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DESIGN CALCULATION

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

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1.0 DESIGN BRIEF:

THIS DOCUMENT PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

2.0 GENERAL DESIGN CRITERIA

2.1. Description of the structure

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

1. Size of the building : 35.70 x 9.10M
2. Height of the building : 15.00M
3. Number of storeys above GL : Stilt Floor +3 upper floors
4. Floor to floor height of this building : Ground 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)

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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.

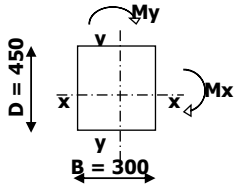
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APPENDIX I

Design Calculations

Column Design

PROJECT	RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET	DOCUMENT. N	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 , IS456:2000
	L_{ey} = **3000** mm	
	Size of the Column B X D = **300** x **450** mm	
1.4	**Analysis Results**	
	Factored Axial Load P_u = **780.0** kN	STAAD OUTPUT
	Factored Moment M_{ux} = **22.00** kNm	
	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 Eccentricity e_x = L_{ox} / 500 + D / 3 = 21.0 mm >20	Cl 25.4 IS456:2000
	e_y = L_{oy} / 500 + B / 3 = 16.0 mm <20	
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 APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET**	**DOCUMENT. N**	**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	
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	
	α_n = 1.186	Cl 39.6 , IS456:2000
7.0	**Criteria for Biaxial Bending (Bresler's Formulation)**	
	$(M_{ux}/M_{ux1})^{\alpha n} + (M_{uy}/M_{uy1})^{\alpha n}$ = **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 Nos Y20 + Nos Y20 $A_{sc,pro}$ = **3142** mm^2	
8.1	**Check for Minimum & Maximum Area of Steel**	
	Minimum Area of steel (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 steel (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.	

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Footing Design

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Design of Isolated Footing **F3** **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 Reinforcement	50	mm
Earth Fill above FGL	0	mm
Base Area of Footing	3.78	m^2
Ixx	1.02	m^4
Izz	1.39	m^4
Weight of Footing	47.25	kN
Weight of soil	98.42	kN

Gross Bearing Pressure Calculation (kN/m^2)

Critical Load Combinations	Pmax	Pmin
200	157.58	157.5833333
0	38.54	38.54

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

Hence **OK**

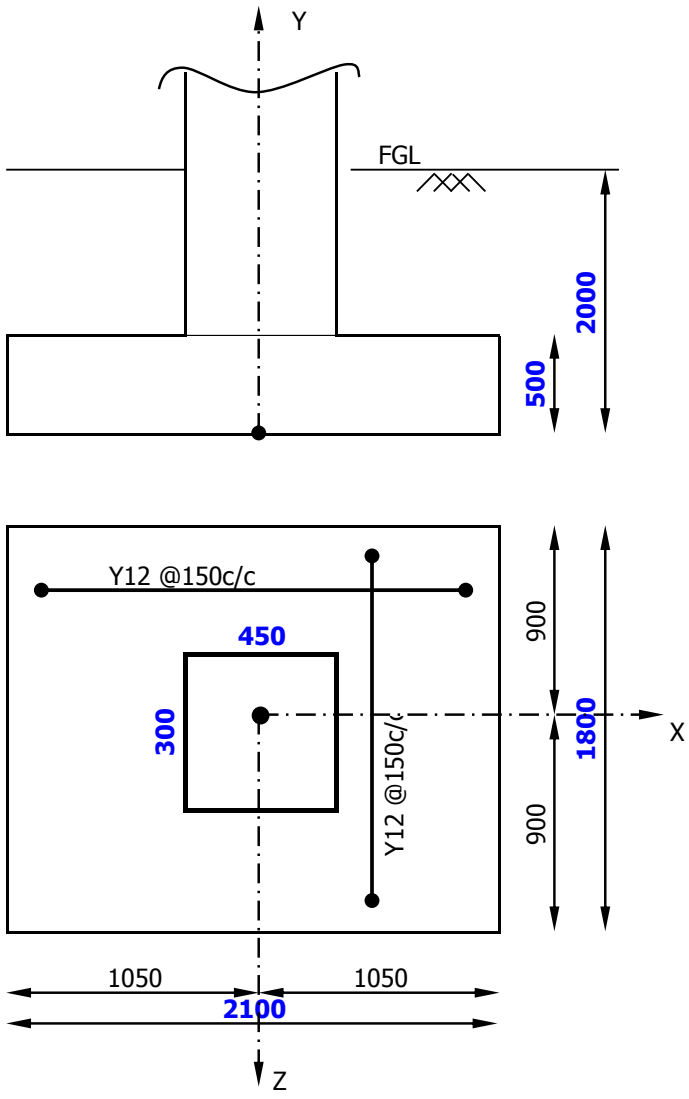
Factored Net Upward Pressure Calculation

Load Factor for Design 1.5

Critical Load Combinations	Pmax	Pmin
200	178.57	178.5714286
0	0.00	0.0

Dsgn.(+ve) BM abt. X-axis Mux	50.22	kN.m
Dsgn.(+ve) BM abt. Z-axis Muz	60.77	kN.m
Dsgn.(-ve) BM abt. X-axis Mux	0.00	kN.m
Dsgn.(-ve) BM abt. Z-axis Muz	0.00	kN.m
Provided Eff. depth for Mux	432.00	mm
Provided Eff. depth for Muz	444.00	mm
Mu,lim	621	kN.m

Depth provided is **OK**



Bottom Reinforcement

Ast Required for Mux	270.6	mm^2
Ast Required for Muz	319.2	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**

Top Reinforcement

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

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Design of Isolated Footing **F3** **Node :** **38**

Check For Flexural / Oneway Shear

	Actual	Allowable		Hence
Shear Stress (Plane ll to X)	0.131	0.311	N/mm^2	**OK**
Shear Stress (Plane ll to Z)	0.153	0.308	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, sliding	=	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	=	47.25	kN				
Weight of Over burden Earth	=	98.42	kN				
Total downward Load	=	595.67	kN				
Stabilizing moment along X-Dir	=	595.67	x	1.05			
	=	625.45	kNm				
Actuating moment, M_{zz}	=	0.00	kNm				
Factor of Safety (Along X-Dir)	=	625.45	/	0.0			
		-	>	1.40	Hence	**OK**	

Check For Sliding

Resistance against Sliding	=	339.5291	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)	=	339.5	/	2.5			
		133.67	>	1.40	Hence	**OK**	
Factor of Safety (Along Z-Dir)	=	339.5	/	5.3			
		64.06	>	1.4	Hence	**OK**	

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Plinth Beam Design

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TITLE		REVISION	DATE	CHECKED RMK	DATE

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	=	230	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 momer (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		=	87.11	kNm	
1.4	**Area of Steel**					
	Minimum Area of S = 0.17% b d		=	131.9625	mm^2	
	Support 1					
	Negative moment (Support 1)		=	84	kNm	
	Hence the Section is designed as Singly Reinforced Section					
		M_u/bd^2	=	3.206		
	Percentage of tension steel reqd	p_t	=	0.028	%	
	Percentage of compression steel	p_c	=	0	%	
	Required Area of tension steel	$A_{st\ reqd}$	=	131.96	mm^2	
	Required Area of compression ste	$A_{sc\ reqd}$	=	0.00	mm^2	
	Detail of bars					
		I st Layer		**II nd Layer**		
		Nos	Dia	Nos	Dia	
	Tension Reinforcemen	**3**	**#**			
		A_{st} provide	=	603.19	mm^2	
		Nos	Dia	Nos	Dia	
	Compression Reinforc	**3**	**#**	**0**		
		A_{sc} provide	=	603.19	mm^2	
	Percentage of tension steel provi	p_t	=	0.777	%	**Hence O.K**
	Percentage of compression steel	p_c	=	0.777	%	**Hence O.K**

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TITLE		REVISION	DATE	CHECKED RMK	DATE

CL. NO.	BEAM DESIGN CALCULATIONS	REFERENCES

Check for Shear

Shear		=	149	kN	
Nominal Shear Stress	τv	=	1.92	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	τc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	$\tau c,max$	=	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		=	190.0		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 @ 190mm c/c spacing

Support 2

Negative moment		=	84	kNm	
Hence the Section is designed as Doubly Reinforced Section					
	M_u/bd^2	=	3.206		
Percentage of tension steel reqd	p_t	=	0.028	%	
Percentage of compression steel	p_c	=	0	%	
Required Area of tension steel	$A_{st\ reqd}$	=	131.96	mm^2	
Required Area of compression ste	$A_{sc\ reqd}$	=	0	mm^2	

Detail of bars

	I st Layer		II nd Layer			
	Nos	Dia	Nos	Dia		
Tension Reinforcemen	3	#	0	0		
	A_{st} provide	=	603.186	mm^2		
	Nos	Dia	Nos	Dia		
Compression Reinforc	3	#	0	0		
	A_{sc} provide	=	603.19	mm^2		
Percentage of tension steel provi	p_t	=	0.777	%	Hence O.K	
Percentage of compression steel	p_c	=	0.777	%	Hence O.K	

Check for Shear

Shear		=	149	kN	
Nominal Shear Stress	τv	=	1.92	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	τc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	$\tau c,max$	=	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		=	190.0		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 @ 190mm c/c spacing

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TITLE		REVISION	DATE	CHECKED RMK	DATE

CL. NO.	BEAM DESIGN CALCULATIONS	REFERENCES

Span

Positive moment (Span) = 84 kNm

Hence the Section is designed as Singly Reinforced Section

M_u/bd^2 = 3.325

Percentage of tension steel reqd p_t = 0.029 %

Percentage of compression steel p_c = 0 %

Required Area of tension steel $A_{st\ reqd}$ = 131.96 mm^2

Required Area of compression ste $A_{sc\ reqd}$ = 0 mm^2

Detail of bars

	I st Layer Nos	I st Layer Dia	II nd Layer Nos	II nd Layer Dia
Tension Reinforcemen	3	#	0	0

A_{st} provide = 603.19 mm^2

	Nos	Dia	Nos	Dia
Compression Reinforc	3	#	0	0

A_{sc} provide = 603.19 mm^2

Percentage of tension steel provi p_t = 0.777 % **Hence O.K**

Percentage of compression steel p_c = 0.777 % **Hence O.K**

Check for Shear

Shear = 149 kN

Nominal Shear Stress	τv	=	1.92	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	τc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	$\tau c,max$	=	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		=	190.0		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 @ 190mm c/c spacing

Check For Deflection

Basic Value		=	26		Cl.23.2, IS456:2000
Service Stress in Steel	f_s	=	63.44	N/mm^2	
Modification Factor(Tension Reinforcemei	F_1	=	2.00		
Allowable Span/Depth		=	52.00		
Actual Span/Depth		=	13.33	**Hence Safe**	



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Floor Beam Design

PROJECT	RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET	DOCUMENT. NO.	DATE	DESIGNE RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE

CL. NO.	BEAM DESIGN CALCULATIONS	REFERENCES

1.1 **Geomentry Data**

Beam Number		=	B3		
Type of Beam		=	Rectangular Beam		
Support Condition		=	Continuous Beam		
Width of beam	b	=	300	mm	
Overall Depth of Beam	D	=	525	mm	
Dia of bar	Φ	=	25	mm	
Nominal Cover	cc	=	30	mm	S 456:200(Table 19
Effective Depth	d	=	482.5	mm	S 456:200(
Effective Cover		=	42.5	mm	Cl 23.0
Effective Span of beam	l_{eff}	=	3700	mm	
Concrete grade		=	M 25		
Steel Grade		=	Fe 500		
$p_{t,lim}$		=	0.944 %		
$p_{t,min}$		=	0.170 %		S 456:200(
p_t & p_{cmax}		=	4.00 %		Cl 26.5.1.1

1.2 **Force Input**

Left negative moment (Support 1)	=	254	kNm	
Mid span positive moment	=	254	kNm	
Right negative moment (Support 2)	=	254	kNm	
Shear @ (Support 1)	=	241	kN	
Shear @ (Span)	=	241	kN	
Shear @ (Support 2)	=	241	kN	

1.3 **Limiting Moment**

M_{ulim} = 0.133 f_{ck} b d^2 = 232.22 kNm

1.4 **Area of Steel**

Minimum Area of S = 0.17% b d = 246.075 mm^2

Support 1

Negative moment (Support 1)		=	254	kNm
Hence the Section is designed as Doubly Reinforced Section				
	M_u/bd^2	=	3.637	
Percentage of tension steel reqd	p_t	=	1.023	%
Percentage of compression steel reqd	p_c	=	0.085	%
Required Area of tension steel	$A_{st\ reqd}$	=	1480.79	mm^2
Required Area of compression steel	$A_{sc\ reqd}$	=	123.04	mm^2

Detail of bars

	I st Layer		II nd Layer			
	Nos	Dia	Nos	Dia		
Tension Reinforcement	3	20	3	20		
	A_{st} provided	=	1884.96	mm^2		
	Nos	Dia	Nos	Dia		
Compression Reinforcem	3	20	3	20		
	A_{sc} provided	=	1884.96	mm^2		
Percentage of tension steel provided	p_t	=	1.302	%	**Hence O.K**	
Percentage of compression steel provic	p_c	=	1.302	%	**Hence O.K**	

PROJECT	**RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET**	**DOCUMENT. NO.**	**DATE**	**DESIGNE RMK**	**DATE**
TITLE		**REVISION**	**DATE**	**CHECKED RMK**	**DATE**
CL. NO.	**BEAM DESIGN CALCULATIONS**				**REFERENCES**

Check for Shear

Shear		=	241	kN	
Nominal Shear Stress	τv	=	1.66	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	τc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	$\tau c,max$	=	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		=	190.0		Cl 40.4, IS456:2000
Maximum Spacing of Shear Reinforcement		=	300		Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 190mm c/c spacing

Support 2

Negative moment		=	254	kNm	
Hence the Section is designed as Doubly Reinforced Section					
	M_u/bd^2	=	3.637		
Percentage of tension steel reqd	p_t	=	1.023	%	
Percentage of compression steel reqd	p_c	=	0.085	%	
Required Area of tension steel	$A_{st\ reqd}$	=	1480.79	mm^2	
Required Area of compression steel	$A_{sc\ reqd}$	=	123.04	mm^2	

Detail of bars

	I st Layer		II nd Layer			
	Nos	Dia	Nos	Dia		
Tension Reinforcement	**3**	**20**	**3**	**20**		
	A_{st} provided	=	1884.956	mm^2		
	Nos	Dia	Nos	Dia		
Compression Reinforcem	**3**	**20**	**3**	**20**		
	A_{sc} provided	=	1884.96	mm^2		
Percentage of tension steel provided	p_t	=	1.302	%	**Hence O.K**	
Percentage of compression steel provic	p_c	=	1.302	%	**Hence O.K**	

Check for Shear

Shear		=	241	kN	
Nominal Shear Stress	τv	=	1.66	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	τc	=	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	$\tau c,max$	=	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		=	190.0		Cl 40.4, IS456:2000
Maximum Spacing of Shear Reinforcement		=	300		Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 190mm c/c spacing

PROJECT	RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET	DOCUMENT. NO.	DATE	DESIGNED RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE

CL. NO.	BEAM DESIGN CALCULATIONS	REFERENCES

Span

Positive moment (Span) = 254 kNm

Hence the Section is designed as Doubly Reinforced Section

M_u/bd^2 = 3.325

Percentage of tension steel reqd p_t = 1.023 %

Percentage of compression steel reqd p_c = 0.085 %

Required Area of tension steel $A_{st\ reqd}$ = 1480.79 mm^2

Required Area of compression steel $A_{sc\ reqd}$ = 123.04 mm^2

Detail of bars

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Tension Reinforcement	3	20	3	20

A_{st} provided = 1884.96 mm^2

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Compression Reinforcem	3	20	3	20

A_{sc} provided = 1884.96 mm^2

Percentage of tension steel provided p_t = 1.302 % **Hence O.K**

Percentage of compression steel provid p_c = 1.302 % **Hence O.K**

Check for Shear

Shear = 241 kN

Nominal Shear Stress	τv =	1.66	N/mm^2	Cl 40.1, IS456:2000
Permissible Shear Stress	τc =	0.92	N/mm^2	β = 1.000
Maximum Shear Stress	$\tau c,max$ =	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	=	190.0		Cl 40.4, IS456:2000
Maximum Spacing of Shear Reinforcement	=	300		Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 190mm c/c spacing

Check For Deflection

Basic Value	=	26		Cl.23.2, IS456:2000
Service Stress in Steel	f_s =	**227.82**	N/mm^2	
Modification Factor(Tension Reinforcement)	F_1 =	0.97		
Allowable Span/Depth	=	25.22		
Actual Span/Depth	=	7.67	**Hence Safe**	

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Floor Slab Design

PROJECT	RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET	DOCUMENT.NO.	DATE	DESIGNED	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
1.0	**Design of Two Way Slab S3**	
1.0.1	**Basic Input Data**	
	Grade of concrete = **M 25**	
	Grade of steel = **Fe 500**	
	Thickness of slab D = **150** mm	
	Clear cover cc = **25** mm	Table 16 Cl.26.4.2 , IS 456 -2000
	Effective thickness of slab (d_{eff}) = 150 - 25 - 5 = 120 mm	
	Unit weight of concrete = 25 KN/m^3	Cl 19.2.1, IS 456-2000
	Effective Shorter Span L_x = **5** m	
	Effective Longer Span L_y = **7.7** m	
	Aspect ratio L_y/L_x = 1.54 < 2	
	Hence designed as Two way slab	Cl D-1.11, IS 456-2000
	Edge Condition : **One Long edge Discontinuous**	
1.0.2	**Load Data**	
	Self Weight of Slab = 0.150 x 25 = 3.750 KN/m^2	
	Floor finish = **1.500** KN/m^2	
	Partition Load = **0.000** KN/m^2	
	Sunken Filling = **0.000** KN/m^2	
	Imposed Load = **3.000** KN/m^2	IS 875 (Part 2) -1987
	Extra Load, (if Any) = **0.000** KN/m^2	
	Total load = 8.250 KN/m^2	
	Design load (Wu) = 1.5 x 8.25 = **12.375** KN/m^2	Table 18 Cl 36.4.1 IS 456 -2000
1.0.3	**Moment and Shear Calculations**	
	Short Span Direction	
	α_x for positive moment 1.5 → 0.051	Table 26 Cl D-1.1, IS 456 -2000
	1.75 → 0.059	
	for 1.54 α_x = 0.052	
	Positive moment M_x : 0.052 x 12.38 x 5 ^2 = **16.17** KN-m	
	α_x for negative moment 1.5 → 0.067	Table 26 Cl D-1.1, IS 456 -2000
	1.75 → 0.077	
	for 1.54 α_x = 0.069	
	Negative moment M_x : 0.069 x 12.38 x 5 ^2 = **21.22** KN-m	

PROJECT	**RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET**	**DOCUMENT.NO.**	**DATE**	**DESIGNED**	**DATE**
TITLE	**TWO WAY SLAB DESIGN**	**REVISION**	**DATE**	**CHECKED**	**DATE**

CL. NO.	**DESIGN CALCULATIONS**	**REFERENCES**
	Long Span Direction	
	For positive moment α_y = 0.028	Table 26 Cl D-1.1,
	Positive moment M_y : 0.028 x 12.38 x 5 ^2 = **8.66** KN-m	IS 456 -2000
	For negative moment α_y = 0.037	Table 26 Cl D-1.1,
	Negative moment M_y : 0.037 x 12.38 x 5 ^2 = **11.45** KN-m	IS 456 -2000
	Shear force V_u = 12.38 x 5 x 0.5 = **30.94** KN	
1.0.4	**Check Effective Depth for Max.Bending Moment**	
	Depth required = $(M_x / (0.133x\ fck \times b))^{1/2}$ = 79.89 mm	Table C,SP 16 :1980
	Depth provided = 150 - 25 - 10 /2 = 120 mm > 79.89 mm	Cl 2.3
	Hence the section is Safe against Bending	
1.0.5	**Check Depth for Shear**	
	Nominal Shear Stress : $\tau_v = V_u / b\ d$ = 0.26 N/mm^2	Cl.40.1, IS 456:2000
	Design shear strength (τ_c) = 0.46 N/mm^2	Table 19 , IS 456:2000
	k = 1.30	Cl.40.2.1.1,
	k * τ_c = 0.60 N/mm^2	IS 456:2000
	τ_v < k * τ_c **Hence the section is Safe against Shear**	
1.0.6	**Check for Maximum Shear Stress:**	
	Nominal Shear Stress : $\tau_v = V_u / b\ d$ = 0.26 N/mm^2	Cl.40.1, IS 456:2000
	Maximum Shear Stress ($\tau_{c,max}$) = 3.1 N/mm^2	Table 20 , IS 456:2000
	0.5 $\tau_{c,max}$ = 1.55 N/mm^2	
	τ_v < 0.5 $\tau_{c,max}$ **Hence the section is Safe against Max.Shear Stress**	Cl.40.2.3.1, IS 456:200
1.0.7	**Reinforcement calculations**	
	Short Span Direction @ Support	
	Mu/bd^2 = $\frac{21.22 \times 10 \wedge 6}{1000 \times 120 \times 120}$ = **1.474**	
	Pt = **0.37** %	Table 2-4, SP16 :1980

PROJECT	**RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET**	**DOCUMENT.NO.**	**DATE**	**DESIGNED**	**DATE**
TITLE	**TWO WAY SLAB DESIGN**	**REVISION**	**DATE**	**CHECKED**	**DATE**

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

Area of steel Ast = 0.0037 x 1000 x 120 = 438.88 mm^2

Minimum area of steel: 0.0012 x 1000 x 150 = 180.00 mm^2 Cl:26.5.2.1

Spacing of Y **10** bars 78.54 x 1000 / 438.88 = 178.86 mm IS 456 -2000

Check for Spacing

Minimum of

1) 3d = 360 mm

2) = 300 mm Cl:26.3.3.(b).1

3) = 178.86 mm IS 456 -2000

Therefore provide Y **10** @ **170** mm C/C

Short Span Direction @ Mid Span

$Mu/bd^2 = \frac{16.17 \times 10 \wedge 6}{1000 \times 120 \times 120} = 1.123$

Pt = 0.273 % SP16 :1980 Table 2-4

Area of steel Ast = 0.0027 x 1000 x 120 = 327.93 mm^2 IS 456:2000

Minimum area of steel: 0.0012 x 1000 x 150 = 180.00 mm^2 Cl:26.5.2.1

Spacing of Y **10** bars 78.54 x 1000 / 327.93 = 239.38 mm

Check for Spacing

Minimum of

1) 3d = 360 mm IS 456:2000

2) = 300 mm Cl:26.3.3.(b).1

3) = 239.38 mm

Therefore provide Y **10** @ **150** mm C/C 150

Provided % of Tension Reinforcement (pt) = **0.436** %

Long Span Direction @ Support

$Mu/bd^2 = \frac{11.45 \times 10 \wedge 6}{1000 \times 120 \times 120} = 0.795$

Pt = 0.190 % SP16 :1980 Table 2-4

Area of steel Ast = 0.0019 x 1000 x 120 = 228.07 mm^2 IS 456:2000

Minimum area of steel: 0.0012 x 1000 x 150 = 180.00 mm^2 Cl:26.5.2.1

Spacing of Y **10** bars 78.54 x 1000 / 228.07 = 344.2 mm

PROJECT	RESIDENTIAL APARTMENT BUILDING (S+05), AT PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET	DOCUMENT.NO.	DATE	DESIGNED	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES

Check for Spacing

Minimum of
1) 3d = 360 mm — IS 456:2000
2) = 300 mm — Cl:26.3.3.(b).1
3) = 344.20 mm

Therefore provide Y **10** @ **300** mm C/C

Long Span Direction @ mid Span

$Mu/bd^2 = \frac{8.66 \times 10 \wedge 6}{1000 \times 120 \times 120} = 0.602$

Pt = 0.142 % — SP16 :1980 Table 2-4

Area of steel Ast = 0.0014 x 1000 x 120 = 170.9 mm^2 — IS 456:2000
Minimum area of steel: 0.0012 x 1000 x 150 = 180.00 mm^2 — Cl:26.5.2.1
Spacing of Y **10** bars 78.54 x 1000 / 180.00 = 436.11 mm

Check for Spacing

Minimum of
1) 3d = 360 mm — IS 456:2000
2) = 300 mm — Cl:26.3.3.(b).1
3) = 436.11 mm

Therefore provide Y **10** @ **300** mm C/C

1.0.8 **Check for Deflection:** **(Simplified Approach)**

Basic Span/depth Ratio	=	**26**	IS 456:2000 Cl:23.2.1
% of Tension Reinforcement provided (p_t)	=	0.436 %	
Service stress of steel (fs) : 0.58 fy (Ast_R/Ast_P)	=	181.63 N/mm^2	IS456:2000 Fig 4
Modification Factor for Tension Reinforcement (F_1)	=	1.71	Page 38
Allowable Span / Effective Depth Ratio	=	44.47	IS 456:2000 Cl:23.2.1
Actual Span/Eff Depth Ratic = 5 x 1000 / 120	=	41.67	

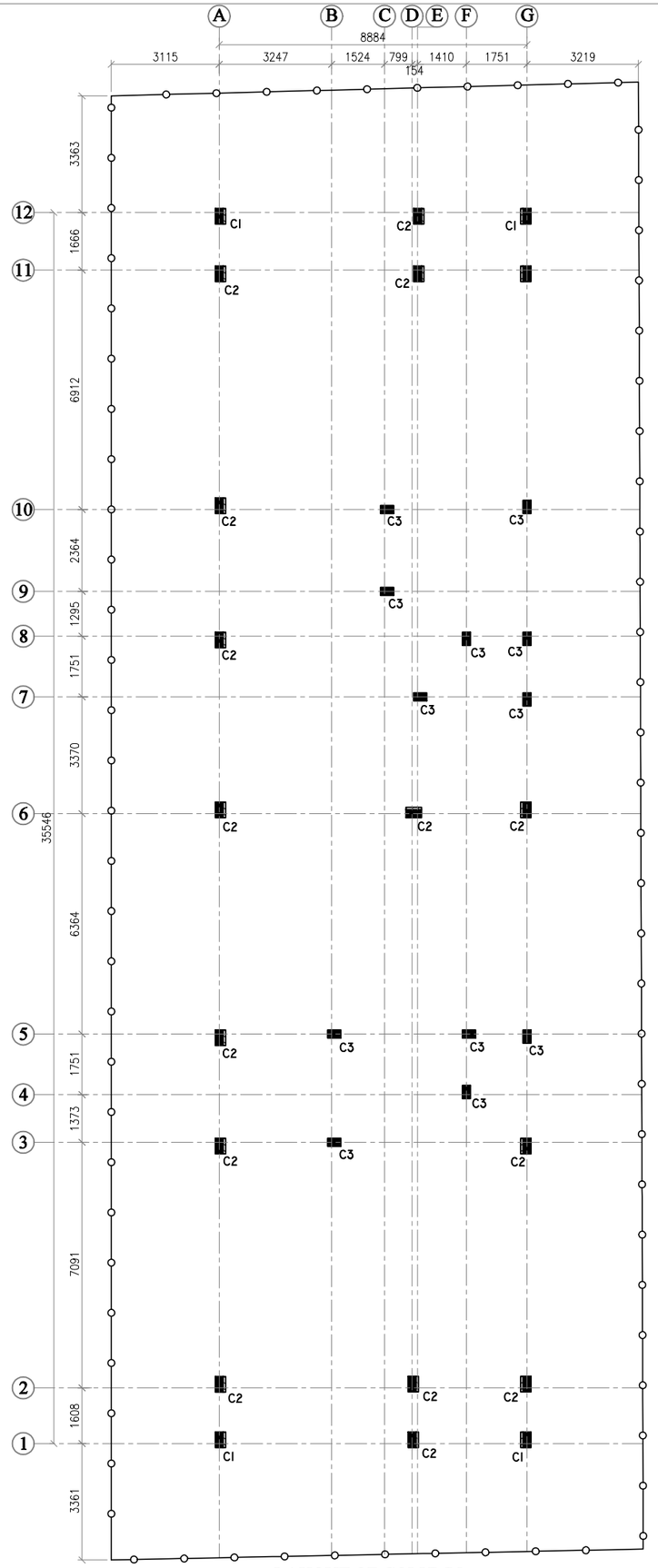
Hence Safe against Deflection

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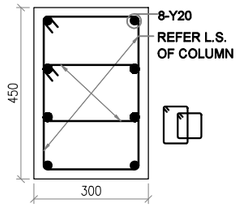
APPENDIX II

GENERAL ARRANGEMENT DRAWINGS

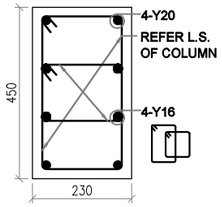
THIS DRAWING IS THE PROPERTY OF M/s. AURA ENGINEERING CONSULTANTS. AND MUST NOT BE COPIED WITHOUT THEIR WRITTEN CONSENT. NOR MADE KNOWN TO THE THIRD PARTY



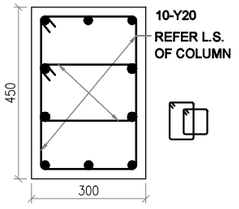
LAYOUT OF COLUMN



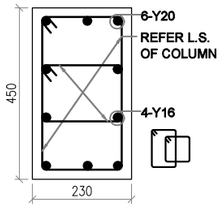
C.S. OF COLUMN "C1"
(300 x 450)
UP TO GFR



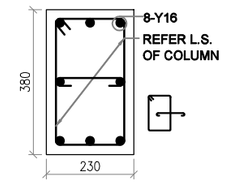
C.S. OF COLUMN "C1"
(230 x 450)
GFR TO TOP



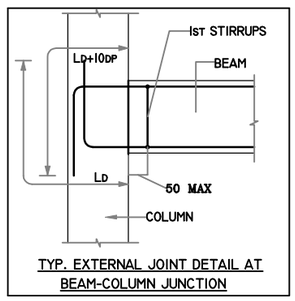
C.S. OF COLUMN "C2"
(300 x 450)
UP TO GFR



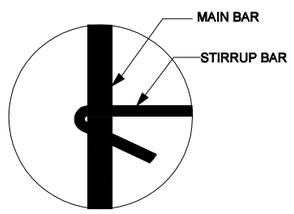
C.S. OF COLUMN "C2"
(230 x 450)
GFR TO TOP



C.S. OF COLUMN "C3"
(230 x 380)
UP TO TOP



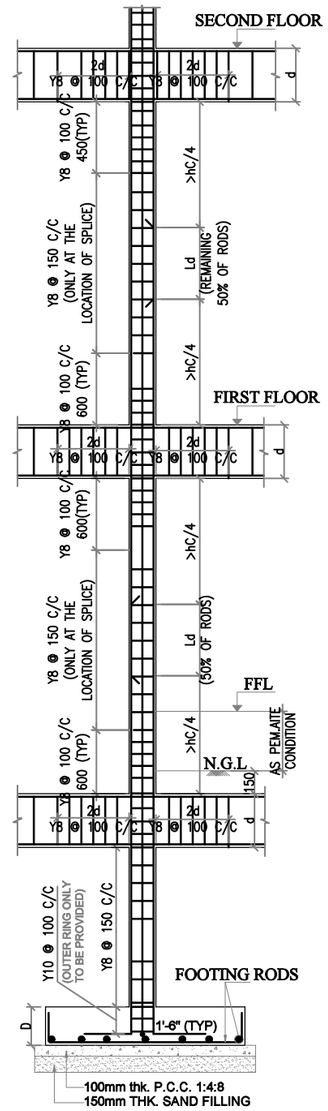
TYP. EXTERNAL JOINT DETAIL AT
BEAM-COLUMN JUNCTION



HOOK DETAIL

COLUMN SCHEDULE			
S.NO.	NAME	SIZE	
		UPTO STILT ROOF	STILT ROOF TO TOP
1.	C1	300 X 450	230 X 450
2.	C2	300 X 450	230 X 450
3.	C3	230 X 380	230 X 380

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REINFORCEMENT DETAILING COLUMN
(ALTERNATE RODS TO BE LAPPED
IN ALTERNATE FLOORS)

NOTE:

N.G.L - NATURAL GROUND LEVEL.

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

FOR APPROVAL ONLY

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% 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

LAP JOINTS FOR REINFORCEMENT BARS :

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

II) LAPS SHALL BE STAGGERED WITH A MINIMUM CENTRE TO CENTRE DISTANCE OF1.3 TIMES LAP LENGTH OF THE BAR FOR TENSION & COMPRESSION MEMBERS.

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

A) DEVELOPMENT LENGTH FOR COLUMN BARS -40D
B) DEVELOPMENT LENGTH FOR BEAM BARS -50D

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

VII) DETAILING OF REBARS SHALL CONFIRM TO IBC

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 OM.AOFT 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.

V) EXCAVATED FINE-GRAINED SOIL ENCOUNTERED AT SHALLOW DEPTHS SHALL BE IN NO CASE USED FOR BACK FILLING PURPOSES.

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 150KN/ SQM. @ 1800 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
00	ISSUE FOR APPROVAL	S.K	R.M	26.06.24

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

DRAWING TITLE :-

LAYOUT & R.C DETAILS OF COLUMN

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 160	———	001

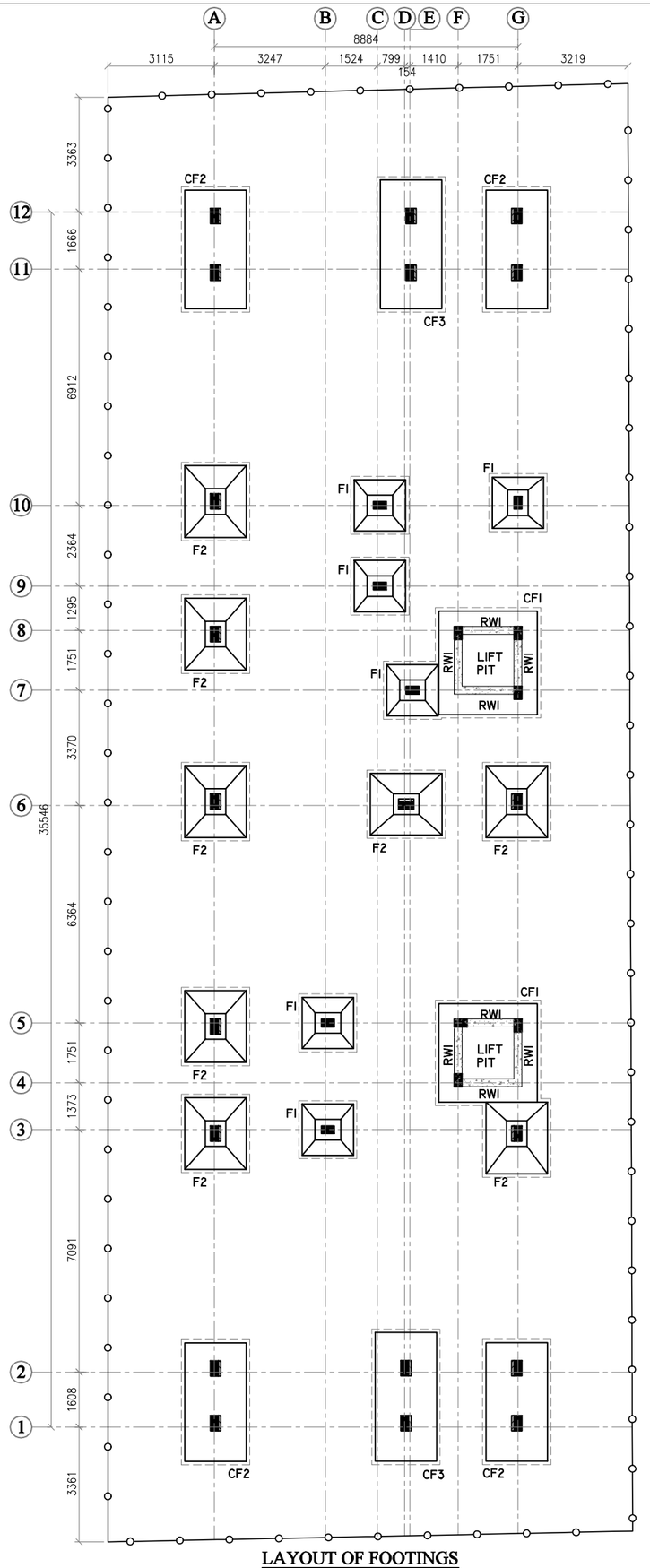
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

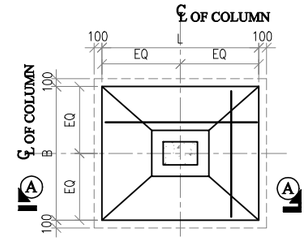
AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineering Consultants

A3

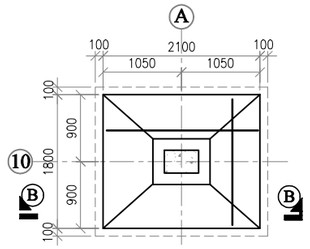
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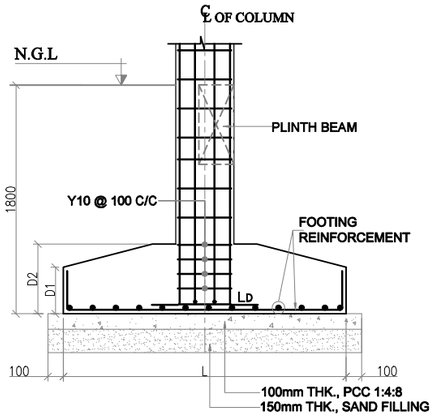
LAYOUT OF FOOTINGS



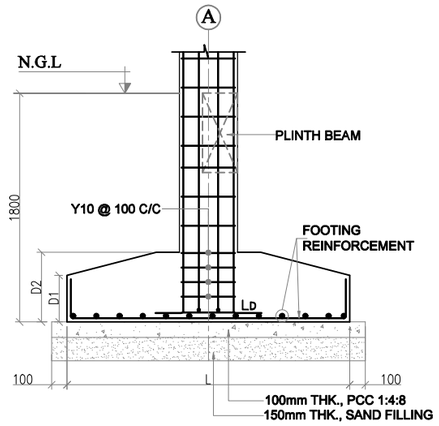
PLAN OF SLOPED FOOTING



PLAN OF SLOPED FOOTING-F2



SECTION "A-A"



SECTION "B-B"

COMBINED FOOTINGS SCHEDULE:-

SI.	FOOTING NAME	FOOTING SIZE	FOOTING REINFORCEMENT
01	CF1	2600 X 1500 D=380	Y12 @ 150 C/C @ BOTHWAYS TOP & BOTTOM

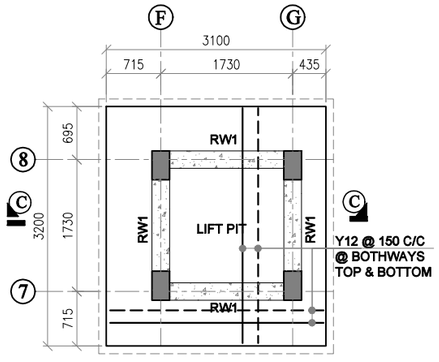
FOOTINGS SCHEDULE:-

SI.	FOOTING NAME	FOOTING SIZE	FOOTING REINFORCEMENT
01	F1	1500 X 1500 SLOPED FOOTING D1=250 , D2=450	Y10 @ 150 C/C BOTHWAYS @ BOTTOM
02	F2	1800 X 2100 SLOPED FOOTING D1=300 , D2=550	Y12 @ 150 C/C BOTHWAYS @ BOTTOM

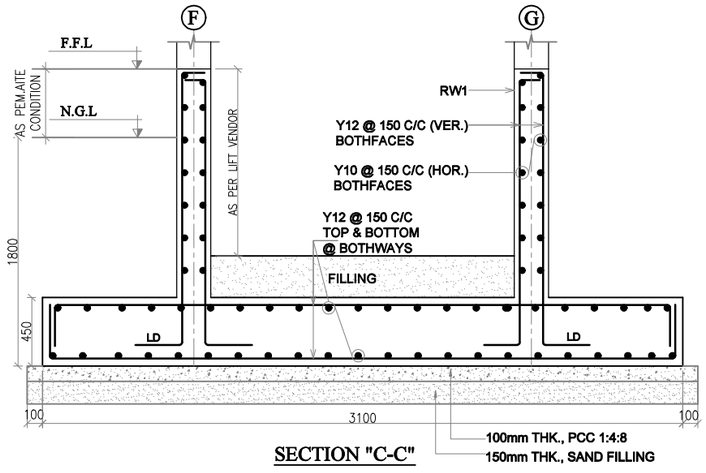
NOTE:

N.G.L - NATURAL GROUND LEVEL.

FOR APPROVAL ONLY



PLAN OF COMBINED FOOTING



SECTION "C-C"

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% 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

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REV.	DESCRIPTIONS	DRN	CHK	DATE
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DRAWING TITLE :-

LAYOUT & R.C DETAILS OF FOOTING

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 160	----------	002

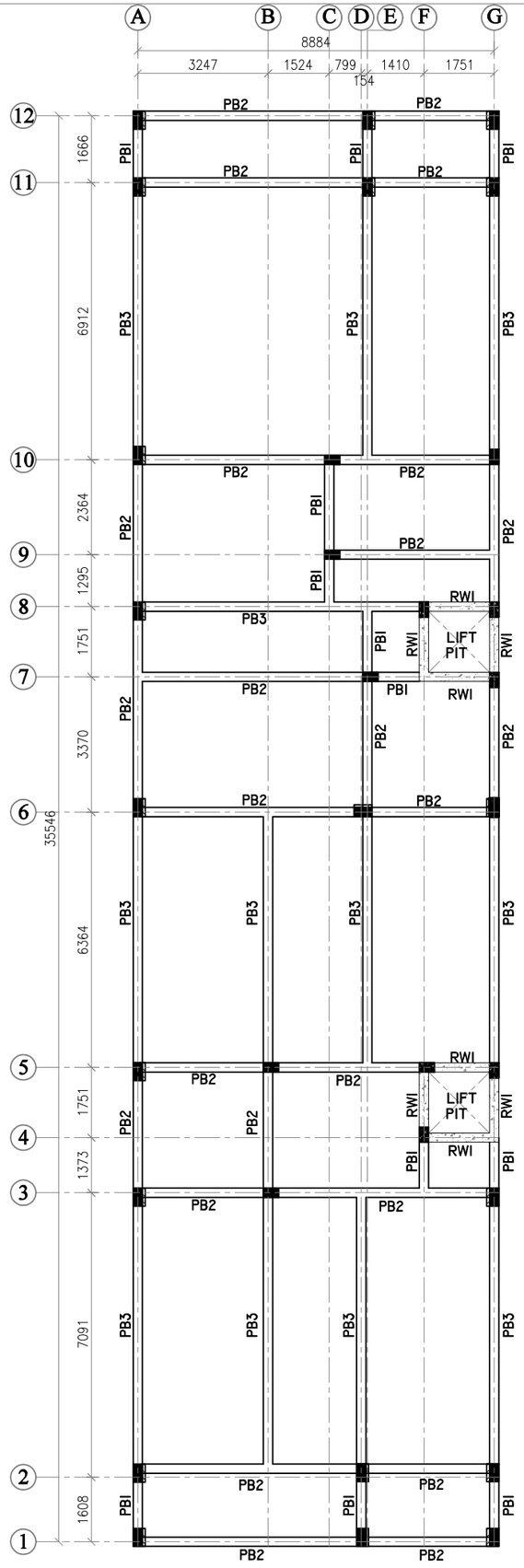
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
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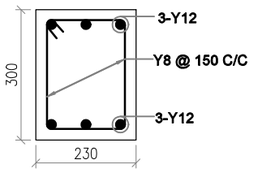
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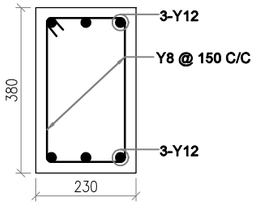


LAYOUT OF PLINTH BEAM

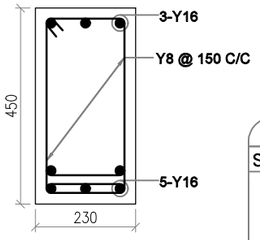
FOR APPROVAL ONLY



C.S. OF BEAM "PB1"
(230 x 300)



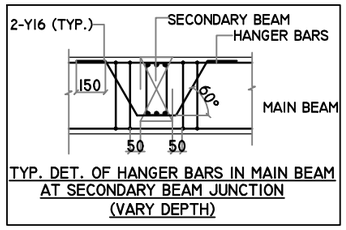
C.S. OF BEAM "PB2"
(230 x 380)



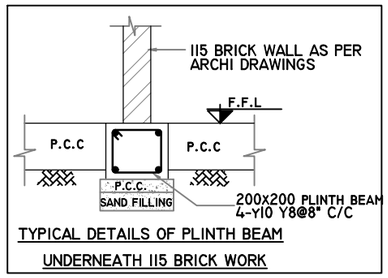
C.S. OF BEAM "PB3"
(230 x 450)

BEAM SCHEDULE

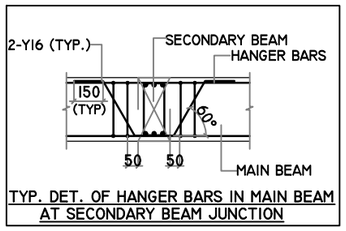
SL.NO	NAME	SIZE
01	PB1	230 x 300
02	PB2	230 x 380
03	PB3	230 x 450



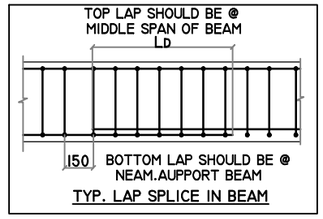
TYP. DET. OF HANGER BARS IN MAIN BEAM AT SECONDARY BEAM JUNCTION (VARY DEPTH)



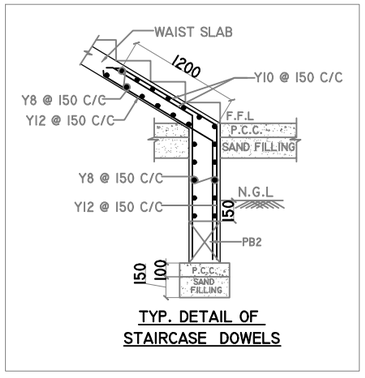
TYPICAL DETAILS OF PLINTH BEAM UNDERNEATH 115 BRICK WORK



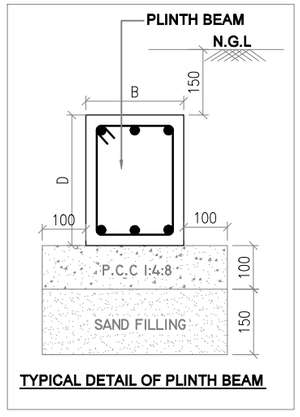
TYP. DET. OF HANGER BARS IN MAIN BEAM AT SECONDARY BEAM JUNCTION



TYP. LAP SPLICE IN BEAM



TYP. DETAIL OF STAIRCASE DOWELS



TYPICAL DETAIL OF PLINTH BEAM

NOTE:

N.G.L - NATURAL GROUND LEVEL.

F.F.L - FLOOR FINISH LEVEL

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

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4. CLEAR COVER FOR REINFORCEMENT
   A) BEAM = 30MM B) R.C WALL = 25MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
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REV.	DESCRIPTIONS	DRN	CHK	DATE
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DRAWING TITLE :-

LAYOUT & R.C DETAILS OF PLINTH BEAM

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 140	--------	003

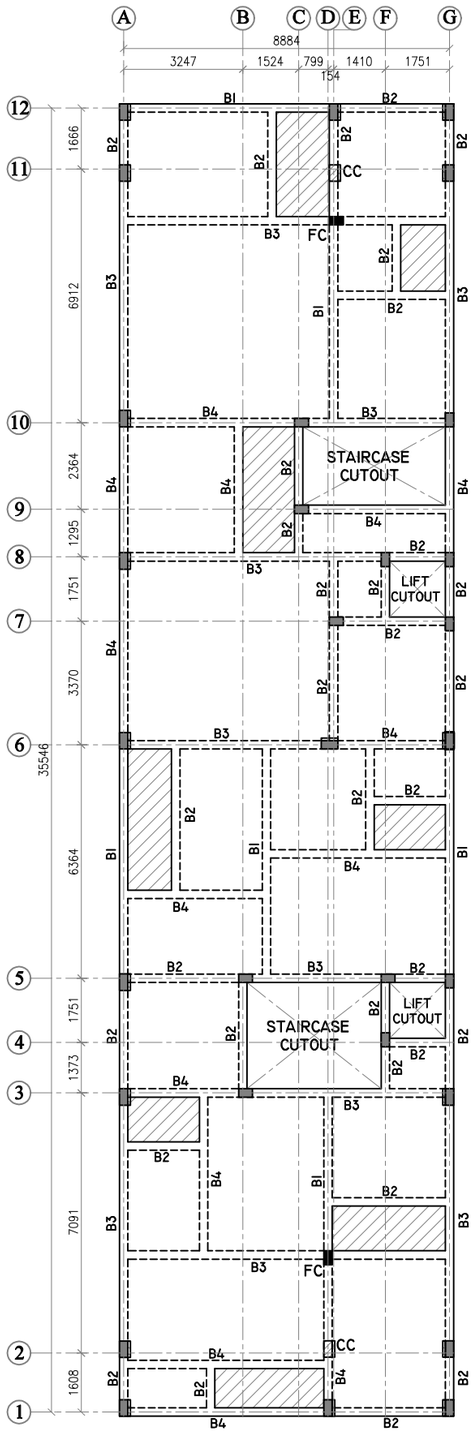
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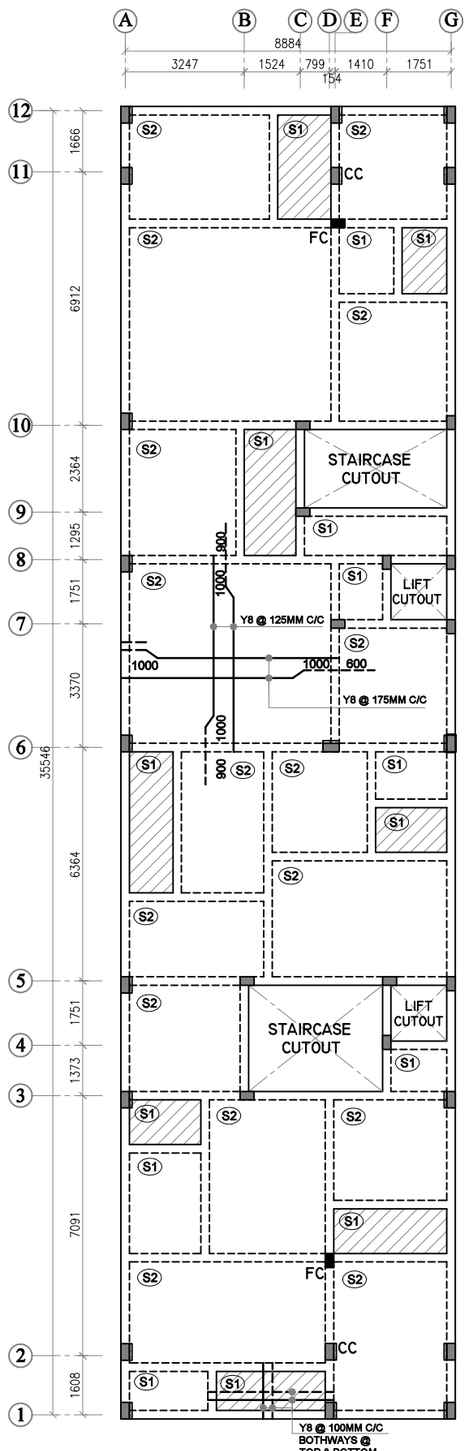
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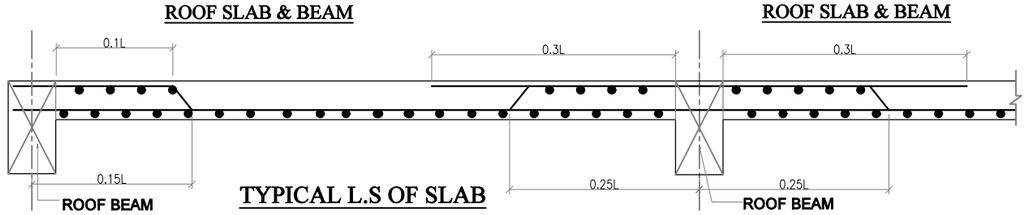
NUMERATION LAYOUT OF STILT FLOOR

ROOF SLAB & BEAM



R.C LAYOUT OF STILT FLOOR

ROOF SLAB & BEAM



TYPICAL L.S OF SLAB

NOTE:

SLAB SUNK BY 0'-10"

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

COLUMN CURTAILED TO BE BEND IN TO TOP OF THE SLAB

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

FOR APPROVAL ONLY

SLAB SCHEDULE

SL.NO	NAME	THICK
01	S1	150 THK.
02	S2	150 THK.

BEAM SCHEDULE

SL.NO	NAME	SIZE
01	B1	230 x 450
02	B2	230 x 450
03	B3	230 x 530
04	B4	230 x 450

GENERAL NOTES:

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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 OM.AOFT 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.

V) EXCAVATED FINE-GRAINED SOIL ENCOUNTERED AT SHALLOW DEPTHS SHALL BE IN NO CASE USED FOR BACK FILLING PURPOSES.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 (1:1.5:3) 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 = 30MM B) SLAB = 20MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
7. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	S.K	R.M	26.06.24

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

DRAWING TITLE :-

NUMERATION LAYOUT & R.C LAYOUT OF STILT FLOOR ROOF SLAB & BEAMS

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 150	———	004

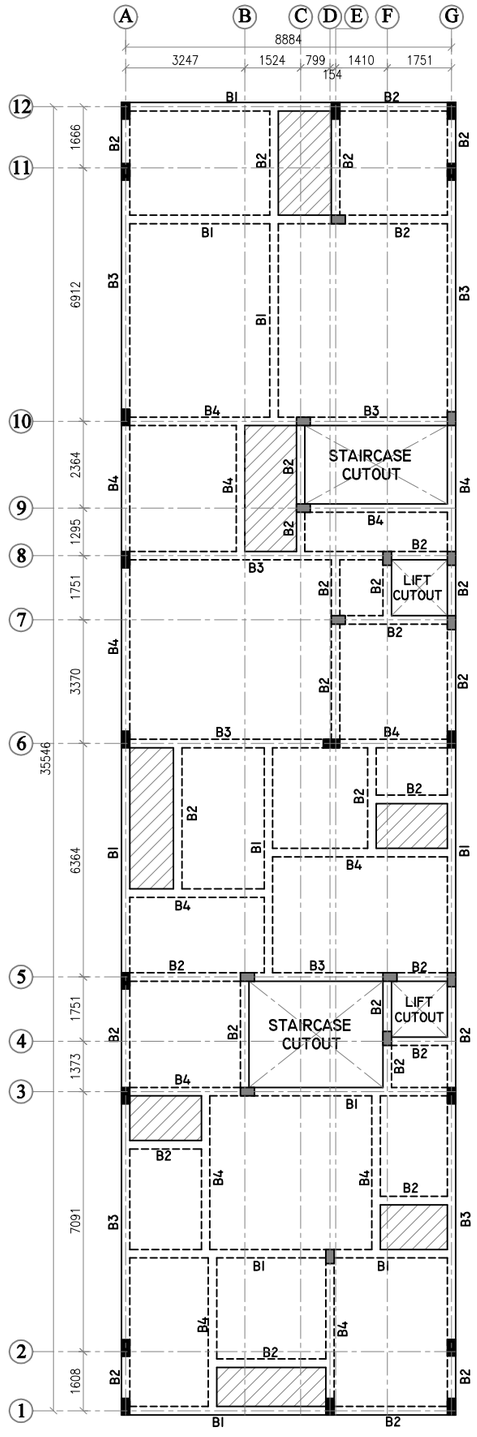
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

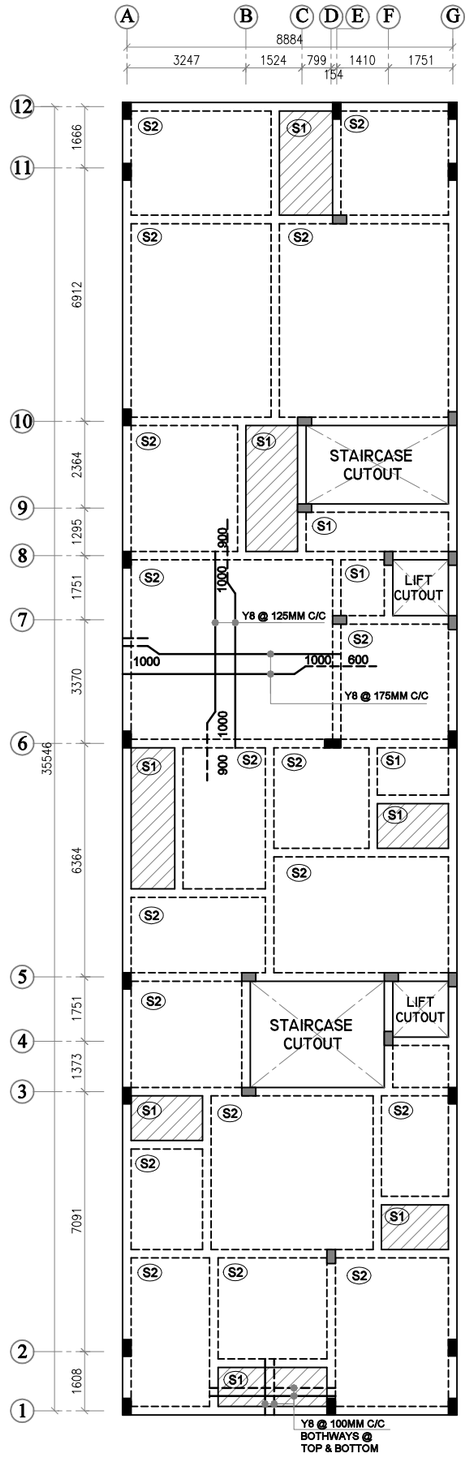
AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineering Consultants

A3

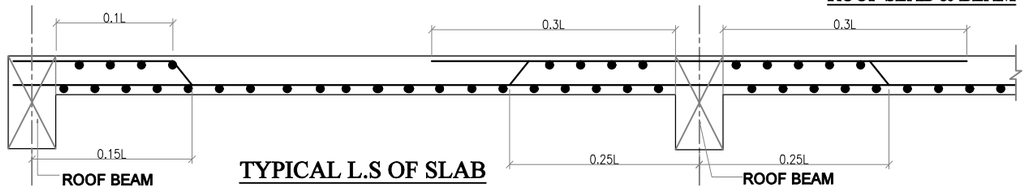
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NUMERATION LAYOUT OF TYPICAL FLOOR ROOF SLAB & BEAM



R.C LAYOUT OF TYPICAL FLOOR ROOF SLAB & BEAM



TYPICAL L.S OF SLAB

NOTE:

SLAB SUNK BY 0'-10"

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

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

FOR APPROVAL ONLY

SLAB SCHEDULE

SL.NO	NAME	THICK
01	S1	150 THK.
02	S2	150 THK.

BEAM SCHEDULE

SL.NO	NAME	SIZE
01	B1	230 x 450
02	B2	230 x 450
03	B3	230 x 530
04	B4	230 x 450

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% 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

LAP JOINTS FOR REINFORCEMENT BARS :

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

II) LAPS SHALL BE STAGGERED WITH A MINIMUM CENTRE TO CENTRE DISTANCE OF1.3 TIMES LAP LENGTH OF THE BAR FOR TENSION & COMPRESSION MEMBERS.

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

A) DEVELOPMENT LENGTH FOR COLUMN BARS -40D
B) DEVELOPMENT LENGTH FOR BEAM BARS -50D

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

VII) DETAILING OF REBARS SHALL CONFIRM TO IBC

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 OM.AOFT 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.

V) EXCAVATED FINE-GRAINED SOIL ENCOUNTERED AT SHALLOW DEPTHS SHALL BE IN NO CASE USED FOR BACK FILLING PURPOSES.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 (1:1.5:3) 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 = 30MM B) SLAB = 20MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
7. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	S.K	R.M	26.06.24

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

DRAWING TITLE :-

NUMERATION LAYOUT & R.C LAYOUT OF TYPICAL FLOOR ROOF SLAB & BEAMS

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 150	------	005

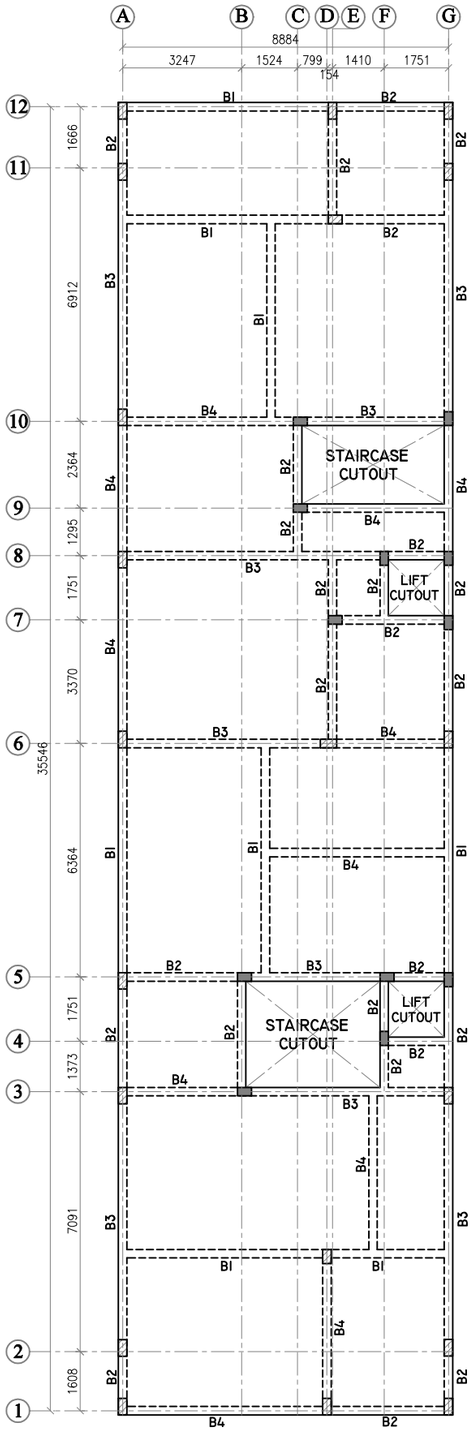
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

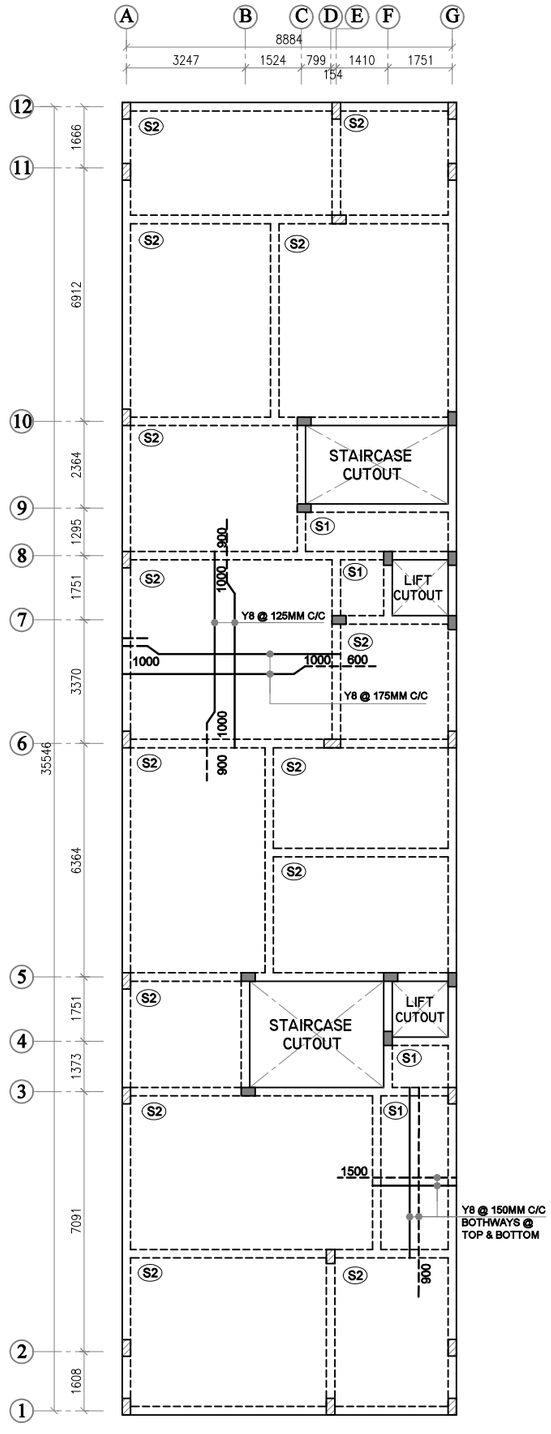
AURA ENGINEERING CONSULTANTS
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Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
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A3

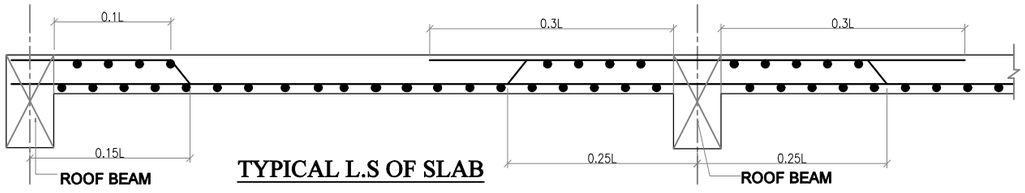
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NUMERATION LAYOUT OF TERRACE FLOOR SLAB & BEAM



R.C LAYOUT OF TERRACE FLOOR SLAB & BEAM



TYPICAL L.S OF SLAB

NOTE:

- COLUMN CURTAILED TO BE BEND IN TO TOP OF THE SLAB

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

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

FOR APPROVAL ONLY

SLAB SCHEDULE

SL.NO	NAME	THICK
01	S1	150 THK.
02	S2	150 THK.

BEAM SCHEDULE

SL.NO	NAME	SIZE
01	B1	230 x 450
02	B2	230 x 450
03	B3	230 x 530
04	B4	230 x 450

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% 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

LAP JOINTS FOR REINFORCEMENT BARS :

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

VII) DETAILING OF REBARS SHALL CONFIRM TO IBC

EXCAVATION AND BACKFILL

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4. CLEAR COVER FOR REINFORCEMENT
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5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
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REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	S.K	R.M	26.06.24

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

DRAWING TITLE :-

NUMERATION LAYOUT & R.C LAYOUT OF TERRACE FLOOR SLAB & BEAMS

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 150	-------	006

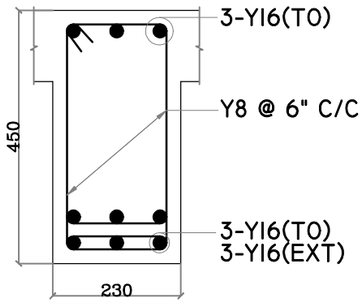
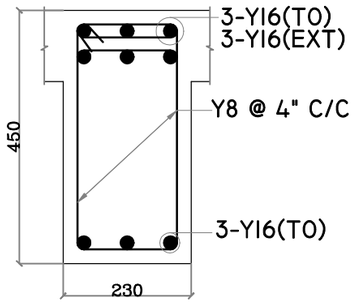
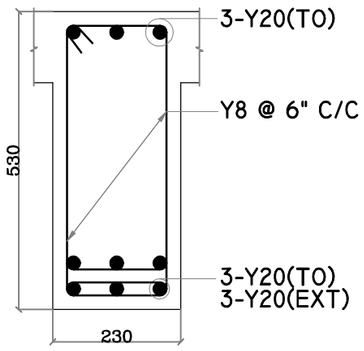
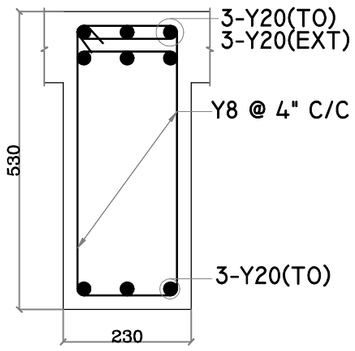
ARCHITECT / CONSULTANTS :-

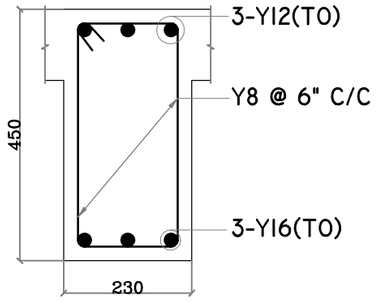
STRUCTURAL CONSULTANTS :-

AURA ENGINEERING CONSULTANTS
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Fixed Line :- 044 4859 7100
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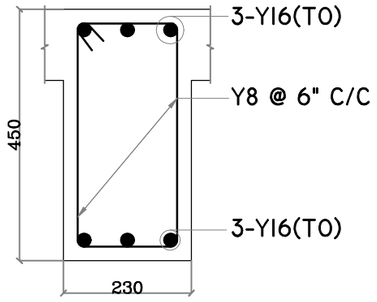
A3

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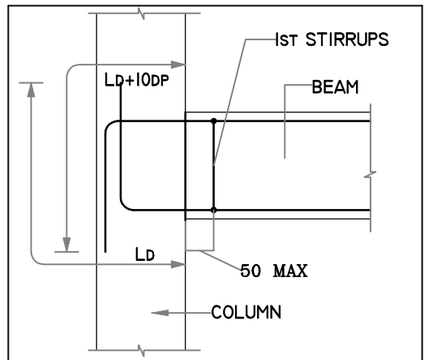
NAME	MID SPAN	END SUPPORT
B1 (230 X 450)		
B3 (230 X 530)		



C.S. OF BEAM "B2"
(230 X 450)



C.S. OF BEAM "B4"
(230 X 450)



TYP. EXTERNAL JOINT DETAIL AT
BEAM-COLUMN JUNCTION

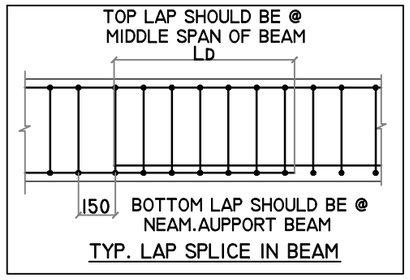
BEAM SCHEDULE		
SL.NO	NAME	SIZE
01	B1	230 x 450
02	B2	230 x 450
03	B3	230 x 530
04	B4	230 x 450

GENERAL NOTES:

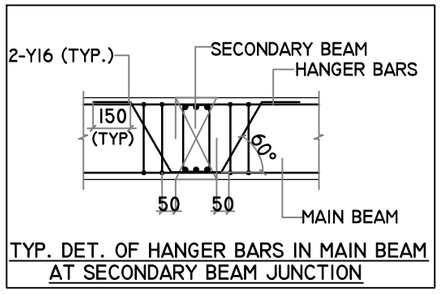
1. ALL DIMENSIONS ARE IN FOOT UNITS.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) COLUMN = 1½" B) BEAM = 1"
   C) SLAB = ¾"
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
7. DEVELOPMENT LENGTH (LD) SHALL BE AS PER (SP:34-1999) TABLE BELOW:

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

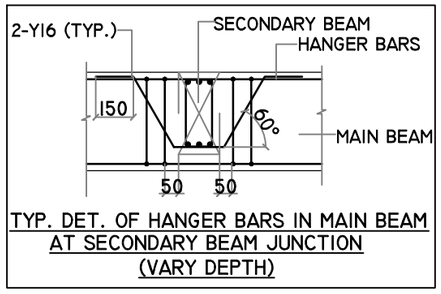
8. DETAILING OF REBARS SHALL CONFIRM TO SP-34 & IS 13920.



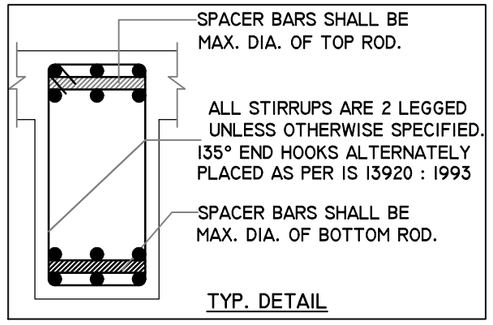
TYP. LAP SPLICE IN BEAM



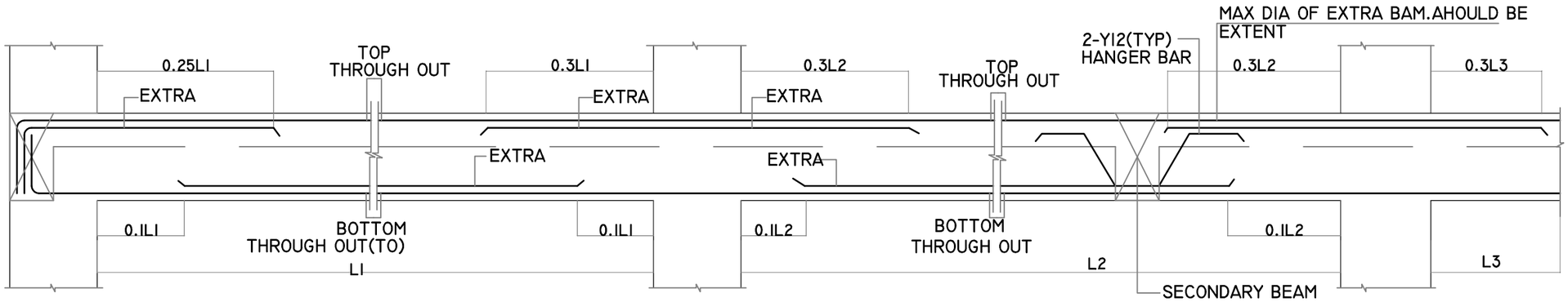
TYP. DET. OF HANGER BARS IN MAIN BEAM
AT SECONDARY BEAM JUNCTION



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



TYP. DETAIL



TYPICAL L.S OF ROOF BEAM

REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	S.K	R.M	26.06.24

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL APARTMENT BUILDING WITH 20 DWELLING UNITS 18.30 M HEIGHT, PLOT NO . 2, IN OLD DOOR NO:6 ,NEW DOOR NO: 38 RAMAN STREET ,(M.C NAGAR) MARAGATHAM CHANDRASEKAR NAGAR HASTHINAPURAM VILLAGE, CHROMPET,CHENNAI, COMPRISED IN OLD S.NOS: 23/1A1A3 AS PER PATTA T.S.NO: 23,WARD-F, BLOCK NO:37,OF PALLAVARAM TALUK.CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF TAMBARAM CITY MUNICIPAL CORPORATION.

DRAWING TITLE :-

R.C. DETAILS OF ALL FLOOR ROOF BEAMS

DATE	SCALE	JOB.NO	DRG.NO
26.06.24	1 : 130	———	007

ARCHITECT / CONSULTANTS :-

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

STRUCTURAL CONSULTANTS :-

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aura Engineeering Consultants

A3

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

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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.