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DESIGN CALCULATION

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +4 FLOORS (16.00 M HEIGHT) RESIDENTIAL BUILDING WITH 12DWELLING UNITS AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM, CHENNAI. COMPRISED IN S.NO: 91/75A, 91/75B & 91/100MADIPAKKAM VILLAGE ,WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

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1.0 DESIGN BRIEF:

THIS DOCUMENT PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +4 FLOORS (16.00 M HEIGHT) RESIDENTIAL BUILDING WITH 12DWELLING UNITS AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM, CHENNAI. COMPRISED IN S.NO: 91/75A, 91/75B & 91/100MADIPAKKAM VILLAGE ,WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

2.0 GENERAL DESIGN CRITERIA

2.1. Description of the structure

The Residential Building consists of Stilt Floor + 4 Upper floors and the structure is designed as a RCC framed structure.

1. Size of the building : 36.73 X 9.99M
2. Height of the building : 16.00M
3. Number of storeys above GL : Stilt Floor +4 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

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- 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

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- 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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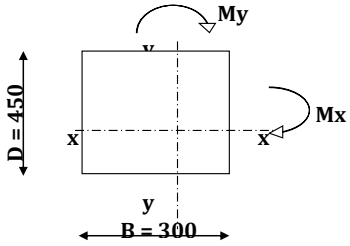
APPENDIX I

Design Calculations

Column Design

PROJECT	RESIDENTIAL BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM	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

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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 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 Reinforcemer	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 Calculatio (kN/m^2)

Critical Load Combinations	Pmax	Pmin
200	157.58	157.58333
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	178.57143
0	0.00	0.0

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

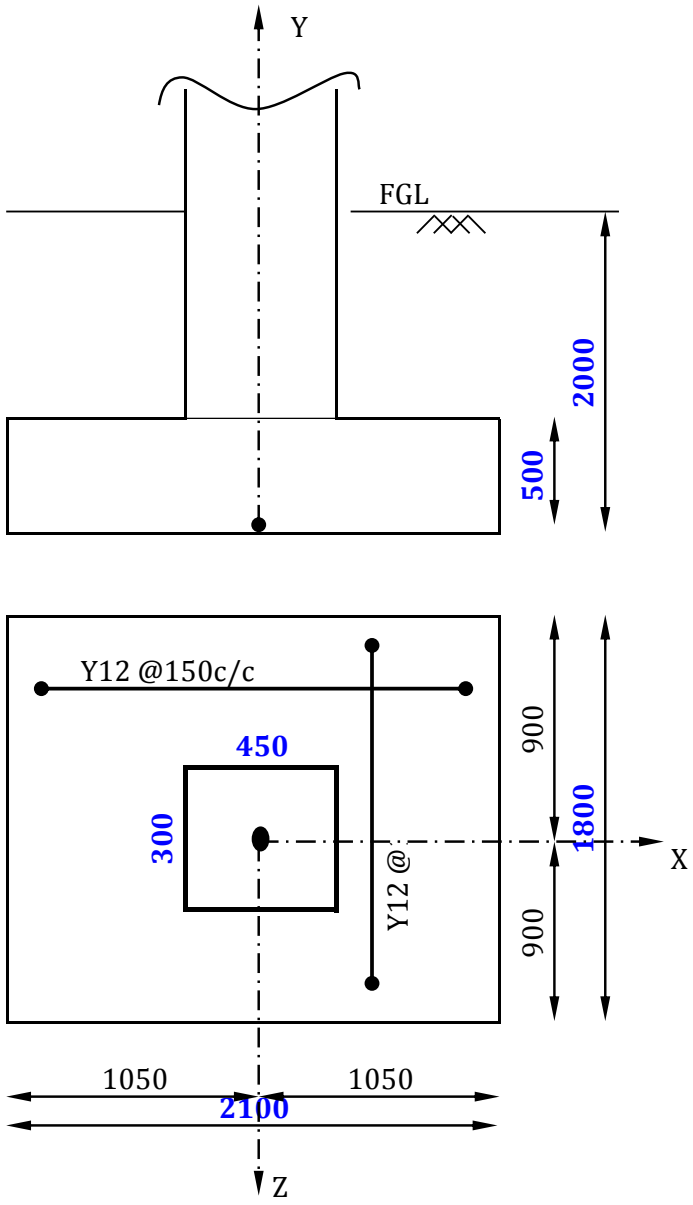
Depth provided is **OK**

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**



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RESIDENTIAL BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM

Design of Isolated Footing **F3** **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)	0.131	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, 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	=	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	=	339.529	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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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 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 = 87.11 kNm

1.4 **Area of Steel**

Minimum Area of Steel = 0.17% b d = 131.963 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 reqd	p_c	=	0	%
Required Area of tension steel	$A_{st\ reqd}$	=	131.96	mm^2
Required Area of compression steel	$A_{sc\ reqd}$	=	0.00	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	mm²					
Percentage of tension steel provided	p_t	=	0.777	% **Hence O.K**				
Percentage of compression steel provid	p_c	=	0.777	% **Hence O.K**				

Check for Shear

Shear		=	149	kN	
Nominal Shear Stress	tv	=	1.92	N/mm²	Cl 40.1, IS456:2000
Permissible Shear Stress	tc	=	0.92	N/mm²	β = 1.000
Maximum Shear Stress	tc,max	=	2.5	N/mm²	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 reqd	p_c	=	0	%	
Required Area of tension steel	$A_{st\ reqd}$	=	131.96	mm²	
Required Area of compression steel	$A_{sc\ reqd}$	=	0	mm²	

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

Check for Shear

Shear		=	149	kN	
Nominal Shear Stress	tv	=	1.92	N/mm²	Cl 40.1, IS456:2000
Permissible Shear Stress	tc	=	0.92	N/mm²	β = 1.000
Maximum Shear Stress	tc,max	=	2.5	N/mm²	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 = 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

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 reqd p_c = 0 %

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

Required Area of compression steel $A_{sc\ reqd}$ = 0 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 = 0.777 % **Hence O.K**

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

Check for Shear

Shear = 149 kN

Nominal Shear Stress tv = 1.92 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 = 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

Modification Factor(Tension Reinforcement) 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 BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM**	**DOCUMENT. NO.**	**DATE**	**DESIGNED** 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	IS 456:2000 Table 19
	Effective Depth	d	=	482.5	mm	IS 456:2000
	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 %		IS 456:2000
	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 Ste = 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 Reinforceme	3	20	3	20		

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PROJECT	**RESIDENTIAL BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM**	**DOCUMENT. NO.**	**DATE**	**DESIGNED** RMK	**DATE**
TITLE		**REVISION**	**DATE**	**CHECKED** RMK	**DATE**
CL. NO.	**BEAM DESIGN CALCULATIONS**				**REFERENCES**

A_{sc} provided = 1884.96 mm^2

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

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

Check for Shear

Shear = 241 kN

Nominal Shear Stress	tv	=	1.66	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		=	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

	I st Layer		II nd Layer	
	Nos	Dia	Nos	Dia
Compression Reinforceme	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 provided p_c = 1.302 % **Hence O.K**

Check for Shear

Shear = 241 kN

Nominal Shear Stress	tv	=	1.66	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		=	190.0		Cl 40.4, IS456:2000
Maximum Spacing of Shear Reinforcement		=	300		Cl 26.5.1.5,IS456:2000

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PROJECT	**RESIDENTIAL BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM**	**DOCUMENT. NO.**	**DATE**	**DESIGNED** RMK	**DATE**
TITLE		**REVISION**	**DATE**	**CHECKED** RMK	**DATE**
CL. NO.	**BEAM DESIGN CALCULATIONS**			**REFERENCES**	

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

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 Reinforceme	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 provided	p_c	=	1.302	%	**Hence O.K**

Check for Shear

Shear = 241 kN

Nominal Shear Stress	tv	=	1.66	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		=	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 BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM	DOCUMENT.N	DATE	DESIGNEI	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 Conditio **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

a_x for positive moment		1.5	→	0.051	Table 26 Cl D-1.1, IS 456 -2000
		1.75	→	0.059	
	for	1.54	a_x =	0.052	
Positive moment	0.052 x 12.38 x	5 ^2	=	**16.17**	KN-m
a_x for negative moment		1.5	→	0.067	Table 26 Cl D-1.1, IS 456 -2000
		1.75	→	0.077	
	for	1.54	a_x =	0.069	
Negative moment	0.069 x 12.38 x	5 ^2	=	**21.22**	KN-m

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TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES

Long Span Direction

For positive moment a_y = 0.028 — Table 26 Cl D-1.1,
Positive moment 0.028 x 12.38 x 5 ^2 = **8.66** KN-m — IS 456 -2000

For negative moment a_y = 0.037 — Table 26 Cl D-1.1,
Negative moment 0.037 x 12.38 x 5 ^2 = **11.45** KN-m — IS 456 -2000
Shear force V = 12.38 x 5 x 1 = **30.94** KN

1.0.4 Check Effective Depth for Max.Bending Moment

Depth require = $(M_u / (0.133 \times fck \times b))^{1/2}$ = 79.89 mm — Table C,SP 16 :1980
Depth provide = 150 - 25 - 10 /2 = 120 mn > ### mn — Cl 2.3

Hence the section is Safe against Bending

1.0.5 Check Depth for Shear

Nominal Shear Stress $t_v = V_u / b\,d$ = 0.26 N/mm^2 — Cl.40.1, IS 456:2000
Design shear stre (t_c) = 0.46 N/mm^2 — Table 19 , IS 456:2000
k = 1.30 — Cl.40.2.1.1,
k * t_c = 0.60 N/mm^2 — IS 456:2000

t_v < k * t_c **Hence the section is Safe against Shear**

1.0.6 Check for Maximum Shear Stress:

Nominal Shear Stress $t_v = V_u / b\,d$ = 0.26 N/mm^2 — Cl.40.1, IS 456:2000
Maximum Shear Stre ($t_{c,max}$) = 3.1 N/mm^2 — Table 20 , IS 456:2000
$t_{c,max}$ = 1.55 N/mm^2

t_v < 1 $t_{c,max}$ **Hence the section is Safe against Max.Shear Stres** — Cl.40.2.3.1, IS 456:200

1.0.7 Reinforcement calculations

Short Span Direction @ Support

$Mu/bd = \frac{21.22 \times 10 \wedge 6}{1000 \times \# \times 120} = \mathbf{1.474}$

Pt = **0.37** % — Table 2-4, SP16 :1980

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PROJECT	RESIDENTIAL BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM	DOCUMENT.N	DATE	DESIGNEI	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
	Area of steel = 0.0037 x 1000 x 120 = 439 mm² Minimum area of 0.001 x 1000 x 150 = #### mm² Spacing of # bar 78.54 x 1000 / 438.88 = 179 mm	Cl:26.5.2.1 IS 456 -2000
	Check for Spacing	
	Minimum of 1) 3d = 360 mm 2) = 300 mm 3) = 178.86 mm Therefore provid # @ **170** mm C/C	Cl:26.3.3.(b).1 IS 456 -2000
	Short Span Direction @ Mid Span	

	Mu/bd = 16.17 x 10 ^ 6 / 1000 x # x 120 = 1.123
	Pt = 0.273 %
		SP16 :1980 Table 2-4

	Area of steel = 0.0027 x 1000 x 120 = 328 mm² Minimum area of 0.001 x 1000 x 150 = #### mm² Spacing of # bar 78.54 x 1000 / 327.93 = 239 mm	IS 456:2000 Cl:26.5.2.1
	Check for Spacing	
	Minimum of 1) 3d = 360 mm 2) = 300 mm 3) = 239.38 mm	IS 456:2000 Cl:26.3.3.(b).1
	Therefore provid # @ **150** mm C/C 150 Provided % of Tension Reinforcement (pt) = **0.436** %	
	Long Span Direction @ Support	

	Mu/bd = 11.45 x 10 ^ 6 / 1000 x # x 120 = 0.795
	Pt = 0.190 %
		SP16 :1980 Table 2-4

	Area of steel = 0.0019 x 1000 x 120 = 228 mm² Minimum area of 0.001 x 1000 x 150 = #### mm² Spacing of # bar 78.54 x 1000 / 228.07 = 344 mm	IS 456:2000 Cl:26.5.2.1

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PROJECT	RESIDENTIAL BUILDING(S+4) AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM	DOCUMENT.N	DATE	DESIGNEI	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 provid # @ **300** mm C/C

Long Span Direction @ mid Span

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

Pt = 0.142 % — SP16 :1980 Table 2-4

Area of steel = 0.0014 x 1000 x 120 = 171 mm^2 — IS 456:2000
Minimum area of 0.001 x 1000 x 150 = #### mm^2 — Cl:26.5.2.1
Spacing of # bar 78.54 x 1000 / 180.00 = 436 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 provid # @ **300** mm C/C

1.0.8 **<u>Check for Deflection:</u> (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 stee 0.58 fy (Ast_R/Ast_P) = 181.63 N/mm^2 — IS456:2000 Fig 4
Modification Factor for Tension Reinforcen = 1.71 — Page 38
Allowable Span / Effective Depth Ratio = 44.47 — IS 456:2000 Cl:23.2.1
Actual Span/Eff Dept = 5 x 1000 / 120 = 41.67

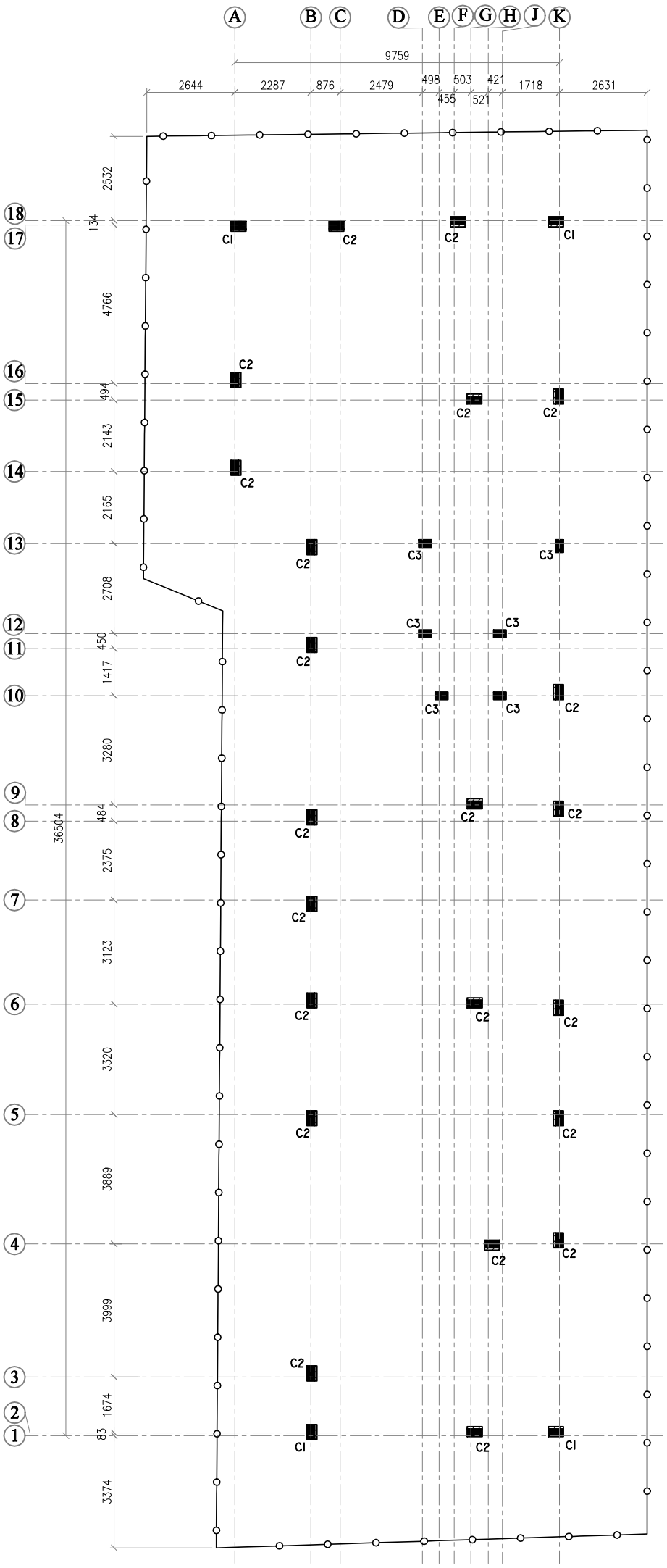
Hence Safe against Deflection

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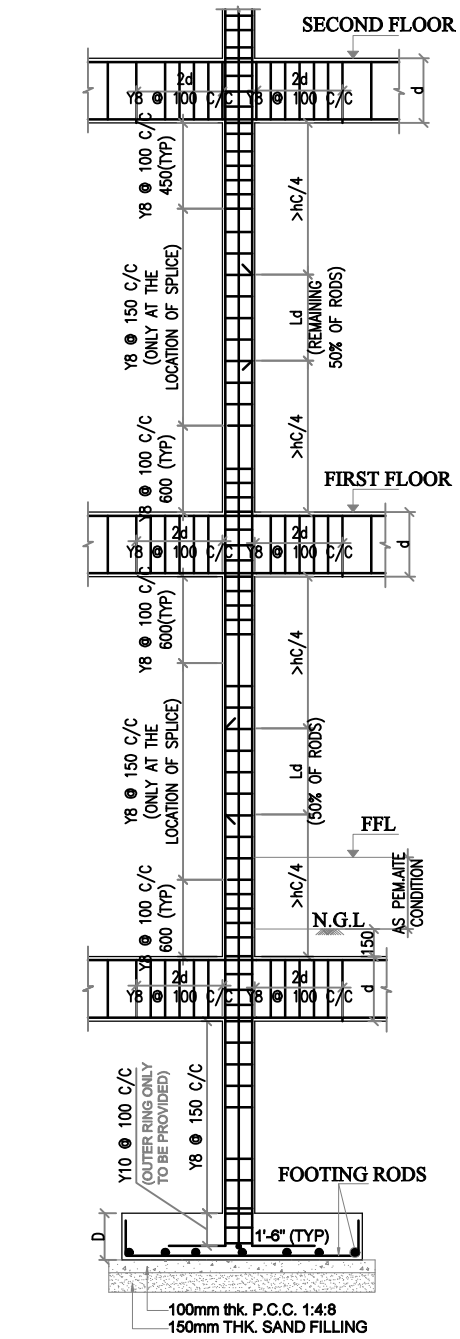
APPENDIX II

GENERAL ARRANGEMENT DRAWINGS

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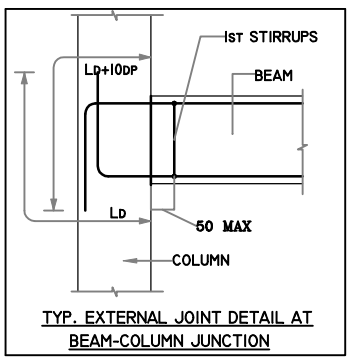


LAYOUT OF COLUMN

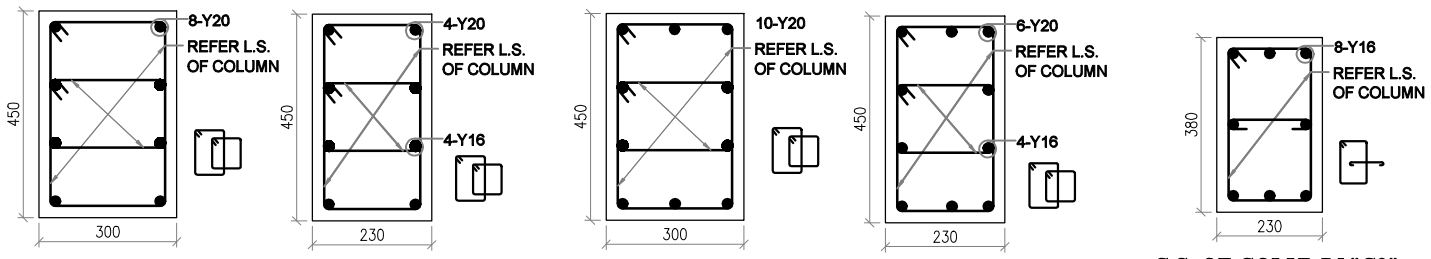


REINFORCEMENT DETAILING COLUMN

(ALTERNATE RODS TO BE LAPPED IN ALTERNATE FLOORS)



TYP. EXTERNAL JOINT DETAIL AT BEAM-COLUMN JUNCTION



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

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

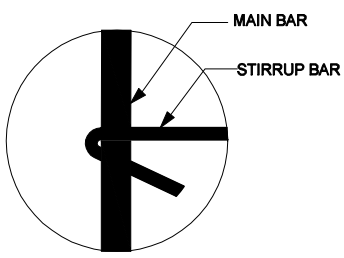
C.S. OF COLUMN "C2" (300 x 450) UP TO GFR

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

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

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



HOOK DETAIL

FOR APPROVAL ONLY

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

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 OFI.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+4 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
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

REV.	DESCRIPTIONS	DRN	CHK	DATE
00	ISSUE FOR APPROVAL	R.P	R.M	06.09.25

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +4 FLOORS (16.00 M HEIGHT) RESIDENTIAL BUILDING WITH 12DWELLING UNITS AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM, CHENNAI. COMPRISED IN S.NO: 91/75A, 91/75B & 91/100MADIPAKKAM VILLAGE ,WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

DRAWING TITLE :-

LAYOUT & R.C DETAILS OF COLUMN

DATE	SCALE	JOB.NO	DRG.NO
06.09.25	1 : 120	--------	001

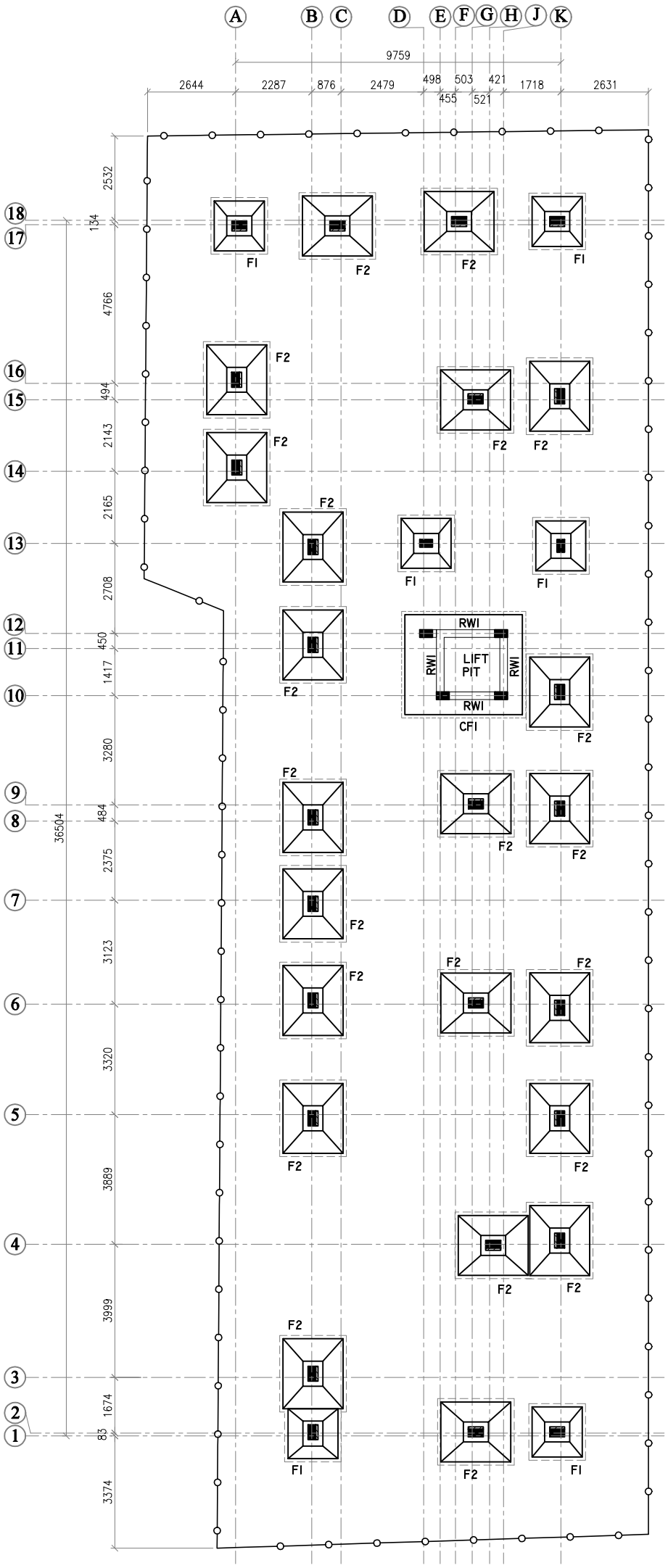
ARCHITECT / CONSULTANTS :-

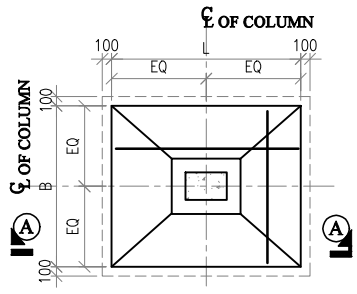
STRUCTURAL CONSULTANTS :-

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
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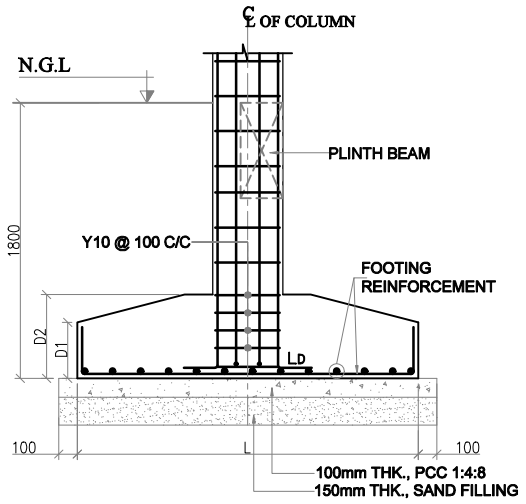
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PLAN OF SLOPED FOOTING



SECTION "A-A"

NOTE:

N.G.L - NATURAL GROUND LEVEL.

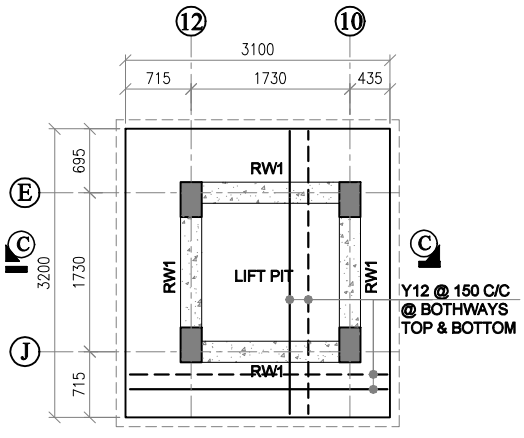
FOR APPROVAL ONLY

FOOTINGS SCHEDULE:-

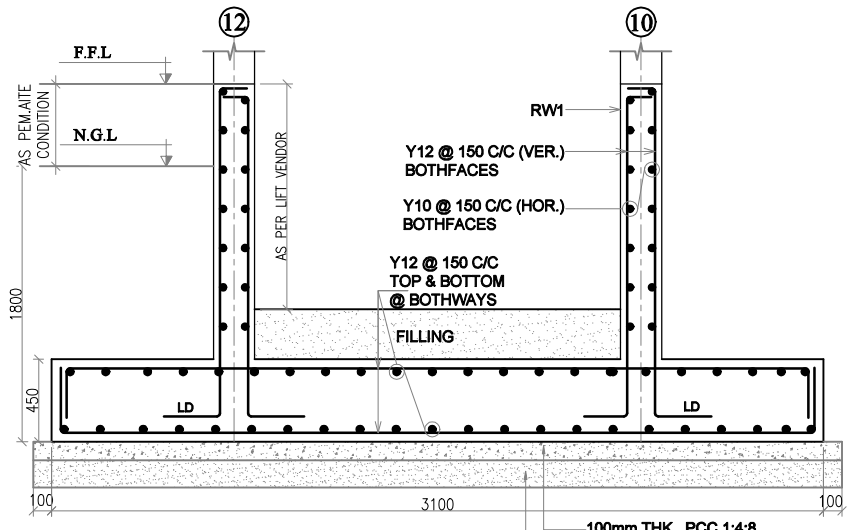
SI.	FOOTING NAME	FOOTING SIZE	FOOTING REINFORCEMENT
01	F1	1500 X 1500 SLOPED FOOTING D1=250 , D2=450	Y10 @ 150 C/C BOTHWAYS @ BOTTOM
02	F2	1800 X 2100 SLOPED FOOTING D1=300 , D2=550	Y12 @ 150 C/C BOTHWAYS @ BOTTOM

COMBINED FOOTINGS SCHEDULE:-

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



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

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 OFI.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

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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
06.09.25	1 : 120	--------	002

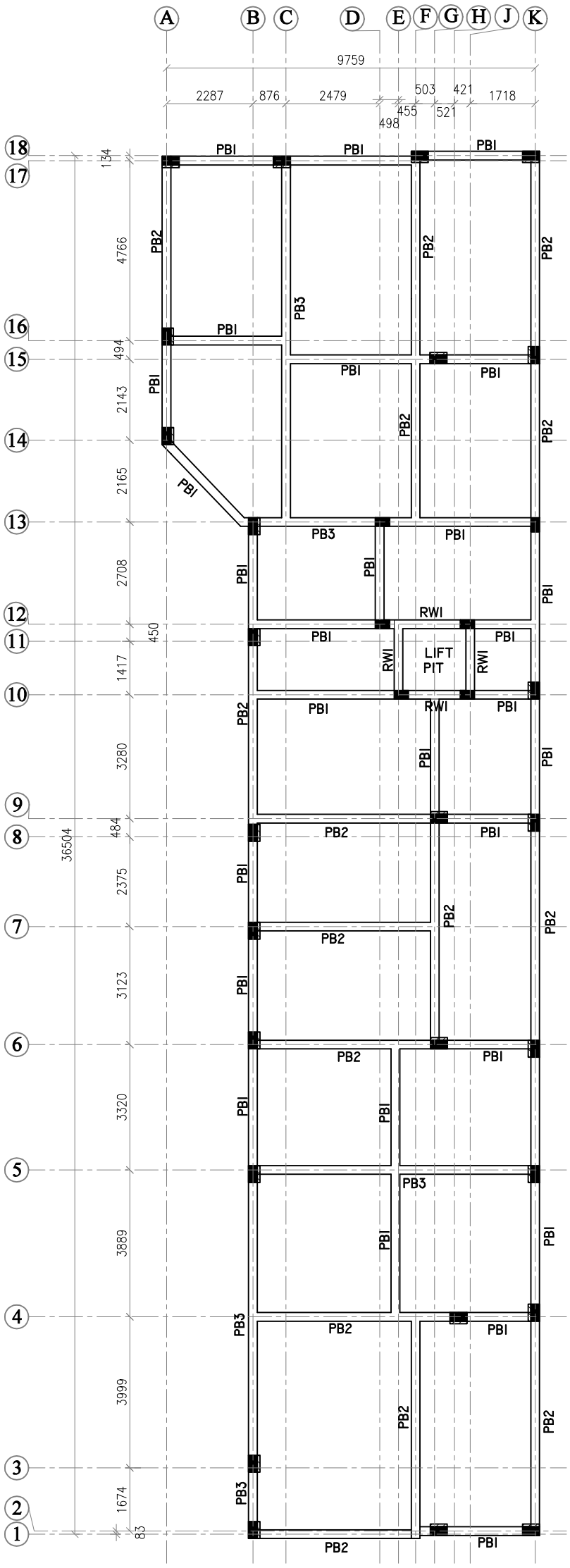
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

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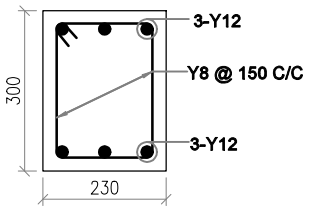
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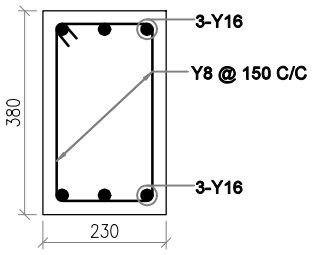


LAYOUT OF PLINTH BEAM

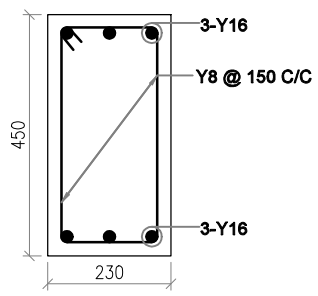
FOR APPROVAL ONLY



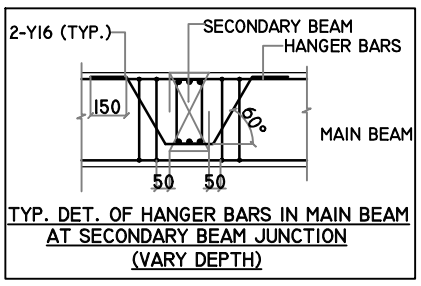
C.S. OF BEAM "PB1"
(230 x 300)



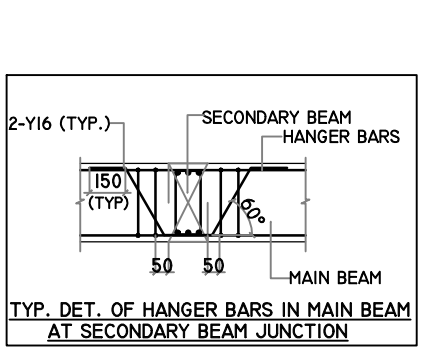
C.S. OF BEAM "PB2"
(230 x 380)



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



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



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

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

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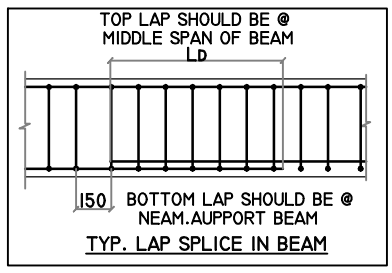
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BEAM SCHEDULE		
SL.NO	NAME	SIZE
01	PBI	230 x 300
02	PB2	230 x 380
03	PB3	230 x 450



TYP. LAP SPLICE IN BEAM

GENERAL NOTES:

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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) FOOTING = 50MM
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
06.09.25	1 : 120	--------	003

ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

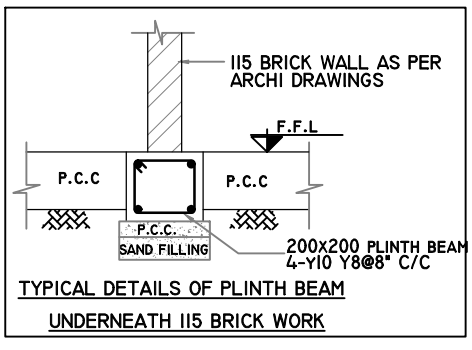
AURA ENGINEERING CONSULTANTS
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A3

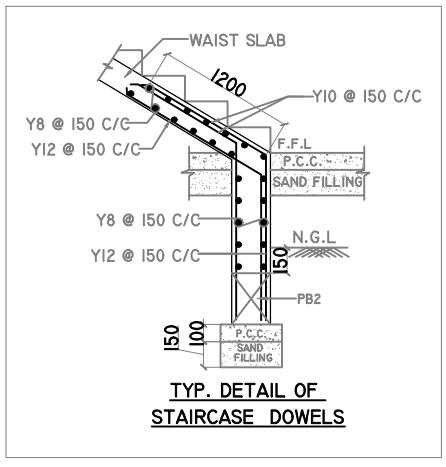
NOTE:

N.G.L - NATURAL GROUND LEVEL.

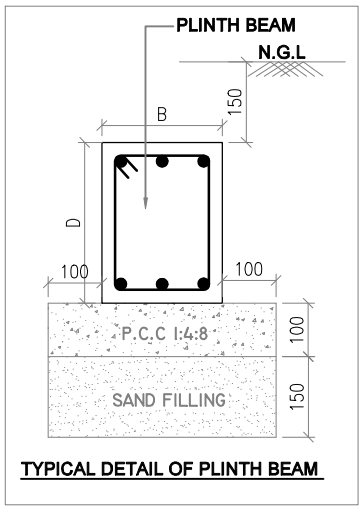
F.F.L - FLOOR FINISH LEVEL



TYPICAL DETAILS OF PLINTH BEAM UNDERNEATH 115 BRICK WORK

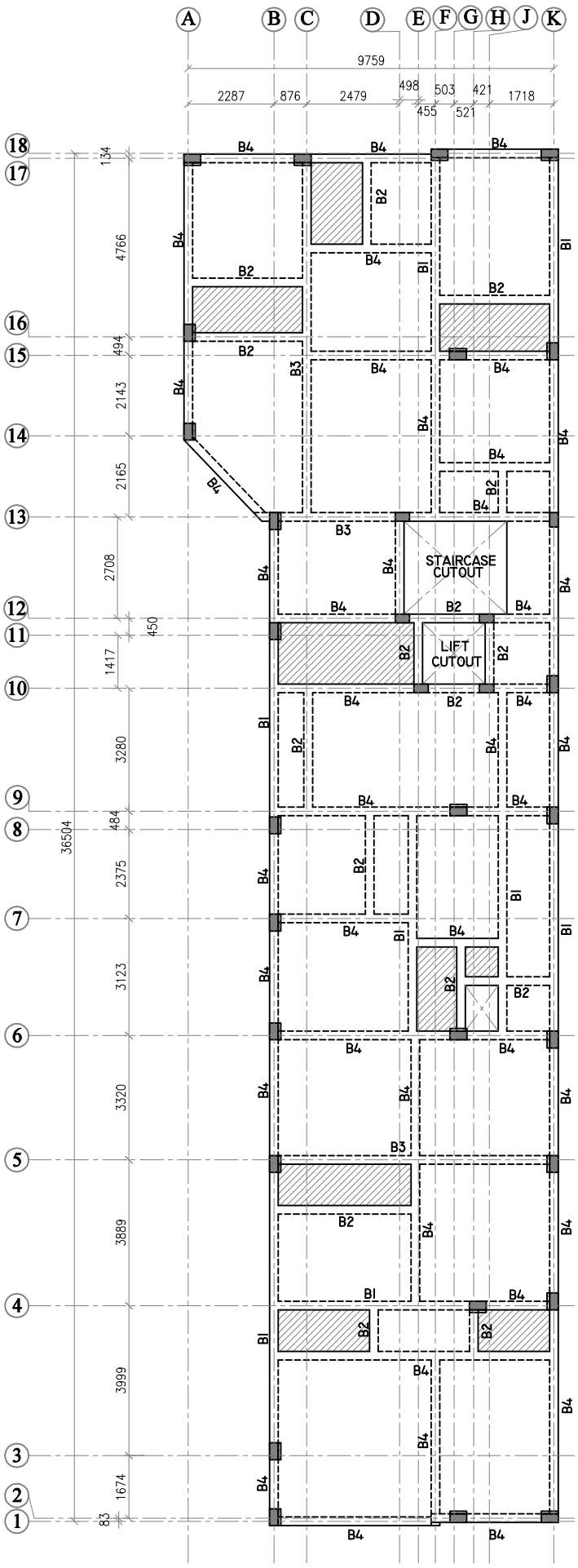


TYP. DETAIL OF STAIRCASE DOWELS

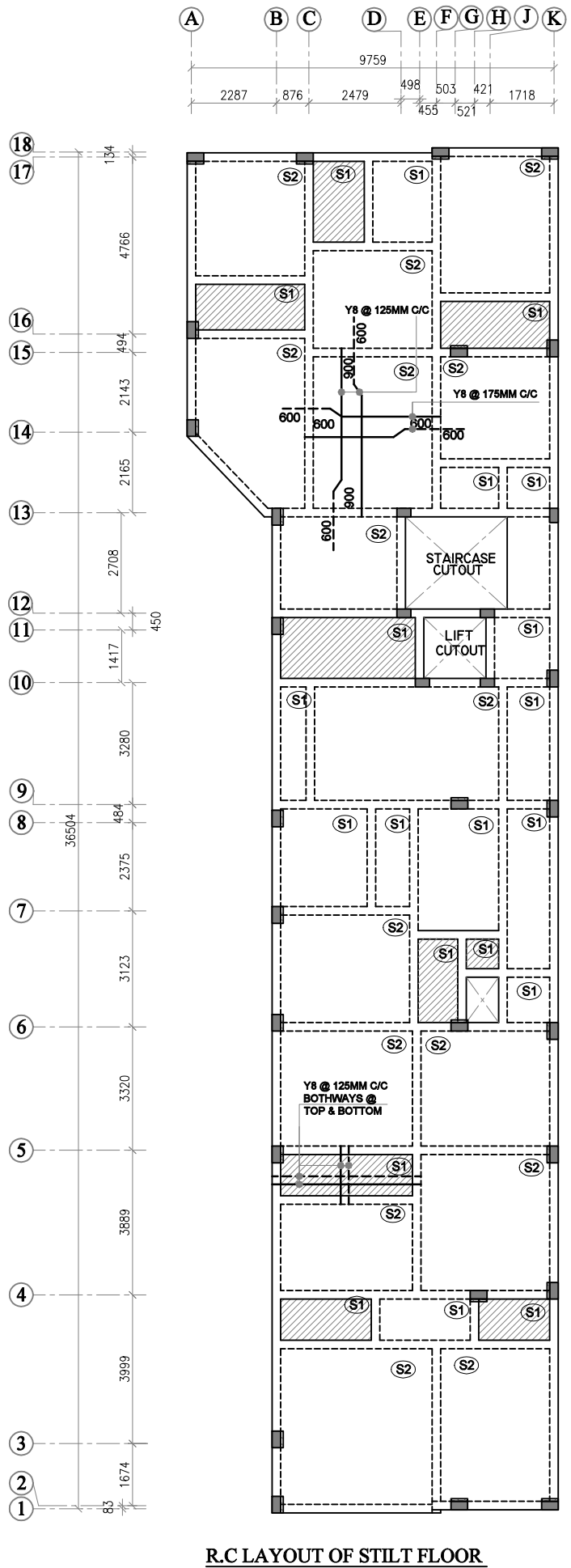


TYPICAL DETAIL OF PLINTH BEAM

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NUMERATION LAYOUT OF STILT FLOOR ROOF SLAB & BEAM



R.C LAYOUT OF STILT FLOOR ROOF SLAB & BEAM

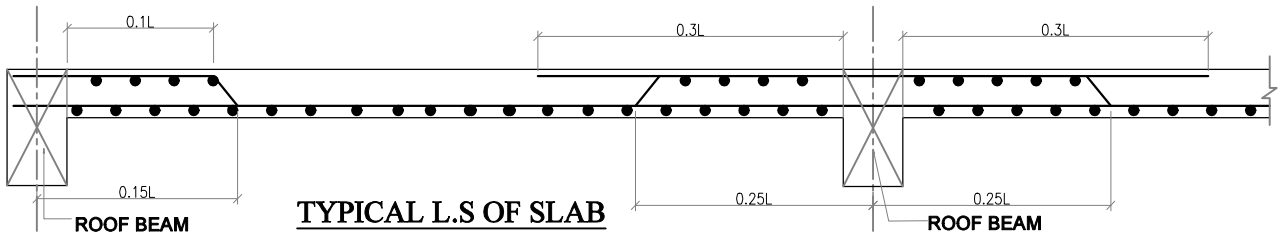
NOTE:

SLAB SUNK BY 0'-10"

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

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

COLUMN CURTAILED TO BE BEND IN TO TOP OF THE SLAB



TYPICAL L.S OF SLAB

FOR APPROVAL ONLY

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

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

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

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00	ISSUE FOR APPROVAL	R.P	R.M	06.09.25

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +4 FLOORS (16.00 M HEIGHT) RESIDENTIAL BUILDING WITH 12DWELLING UNITS AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM, CHENNAI. COMPRISED IN S.NO: 91/75A, 91/75B & 91/100MADIPAKKAM VILLAGE ,WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

DRAWING TITLE :-

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

DATE	SCALE	JOB.NO	DRG.NO
06.09.25	1 : 100	------	004

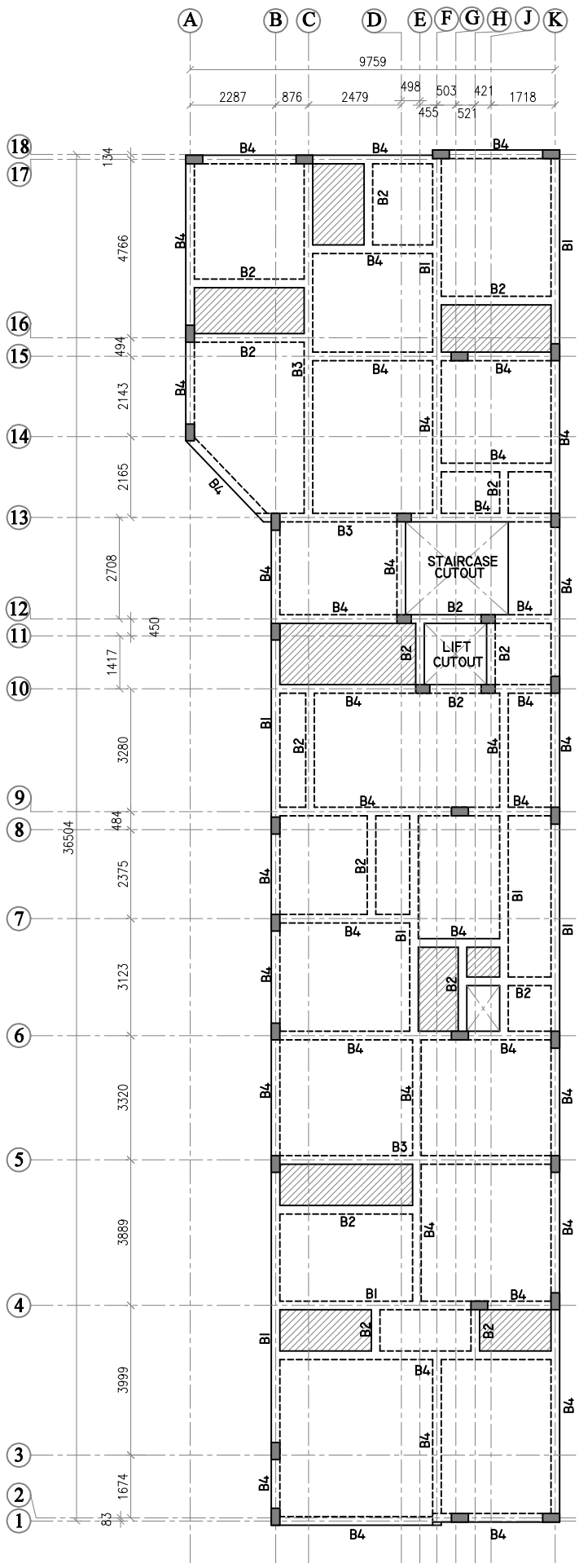
ARCHITECT / CONSULTANTS :-

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/
Engineering Consultants

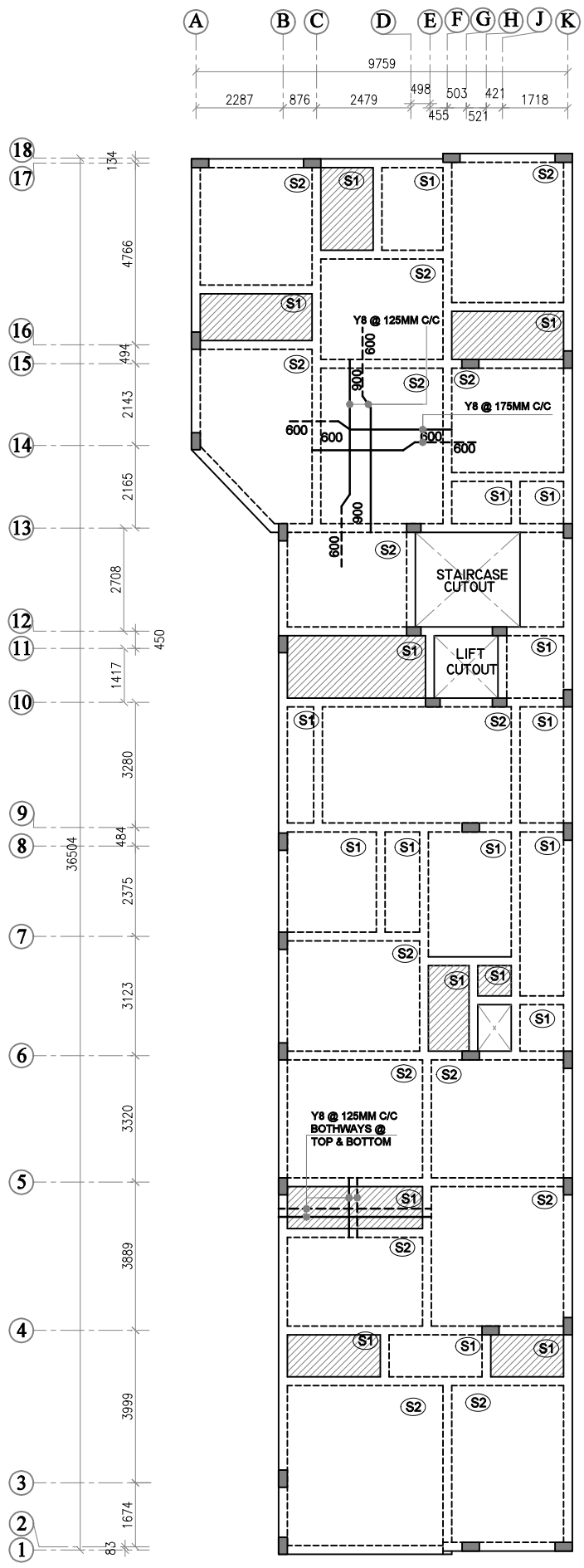
A3

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NUMERATION LAYOUT OF TYPICAL FLOOR

ROOF SLAB & BEAM



R.C LAYOUT OF TYPICAL FLOOR

ROOF SLAB & BEAM

FOR APPROVAL ONLY

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

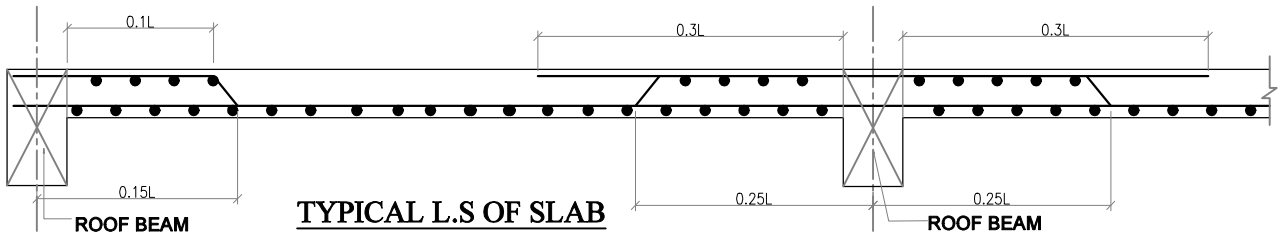
SLAB SCHEDULE		
SL.NO	NAME	THICK
01	S1	150 THK.
02	S2	150 THK.

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

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

NOTE:

SLAB SUNK BY 0'-10"



TYPICAL L.S OF SLAB

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	R.P	R.M	06.09.25

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +4 FLOORS (16.00 M HEIGHT) RESIDENTIAL BUILDING WITH 12DWELLING UNITS AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM, CHENNAI. COMPRISED IN S.NO: 91/75A, 91/75B & 91/100MADIPAKKAM VILLAGE ,WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

DRAWING TITLE :-

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

DATE	SCALE	JOB.NO	DRG.NO
06.09.25	1 : 100	------	005

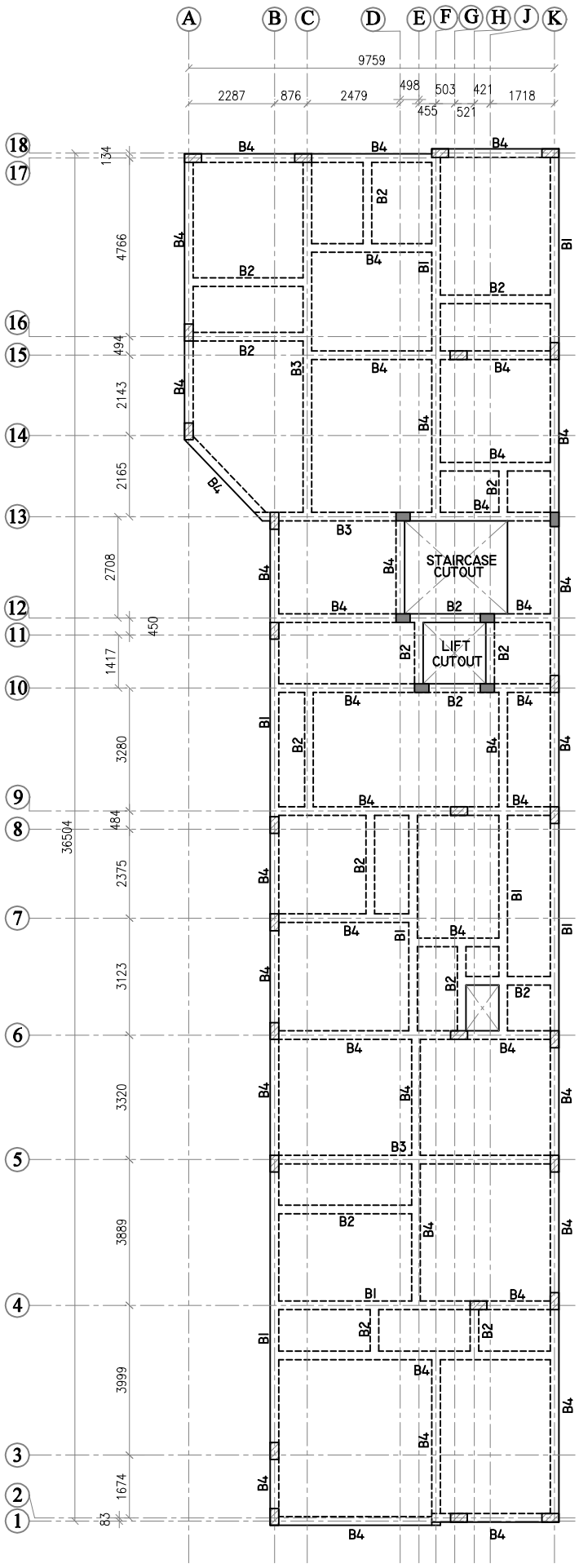
ARCHITECT / CONSULTANTS :-

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

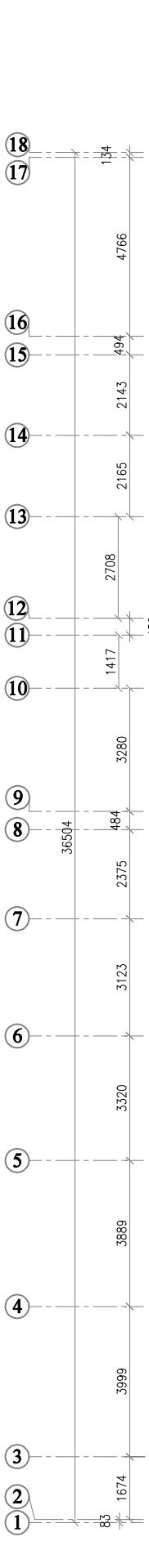
A3

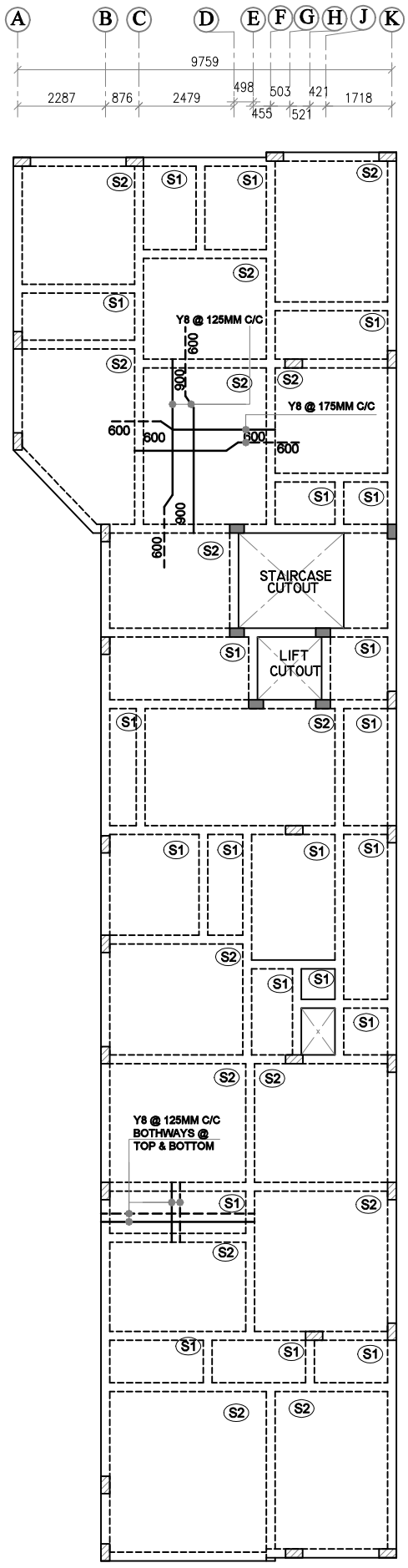
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NUMERATION LAYOUT OF TERRACE FLOOR

SLAB & BEAM





R.C LAYOUT OF TERRACE FLOOR

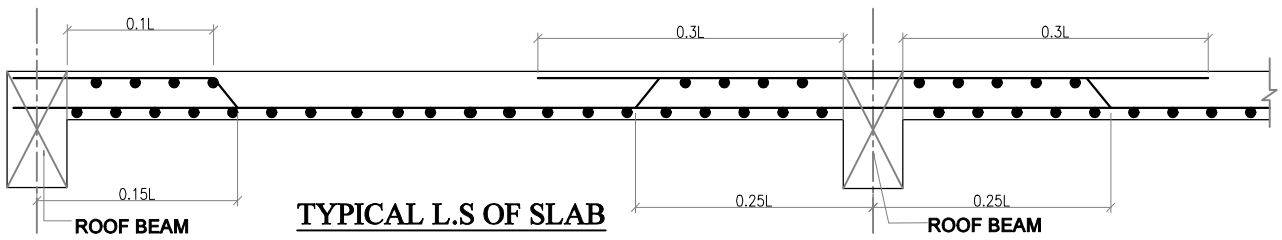
SLAB & BEAM

NOTE:

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

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

COLUMN CURTAILED TO BE BEND IN TO TOP OF THE SLAB



TYPICAL L.S OF SLAB

FOR APPROVAL ONLY

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

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

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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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	R.P	R.M	06.09.25

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR +4 FLOORS (16.00 M HEIGHT) RESIDENTIAL BUILDING WITH 12DWELLING UNITS AT PLOT NO.155/4, 155/5 & 155/6IN BALAJI STREET, SRINIVASA NAGAR, MADIPAKKAM, CHENNAL COMPRISED IN S.NO: 91/75A, 91/75B & 91/100MADIPAKKAM VILLAGE ,WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

DRAWING TITLE :-

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

DATE	SCALE	JOB.NO	DRG.NO
06.09.25	1 : 100	------	006

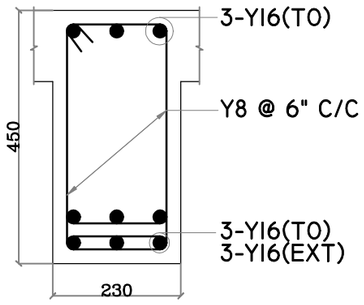
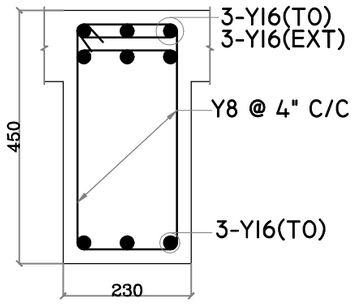
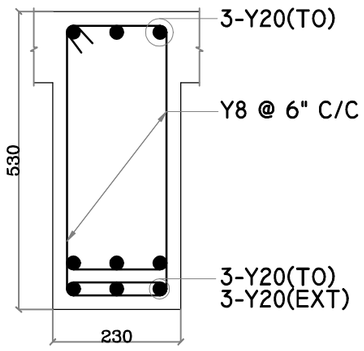
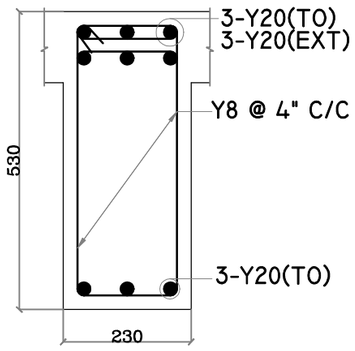
ARCHITECT / CONSULTANTS :-

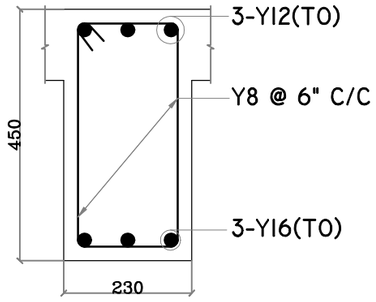
STRUCTURAL CONSULTANTS :-

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue, ASHOK NAGAR, CHENNAI- 600 083.
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aura Engineering Consultants

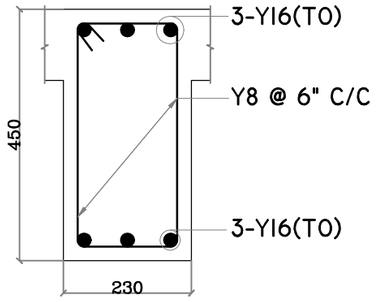
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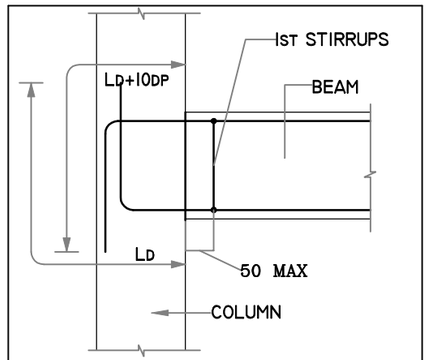
NAME	MID SPAN	END SUPPORT
B1 (230 X 450)		
B3 (230 X 530)		



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



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



TYP. EXTERNAL JOINT DETAIL AT
BEAM-COLUMN JUNCTION

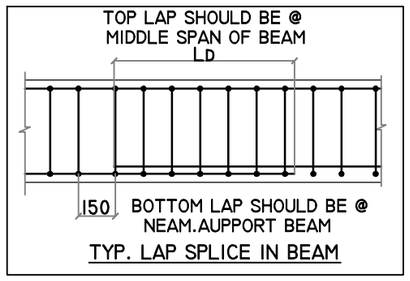
BEAM SCHEDULE		
SL.NO	NAME	SIZE
01	B1	230 x 450
02	B2	230 x 450
03	B3	230 x 530
04	B4	230 x 450

GENERAL NOTES:

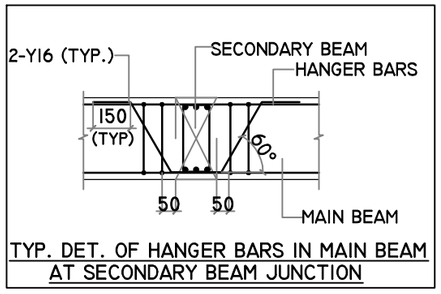
1. ALL DIMENSIONS ARE IN FOOT UNITS.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   a) COLUMN = 1½" b) BEAM = 1"
   c) SLAB = ¾"
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
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

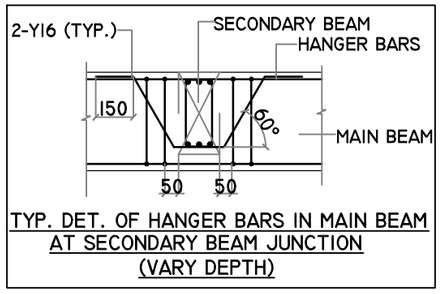
8. DETAILING OF REBARS SHALL CONFIRM TO SP-34 & IS 13920.



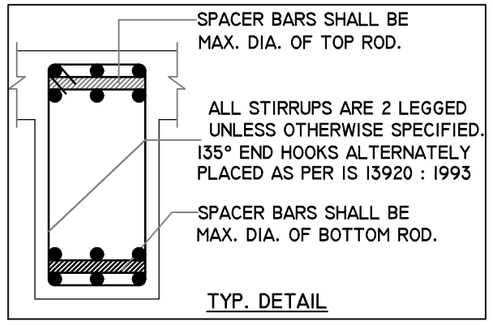
TYP. LAP SPLICE IN BEAM



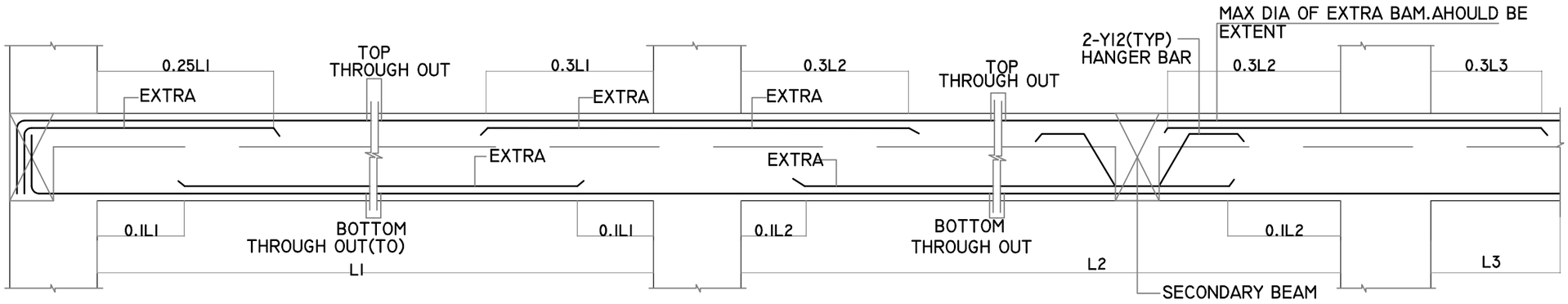
TYP. DET. OF HANGER BARS IN MAIN BEAM
AT SECONDARY BEAM JUNCTION



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	R.P	R.M	06.09.25

PROJECT :-

PLAN SHOWING THE PROPOSED DEMOLITION AND RE - CONSTRUCTION OF RESIDENTIAL BUILDING AT OLD DOOR NO. 4 , NEW DOOR NO. 27 , THIRU NAGAR 4TH STREET , PULIYUR , CHENNAI 600 026 , COMPRISED IN OLD T.S.NO. 7 / 1 , AS PER PATTA T.S.NO: 7 / 42 , BLOCK NO. 2 , OF PULIYUR VILLAGE , DIVISION NO: 129 , ZONE: 10 , GREATER CHENNAI CORPORATION.

DRAWING TITLE :-

R.C. DETAILS FOR ALL FLOOR BEAMS

DATE	SCALE	JOB.NO	DRG.NO
06.09.25	1 : 130	———	007

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
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http://auraengineers.co.in/
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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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.