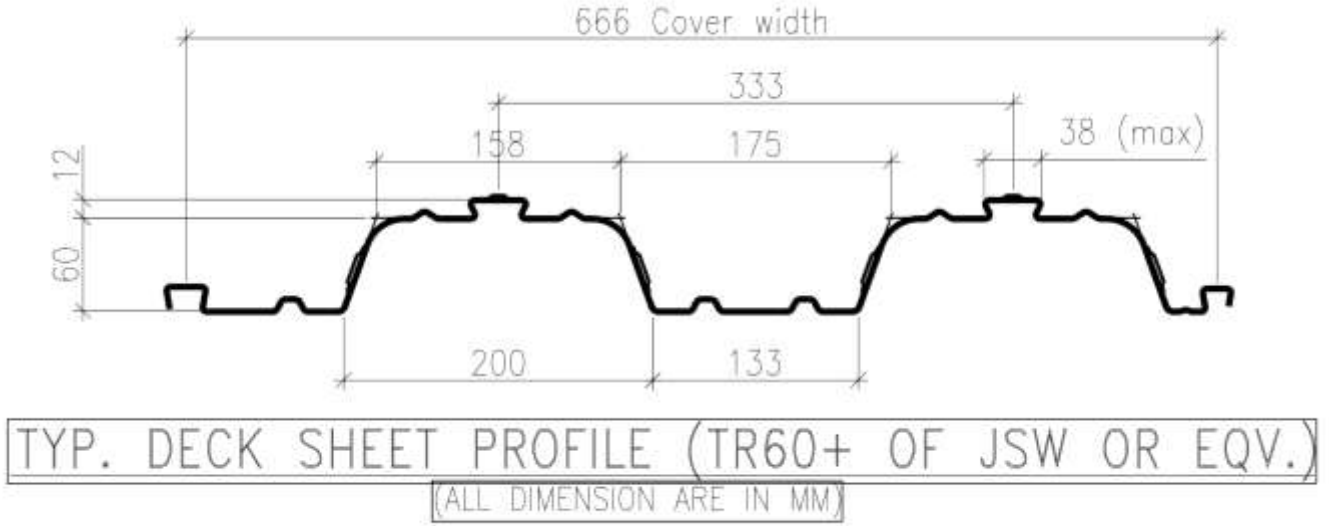
STRUCTURAL SYSTEM

Erection of LGSF wall panels

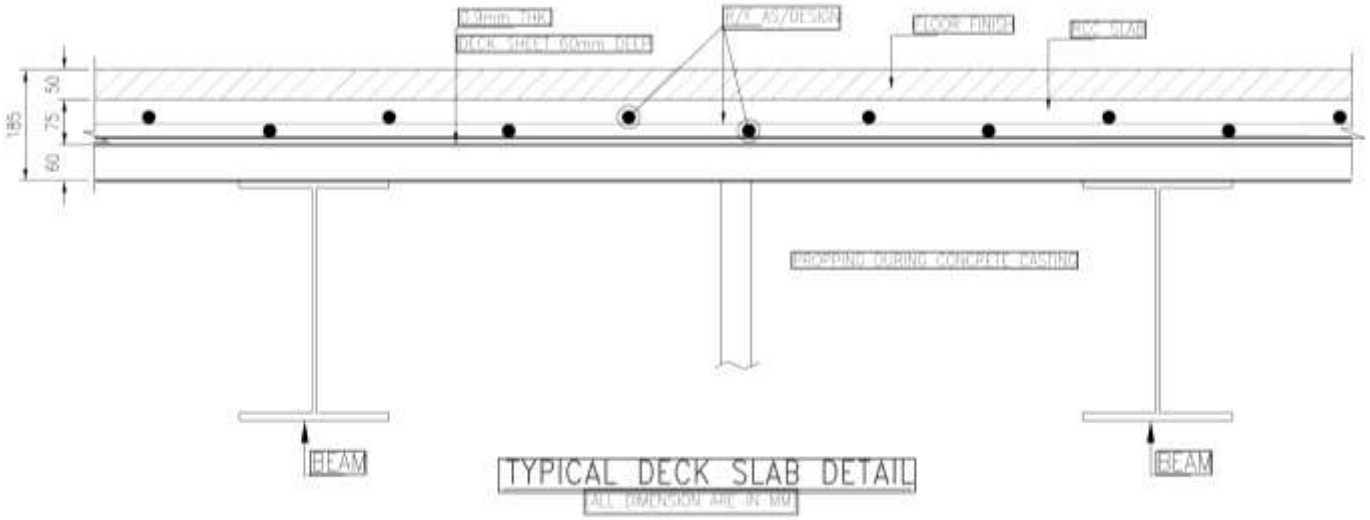
FLOORS

- Floor slab details : Deck slab

- After erection of steel beams and column (PEB Structure), steel deck sheet of thickness 0.9 mm are placed with required bearing on the beams.
- Concrete screed of 75 mm is poured on the deck sheet in M25 with reinforcement as per structural design.
- Structural design for reinforcement is as per IS 456-2000.
- Generally, nominal reinforcement is provided in concrete screed of deck slab to take care of shrinkage & cracking.



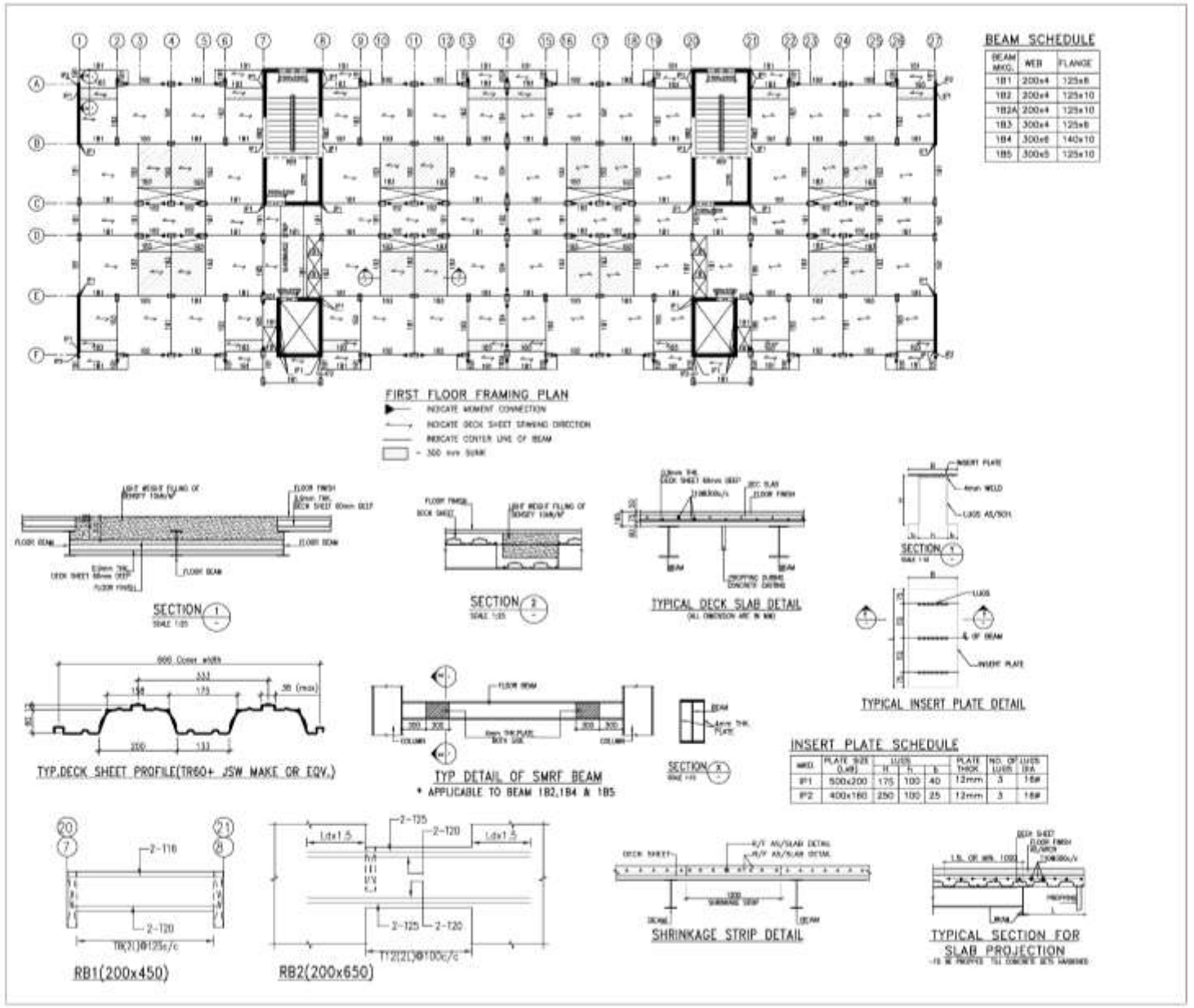
a) Typical deck sheet profile



b) typical deck slab detail

FLOORS

- Typical Floor Framing Plan



Placing of deck slab and reinforcement


Screed concrete on deck slab

WALL PANELS

Construction & Installation Process with LGSF

Construction is done in a following sequential manner:

1. Transportation of LGSF and Steel Sections as per the design to the site.
2. Erection of built up sections for structural frames on RCC foundations using cranes and connections as designed (connection details already explained)
3. Installation of decking sheets on structural frame at floor level followed by pouring of concrete screed with nominal reinforcement.
4. Fabrication of LGSF frames with the connecting screws at site as per design.
5. The wall position shall be marked on the floor and the wall structure placed on the marking. After completing the same, straightness, square and the levels shall be checked by magnetic spirit level. The bottom track shall then be connected with the floor using anchor bolts at the required spacing.
6. The precast concrete panels shall be fixed on the LGSF wall structure on studs and tracks by using metal screws. The panels shall be fixed first on the outer side of the LGSFS wall. Electrical/plumbing pipes/conduits shall be fixed as designed and cut-outs for services shall be marked on the panel.
7. Self-compacting concrete of required grade/light weight concrete shall be mixed using concrete mixing machine and then pumped into the gap between two panels using a special pumping unit.
8. Upon installment of wall panels, flooring and ceiling, the finishing work is executed.

Wall Panels

- Typical view of LGSF panels and steel frame construction

MEP

- The plumbing and electrical services are incorporated before laying of light weight concrete between the panels

FINISHING ITEMS

- The finishing items include pressed steel door frame with flush shutters and PVC doors in toilets.
- uPVC frame with glazed panel and wire mesh shutter are used in windows.
- Vitrified tiles are used in flooring in rooms and kitchen.
- Anti-skid ceramic tiles are used in bath & WC.
- Kota stone flooring is used in common areas & Staircase steps.

OTHER INFRASTRUCTURE ITEMS

- The external infrastructure includes
- Laying of Sewerage Pipe Line,
- RCC storm water drain,
- Provisions for Fire Fighting
- Bituminous Internal Road & Paver blocks for Pathway,
- Providing Lifts in building blocks,
- Landscaping of site,
- Street light with LED lights,
- Solar Street Light System,
- Sewerage Treatment Plant (STP),
- External Electrification,
- Water Supply System including underground water reservoir,
- Compound wall with Boundary Gates,
- Horticulture facilities,
- Rain Water Harvesting,
- Solid Waste Management.

Live status of LHP site can be accessed at

https://ghtc-india.gov.in

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