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DIGITALLY VERIFIED RECORD

RAJAN.A. M.E(STRUCTURES)
No: 1/102, NAKKALA KOTTAI,
VIRUDHU NAGAR, METUGUNDU, TN-626004

Reg No SE/GR-1/2022/05/321
CELL: 9600100288

STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed building comprising of Ground +1 floor, Plot No 1 to 30, 30 dwelling units, in Vetri Nagar, Korattur, Chennai, Comprised In S.No.598/1B1A Part, 1B1A2, 1B1A3, 1B1A4, 2B Part, 598/1A1B, As Per Patta New Town Survey No.3/16, Block No- 21, Ward -E Of Korattur Village , Ambattur Taluk, Chennai- 76, Greater Chennai Corporation, Division - 83,Zone - 07.Chennai District has been done by me based on the report of geotechnical investigation (soil test) done by Mr M.Ammaiappan Report No. GTC/193A/09/08/2025-26 Dated 02/08/2025 and considering the functional requirement of the building.

2. It is certified that among other factors, the proposed building has been designed to resist earthquake. I/We have checked various parameters and found that the proposed building would be safe.

3. I further certify that:

(i) The minimum grade of concrete is M25

(ii) The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS Codes No 456-2000 and design of earthquake resistant structure as per IS Code No 13920-2016

4. The building will be safe and sound when used for the purpose for which it is designed.

Stamp and Signature

A.RAJAN, ME.,(STRUCTURE)
REGISTERED GRADE-1
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2022/05/321
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-88070 78990

Encl.: Structural Design Calculation

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

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that **Thiru. RAJAN. A** has enrolled as **Registered Structural Engineer Grade-I (SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E., (Structural Engg.)** and experience in the relevant field for **5 years**.

He has been given the Registration No.**SE/GR-I/2022/05/321** on **19.05.2022.** He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part-V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(Ms) No.18 MAWS (MA1) Dept. dated 04.02.2019.

This Registration is valid upto **18.05.2027.**



19-5-2022
T. ARIVALAGAN
SUPERINTENDENT
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
EGMORE, CHENNAI-600 008.

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Annexure – XIV

[See rule 51 (3)]

Form 1

Structural Design Basis Report

(1) This report to accompany the application for Building Developments

Part1	General Data		
S.No.	**Description**	**Information**	**Notes**
1.	Site Address PLOT 1 to 30 @ VETRI NAGAR COMPRISED IN S.NO.598/1A,1B,2B AS PER PATTA NEW TOWN SURVEY NO.3/16 BLOCK NO- 21, WARD 'E' OF KORATTUR VILLAGE AND AMBATTUR TALUK,GREATER CHENNAI CORPORATION.ZONE -07 AND DIVISION -83		
2	Name of Owner - M.S PAWAN CASTLES PVT LTD		
3	Name of Registered Developer along with the Registration Number		
4	Name of Registered Architect/Engineer along with the Registration Number		
5	Name of Registered Structural engineer along with the Registration Number	RAJAN. A	Structural Engineer (Grade-1) CMDA Reg. S.E/GR-1/22/05/321
6	Use of the building	RESIDENTIAL	
7	Number of stories above ground level (including storeys to be added later, if any)	G+1	
8	Number of basements below ground level	-	
9	Type of structure Load bearing walls R.C.C. frame R.C.C. frame and Shear Walls Steel frame	R.C.C. FRAME	
10	Soil data Type of soil Design safe bearing capacity	REFER BORELOG	IS:1893 C1.6.3.5.2 IS: 1904 IS: 1892 IS: 2131 IS: 2720
11	Dead loads (unit weight adopted) • Earth • Water • Brick masonry • Plain cement concrete • Reinforced cement concrete • Floor finish • Other fill materials	 18 KN/m^2 9.8 KN/m^2 7.50 KN/m^2 AAC 24 KN/m^2 25 KN/m^2	IS: 875 Part 1
12	Imposed (live) loads Floor loads Roof loads	 2+1.2 2+2 KN/m^2	IS: 875 Part 2

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13	Cyclone/Wind • Speed • Design pressure intensity		IS: 875 Part 3
14	Seismic zone		IS: 1893 (2002)
15	Importance factor		IS:1893(2002) Table 6
16	Seismic zone factor (Z)		IS:1893 Table 2
17	Response reduction factor		IS:1893 Table 7
18	Fundamental natural period – approx.		IS:1893 C1.7.6
19	Design horizontal acceleration spectrum value (A_h)		IS: 1893 C1.6.4.2
20	• Expansion/Separation Joints	-	
21	Building is regular/irregular	REGULAR	IS 1893

□ Enclose detailed drawings drawn to scale for each floor

□ In case terrace garden is provided, indicate additional fill load and live load along with the detailed drawings drawn to scale

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Notes: (i) Information in Item 6 should be given on separate A4 sheets for all walls with large number of openings

(ii) IP indicated "Information Provided"

IP indicates "Information to be provided"

NA indicates "Not Applicable"

Tick mark one box

Part 3	**Reinforced concrete framed buildings**		
Sl. No.	**Description**	**Information**	**Notes**
1	Type of building • Regular frames • Regular frames with Shear Walls • Irregular frames • Irregular frames with Shear Walls • Soft storey	REGULAR FRAMES	IS: 1893 C1 7.1
2	Number of basements	-	
3	Number of floors including ground floor	G+1 FLOORS	
4	Horizontal floor system • Beams and slabs • Waffles • Ribbed floor • Flat slab with drops • Flat plate without drops	BEAMS & SLABS	
5	Soil data • Type of soil • Recommended type of foundation -Independent footings -Raft -Piles • Recommended bearing capacity of soil	REFER SOIL REPORT ISOLATED	IS: 1498
	• Recommended type, length, diameter and load capacity of piles • Depth of water table • Chemical analysis of ground water • Chemical analysis of soil	REFER SOIL REPORT	
6	Foundations Depth below ground level Type Independent Interconnected Raft Piles	-2.45m ISOLATED	

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7	System of interconnecting foundations Plinth beams Foundation beams	PLINTH BEAM	IS: 1893 Cl 7.12.1
8	Grades if concrete used in different parts of building	M25	
9	Method of analysis used	GRAVITY LOADS ONLY	
10	Computer software used	E-TABS	
11	Torsion included	-	IS: 1893 Cl 7.9
12	Base shear a. Based on approximate fundamental period b. Based on dynamic analysis c. Ratio of a/b	- REFER ETABS REPORT	IS: 1893 Cl. 7.5.3
13	Distribution of seismic forces along the height of the building.	REFER ETABS REPORT	IS:1893 Cl.7.7 (Provide sketch)
14	The Column of soft ground storey specially designed.		IS: 1893 Cl.7.10
15	Clear minimum cover provided in • Footing • Column • Beams • Slabs • Walls	 50mm 40mm 30mm 25mm 30mm	IS: 456 Cl. 26.4
16	Ductile detailing of RC frame • Type of reinforcement used • Minimum dimension of beams • Minimum dimension of columns • Minimum percentage of reinforcement of beams at any cross section • Maximum percentage of reinforcement at any section of beam • Spacing of transverse reinforcement in 2-d length of beams near the ends • Ratio of capacity of beams in shear to capacity of beams in flexure • Maximum percentage of reinforcement in column	 FE-500 230 x 450 230 x 450 0.12 % 100mm 4%	 IS: 456 Cl. 5.6 IS: 13920 Cl.6.1 IS: 13920 Cl.7.1.2 IS: 456 Cl.26.5.1(a) IS: 13920 Cl.6.2.1 IS: 456 Cl.26.5.1.1(b) IS: 13920 Cl.6.2.2 IS: 13920 Cl.6.3.5 IS: 456 Cl.26.5.3.1 IS: 13920 Cl. 7.4
	• Confining stirrups near ends of columns and in beam-column joints Diameter Spacing • Ratio of shear capacity of columns to maximum seismic shear in the storey.	8mm 100/200/100mm	

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SCOPE OF WORK

Scope of Work includes performing Structural Analysis and Design Calculations for the Project. Also includes Preparing Structural Drawings from Foundation to Terrace including OHT & LMR.

1.0 PROJECT DESCRIPTION

The proposed RESIDENTIAL development for G+1 house. Configuration are considered for design is summarized as below:

GROUND Floor + 1 floors

Sl. No		Description	Floor to Floor Height (mm)
1	RESIDENTIAL Building	G+1	Building Heights: ISOLATED Depth = 2450 GROUND Floor = 4000 First Floor = 3000

B –Basement, P-Parking, G-GROUND Floor, S-Stilt Floor, F-Floor,

2.1 Structural System

The Structural system for RESIDENTIAL building comprises of RC Beam & Slab. The vertical loads are transferred through the slabs/beams to structural walls/columns and then transferred through the supporting columns and shear walls at lower level to the foundations. The thickness of RC wall & RC Column is considered as 300mm/160mm thick with minimum percentage of reinforcement as per IS 456-2000. Based on the Latest Code (IS 1893: 2016), some modifications might be required in the Typical Floor Plans to satisfy the torsional irregularity, which can be dealt during the Detailed Design Stage.

The horizontal loads are transferred through the floor to the structural beams, walls, columns and then to the foundation system.

The foundation system consists of ISOLATED foundation at 2.45m below Existing GROUND level.

Structural system for the Building consists of Beam Column/ Slab System.

Based on the geotechnical investigation report provided by Client

2.0 DESIGN PHILOSOPHY

All R.C.C structures shall be designed according to the Limit State Method as specified in IS: 456 – 2000 using in house design program / spread sheets, RCDC, ETABS & SAFE software's. However, for design requirements, where Indian code is silent and / not clear, requirements as given in international standards shall be used.

LOADING ON STRUCTURE

2.1 DEAD LOAD - This load case comprises of self-weight of the entire frame and shell elements forming a part of the structure.

2.2 SUPERIMPOSED DEAD LOAD

Item No	Function	Loads Used	
		UDL KN/m²	Remarks
1	Floor Finishes – (50mm) RESIDENTIAL areas	1.2	Including ceiling plaster
2	Floor Finishes - parking areas in basement levels – (Average 75mm thk screed)	1.8	
3	50mm thick fill (sunken toilets)	1.0	
4	DG Room	10 (Min.) or as per actuals	
5	Weatherproof course (Terrace level)	2	
6	Swimming pool and Overhead Water tank	As per drawing	
7	Podium Fire Driveways (200mm thk fill)	5	Driveways
8	Podium Landscape (600mm Soil Fill)	15	Including Floor Finish
9	Floor Finishes – (50mm) Office	2.4	

2.3 LIVE LOAD

Item No	Function	Loads Used	
		UDL KN/m²	Concentrated * KN
1	Car Parking Area a) Without stack parking (vehicles not exceeding 2.5tonnes weight)	2.5	9.0
2	Truck / Fire Tender Vehicle Movement (45 MT Fire Tender)	10	As per actuals
3	Stair & Corridor	3	4.5
4	All Rooms & kitchen (RESIDENTIAL level)	2	1.8
5	Toilets & Bathroom	2	-
6	Balcony	3	1.5/meter run
7	AHU / Electrical Room / Office	3	
8	Roof Live load (access not provided except for maintenance)	0.75	Roof Slab: 1.9KN uniformly distributed over any span of 1m width
9	Roof Live Load (access provided)	2.0	-
10	Lift Machine Room	10	Manufacturer recommendation

*The concentrated loads are considered to be applied in positions, which produce maximum stresses and where deflection is the main criteria, in the positions, which produce the maximum deflections.

Live load reduction in column / walls & foundations will be considered as per IS 875 (Part 2) -1987.

2.4 WIND LOAD

Wind loads and pressures are calculated based on the static design wind pressure. This pressure has been considered for the load analysis and applied to the model. Joint loads for all floors have been calculated based on the contributory areas and applied in the respective diaphragms.

The wind pressure shall be calculated based on the data furnished below and other provisions laid in IS: 875 (Part 3) – 2015.

Basic wind speed = 50 m/sec

Risk coefficient, k1 = 1.0 (Mean Probable Design Life of Structure = 50 years)

Terrain category - = 2

Height factor- k2 = Varies with height

2.5 EARTHQUAKE LOAD

Dynamic analysis for earthquake forces in both the directions is carried out by Response Spectrum Method. Response Spectrum values are calculated based on the T Vs Sa/g equations as per clause no 6.4.2 of IS 1893 (Part 1)-2016. Base shears of the analysis are raised to a factor of (VB/V'B) as per clause no 7.7.3. The effect of torsion has been taken into effect by giving the eccentricity overrides in ETABS itself.

The loading due to earthquake is assessed based on the provisions of IS: 1893 (Part 1) – 2016.

Seismic zone	= III
Zone factor	= 0.16
Response reduction factor	= 3 (**OMRF**)
Importance factor	= 1.2.

But Structure is designed for Gravity Loads only.

2.6 SHRINKAGE, CREEP & TEMPERATURE EFFECTS

This effect depends on the climatic conditions and shall be considered based on IS 875 – Part 5. Expansion/ Separation gap requirement.

2.7 SPECIAL LOADS

Imposed load of 10kN/ Sqm is considered in LMR base slab in the absence of vendor inputs.

2.8 LOAD COMBINATIONS

The various loads shall be combined in accordance with the stipulations in IS: 875 (Part 5) – 1987. Whichever combination produces the most unfavourable effect in the building, foundation or structural member concerned shall be adopted.

Values of Partial Safety Factor γ_f for Loads

Load Combination	**Limit State of Collapse**			**Limit State of Serviceability**		
	DL	LL	WL/EL	DL	LL	WL/EL
DL + LL	1.5	1.5	--	1.0	1.0	--

DL +/- WL	1.5 or 0.9[§]	--	1.5	1.0	--	1.0
DL + LL +/- WL	1.2	1.2	1.2	1.0	0.8	0.8
DL +/- EL	1.5 or 0.9[§]	--	1.5	1.0	--	1.0
DL + LL +/- EL	1.2	1.2	1.2	1.0	0.8	0.8

[§] This value is to be considered when stability against overturning or stress reversal is critical

DL - Dead load
LL - Live load
WL - Wind load
EL - Earthquake load

Wind load and earthquake load shall be considered for both x & y directions.

The above load combinations will be considered and effect of worst combinations will be taken for design of various building elements. Fire tender load considered as accidental load with a partial safety factor of 1.05.

General Load Combinations considered in the analysis are as follows:

Combinations considered for the design of the various building elements:					
COMB01	1.5 DL	+	1.5 LL		
COMB02	1.2 DL	+	1.2 LL	+	1.2 SPECX
COMB03	1.2 DL	+	1.2 LL	+	1.2 SPECY
COMB04	1.5 DL			+	1.5 SPECX
COMB05	1.5 DL			+	1.5 SPECY
COMB06	0.9 DL			+	1.5 SPECX
COMB07	0.9 DL			+	1.5 SPECY
COMB08	1.2 DL	+	1.2 LL	+	1.2 WLX
COMB09	1.2 DL	+	1.2 LL	-	1.2 WLX
COMB10	1.2 DL	+	1.2 LL	+	1.2 WLY
COMB11	1.2 DL	+	1.2 LL	-	1.2 WLY
COMB12	1.5 DL			+	1.5 WLX
COMB13	1.5 DL			-	1.5 WLX
COMB14	1.5 DL			+	1.5 WLY
COMB15	1.5 DL			-	1.5 WLY
COMB16	0.9 DL			+	1.5 WLX
COMB17	0.9 DL			-	1.5 WLX

COMB18	0.9 DL			+	1.5 WLY
COMB19	0.9 DL			-	1.5 WLY
COMB20	1.0 DL			+	1.2 UPLIFT
Un-factored Loads to be taken for foundation design:					
FOUN01	1.0 DL	+	1.0 LL		
FOUN02	1.0 DL	+	0.8 LL	+	0.8 SPECX
FOUN03	1.0 DL	+	0.8 LL	+	0.8 SPECY
FOUN04	1.0 DL			+	1.0 SPECX
FOUN05	1.0 DL			+	1.0 SPECY
FOUN06	1.0 DL	+	0.8 LL	+	0.8 WLX
FOUN07	1.0 DL	+	0.8 LL	-	0.8 WLX
FOUN08	1.0 DL	+	0.8 LL	+	0.8 WLY
FOUN09	1.0 DL	+	0.8 LL	-	0.8 WLY
FOUN10	1.0 DL			+	1.0 WLX
FOUN11	1.0 DL			-	1.0 WLX
FOUN12	1.0 DL			+	1.0 WLY
FOUN13	1.0 DL			-	1.0 WLY
DL - Dead Load					
LL - Live Load					
EL - Earthquake Load					
WL - Wind Load					
* Note - Seismic Load Cases have both "MAX" and "MIN" Load Cases for +ve & -ve Directions respectively.					

3.0 ANALYSIS METHODS

The analysis of the structure is carried out using the ETABS V-2017 / STAAD.Pro V8 / SAFE V16.0 software package accordingly. The structural elements are modelled as frame/ shell/ membrane as appropriate. The slab has been considered as rigid diaphragm at the respective floor levels to transfer the lateral forces. Appropriate loads and its combinations, as per relevant clauses in IS codes, for most unfavourable effects are chosen for design.

4.0 CONCRETE

Concrete item	Grade	Max. Size of Aggregate (mm)	Type of cement
Foundation	M25	20	OPC
Retaining Wall	M25	20	OPC
Columns	M25	20	OPC
Beams	M25	20	OPC
Structural Slab	M25	20	OPC
Grade Slab	M25	20	OPC
RC Walls	M25	20	OPC
ISOLATED & ISOLATED Cap	M25	20	OPC

Normal weight of locally available aggregates are considered for all concrete works. Design mix shall be OPC with Crushed sand, Crushed aggregate, Mineral Admixture (Fly-ash or GGBS) and Chemical Admixture. Minimum cementitious content (Cement plus mineral admixture) shall be as per IS 456 table no. 5. 100% crushed sand is considered for concrete, masonry and plastering.

Fly ash confirming IS 3812 part 1 shall be used as part replacement of cement in normal concrete minimum of 15% and maximum of 35%, for RC walls minimum of 25% and maximum of 50% shall be used depending upon the grade of concrete and early strength requirement.

GGBS confirming BS 6699 shall be used as replacement, a minimum of 25% and maximum of 70% shall be used depending upon the grade of concrete and early strength requirement.

Mix design will be carried out by Client team confirming IS 456, IS 10262 and SP 23 considering the required workability (normal concrete – 150+/-25mm and high flow concrete – 650+/-100mm) at the time of placement which shall be duly approved by Client/Contractor.

5.0 REINFORCEMENT

Reinforcement steel (Local or imported) shall be Coil or T.M.T of Fe-500/Fe-500D/Fe-550/Fe-600 grade confirming to IS 1786:2008. For design calculations of shear reinforcement in beams as per IS 456, reinforcing steel of Fe-415 grade will be used. We shall also be allowed to use Torkari bars (local or imported) as per manufacturer's specification.
Dia of Reinforcement used – 7, 8, 9, 10, 12, 16, 20, 25, 28, 32mm.

6.0 FIRE RATING

The structure is designed for 2-hour fire rating for staircases & lift core location and 1 hour fire rating for other areas of buildings (structural elements). The concrete structural members shall be designed and constructed as per IS codes. The structural adequacy is checked as per International standards with respect to the fire rating for RCC load bearing walls / shear walls of 160mm thick with normal reinforcement as per gravity/lateral loading design and with minimum 25mm cover to reinforcement. The nominal reinforcement shall be as per clause 32.5 of IS 456: 2000

7.0 CLEAR COVER TO REINFORCEMENT

The Nominal cover to main reinforcement considering exposure condition as mild shall be as follows: -

Sl. No	Structural Member	Clear Cover, mm
1	ISOLATED	75
3	Retaining wall (earth face)	30
4	Retaining wall (inner face)	25
5	Walls	25
6	Slabs	25
7	Beams	30
8	Columns	40
9	Water Tank walls in contact with earth/water	45
10	Water tank walls in contact with air	30
11	ISOLATED	50

For any other elements not specified above, clear cover shall be as per the clause 26.4 of IS: 456-2000.

8.0 FOUNDATION SYSTEM AND SOIL PARAMETERS

Based on the Geotechnical Investigation reports provided by Client, ISOLATED recommendations at the proposed Capacity are as mentioned in the table below.

Depth of Footing	SBC (T)
2.45m	15.0T

9.0 MATERIALS

The self-weight of the various elements is computed based on the unit weight of materials as given below:

Materials	Unit weight kN/m^3
Steel	78.50
Plain Cement Concrete	24.00
Reinforced Cement Concrete	25.00
Light weight Block (AAC)	7.50
Soil	18.00
Water	10.00
Cement Concrete screed	24.00
Sand	18.00
BJLC	18.00
CLSM	18.00

Normal weight aggregates shall be considered for arriving at self-weight of all Concrete works.

10.0 WATER PROOFING

Type of Water proofing proposed for several locations in building are as follows:

- Toilets, Utilities & Balcony - Acrylic polymer-based Water proofing system
- OHT Tanks - Crystalline based (Admixture) Water proofing
- Terrace - Cement Based water proofing system

11.0 SERVICEABILITY CHECK

a. **For Deflections:**

The final deflection due to all loads including the effect of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members should not normally exceed span / 250.

The deflection including the effect of temperature, creep and shrinkage occurring after the erection of partitions and the application of finishes should not normally exceed Span / 350 or 20 mm whichever is less.

b. **Lateral drift:**

Under transient wind load the lateral sway at the top should not exceed H/500, where H is the total height of the building.

The storey drift in any storey due to the minimum specified design lateral force, with partial load factor of 1, shall not exceed 0.004 times the storey height.

c. **For Cracking:**

Surface crack width shall not exceed 0.3 mm in general and for water retaining structure it is limited to 0.1 mm.

12.0 DESIGN STANDARDS

The relevant Indian Standard Codes, as given below, shall be followed for structural design:

Sl.No.	Code	Description
1.	IS-875 (Part 1) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Unit weights of buildings materials and stored material.
2.	IS-875 (Part 2) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Imposed loads.
3.	IS-875 (Part 3) – 2015	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Wind loads.
4.	IS-875 (Part 4) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Snow loads.
5.	IS-875 (Part 5) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Special loads and load combinations.
6.	IS: 456 – 2000	Code of Practice for Plain and Reinforced Concrete.
7.	IS: 1786 – 2008	High Strength Deformed Steel Bars and Wires for Concrete Reinforcement - Specification.
8.	IS: 13920 – 2016	Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice.
9.	IS: 800 – 1984/2007	Code of Practice for General Construction in Steel.
10.	IS: 1893 (Part 1) – 2016	Criteria for Earthquake resistant design of structures.
11	IS 16700: 2017	Criteria for Structural Safety of Tall Concrete Buildings.
12.	IS3370-(PART II)-2009	Code of Practice for Concrete structures for the storage of liquids – Reinforced concrete structures.
13.	SP 7: 2016	National Building Code of India.
14.	IS 2950 (Part I) -1981	Code of Practice for Design and construction of ISOLATED foundation.
15.	IS 2911	Code of Practice for Design and construction of Footing foundation.

FOOTING DESIGN CALCULATIONS

Definitions:

1.	α	=	Coefficient of Thermal Expansion
2.	ε1	=	Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
3.	εm	=	Average steel strain at level considered
4.	ρact	=	Percentage steel provided
5.	ρcrit	=	Percentage steel critical as per code
6.	A	=	Plan area of footing base
7.	Acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
8.	AstPrv	=	Area of tensile reinforcement provided
9.	Astrqd	=	Area of tensile reinforcement required
10.	Asv	=	Area of shear reinforcement required
11.	AsvPrv	=	Area of shear reinforcement provided
12.	A1	=	Bearing area of footing at slope of 1:2
13.	A2	=	C/s Area of column
14.	B	=	Width of footing base
15.	Beff	=	Effective width of footing
16.	BoffB	=	Footing offset along B below column in plan
17.	BoffT	=	Footing offset along B above column in plan
18.	B1	=	Width of sloped footing at top
19.	ColOff	=	Column offset in sloped footing
20.	D	=	Depth of footing
21.	Deff	=	Effective Depth of footing
22.	Df	=	Depth of founding layer
23.	Dw	=	Ground water level
24.	Ec	=	Modulus of elasticity of concrete
25.	Es	=	Modulus of elasticity of steel
26.	Foss	=	Safety factor against sliding
27.	Fosu	=	Safety factor against uplift
28.	Fst	=	Stress in steel
29.	L	=	Length of footing base
30.	Leff	=	Effective length of footing
31.	LoffL	=	Footing offset along L on left side of column
32.	LoffR	=	Footing offset along L on right side of column
33.	L1	=	Length of sloped footing at top

34.	Mx	=	Bending Moment along column D
35.	Mx'	=	Bending Moment along column D due to odd shaped column
36.	Mex	=	Eccentricity moment along column D
37.	Mxx	=	Total Bending Moment along column D (Mx + Mx' + Mex)
38.	My	=	Bending Moment along column B
39.	My'	=	Bending Moment along column B due to odd shaped column
40.	Mey	=	Eccentricity moment along column B
41.	Myy	=	Total Bending Moment along column B (My + My' + Mey)
42.	Muy	=	Factored moment along column B
43.	Muy'	=	Factored Moment along column B due to odd shaped column
44.	Mux	=	Factored moment along column D
45.	Mux'	=	Factored Moment along column D due to odd shaped column
46.	Netdown	=	Net downward load
47.	OB	=	Maximum permissible offset on bottom side of column in plan
48.	OL	=	Maximum permissible offset on left side of column in plan
49.	OR	=	Maximum permissible offset on right side of column in plan
50.	OT	=	Maximum permissible offset on top side of column in plan
51.	P	=	Axial load for footing sizing
52.	P1	=	Soil pressure at corner 1
53.	P2	=	Soil pressure at corner 2
54.	P3	=	Soil pressure at corner 3
55.	P4	=	Soil pressure at corner 4
56.	Pdelta	=	Column Load to be transferred by reinforcement
57.	Pt	=	Calculated percentage tensile reinforcement
58.	Pu	=	Factored axial load
59.	q	=	Surcharge Load
60.	sp	=	Spacing Between bars at outer most layer
61.	SPu	=	Upward Soil Pressure
62.	SPuL	=	Upward Soil Pressure from left
63.	SPuR	=	Upward Soil Pressure from right
64.	SPuB	=	Upward Soil Pressure from bottom
65.	SPuT	=	Upward Soil Pressure from top
66.	Tc	=	Design shear strength of concrete
67.	Temp1	=	Peak Hydration temperature
68.	Temp2	=	Seasonal Temperature Variations
69.	Tv	=	Nominal shear stress
70.	Vu	=	Design shear force
71.	Vus	=	Strength of shear reinforcement

72.	Vx	=	Shear along major axis
73.	Vy	=	Shear along minor axis
74.	Waterpr	=	Upward water pressure
75.	Waterup	=	Upward force due to water
76.	Wcr	=	Surface Crack Width
77.	WFoot	=	Add. Wt. due to difference in concrete and soil density
78.	WFootc	=	Weight of footing and column with concrete density
79.	WSoil	=	Weight of soil covering footing area
80.	Zx	=	Section modulus of footing base along L
81.	Zy	=	Section modulus of footing base along B

Code References:

IS 456

	Parameter		Reference
1.	Ptmax	:	Cl. 26.5.2.1
2.	Ptmin	:	Cl. 26.5.2.1
3.	Pt	:	Cl. 38
4.	Tc	:	Cl. 40.2.1
5.	Tcmax	:	Cl. 40.2.3
6.	Asv	:	Cl. 40.4
7.	Min Shear Reinf	:	Cl. 26.5.1.6
8.	Max Stirrup Spacing	:	Cl. 26.5.1.5
9.	Punching Shear design	:	Cl. 31.6.3
10.	Load transfer	:	Cl. 34.4
11.	Ptnominal	:	Cl. 34.5.2
12.	Crack width calculation	:	Annex-F
13.	Cracking	:	Cl. 35.3.2

BS 8007 (For Early / Initial Thermal Cracking)

1.	Surface Zone for suspended slab	:	Figure A.1
2.	Surface Zone for ground slab	:	Figure A.2
3.	Factors for the calculation of minimum reinforcement	:	Table A.1

Design Code	: IS 456 + IS 13920 - 2016	
Footing No	: FC19	
Column No	: C19,C21,C22,C9,C8,C3,C1 (450mm X 230mm)	
Analysis No	: C19,C21,C22,C9,C8,C3,C1	
Concrete Grade	: M25	N/sqmm
Steel Grade	: Fe550	N/sqmm
Clear Cover	: 50	mm
Df	: 2 M	
Dw	: 0 M	

Density of Soil	= 18	kN/cum
Soil Bearing Capacity	= 150	kN/sqm
Permissible SBC Increase for EQ	= 25	%
Permissible SBC Increase for Wind	= 25	%
Live Load Reduction	= 0	%
Permissible area of loss of contact	= 0	%

Design cross section by : Average pressure

Footing Type	:	Pad	
Footing Size (L x B x D)	:	1850mm X 1650mm X 450mm	
Effective Self Weight	=	34.34	kN
Offset Along L (Loff)	=	700	mm
Offset Along B (Boff)	=	710	mm

Check For Maximum Soil Pressure:

Critical Column No	=	C3	
Critical Load Combination	=	[1] : (Dead) +(Filling) +(Sdl) +(Wall) +(Live<3) + (Live>3) +(Rooflive)	
Pcomb	=	374.39	kN
P	=	Pcomb + Effective Self Weight	
P	=	408.73	kN
Mx	=	-2.18	kNm
My	=	-0.42	kNm
P/A	=	133.9	kN/sqm
Mx/Zx	=	-2.32	kN/sqm
My/Zy	=	-0.5	kN/sqm
Maximum Soil Pressure	=	136.72	kN/sqm
Allowable Soil Pressure	=	1x150	kN/sqm
	=	150	kN/sqm

Check For Minimum Soil Pressure:

Critical Column No	=	C22	
Critical Load Combination	=	[1] : (Dead) +(Filling) + (Sdl) +(Wall) +(Live<3) + (Live>3) +(Rooflive)	
Pcomb	=	247.55	kN
P	=	Pcomb + Effective Self Weight	
P	=	281.89	kN
Mx	=	-1.35	kNm
My	=	0.1	kNm

P/A	=	92.35	kN/sqm
Mx/Zx	=	-1.44	kN/sqm
My/Zy	=	0.12	kN/sqm
Minimum Soil Pressure	=	90.8	kN/sqm
	>	0	

Design For Bending:

Bottom Reinforcement Along L:

Critical Column No	=	C3	
Critical Load Combination	=	[2] : 1.5 (Dead) +1.5 (Filling) +1.5 (Sdl) +1.5 (Wall) +1.5 (Live<3) +1.5 (Live>3) +1.5 (Rooflive)	
Pu	=	561.59	kN
Mux	=	-3.28	kNm
Muy	=	-0.63	kNm
P/A	=	183.98	kN/sqm
Mx/Zx	=	-3.48	kN/sqm
My/Zy	=	-0.75	kN/sqm
Deff	=	392	mm
Beff	=	1650	mm
SPu	=	187.46	kN/sqm
Mu	=	SPu X B X Loff X Loff / 2	
	=	75.78	kNm
Pt	=	0.138	%
Ast Rqd (BM)	=	891	sqmm
Ast Prv (Distributed Across Total Width)	=	12 - T10 @ 150	
	=	942	sqmm

Bottom Reinforcement Along B:

Critical Column No	=	C3	
Critical Load Combination	=	[2] : 1.5 (Dead) +1.5 (Filling) +1.5 (Sdl) +1.5 (Wall) +1.5 (Live<3) +1.5 (Live>3) +1.5 (Rooflive)	
Pu	=	561.59	kN
Mux	=	-3.28	kNm
Muy	=	-0.63	kNm
P/A	=	183.98	kN/sqm
Mx/Zx	=	-3.48	kN/sqm
My/Zy	=	-0.75	kN/sqm
Deff	=	376	mm
Leff	=	1850	mm
SPu	=	184.73	kN/sqm
Mu	=	SPu X L X Boff X Boff / 2	
	=	86.14	kNm
Pt	=	0.144	%
Ast Rqd (BM)	=	999	sqmm

Ast Prv (Distributed Across Total Length)	=	14 - T10 @ 150	
	=	1100	sqmm

Design For Shear:

One Way Shear Along L:

Critical Section @ d from Column Face

	=	392	mm
Critical Column No	=	C3	
Critical Load Combination	=	[2] : 1.5 (Dead) +1.5 (Filling) +1.5 (Sdl) +1.5 (Wall) +1.5 (Live<3) +1.5 (Live>3) +1.5 (Rooflive)	
Pu	=	561.59	kN
Mux	=	-3.28	kNm
Muy	=	-0.63	kNm
P/A	=	183.98	kN/sqm
Mx/Zx	=	-3.48	kN/sqm
My/Zy	=	-0.75	kN/sqm
Deff	=	392	mm
Beff	=	1650	mm
SPu	=	187.46	kN/sqm
Vu	=	SPu X (Loff - d) X B	
	=	95.27	kN
Tv	=	Vu / (Beff X Deff)	
	=	0.15	N/sqmm
Tc	=	0.29	N/sqmm
Tv	<	Tc	

One Way Shear Along B:

Critical Section @ d from Column Face

	=	376	mm
Critical Column No	=	C3	
Critical Load Combination	=	[2] : 1.5 (Dead) +1.5 (Filling) +1.5 (Sdl) +1.5 (Wall) +1.5 (Live<3) +1.5 (Live>3) +1.5 (Rooflive)	
Pu	=	561.59	kN
Mux	=	-3.28	kNm
Muy	=	-0.63	kNm
P/A	=	183.98	kN/sqm
Mx/Zx	=	-3.48	kN/sqm
My/Zy	=	-0.75	kN/sqm
Deff	=	376	mm
Leff	=	1850	mm

SPu	=	184.73	kN/sqm
Vu	=	SPu X (Boff - d) X L	
	=	114.14	kN
Tv	=	Vu / (Leff X Deff)	
	=	0.16	N/sqmm
Tc	=	0.3	N/sqmm
Tv	<	Tc	

Design For Punching Shear:

Critical Section @ d/2 from Column Face

	=	192	mm
Critical Column No	=	C3	
Critical Load Combination	=	[2] : 1.5 (Dead) +1.5 (Filling) +1.5 (Sdl) +1.5 (Wall) +1.5 (Live<3) +1.5 (Live>3) +1.5 (Rooflive)	
Pu	=	561.59	kN
Mux	=	-3.28	kNm
Muy	=	-0.63	kNm
P/A	=	183.98	kN/sqm
Mx/Zx	=	-3.48	kN/sqm
My/Zy	=	-0.75	kN/sqm
Deff	=	384	mm
Leff	=	834	mm
Beff	=	614	mm
Punching Perimeter	=	2896	mm
Punching Area	=	1112064	sqmm
SPu	=	Average Pressure	
	=	183.98	kN/sqm
Vu	=	SPu X ((L X B)-(Leff X Beff))	
	=	467.38	kN
Tv	=	Vu / Punching Area	
	=	0.42	N/sqmm
Tc	=	1.25	N/sqmm
Tv	<	Tc	

Load Transfer Check For Load Transfer From Column To Footing

Critical Column No	=	C3	
Critical Load Combination	=	[2] : 1.5 (Dead) +1.5 (Filling) +1.5 (Sdl) +1.5 (Wall) +1.5 (Live<3) +1.5 (Live>3) +1.5 (Rooflive)	
Pu	=	561.59	kN
A2	=	0.1	sqm
A1	=	4.57	sqm
Base Area	=	3.05	sqm
A1	>	Base Area	

Thus, A1	=	3.05
Modification Factor	=	SquareRoot(A1/A2) < = 2
SquareRoot(A1/A2)	=	5.5227
Thus, Modification Factor	=	2
Concrete Bearing Capacity	=	0.45 X Fck X Modification Factor X Column Area
	=	2328.75 kN
Concrete Bearing Capacity	>	Pu, Hence Safe.

SLAB DESIGN CALCULATIONS

NOTES:

1. Slab is designed as per 1 M width of panel.
2. Density of concrete assumed as 25 kN/Cum.
3. Maximum spacing of Main steel is smaller of (3 x Deff and 300 mm)
4. Maximum spacing of Distribution steel is smaller of (5 x Deff and 450 mm)
5. All 6 mm diameter bars assumed of Fe250 grade with Fy=250 N/sq.mm

Definitions Of Terms:

1.	α	=	Coefficient of Thermal Expansion
2.	acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
3.	εm	=	Average steel strain at level considered
4.	ε1	=	Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
5.	ρact	=	Percentage steel provided
6.	ρcrit	=	Percentage steel critical as per code
7.	BM	=	Bending moment in kNm
8.	D	=	Overall depth of slab in mm
9.	Deff	=	Effective depth of slab in mm
10.	Ec	=	Modulus of elasticity of concrete
11.	Es	=	Modulus of elasticity of steel
12.	Fck	=	Characteristic compressive strength of concrete cube in N/sqmm
13.	Fst	=	Stress in steel
14.	Fy	=	Yield Stress Of Steel in N/sqmm
15.	Mu	=	Factored Bending moment in kNm
16.	Sp	=	Spacing Between bars at outer most layer
17.	Tc	=	Permissible Shear stress in concrete in N/sqmm
18.	Temp1	=	Peak Hydration temperature
19.	Temp2	=	Seasonal Temperature Variations
20.	Tv	=	Shear stress due to Vu in N/sqmm
21.	V	=	Shear force in kN
22.	Vu	=	Factored shear force in kN
23.	Wcr	=	Surface Crack Width

Code References :

IS 456

	ELEMENT		CLAUSE / TABLE
1.	Moment Coeffs For 2-Way Slabs	:	Greschoff-Rankine Formulation and yield line theory
2.	Ptmin	:	26.5.2.1
3.	Ptcalculated	:	38
4.	Shear Strength Of Concrete	:	40.3
5.	Modification Factor for Shear	:	40.2.1.1
6.	Max Nominal Shear Stress	:	40.2.3
7.	Basic Span To Depth Ratio	:	23.2.1
8.	Tensile Steel Factor	:	23.2.1
9.	Compression Steel Factor	:	23.2.1
10.	Flange correction factor	:	23.2.1
11.	spacing between main bars	:	26.3.3
12.	spacing between distribution bars	:	26.3.3
13.	crack width calculation	:	Annex-F
14.	cracking	:	Clause 35.3.2

BS 8007 (For Early / Initial Thermal Cracking)

	ELEMENT		CLAUSE / TABLE
1.	Surface Zone for suspended slab	:	Figure A.1
2.	Surface Zone for ground slab	:	Figure A.2
3.	Factors for the calculation of minimum reinforcement	:	Table A.1

Slab No. :	S7		
Level	=	GF ROOF	
Design Code	=	IS 456 + IS 13920 - 2016	
Grade Of Concrete	=	M25	
Grade Of Steel	=	Fe550	
Clear Cover	=	20.000	mm
Long Span, Ly	=	3.340	m
Short Span, Lx	=	2.270	m
Imposed Load	=	1.200	kN/sqm
Live Load	=	2.000	kN/sqm
Slab Thickness	=	125.000	mm
Effective Depth Along LX, Deffx	=	100.000	mm
Effective Depth Along LY, Deffy	=	90.000	mm
Self Weight	=	3.125	kN/sqm
Total Load, TL	=	6.325	kN/sqm

Span	=	2-Way	
Panel Type	=	Two Adjacent Edges Discontinuous	

Design Moments:

Short Span Positive Moment At Midspan -

Moment Coefficient	=	0.058	
BM	=	1.878	kNm
Mu = 1.5 X BM	=	2.816	kNm
Area Of Reinforcement Required (Mu)	=	150.000	sqmm/m
Reinforcement Provided	=	T8 @ 200 C/C	
	=	251.000	sqmm/m

Short Span Negative Moment At Continuous Support -

Moment Coefficient	=	0.077	
BM	=	2.503	kNm
Mu = 1.5 X BM	=	3.755	kNm
Area Of Reinforcement Required (Mu)	=	150.000	sqmm/m
Additional Area Of Reinforcement Required	=	75.000	sqmm/m
Reinforcement Provided	=	T8 @ 200 C/C	
	=	251.000	sqmm/m

Long Span Positive Moment At Midspan -

Moment Coefficient	=	0.034	
BM	=	1.108	kNm
Mu = 1.5 X BM	=	1.662	kNm
Area Of Reinforcement Required (Mu)	=	150.000	sqmm/m
Reinforcement Provided	=	T8 @ 200 C/C	
	=	251.000	sqmm/m

Long Span Negative Moment At Continuous Support -

Moment Coefficient	=	0.045	
BM	=	1.478	kNm
Mu = 1.5 X BM	=	2.216	kNm
Area Of Reinforcement Required (Mu)	=	150.000	sqmm/m
Additional Area Of Reinforcement Required	=	75.000	sqmm/m
Reinforcement Provided	=	T8 @ 200 C/C	
	=	251.000	sqmm/m

Distribution Reinforcement @ 0.12% -

Area Of Reinforcement Required	=	120.000	sqmm/m
Reinforcement Provided	=	T8 @ 200 C/C	
	=	251.000	sqmm/m

Shear Check :

Along Short Span

Shear Coefficient(Lx), SF1	=	0.534	
V = SF1 x TL x Lx	=	7.671	kN
Vu = 1.5 X V	=	11.506	kN
Shear Stress, Tv	=	0.115	N/sqmm
Nominal Shear Stress, Tc	=	0.291	N/sqmm
Modification Factor 'K'	=	1.300	
K x Tc	=	0.378	
	>	0.115	Slab Is Safe In Shear

Along Long Span

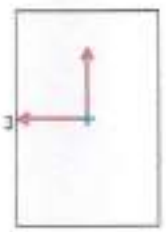
Shear Coefficient(Ly), SF2	=	0.400	
V = SF2 x TL x Lx	=	5.743	kN
Vu = 1.5 X V	=	8.615	kN
Shear Stress, Tv	=	0.096	N/sqmm
Nominal Shear Stress, Tc	=	0.291	N/sqmm
Modification Factor 'K'	=	1.300	
K x Tc	=	0.378	
	>	0.096	Slab Is Safe In Shear

Deflection Check:

Basic Span To Depth Ratio	=	32	
Span Correction Factor	=	1.000	
Tensile Steel Factor	=	2.159	
Compression Steel Factor	=	1.000	
Flange Correction Factor	=	1.000	
Max Span To Depth Ratio	=	32.00 x 1.00 x 2.16 x 1.00 x 1.00	
	=	69.084	
Lx/d	=	22.700	
	<	69.084	Slab Is Safe In Deflection

ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
TF ROOF	B31	247	B 300X450	Comb2	4715	9430	1	Ordinary Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_c (mm)	d_{cs} (mm)
300	450	300	0	35	35

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
25000	25	1	500	500

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
151.463	0.0003	0.1427	38.8388

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
151.463	0.0005	151.4634	0

Design Moment and Flexural Reinforcement for Moment, M_{22} & T_{12}

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	0		0	0	0	0
Bottom (-2 Axis)		151.4634	897	897	0	212

Shear Force and Reinforcement for Shear, V_{23} & T_{12}

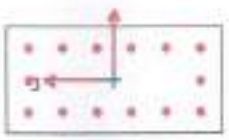
Shear V_u kN	Shear V_2 kN	Shear V_c kN	Shear V_s kN	Rebar A_{vr}/s mm²/m
0.1427	72.1858	49.8	0	332.53

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{u2}

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{vr}/s mm²/m
0.0003	0.1427	250	400	0

ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
TF ROOF	C20	283	C-600X300	Comb2	0	3650	1	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	300	60	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
25000	25	1	500	500

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u, M_{u2}, M_{u3}

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm^2	Rebar % %
176.1551	-28.0181	141.8637	4.6505	3.5231	3283	1.82

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	0.791756	3200	56.7455	0	3.5231
Minor Bend(M2)	1	3200	-11.2073	0	4.6505

Shear Design for V_{u2} , V_{u3}

	Shear V_s kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv}/s mm²/m
Major, V_{u2}	82.0773	108.3853	57.6005	0	665.06
Minor, V_{u3}	16.8531	116.4306	64.8002	0	332.53

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{h,TH}$ kN	Shear V_s kN	Joint Area cm²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g cm²	A_{sc} cm²	P_{uc} kN	P_b kN	P_v kN	k Unitless
1800	32.8	3256.0554	908.9314	176.1551	1

Additional Moment (IS 39.7.1)

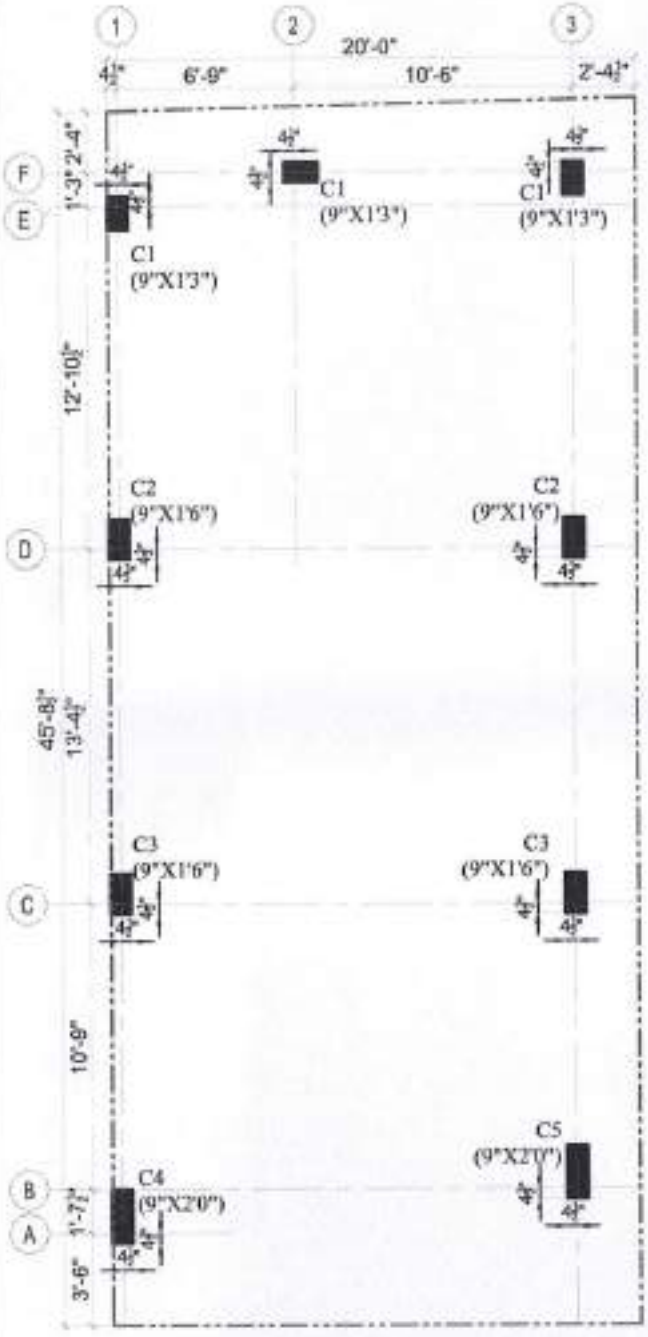
	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (kN-m)
Major Bending (M_3)	Yes	0.877	300	8.445	12	No	0
Minor Bending (M_2)	Yes	0.877	600	5.333	12	No	0

Notes:

N/A: Not Applicable

N/C: Not Calculated

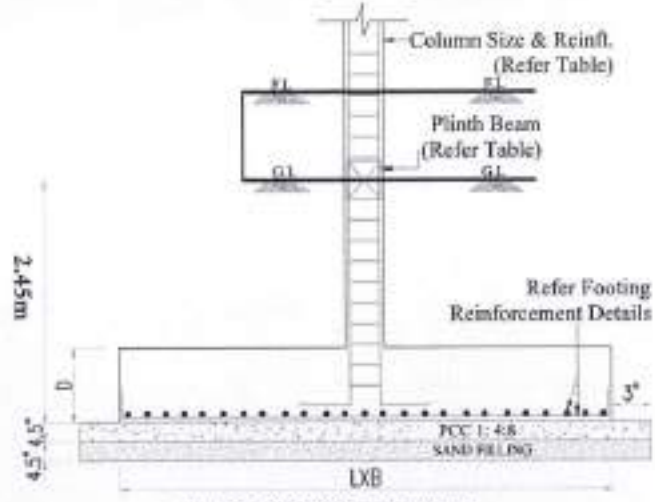
N/N: Not Needed



GRID PLAN/ CENTERLINE DRAWING

COLUMN REINFORCEMENT DETAILS

COLUMN MARK	SIZE	NO'S	UPTO GF ROOF	GF ROOF TO FF ROOF	FF ROOF TO HR ROOF
C1	9"x1'3"	03	8# -12mm 8Y @ 6" c/c	8# -12mm 8Y @ 6" c/c	8# -12mm 8Y @ 6" c/c
C2	9"x1'6"	02	4# -16mm+ 4# -12mm 8Y @ 6" c/c	4# -16mm+ 4# -12mm 8Y @ 6" c/c	4# -16mm+ 4# -12mm 8Y @ 6" c/c
C3	9"x1'6"	02	8# -16mm 8Y @ 6" c/c	8# -16mm 8Y @ 6" c/c	8# -16mm 8Y @ 6" c/c
C4	9"x2'0"	01	4# -20mm+ 4# -16mm 8Y @ 6" c/c	4# -20mm+ 4# -16mm 8Y @ 6" c/c	4# -20mm+ 4# -16mm 8Y @ 6" c/c
C5	9"x2'0"	01	10# -20mm 8Y @ 6" c/c	10# -20mm 8Y @ 6" c/c	10# -16mm 8Y @ 6" c/c



FLAT FOOTING DETAILS

PLOT-10
TYPE A

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REVISION		
S.NO	DESCRIPTION	APPROVED DATE

PROJECT :
Proposed G+1 Residential Building For Chennai

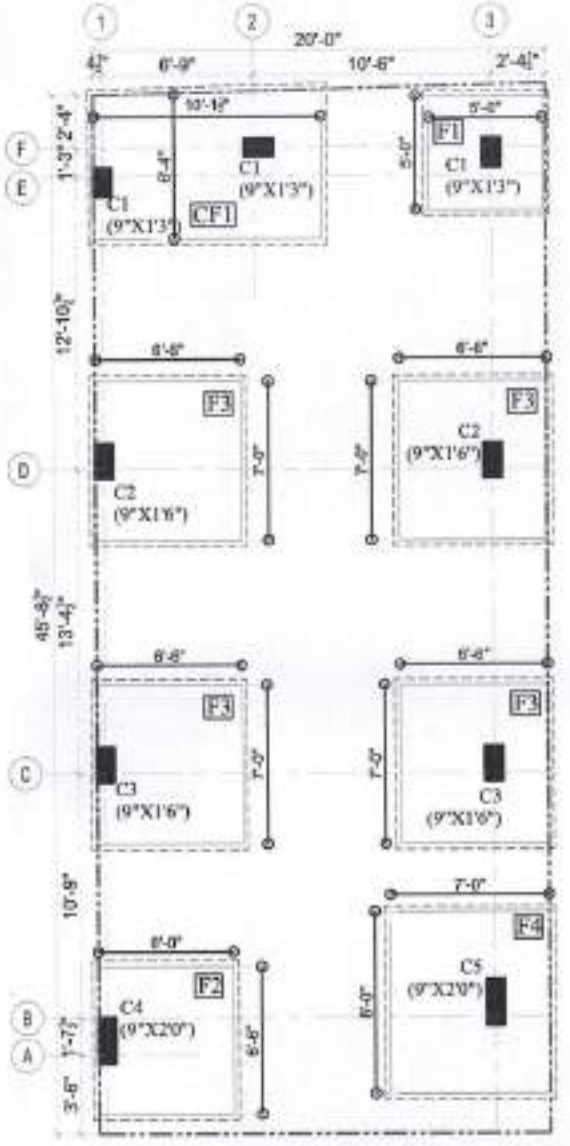
CLIENT:

DRAWING DETAILS :
GRID PLAN/ CENTERLINE DRAWING

JOB NUMBER:	**REVISON NO - 00**
DRAWN BY :	**DRAWING NO-**
SCALE: N.T.S	**DATE :** 06.10.2023
SHEET NUMBER :	**SIZE:** A3

A.RAJAN, ME.(STRUCTURE)
REGISTERED GRADE-1
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2022/US/321
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-88070 78990

NOTES :
1.GRADE OF CONCRETE : M 25
FOR ALL STRUCTURAL MEMBERS AS PER IS-456
2.GRADE OF STEEL Fe 500
(AS PER IS 1786-1985)
3.COVERS
3.1 FOR GRADE BEAM -1" (25MM)
3.2 FOR FOOTING BOTTOM - 2" (50 MM)
3.3 FOR COLUMN - 1 1/2" (40 MM)
3.4 FOR COLUMN BELOW G.L -2" CUSTOM COVER
3.5 FOR FOOTING SIDE - 2" (50 MM)
4. REMOVAL OF FORMWORKS
FOR COLUMNS 24 HRS AFTER CASTING
5. LAP LENGTH FOR ALL BARS SHALL BE 50 x DIA
6.ISOLATED FOUNDATION IS ADOPTED AS PER SOIL CONSULTANT
7.FOUNDATION IS DESIGNED FOR G+1
UPPER FLOORS ONLY



GRID PLAN/ CENTERLINE DRAWING

PLOT-10
TYPE A

FOOTING REINFORCEMENT DETAILS

FOOTING MARK	NOS	L	B	D	Dia. (mm)	Spacing Main (B)	Spacing Dist (L)	Remarks
F1	01	5'0"	5'0"	18"	10	6"	6"	Single Mat
F2	01	6'0"	6'6"	18"	10	6"	6"	Single Mat
F3	04	7'0"	6'6"	18"	10	6"	6"	Single Mat
F4	01	8'0"	7'0"	18"	10	6"	6"	Single Mat
CF1	01	Refer Plan		18"	12	6"	6"	Top Mat
					12	6"	6"	Bottom Mat

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S.NO	REVISION: DESCRIPTION	APPROVED DATE

PROJECT :
Proposed G+1 Residential Building For Chennai

CLIENT:

DRAWING DETAILS :
FOUNDATION LAYOUT & DETAILS.

JOB NUMBER:	**REVISON NO - 00**
DRAWN BY :	**DRAWING NO-**
SCALE: N.T.S	**DATE :** 06.10.2023
SHEET NUMBER :	**SIZE:** A3

A.RAJAN M.E.,(STRUCTURE)
REGISTERED GRADE-I
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2022/05:221
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-88070 78990

NOTES :
1.GRADE OF CONCRETE : M 20
FOR ALL STRUCTURAL MEMBERS AS PER IS:456
2.GRADE OF STEEL Fe 500
(AS PER IS 1786:1985)
3.COVERS
3.1 FOR GRADE BEAM - 1" (25MM)
3.2 FOR FOOTING BOTTOM - 2" (50 MM)
3.3 FOR COLUMN - 1 1/2" (40 MM)
3.4 FOR COLUMN BELOW G.L -2" EXTRA COVER
3.5 FOR FOOTING SIDE - 2" (75 MM)
4. REMOVAL OF FORM WORKS
FOR COLUMNS -24 HRS AFTER CASTING
5. LAP LENGTH FOR ALL BARS SHALL BE 50 x DIA
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UPPER FLOORS ONLY

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S.NO	REVISION DESCRIPTION	APPROVED DATE

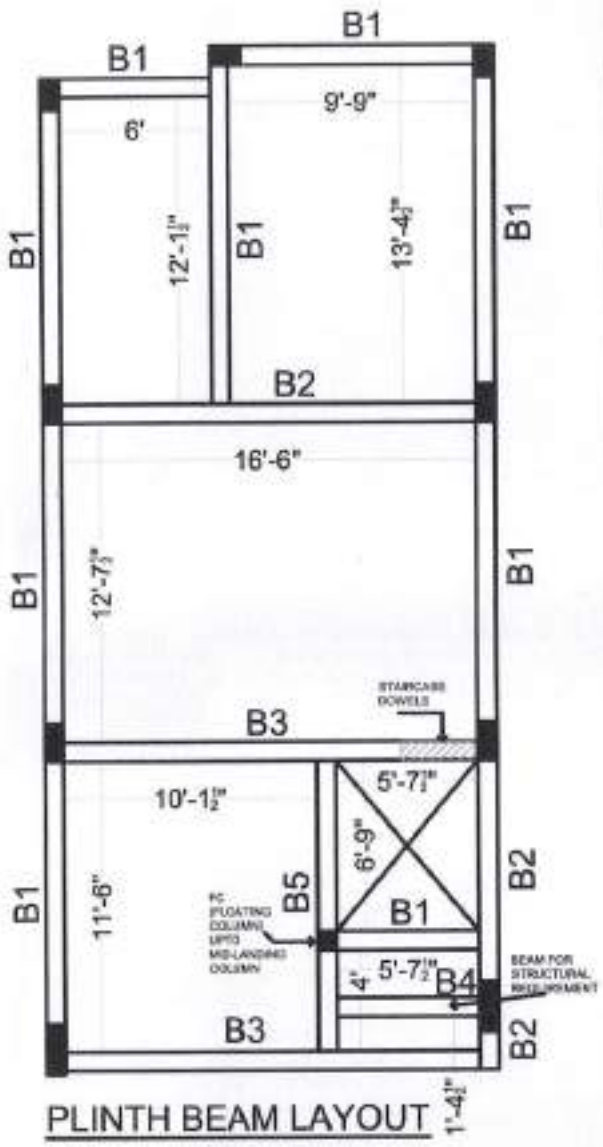
PROJECT :
Proposed G+1 Residential Building For Chennai

CLIENT:

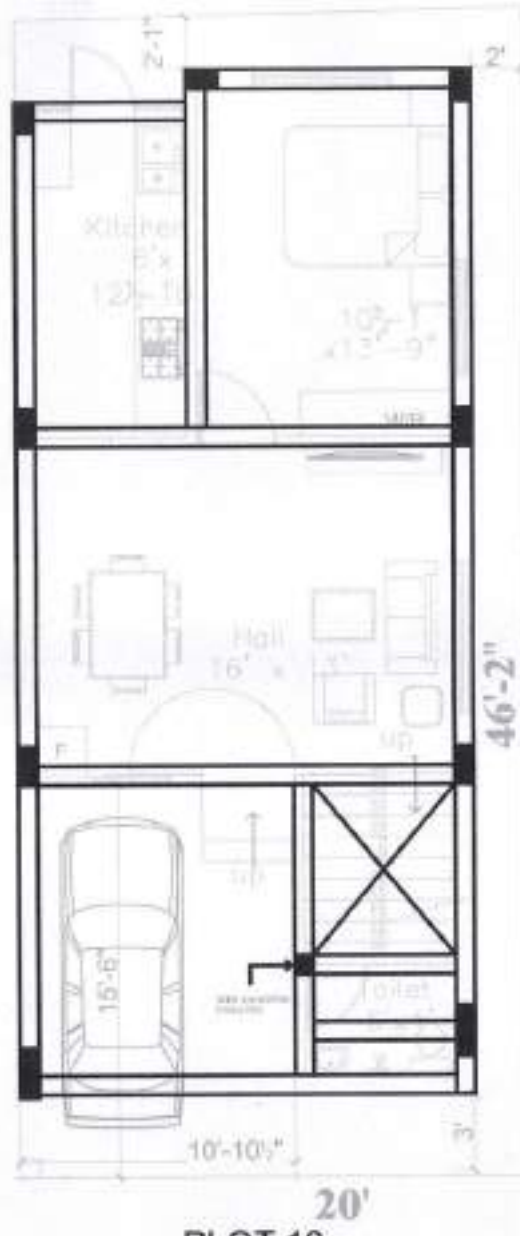
DRAWING DETAILS :
PLINTH LAYOUT & DETAILS.

JOB NUMBER:	**REVISON NO** - 00
DRAWN BY :	**DRAWING NO-**
SCALE: N.T.S	**DATE :** 06.10.2023
SHEET NUMBER :	**SIZE:** A3

A.RAJAN, M.E.(STRUCTURE)
REGISTERED GRADE-1
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2022/05/321
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-88070 78990



PLINTH BEAM LAYOUT



PLOT 10



4# -12mm
8Y @ 6" c/c
FC-9"x9"

B1 (9"X1'6")
2 /12Y
Straight - Top
8 Y @ 6"c/c Stirrups
Straight - Bottom
2 /12 Y

B2 (9"X1'6")
2 /16Y
Straight - Top
8 Y @ 6"c/c Stirrups
Straight - Bottom
2 /16 Y

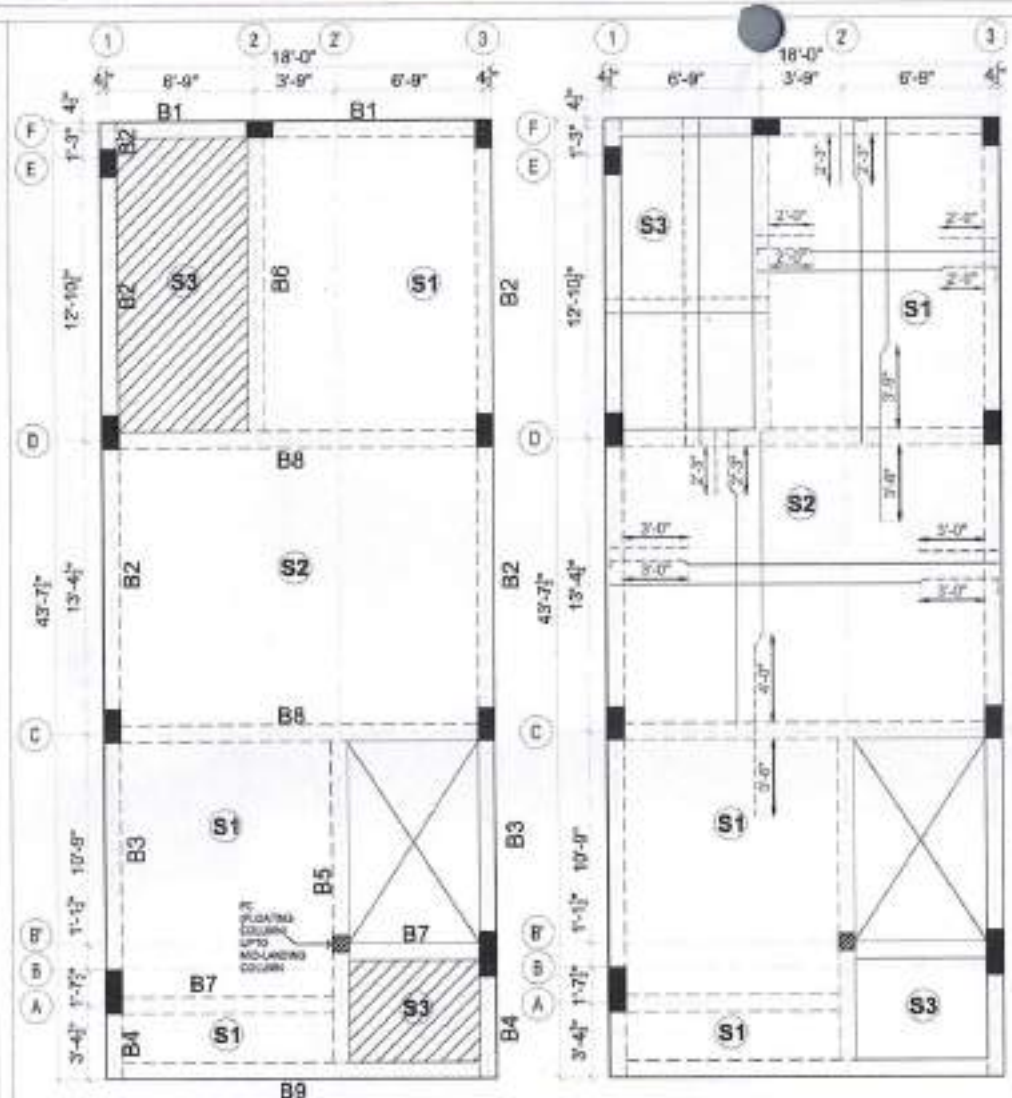
B3 (9"X1'6")
2 /16Y
Straight - Top
8 Y @ 6"c/c Stirrups
Straight - Bottom
2 /16 Y

B4 (9"X1'6")
2 /16Y+2 /12Y
Straight - Top
8 Y @ 6"c/c Stirrups
Straight - Bottom
2 /16 Y

B5 (9"X1'6")
2 /12Y
Straight - Top
8 Y @ 6"c/c Stirrups
Straight - Bottom
2 /16 Y+2 /12 Y

PLOT-10
TYPE A

NOTES :
1.GRADE OF CONCRETE - M 25
FOR ALL STRUCTURAL MEMBERS AS PER IS-456
2.GRADE OF STEEL Fe 500
(AS PER IS 1786:1985)
3.COVERS
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3.3 FOR COLUMN - 1 ½" (40 MM)
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5. LAP LENGTH FOR ALL BARS SHALL BE 50 x DIA
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7.FOUNDATION IS DESIGNED FOR G+1
UPPER FLOORS ONLY



GROUND ROOF BEAM LAYOUT

GROUND ROOF SLAB LAYOUT

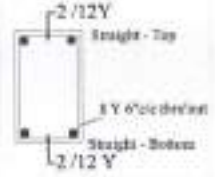


SLAB REINFORCEMENT PATTERN

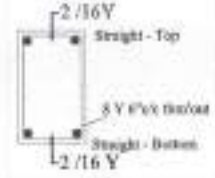
SLAB NO	SLAB REINFORCEMENT DETAILS				THICK.
	SHORT SPAN (MAIN)		LONG SPAN (DIS)		
	DIA	SPACING	DIA	SPACING	
S1	8mm	6"	8mm	6"	5"
S2	10mm	6"	8mm	6"	5"
S3	8mm	6"	8mm	6"	5"

S3* - TOP & BOTTOM REINFORCEMENT (SUNKEN)

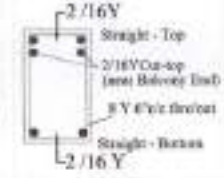
B1 (9"X1'3")



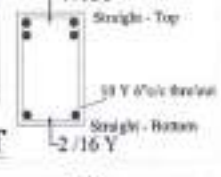
B2 (9"X1'6")



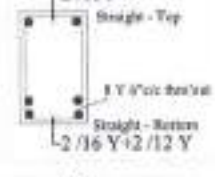
B3 (9"X1'6")



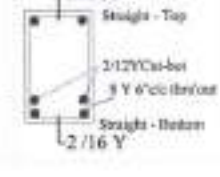
B4 (9"X1'6")



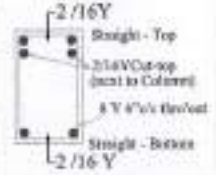
B5 (9"X1'6")



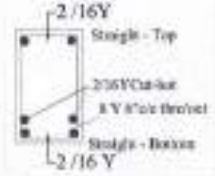
B6 (9"X1'6")



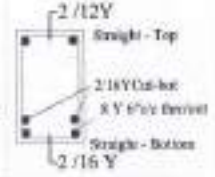
B7 (9"X1'6")

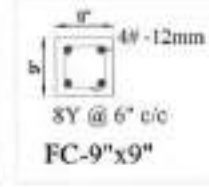


B8 (9"X2'0")



B9 (9"X1'6")





PLOT-10 (TYPE A)

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REVISION		
S.NO	DESCRIPTION	APPROVED DATE
	FOR SITE	

PROJECT :
Proposed G+1 Residential Building For Chennai

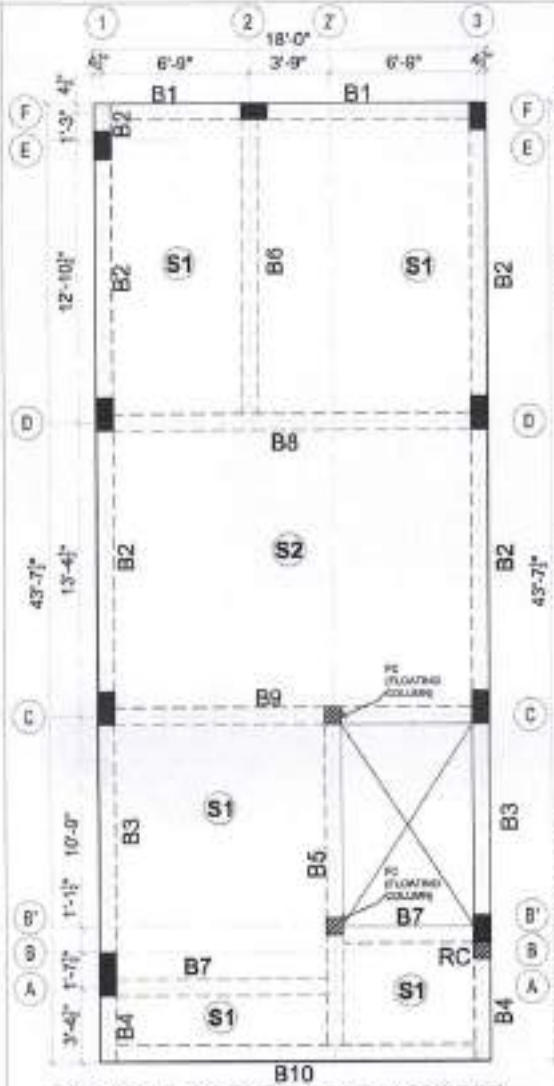
CLIENT:

DRAWING DETAILS :
GROUND ROOF BEAM & SLAB DETAILS

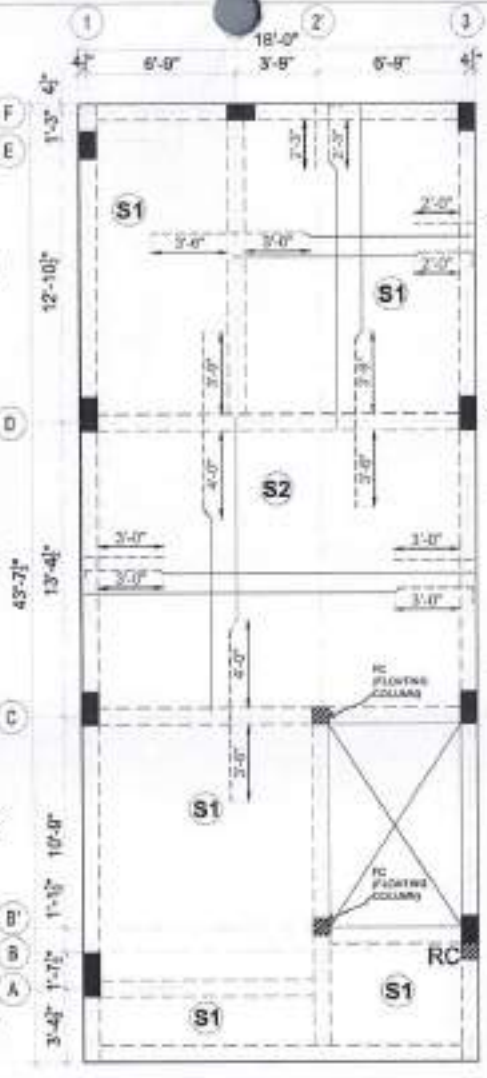
JOB NUMBER:	REVISON NO - 00
DRAWN BY :	DRAWING NO-
SCALE: N.T.S	DATE : 21.09.2024
SHEET NUMBER :	SIZE: A3

A.RAJAN, M.E.(STRUCTURE)
REGISTERED GRADE-1
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2002/05 221
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-88070 78990

NOTES :
1.GRADE OF CONCRETE - M 25
FOR ALL STRUCTURAL MEMBERS AS PER IS-456
2.GRADE OF STEEL Fe 500
(IS PCK IS 1786-1985)
3.COVERS
3.1 FOR GRADE BEAM - 1" (25MM)
3.2 FOR FOOTING BOTTOM - 2" (50 MM)
3.3 FOR COLUMN - 1 1/2" (40 MM)
3.4 FOR COLUMN BELOW G.L -2" EXTRA COVER
3.5 FOR FOOTING SIDE - 3" (75 MM)
4. REMOVAL OF FORM WORKS
FOR COLUMNS -24 HRS AFTER CASTING
5. LAP LENGTH FOR ALL BARS SHALL BE 50 x DIA
6.ISOLATED FOUNDATION IS ADOPTED AS PER SOIL CONSULTANT
7.FOUNDATION IS DESIGNED FOR G+1
UPPER FLOORS ONLY



FIRST ROOF BEAM LAYOUT



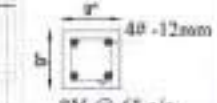
FIRST ROOF SLAB LAYOUT



SLAB REINFORCEMENT PATTERN

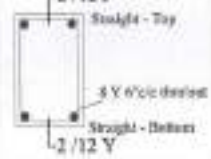


RC-9"x15" (Reduction Column)

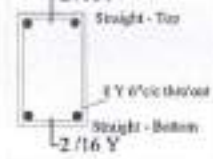


FC-9"x9"

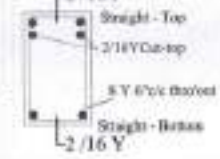
B1 (9"X1'3")



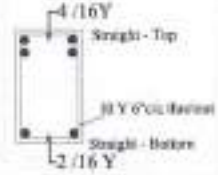
B2 (9"X1'6")



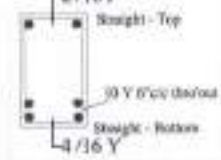
B3 (9"X1'6")



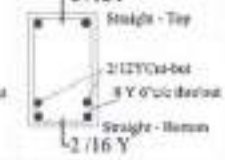
B4 (9"X1'6")



B5 (9"X1'6")

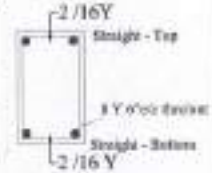


B6 (9"X1'6")

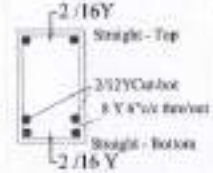


SLAB NO	SLAB REINFORCEMENT DETAILS				THICK.
	SHORT SPAN (MAIN)		LONG SPAN (DIS)		
	DIA	SPACING	DIA	SPACING	
S1	8mm	6"	8mm	6"	5"
S2	10mm	6"	10mm	6"	5"

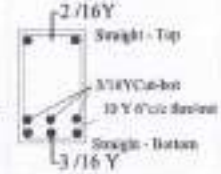
B7 (9"X1'6")



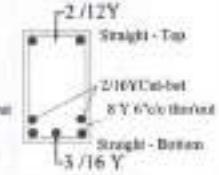
B8 (9"X2'0")



B9 (9"X2'0")



B10 (9"X1'6")



PLOT-10 (TYPE A)

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S.NO	REVISION DESCRIPTION	APPROVED DATE
	FOR SITE	

PROJECT :
Proposed G+1 Residential Building For Chennai

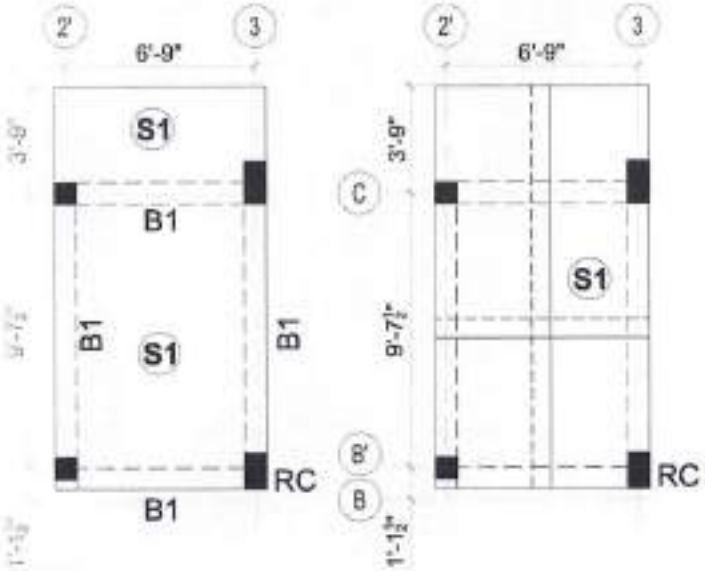
CLIENT:

DRAWING DETAILS :
FIRST ROOF BEAM & SLAB DETAILS

JOB NUMBER:	REVISON NO - 00
DRAWN BY :	DRAWING NO-
SCALE: N.T.S	DATE : 21.09.2024
SHEET NUMBER :	SIZE: A3

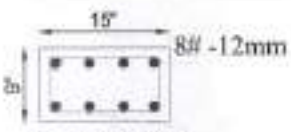
A.RAJAN, ME.,(STRUCTURE)
REGISTERED GRADE-I
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2022/03321
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-98070 78990

NOTES :
1.GRADE OF CONCRETE - M 20
FOR ALL STRUCTURAL MEMBERS AS PER IS:456
2.GRADE OF STEEL Fe 500
(AS PER IS 1786-1985)
3.COVERS
3.1 FOR GRADE BEAM -1" (25MM)
3.2 FOR FOOTING BOTTOM - 2" (50 MM)
3.3 FOR COLUMN - 1 1/2" (40 MM)
3.4 FOR COLUMN BELOW G.L -2" EXTRA COVER
3.5 FOR FOOTING SIDE - 3" (75 MM)
4. REMOVAL OF FORM WORKS
FOR COLUMNS 24 HRS AFTER CASTING.
5. LAP LENGTH FOR ALL BARS SHALL BE 50 x DIA
6.ISOLATED FOUNDATION IS ADOPTED AS PER SOIL CONSULTANT
7.FOUNDATION IS DESIGNED FOR G+1
UPPER FLOORS ONLY



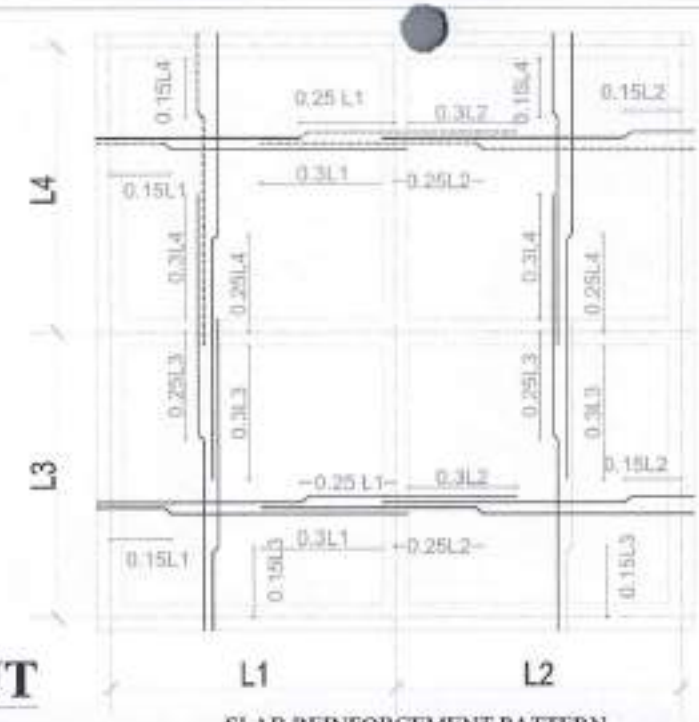
DROOM BEAM & SLAB LAYOUT

SLAB REINFORCEMENT DETAILS				THICK.
SHORT SPAN (MAIN)		LONG SPAN (DIS)		
DIA	SPACING	DIA	SPACING	
8mm	6"	8mm	6"	5"



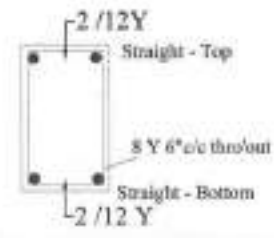
8Y @ 6" c/c

RC-9"x15"
Reduction Column



SLAB REINFORCEMENT PATTERN

B1
(9"X1'3")



PLOT-10 (TYPE A)

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S.NO	REVISION DESCRIPTION	APPROVED DATE
	FOR SITE	

PROJECT :
Proposed G+1 Residential Building at CHENNAI.

DRAWING DETAILS :
HEAD ROOM BEAM & SLAB DETAILS

JOB NUMBER:	REVISON NO - 00
DRAWN BY : E.KARTHICK	
SCALE: N.T.S	DATE : 2.01.24
SHEET NUMBER :	SIZE: A3

A.RAJAN
REGISTERED GRADE-1
CMDA STRUCTURAL ENGINEER
REG.No. SE/GR-1/2020/0321
BSC CONSULTANTS
KODUNGAIYUR, CHENNAI-118.
MOB.: +91-88070 78990

NOTES :
1.GRADE OF CONCRETE : M 25
FOR ALL STRUCTURAL MEMBERS AS PER IS-456
2.GRADE OF STEEL Fe 500
(AS PER IS 1786-1985)
3.COVERS
3.1 FOR GRADE BEAM - 1" (25MM)
3.2 FOR FOOTING BOTTOM - 2" (50 MM)
3.3 FOR SLAB - 1 1/2" (40 MM)
3.4 FOR COLUMN BELOW G.L 2" EXTRA COVER
3.5 FOR FOOTING SIDE - 3" (75 MM)
4. REMOVAL OF FORM WORKS
FOR COLUMNS -24 HRS AFTER CASTING
5. LAP LENGTH FOR ALL BARS SHALL BE 50 x DIA.
6.ISOLATED FOUNDATION IS ADOPTED AS PER SOIL CONSULTANT
7.FOUNDATION IS DESIGNED FOR G+1
UPPER FLOORS ONLY

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.