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DIGITALLY VERIFIED RECORD

DESIGN BASIS REPORT

FOR PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS RESIDENTIAL BUILDING WITH 15 DWELLING UNITS AT DOOR NO.16 & 18, AGS COLONY 2ND MAIN ROAD, VELACHERY, CHENNAI 600 042 COMPRISED IN OLD S.NO.609/1 NEW S.NO.44, BLOCK NO.151 OF VELACHERY VILLAGE WITHIN THE LIMITS OF GCC

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1.0 OBJECTIVE

The Design basis covers the basic requirement that will be followed for the design of PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING AT VELACHERY, CHENNAI

The building is designed for Stilt + 5 Floors. The structure is supported on columns in turn resting on Pile Foundation. The structural system comprises columns, beams, slabs and wall structure.

3-D Analysis of all the building structures will be carried out using STAAD PRO software package and analysis results shall be used for designing the various elements.

2.0 DESIGN LOADS

2.1 Dead Loads

The Dead loads that are envisaged to act permanently are considered as per IS: **875 (Part 1) – 1987 – Dead loads.** Indian Standard **"Code of Practice for Design Loads (other than earthquake) for Buildings and Structures"**.

1. Slab is assumed to be 150mm thick – 3.75 KN/m²
2. Slab is assumed to be 125mm thick – 3.125 KN/m²
3. Floor finish – 1.5KN/m²
4. Brick work masonry walls 230thick are proposed to be used (location of walls per Architectural drawings) Unit weight is taken as 20 KN/m^3
5. Weathering course in Terrace finish – 3 KN/m^2

2.2 Imposed Loads

The imposed loads that are envisaged to act permanently are considered as per **IS : 875 (Part 2) – 1987 .** Indian Standard **"Code of Practice for Design Loads (other than earthquake) for Buildings and Structures"**.

1.	Living	=	2 KN/m^2
2.	Staircase	=	3 KN/m^2
3.	Toilets	=	2 KN/m^2
4.	Terrace floors	=	1.5 KN/m^2

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2.3 Earthquake Load

The loading due to earthquake is assessed based on the provisions of **IS: 1893-2016**. Structure with ductile detailing is considered as per **IS: 13920-2016.**

CHENNAIfalls under Seismic Zone III

Zone factor	=	**0.16**
Response reduction factor	=	**5**
Importance factor	=	**1.0**

Structure with ductile detailing is considered as per IS: 13920-2016

2.4 Load Combinations

The various loads shall be combined in accordance with the stipulations in IS: 875 (Part 5) – 1987. Whichever combinations produced the most unfavorable effect in the building, foundations or structural member concerned shall be adopted. The various load combinations considered in the analysis are as follows:

1. 1(DL+LL)
2. 1 DL+0.8 LL+ 0.8 SQX +1
3. 1 DL+0.8 LL+ 0.8 SQX -1
4. 1 DL+0.8 LL+ 0.8 SQZ +1
5. 1 DL+0.8 LL+ 0.8 SQZ -1
6. 1.0 (DL+SQX +)
7. 1.0 (DL+SQX -1)
8. 1.0 (DL+SQZ +1)
9. 1.0 (DL+SQZ -1)
10. 1.5(DL+LL)
11. 1.5(DL+SQX +1)
12. 1.5(DL+SQX -1)

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13. 1.5(DL+SQZ +1)

14. 1.5(DL+SQZ -1)

15. 1.2(DL+LL+SQX +1)

16. 1.2(DL+LL+SQX -1)

17. 1.2(DL+LL+SQZ +1)

18. 1.2(DL+LL+SQZ -1)

19. 0.9DL+1.5SQX+1

20. 0.9DL+1.5SQX -1

21. 0.9DL+1.5SQZ +1

22. 0.9DL+1.5SQZ -1

The above load combinations will be considered and effect of worst combinations will be taken for design of various building elements.

3.0 ANALYSIS METHODS

The analysis of the structures is carried out using the STAAD PRO. The entire super-structure is modeled using frame elements as appropriate. Beams and columns are modeled as frame elements. Appropriate loads and its combinations, as per relevant IS code clauses, for most unfavorable effects are chosen for design. Various load cases considered in the analysis are briefed above.

4.0 DESIGN ASSUMPTION

4.1.1 The Base of the Foundation is assumed to be FIXED.

4.1.2 All Concrete elements shall be designed in accordance with IS 456: 2000 Limit State Design.

4.1.3 Appropriate loads and its combinations, as per relevant clauses, for the most unfavorable effects are chosen for design. (Refer Load Combination below).

5.0 FOUNDATION DESIGN

Type of Foundation : Pile foundation.

Safe load Capacity of the pile
For 450 mm Dia pile : 600 KN

Depth of Foundation : 8 m

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6.0 MATERIALS

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

S.no	Materials	Unit weight KN/m^3
1	Reinforced Cement Concrete	25
2	Solid Block / Brick	20
3	Steel	78.50

Structural concrete shall be of grade M30 for Pile

Structural concrete shall be of grade M25 for Pile cap & Column

Structural concrete shall be of grade M25 for Beam & Slab

Steel reinforcement shall be of Grade Fe500 confirming to IS: 1786-2008.

7.0 NOMINAL COVER TO REINFORCEMENT

From Durability requirement, exposure condition is assumed as mild for structural elements above ground level and moderate for structural elements below ground level.

The Clear cover to reinforcement to meet durability requirement shall be as follows:

Column – 40mm

Pile cap – 100mm

Beam – 25mm

Slab – 20mm

DESIGN OF BEAM: 1

Beam size: 230mm x 450mm

Bending moment at support = 140kNm

Bending moment at mid span = 133kNm

Shear force, Vu = 149kN

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Bending moment at support, Mu = 140kNm

R = $(140 \times 10^6)/230x409^2$

= 3.64

Pt/100 =Ast/bd = fck/2fy [1-Sq.rt (1-4.598xR/fck)\

fck = 20 N/mm^2

fy = 500 N/mm^2

Pt = 1.07%

Ast required = 1013 mm^2

Provide 6nos of 16Y

Ast provided = 1206 mm^2

Hence safe.

Bending moment at mid span, Mu = 133kNm

R = $(133 \times 10^6)/230 \times 409^2$

= 3.46

Pt = 1.0%

Ast required = 944 mm^2

Provide 6nos of 16Y

Ast provided = 1206 mm^2

Hence it is safe

Shear force, Vu, = 149kN

$\bar{C}v$ = Vu/bd

= $(149 \times 10^3)/ 230 \times 409$

= 1.58 N/mm^2

Hence ok.

Shear capacity of concrete:

Pt = 1.0 %

$\bar{C}c$ = 0.62

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= τ_c bd

= 0.62X 230 X 409

= 58323 N (or) 58 kN

Shear to be carried by stirrups

Vu = Vs – τ_c bd

= 149 – 58 kN

= 91kN

Therefore, provide 2 legged 10Y @ 150 mm C/C at the supports.

Provide 2 legged 10Y @ 200mm C/C at the midspan.

DESIGN OF BEAM: 2

Beam size: 230mm x 525mm

Bending moment at support = 132kNm

Bending moment at mid span = 111kNm

Shear force, Vu = 96kN

Bending moment at support, Mu = 132kNm

R = $(132 \times 10^6)/230x484^2$

= 2.44

Pt/100 =Ast/bd = fck/2fy [1-Sq.rt (1-4.598xR/fck)\

fck = 20 N/mm^2

fy = 500 N/mm^2

Pt = 0.65%

Ast required = 725 mm^2

Provide 4nos of 16Y

Ast provided = 804 mm^2

Hence safe.

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Bending moment at mid span, Mu = 111kNm

R = $(111 \times 10^6)/230 \times 484^2$

= 2.06

Pt = 0.53%

Ast required = 593 mm^2

Provide 4 nos of 16Y

Ast provided = 804 mm^2

Hence it is safe

Shear force, Vu, = 96kN

τv = Vu/bd

= $96 \times 10^3 / 230 \times 484$

= 0.86 N/mm^2

Hence ok.

Shear capacity of concrete:

Pt = 0.65 %

τc = 0.53

= τc bd

= 0.53 X 230 X 484

= 58999 N (or) 59kN

Shear to be carried by stirrups

Vu = Vs – τc bd

= 96 – 59 kN

= 37kN

Therefore, provide 2 legged 8Y @ 100 mm C/C at the supports.

Provide 2 legged 8Y @ 200 mm C/C at the midspan.

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Design of Pile Cap :

Safe load for 450mm Dia pile	=	500 KN
Concrete grade for pile cap	=	M20
Un factored Column load	=	632KN
No of piles required	=	632/500 = 1.264
Provide 2 nos of Pile (450Ø)		
Spacing of Piles	=	1350mm
	=	1.35m
Factored load	=	632 x 1.5
	=	948
Bending moment WL/4	=	948 x 1.35 / 4
	=	319KNM
$R = MU/bd^2$	=	$948 \times 10^6 / 750 \times 630^2$
	=	1.3
fck	=	$20N/mm^2$
fy	=	$500N/mm^2$
Pt/100 = Ast/bd	=	fck/2fy [1-sqrt (1 - 4.598xR/20)]
Ast required	=	$1500\ mm^2$

Provide 7nos of 25Dia bar

Ast provided	=	$1570mm^2$
Ast required	>	Ast provided

Hence it is safe.

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DESIGN OF COLUMN - C1

Length of column	D	750	mm
Breadth of column	b	300	mm
Unsupported length (longer direction)	L_x	3000	mm
Unsupported length (shorter direction)	L_y	3000	mm
Eff. Length (longer direction)	L_{ex}	2400	mm
Eff. Length (shorter direction)	L_{ey}	2400	mm
Factored Load	P_u	1415	kN
Factored moment (longer direction)	Mux	100	kNm
Factored moment (shorter direction)	Muz	85	kNm
Charac. comp strength of concrete	f_{ck}	25	N/mm^2
Yield stress of steel	f_y	500	N/mm^2
Dia of bar used	Φ	16	mm
Clear cover		40	mm
Effective cover	d'	48	mm
Effective depth	d	702	mm
Check for slenderness			
Longer Direction			
Slenderness ratio	L_{ex}/D	3.20	**short**
Additional moment due to slenderness	M_{ax}	0	kN-m
Shorter Direction			
Slenderness ratio	L_{ey}/b	8.00	**short**
Additional moment due to slenderness	M_{ay}	0	kN-m
Calculation of P_{uz}			
No of bars used		18	
Area of reinforcement	Ast	3617.28	
Provided steel		18 nos Y16	
Percentage of reinforcement	p_t	1.608	%
Area of concrete	Ag	225000	mm^2
Ultimate axial load (without moments)	P_{uz}	3847	kN
Calculation of P_b:			
Longer Direction			
	d'/D	0.064	
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1x}	0.216	From Sp16
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2x}	0.511	
Axial load corresponding to balanced failure	P_{bx}	1398	kN
Reduction factor for additional moments	k_x	1.000	
Moment due to slenderness	M_{ax}	**0.00**	kN-m
Shorter Direction			
	d'/b	0.160	
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1y}	0.193	
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2y}	0.281	
Axial load corresponding to balanced failure	P_{by}	1185	kN
Reduction factor for additional moments	k_y	0.914	
Moment due to slenderness	M_{ax}	**0.00**	kN-m

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Check for moments due to min. eccentricity					
Longer Direction					
Minimum eccentricity			e_x	31.00	mm
Moment due to min. eccentricity			M_x	43.87	kN-m
Moment in longer direction			M_{ux}	100.00	kNm
Shorter direction					
Minimum eccentricity			e_y	16.00	mm
Moment due to min. eccentricity			M_y	22.64	kN-m
Moment in shorter direction			M_{uy}	85	kNm
Final design moments					
Moment in longer direction			M_{ux}	**100.00**	kNm
Moment in shorter direction			M_{uy}	**85.00**	kNm
Check for interaction					
			d'/D	0.064	
			d'/b	0.160	
p/f_{ck}			p/f_{ck}	0.064	
$P_u/f_{ck}bD$ value			$P_u/f_{ck}bD$	0.252	
$M_{ux1}/f_{ck}bD^2$ value (from SP 16:1980 charts)			$M_{ux1}/f_{ck}bD^2$	0.110	
Uniaxial moment capacity (longer direction)			M_{ux1}	**464.0625**	kNm
$M_{uy1}/f_{ck}bD^2$ value (from SP 16:1980 charts)			$M_{uy1}/f_{ck}bD^2$	0.095	
Uniaxial moment capacity (shorter direction)			M_{uy1}	**160.3125**	kNm
P_u/P_{uz} ratio			P_u/P_{uz}	**0.368**	
Value of exponent				1.280	
Interaction ratio				**0.584**	
Percentage reinforcement satisfactory or not				**safe**	
b/D ratio			b/D	0.4	
Status of dimensions				**REVISE**	
Gross area			A_g	225000	mm^2
Area of core			A_k	156400	mm^2
Spacing of lateral ties			S	75	mm
Larger dimension of the hoop			H	230	mm
Cross sectional area of hoop			A_{sh}	68.10	mm^2

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DESIGN OF SLAB - S1

Design of two way Slab

Basic Data

Grade of concrete (fck)		=	M 25	
Grade of steel (fy)		=	Fe 500	
Thickness of slab (D)		=	125	mm
Clear cover (cc)		=	20	mm
Effective thickness of slab (deff)	= 125 - 20 - 8 /2	=	101	mm
Unit weight of concrete		=	25	KN/m^3
Effective Shorter Span (Lx)		=	3.15	m
Effective Longer Span (Ly)		=	3.3	m
Aspect ratio Ly/Lx		=	1.05	**Two way slab**

Edge Condition : **Three Edges Discontinuous(One Short Edge Continuous)**

Load Data

Dead Load	= 0.13 x 25	=	3.125	KN/m^2
Floor finish		=	1.50	KN/m^2
Imposed Load		=	2.00	KN/m^2
Total load		=	6.63	KN/m^2
Design load (Wu) = 1.5 x 6.625		=	**9.94**	KN/m^2

Moment and Shear Calculations

Short Span Direction

ax for positive moment			1	→	0.043	
			1.1	→	0.051	
		for	1.05	αx =	0.047	
Positive moment Mx :	0.047 x	9.94 x	3.15 ^2	=	**4.6**	KN-m
ax for negative moment			1	→	0.000	
			1.1	→	0.000	
		for	1.05	αx =	0.000	
Negative moment Mx :	0.000 x	9.94 x	3.15 ^2	=	**0.00**	KN-m

Long Span Direction

For positive moment				αy =	0.043	
Positive moment My :	0.043 x	9.94 x	3.15 ^2	=	**4.2**	KN-m

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For negative moment αy = 0.057

Negative moment My : 0.057 x 9.94 x 3.15 ^2 = **5.62** KN-m

Shear force V_u = 9.94 x 3.2 x 0.5 = **15.65** KN

Check Effective Depth for Bending

Depth required = $(M_x / (0.133x\ fck \times b))^{1/2}$ = 37.26 mm

Depth provided = 125 - 20 - 8 /2 = 101 mm

Hence O.K

Reinforcement calculations

Short Span Direction @ Support

$Mu/bd^2 = \frac{0.00 \times 10 \wedge 6}{1000 \times 101 \times 101} = \mathbf{0.000}$

Pt = **0.00** %

Area of steel Ast = 0.00000 x 1000 x 101 = 0 mm^2

Minimum area of steel: 0.0012 x 1000 x 125 = 0.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 0.00 = 0 mm

Ast provided = 335.104 mm^2

Check for Spacing

Minimum of 1) 3d = 303 mm

2) = 300 mm

3) = 0.00 mm

Therefore provide Y **8** @ **150** mm C/C

Short Span Direction @ Mid Span

$Mu/bd^2 = \frac{4.62 \times 10 \wedge 6}{1000 \times 101 \times 101} = 0.452$

Pt = 0.106 %

Area of steel Ast = 0.00106 x 1000 x 101 = 107.393 mm^2

Minimum area of steel: 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.933 mm

Ast provided = 335.104 mm^2

Check for Spacing Safe

Minimum of 1) 3d = 303 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C 150

Provided % of Tension Reinforcement (pt) = **0.332** %

Long Span Direction @ Support

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Mu/bd^2 = 5.62 x 10 ^ 6 / (1000 x 101 x 101) = 0.551

Pt = 0.130 %

Area of steel Ast	=	0.00130	x	1000 x	101	=	131.411	mm^2
Minimum area of steel:		0.0012	x	1000 x	125	=	150.00	mm^2
Spacing of Y	**8** bars	50.27	x	1000 /	150.00	=	334.933	mm
Ast provided						=	335.104	mm^2
Check for Spacing							Safe	

Minimum of	1) 3d	=	303	mm
	2)	=	300	mm
	3)	=	334.93	mm

Therefore provide Y **8** @ **150** mm C/C

Long Span Direction @ mid Span

Mu/bd^2 = 4.24 x 10 ^ 6 / (1000 x 101 x 101) = 0.416

Pt = 0.097 %

Area of steel Ast	=	0.00097	x	1000 x	101	=	98.4749	mm^2
Minimum area of steel:		0.0012	x	1000 x	125	=	150.00	mm^2
Spacing of Y	**8** bars	50.27	x	1000 /	150.00	=	334.933	mm
Ast provided						=	335.104	mm^2
Check for Spacing							Safe	

Minimum of	1) 3d	=	303	mm
	2)	=	300	mm
	3)	=	334.93	mm

Therefore provide Y **8** @ **150** mm C/C

Check for Deflection:

Basic Span/depth Ratio	=	20	
% of Tension Reinforcement provided (pt)	=	0.332	%
Service stress of steel (fs) : 0.58fy(Ast_r/Ast_p)	=	92.94	N/mm^2
Modification Factor for Tension Reinforcement (F1)	=	2.00	
Allowable Span/Eff Depth Ratio	=	40	
Actual Span/Eff Depth Ratio = 3.15 x 1000 / 101	=	31.19	

Hence O.K

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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

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.