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hello@verified.realestate
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DESIGN CALCULATION

PLAN SHOWING THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (STILT +5) AT TOWN SURVEY NO. 30/7 OLD S.NO 310/7 BLOCK 25 WARD- B , ZAMIN PALLAVARAM , PALLAVARAM TALUK ,CHENGALPATTU DISTRICT.

STRUCTURAL CONSULTANTS:-

Aura engineering consultants
#8, 50th st, Sarvamangala Colony,
7th Avenue,,Ashok Nagar,
Chennai – 600 083 .
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com

R. MANIKANDAN, M.Tech,(Structures)
Registered Structural Engineer Grade I
SE/GR-I/19/06/154 (CMDA), RSE 100692019 (GCC)
AURA ENGINEERING CONSULTANTS
13/27, 67th Street, R.V. Nagar,
Ashok Nagar, Chennai 600 083.
Ph: 044-48597100 Cell: 9790751378

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1.0 DESIGN BRIEF:

THIS DOCUMENT PLAN SHOWING THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (STILT +5) AT TOWN SURVEY NO. 30/7 OLD S.NO 310/7 BLOCK 25 WARD- B , ZAMIN PALLAVARAM , PALLAVARAM TALUK ,CHENGALPATTU DISTRICT.

2.0 GENERAL DESIGN CRITERIA

2.1. Description of the structure

The Residential Building consists of Stilt Floor + 5 Upper floors and the structure is designed as a RCC framed structure.

1. Size of the building : 149.99 X 24.05M
2. Height of the building : 14.00M
3. Number of storeys above GL : Stilt Floor +5 upper floors
4. Floor to floor height of this building : Stilt and First floors - 3.0m
   : Typical floor – 3.0m
5. Type of foundation : Isolated foundation as per geotechnical report

2.2. Materials Used

Following materials are generally used in the design of the various components of the structure.
For Concrete Structure

- M25 grade concrete for all reinforced concrete parts of the structure
- Fe500 grade Structural reinforcement steel
- Masonry for all walls : Brick / Block

2.3. Design Codes & Standards

Following codes and specifications have been generally used in the design of the members of the structure.

- IS 456 : 2000 Code of practice for Plain and Reinforced concrete
- SP: 16 Design Aids for Reinforced concrete
- IS 875 : 1987 Design Loads for building and structures
- IS 1893 : 2002 Criteria for Earthquake Resistant design of structures
- IS 13920: 1993 Ductile Detailing of R.C structures subjected to Seismic forces
- SP: 34 Handbook on Concrete Reinforcement & Detailing
- IS 800 : 1984 Code of practice for general construction in steel
- IS 2062 : 1999 Steel for general structural purposes specification
- IS 1786: 1985 Specification for high strength deformed bars and wires for concrete reinforcement

3.0 LOADING

Primary Load:

- Dead Load (DL)
- Live Load (LL)

3.1. Dead load (DL)

Material weight

- Density of Concrete =25 kN/m^3

- D.L. due to partitions
  (Light Partition as per IS 875) =1.50 kN/m^2
- D.L due to floor finish 50mm thick = 0.05x25 = 1.25 kN/m^2

3.2. Live load (LL)

Minimum Uniformly Distributed Live Loads:

Occupancy or use	Live Load (kn/m^2)
All rooms and kitchens	2.00
Toilet and bath rooms	3.00
Corridors, passages, staircases	3.00
Balconies	3.00
Terrace Floor	1.50
Basic wind speed	=50 m/sec
Seismic Zone	=Zone III

3.5 Loading Combinations

The following combinations of Loads as per IS 1893 is considered in the STAAD Analysis

- 1.5(DL +LL)
- 1.2(DL + LL)

The below load combinations are used to check the structure in serviceability condition.

- 1.0(DL +LL)

4.0 STRUCTURAL MATERIAL:

4.1 Concrete Material Specifications:

Concrete compressive cube strength	- 25 N/mm^2
Minimum cement content	- Refer standard drawings for general & Legends
Cement type	- OPC
Free water cement ratio	- 0.5 (Maximum)
Nominal maximum size of aggregate	- 20mm UNO

4.2 Reinforcement:

Steel reinforcement shall be deformed bars, the characteristic of reinforcement bars shall conform to the following specification:

Grade of Steel	Actual Yield Strength (MPa)
Grade Fe500	Minimum 500 MPa,

4.4 Concrete cover:

Cover for Reinforcement is considered as per Table 16A of NBC, for a Fire resistance of 2 hrs.

- Raft Slab = 50mm
- Footing = 50mm
- RC Wall = 30mm

- Columns = 40mm
- Beams = 30mm
- Slabs = 25mm

5.0 Structural Description

5.1. Method of analysis

Structure analysis & design:

The structure is analyzed as a Space frame structure in STADD Pro Vi8. Columns, Footing, Basement walls, slabs, Beams and Staircases are designed as reinforced concrete members.

5.2. Framing System, Analysis and Design

Limit State concept of design will be used as per IS: 456-2000 & SP - 16. The detailing of reinforcement shall be done satisfying the requirements of IS: 456-2000, SP-16, IS: 13920, IS: 4326-1993 and SP-34.

The Slabs and beams are checked for deflection as per IS 456:2000. Cover for Reinforcement is considered as per Table 16A of NBC, for a Fire resistance of 2 hrs.

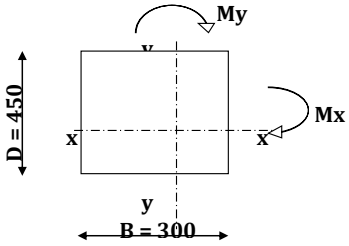
R. MANIKANDAN, M.Tech,(Structures)
Registered Structural Engineer Grade I
SE/GR-I/19/06/154 (CMDA), RSE 100692019 (GCC)
AURA ENGINEERING CONSULTANTS
13/27, 67th Street, R.V. Nagar,
Ashok Nagar, Chennai-600 083.
Ph: 044-48597100 Cell: 9790751378

APPENDIX I

Design Calculations

Column Design

PROJECT	RESIDENTIAL BUILDING (STILT +5) AT TOWN SURVEY NO. 30/7 OLD S.NO 310/7 BLOCK 25 WARD- B , ZAMIN PALLAVARAM.	DOCUMENT. NO.	DATE	DESIGNED	DATE
TITLE	Design for a Short Column with Biaxial Bending	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
	Column No:  **CRITICAL LOAD CASE:**	
1.0	**Basic Data**	
1.1	**Material Data**	
	Grade of Concrete: M 25	
	Grade of Steel: Fe 500	
1.2	**Codal Data**	
	Nominal Cover = 40 mm	Cl 26.4.2.1,IS456:2000
	Diameter of the Bar = 25 mm ≥ 12 mm	
	d' = 52.5 mm	
1.3	**Basic Dimensions**	
	Unsupported Length of the Column L_{ox} = 3000 mm	
	L_{oy} = 3000 mm	
	L_{ex} = 3000 mm	Table 28 ,
	L_{ey} = 3000 mm	IS456:2000
	Size of the Column B X D = 300 x 450 mm	
1.4	**Analysis Results**	
	Factored Axial Load P_u = 780.0 kN	STAAD
	Factored Moment M_{ux} = 22.00 kNm	OUTPUT
	Factored Moment M_{uy} = 71.00 kNm	
2.0	**Check for Slenderness**	
	Slenderness Ratio about Major Axis L_{ex} / D = 6.667	
	Slenderness Ratio about Minor Axis L_{ey} / B = 10.000	
	Since Leff / LLD <12 Designed as Short Column	Cl 25.1.2, IS456:2000
3.0	**Check for Eccentricity**	
	Minimum Eccentricit e_x = L_{ox} / 500 + D / 30 = 21.0 mm >20	Cl 25.4
	e_y = L_{oy} / 500 + B / 30 = 16.0 mm <20	IS456:2000
3.1	**Moments Due to Minimum Eccentricity**	
	Me_x = 16.38 kN.m	
	Me_y = 15.60 kN.m	
4.0	**Design Moment**	
	Design Moment about X axis M_{ux} = 22.00 kN.m	
	Design Moment about Y axis M_{uy} = 71.00 kN.m	

PROJECT	RESIDENTIAL BUILDING (STILT +5) AT TOWN SURVEY NO. 30/7 OLD S.NO 310/7 BLOCK 25 WARD- B , ZAMIN PALLAVARAM.	DOCUMENT. NO.	DATE	DESIGNED	DATE
TITLE	Design for a Short Column with Biaxial Bending	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
5.0	**Uniaxial Moment Carrying capacity of the Section about X & Y- axis**	
	d' / D = 0.117	
	d' / B = 0.175	
	Assume the Reinforcement Percentage p = **2.00**	
	p / f_{ck} = 0.080	
	$p_u / f_{ck}BD$ = 0.231	
	Reinforcement distributed equally on four sides = **4**	
	$M_{ux1} / f_{ck}BD^2$ = 0.137	Chart 43 - 46
	$M_{uy1} / f_{ck}DB^2$ = 0.119	SP 16 : 1980
	Moment carrying capacity about X axis M_{ux1} = 207.89 kN.m	
	Moment carrying capacity about Y axis M_{uy1} = 120.61 kN.m	
	Pu < Axial Load Carrying capacity ; Hence O.K	
6.0	**Calculation of P_{uz}**	
	$P_{uz} = 0.45 f_{ck} A_c + 0.75 f_y A_{sc}$ = 2500.88 kN	Cl 39.6 , IS456:2000
	P_u/P_{uz} = 0.312	
	a_n = 1.186	Cl 39.6 , IS456:2000
7.0	**Criteria for Biaxial Bending (Bresler's Formulation)**	
	$(M_{ux}/M_{ux1})^{an} + (M_{uy}/M_{uy1})^{an}$ = **0.603** < 1	Cl 39.6 , IS456:2000
	Hence Safe	
8.0	**Longitudinal Reinforcement**	
	Area of compression Steel $A_{sc,reqd}$ = **2700** mm^2	
	10 No Y20 + No Y20 $A_{sc,pro}$ = **3142** mm^2	
8.1	**Check for Minimum & Maximum Area of Steel**	
	Minimum Area of ste (0.8 % of A_g dir) = **441** mm^2	Cl 26.5.3.1 a & b ,
	(Based on the area of concrete reqd to resist direct stress)	IS 456 : 2000
	Maximum Area of ste (4 % of A_g) = **5400** mm^2	
	441 < **3142** < **5400** mm^2	
	Area of Steel is with in the permissible limit ; Hence O.K	
9.0	**Transverse Reinforcement**	
9.1	Diameter of Transverse Reinforcement = **8** mm ≥ 6 mm	Cl 26.5.3.2 c 2) ,
9.2	**Spacing of Lateral Ties :**	
	i) Least Lateral Dimension of the column = 300 mm	Cl 26.5.3.2 c 1) ,
	ii) 16 times the Smallest dia of Longitudinal Steel = 320 mm	IS 456 : 2000
	iii) = 300 mm	
	Reqd. Spacing of Ties (Minimum of the above) = 300 mm	
	Provide 8 mm dia Lateral Ties @ **300** mm Spacing	
	Provide closer spacing on either side of the column above and below beam/slab	

R. Manikandan

R. MANIKANDAN, M.Tech,(Structures)
Registered Structural Engineer Grade I
SE/GR-I/19/06/154 (CMDA), RSE 100692019 (GCC)
AURA ENGINEERING CONSULTANTS
13/27, 67th Street, R.V. Nagar,
Ashok Nagar, Chennai-600 083.
Ph: 044-48597100 Cell: 9790751378

Footing Design

RESIDENTIAL BUILDING (STILT +5) AT TOWN SURVEY NO. 30/7 OLD S.NO 310/7 BLOCK 25 WARD- B , ZAMIN PALLAVARAM.

Design of Isolated Footing **F2** **Node :** **38**

Basic Data:

Net Safe Bearing Capacity	150	kN/m^2
Unit wieght of Soil	18	kN/m^3
Unit wieght of Concrete	25	kN/m^3
Grade of Concrete	25	N/mm^2
Grade of Steel	500	N/mm^2
Clear Cover to Reinforcemer	50	mm
Earth Fill above FGL	0	mm
Base Area of Footing	5.76	m^2
Ixx	2.76	m^4
Izz	2.76	m^4
Weight of Footing	72.00	kN
Weight of soil	151.88	kN

Gross Bearing Pressure Calculatio (kN/m^2)

Critical Load Combinations	Pmax	Pmin
200	116.99	116.99219
0	38.87	38.87

Gross SB((w/o increase) 186 kN/m^2

Hence **OK**

Factored Net Upward Pressure Calculation

Load Factor for Design 1.5

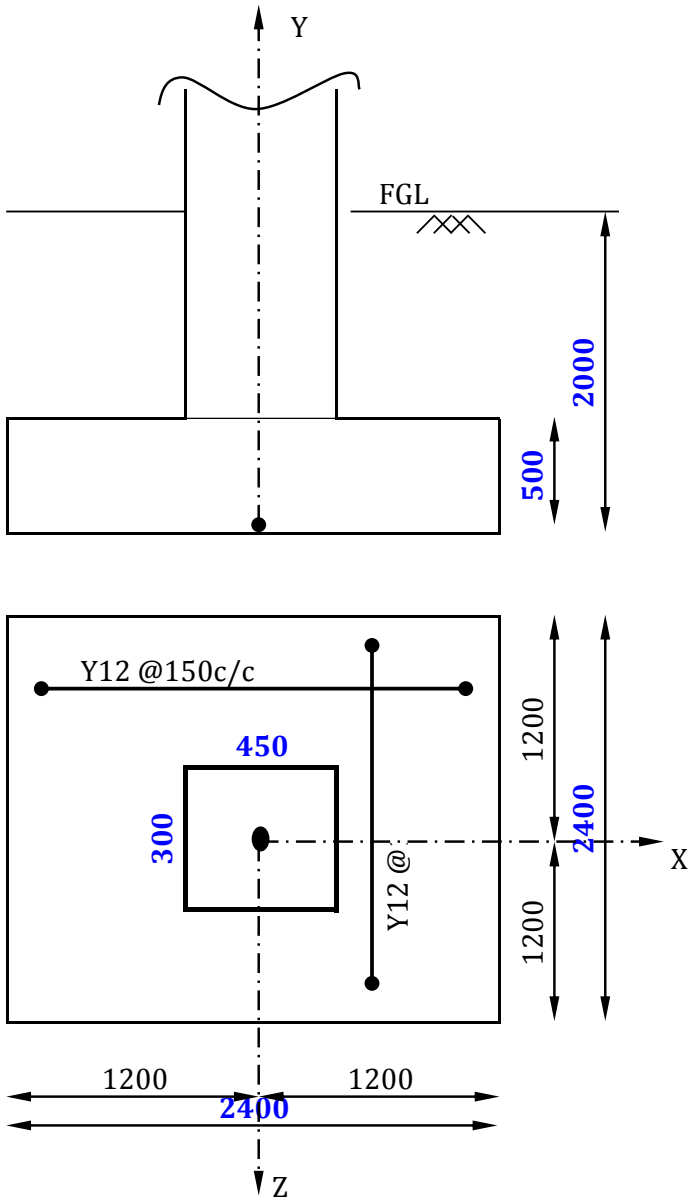
Critical Load Combinations	Pmax	Pmin
200	117.19	117.1875
0	0.00	0.0

Dsgn.(+ve) BM abt. X-axis M	64.60	kN.m
Dsgn.(+ve) BM abt. Z-axis M	55.70	kN.m
Dsgn.(-ve) BM abt. X-axis M	0.00	kN.m
Dsgn.(-ve) BM abt. Z-axis M	0.00	kN.m
Provided Eff. depth for Mux	444.00	mm
Provided Eff. depth for Muz	432.00	mm
Mu,lim	621	kN.m

Depth provided is **OK**

Bottom Reinforcement

Ast Required for Mux	339.7	mm^2
Ast Required for Muz	300.6	mm^2
Min. Ast Reqd.	600	mm^2



Bottom Reinforcement

						Ast Provided	Ast Required		
Provide	12	@	150	C/C	along Z	754	600.0	mm^2	Hence
Provide	12	@	150	C/C	along X	754	600.0	mm^2	**OK**

RESIDENTIAL BUILDING (STILT +5) AT TOWN SURVEY NO. 30/7 OLD S.NO 310/7 BLOCK 25 WARD- B , ZAMIN PALLAVARAM.

Design of Isolated Footing **F2** **Node :** **38**

Top Reinforcement

Ast Required for Mux	0.00	mm^2
Ast Required for Muz	0.00	mm^2
Min. Ast Reqd.	Not Req	mm^2

Check For Flexural / Oneway Shear

	Actual	Allowable		Hence
Shear Stress (Plane ll to X)	0.160	0.308	N/mm^2	**OK**
Shear Stress (Plane ll to Z)	0.147	0.311	N/mm^2	**OK**

Check For Punching / Twoway Shear

Allowable Shear Stress		1.25	N/mm^2	
Actual Shear Stress		0.46	N/mm^2	Hence **OK**

Check For Overturning

Co-efficient of friction	=	0.57				
Factor of safety for overturning, slidi	=	1.4				
Net Moments acting at Pad Level, M_{xx}	=	0.00	kNm			
Net Moments acting at Pad Level, M_{zz}	=	0.00	kNm			
Weight of pad	=	72.00	kN			
Weight of Over burden Earth	=	151.88	kN			
Total downward Load	=	673.88	kN			
Stabilizing moment along X-Dir	=	673.88	x	1.20		
	=	808.65	kNm			
Actuating moment, M_{zz}	=	0.00	kNm			
Factor of Safety (Along X-Dir)	=	808.65	/	0.0		
		-	>	1.40	Hence	**OK**

Check For Sliding

Resistance against Sliding	=	384.109	kN			
Max. Shear Load @ Pad level in X-Dir	=	2.5	kN			
Max. Shear Load @ Pad level in Z-Dir	=	5.3	kN			
Factor of Safety (Along X-Dir)	=	384.1	/	2.5		
		151.22	>	1.40	Hence	**OK**
Factor of Safety (Along Z-Dir)	=	384.1	/	5.3		
		72.47	>	1.4	Hence	**OK**

Plinth Beam Design

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CL. NO.	**BEAM DESIGN CALCULATIONS**			**REFERENCES**	

1.1 **Geomentry Data**

Beam Number		=	**PB1**		
Type of Beam		=	Rectangular Beam		
Support Condition		=	Continuous Beam		
Width of beam	b	=	200	mm	
Overall Depth of Beam	D	=	380	mm	
Dia of bar	Φ	=	25	mm	
Nominal Cover	cc	=	30	mm	IS 456:2000 Table 19
Effective Depth	d	=	337.5	mm	IS 456:2000
Effective Cover		=	42.5	mm	Cl 23.0
Effective Span of beam	l_{eff}	=	4500	mm	
Concrete grade		=	M 25		
Steel Grade		=	Fe 500		
$p_{t,lim}$		=	0.944 %		
$p_{t,min}$		=	0.170 %		IS 456:2000
p_t & p_{cmax}		=	4.00 %		Cl 26.5.1.1

1.2 **Force Input**

Left negative moment	(Support 1)	=	84	kNm
Mid span positive moment		=	84	kNm
Right negative moment	(Support 2)	=	84	kNm
Shear @ (Support 1)		=	149	kN
Shear @ (Span)		=	149	kN
Shear @ (Support 2)		=	149	kN

1.3 **Limiting Moment**

M_{ulim} = 0.133 f_{ck} b d^2 = 75.75 kNm

1.4 **Area of Steel**

Minimum Area of Steel = 0.17% b d = 114.75 mm^2

Support 1

Negative moment	(Support 1)	=	84	kNm

Hence the Section is designed as Doubly Reinforced Section

	M_u/bd^2	=	3.687	
Percentage of tension steel reqd	p_t	=	1.039	%
Percentage of compression steel reqd	p_c	=	0.106	%
Required Area of tension steel	$A_{st\ reqd}$	=	701.33	mm^2
Required Area of compression steel	$A_{sc\ reqd}$	=	71.55	mm^2

Detail of bars

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Tension Reinforcement	**3**	**16**		

A_{st} provided = 603.19 mm

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CL. NO.	**BEAM DESIGN CALCULATIONS**				**REFERENCES**

	Nos	Dia	Nos	Dia		
Compression Reinforcemer	3	16	0			
A_{sc} provided	=	603.19	mm^2			
Percentage of tension steel provided	p_t	=	0.894	% **Not safe**		
Percentage of compression steel provid	p_c	=	0.894	% **Hence O.K**		

Check for Shear

Shear		=	149	kN	
Nominal Shear Stress	tv	=	2.21	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	tc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	tc,max	=	2.5	N/mm^2	Table 19, IS456:2000
Diameter of the Stirrup bar		=	8	mm	Table 20, IS456:2000
Number of Legs		=	2		
Spacing of Shear reinforcement Required		=	160.0		Cl 40.4, IS456:2000
Maximum Spacing of Shear Reinforcement		=	250		Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 160mm c/c spacing

Support 2

Negative moment		=	84	kNm	
Hence the Section is designed as Doubly Reinforced Section					
	M_u/bd^2	=	3.687		
Percentage of tension steel reqd	p_t	=	1.039	%	
Percentage of compression steel reqd	p_c	=	0.106	%	
Required Area of tension steel	$A_{st\ reqd}$	=	701.33	mm^2	
Required Area of compression steel	$A_{sc\ reqd}$	=	71.55	mm^2	

Detail of bars

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Tension Reinforcement	3	16	0	0
A_{st} provided	=	603.19	mm	

	Nos	Dia	Nos	Dia
Compression Reinforcemer	3	16	0	0
A_{sc} provided	=	603.19	mm	

Percentage of tension steel provided	p_t	=	0.894	% **Not safe**	
Percentage of compression steel provid	p_c	=	0.894	% **Hence O.K**	

Check for Shear

Shear		=	149	kN	
Nominal Shear Stress	tv	=	2.21	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	tc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	tc,max	=	2.5	N/mm^2	Table 19, IS456:2000
Diameter of the Stirrup bar		=	8	mm	Table 20, IS456:2000

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Number of Legs = 2

Spacing of Shear reinforcement Required = 160.0 — Cl 40.4, IS456:2000

Maximum Spacing of Shear Reinforcement = 250 — Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 160mm c/c spacing

Span

Positive moment (Span) = 84 kNm

Hence the Section is designed as Doubly Reinforced Section

M_u/bd^2 = 3.325

Percentage of tension steel reqd p_t = 1.039 %

Percentage of compression steel reqd p_c = 0.106 %

Required Area of tension steel $A_{st\ reqd}$ = 701.33 mm^2

Required Area of compression steel $A_{sc\ reqd}$ = 71.55 mm

Detail of bars

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Tension Reinforcement	3	16	0	0

A_{st} provided = 603.19 mm^2

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Compression Reinforcemer	3	16	0	0

A_{sc} provided = 603.19 mm^2

Percentage of tension steel provided p_t = 0.894 % **Not safe**

Percentage of compression steel provid p_c = 0.894 % **Hence O.K**

Check for Shear

Shear = 149 kN

Nominal Shear Stress tv = 2.21 N/mm^2 — Cl 40.1, IS456:2000

Permissible Shear Stress tc = 0.92 N/mm^2 — β = 1.000

Maximum Shear Stress tc,max = 2.5 N/mm^2 — Table 19, IS456:2000

Diameter of the Stirrup bar = 8 mm — Table 20, IS456:2000

Number of Legs = 2

Spacing of Shear reinforcement Required = 160.0 — Cl 40.4, IS456:2000

Maximum Spacing of Shear Reinforcement = 250 — Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 160mm c/c spacing

Check For Deflection

Basic Value = 26 — Cl.23.2, IS456:2000

Service Stress in Steel f_s = **337.19** N/mm

Modification Factor(Tension Reinforcement) F_1 = 0.78

Allowable Span/Depth = 20.28

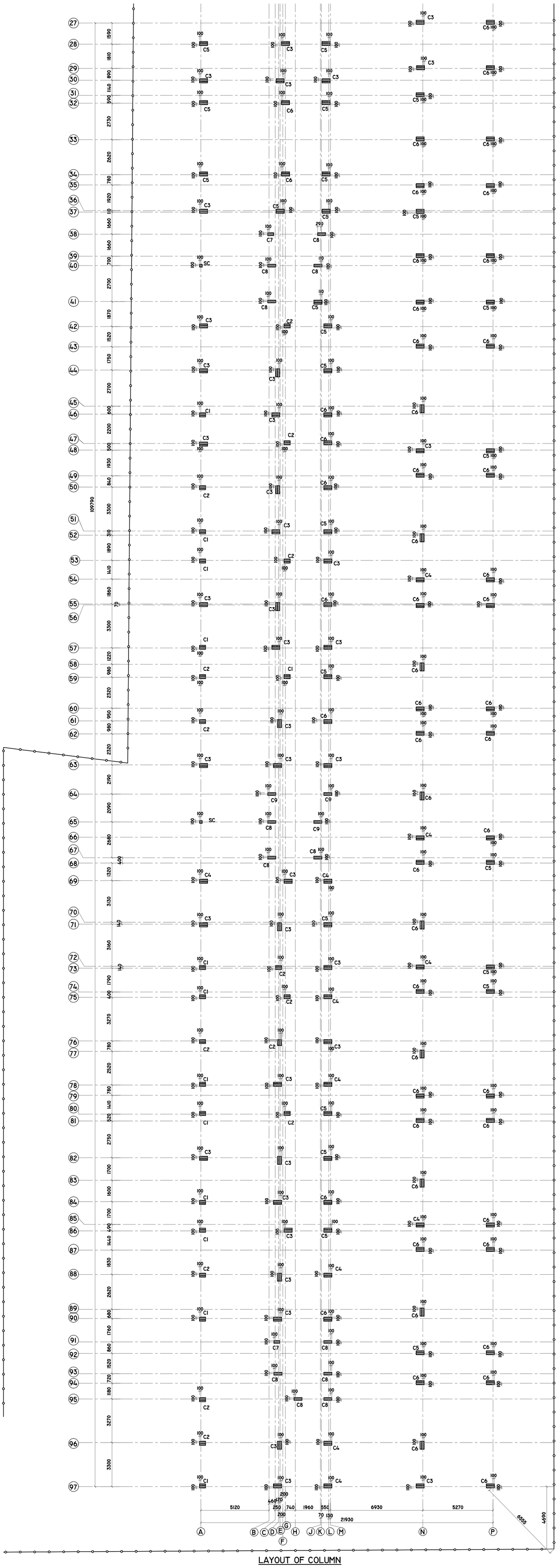
Actual Span/Depth = 13.33 **Hence Safe**

APPENDIX II

GENERAL ARRANGEMENT DRAWINGS

R. MANIKANDAN, M.Tech,(Structures)
Registered Structural Engineer Grade I
SE/GR-I/19/06/154 (CMDA), RSE 100692019 (GCC)
AURA ENGINEERING CONSULTANTS
13/27, 67th Street, R.V. Nagar,
Ashok Nagar, Chennai-600 083.
Ph: 044-48597100 Cell: 9790751378

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LAYOUT OF COLUMN

COLUMN SCHEDULE			
S.NO.	NAME	SIZE	
		UPTO SFR	SFR TO TOP
1.	C1	300 x 450	200 x 450
2.	C2	300 x 450	200 x 450
3.	C3	300 x 600	200 x 600
4.	C4	300 x 600	200 x 600
5.	C5	300 x 600	300 x 600
6.	C6	300 x 600	300 x 600
7.	C7	200 x 450	200 x 450
8.	C8	200 x 600	200 x 600
9.	C9	200 x 600	200 x 600
10.	SC	200 x 200	UPTO PLINTH

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   a) COLUMN = 40MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+5 FLOOR LOADS AND SBC OF THE SOIL IS 200KN/ SQM. @ 2000 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	A.P	R.M	03.01.26

PROJECT :-

THE PROPOSED CONSTRUCTION OF SKI APARTMENT AT PALLAVARAM, CHENNAI.

DRAWING TITLE :-

LAYOUT OF COLUMN

DATE	SCALE	JOB.NO	DRG.NO
03.01.26	1 : 150	---------	001

ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineeering Consultants

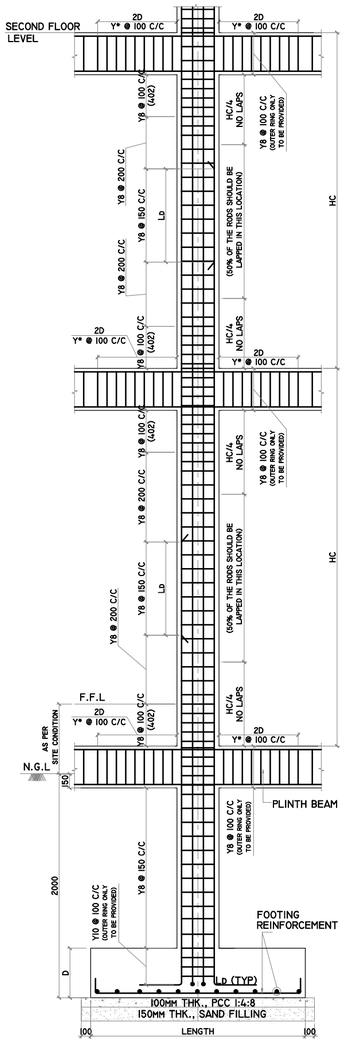
A1

COLUMN SCHEDULE

S.NO.	NAME	SIZE			
		UPTO SFR	(SFR TO IST FR)	(IST FR TO 3RD FR)	(3RD FR TO TOP)
1.	C1	10-Y20 REFER L.S. OF COLUMN 5-Y12 (300 x 450)	10-Y20 REFER L.S. OF COLUMN (200 x 450)	6-Y20 REFER L.S. OF COLUMN 4-Y16 (200 x 450)	10-Y16 REFER L.S. OF COLUMN (200 x 450)
2.	C2	6-Y25 REFER L.S. OF COLUMN 5-Y12 4-Y20 (300 x 450)	6-Y25 REFER L.S. OF COLUMN 4-Y20 (200 x 450)	10-Y20 REFER L.S. OF COLUMN (200 x 450)	6-Y20 REFER L.S. OF COLUMN 4-Y16 (200 x 450)
3.	C3	8-Y25 REFER L.S. OF COLUMN 6-Y12 4-Y20 (300 x 600)	8-Y25 REFER L.S. OF COLUMN 4-Y20 (200 x 600)	12-Y20 REFER L.S. OF COLUMN (200 x 600)	8-Y20 REFER L.S. OF COLUMN 4-Y16 (200 x 600)
4.	C4	12-Y25 REFER L.S. OF COLUMN 6-Y12 (300 x 600)	12-Y25 REFER L.S. OF COLUMN (200 x 600)	8-Y25 REFER L.S. OF COLUMN 4-Y20 (200 x 600)	12-Y20 REFER L.S. OF COLUMN (200 x 600)

COLUMN SCHEDULE

S.NO.	NAME	SIZE		
		UPTO FFR	(IST FR TO 3RD FR)	(3RD FR TO TOP)
5.	C5	6-Y25 REFER L.S. OF COLUMN 6-Y20 (300 x 600)	12-Y20 REFER L.S. OF COLUMN (300 x 600)	6-Y20 REFER L.S. OF COLUMN 6-Y16 (300 x 600)
6.	C6	12-Y25 REFER L.S. OF COLUMN (300 x 600)	6-Y25 REFER L.S. OF COLUMN 6-Y20 (300 x 600)	12-Y20 REFER L.S. OF COLUMN (300 x 600)
7.	C7	6-Y25 REFER L.S. OF COLUMN 4-Y20 (200 x 450)	10-Y20 REFER L.S. OF COLUMN (200 x 450)	6-Y20 REFER L.S. OF COLUMN 4-Y16 (200 x 450)
8.	C8	8-Y25 REFER L.S. OF COLUMN 4-Y20 (200 x 600)	12-Y20 REFER L.S. OF COLUMN (200 x 600)	8-Y20 REFER L.S. OF COLUMN 4-Y16 (200 x 600)
9.	C9	12-Y25 REFER L.S. OF COLUMN (200 x 600)	8-Y25 REFER L.S. OF COLUMN 4-Y20 (200 x 600)	12-Y20 REFER L.S. OF COLUMN (200 x 600)



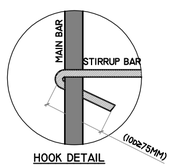
COLUMN AND BEAM JUNCTION

REINFORCEMENT DETAILING COLUMN

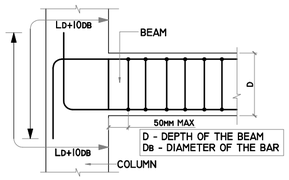
(AS PER SEISMIC DETAILING CODE IS13920)

(ALTERNATE RODS TO BE LAPPED IN ALTERNATE FLOORS)

(Y* = DIA OF ROD REFER FLOOR BEAM DETAILS)



HOOK DETAIL



TYP. EXTERNAL JOINT DETAIL AT BEAM-COLUMN JUNCTION

WHEREVER LAP SPLICES AND CONFINING TIES ARE NOT REQUIRED, SPACING OF LATERAL TIES SHALL BE Y8 @ 200 C/C.

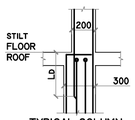
ALL HOOKS SHOULD BE BENT TO AN ANGLE OF 135° WITH A LENGTH NOT LESS THAN 75 MM

NOTE:

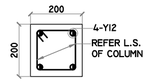
N.G.L - NATURAL GROUND LEVEL.

S.F.R - STILT FLOOR ROOF LEVEL.
F.F.R - FIRST FLOOR ROOF LEVEL.

F.F.L - FINISHED FLOOR LEVEL.



TYPICAL COLUMN REDUCTION DETAILS



C.S. OF COLUMN "SC"
(200 x 200)

SC - STUB COLUMN UPTO PLINTH BEAM

COLUMN SCHEDULE

S.NO.	NAME	SIZE	
		UPTO SFR	SFR TO TOP
1.	C1	300 x 450	200 x 450
2.	C2	300 x 450	200 x 450
3.	C3	300 x 600	200 x 600
4.	C4	300 x 600	200 x 600
5.	C5	300 x 600	300 x 600
6.	C6	300 x 600	300 x 600
7.	C7	200 x 450	200 x 450
8.	C8	200 x 600	200 x 600
9.	C9	200 x 600	200 x 600
10.	SC	200 x 200	UPTO PLINTH

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% OF THE SPECIFIED STRENGTH OF CONCRETE. HOWEVER THE FOLLOWING MINIMUM PERIOD (AFTER FINAL POUR) SHALL BE ALLOWED BEFORE REMOVAL OF SHUTTERING AS PER CLAUSE 11.3.1, IS 456:2000

A) VERTICAL SIDE OF SHUTTERING OF COLUMNS,WALLS & BEAMS - 24HOURS

LAP JOINTS FOR REINFORCEMENT BARS :

I) AT ANY CROSS SECTION OF THE MEMBER,NOT MORE THAN 50% OF THE BARS SHALL BE LAPPED.

II) LAPS SHALL BE STAGGERED WITH A MINIMUM CENTRE TO CENTRE DISTANCE OF 1.3 TIMES LAP LENGTH OF THE BAR FOR TENSION & COMPRESSION MEMBERS.

III) DEVELOPMENT LENGTH(Ld) SHALL BE AS PER (SP:34-1999) TABLE BELOW:

DEVELOPMENT LENGTH FOR COLUMNS ROD = 40D
DEVELOPMENT LENGTH FOR BEAMS ROD = 50D

IV) LAPS IN COLUMNS SHALL BE PROVIDED AT MID HEIGHT OF FLOOR AND NOT AT SLAB LEVEL

V). DETAILING OF REBARS SHALL CONFIRM TO SP-34 & IS 13920

EXCAVATION AND BACKFILL

I) BACKFILL FOR FOUNDATIONS AND PITS SHALL BE PLACED EVENLY LAYERS OF 300 MM THICKNESS AND SHALL BE WELL COMPACTED. THE FILL SHALL CONTAIN NO STONES WITH A DIAMETER GREATER THAN 100 MM. THE DEGREE OF COMPACTION OF BACKFILL SHALL BE 95% OF THE MAXIMUM DRY DENSITY AT OPTIMUM MOISTURE CONTENT OBTAINED BY THE MODIFIED PROCTOR COMPACTION TEST.

II) UNSUITABLE MATERIALS LIKE ROCKS/ EXISTING FOOTINGS ARE DETECTED BELOW FOUNDATION LEVEL IN AREAS OF CUT SHALL BE EXCAVATED TO FIRM GROUND. THE RESULTANT EXCAVATION SHALL BE FILLED TO THE REQUIRED LEVELS WITH MASS CONCRETE GRADE M10. ALSO WHEREVER EXCAVATION OCCURS BELOW THE FOUNDATION LEVEL STATED ON THE DESIGN DRAWING THE RESULTING VOID SHALL BE BACK FILLED WITH MASS CONCRETE GRADE-10.

III) BEFORE CASTING FOUNDATIONS, ANY IMMEDIATE OR ADJACENT AREAS OF DISTURBED OR SOFT SOIL MUST BE REMOVED AND REPLACED WITH MASS CONCRETE OF GRADE 10

IV) A LAYER OF BLINDING CONCRETE 100 MM THICK SHALL BE PLACED UNDER ALL FOUNDATIONS. BLINDING CONCRETE SHALL HAVE A CHARACTERISTIC STRENGTH OF 10 N/MM AT 28 DAYS.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE CONFIRMING TO IS 1786-2008 — Fe 500
4. CLEAR COVER FOR REINFORCEMENT.
   A) COLUMN = 40MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+5 FLOOR LOADS AND SBC OF THE SOIL IS 200KN/ SQM. @ 2000 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
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REV.	DESCRIPTIONS	DRN	CHK	DATE
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PROJECT :-

THE PROPOSED CONSTRUCTION OF SKI APARTMENT AT PALLAVARAM, CHENNAI.

DRAWING TITLE :-

R.C DETAILS OF COLUMN

DATE	SCALE	JOB.NO	DRG.NO
03.01.26	1 : 120	-------	001A

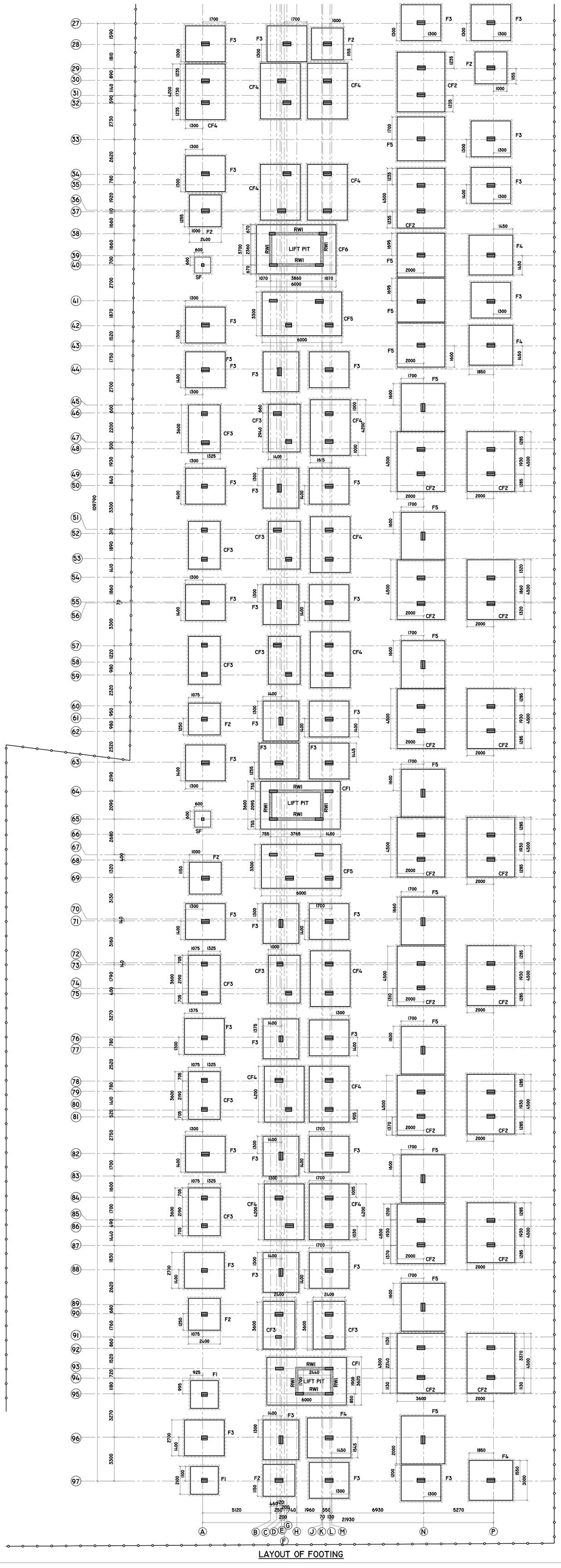
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineering Consultants

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LAYOUT OF FOOTING

FOOTINGS SCHEDULE:-

Sl.	FOOTING NAME	FOOTING SIZE	FOOTING REINFORCEMENT X =MAIN REINFD Y =DISTRIBUTOR REINFD
01	F1	2100 X 2100 D=530	Y12 @ 125 C/C BOTHWAYS @ BOTTOM
02	F2	2400 X 2400 D=600	Y12 @ 125 C/C BOTHWAYS @ BOTTOM
03	F3	2700 X 3000 D=750	Y12 @ 100 C/C BOTHWAYS @ BOTTOM
04	F4	3000 X 3300 D=750	Y12 @ 100 C/C BOTHWAYS @ BOTTOM
05	F5	3600 X 3600 D=750	Y16 @ 100 C/C BOTHWAYS @ BOTTOM
06	SF	1200 X 1200 D=300	Y10 @ 125 C/C BOTHWAYS @ BOTTOM

COMBINED FOOTINGS SCHEDULE:-

Sl.	FOOTING NAME	FOOTING SIZE	FOOTING REINFORCEMENT
01	CF1	6000 X 3600 X 680	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
02	CF2	4500 X 3600 X 750	Y16 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
03	CF3	3600 X 2400 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
04	CF4	4200 X 3000 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
05	CF5	6000 X 3300 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
06	CF6	6000 X 3700 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM

NOTE:

N.G.L - NATURAL GROUND LEVEL.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
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   a) COLUMN = 40MM
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REV.	DESCRIPTIONS	DRN	CHK	DATE
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PROJECT :-

THE PROPOSED CONSTRUCTION OF SKI APARTMENT AT PALLAVARAM, CHENNAI.

DRAWING TITLE :-

LAYOUT OF FOOTING

DATE	SCALE	JOB.NO	DRG.NO
03.01.26	1 : 150	---------	002

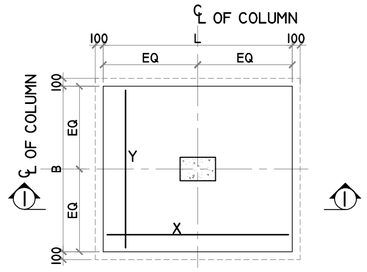
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

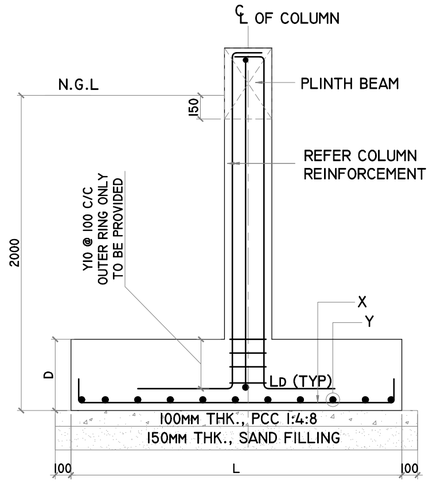
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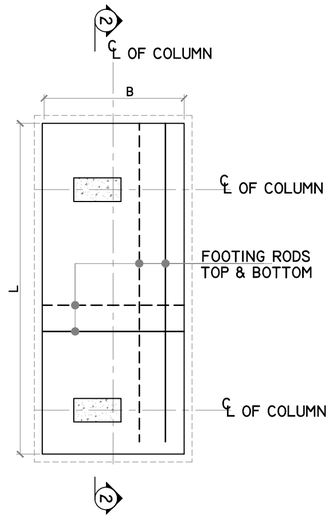
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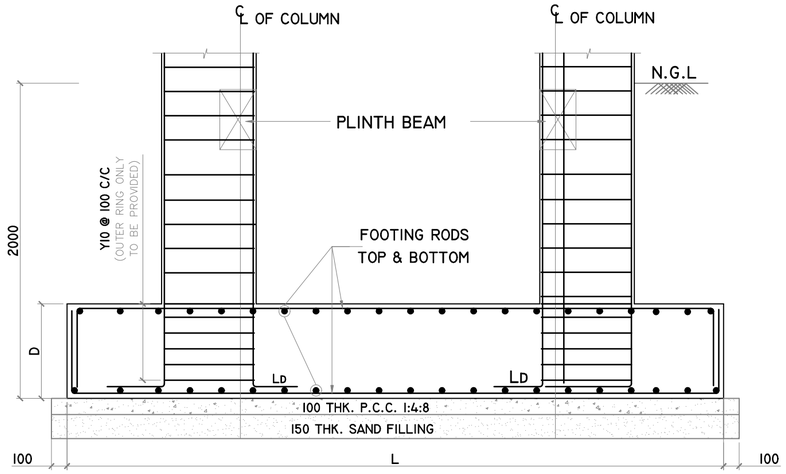


TYPICAL PLAN OF FLAT FOOTING



SECTION "1-1"





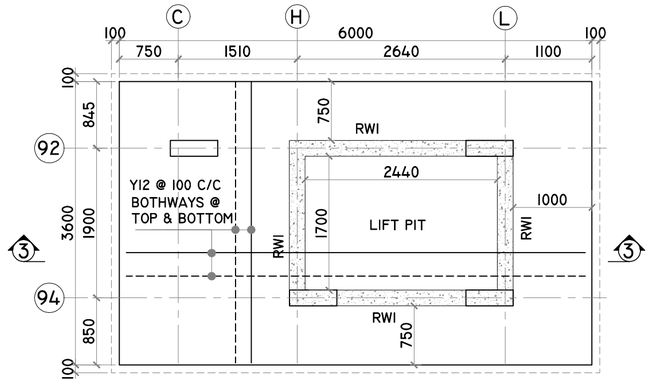
SECTION "2-2"

NOTE:

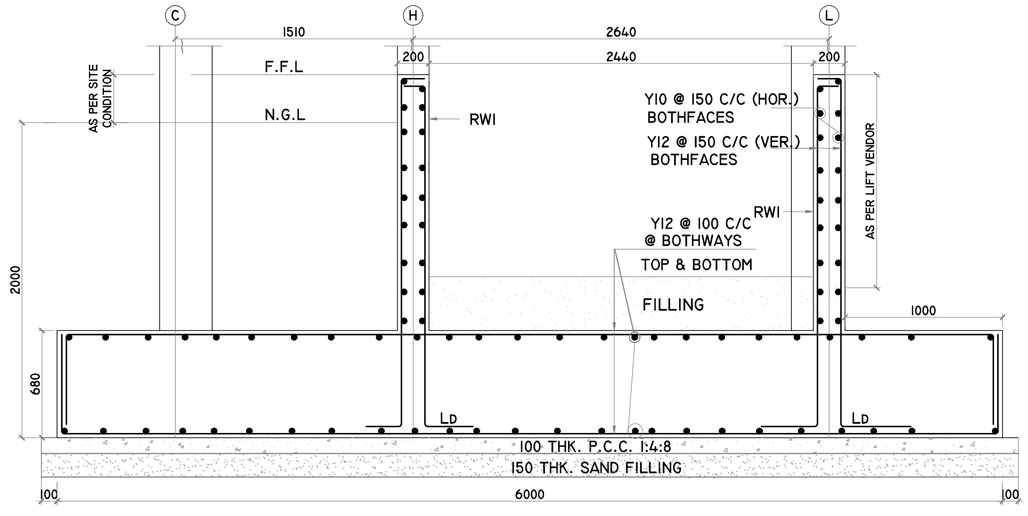
N.G.L - NATURAL GROUND LEVEL.

COMBINED FOOTINGS SCHEDULE:-

SI.	FOOTING NAME	FOOTING SIZE	FOOTING REINFORCEMENT
01	CF1	6000 X 3600 X 680	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
02	CF2	4500 X 3600 X 750	Y16 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
03	CF3	3600 X 2400 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
04	CF4	4200 X 3000 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
05	CF5	6000 X 3300 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM
06	CF6	6000 X 3700 X 750	Y12 @ 100 C/C @ BOTHWAYS TOP & BOTTOM



PLAN OF COMBINED FOOTING "CF1"



SECTION "3-3"

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% OF THE SPECIFIED STRENGTH OF CONCRETE. HOWEVER THE FOLLOWING MINIMUM PERIOD (AFTER FINAL POUR) SHALL BE ALLOWED BEFORE REMOVAL OF SHUTTERING AS PER CLAUSE 11.3.1, IS 456:2000

A) VERTICAL SIDE OF SHUTTERING OF COLUMNS,WALLS & BEAMS - 24HOURS

LAP JOINTS FOR REINFORCEMENT BARS :

I) AT ANY CROSS SECTION OF THE MEMBER,NOT MORE THAN 50% OF THE BARS SHALL BE LAPPED.

II) LAPS SHALL BE STAGGERED WITH A MINIMUM CENTRE TO CENTRE DISTANCE OF 1.3 TIMES LAP LENGTH OF THE BAR FOR TENSION & COMPRESSION MEMBERS.

III) DEVELOPMENT LENGTH(Ld) SHALL BE AS PER (SP:34-1999) TABLE BELOW:

DEVELOPMENT LENGTH FOR COLUMNS ROD = 40ϕ
DEVELOPMENT LENGTH FOR BEAMS ROD = 50ϕ

IV) LAPS IN COLUMNS SHALL BE PROVIDED AT MID HEIGHT OF FLOOR AND NOT AT SLAB LEVEL

V). DETAILING OF REBARS SHALL CONFIRM TO SP-34 & IS 13920

EXCAVATION AND BACKFILL

I) BACKFILL FOR FOUNDATIONS AND PITS SHALL BE PLACED EVENLY LAYERS OF 300 MM THICKNESS AND SHALL BE WELL COMPACTED. THE FILL SHALL CONTAIN NO STONES WITH A DIAMETER GREATER THAN 100 MM. THE DEGREE OF COMPACTION OF BACKFILL SHALL BE 95% OF THE MAXIMUM DRY DENSITY AT OPTIMUM MOISTURE CONTENT OBTAINED BY THE MODIFIED PROCTOR COMPACTION TEST.

II) UNSUITABLE MATERIALS LIKE ROCKS/ EXISTING FOOTINGS ARE DETECTED BELOW FOUNDATION LEVEL IN AREAS OF CUT SHALL BE EXCAVATED TO FIRM GROUND. THE RESULTANT EXCAVATION SHALL BE FILLED TO THE REQUIRED LEVELS WITH MASS CONCRETE GRADE M10. ALSO WHEREVER EXCAVATION OCCURS BELOW THE FOUNDATION LEVEL STATED ON THE DESIGN DRAWING THE RESULTING VOID SHALL BE BACK FILLED WITH MASS CONCRETE GRADE-10.

III) BEFORE CASTING FOUNDATIONS, ANY IMMEDIATE OR ADJACENT AREAS OF DISTURBED OR SOFT SOIL MUST BE REMOVED AND REPLACED WITH MASS CONCRETE OF GRADE 10

IV) A LAYER OF BLINDING CONCRETE 100 MM THICK SHALL BE PLACED UNDER ALL FOUNDATIONS. BLINDING CONCRETE SHALL HAVE A CHARACTERISTIC STRENGTH OF 10 N/MM AT 28 DAYS.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT.
   A) COLUMN = 40MM B) FOOTING = 50MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+5 FLOOR LOADS AND SBC OF THE SOIL IS 250KN/ SQM. @ 2000 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

REV.	DESCRIPTIONS	DRN	CHK	DATE
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PROJECT :-

THE PROPOSED CONSTRUCTION OF SKI APARTMENT AT PALLAVARAM, CHENNAI.

DRAWING TITLE :-

R.C DETAILS OF COMBINED FOOTING

DATE	SCALE	JOB.NO	DRG.NO
03.01.26	1 : 125	-------	002A

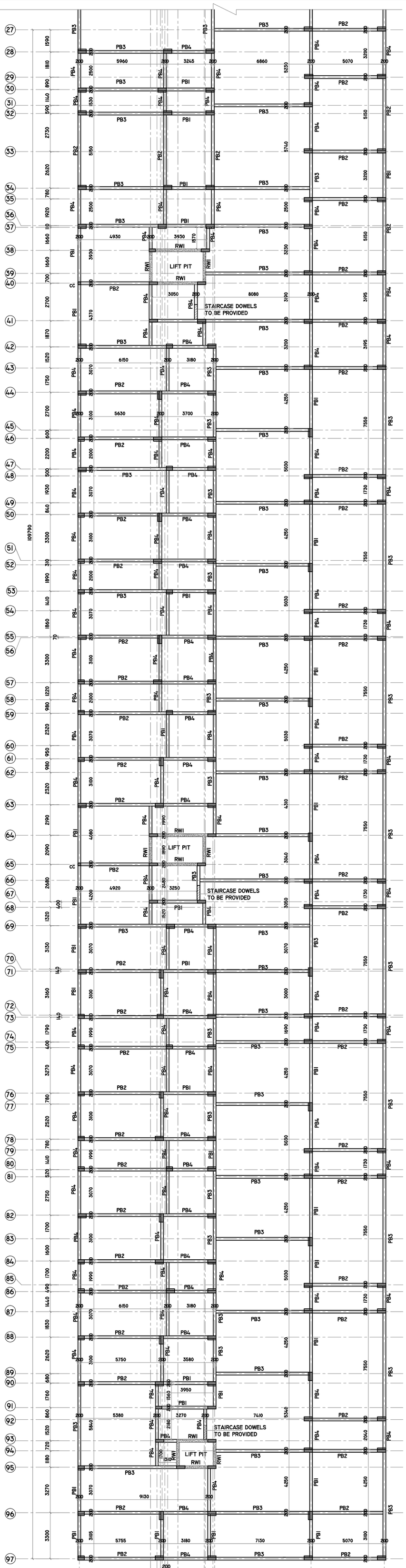
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

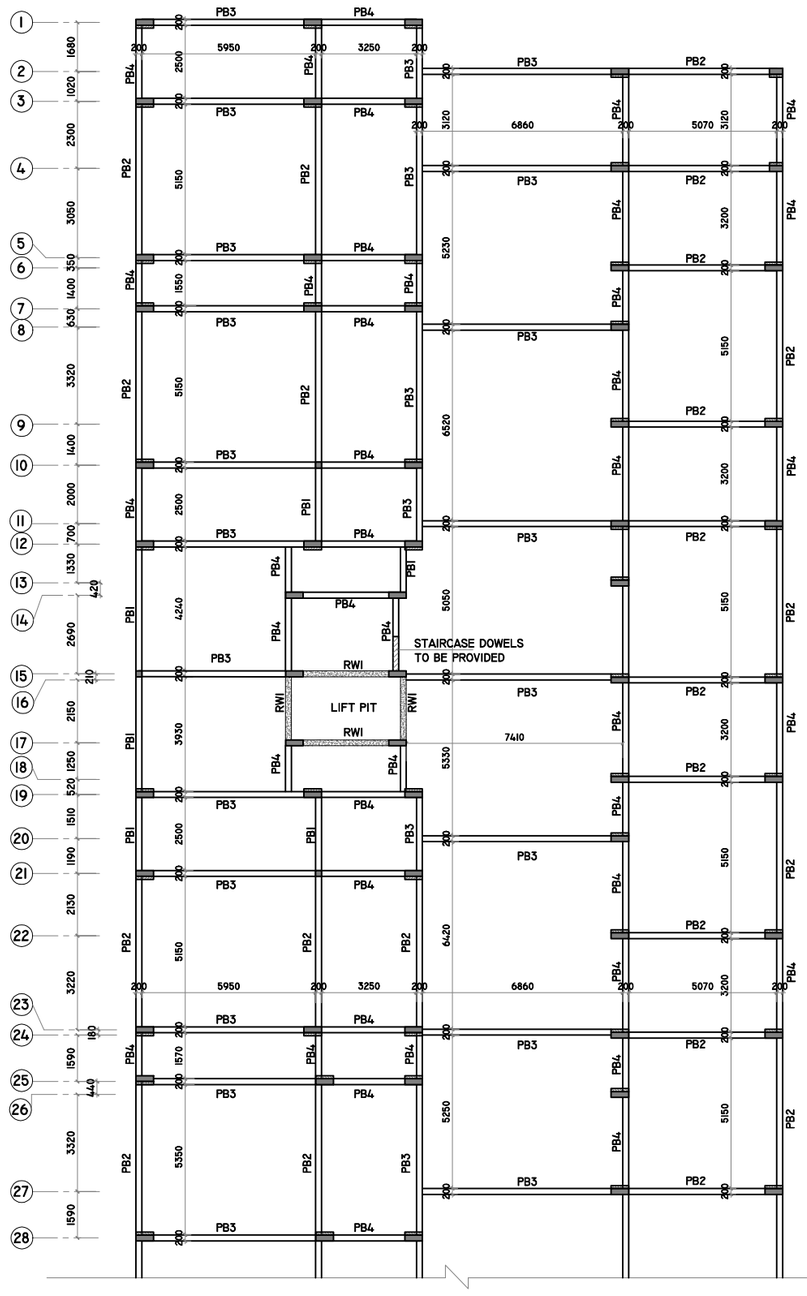
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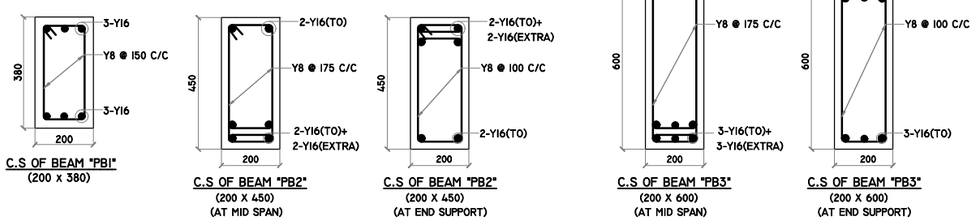
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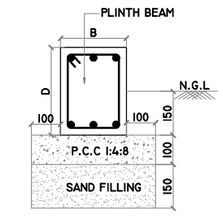


LAYOUT OF PLINTH BEAM

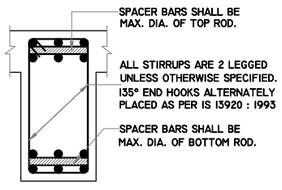




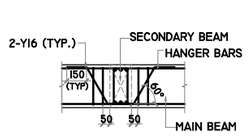
BEAM SCHEDULE		
SL.NO	NAME	SIZE
01	PB1	200 X 380
02	PB2	200 X 450
03	PB3	200 X 600
04	PB4	200 X 380



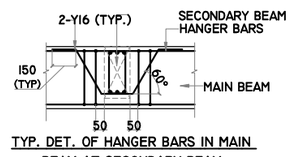
TYPICAL DETAIL OF PLINTH BEAM



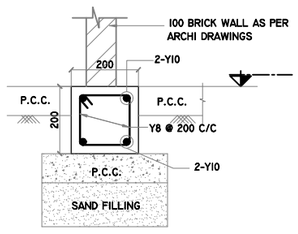
TYP. DETAIL



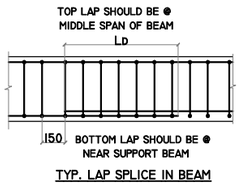
TYP. DET. OF HANGER BARS IN MAIN BEAM AT SECONDARY BEAM JUNCTION



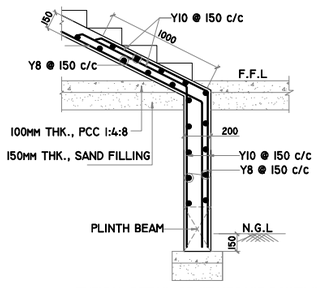
TYP. DET. OF HANGER BARS IN MAIN BEAM AT SECONDARY BEAM JUNCTION (VARY DEPTH)



TYPICAL DETAILS OF PLINTH BEAM UNDERNEATH 100 BRICK WORK



TYP. LAP SPLICE IN BEAM



TYPICAL DETAIL OF STAIRCASE DOWELS

NOTE:
PROVIDE Y8 @ 8" C/C AS DISTRIBUTORS WHERE EVER REQUIRED

NOTE:
N.G.L - NATURAL GROUND LEVEL.
F.F.L - FINISHED FLOOR LEVEL.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) BEAM = 25MM B) R.C WALL = 25MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+5 FLOOR LOADS AND SBC OF THE SOIL IS 200KN/ SQM. @ 2000 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	A.P	R.M	03.01.26

PROJECT :-

THE PROPOSED CONSTRUCTION OF SKI APARTMENT AT PALLAVARAM, CHENNAI.

DRAWING TITLE :-

LAYOUT OF PLINTH BEAM

DATE	SCALE	JOB.NO	DRG.NO
03.01.26	1 : 150	---------	003

ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineeering Consultants

A2

THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

Verified RealEstate
3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai 600 097, India
hello@verified.realestate
+91 9996 12 9996

Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.