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STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed building **THE WHITE HOUSE – TOWER A with 18 dwelling units** comprising of Stilt + 3 Floors at Plot no 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11, in the layout named MP Villa Vista, S.NO. 26/2A1, Kolapakkam Village, Kundrathur Panchayat Union Limit, Kundrathur Taluk, Kanchipuram District has been done by me based on the report of geotechnical investigation done by **GEO MINES ENGINEERS PVT LTD** Report No **GMEPL/MP DEVELOPERS/315/2024-25** dated 30-09-2024 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 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 875 Part I to V and design of earthquake resistant structure for Seismic Zone III as per IS 1893 (Part-I)-2016

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

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Encl.: Structural Design Calculation

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DESIGN OF SLAB

First Floor	Level: + 4.00 m	Dwg No	DWG-THE WHITE HOUSE-ST-GFC-03
Along Grid (E-K,25-26)		Slab Reff.	S4 (TWO WAY)

INPUT DATA

Slab					Loads			
Shorter Span	Lx =	3.900 m	11.9		Dead Load	DL =	3.13	kN/m²
Longer Span	Ly =	5.950 m	3.53		Live load	LL =	2.00	kN/m²
Thickness of Slab	D =	125 mm			Floor Finishes	FF =	1.50	kN/m²
Clear Cover	d' =	20 mm			False Ceilling Load	=	0.25	kN/m²
Ly/Lx ratio	k =	1.53	Two-Way Slab		Total Load	w =	6.88	kN/m²

Panel Type		Materials		
Basic L/d ratio	= 20	Grade of Concrete	= 25	N/mm²
Edge Condition:	= 7	Grade of Reinf. Steel	= 550	N/mm²
One Long Edge Continuous		Young's Modulus E	3E+04	N/mm²

DESIGN

Direction	BM Coefficients (IS:456-2000)		Flexural Design			dia & Required Spacing				Provided Reinforcement		
			Mu	Ast_{req}	Ast_{pro}	8	10	12	16			
			kNm	mm²	mm²	mm	mm	mm	mm			
Shorter Span	ax (-) =	0.0847	13.288	297	707	169	264	297	291	10 @	125	Safe
	ax (+) =	0.0645	10.119	222	707	226	300	297	291	10 @	125	Safe
Longer Span	ay (-) =	0.0000	0.000	121	452.4	279	270	261	243	8 @	125	Safe
	ay (+) =	0.0430	6.745	144	452.4	279	270	261	243	8 @	125	Safe

CHECK FOR DEFLECTION

13

Area of Steel required = 222 mm²

Area of Steel Provided = 707 mm²

Steel stress of service load = 100.39 N/mm²

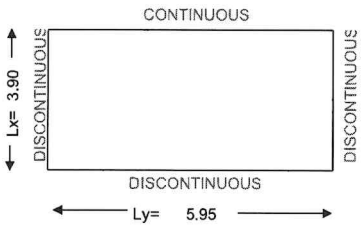
Provided reinforcement (%) = 0.71%

Modification ratio MF = 2.000

Effective depth required for deflection point of view

d_{req} = 97.5 mm

Eff. depth provided d = 100 mm Safe



SLAB SUMMARY

Shorter Span: Provide T 10 @ 125 mm c/c + 1 T 10 Extra between the two cranked bars

Longer Span : Provide T 8 @ 125 mm c/c + 1 T 8 Extra between the two cranked bars

CHECK FOR SHEAR

Max Shear Force = 20 KN

Actual Shear stress tv = 0.201 N/mm2

P_t of A_{st} = 0.7%

Design Shear Stress tc = 0.56 N/mm²

Shear is less than Design Shear Stress, Hence Safe against shear

NOTES

1. Crank alternate bars at 0.3 times the respective span.
2. Provide 12mm dia chairs at 1000mm c/c in both directions.
3. Provide 20 mm thick cover blocks at 600mm c/c in both directions.

Reinforcement Summary:

Along Shorter Span

Provided T10@ 125mm c/c

Along Longer Span

Provided T8@ 125mm c/c

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DESIGN OF FLOOR BEAM (GRID E25 -K25)-FIRST FLOOR

Input Data:	**Beam No**	:	B233/(9"X21")		LOAD CASE: 1.5DL+1.5EQX+0.45EQZ+TLMIN	
Breadth			B	=	230 mm	
Overall Depth			D	=	530 mm	380
Clear Cover			d'	=	25 mm	
Effective Depth			d	=	465 mm	
			fy	=	550 N/mm^2	
			fck	=	25 N/mm^2	
Sagging Moments			Mu	=	88.79 kNm	
End moments		LHS	M1	=	184.24 kNm	
		RHS	M2	=	81.69 kNm	
Shear at		END	Vu	=	187.5 kN	
		K	$Mu/(bd^2)$	=	**3.70** Mpa	

The section is Singly Reinforced Xn

Design Calculation:

Step 1:

For Sagging moments		**Mu**	=	88.79	kNm
		$k = (Mu/bd^2)$	=	1.785	Mpa
		Ast required	=	439	mm^2
		Ast min	=	165	mm^2
Choose dia of bar	**16**	Nos req	=	0.5	Nos
		Dia	=	16	mm
		No	=	4	Nos
		Ast provided	=	804	mm^2

Provide 4Y16 as Bottom Steel Reinforcement

Step 2:

For End moments	***LHS***	**Mu**	=	184.24	kNm
		$k = (Mu/bd^2)$	=	3.705	Mpa
		Ast required	=	1058.742	mm^2
		Ast min	=	165	mm^2
Choose dia of bar	**16**	Nos req	=	1.3	Nos
		Dia	=	16	mm
		No	=	6	Nos
		Ast provided	=	1206	mm^2

Provide 6Y16 as Top Steel Reinforcement at LHS

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Step 3:

For End moments	***RHS***	**Mu**	=	81.69	kNm
		$k = (Mu/bd^2)$	=	1.643	Mpa
		Ast required	=	400.1975	mm^2
		Ast min	=	165	mm^2
Choose dia of bar	16	Nos req	=	0.5	Nos
		Dia	=	16	mm
		No	=	2	Nos
		Ast provided	=	402	mm^2

Provide 2Y16 as Top Steel Reinforcement at RHS

Step 4:

Top Steel @ Middle

(20% of Max.Mt)		Ast required	=	160.8	mm^2
Choose dia of bar	16	Nos req	=	0.2	Nos
		Dia	=	16	mm
		No	=	2	Nos

Provide 2Y16 as Top Steel Reinforcement at Middle

Step 5:

Shear Reinforcement

	Vu	=	187.500	kN
	ζv	=	1.753	N/mm^2
	pt	=	0.989	%
	ζc	=	0.640	N/mm^2
	ζc max	=	4.000	N/mm^2
If,			0	
i.ζv <ζc mini shear ,	Here.,			
ii.ζc <ζv >ζcmax design shear.,	**DESIGN SHEAR REQD**			
iii.ζv >ζcmax Increase Depth.				

choose No.of Legs 2 and Choose dia of bar 8

	Asv	=	100.531	mm^2
Design Shear Force	Vus	=	119.052	kN

Spacing of shear reinforement as per

i. Mini Shear Reinf	Sv	=	523	mm
ii. Design shear-Vertical Stirrups	Sv	=	187.89	mm
iii. Maximum spacing 0.75xd	Sv	=	348.75	mm
iv. Not greater than 300mm	Sv	=	300	mm

whichever is less

Provide 2 legged stirrup Y8 @ 100c/c

Step 6:

Results

		Bottom steel			Top steel at Support		Stirrups	
Beam No	**Size**	**Straight**	**Curtail**	**Middle**	**LHS**	**RHS**	**Ends**	**Middle**
B233/(9"X21")	230X530	2Y16	2Y16	2Y16	6Y16	2Y16	2LY8/100	2LY8/200

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COLUMN / GRID NO. C7 / (E/25)
DESIGN RESULTS

M25 Fe550 (Main) Fe550 (Sec.)

LENGTH: 3400.0 mm CROSS SECTION: 230.0 mm X 450.0 mm COVER: 40.0 mm

LOAD CASE: 120 SHORT (Z) /BRACED LONG(Y)

REQD. STEEL AREA : 2443.05 Sq.mm.

REQD. CONCRETE AREA: 101056.95 Sq.mm.

MAIN REINFORCEMENT: Provide 8 - 20 dia. (2.43%, 2513.27 Sq.mm.)

(Equally distributed)

TIE REINFORCEMENT: Provide 8 mm dia. rectangular ties @ 150 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)

Puz : 2144.65 Muz1 : 163.66 Muy1 : 64.19

INTERACTION RATIO: 0.99 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)

WORST LOAD CASE: 120(1.5DL+1.5EQX+0.45EQZ+TLMIN)

Puz : 2172.83 Muz : 172.59 Muy : 65.22 IR: 0.94

==========

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Design Code	:	IS 456 + IS 13920 - 2016	
Pilecap No	:	PC1	
Column No	:	C7	(300mm X 450mm)
Grid No	:	E/25	
Concrete Grade	:	M25	
Steel Grade	:	Fe550	
Clear Cover	:	75	mm
Top of pile-cap below ground	:	0.25	m
Density of Soil	=	18	kN/cum
Founding Depth	=	1	m
Pile Capacity in Compression	=	500	kN
Pile Capacity in Tension	=	250	kN
Pile Capacity in Shear	=	25	kN
Pile Capacity Reduction	=	0	%
Pile Overloading	=	10	%
Pile Group Overloading	=	10	%
Pile Capacity Increase for EQ	=	25	%
Pile Capacity Increase for Wind	=	25	%
Live Load Reduction	=	0	%
Consider Capacity Design	:	No	
Consider Overburden Pressure	:	Yes	
No. of Piles	=	2	
Pile Diameter	=	450	mm
Pilecap Offset	=	150	mm
Pile Spacing	=	2.5	x Ø
Pilecap Size	=	1875 X 750	mm
Pilecap Depth	=	750	mm
Soil Wt. + Pile-cap Wt.	=	32.695	kN

For design, moments along shorter direction of pile cap has been ignored

Check for Maximum Load on One Pile:

Critical Analysis Load Combination	:	228	
Critical Load Combination	:	[79] : (LOAD 3: DL) +0.8 (LOAD 4: LL) +0.8 (LOAD 1: EQX) +0.24 (LOAD 2: EQZ) +(LOAD 6: TEMP(MAX))	
Pcomb	=	952.27	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	984.96	kN
Mx	=	7.67	kNm
My	=	5.48	kNm
P	=	Ptotal/ No. of Piles	
	=	492.48	kN

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Pmx	=	6.819	kN
Pmy	=	0	kN
Maximum load on pile	=	499.3	kN
Allowable load on pile	=	500 x 1.25	
	=	625	kN

Check for Maximum Load on Pile Group:

Critical Analysis Load Combination	:	203	
Critical Load Combination	:	[54] : (LOAD 3: DL) +(LOAD 4: LL) +(LOAD 6: TEMP(MAX))	
Pcomb	=	896.42	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	929.11	kN
Mx	=	-0.99	kNm
My	=	4.42	kNm
Maximum load on pile group	=	929.11	kN
Allowable load on pile group	=	2 x 500 x 1.1	
	=	1100	kN

Check for Maximum shear on Pile Group:

Critical Analysis Load Combination	:	207	
Critical Load Combination	:	[58] : (LOAD 3: DL) -(LOAD 1: EQX) -0.3 (LOAD 2: EQZ) +(LOAD 5: TEMP(MIN))	
Pcomb	=	643.46	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	676.16	kN
Mx	=	-13.33	kNm
My	=	1.91	kNm
Vx	=	-6.89	kNm
Vy	=	-11.01	kNm
Maximum shear on pile group	=	$\text{sqrt}(-6.89^2 + -11.01^2)$	
	=	12.99	kN
Shear capacity of pile group	=	2 x 25 x 1 x 1.25	
	=	62.5	kN

Check for Uplift Load on Pile:

No uplift in any pile

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Design for Bending:

Bottom Reinforcement Along Column-D

Critical Analysis Load Combination	:	101	
Critical Load Combination	:	[87] : 1.5 (LOAD 3: DL) +1.5 (LOAD 4: LL)	
Pcomb	=	1336.62	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	1385.663	kN
Mx	=	-5.5	kNm
My	=	6.7	kNm
Ppile	=	Max Load on pile	
	=	697.72	kN
Deff	=	665	mm
Beff	=	750	mm
DfCol	=	0.34	m
BMux	=	Ppile X DfCol	
	=	235.48	kNm
PtReq	=	0.2	%
AstReq (BM)	=	1330	sqmm/m
AstPrv	=	T16 @ 150 C/C	
	=	1340.4	sqmm/m

Top Reinforcement Along Column-D

D	=	750	mm
	<=	1000	mm, Hence
AstReq (BM)	=	Min Pt for Top Reinforcement X D X 1000	
	=	0.06% X 750 X 1000	
	=	450	sqmm/m
AstPrv	=	T10 @ 170 C/C	
	=	462	sqmm/m

Bottom Reinforcement Along Column-B

AstReq (BM)	=	0.2 x (D/2) x 1000/100	
	=	0.2 x 375 x 1000/100	
	=	750	sqmm/m
AstPrv	=	T10 @ 100 C/C	
	=	785.4	sqmm/m

Top Reinforcement Along Column-B

D	=	750	mm
	<=	1000	mm, Hence
AstReq (BM)	=	Min Pt for Top Reinforcement X D X 1000	
	=	0.06% X 750 X 1000	
	=	450	sqmm/m
AstPrv	=	T10 @ 170 C/C	
	=	462	sqmm/m

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Design for One Way Shear:

Along Column-D

Critical Analysis Load Combination	:	102	
Critical Load Combination	:	[88] : 1.5 (LOAD 3: DL) +1.5 (LOAD 4: LL) +(LOAD 6: TEMP(MAX))	
Pcomb	=	1341.96	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	1391	kN
Mx	=	-2.82	kNm
My	=	6.65	kNm
Ppile	=	Max Load on pile	
	=	698.0093	kN

Location of critical section is at d/2 from face of column

Section Location from column center	=	557.5	mm

Data for Piles

Pile No	Load (kN)	% covered	Shear (kN)
P1	698.01	48.89	356.76
P2	692.99	48.89	354.2

Design Shear Force (Vu)	=	Max. of (Shear due to P1, P2)	
	=	356.76	kN
Deff	=	665	mm
Beff	=	750	mm
Tv	=	Vu/(Beff x Deff)	
	=	0.72	N/sqmm
Tc	=	0.33	N/sqmm
Av	=	5	mm
Shear enhancement factor	=	2 X Deff / Av	
	=	266	
Enhanced shear strength (Tce)	=	3.1	N/sqmm
Tv	<	Tce, Hence Shear Reinforcement is not required	

Along Column-B

One way shear check do not applicable for 2 pile pile-cap design

Design of Face Reinforcement:

AsfrReq	=	SFR % X D X Beffsfr	
	=	0.05 X 750 X 500 / 100	
	=	188	sqmm
Asfr Prv	=	3-T10	
	=	236	sqmm

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Check for Load Transfer from Column to PileCap

Critical Analysis Load Combination	=	102	
Critical Load Combination	:	[88] : 1.5 (LOAD 3: DL) +1.5 (LOAD 4: LL) +(LOAD 6: TEMP(MAX))	
P	=	1341.96	kN
A2	=	0.14	sqm
A1	=	1.41	sqm
Base Area	=	1.41	sqm
A1	<	Base Area	
Modification Factor	=	SquareRoot(A1/A2) < = 2	
SquareRoot(A1/A2)	=	3.23	
Thus, Modification Factor	=	2	
Concrete Bearing Capacity	=	0.45 X Fck X Modication Factor X Column Area	
	=	3037.5	kN
Concrete Bearing Capacity	>	P, Hence Safe.	

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