CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'ThalamuthuNatarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru. A. VEERAPPAN** has enrolled as **Registered Structural Engineer Grade-I (SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E., (Structural Engg.)** and experience in the relevant field for **40 years**.

He has been given the Registration No.**SE/GR-I/2019/05/113 Renewed** on **02.05.2024.** He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part-V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(Ms) No.18 MAWS (MA1) Dept. dated 04.02.2019.

This Registration is valid upto **01.05.2029**.

2/5/24

(A. MEGANATHAN)
Superintendent

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Structural Design Basis Report

Project :

Proposed Construction of Residential Apartments

(Stilt + 5 Floors) at Plot No:26 & 27 , EVP Sri Ram Nagar ,

at Nolambur, Chennai.

(with M25 / Fe500-D TMT Rebars).

Er. A. VEERAPPAN & ASSOCIATES

(TAMIL NADU) PRIVATE LTD

Engineers Designers & Structural Consultants

Er. Dr. A. Veerappan, ME (Struct), Ph.D (Struct) FIE, MICI, Dip. LL & AL - Managing Director

Structural Design Basis Report

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BETTER THAN THE BEST
ENGINEERS MAKE THE WORLD

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Design Information and Criteria

1.0 Introduction

Proposed Construction of **Office cum Residential Apartments (Stilt + 5 Floors) at Plot No: 26 & 27, EVP Sri Ram Nagar, Nolambur, Chennai.** It is structurally designed as RCC Framed building cast in situ structure and shall be constructed using conventional method of construction. The sizes and height of buildings are listed below:

(Stilt + 5 Floors)

Building Size	-	12.08 m x 25.49m
Plinth Area	-	304.46 sqm
Floor Height:		
Stilt Floor	-	3.20 m
First Floor	-	3.20 m
Second Floor	-	3.20 m
Third Floor	-	3.20 m
Fourth Floor	-	3.20 m
Fifth Floor	-	3.20 m
Building Height (Total)	-	19.20 m

This report generally discusses the structural concept, foundation system assumptions, objectives and design approach.

2.0 DESIGN CRITERIA

2.1 Codes of Practice

CODE	DESCRIPTION
IS 875(Part 1) 1987	Code of practice for Design Loads (other then earthquake) for buildings and structures – Unit weights of buildings materials and stored material
IS 875(Part 2) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Imposed Loads
IS 875(Part 3) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Wind Loads
IS 875(Part 4) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – snow Loads
IS 875(Part 5) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Special Loads and load combinations
IS 456 – 2000	Code of Practice for Plain and Reinforced Concrete
IS 1786 – 2008	Specification for High strength Deformed bars and Wires for concrete reinforcement
IS 13920 – 1993	Ductile detailing of reinforces concrete structures subjected to seismic forces – Code of practice
IS 1893 – 2016	Criteria for earthquake resistant design of structures

2.2 LOADS

The following loads are taken into consideration while designing the structural elements of the building and the development as per IS : 875 - 1987.

2.2.1 Superimposed Dead Loads

TYPE OF LOADS	MINIMUM UDL (KN/m^2)
Screed and Finishes (50mm)	1.20
Partition Loads (Non load bearing Wall)	115mm thick Fly Ash Brick work or its Equivalent density 20Kn/Cum
Mechanical & Electrical Services (Ceiling)	0.50
Waterproofing (Terrace)	3.00

2.2.2 Live Loads

LOCATION	MINIMUM UDL (KN/m^2)
Rooms, Baths and Toilets	3.00
Lobby, Staircase & Balconies	3.00
Terrace	2.00
LMR	5.00
Sump	10,000 litres with 2m liquid depth

2.2.3 LATERAL LOADS

2.2.3.1 Wind Loads

The wind pressure shall be calculated based on the basic wind speed and other provisions laid in IS 875 (part 3) – 1987. The wind speed is considered in the analysis for the specified location is **39m/sec**. The design parameters for wind load calculation is as follows.

Design wind Pressure $Pz = 0.6\ Vz^2$

But $Vz = Vb*K1*K2*K3$.

Where Vb – Design wind Speed
K1 – 1.00 probability factor of risk coefficient
K2 – 1.02, Terrain height, structure size factor
Terrain Category – 2 and Structure Class – C
K3 – 1.0, Topography factor

Hence Design Wind Pressure $= 0.6 \times (50 \times 1.00 \times 1.02 \times 1.0)^2\ N/m^2$
$= 1560\ N/m^2$
$= 1.56\ KN/m^2$

The design wind load will be calculated based on the surface area with the calculated design wind pressure and it shall be applied on surface area of the building in both the orthogonal direction.

2.2.3.2

Chennai is classified under Earthquake Zone III (Moderate) as per the latest classification. The loading due to earthquake shall be assessed based on the provisions of IS : 1893 – 2016 and the ductile detailing of the Structural elements shall be complied with IS 13920 – 1993.

The design parameters adopted are as follows:

Seismic Zone III with seismic zone factor Z = 0.16 (Moderate) and Response reduction factor is to 1893 – 2016, Table – 7. Soil considered is to be Type – 11, medium soil.
Length of the Building (L) = 25.49m; Breadth of the Building (B) = 12.08m.

$$L/B = 25.49/12.08 = 2.11$$

However since (L/B) ≈ 2, and it has only S+5 floors, Rectangular Regular shape, it will be safe for seismic forces.

2.3 LOAD COMBINATIONS

The various loads shall be combined in accordance with the stipulations in IS : 875 (Part V) 1987 and IS : 456 - 2000. The structural elements shall be designed for the combination that produces most unfavorable effect out of the following combinations.

Limit State of Serviceability

1. 1.0* (DL+IL)
2. 1.0* (DL+EQ/WL)
3. 1.0* DL+0.8*IL+0.8(EQ/WL)

Limit State of Collapse

1. 1.5* (DL+IL)
2. 1.2* (DL+IL+EQx)
3. 1.2* (DL+IL+WLx)

DL – Dead Load which includes all finishes and partition loads, IL – Imposed Load, EQ – Earthquake Load and WL – Wind Load.

2.4 Base Shear

Base Shear Calculation for Static Analysis
As per IS 1893:2016, the total design lateral force or design seismic base shear (Vb) is determined by the following expressions.

$$Vb = AhW$$

Where Ah is Design horizontal acceleration spectrum value using fundamental natural period and W is Seismic weight of the building.

The Seismic weight is estimated based on Full dead load + 25% Live Load.

The Fundamental natural period of vibration (Ta) id seconds of a DC building is estimated by using the following formula

$$Ta = 0.09h/(\sqrt{d})$$

Where h is the height of building in meters?
d is the base dimension of the building at the plinth level, in making the considered direction of the lateral force.

Height of the building, h	= 19.20 m
d (along the length of the building)	= 25.49 m
b (along the breadth of the building)	= 12.08 m
Ta (along x&y)	= 0.09x 19.20/(√12.08)
	= 0.4972 Sec.

From IS 1893: 2016, Clause 6.4.2, Design horizontal seismic coefficient

$$Ah = \frac{ZI\,Sa}{2Rg}$$

Where

Z for Zone III	= 0.16
Importance Factor for General Building	= 1.20
R for Ordinary Moment Resisting Frame	= 3.00
Sa/g, as per (Table 7)	= 2.5 (Refer to IS 1893)

Design horizontal seismic coefficient Ah = 0.08

Base Shear = 0.08w

As per IS 1893: 2016, Clause 7.7.1, static analysis shall be carried out to study the structural behavior of the building and to design the structural elements like columns and RC walls including floor elements like beam etc. using ACI – 2 cycle moment distribution software evolved by TN PWD Buildingd – Planning & Designs Circle, Chennai–600005.

2.5 DEFLECTION CRITERIA

2.5.1 Lateral Deflection (Wind)

Overall Deflection	<	Height / 250
Storey Deflection	<	Storey height / 250

2.5.2 Lateral Deflection (Seismic)

Overall Drift	<	H / 250
Storey Drift	<	0.004 time storey height

2.5.3 Vertical Deflection of Beams and Slabs due to Gravity Loads:

Total Deflection (DL+LL)	<	Span / 250 upto 20mm maximum
Live Load Deflection	<	Span / 350

2.6 Material Properties

2.6.1 Concrete

Since the buildings are coming under moderate exposure condition, M25 Grade of Concrete is proposed as per Table 5 of IS: 456-2000

Foundation System	- M25 (fck= 25N/mm^2)
Columns	- M25 (fck= 25N/mm^2)
RCC Slabs, Beams	– M25 (fck= 25N/mm^2)
RCC Lift Well	- M25 (fck= 25N/mm^2)
Staircases	- M25 (fck= 25N/mm^2)

2.6.2 Reinforcement

Steel reinforcement shall be of Grade Fe 500 Ductile -TMT rebars conforming to IS 1786:2008 with a minimum elongation of 14.50%.

2.7 DURABILTY

Cover to reinforcement

Foundation	- 75mm
Columns (min dimension >200mm)	- 40mm
RC Wall	- 30mm
Beams	- 25mm
Slabs	- 20mm

3.0 **SUB -SOIL CONDITION**

Based on the Soil investigation report and the field and Lab test results, it's concluded that,

The sub soil profile consists of Brown Colored Clayey soil upto 27.00m depth. As per soil report, the SBC of soil is **100 KN/m^2. Hence, Under reamed Piles – 300mm& 450mm dia for 3.50m and 4.50m depth – 2 Piles,4 Piles,6 Piles group with pile cap. Further to Supplement load Carrying capacity piled soil raft with 3 Nos of geogrid 40 x 40 x 20 N/mm^2 – sandwiched is also provided below pile cap.(Refer Foundation Table attached)**

4.0 STRUCTURAL SYSTEM

4.1 General Description

The Residential Apartment Building consists of Stilt + 5 floors. It is Structurally designed as RCC framed structure cast in situ structure shall be constructed using conventional method of construction

4.2 Super structure

The structural system of superstructure from Stilt + 5 floors upto to terrace is of M25 grade RCC beam 230mm wide and depth varies between 300mm, 450mm, 600mm and 750mm. The RCC slab thickness are 125mm and 135mm as per span, edge conditions and loading in the superstructure.

4.3 Lateral Stability Analysis

Lateral loads due to wind and earthquake loads has been calculated as per relevant IS codes and it has been considered in the analysis. It is found that the wind forces is not governing the design and hence design of the building carried out according to Indian Standard codes IS : 1893 and IS : 13920 with ductile detailing of rebars. The slab acts as rigid diaphragm which transfers the lateral load to the vertical element. The drifts, lateral deformation, base shear parameters has been verified and confirmed before commencement of the design of structural elements. Ductile detailing of Rebars at Beam – Column Junctions to resist seismic forces is also attached with Structural Drawings

5.0 FOUNDATION SYSTEM

The foundation system designed such that the building will be resting on Under reamed Piles – 300mm& 450mm dia for 3.50m and 4.50m depth – 2 Piles, 4 Piles,6 Piles group with pile cap. Further to Supplement load Carrying capacity piled soil raft with 3 Nos of geogrid 40x40x20 N/mm^2 – sandwiched is also provided below pile cap.

Structural Design Computations

Design Sheets

Proposed Residential Apartment Building (Stilt + 5 floors at Plot No 26 & 27 ,EVP Sri Ram Nagar ,Nolambur, Chennai.

Input Data

Stilt + 5 floors

M25 Concrete / Fe 500 TMT Bars

SBC = 100 KN/m^2 , Clayey soil upto 27.00m depth

Load for 5 Floors = 5 x 16 KN/m^2 +1 x 12 KN/m^2 =92 KN/m^2

Total Load = 92 KN/m^2 for all columns

Load for Staircase = 6 x 18KN/m^2 + 1 x 12KN/m^2 = 120 KN/m^2

Total Load = 120 KN /m^2 for Staircase columns

Proposed Residential Apartment Building (Stilt + 5 floors) at

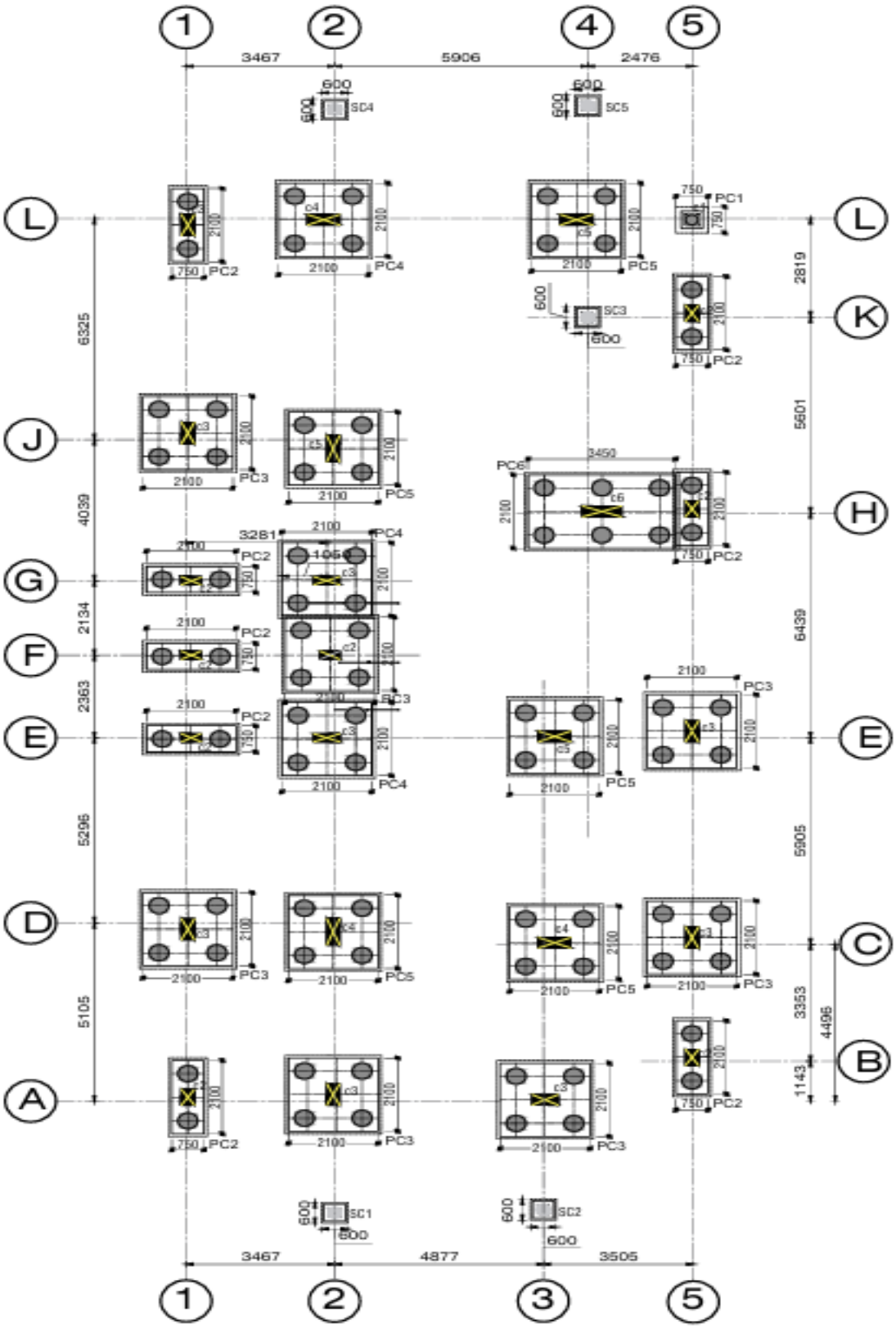
Plot No. 26 & 27, EVP Sriram Nagar,Nolambur, Chennai.

Load Computation

Column Designation	Design Calculation	Foundation (KN)	Moment factor	Equivalent Column Load (KN)
A1	{(3.467/2) x (5.105/2) x 92 x 1.30}	530	1.80	955
A2	{[(3.467 + 4.877) / 2] x (5.105/2) x 92 x 1.10}	1080	1.30	1410
A3	{[(4.877 + 3.505) / 2] x (4.486/2) x 92 x 1.10}	960	1.30	1250
B5	{(3.51/2) x (1.143/2) x 92 x 1.30} +{(3.505/2) x (3.353/2) x 92 x 1.30}	475	1.80	855
C3	{[(4.877 + 3.505) / 2] x [(5.905 + 4.496) / 2] x 92 x 1}	2010	1.10	2215
C5	{(3.505 / 2) x [(3.353 + 5.905) / 2] x 92 x 1.1}	825	1.30	1075
D1	{(3.467 / 2) x [(5.105 + 5.296) / 2] x 92 x 1.1}	920	1.30	1200
D2	{[(3.467 + 4.877) / 2] x [(5.105 + 5.296) / 2] x 92 x 1}	2000	1.10	2200
E1	{(3.467/2) x (5.296/2) x 92 x 1.10} + {(3.467/2) x (2.363/2) x 92 x 1.10}	740	1.30	965
E2	{[(3.467 + 4.877) / 2] x (5.296) / 2] x 92 x 1} + {(4.877/2) x (2.363/2) x 120 x 1}	1370	1.10	1510
E3	{[(6.439 + 5.905) / 2] x [(4.877 + 3.505) / 2] x 92 x 1}	2380	1.10	2620
E5	{[(6.439 + 5.905) / 2] x (3.505 / 2) x 92 x 1.1}	1100	1.30	1430
F1	{[(2.363 + 2.134) / 2] x (3.467 / 2) x 120 x 1.1}	450	1.30	585
F2	{(3.467) / 2] x (2.134 + 2.363) / 2] x 120x 1} + {(4.887/2) x [(2.134 + 2.363) / 2] x 92 x 1}	980	1.10	1080
G1	{(2.134/2) x (3.467/2) x 120 x 1.10 } + {(3.467/2) x (4.039/2) x 92 x 1.10}	610	1.30	795

G2	{(2.134/2) x (3.467/2) x 120 x 1 } + {[(3.467 + 5.906) / 2] x (4.039 / 2) x 92 x 1} + {(2.134/2) x (5.906/2) x 92 x 1 }	1390	1.10	1530
H4	{[(5.906 + 2.477) / 2] x [(8.42 + 6.439) / 2] x 92 x 1}	2870	1.10	3160
H5	{(2.477/ 2) x [(5.601 + 6.439) / 2] x 92 x 1.1}	760	1.30	990
J1	{(3.467/ 2) x [(4.039 + 6.325) / 2] x 92 x 1.1}	910	1.30	1190
J2	{[(5.906 + 3.467) / 2] x [(4.039 + 6.325) / 2] x 92 x 1}	2240	1.10	2470
K5	{(2.477/ 2) x [(2.819 + 5.601) / 2] x 92 x 1.1}	530	1.30	690
L1	{(3.467/2) x (6.325/2) x 92 x 1.30}	660	1.80	1190
L2	{(6.325/ 2) x [(3.467 + 5.906) / 2] x 92 x 1.1}	1500	1.30	1950
L4	{(8.42/ 2) x [(2.477 + 5.906) / 2] x 92 x 1.1}	1790	1.30	2330
L5	{(2.819/2) x (2.477/2) x 92 x 1.30}	210	1.8	380

Foundation System



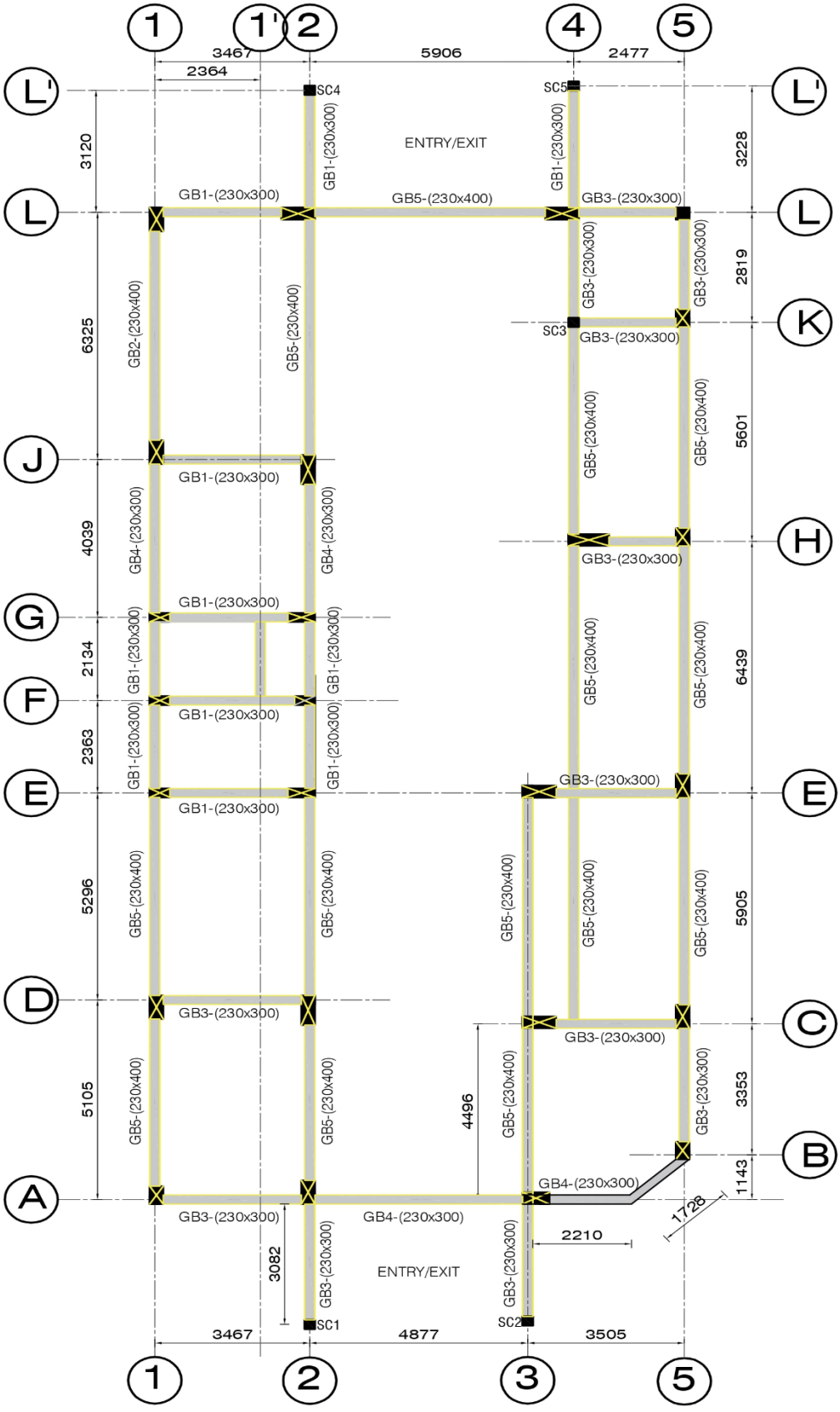
UNDER REAMED PILE FOUNDATION LAYOUT

FOUNDATION SYSTEM WITH UNDER REAMED PILES WITH PILE CAP

(with piled soil raft sandwiched 3 layers of Geogrid)
NO. OF FLOORS : STILT + 5 FLOORS

STEEL : Fe 500 -TMT BARS
GRADE OF CONCRETE : M25

PILE NO.	LOAD (KN) ON FOUNDATION	COLUMNS DESCRIPTION	COLUMNS SIZE S.F.	COLUMNS SIZE F.F	UNDER REAMED PILES				PILED SOIL RAFT		TOTAL LOAD CARRYING CAPACITY	PILE CAP DETAILING	REBAR DETAILING		
					TOTAL NO.OF	DIA (mm)	DEPTH (m)	NOS.	SIZE	Addl.LOAD carrying Capacity(KN)		SIZE (L x B x D)	MAIN BOTTOM	TOP	SKIN REBARS
PC1	300KN	L5	300X300	230X300	1	300	3.50	1	1.40X1.40X100KN/m2	160+196	356KN	500x500x450 mm	6 Nos 12Y Dist.- 12Y@150 c/c	6 Nos 10Y	8mm @ 140 c/c
PC2	800KN	E1,F1(stair) G1(Lift)	230X450	230X450	3	450	4.50	2	3.00X1.65X100KN/m2	758+495	1253KN	2100x750x675 mm	17 Nos 12Y Dist.- 12Y@125 c/c	17 Nos 10Y	8mm @ 140 c/c
		A1,B5,H5,K5	300X450	230X450	4	450	4.50	2	3.00X1.65X100KN/m2	758+495	1253KN	2100x750x675 mm	17 Nos 12Y Dist.- 12Y@125 c/c	17 Nos 10Y	8mm @ 140 c/c
		L1	300X600	230X600	1	450	4.50	2	3.00X1.65X100KN/m2	758+495	1253KN	2100x750x675 mm	17 Nos 12Y Dist.- 12Y@125 c/c	17 Nos 10Y	8mm @ 140 c/c
PC3	1200KN	F2 (stair)	230X450	230X450	1	450	3.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x675 mm	12Y@125 c/c Dist.- 12Y@125 c/c	12Y@125 c/c	8mm @ 140 c/c
		A2,A3,D1,E5,J1,C5	300X600	230X600	6	450	3.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x675 mm	12Y@125 c/c Dist.- 12Y@125 c/c	12Y@125 c/c	8mm @ 140 c/c
PC4	1600KN	E2 (stair)	230X600	230X600	1	450	4.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x725 mm	12Y@125 c/c Dist.- 12Y@125 c/c	12Y@125 c/c	8mm @ 140 c/c
		G2 (lift)	230X600	230X600	1	450	4.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x725 mm	12Y@125 c/c Dist.- 12Y@125 c/c	12Y@125 c/c	8mm @ 140 c/c
		L2	300X750	230X750	1	450	4.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x725 mm	12Y@125 c/c Dist.- 12Y@125 c/c	12Y@125 c/c	8mm @ 140 c/c
PC5	2000KN	C3,D2	300X750	230X750	2	450	4.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x875 mm	12Y@100 c/c Dist.- 12Y@100 c/c	12Y@100 c/c	8mm @ 140 c/c
		E3,J2,L4	300X750	230X750	3	450	4.50	4	3.00X3.00X100KN/m2	1260+900	2160KN	2100x2100x875 mm	12Y@100 c/c Dist.- 12Y@100 c/c	12Y@100 c/c	8mm @ 140 c/c
PC6	3000KN	H4	300X900	230X900	1	450	4.50	6	4.35X3.00X100KN/m2	2276+1175	3451KN	3450x2100x1000 mm	16Y@150 c/c Dist.- 16Y@150 c/c	16Y@150 c/c	8mm @ 140 c/c
SC	STUB COLUMNS		300x300	-	1	300	2.40	1	-	-	-	600x600x400 mm	6 Nos 16Y Dist.- 8Y@150 c/c	6 Nos 12Y	8mm @ 140 c/c



GRADE BEAM LAYOUT

Column Schedule

Column Schedule for : Stilt + 5 Floors

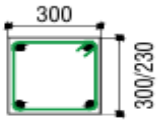
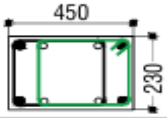
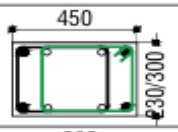
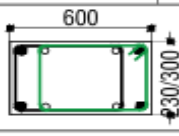
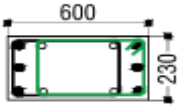
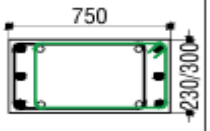
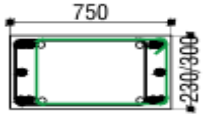
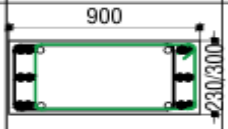
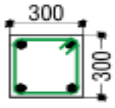
Grade of Concrete : M25

Grade of Steel : Fe 500 D-TMT Bars

COLUMN SCHEDULE

NO.OF FLOORS :STILT + 5 FLOOR

GRADE OF CONCRETE -M25
STEEL : Fe 500 D-TMT BARS
CLEAR COVER - 40MM

No.	LOAD KN	COLUMN MARKING	NO. OF COLUMNS	COLUMN SIZE	REINFORCEMENT DETAILS LONGITUDINAL BARS	SKETCH	LATERAL TIES
c1.	500KN	L5	1 (STILT)	300x300	0.80% 720 sqmm 4Nos-16Y●		8Y @ 200 C/C 
			1 (FF)	230x300			
c2.	1000KN	E1,F1,G1,F2 (Staircase & Lift Columns)	4 (STILT)	230x450	1.50% 1553 sqmm 4Nos-20Y● + 4Nos-16Y○		8Y @ 200 C/C 
		A1,B5,H5,K5	4 (STILT)	300x450	1.50% 2025 sqmm 4Nos-25Y● + 4Nos-12Y○		8Y @ 200 C/C 
			4 (FF)	230x450			
c3.	1600KN	A2,A3,D1,C5, E5,J1,L1	8 (STILT)	300x600	1.50% 2700 sqmm 4Nos-25Y● + 4Nos-20Y○		8Y @ 200 C/C 
			8 (FF)	230x600			
		E2,G2 (Staircase & Lift Columns)	2 (STILT)	230x600	2.50% 3450 sqmm 6Nos-25Y● + 4Nos-16Y○		
c4.	2200KN	C3,D2,L2	3 (STILT)	300x750	1.5% 3375 sqmm 6Nos-25Y● + 4Nos-16Y○		8Y @ 200 C/C 
			3 (FF)	230x750			
c5.	2700KN	E3,J2,L4	3 (STILT)	300x750	2.5% 5625sqmm 10Nos-25Y● + 4Nos-16Y○		8Y @ 200 C/C 
			3 (FF)	230x750			
C6.	3200KN	H4	1 (STILT)	300x900	2.5% 6750sqmm 12Nos-25Y● + 6Nos-20Y○		8Y @ 200 C/C 
			1 (FF)	230x900			
STUB COLUMN		SC1 TO SC5	5 (STILT)	300x300	0.80% 423 sqmm		8Y @ 200 C/C 

Column Carrying Capacity as per IS 456-2000:-

Concrete Grade M25 / Steel Fe 500 TMT Bars

1) Column Size 300 x 300 mm **Load transmitted = 500 KN**

Rebars : 4/16# = 804 mm²

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 300 x 300 + 0.67 x 500 x 804)/1500

P = (900000 + 269340) / 1500 = 1169340 / 1500 = **780 KN > 500KN**

2) Column Size 230 x 450 mm **Load transmitted = 1000 KN**

Rebars : 4/20# + 4/16#= 2060 mm²

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 230 x 450 + 0.67 x 500 x 2060)/1500

P = (1035000 + 690100) / 1500 = 1725100 / 1500 = **1150 KN > 1000KN**

3) Column Size 300 x 450 mm **Load transmitted = 1000 KN**

Rebars : 4/25 + 4/12#= 2416 mm²

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 300 x 450 + 0.67 x 500 x 2416)/1500

P = (1350000 + 809360) / 1500 = 2159360 / 1500 = **1440 KN > 1000KN**

4) Column Size 230 x 600 mm **Load transmitted = 1600 KN**

Rebars : 6/25# +4/16#= 3750mm²

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 230 x 600 + 0.67 x 500 x 3750)/1500

P = (1380000 + 1256250) / 1500 =2636250 / 1500 = **1758 KN > 1600KN**

5) Column Size 300 x 600 mm **Load transmitted = 1600 KN**

Rebars : 4/25 # + 4/20# = 3220mm²

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 300 x 600 + 0.67 x 500 x 3220) / 1500

P = (1800000 + 1078700) / 1500 = 2878700/1500 **= 1920 KN > 1600KN**

6) Column Size 300 x 750 mm **Load transmitted = 2200 KN**

Rebars : 6/25 # + 4/16# = 3750mm^2

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 300 x 750 + 0.67 x 500 x 3750) / 1500

P = (2250000 + 1256250) / 1500 = 3506250/1500 **= 2338 KN > 2200KN**

7) Column Size 300 x 750 mm **Load transmitted = 2700 KN**

Rebars : 10/25# + 4/16# = 5714mm^2

Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 300 x 750 + 0.67 x 500 x 5714) / 1500

P = (2250000 + 1914190) / 1500 = 4164190/1500 = **2777 KN > 2700KN**

8) Column Size 300 x 900 mm **Load transmitted = 3200 KN**

Rebars : 12/25# + 6/20# = 7776mm^2

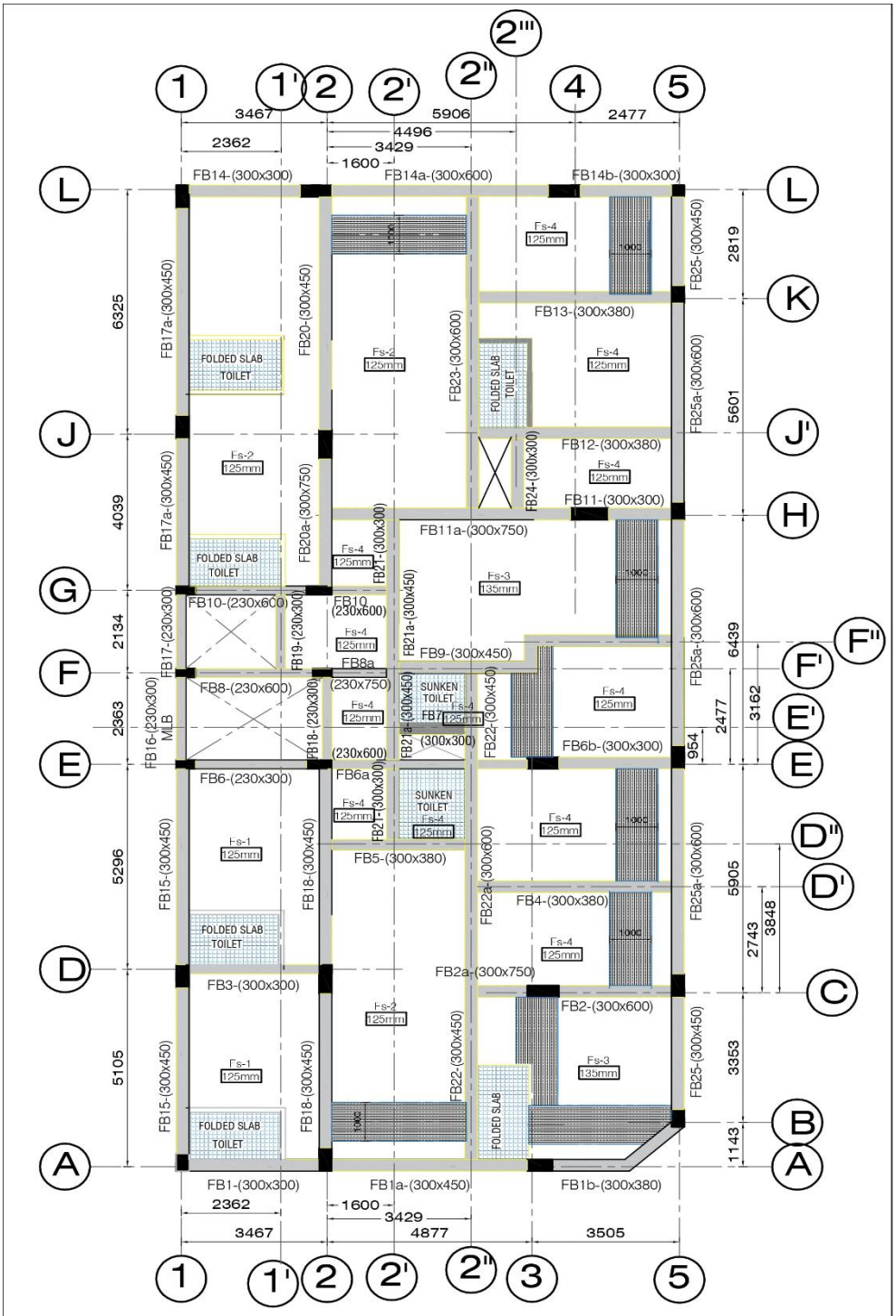
Pu = 0.4fck Ac + 0.67 fy Asc

P = (0.4 x 25 x 300 x 900 + 0.67 x 500 x 7776) / 1500

P = (2700000 + 2604960) / 1500 = 5304960/1500 = **3537 KN > 3200KN**

Since the carrying capacity of all RC Columns is greater than the loads transmitted, all columns are certified to be safe.

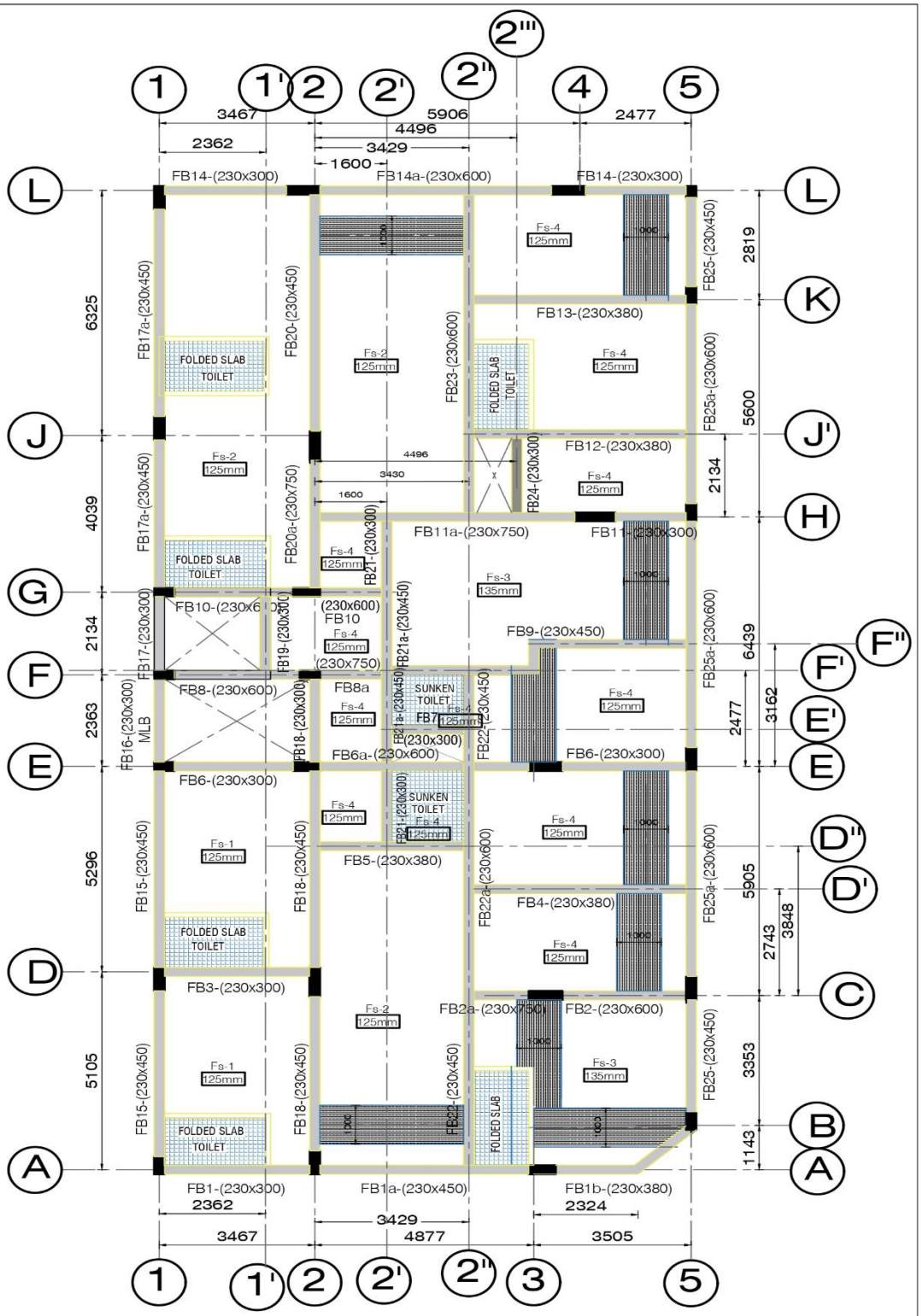
Floors Slabs Design



FOLDED SLAB
(Refer Detailed
CrossSection-Below)

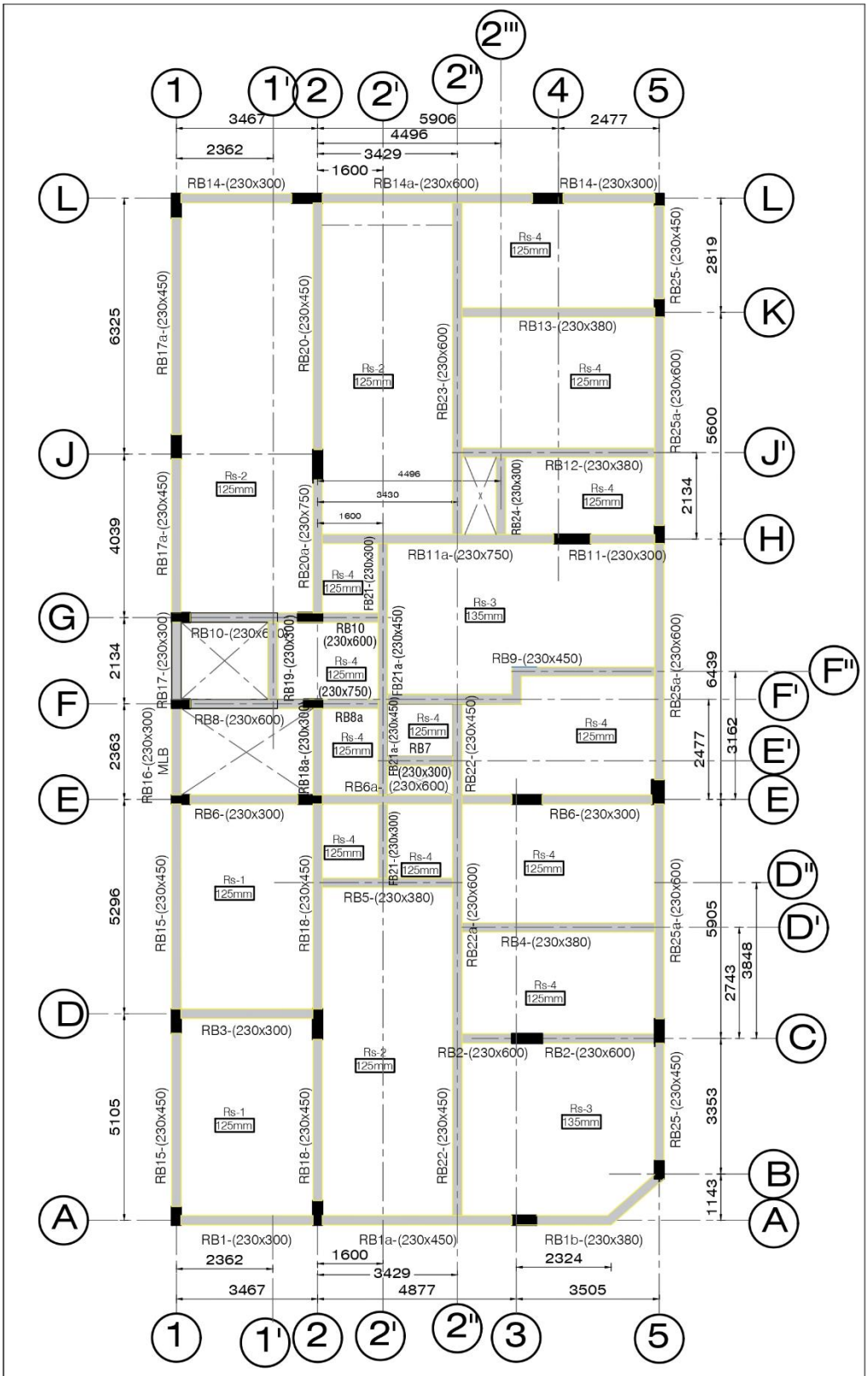
Provide 8Y @ 100 C/C
for 1000mm width (@ top)
below 115mm Partition wall

STILT FLOOR ROOF FRAMING PLAN

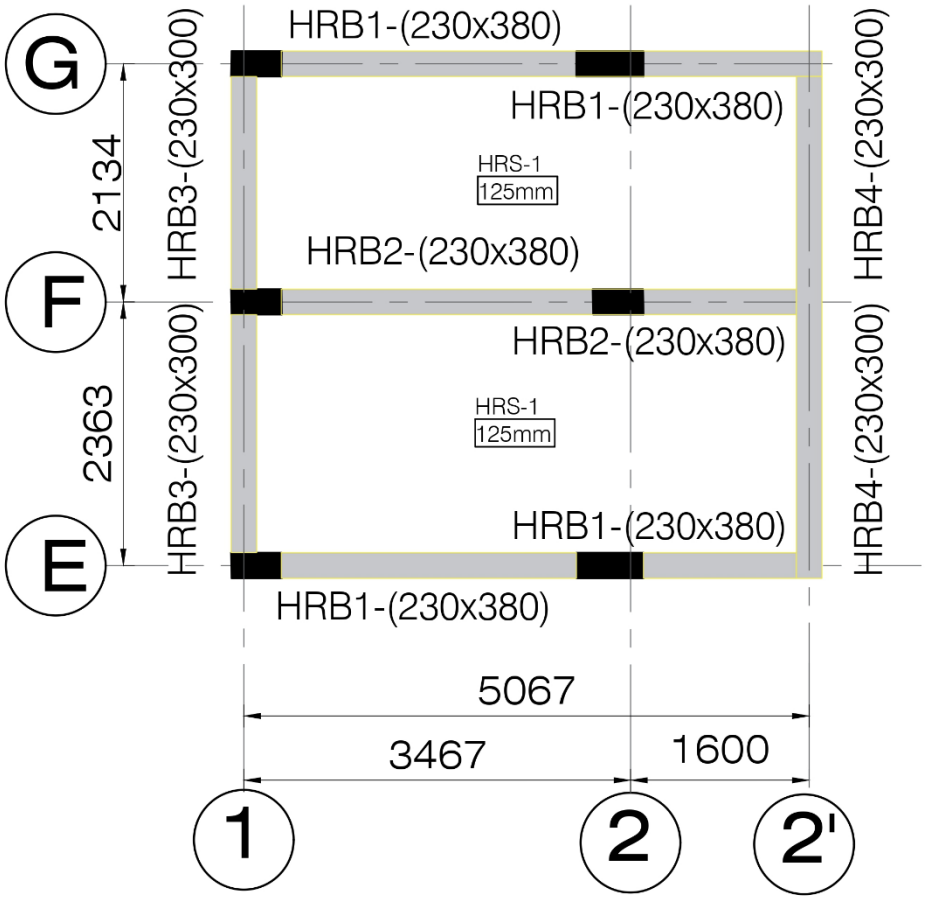


FIRST FLOOR ROOF FRAMING PLAN

Also for 2nd, 3rd & 4th Floor Roof



FIFTH FLOOR ROOF FRAMING PLAN



HEAD ROOM ROOF FRAMING PLAN

Stilt Floor Roof/First Floor Roof Slab Reinforcement Details

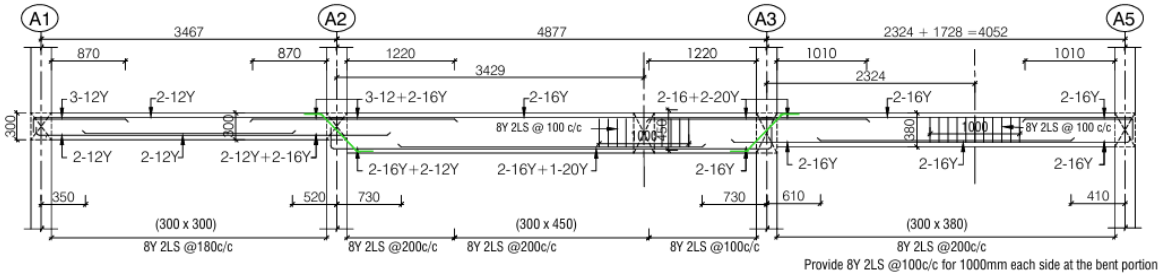
SLAB	REINFORCEMENT DETAILS	SLAB THICKNESS
FS1	8Y@ 150 C/C-short 8Y@ 200 C/C-long	125mm
FS2	8Y@ 125 C/C-short 8Y@ 200 C/C-long	125mm
FS3	10Y@ 200 C/C-short 10Y@ 230 C/C-long	135mm
FS4	8Y@ 200 C/C-short 8Y@ 230 C/C-long	125mm

Fifth Floor Roof & Head Room Roof Slab Reinforcement Details

SLAB	REINFORCEMENT DETAILS	SLAB THICKNESS
RS1	8Y@ 150 C/C-short 8Y@ 200 C/C-long	125mm
RS2	8Y@ 125 C/C-short 8Y@ 200 C/C-long	125mm
RS3	10Y@ 200 C/C-short 10Y@ 230 C/C-long	135mm
RS4	8Y@ 200 C/C-short 8Y@ 230 C/C-long	125mm
HRS1	8Y@ 200 C/C-short 8Y@ 230 C/C-long	125mm

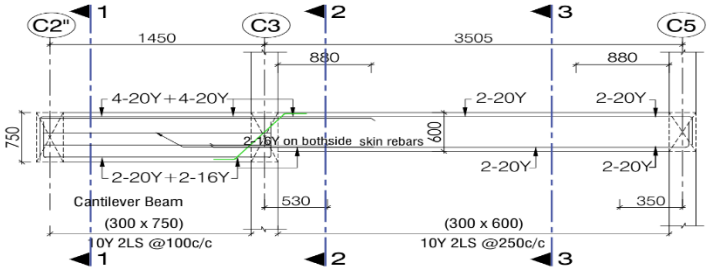
Floor Beams Detailing (CADD Drawings)

Stilt Floor Roof Beam Detailing



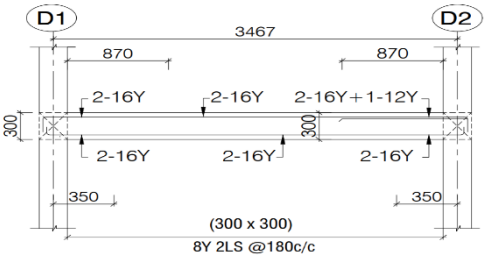
L.S OF FLOOR BEAM FB1-(300x300)/FB1a-(300x450)/ FB1b-(300x380)

*PLS REFER STILT FLOOR ROOF FRAMING PLAN , SPAN A3- A5 IS NOT STRAIGHT IN PLAN

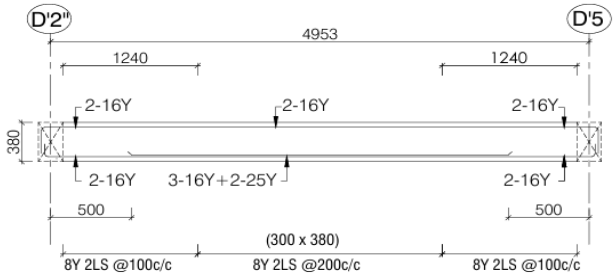


L.S OF FB2b-(300x750) / FB2-(300x600)

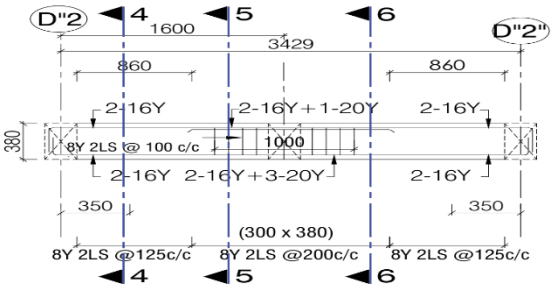
PLS PROVIDE SKIN REBARS 2-16Y on bothside



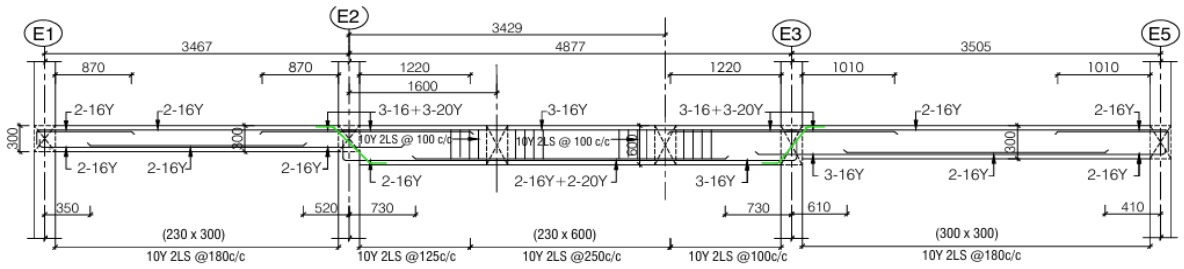
L.S OF FB3-(300x300)



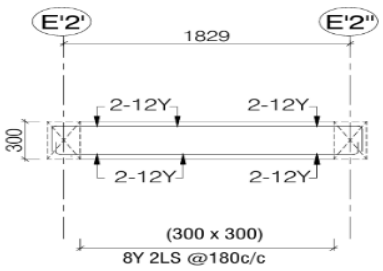
L.S OF FLOOR BEAM FB4-(300x380)



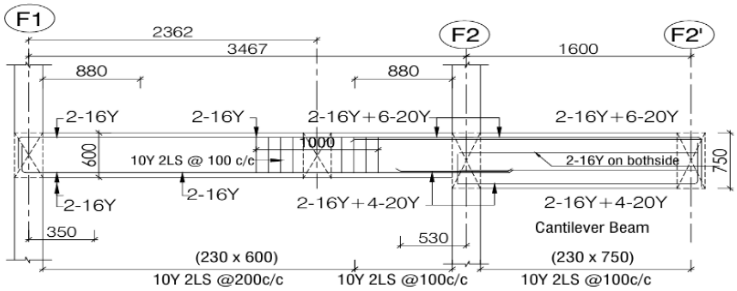
L.S OF FB5-(300x380)



L.S OF FLOOR BEAM FB6-(230x300)/FB6a-(230x600)/ FB6b-(300x300)

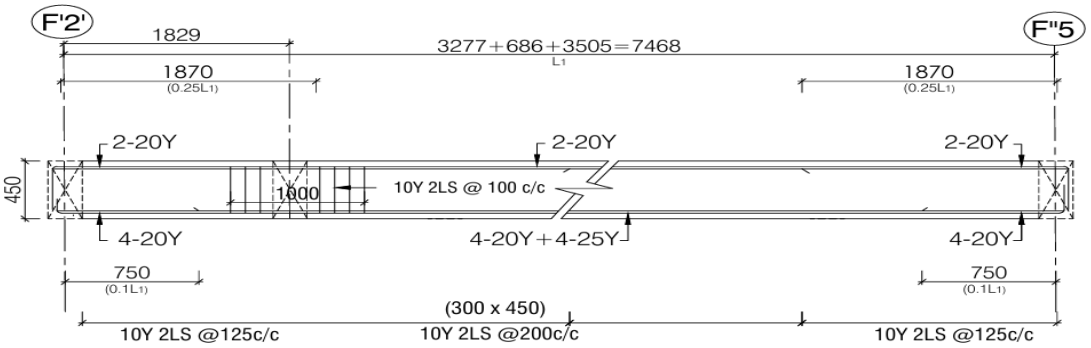


L.S OF FB7-(300x300)



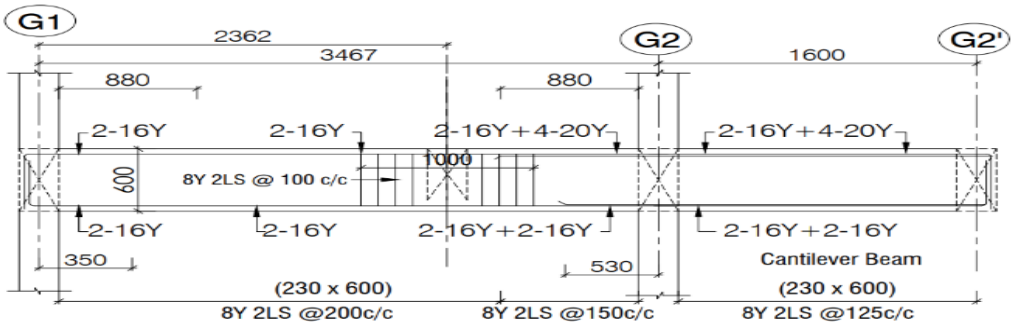
L.S OF FB8b-(230x750) / FB8-(230x600)

PLS PROVIDE SKIN REBARS 2-16Y on bothside

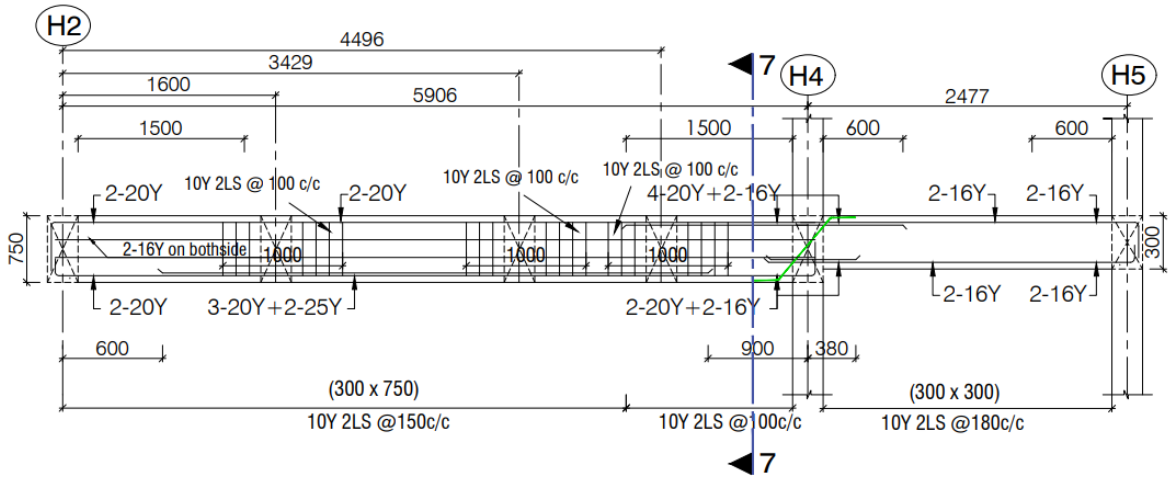


L.S OF FLOOR BEAM FB9-(300x450)

*PLS REFER STILT FLOOR ROOF FRAMING PLAN , SPAN F'2'-F"5 IS NOT STRAIGHT IN PLAN

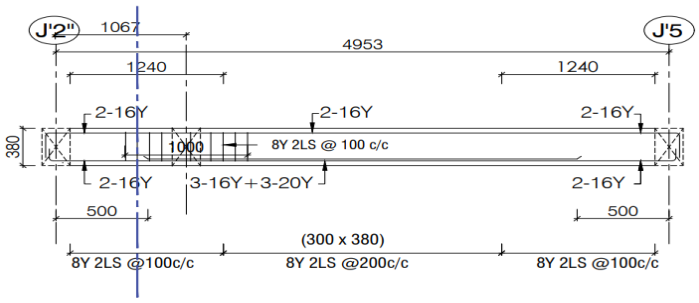


L.S OF FLOOR BEAM FB10-(230x600)

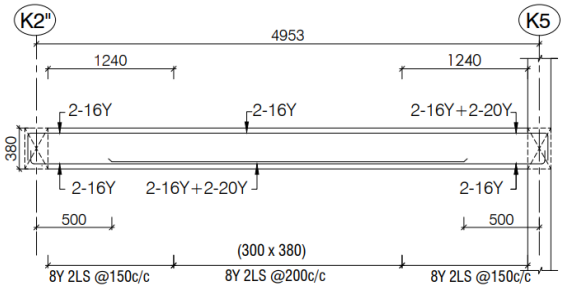


L.S OF FLOOR BEAM FB11a-(300x750) /FB11-(300x300)

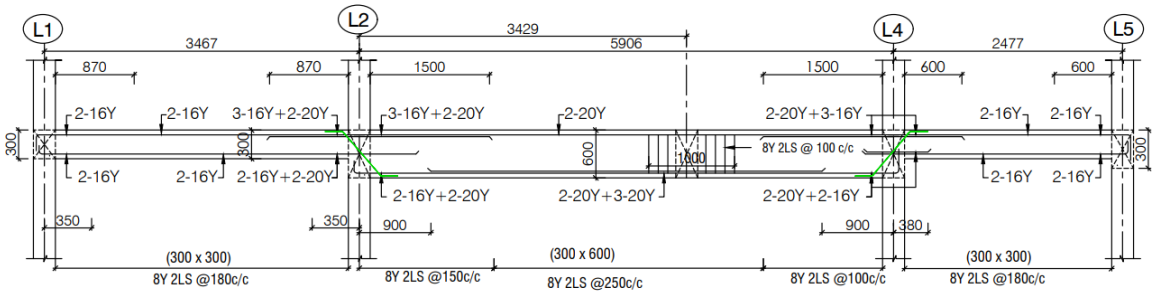
PLS PROVIDE SKIN REBARS 2-16Y on bothside



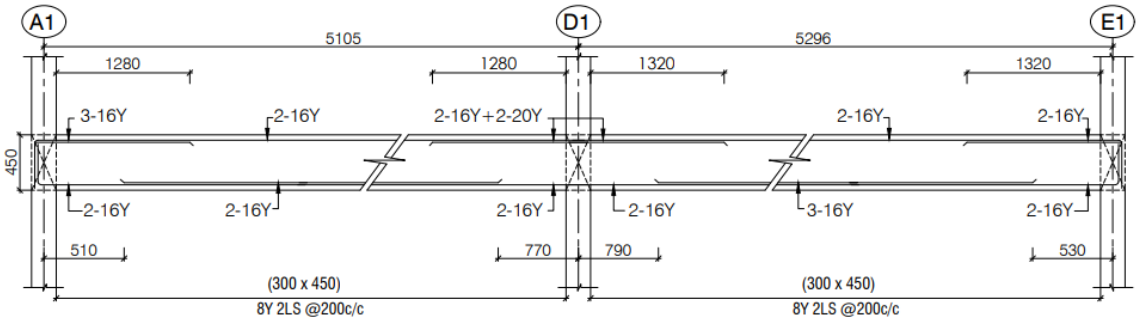
L.S OF FLOOR BEAM FB12-(300x380)



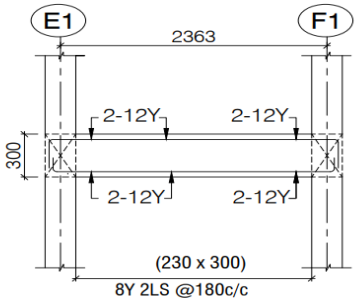
L.S OF FLOOR BEAM FB13-(300x380)



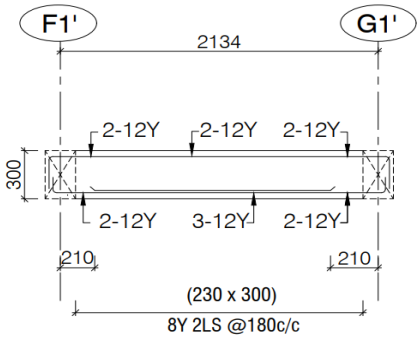
L.S OF FLOOR BEAM FB14-(300x300)/FB14a-(300x600)/ FB14b-(300x300)



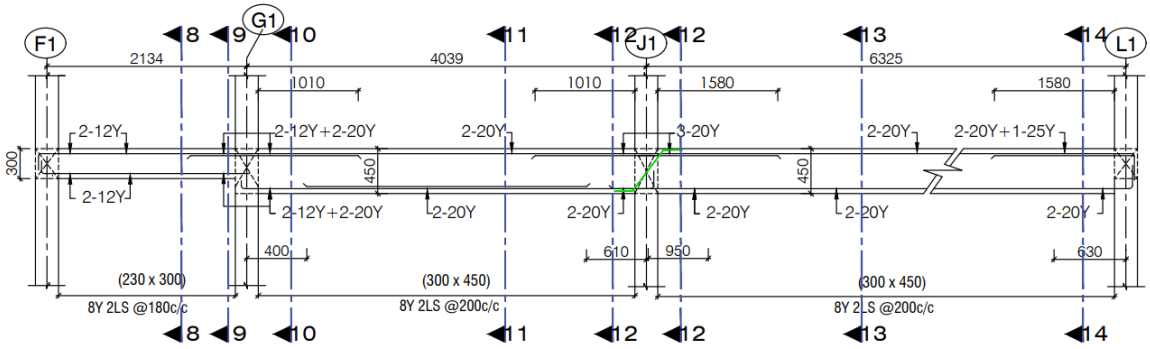
L.S OF FLOOR BEAM FB15-(300x450)



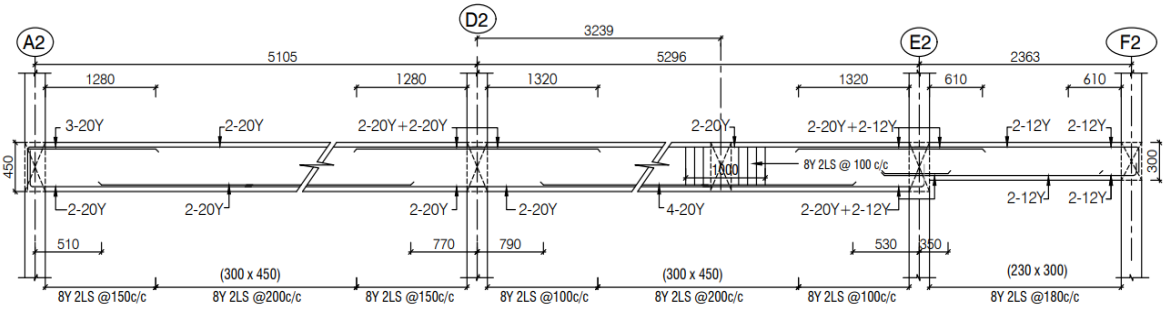
L.S OF MLB FB16-(230x300)



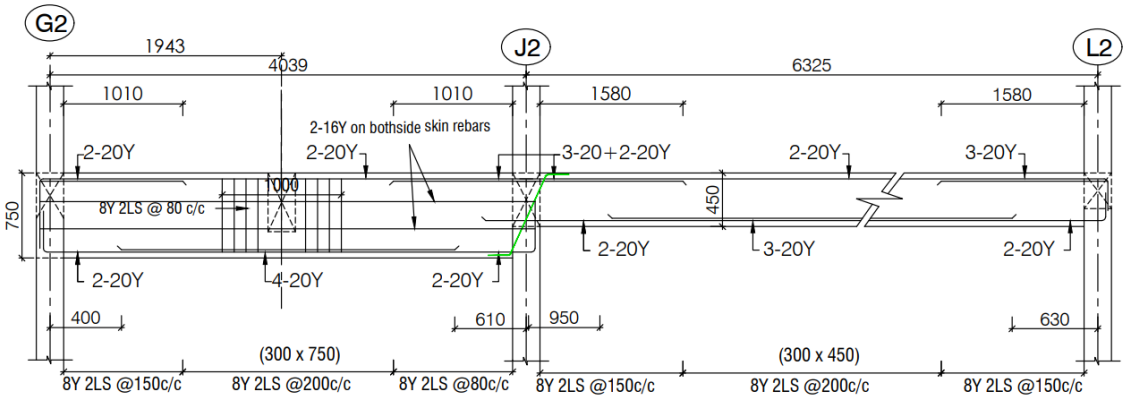
L.S OF FB19-(230x300)



L.S OF FLOOR BEAM FB17a-(300x450) /FB17-(230x300)

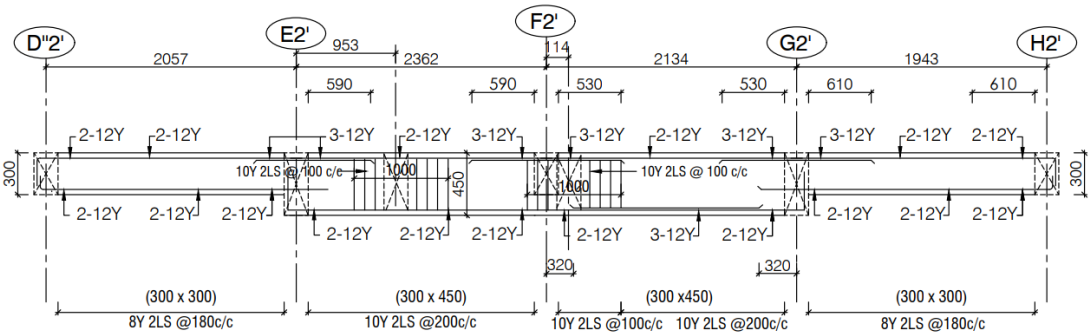


L.S OF FLOOR BEAM FB18-(300x450)/FB18a-(230x300)

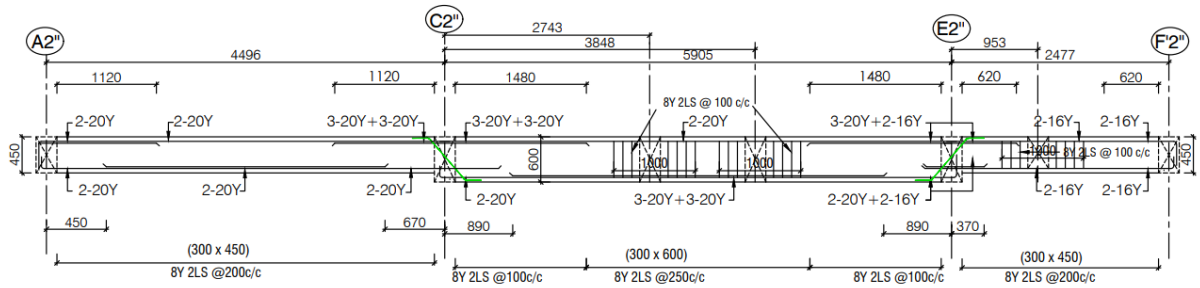


L.S OF FLOOR BEAM FB20a-(300x750) /FB20-(300x450)

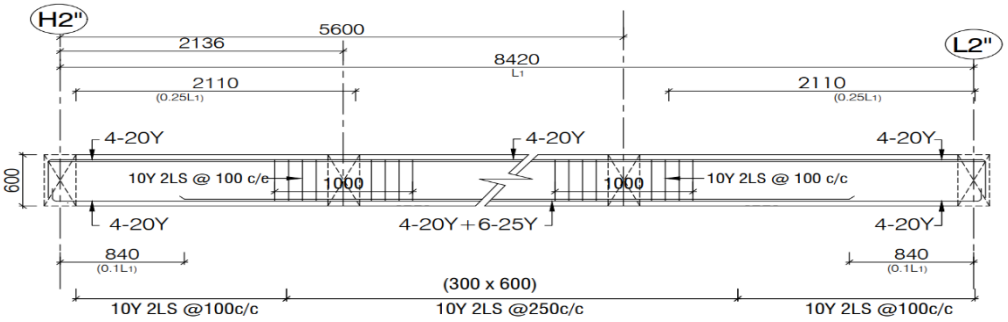
PLS PROVIDE SKIN REBARS 2-16Y on bothside



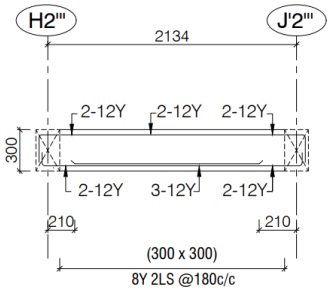
L.S OF FLOOR BEAM FB21-(300x300)/FB21a-(300x450)



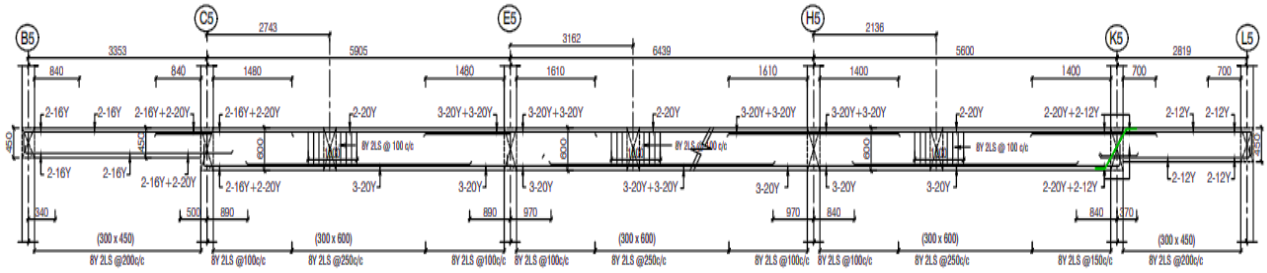
L.S OF FLOOR BEAM FB22(300x450)/FB22a-(300x600)



L.S OF FLOOR BEAM FB23-(300x600)

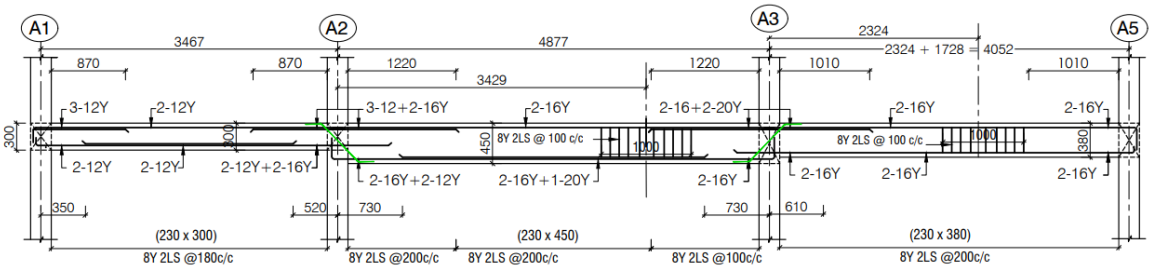


L.S OF FB24-(300x300)



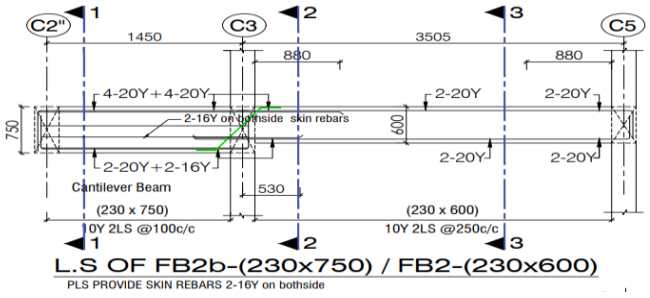
L.S OF FLOOR BEAM FB25-(300x450) /FB25a-(300x600)

First Floor Roof Beam Detailing



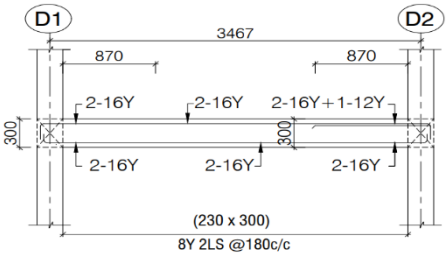
L.S OF FLOOR BEAM FB1-(230x300)/FB1a-(230x450)/ FB1b-(230x380)

*PLS REFER FIRST FLOOR ROOF FRAMING PLAN , SPAN A3- A5 IS NOT STRAIGHT IN PLAN

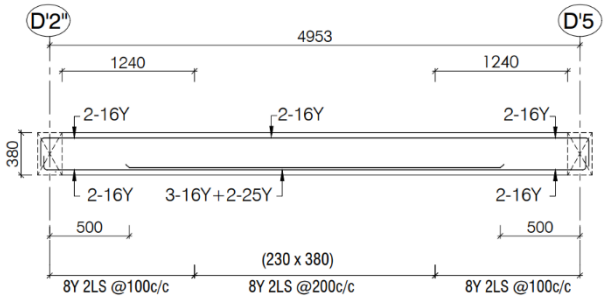


L.S OF FB2b-(230x750) / FB2-(230x600)

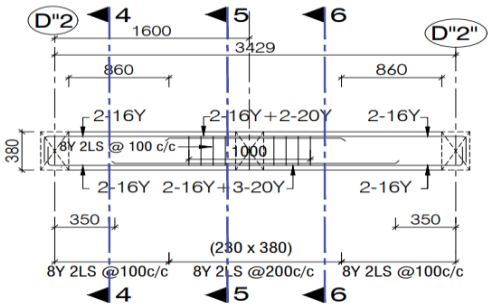
PLS PROVIDE SKIN REBARS 2-16Y on bothside



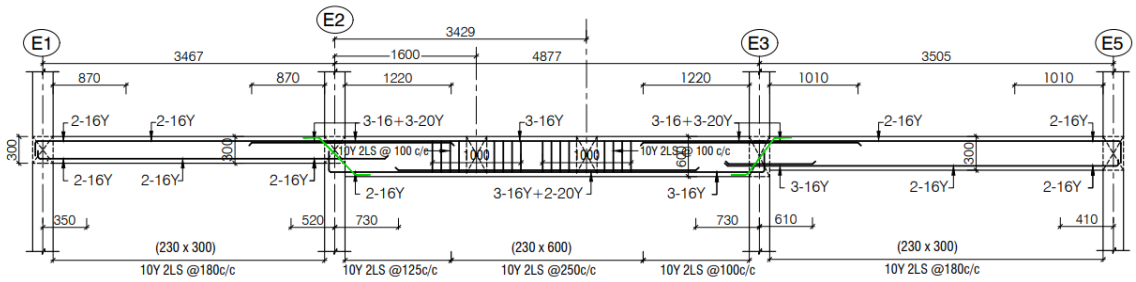
L.S OF FB3-(230x300)



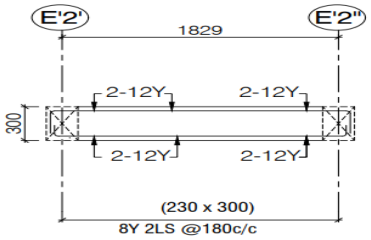
L.S OF FLOOR BEAM FB4-(230x380)



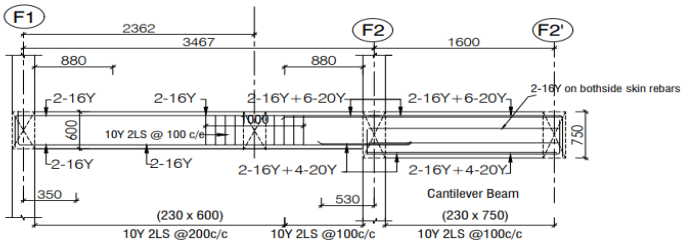
L.S OF FB5-(230x380)



L.S OF FLOOR BEAM FB6-(230x300)/FB6a-(230x600)

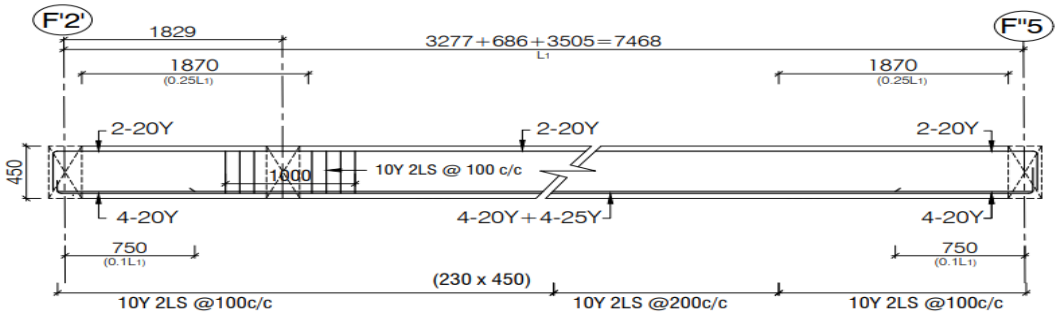


L.S OF FB7-(230x300)



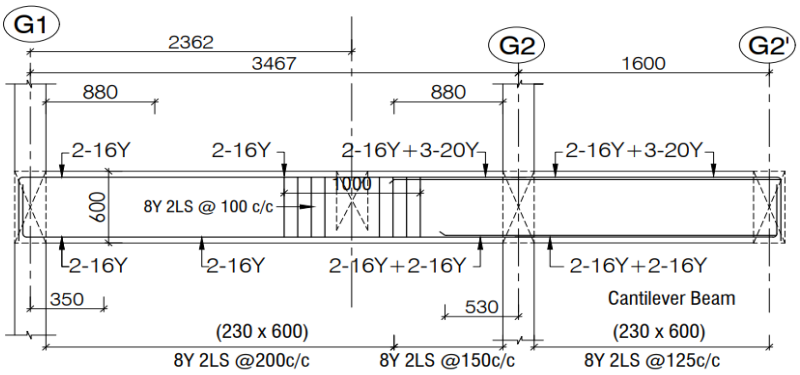
L.S OF FB8-(230x600) / FB8a-(230x750)

PLS PROVIDE SKIN REBARS 2-16Y on bothside

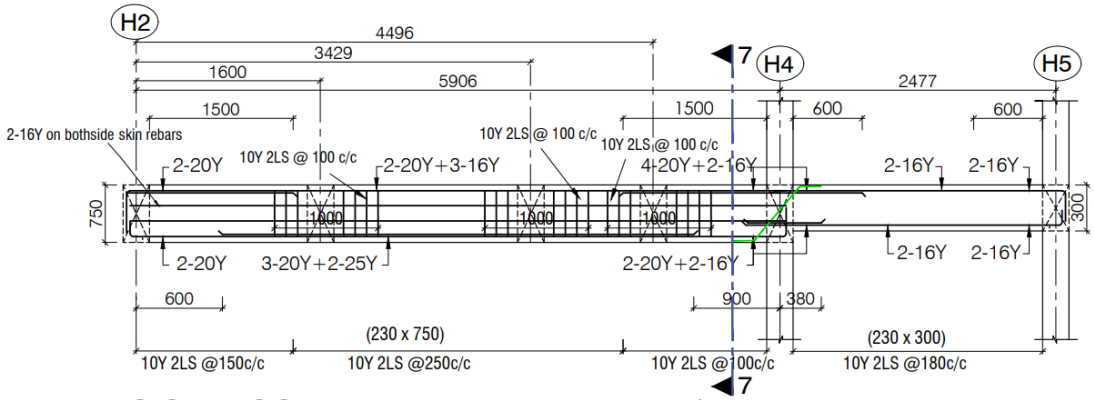


L.S OF FLOOR BEAM FB9-(230x450)

*PLS REFER FIRST FLOOR ROOF FRAMING PLAN , SPAN F'2'- F"5 IS NOT STRAIGHT IN PLAN

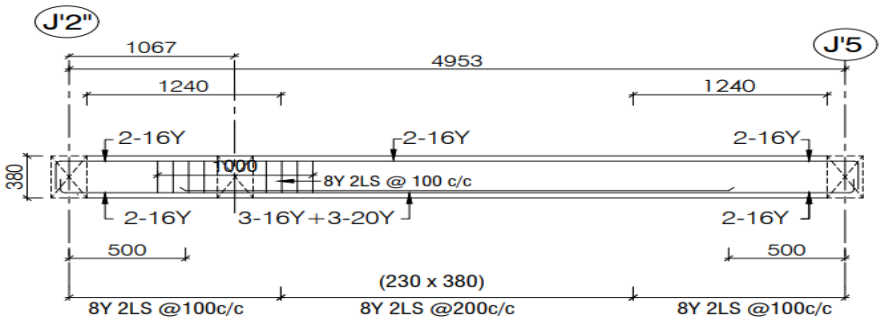


L.S OF FLOOR BEAM FB10-(230x600)

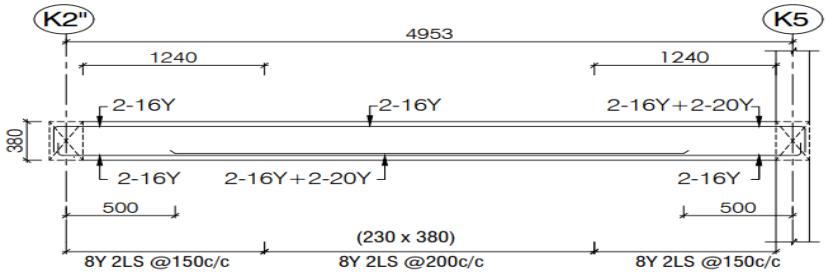


L.S OF FLOOR BEAM FB11a-(230x750) /FB11-(230x300)

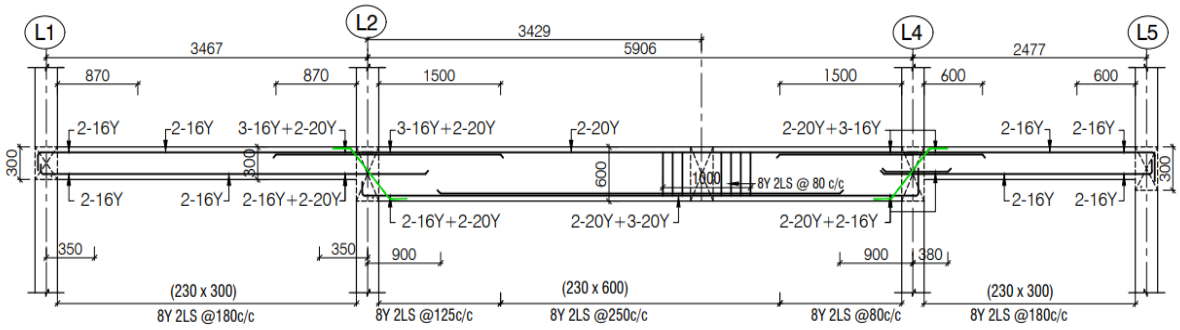
PLS PROVIDE SKIN REBARS 2-16Y on bothside



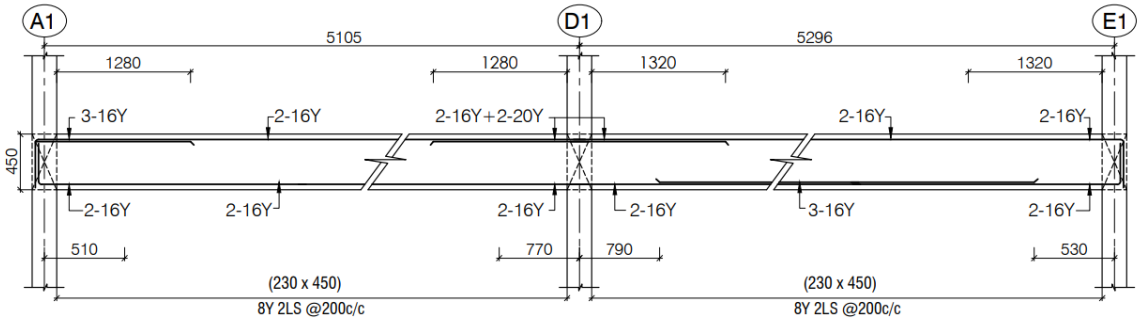
L.S OF FLOOR BEAM FB12-(230x380)



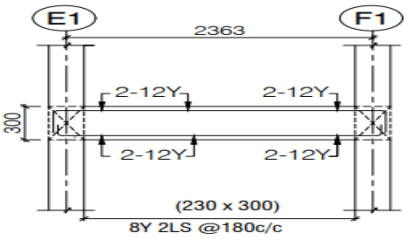
L.S OF FLOOR BEAM FB13-(230x380)



L.S OF FLOOR BEAM FB14-(230x300)/FB14a-(230x600)

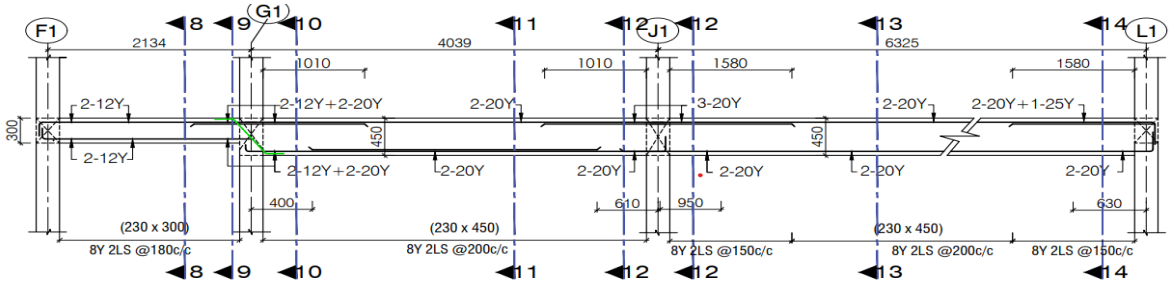


L.S OF FLOOR BEAM FB15-(230x450)

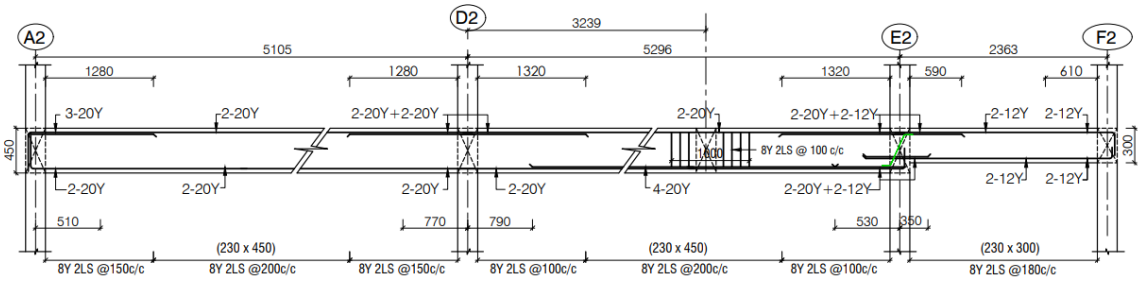


L.S OF MLB-(230x300)

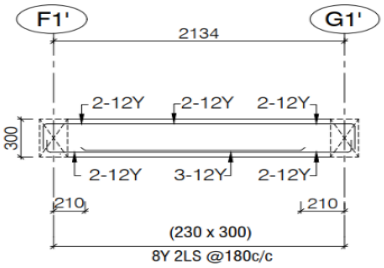
L.S OF FB16-(230x300)



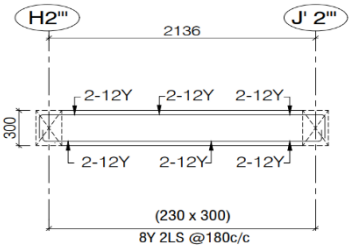
L.S OF FLOOR BEAM FB17a-(230x450) /FB17-(230x300)



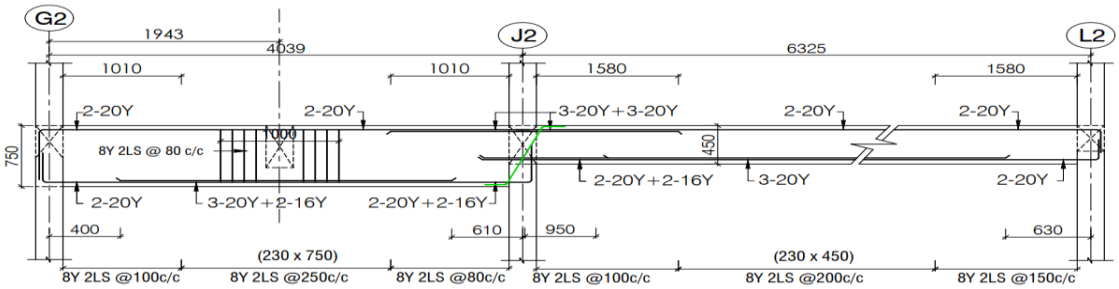
L.S OF FLOOR BEAM FB18-(230x450) / FB18a-(230x300)



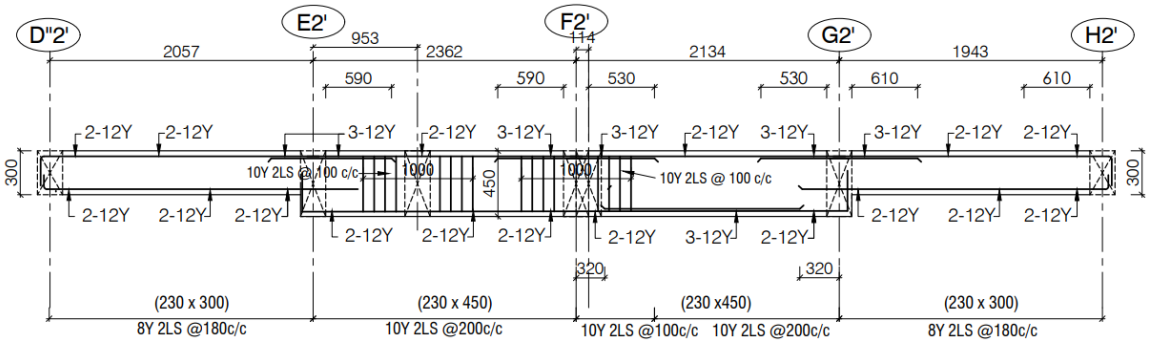
L.S OF FB19-(230x300)



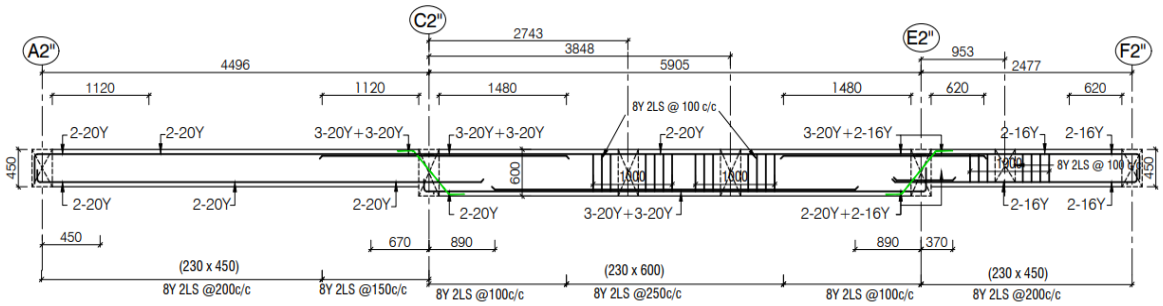
L.S OF FB24-(230x300)



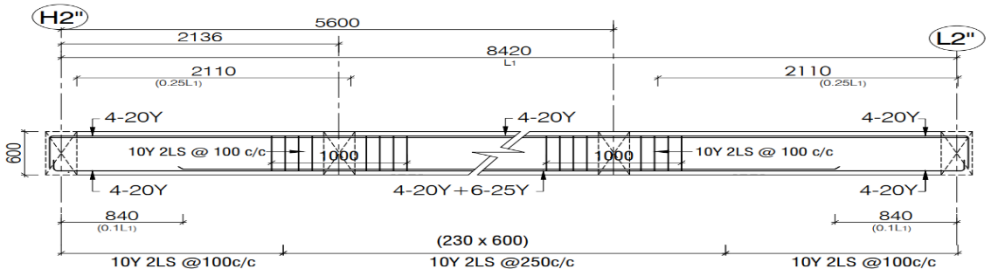
L.S OF FLOOR BEAM FB20a-(230x750) /FB20-(230x450)



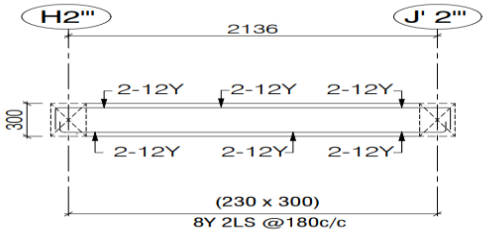
L.S OF FLOOR BEAM FB21-(230x300)/FB21a-(230x450)



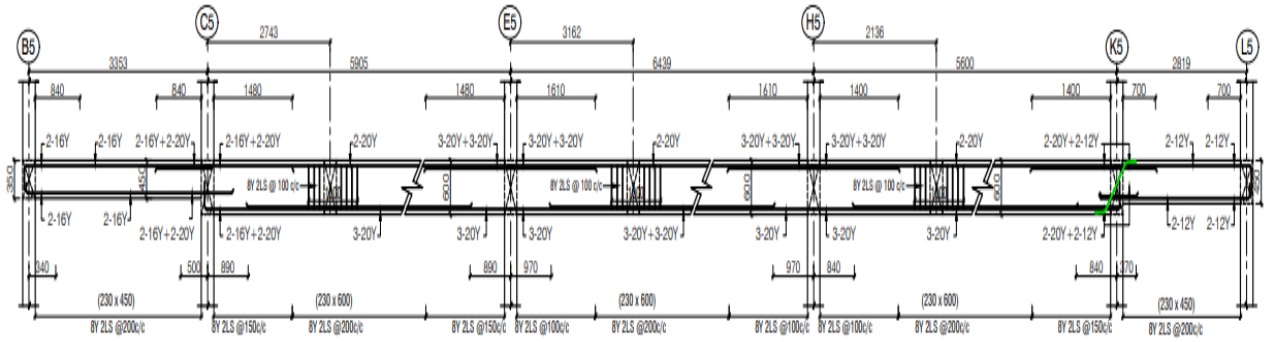
L.S OF FLOOR BEAM FB22(230x450) / FB22a-(230x600)



L.S OF FLOOR BEAM FB23-(230x600)

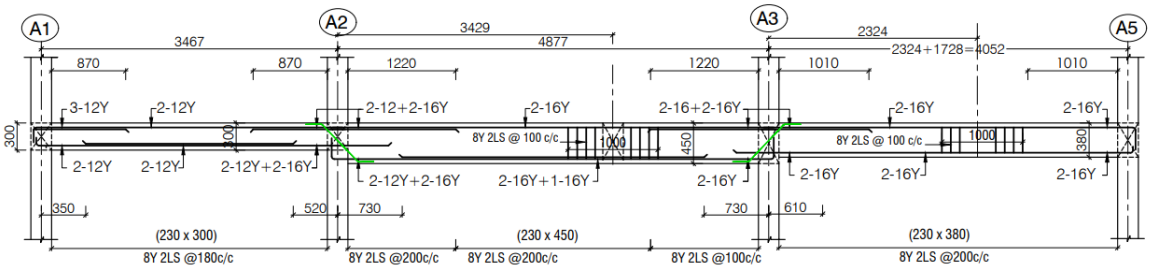


L.S OF FB24-(230x300)



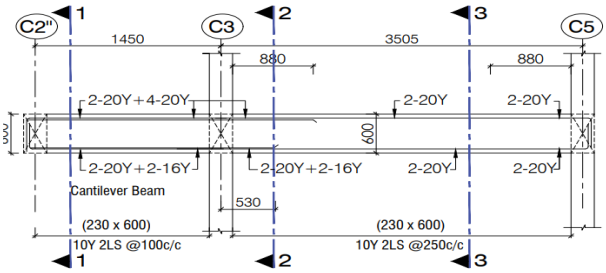
L.S OF FLOOR BEAM FB25-(230x450) / FB25a-(230x600)

Fifth Floor Roof Beam Detailing

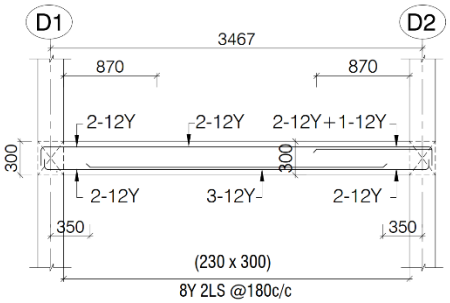


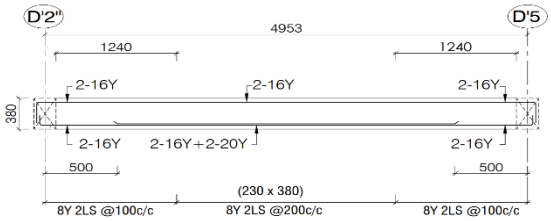
L.S OF ROOF BEAM RB1-(230x300)/RB1a-(230x450)/ RB1b-(230x380)

*PLS REFER FIFTH FLOOR ROOF FRAMING PLAN , SPAN A3- A5 IS NOT STRAIGHT IN PLAN

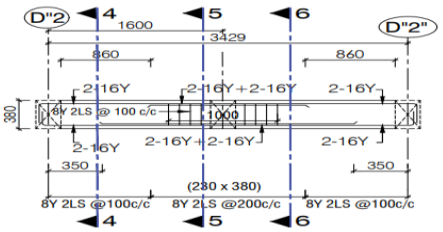


L.S OF RB2-(230x600)

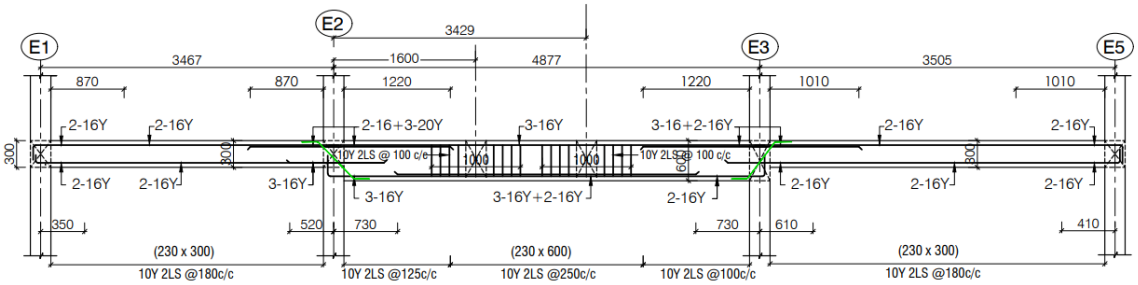




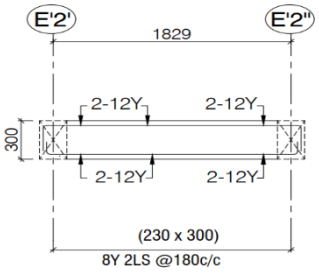
L.S OF ROOF BEAM RB4-(230x380)



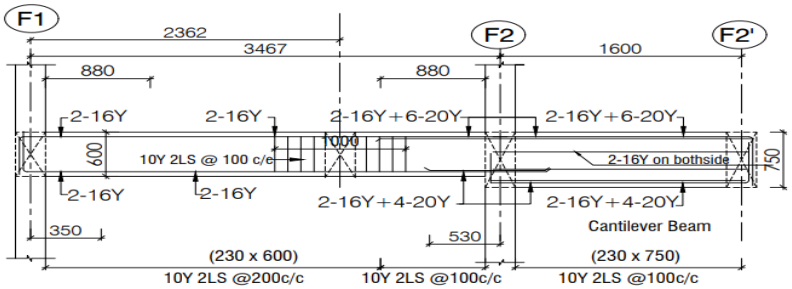
L.S OF RB5-(230x380)



L.S OF ROOF BEAM RB6-(230x300) / RB6a-(230x600)

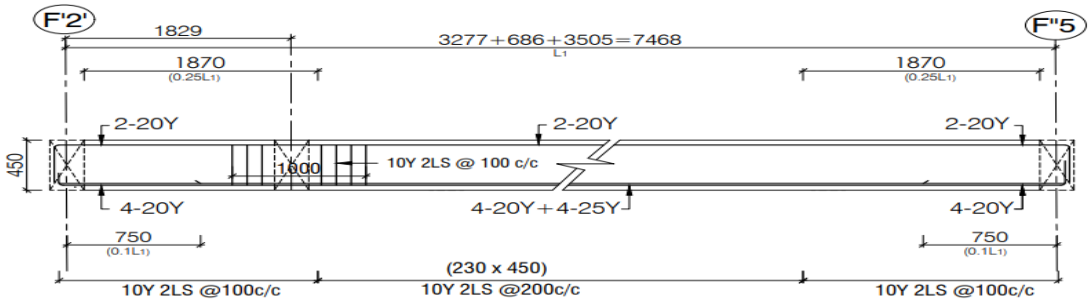


L.S OF RB7-(230x300)



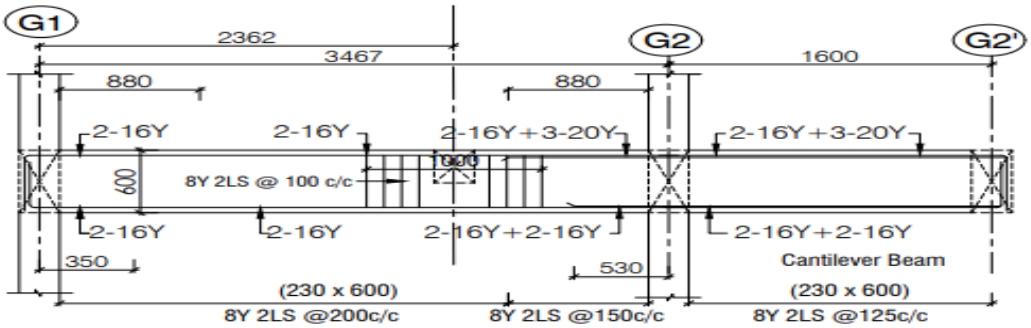
L.S OF RB8-(230x600) / RB8a-(230x750)

PLS PROVIDE SKIN REBARS 2-16Y on bothside

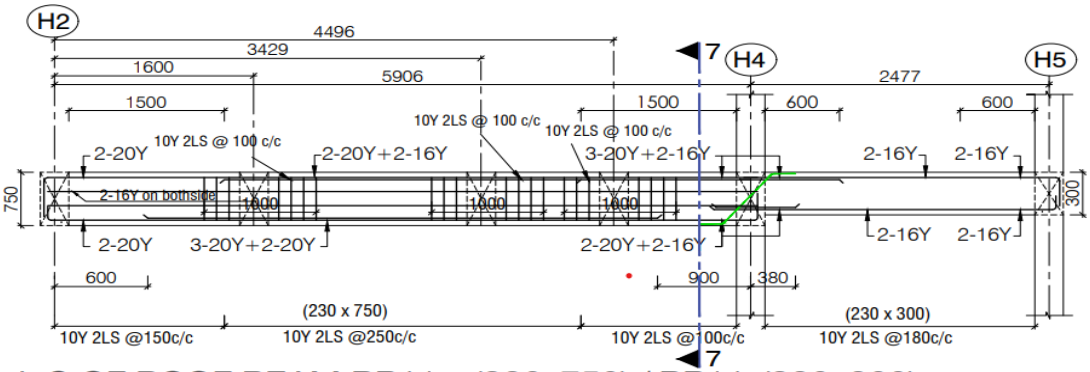


L.S OF ROOF BEAM RB9-(230x450)

*PLS REFER FIFTH FLOOR ROOF FRAMING PLAN , SPAN F'2'- F"5 IS NOT STRAIGHT IN PLAN

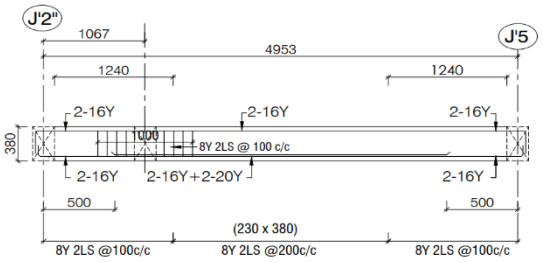


L.S OF ROOF BEAM RB10-(230x600)

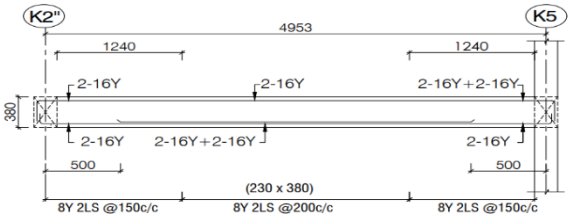


L.S OF ROOF BEAM RB11a-(230x750) / RB11-(230x300)

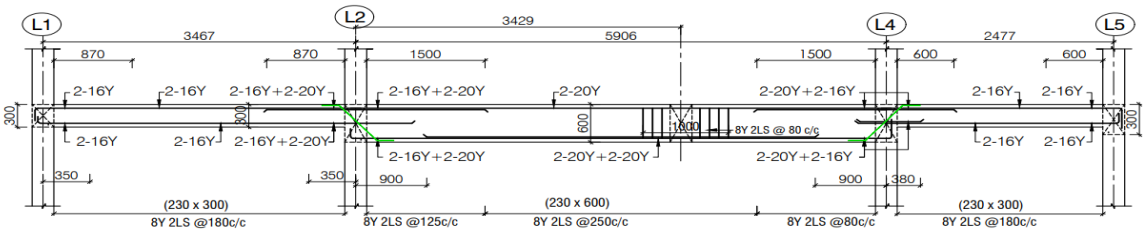
PLS PROVIDE SKIN REBARS 2-16Y on bothside



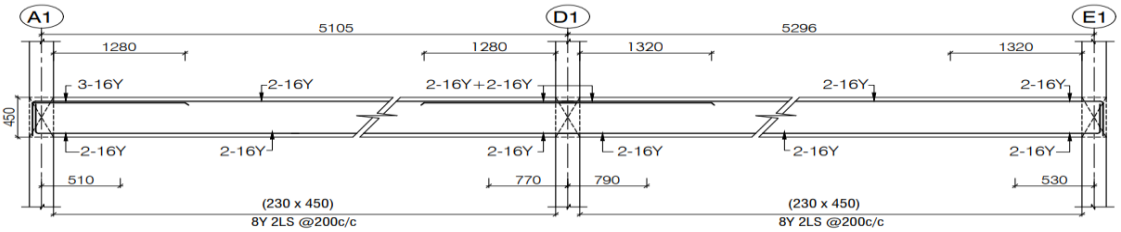
L.S OF ROOF BEAM RB12-(230x380)



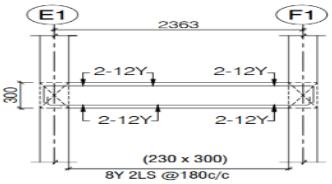
L.S OF ROOF BEAM RB13-(230x380)



L.S OF ROOF BEAM RB14-(230x300)/ RB14a-(230x600)

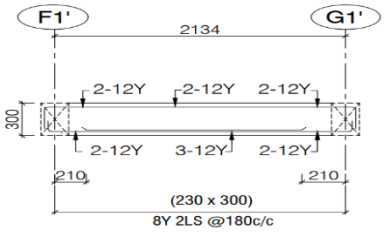


L.S OF ROOF BEAM RB15-(230x450)

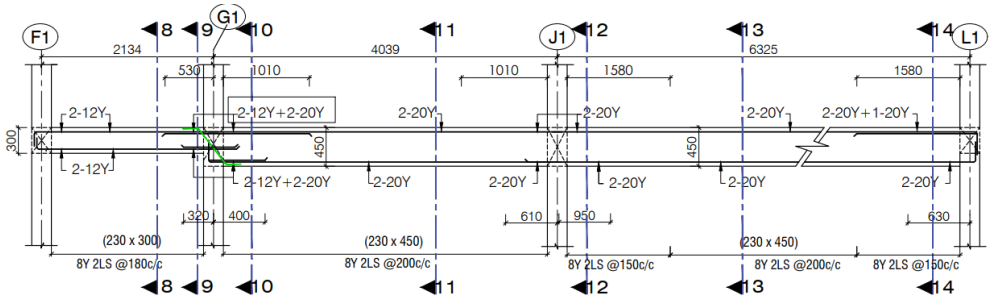


L.S OF MLB-(230x300)

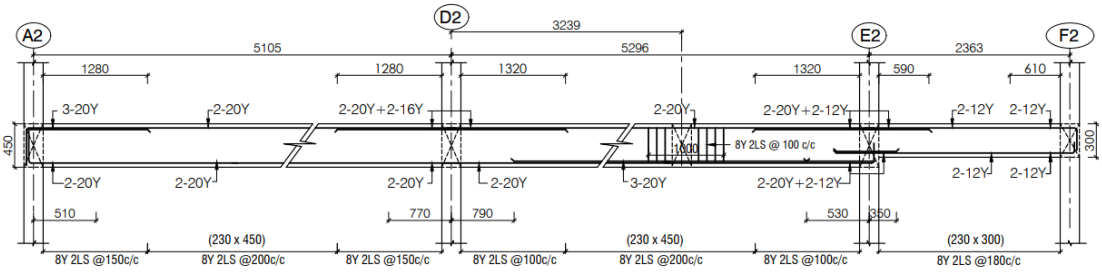
L.S OF RB16-(230x300)



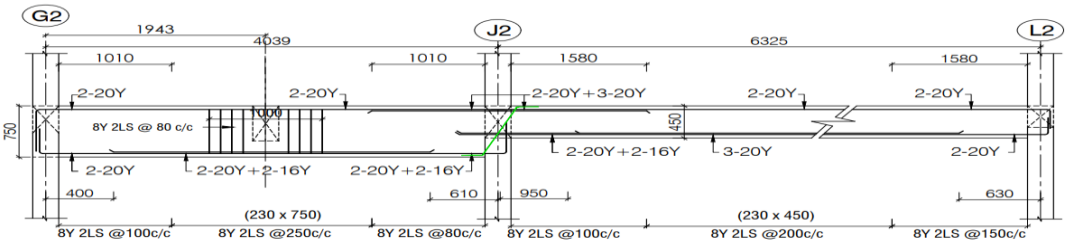
L.S OF RB19-(230x300)



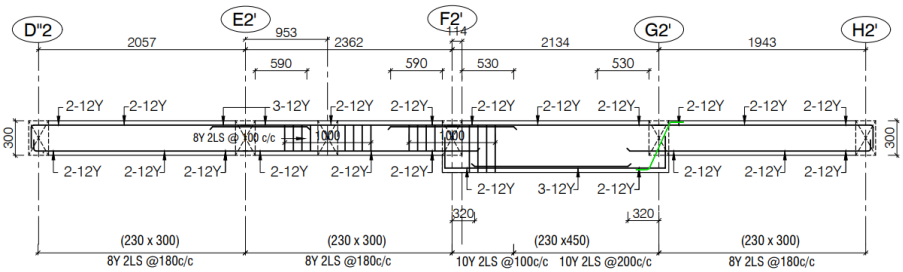
L.S OF ROOF BEAM RB17a-(230x450) / RB17-(230x300)



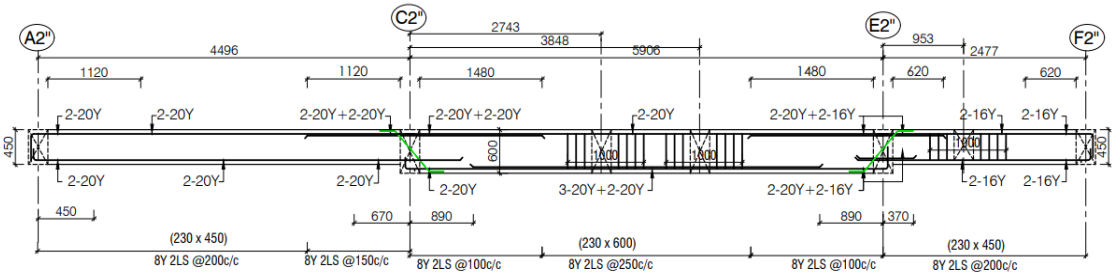
L.S OF ROOF BEAM RB18-(230x450) / RB18a-(230x300)



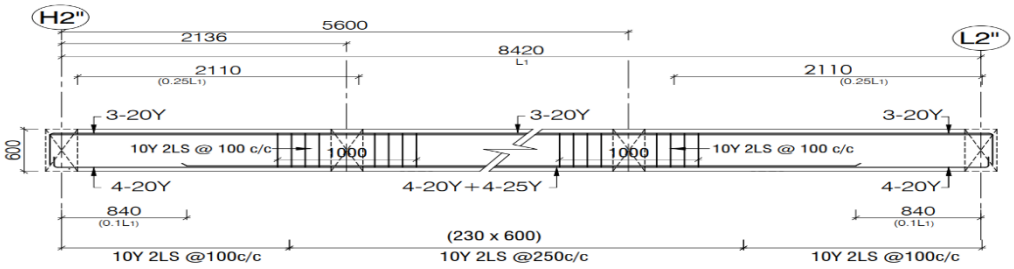
L.S OF ROOF BEAM RB20a-(230x750) / RB20-(230x450)



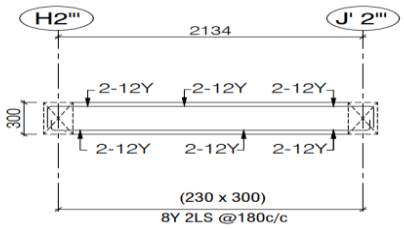
L.S OF ROOF BEAM RB21-(230x300) / RB21a-(230x450)



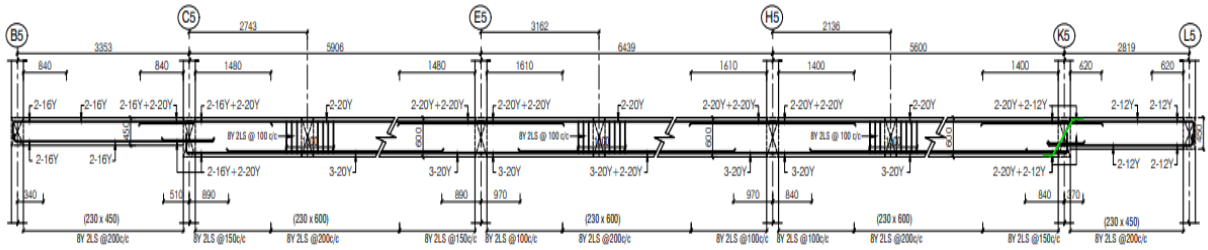
L.S OF ROOF BEAM RB22(230x450) / RB22a-(230x600)



L.S OF ROOF BEAM RB23-(230x600)

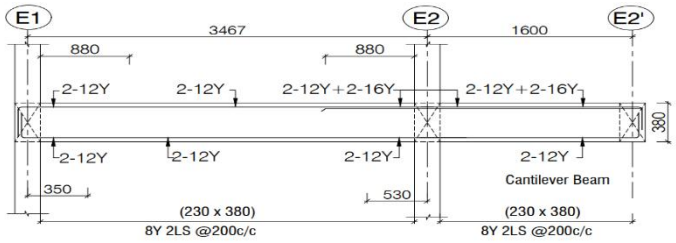


L.S OF RB24-(230x300)

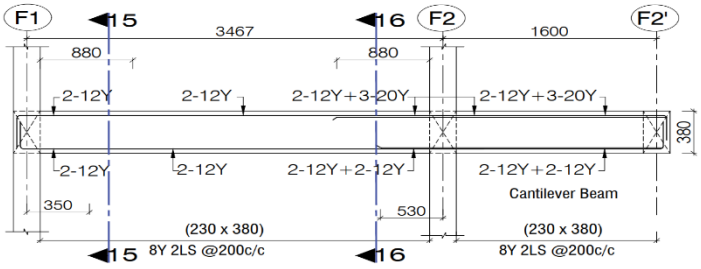


L.S OF ROOF BEAM RB25-(230x450) / RB25a-(230x600)

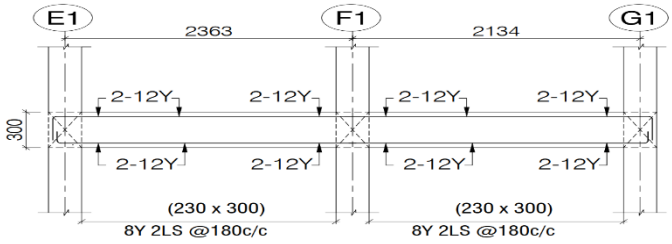
Head Room Roof Beam Detailing



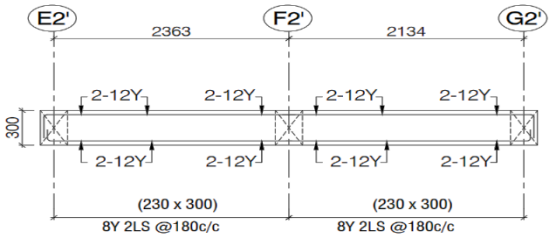
L.S OF HRB1-(230x380)
ALSO FOR G1-G2-G2'



L.S OF HRB2-(230x380)



L.S OF HRB3-(230x300)



L.S OF HRB4-(230x300)

Staircase

Design of Staircase

1ST and 2nd Flight

Input Data :

Concrete : M25
Steel : Fe 500
Span : 3.47 m

Imposed Load = 3.0 KN/m^2
Steps = 4.0 KN/m^2
Tiles = 0.5 KN/m^2
Ceiling = 1.0 KN/m^2
Hand rail = 1.5 KN/m^2
Total Load = **11.00 KN/m^2**

Total loading = 11 KN /m^2

Waist Slab thickness = D = 125mm ; d = 105 m

Bending Moment M = 11 x 3.89^2 /12 = 11.04 KN m

Factored Moment Mu = 1.5 x 11.04 = 16.56 KN m

K = Mu / bd^2 = 16.56 x 10^6 / (1000 x 105 x 105) = 1.50 N / mm^2

From Table 3 of Design Aids SP:16, Pt = 0.373 %

Ast = 392 mm^2 (3.92cm^2)

Provide 10 # @ 200 mm c/c

Distributors : 0.12% x b x D = (0.12 x 1000 x 125)/100 = 150 mm^2 (or 1.50cm^2)

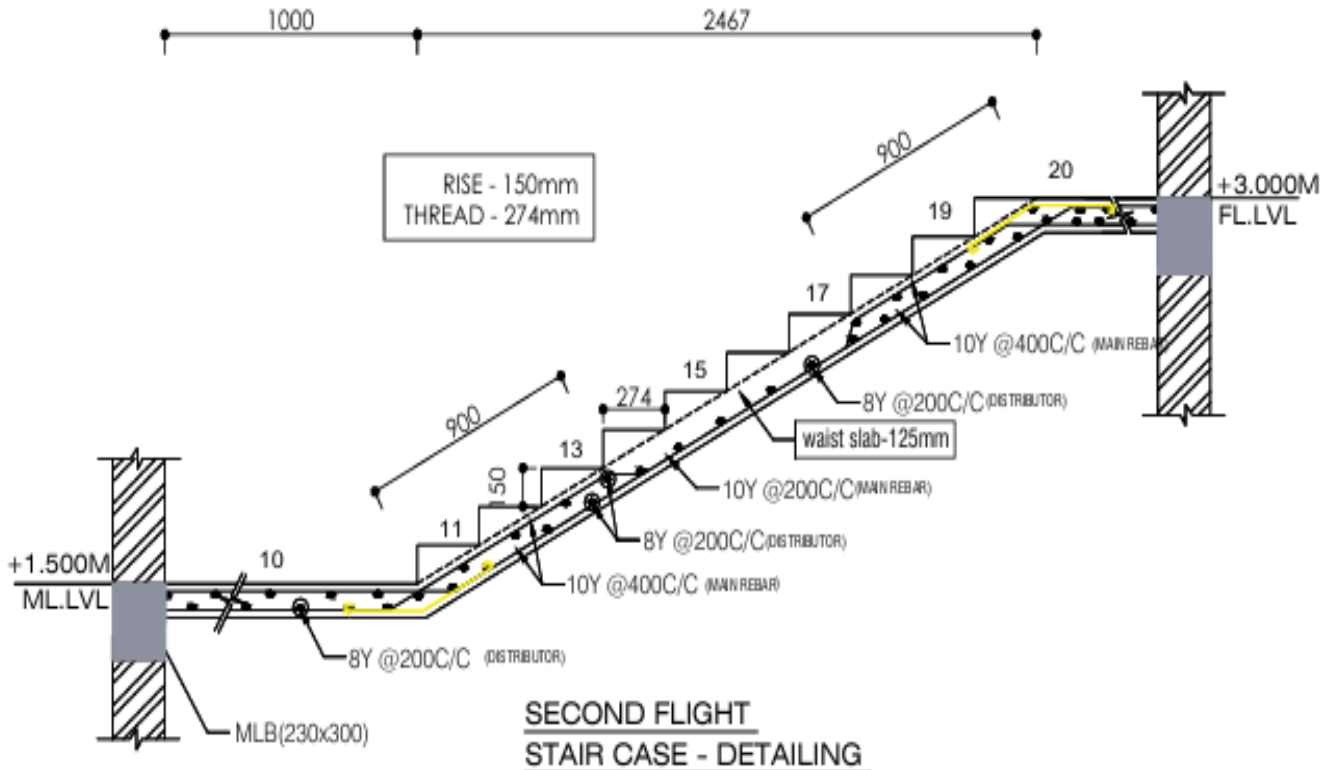
Distributors : Provide 8# @ 200 mm c/c

Output Data:

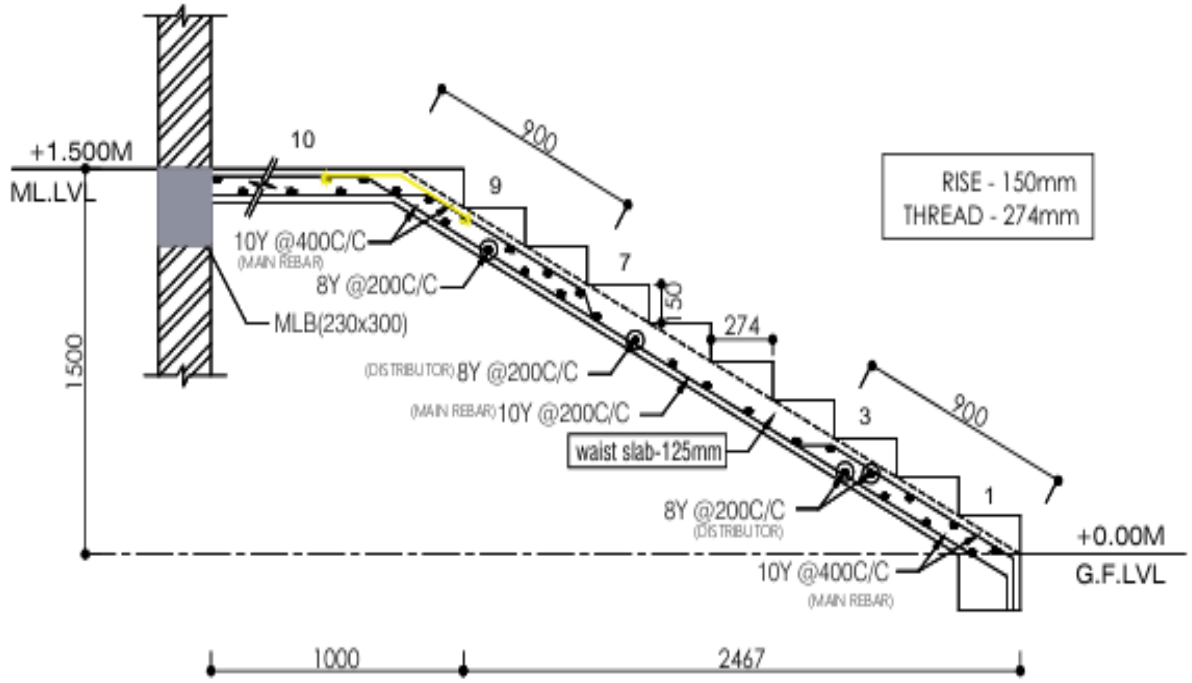
Waist Slab D = 125 mm

Main Rebars : 10# @ 200mm c/c

Distributors : 8# @ 200mm c/c



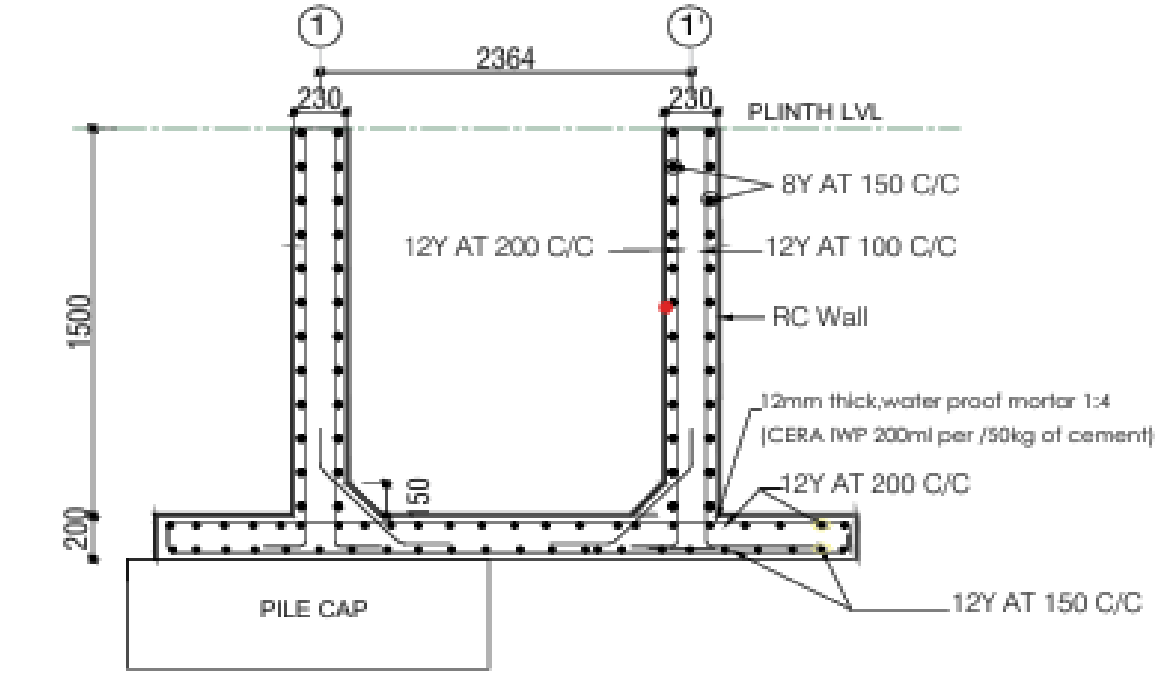
SECOND FLIGHT
STAIR CASE - DETAILING
SCALE 1:25



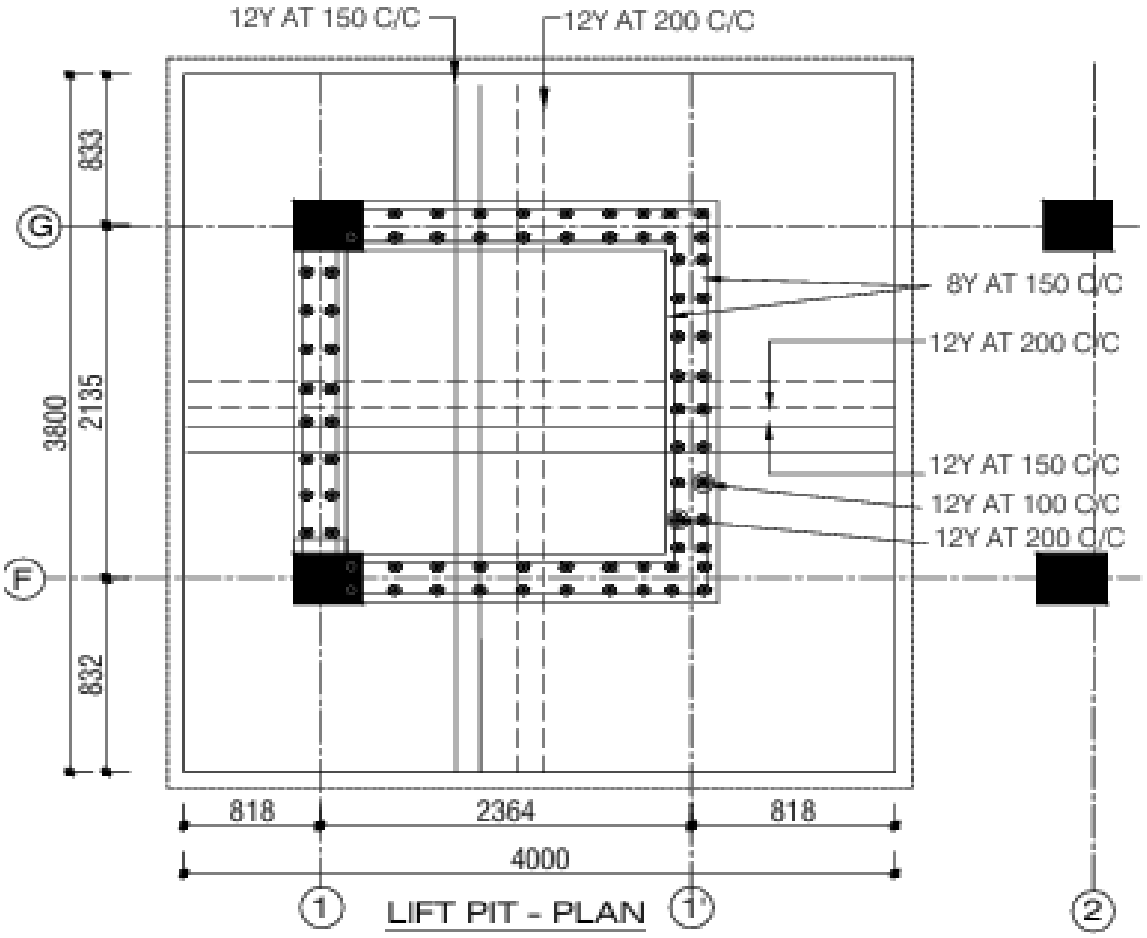
Note:
First Flight Bottom beam should rest on Grade Beam

FIRST FLIGHT
STAIR CASE DETAILING

Lift

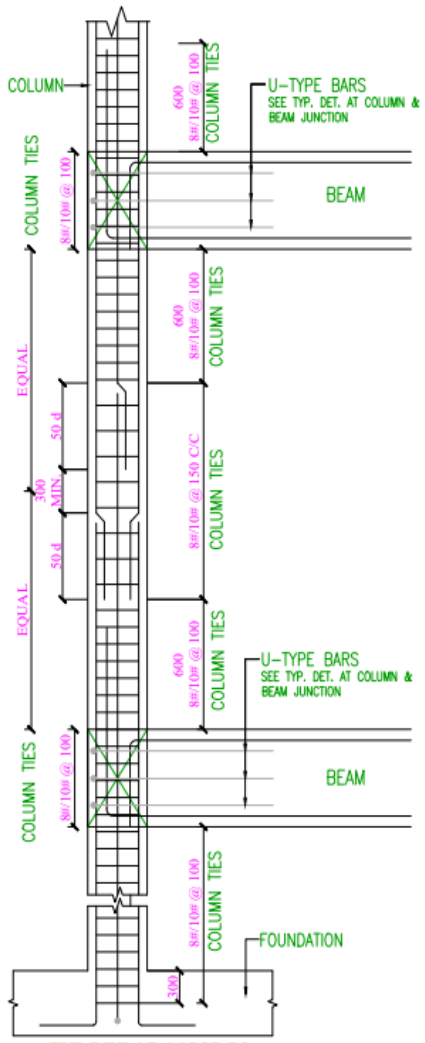


LIFT PIT - SECTION A-A

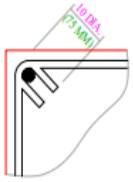


TYPICAL DETAIL OF LIFT PIT

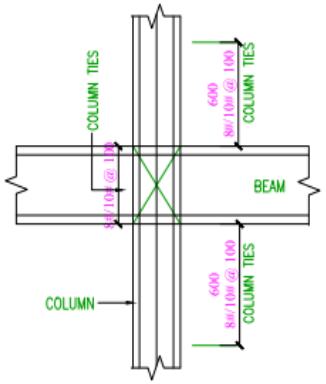
Ductile Detailing Of Rebars @ Beam – Column Junctions to resist Seismic Forces.



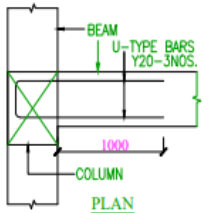
TYP.DET.OF COLUMN
(BEAM ON ONE SIDE OF COLUMN)



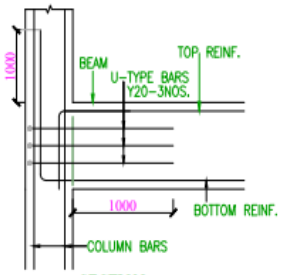
TYP.DET.OF HOOK FOR
BEAM STIRRUP



TYP.DET.OF COLUMN &
BEAM JUNCTION
(BEAMS ON TWO SIDES OF COLUMN)

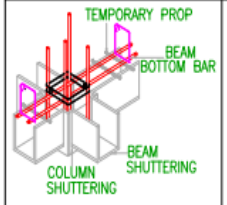


PLAN
TYP.DET.OF COLUMN &
BEAM JUNCTION
(BEAM ON ONE SIDE OF COLUMN)

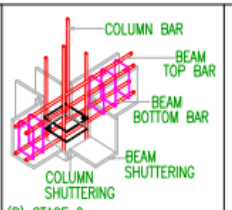


SECTION
TYP.DET.OF COLUMN &
BEAM JUNCTION
(BEAM ON ONE SIDE OF COLUMN)

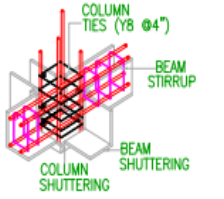
PROCEDURE FOR PLACING COLUMN TIES AT COLUMN BEAM JUNCTION



(A) STAGE 1:
BEAM TOP BARS ARE NOT PLACED, BUT HORIZONTAL TIES IN THE JOINT REGION ARE STACKED UP.



(B) STAGE 2:
TOP BARS OF THE BEAM ARE INSERTED IN THE BEAM STIRRUPS, AND BEAM REINFORCEMENT CAGE IS LOWERED INTO THE FORMWORK.



(C) STAGE 3:
TIES IN THE JOINT REGION ARE RAISED TO THEIR FINAL LOCATIONS, TIED WITH BINDING WIRE, AND COLUMN TIES ARE CONTINUED

Technical Notes

1. All dimensions are in millimeters
2. Working Stress Design as per IS:456-2000
3. Concrete Grade **M-25**, # - Refers Steel **Fe 500D - TMT** Bars as per IS: 1786-1985
4. For all concretes and mortar; Blended Cement (Flyash Based-PPC) should be used for better durability
5. All RC Concrete to be Mixed with Superplasticiser (CERAPLAST 300) @ 300ml per bag of Cement
6. **M-Sand** (Artificial-manufactured Sand or CS-Sand (crushed stone sand) shall be advantageously used in all civil constructions with the addition of superplasticiser since it **has better quality and higher strength** when compared to the river sand due to absence of impurities.
7. **Stone Crusher Dust (Quarry dust)** can also be used - 100% in PCC, Masonry mortar and all grades of concretes with the addition of Superplasticiser (100ml per bag for PCC & Masonry mortar) & 300ml for RC concretes) which produces mortar & concretes with the required workability with less water.
8. Clear Cover for Footing - 75mm (bottom),Beam - 25mm, Slab - 20mm, Column - 40mm
9. To avoid corrosion of steel rebars, please apply one coat of "Steel Guard - Nano Coating" Manufactured by One Touch Solutions, Chennai -17 (ph:044-24355953 / 8124076543)
10. Wherever bundling of rebars (2/3/4 put together without spacer bar) they may be adopted for better flow and compaction of RC Concrete in Columns and Beams

Structural Engineer Certificate:

1. Certified that structural designs and structural drawings furnished by us for the proposed building / structure are accurate and safe in accordance with the BIS codes and NBC-2016 ensuring safety, serviceability and durability of the structural members of the proposed building provided they are adopted in the actual execution/construction.
2. The foundation system adopted for the above structure is evolved and designed based on actual soil met with at site of construction in accordance with the relevant BIS codes and expertise developed in the past 45 years by the Structural Engineer / Structural Consultant
3. However it is clearly informed that the Violation / Deviation of setback norms and FSI in the Development Control rules, correctness of construction, quality and construction management of the above building entirely rest with the promoter and builder(s) as the Structural Engineer is not involved in the same and hence the structural engineer takes no responsibility/accountability what so ever for the same.

Structural Engineer
Er.Dr.A.Veerappan
FIE Reg.No:F-016434-4
ECI Reg.No:Sr.PE/00075/16
CMDA Reg.No:S.E/GR-II/19/05/113

DUCTILE DETAILING OF BEAMS AND COLUMNS
(SP : 34 (S&T) -1987 AND IS:13920 - 2016)

DRAWN:- Er LVP	SCALE 1:100	DATE : 03-04-2024

DESIGNED BY :
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