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STRUCTURAL STABILITY CERTIFICATE

Name of work: Plan Showing The Proposed Construction Of 30 Dwelling Units House Building In New T.S.No : 3/11 , T.S.Ward : BS Block : 06 , (Old T.S.No : 3/7 Part , T.S.Ward : BS , Block : 06) Old S.No : 287/3a Part , V.M Chatram Village , Sivanthipatti Road Highground D.D Plan , Palayamkottai Ward Office , Tirunelveli City Municipal Corporation

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 Stilt + 5 Floors upper Floors.

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

4. All concrete for RCC members in Stilt + 5 Floors upper Floors are M30 concrete.

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

This is to certify that the Structural Design of the proposed construction of 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.

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CALCULATION OF SEISMIC CO-EFFICIENT

Name of city	: Tirunelveli
Type of Building	: 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)	: 2.35

EARTH QUAKE ANALYSIS:

Horizontal Seismic Co-efficient (Ah)	= (Z/2)(I / R)(Sa/g) = (0.16/2) (1/5.0) (2.35) = 0.038
Design value of Ah	= 0.038
Type of Foundation	: Isolated Foundation

1. GENERAL LOADING CONDITIONS:

(a) Imposed loads on Roof	- 1.50kN/m^2
(b) Imposed loads on Hall, Kitchen. & Bed, Residential	- 2.00kN/m^2
(d) Dead weight of R.C.C	- 25kN/m^3
(e) Dead weight of Brick Work	- 20kN/m^3

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2. LOADING ON SLABS:

2.1 Loading on Roof slab:

Roof finished with lime concrete terracing	=(0.10)(20) =2.000kN/m^2

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S/W of slab 125mm thick	=(.125)(25) =3.125kN/m^2
Dead load	=5.125kN/m^2
Live load	=1.50kN/m^2
Total load on Roof	= 6.625kN/m^2

2.2 Loading on Floor slabs:

Floor finish	= 1.00kN/m^2
S/w of slab 125mm thick	= 3.125kN/m^2
Dead load	=4.125kN/m^2
Live load	=2.00kN/m^2
Total load on Roof	= 6.125kN/m^2

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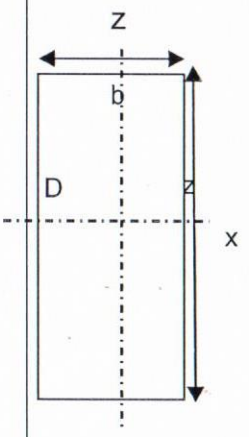
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3 DESIGN:

3.1 COLUMN DESIGN

Grade of Concrete			M 30	
Characteristic Strength of Reinf.		N/mm^2	500	
Width of Column	b	mm	300	
Depth of Column	D	mm	530	
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	20	
Load		T		
Moment	M_{xx}	T.m		
Moment	M_{zz}	T.m		
Factored Load	P_u	kN	1740.260	1
Factored Moment	M_{ux}	kN.m	11.000	1
Factored Moment	M_{uz}	kN.m	56.000	1
Effective Length of Column	l_{ex}	mm	3600	1.2
	l_{ez}	mm	3600	1.2
	l_{ex}/D		6.7924528	0
			<12- Short Column	
	l_{ey}/b		12	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	%	1.9	
Gross Area of Cross Section	A_g	mm^2	159000	
Ultimate Axial Load	P_{uz}	kN	3238.5915	
d'/D (about x-x axis)			0.095	0.1



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d'/D (about y-y axis)			0.167	0.2	
(Table 60)	k1		0.207		
	k2		0.328		
	P_{bx}	kN	1086.479		
	k1		0.184		
	k2		0.028		
	P_{bz}	kN	886.139		
	k_x		0.696		
	k_y		0.637		
Minimum Eccentricity	e_x	mm	23.666667		
	e_y	mm	16		
Moments due to min. eccentricity	M_{ex}	kN.m	41.19	> 11.000 kN.m	
Moments due to min. eccentricity	M_{ez}	kN.m	27.84	< 56.000 kN.m	
Total Moments for which the column is to be designed are					
	M_{ux}	kN.m	41.186		
	M_{uz}	kN.m	56.000		
The section is to be checked for biaxial bending					
	$P_u/f_{ck}bD$		0.365		
	p/f_{ck}		0.0633333		
Referring (d'/D is0.1)	$M_u/f_{ck}bD^2$		0.12		
	M_{ux1}	kN.m	303.372		
Referring to (d'/D = 0.2)	$M_u/f_{ck}bD^2$		0.090		
	M_{uy1}	kN.m	128.790		
	M_{ux}/M_{ux1}		0.136		
	M_{uy}/M_{uy1}		0.435		
	P_u/P_{uz}		0.538		
		a	1	1.5633 < 1	
Mux/Mux1 + Muy/Muy1			0.316	OK	
Area of Reinforcement	As	mm^2	3021		
Minimum no of to be provided			6		
No of Bars to be provided	Nos.		10		
Provide 10 Nos of 20 Diameter					

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3.2 FOUNDATION DESIGN

3.2.1 ISOLATED FOOTING DESIGN

1 **Footing Size Design**

Load	Pu	1380 KN
Design Load	P	1012 KN
Moment in x dir	Mux	10 KN-m
Moment in y dir	Muy	6 KN-m
Column size	cx	300 mm
	cy	530 mm
SBC	q	348 KN/sqm
Footing Size required	A req	2.91 sqmm
Footing Size Provided	L	**2.10 meters**
	B	**2.10 meters**
Area Provided	A prvd	4.41 meters
	Zx	1.54
	Zx	1.54
Net upward pressure	Nup	236 KNm2

Footing Size OK

2 **Slab Design**

	lx	0.900
	ly	0.785
Bending Moment in x dir	Mx	144 KN-m
Bending Moment in y dir	My	109 KN-m
Concrete	fck	30 MPa
Steel	fy	500 MPa
Minimum Depth Required	dmin	190

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Depth Provided	D	**600 mm**
Clear Cover	c	50 mm
Effective Cover	d'	56 mm
Effective Depth	d'	544 mm

Area of Steel	Spacing c/c in mm		
	12#	16#	20#
653 sqmm	173 c/c	308 c/c	481 c/c
653 sqmm	173 c/c	308 c/c	481 c/c

Minimum Ast required across x direcion

Minimum Ast required across y direcion

Ast across x direction	**12 mm dia**	**@ 125 mm c/c**	**905 sqmm**
Ast across y direction	**12 mm dia**	**@ 125 mm c/c**	**905 sqmm**

3 **One Way Shear along x direction**

Vu1	265 KN
ζv	0.232 MPa
ζc	0.265 MPa
Vc1	303 KN

One Way Shear Check OK

4 **One Way Shear along y direction**

Vu1	179 KN
ζv	0.157 MPa
ζc	0.265 MPa
Vc1	303 KN

One Way Shear Check OK

5 **Two Way Shear**

Vu2	1242 KN
ζv	0.595 MPa
ks*ζc	1.369 MPa
Vc1	2857 KN

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Two Way Shear Check OK

3.3 BEAM DESIGN

Beam Design

Beam Data

width	230 mm				
depth	530 mm		d'	43 mm	*.= cc+ sdia + mdia/2*
clear cover to main reinf.	25 mm		eff depth	557 mm	*.= d - d'*
Slab Thickness	125 mm				

Material Grades

Concrete	30 MPa				
Steel	500 MPa			Span Moment	Support Moment
Span Moment	193 KN-m		Mu/bd^2	3.11	2.35
			xumax	254	254
			Mulim	248	248
Support Moment	146 KN-m	187 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	0.831 %	------
Area of Steel	925 sqmm	

Refer Table 2 SP 16 pg 48

380 KN-m

Tension Reinforcement

Type	Bar dia	Nos	Area of Steel
Layer 1	20 mm	3	942 sqmm
Layer 2	16 mm	2	402 sqmm
Layer 3	16 mm		0 sqmm
		Total Steel Provided	1344 sqmm

1600 sqmm

1.410 %

Provided Steel OK

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Compression Reinforcement

Type	Bar dia	Nos	Area of Steel
Layer 1	25 mm		
Layer 2	16 mm		
Layer 3			
Total Steel Provided			#VALUE!

Support Reinforcement

Beam is designed as Singly Reinforced Beam

Area of Steel	Tension (Ast)	Compr (Asc)	
Percentage	0.602 %	------	*Refer Table 2 SP 16 pg 48*
Area of Steel	670 sqmm		

3.13736250190184

-

0.89672130229147

5

0.22907856686798

9

Tension Reinforcement

Type	Bar dia	Nos	Area of Steel
Layer 1	16 mm	2	402 sqmm
Layer 2	20 mm	3	942 sqmm
Layer 3	12 mm		0 sqmm
Total Steel Provided			1344 sqmm
Provided Steel OK			1.727 %

1390 sqmm

1031 sqmm

Compression Reinforcement

2072 sqmm

Type	Bar dia	Nos	Area of Steel
Layer 1	20 mm	3	
Layer 2	16 mm		
Layer 3			
Total Steel Provided			#VALUE!

Shear Force (Vu)	195 KN		
ζv	1.696	*=Vu / (b * d)*	*or =(0.85*√(0.8*fck)*√(1+5β)-1)) / (6β)*
ζc	0.746	*Refer Table 61 SP 16 pg 179*	
ζcmax	3.5	*Refer Table J SP 16 pg 175*	

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Type	Bar Dia	Nos	Area of Steel
Layer 1	16 mm		0 sqmm
Layer 2	25 mm		0 sqmm
Layer 3	20 mm		0 sqmm
			0 sqmm

0.000 %

Sectional Dimensions OK
Shear Reinforcements required

Steel	**415 MPa**			
Type of stirrup	**4 legged**			
Stirrup diameter	**8 mm**			
Spacing	300 c/c	Safe	Vus/d	2.010 kN/cm	2.915

3.4 TWO WAY SLAB DESIGN

Slab Design

Slab thickness	t	125 mm
Concrete	fck	30 MPa
Steel	fy	500 MPa

Sunken Depth: 0 mm

Loading

Slab Load

Dead Load	DL	3.125 KN/m
Live Load	LL	2.000 KN/m
Finishes Load	WL	1.000 KN/m
Total Load	Ws	6.125 KN/m
Factored Load	Wsu	9 KN/m

Sunken Slab Load

Dead Load	DL	3.125 KN/m
Filler Load	FL	0 KN/m
Live Load	LL	3.0 KN/m
Finishes Load	WL	1.0 KN/m
Total Load	Wsk	7.13 KN/m
Factored Load	Wsku	11 KN/m

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Slab Data

Slab Type	Regular
Load	9 KN/m
Longer Span (ly)	4.00 m
Shorter Span (lx)	4.00 m

ly/lx ratio	1.00
Slab type	+

Loading on edges		one way	two way
W_{longer}	**12 KN/m**	.=w*lx/2	.=(w*lx/2) + (1-(1/3)*(lx/ly)^2)
$W_{shorter}$	**12 KN/m**		.=w*lx/3

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

Thickness Check	OK	.=Mulim > Mux or Muy
Deflection	7 mm	.= 5*W*l^4/(384EI)

Area of Steel	Astx	Asty
	186 sqmm	**186 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
271 c/c	**271 c/c**	**423 c/c**	**423 c/c**	**609 c/c**	**609 c/c**	**#######**	**1083 c/c**

.=ast of bar*1000/ast req

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

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