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DIGITALLY VERIFIED RECORD

Project :	**PROPOSED RESIDENTIAL GROUP HOUSING PHASE -8 Coimbatore.**
Structural Consultant	**Mithran Structures Private Limited** Coimbatore - 641043
Architect	**INFINUS TECH, COIMBATORE**
Title :	**ANANYA'S NANA NANI RESIDENTIAL GROUP HOUSING PHASE-8 – Analysis & Design Report**

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Chapter 1 INTRODUCTION

1.1 General

This document details the input data, principles, methods and performance criteria to be used in the structural engineering design of the project.

1.2 Scope

The Proposed Stilt+5 Floors residential group housing is located at S.F. No:830, 832/2, 833/1, 833/2 & 866/2, Kalikkanaickenpalayam Village, Dhaliyur Town Panchayat, Perur Taluk within the limits of Coimbatore Corporation. This report presents the details of structural analysis and design of the building for static loading. The sizes and details of the sections of RC elements are based on detailed analysis, which is elaborated in this report. This report specifies the details of structural layout, mathematical model, material properties, loads and load combinations, static analysis results, design summary for Isolated footings, columns, beams and slabs.

Chapter 2 DESCRIPTION OF BUILDING

The Proposed Building consists of Stilt+5 floors. Stilt floor consists of parking space, remaining floors comprises of residential flats. Isolated footings are provided. Safe bearing capacity of the soil for the footings is considered as per Geo-technical Investigation report.

Chapter 3 LOADS & LOAD COMBINATIONS

3.1 General

This chapter discusses applicable loading for structural analysis & design of the proposed building. The loading is classified and described in the following paragraphs

3.2 Description of types of loading & Load calculation

Dead load & Live Loads are considered for analysis and design as per relevant Indian Standards and Specifications applicable to Coimbatore region.

The sizes of members have been fixed based on stiffness criterion and based on compatibility with architectural drawings.

3.2.1 Dead load comprises of self-weight of various structural elements indicated below:

- Self-weight of Columns, beams, slabs, brick walls.
- Floor & roof finishes.

Self-weight of the modeled elements is assigned in Staad.Pro Advanced Software. The applied floor loads are distributed on the beams as trapezoidal or triangular loads in two way slabs and as rectangular loads in one way slab.

Loads from components like brick walls are applied explicitly as member loads and UDL (Uniformly Distributed Load) as applicable.

Component	Unit weight (kN/m^3)	Thickness (mm)	Area load (kN/m^2)
RCC Slab	25	125	3.125
Floor Finish	-	-	1.00
Partition wall load	-	-	0.50
Terrace Floor Finish	-	-	1.50

Calculation of Brick wall load.

Height of brick wall = 2.7m (3.0m - 0.30m)

DL of 230mm tk. Brick wall = 11.8 kN/m. (0.23x2.7x19)

DL of 115mm tk. Brick wall = 5.9 kN/m. (0.115x2.7x19)

FLOOR FINISHES:

Living, Kitchen, Bedroom,Toilet, Parking	-	1 kN/sq.m + 0.5 kN/sq.m (Partition wall Load) = 1.5 kN/sq.m
Terrace	-	1.5 kN/sq.m

3.2.2 Live Loads are considered for the analysis in addition to dead loads as follows,

Living, Kitchen, Bedroom, Toilet	-	2 kN/sq.m
Staircase, Balcony, Corridor	-	3 kN/sq.m
Lift	-	10 kN/sq.m
Terrace	-	2 kN/sq.m

3.3 LOAD COMBINATIONS

STRENGTH LOAD COMBINATIONS

1.5 (DL)

1.5 (DL + LL)

SERVICE LOAD COMBINATIONS

1.0 (DL + LL)

Chapter 4 MATERIAL PROPERTIES

4.1 General

This chapter describes the physical and elastic properties for various materials used. These are used for defining the stiffness calculation of the modeled structural members and lumped mass calculations for static analysis model.

4.2 Elastic & Physical Properties

The elastic properties of materials used are tabulated below in Table 1

Table.1 – **Elastic properties of materials**

S.No.	Material	Elastic Modulus (MPa)	Poisson's Ratio
1	Normal density reinforced concrete (M25 Grade)	25000.00 calculated using $5000\sqrt{fck}$	0.15

4.3 Grade of Reinforcement

Reinforcement of Fe-550 is used for RCC design.

4.4 Unit Weight of Materials

Unit weight of various materials used are given below

Reinforced cement concrete = 25 kN/m^3

Brick Weight = 19 kN/m^3

Chapter 5 ANALYSIS

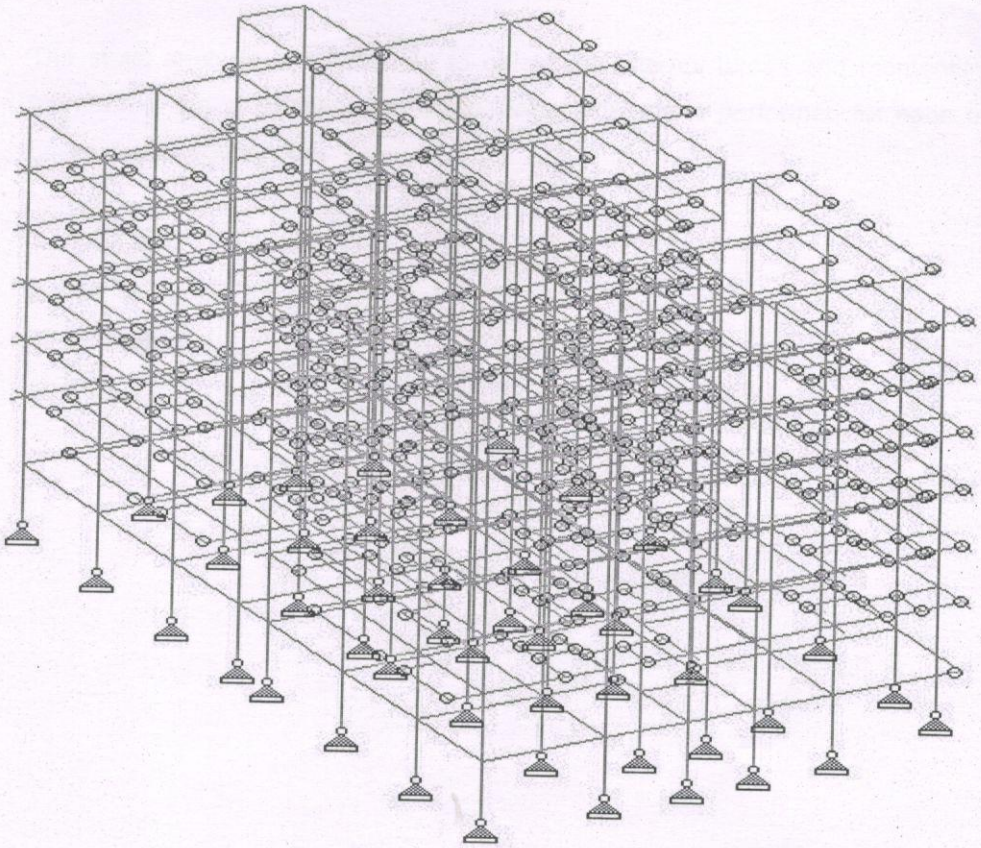
5.1 General

The analysis of the structure is carried out by mathematical modelling of the structure in Staad.Pro Advanced Software and performing an analysis run.

5.2 Mathematical Modeling of Structure

The Proposed building is modeled and analyzed using Staad.Pro Advanced Software. The physical structure of building is transformed into a mathematical model for structural analysis using 3D frame elements. Entire structure is composed of integrated three dimensional structure of columns and beams forming frames tied together to act as one unit responding to the loading on the structure. The discretization of the structure involves structural components such as Isolated Footings & columns, RC beams and RC slabs.

Fig. 1 – 3D Model of the Structure



5.3 Approximations in Modelling

Following approximations are made in the modelling of the building:

1. Offset eccentricities between centre-line of column & beams are ignored. Accordingly, nodal co-ordinates are fixed.
2. The components such as slabs and brick walls are neglected in modelling, but their loading effect on the structure is accounted.
3. Column positions are shifted marginally for aligning them along the grid lines.

5.4. Boundary Conditions

For the purpose of analysis and design, the bottoms of the columns are fixed at the footing level.

5.5 Analysis for Static Loading

The static analysis is carried out to obtain the internal forces and moments on all the member of the structure under static loads. Analysis is performed for each of the load cases mentioned below.

1. Dead load
2. Live load

Chapter 6 DESIGN OF RC MEMBERS

6.1 General

Limit State design using IS: 456-2000 is carried out for RC beams and columns using the forces obtained from the critical combination of loads from the analysis results in Staad.Pro Advanced Software. Other components like Isolated footings and Slabs are designed using simplified provisions as per applicable codes with the help of spread sheets developed in-house.

6.2 Nominal Clear Cover to Reinforcement

Nominal clear cover used for various elements are listed below:

Isolated Footing	:	50mm
Column	:	40mm
Roof beam	:	25mm
Slab	:	20mm

6.3 Foundation Parameters

The following parameters are used in the design of Isolated footing.

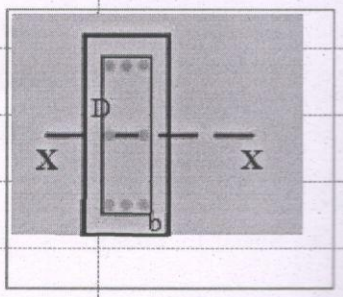
Safe baring capacity of soil	=	25 T/m^2
Footing depth from GL	=	3.0m

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DESIGN OF COLUMN

OLUMN ID : C1 (230 x 450) STILT - TERRACE FLOOR (GRID E5)

Column Dimensions:						
Breadth, 'b' =	230	mm				
Depth, 'D' =	450	mm				
Concrete Grade =	M	25				
Yield Strength of Steel, fy =	550	N/mm2				
Concrete Cover to main bars =	48	mm				
Details of Reinforcement:						
Diameter of bars =	20	mm				
No. of bars on 230 mm face =	3					
No. of bars on 450 mm face =	3		**# 8 - 20**			
Total number of bars =	8					
Total A_{st} =	2513	mm2				
Percentage of Reinforcement =	2.428	< 4% O.K.				



COLUMN SECTION

(Max. nos. of bar that can be shown in the section at each face =6 only)

Col. Mk.	Applied Ultimate Loads: Axial Load Pu (kN)	Initial Moment Mu-ix(kN.m): M^*_{uix1} (+ or -)	Initial Moment Mu-ix(kN.m): M_{uix2} (+ only)	Initial Moment M_{uiy}(kN.m): M^*_{uiy1} (+ or -)	Initial Moment M_{uiy}(kN.m): M_{uiy2} (+ only)	Effective Length L_{ex}, l_{ey} (m)	Un-Supported Length (m)	Braced / Unbraced Column	I/R	Status
260	1506.652	6.011		8.484		2.593	3.050	braced	0.734	Section O.K.
	1492.752		18.008		18.986	2.593	3.050	Braced	0.703	Section O.K.
308	1532.748	0		0		2.593	3.050	Braced	0.798	Section O.K.
	1521.226		0.332		1.308	2.593	3.050	Braced	0.769	Section

										O.K.
673	1234.753	28.212		33.172		2.593	3.050	Braced	0.596	Section O.K.
	1223.231		27.114		30.361	2.593	3.050	Braced	0.517	Section O.K.
936	971.022	24.708		28.546		2.593	3.050	Braced	0.441	Section O.K.
	959.5		25.79		28.674	2.593	3.050	Braced	0.448	Section O.K.
1199	709.578	25.873		29.494		2.593	3.050	Braced	0.487	Section O.K.
	698.055		26.684		29.478	2.593	3.050	Braced	0.493	Section O.K.
1462	449.689	24.541		28.885		2.593	3.050	Braced	0.542	Section O.K.
	438.166		26.558		27.49	2.593	3.050	Braced	0.537	Section O.K.
1725	190.574	17.425		35.15		2.593	3.050	Braced	0.626	Section O.K.
	179.051		18.623		43.261	2.593	3.050	Braced	0.758	Section O.K.

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STILT - TERRACE FLOOR

MAIN REINFORCEMENT : 8-Y20

STIRRUPS : 4 legged Y8 stirrups @ 8" c/c

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DESIGN OF BEAM

EAM ID : R22 (230 x 450) FIRST FLOOR

				Bar Diameter	Nos.	Ast
Input data :				12	5.1	576.5
Overall Depth	**Depth**	**450**		16	2.9	582.8
				20	1.9	596.6
Breadth	**Breadth**	**230**		25	1.2	588.8
				32	0.8	643.1
Factored Moment	**(Mu) kN.m**	**90**				
				Cl Cover	:	25
Torsion	**(Tu) kN.m**	**0**		Dia of stirrups	:	8
				Dia of bar	:	16
Equivalent Moment	**(Me) kN.m**	**90**		No of layers	:	2
				Eff Cover	:	49
Grade of Steel (fy) Mpa		**550**				
Grade of Concrete (fck) Mpa		**25**				
Effective cover Bottom(d')		**49**		B	:	230
Effective cover Top(dc)		**49**		D	:	450
Amount of redistribution (%)		**0**		Pt	:	0.67
Solution :				V	:	60
WITH OUT REDISTRIBUTION				Torsion	:	0
eff.depth(d)		**401**		Resultant V	:	60
Xu.max		**177.8**				
Ku.max		**0.443**		no of legs	:	2
Mu1		**120.1**		Dia of stirrups	:	8
ast1		**576.4**				
ast2		**0.0**		**Provide 8 dia @ 300 c/c**		
Ast		**576.4**				

		0.62		Section	Ok
d'/d		0.1			
fsc		348.1			
Asc		0.0			

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TOP REINFORCEMENT : 3-Y12

BOTTOM REINFORCEMENT : 3-Y12+2-Y12

SHEAR REINFORCEMENT : 2 legged Y8 stirrups @ 7" c/c

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DESIGN OF SLAB

Design of Slab

1	Size of the slab					
	Breadth of the slab	l_x	=	5.26	m	
	Length of the slab	l_y	=	6.48	m	
2	Assumed thickness of slab	D	=	125	mm	
3	Grade of concrete	f_{ck}	=	25	N/mm^2	
4	Grade of steel	f_y	=	550	N/mm^2	
5	Condition of slab		=	Interior panels		
6	Load considerations :					
	Self weight of the slab	W_{se}	=	3.13	kN/m^2	Loads as per IS 875-1987
	Floor finish loads on slab	W_{ff}	=	1.00	kN/m^2	Part I & II
	Live load on slab	W_{LL}	=	2.00	kN/m^2	
	Total dead load on slab	W_{td}	=	4.13	kN/m^2	
	Total live load on slab	W_{tL}	=	2.00	kN/m^2	
	Total Factored load on slab	TL	=	9.19	kN/m^2	

7 Bending moment & A_{st} Calculations :

Edge condition of the slab	=	Interior panels	BM coefficients as per
Shorter direction steel requirements :			IS 456-2000, Table 26

Support condition	Coeff a	BM M_u	M_u/bd^2	P_t % A_{st}	A_{st} mm^2	Bar spacing (mm) 8Ø	10Ø	12Ø
Continues supp.	0.044	11.1	1.0	0.22	231.9	220	315	315
Span moment	0.033	8.3	0.75	0.16	171.7	300	315	315
Discont. Support	0.042	10.6	0.96	0.21	221.2	230	315	315

Longer direction steel requirements :

Support condition	Coeff a	BM M_u	M_u/bd^2	P_t % A_{st}	A_{st} mm^2	Bar spacing (mm) 8Ø	10Ø	12Ø
Continues supp.	0.032	8.1	0.74	0.16	167.9	300	315	315

Span moment	0.024	6.1	0.55	0.12	150.0	315	315	315
Discont. Support	0.042	10.6	0.96	0.21	221.2	230	315	315

8	Check for under reinforced section :								
	Limiting moment of resistance	$M_{u\,lim}$	=	$0.138 \times f_{ck} \times bd^2$					As per IS 456-2000, Cl.38
			=	38.0	KN.m	>	11.1	KN.m	Under reinforced section
	Depth required for flexure	d	=	56.7	mm	<	105	mm	Depth is sufficient

9	Check the depth for deflection :								
	Diameter of the rod used provided spacing	f	=	8	mm				As per,IS 456-2000, clause 23.2.1
				125	mm				
	Percentage of steel	$\%A_{st}$	=	0.38%					
	MF due to effect of tension steel	MF	=	2.48					
	Depth required for deflection	d	=	82	mm	<	105	mm	Slab safe for deflection

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SLAB THICKNESS : 125mm

TOP REINFORCEMENT : SHORTER - Y8 @ 150mm, LONGER - Y8 @ 150mm

BOTTOM REINFORCEMENT : SHORTER - Y8 @ 125mm, LONGER - Y8 @ 125mm

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DESIGN OF ISOLATED FOOTING

sign of Isolated Footing : C1-F4

	Design of Isolated square footing					
1	Factored load on the column		P_u	=	1650	kN
2	Safe bearing capacity of soil		SBC	=	250	kN/m^2
3	Grade of concrete		f_{ck}	=	25	N/mm^2
4	Grade of steel		f_y	=	550	N/mm^2
5	Size of column					
			b	=	230	mm
			D	=	450	mm
6	Area of footing		A	=	4.8	m^2
7	Footing dimensions		l	=	2.20	m
			b	=	2.20	m
	Ultimate pressure below foundation			=	340.9	kN/m^2
8	**Depth for Punching shear**					
	Design shear strength		t_c	=	1.25	N/mm^2
9	Actual punching shear equation	=	d^2		d	const
			-0.3		-231.82	1614715.909
	Allowable punching shear equation	=	d^2		d	const
			5.0		1700.0	0
	Depth required for punching shear		d	=	***398.0***	mm
10	***Depth for Bending moment***					
	BM about minor axis of column		m_u	=	165.4	kN.m
	Depth required for bending moment		d	=	***223.0***	mm
	Depth taken for iteration calculations		D	=	450.0	mm

11	***Depth for one-way shear***				
	Iterated Percentage of steel	p_t	=	0.13	%
	Design shear strength	t_c	=	0.27	N/mm^2
	Depth required for One way shear	d	=	***486.8***	mm
		D	=	550.0	mm
	Governing depth of footing	D	=	*575*	mm
	Size of footing to provide	=		*2.2m x 2.2m x 0.575m*	
12	***Area of steel calculation***	A_{st}^2		A_{st}	Const
		10.5		-251213	165379261
		A_{st}	=	***1491***	mm^2
13	***Size of footing to provide***	=		*2.2m x 2.2m x 0.575m*	

14	***Reinforcement to provide***	=	Dia	no. bar	Spacing	c/c
			10.0	19	110.00	mm
			12.0	14	150.00	mm
			16.0	8	260.00	mm

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FOOTING SIZE : **2.2m x 2.2m x** 0.6m

BOTTOM REINFORCEMENT : Y12 @ 125mm c/c

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Ask anything about a property and get an answer grounded in live government records, with the sources shown.
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Verify My Land
Every record check run on one property and returned as a single report.
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Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
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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.
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Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
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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.
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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
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The LandLens suite
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- Land survey, soil testing, architecture and construction

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