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STRUCTURAL STABILITY CERTIFICATE

Name of work: Plan showing the proposed construction of stilt + 5 floors Office cum residential building with one dwelling unit at old door No:12, new no:5, plot no:270 C, E-block, 1st street, Anna nagar east, Chennai-600 102. In T.S.no:118 part (as per doc), old s.no:44/ 1 part, 44 /4 part and 46 part, T.S.no:118/8 (as per patta) block no:1, of Periyakudal village, Aminjikarai Taluk, within the limit of greater Chennai Corporation, Zone : VIII, division - 101

Preamble : 1. I hereby certify that the structural design sheet is done for column, Foundation, Slab and beam.

2. The usage of the building is Ground floor + 5 upper Floors.

3. The Super Structure is built on outer 230mm walls and inner 115mm walls.

4. All concrete for RCC members in Ground + 5 Floors are M40 concrete.

5. The structural design includes the Earth quake Criteria as per IS: 1893(part 1)-latest revision.

ADDITIONAL CRITERIA

1. The structure is idealized as Special RC-Moment Resisting Frame (SMRF) and analyzed using software package (ETABS) for both vertical and lateral loads.
2. The lateral load includes wind load and earthquake load, Seismic load of medium and moderate intensity of ZONE-III considered is for design and analysis purpose.
3. The Foundation is designed for critical un-Factored load combinations.
4. The Superstructure members are designed for actual flexure, shear and forces.
5. The structure is analyzed for specific loads (Dead and Live Loads) and for the load combinations given in relevant loads.
6. The design of the structure is structurally **sound and safe.**

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For HEXEL BUILDTECH PRIVATE LIMITED

DIRECTOR

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This is to certify that the Structural Design of the proposed construction of Office cum residential building at above said site has been DESIGNED on the basis of EARTHQUAKE RESISTANT DESIGN OF STRUCTURES IS 1893 (Part1): 2002 General Provisions & Buildings, with latest declaration of Seismic Zone III, Zone factor 0.16 and according to I.S. Loading standards I.S. – 875 All precautions have been taken as per the CONTENTS OF REPORT FOUNDATION ANALYSIS. This Report has recommendations for effect of Seismic Condition for this Soil.

CALCULATION OF SEISMIC CO-EFFICIENT

Name of city	: Chennai
Type of Building	: Office cum Residential Building
Building Frame System	: Special RC-Moment resisting frame (SMRF)
Fundamental Natural Period (Ts)	: (0.075)h ^3/4 =0.655sec.
Soil conditions	: medium
Zone Factor (Refer Table:2) (Z)	: 0.16 (moderate)
Importance Factor (Refer Table:6) (I)	: 1
Response Reduction (Refer Table:7)	: 5.0
Average response acceleration Co-efficient (Sa/g)	: 2.4

EARTH QUAKE ANALYSIS:

Horizontal Seismic Co-efficient (Ah)	= (Z/2)(I / R)(Sa/g) = (0.16/2) (1.2/5.0) (2.35) = 0.045
Design value of Ah	= 0.045
Type of Foundation	: Pile Foundation

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1. GENERAL LOADING CONDITIONS:

(a) Imposed loads on Roof	- 1.50kN/m^2
(b) Imposed loads on Office	- 4.00kN/m^2
(d) Dead weight of R.C.C	- 25kN/m^3
(e) Dead weight of Brick Work	- 20kN/m^3

2. LOADING ON SLABS:

2.1 Loading on Roof slab:

Roof finished with lime concrete terracing	=(0.10)(20)	=2.000kN/m^2
S/W of slab 150mm thick	=(.15)(25)	=3.625kN/m^2
Dead load	=5.625kN/m^2	
Live load	=1.50kN/m^2	
Total load on Roof	= 7.125kN/m^2	

2.2 Loading on Floor slabs:

Floor finish	= 1.00kN/m^2
S/w of slab 150mm thick	= 3.725kN/m^2
Dead load	=4.725kN/m^2
Live load	=4.00kN/m^2
Total load on Roof	= 8.725kN/m^2

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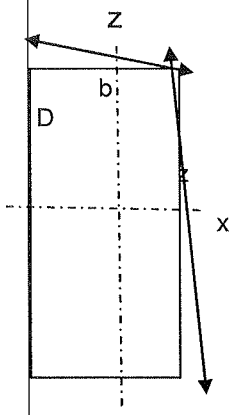
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3 DESIGN:

3.1 COLUMN DESIGN

Grade of Concrete			M 40	
Characteristic Strength of Reinf.		N/mm^2	500	
Width of Column	b	mm	600	
Depth of Column	D	mm	600	
Unsupported Length of Column	l_x	mm	3000	
Unsupported Length of Column	l_y	mm	3000	
Clear Cover to Reinf.		mm	40	
Diameter of Bar		mm	25	
Load		T		
Moment	M_{xx}	T.m		
Moment	M_{zz}	T.m		
Factored Load	P_u	kN	260.000	1
Factored Moment	M_{ux}	kN.m	130.000	1
Factored Moment	M_{uz}	kN.m	316.000	1
Effective Length of Column	l_{ex}	mm	3600	1.2
	l_{ez}	mm	3600	1.2
	l_{ex}/D		6	0
			<12- Short Column	
	l_{ey}/b		6	0
			<12- Short Column	
Additional Moment due to Slender	M_{ax}	kN.m	0	
Additional Moment due to Slender	M_{az}	kN.m	0	
Percentage of Reinf.	p		2.6	
Gross Area of Cross Section	A_g	mm^2	360000	
Ultimate Axial Load	P_{uz}	kN	9821.52	
d'/D (about x-x axis)			0.088	0
d'/D (about y-y axis)			0.088	0.1
(Table 60)	k1		0.207	



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	k2		0.328		
	P_{bx}	kN	3287.808		
	k1		0.207		
	k2		0.328		
	P_{bz}	kN	3287.808		
	k_x		1.000		
	k_y		1.000		
Minimum Eccentricity	e_x	mm	26		
	e_y	mm	26		
Moments due to min. eccentricity	M_{ex}	kN.m	6.76 130.000	< kN.m	
Moments due to min. eccentricity	M_{ez}	kN.m	6.76 316.000	< kN.m	
Total Moments for which the column is to be designed are					
	M_{ux}	kN.m	130.000		
	M_{uz}	kN.m	316.000		
The section is to be checked for biaxial bending					
	$P_u/f_{ck}bD$		0.018		
	p/f_{ck}		0.065		
Referring (d'/D is 0.1)	$M_u/f_{ck}bD^2$		0.07		
	M_{ux1}	kN.m	604.800		
Referring to (d'/D = 0.1)	$M_u/f_{ck}bD^2$		0.070		
	M_{uy1}	kN.m	604.800		
	M_{ux}/M_{ux1}		0.215		
	M_{uy}/M_{uy1}		0.522		
	P_u/P_{uz}		0.027		
		a	0	1	
				< 1	
Mux/Mux1 + Muy/Muy1			0.737	OK	
Area of Reinforcement	As	mm^2	9360		
Minimum no of to be provided			8		
No of Bars to be provided	Nos.		20		
Provide 20 Nos of 25 Diameter					

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3.2 FOUNDATION DESIGN

3.2.1 PILE CAP DESIGN

Concrete Grade:	M40
Steel :	Fe 500

BASE SLAB

Bending moment (Mu) (kN-m/m)		Req.depth (D) (mm)	Total depth (D) (mm)	Bar dia. (mm)	Clear cover (mm)	Effect. depth (d) (mm)
Mx (+) =	12.80	92.38	1000	20	50	940
Mx (-) =	782.00	722.03	1000	20	50	940
My (+) =	22.00	121.11	1000	20	50	940
My (-) =	681.00	673.80	1000	20	50	940

Width (b) (mm)	Mu/bd^2	p_t required (%)	Ast required (mm^2/m)	S required mm c/c	S provided mm c/c	p_t provided (%)	Remarks
1000	0.014	0.170	1598.00	197	125	0.267	20Y @ 125
1000	0.885	0.210	1974.00	159	125	0.267	20Y @ 125
1000	0.025	0.170	1598.00	197	125	0.267	20Y @ 125
1000	0.771	0.182	1710.80	184	125	0.267	20Y @ 125

Check for Shear stresses :

Shear stress (τ_v) (N/mm^2)		p_t provided (%)	τ_c table 19, IS:456 (N/mm^2)	Remarks
SQx =	0.294	0.267	0.387	safe
SQy =	0.210	0.267	0.387	safe

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3.3 BEAM DESIGN

Beam Data

width	450 mm
depth	700 mm
clear cover to main reinf.	25 mm
Slab Thickness	150 mm

d'	46 mm	.= cc+ sdia + mdia/2
eff depth	655 mm	.= d - d'

Material Grades

Concrete	30 MPa
Steel	500 MPa

				Span Moment	Support Moment
Span Moment	352 KN-m		Mu/bd^2	1.83	2.45
			xumax	298	298
			Mulim	769	769
Support Moment	472 KN-m	472 KN-m	$Mulim/bd^2$	3.99	3.99
		0 KN-m			

Span Reinforcement

Beam is designed as Singly Reinforced Beam

Area of Steel	Tension (Ast)	Compr (Asc)	
Percentage	0.454 %	------	*Refer Table 2 SP 16 pg 48*
Area of Steel	1338 sqmm		

824 KN-m

Tension Reinforcement

Type	Bar dia	Nos	Area of Steel	
Layer 1	25 mm	6	2945 sqmm	
Layer 2	20 mm	0	0 sqmm	2783 sqmm
Layer 3	20 mm	0	0 sqmm	
		Total Steel Provided	2945 sqmm	1.000 %

Provided Steel OK

Compression Reinforcement

Type	Bar dia	Nos	Area of Steel
Layer 1	25 mm	6	

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Layer 2	20 mm	0	
Layer 3			
Total Steel Provided			#VALUE!

Support Reinforcement
Beam is designed as Singly Reinforced Beam

Area of Steel	Tension (Ast)	Compr (Asc)	
Percentage	0.629 %	------	*Refer Table 2 SP 16 pg 48*
Area of Steel	1853 sqmm		

1.99999532314094
-0.545638773922828
-0.174839386681158

Tension Reinforcement

Type	Bar dia	Nos	Area of Steel	
Layer 1	**25 mm**	**6**	2945 sqmm	
Layer 2	**20 mm**	**0**	0 sqmm	
Layer 3	**12 mm**		0 sqmm	
Total Steel Provided			2945 sqmm	1.000 %
Provided Steel OK				2573 sqmm
				2214 sqmm

Compression Reinforcement 3255 sqmm

Type	Bar dia	Nos	Area of Steel
Layer 1	**25 mm**	**0**	
Layer 2	**25 mm**	**0**	
Layer 3			
Total Steel Provided			#VALUE!

Shear Force (Vu)	**313 KN**		
ζv	1.030	*.=Vu / (b * d)*	
ζc	0.656	*Refer Table 61 SP 16 pg 179*	*or =(0.85*√(0.8*fck)*√(1+5β)-1)) / (6β)*
ζcmax	3.5	*Refer Table J SP 16 pg 175*	

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Type	Bar Dia	Nos	Area of

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			Steel		
Layer 1	25 mm	0	0 sqmm		
Layer 2	25 mm	0	0 sqmm		
Layer 3	20 mm	0	0 sqmm		
			0 sqmm	0.000 %	

Sectional Dimensions OK
Shear Reinforcements required

Steel	**500 MPa**		Vus/d	1.831 kN/cm	1.831
Type of stirrup	**2 legged**				
Stirrup diameter	**10 mm**				
Spacing	239 c/c	Safe			

3.4 TWO WAY SLAB DESIGN

Slab thickness	t	150 mm
Concrete	fck	30 MPa
Steel	fy	500 MPa

Sunken Depth: 0 mm

Loading

Slab Load

Dead Load	DL	3.750 KN/m
Live Load	LL	4.000 KN/m
Finishes Load	WL	1.000 KN/m
Total Load	Ws	8.750 KN/m
Factored Load	Wsu	13 KN/m

Sunken Slab Load

Dead Load	DL	3.750 KN/m
Filler Load	FL	0 KN/m
Live Load	LL	2.0 KN/m
Finishes Load	WL	1.0 KN/m
Total Load	Wsk	6.75 KN/m
Factored Load	Wsku	10 KN/m

Slab Data

Slab Type	Regular
Load	13 KN/m
Longer Span (ly)	5.80 m
Shorter Span (lx)	4.00 m

ly/lx ratio	1.45
Slab type	+

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Loading on edges		one way	two way
W_{longer}	**22 KN/m**	.=w*lx/2	.=(w*lx/2) + (1-(1/3)*(lx/ly)^2)
$W_{shorter}$	**18 KN/m**		.=w*lx/3

Moments		one way	two way
Mx	18 KN-m	.=w*lx^2/ 8	.=ax * w*lx^2
My	12 KN-m		.=ay * w*lx^2

Thickness Check	OK	.=Mulim > Mux or Muy
Deflection	25 mm	.= 5*W*l^4/(384EI)

Area of Steel	Astx	Asty
	338 sqmm	**214 sqmm**

Refer Chart 4 SP 16 pg 21 Refer Table 5-44 SP 16 pg 51-80

or

Spacing required in mm

8#		10#		12#		16#	
x	y	x	y	x	y	x	x
149 c/c	**235 c/c**	**233 c/c**	**367 c/c**	**335 c/c**	**529 c/c**	**595 c/c**	**940 c/c**

*.=ast of bar*1000/ast req*

Final Ast provided	x	y
	10# @ 150c/c	**10# @ 150c/c**

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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

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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
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- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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