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STRUCTURAL ENGINEERING
DESIGN BASIS REPORT

FOR

ASHIANA SHUBHAM CARE HOMES AT CHENNAI

Architects

B.SENGUPTA ARCHITECT
A-305,RANGOLI, ASHIANA VILLAGE

Document No. 717/S/DB-01A

CIVTECH	
GOOD FOR CONSTRUCTION	
DATE	26 April 2025
	
SIGNATURE	

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A. INTRODUCTION

This document specifies the various design considerations and assumptions for the Structural Engineering Design of the proposed housing.

Our scope of design consists of structural analysis, design and detailing for the Care Home. The proposed building configuration is G+3.

B. STRUCTURAL SYSTEM

The structure will be RC building with special moment resisting frame (SMRF). This structure type is the most economical system for this type of building in consideration of the latest applicable codes. Etabs model will be prepared for each building, from which the analysis results and member design will taken.

Lift Shear walls will be 230 mm thick & minimum 320 mm thick columns. All external walls shall be of 230 mm thick Fly Ash brick with internal walls thickness as per architecture. The external & internal beams are generally proposed as 500 mm deep in the towers.

All the lateral loads will be taken by columns and the building will be designed as SMRF as per IS 1893:2016. The slabs will be modeled as 'Shell thin elements'. The columns will be modelled as 'line element' with modification factor of 0.7. and beams will be modelled as line element with modification factor of 0.35 for design purpose. The Lift Shear Walls will be modelled as shell elements with appropriate modification factors as per analysis.

Long term deflection for all members will be ensured within limits of IS: 456:2000.

In all the shafts reinforcement will be continued and slab will be casted after laying of plumbing pipes/services.

C. METHOD OF ANALYSIS AND DESIGN

The building shall be analyzed as 3-D structure with shear walls/columns as vertical members and beam and slab as horizontal members. Analysis will be carried out both for vertical (dead and live loads) as well as horizontal loads (earthquake /wind loads) for different load combinations. The analysis & design of idealized model is carried using "ETABS" computer program providing design for beam & RCC walls/columns as per IS 456-2000. For Seismic analysis slab at each floor has been idealized as rigid diaphragm so that all frames sway equally under lateral loads, with masses lumped at the joints with 5% damping. Seismic Coefficients are as applicable to Seismic Zone III as per IS-1893:2016. Dynamic analysis shall be done for the structural performance of the building. The slab panels shall be designed for Dead & Live loads as per IS-456:2000.

All stiffener modifiers as per IS1893:2016 to be considered for design for serviceability and collapse conditions.

Minimum design earthquake horizontal lateral force for buildings will be as per Table 7 of IS 1893:2016.

D. DEAD LOADS

The dead loads for the RCC members are considered on the basis of the density of RCC as 25 KN/cum. The density of Fly Ash wall is taken as 18 KN/cum i/c of plaster on both sides.

Dry Density of Block wall = 18 kN/cum

Average density considering 10mm plaster on both sides:

For 230mm thk Wall: $\{(3.3-0.5) * (0.230+0.02) * 18\} = 12.6$

For 115mm thk Wall: $\{(3.3-0.5) * (0.115+0.02) * 18\} = 6.8$

The allowance for the floor finish is considered as 50 mm for Typical Floor, Lobbies, Arrival.

E IMPOSED LOADS

The Imposed Loads are considered as per IS: 875 as follows:

- | | |
|--|--------------------------|
| a) Living Area | = 2 KN/m ² |
| b) Roof with access | = 1.5 KN/m ² |
| c) Roof without access | = 0.75 KN/m ² |
| c) Toilets | = 2 KN/m ² |
| e) Stair, Landings, corridors, Balcony | = 3 KN/m ² |

Load due to equipment shall be restricted to the areas as per Architectural drawings

Live load reduction will be considered as per clause 3.2.1 of IS 875 Part 2

F SEISMIC LOAD

The site is located in Seismic Zone III, and Seismic Loads are considered for Zone III as per IS: 1893-2016 with the following factors:

Zone Factor (Z)	0.16
Importance Factor (I)	1.0
Response Reduction Factor (R)	5.00
Time Period (Ta)	as per clause 7.6.2(c) of IS 1893

The structural system is considered as RC Special Moment Resistant Frame (SMRF) with ductility details as per IS: 4326 and IS: 13920. Unreinforced masonry infill walls without any openings are modelled as per clause 7.9 of IS-1893:2016.

For the purpose of the Response Spectrum, the soil is considered as Medium Soil. Vertical earthquake as per code will be considered. As per clause 7.8.1 of IS-1893:2016 (Part-1) Dynamic analysis will be performed to obtain design seismic forces and its distribution along various levels along the height of the building for all the buildings, after equating equal base shear in static and dynamic loading.

G. WIND LOAD

Wind Load is considered based upon basic wind speed of 50m/s as per NBC 2016. Terrain Category is considered as Category 3. Building structure shall be designed for the applicable external wind pressure. For overall wind load calculation for frames and foundation design, force coefficient method will be used as per Fig 4 of IS 875 (Part 3). In addition to normal wind, dynamic wind load with cross wind will be considered. Gust factor wind loading will be applicable as per latest code IS:875-2015 (Part-3).

H. DESIGN LOAD COMBINATIONS

The structure shall be designed for the following load combinations as stipulated by IS:1893-2016.

1.5DL + 1.5LL
1.2DL + 1.2LL +/- 1.2EQX
1.2DL + 1.2L L +/- 1.2EQY
1.5DL +/- 1.5EQX
1.5DL +/- 1.5EQY
0.9DL +/- 1.5EQX
0.9DL +/- 1.5EQY
1.2DL + 1.2L L +/- 1.2WLX
1.2DL + 1.2L L +/- 1.2WLY
1.5DL +/- 1.5WLX
1.5DL +/- 1.5WLY
0.9DL +/- 1.5WLX
0.9DL +/- 1.5WLY

Where	DL	=	Dead load
	LL	=	Live load
	EQX/EQY/EQZ	=	Earthquake loads in X, Y and Z direction
	WINDX/WINDY	=	Wind loads in X and Y direction

CWINDX/CWINDY = Cross wind load in X and Y directions

As all lateral load resisting elements are oriented along two mutually orthogonal horizontal directions, there is no need of considering 30% of earthquake load from the perpendicular direction, but vertical earthquake will be considered (refer IS1893:2016, Cl 1.6.3.3). Load combination for serviceability check will be as per table 18 of IS 456 provisions.

I. DURABILITY CRITERIA

The materials and mix proportions specified and used should be such as to maintain its integrity and to protect embedded metal from corrosion. Proper shape and size of member and adequate cover to reinforcement shall be used in design to keep concrete durable as per the code provisions. For the purpose of durability of the structure, the following Exposure Conditions are considered:

- | | |
|-------------------------------------|----------|
| a. Foundation | Moderate |
| b. Beams, Slabs, Columns, RCC Walls | Moderate |

Moderate exposure is considered as concrete exposed to condensation and rain, and/or in contact with, or buried under non-aggressive soil/ ground water, and also for concrete surfaces sheltered from saturated salt air in coastal areas.

J. FIRE RESISTANCE.

The building is Type 2 Building (Refer Table-19 of N.B.C Part-4-2016). Fire Resistance provision for Structural member as per IS456:2000 (Fig 1 and Table 16A) are provided considering a building as Type 2 as follows:

- | | |
|----------------------------------|-----------------------|
| Columns, Shear Walls, Staircases | 2.0 hours Fire Rating |
| Beams and Slabs | 1.5 hours Fire Rating |

50

K. FOUNDATION

Recommendations of foundations is referred from soil investigation report.

L. MATERIALS OF CONSTRUCTION:**RCC WORKS**

The cement used for RCC work in the sub structure & super structure will be OPC (Grade 43 and 53) conforming to IS: 8112-1989 and 12269-1987 with fly ash (max 25%) or Portland Pozzolana cement (fly ash based) conforming to IS 1489 (Part 1). The Fly Ash will conform to Grade I of IS: 3812. All RCC works will be mechanically vibrated to produce dense, sound and durable concrete as per specifications. The water used in all stages of construction including curing shall strictly conform to IS: 456-2000.

Minimum grade of RCC shall be M 25 with minimum cement content of 300 kg/cum. Grade of concrete for various members is as below

RCC column/Shear wall	M25
Beam and slabs, stairs	M25
Foundation	M25
Water tanks	M30

Lean Concrete of minimum 100mm thickness of lean concrete mix 1:4:8 or (M7.5 grade) using 20mm down size graded crushed stone aggregate shall be provided under all RCC foundations.

M. REINFORCEMENT

All reinforcement bars will be TMT bars of Fe500 grade with min elongation of 14.5 % as per IS 1786 and dia varying from 8 mm to 32 mm will be used. The confining reinforcement in shear walls/columns will also be of Fe500 grade. The min Dia of bars used for various components will be as below:

a.	Shear walls vertical steel	12 mm in Boundary zone
b.	Shear walls vertical steel	10 mm in non-Boundary zone
c.	Shear wall confining steel	8 mm
d.	Column vertical steel	12 mm
e.	Column stirrups/ties	8 mm
f.	Beam stirrups	8 mm
g.	Beams longitudinal steel	12mm
h.	Slab steel	8 mm

Clear cover to any reinforcement shall be as follows for Fire Rating as Type 2 and for the specified durability criteria.

1. Slab (roof & floor) Canopy, Chajja, Waist slab of staircases	30mm
2. Beams (Roof & floor) & Lintels	30mm
3. Columns/Pedestals	40mm
4. RCC Shear Walls	40mm
5. Foundation slab, base slab & footings in contact with soil	50mm
6. Retaining Walls (earth side)	40mm
7. Retaining Walls (inside)	30mm

N. DETAILING OF RCC STRUCTURE

Detailing of RCC structure will conform to IS: 456-2000 and as per IS 13920: 2016. For laps of column/shear-walls reinforcement, approved mechanical couplers (Parallel Type) may be provided for bars of dia 16mm and above as per IS 16172: 2014.

Min/Max rebar percentage as per IS 456 Cl 26.5

	Minimum %	Maximum %
Column	0.8%	4.0%
Beams	0.2%	2.5%
Slab	0.12%	
Shear wall	As per IS13920:2014 (Cl 10.1)	

O. SERVICEABILITY CRITERIA

Vertical Deflection of beams / slabs will be limited to following:

The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the, supports of floors, roofs and all other horizontal members, should not normally exceed span/250.

The deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and the application of finishes should not normally exceed span/350 or 20 mm whichever is less. Although, this criteria is generally satisfied by providing span / depth ratios given in clause 23.2.1 of IS 456, deflection of critical members will be checked by calculating actual deflections.

Horizontal deflections due to wind loads will be limited to height of building/500 and due to seismic loads will be limited to height/250. The drift at each story will be limited to $h_i/250$. For

estimation, deflection from first mode of dynamic analysis shall be considered without any scaling factor.

P. DYNAMIC ANALYSIS

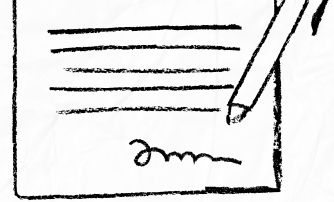
Dynamic Analysis by Response Spectrum Method with IS code spectra will be performed. The number of modes to be used in the analysis will be taken so that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic Mass. The peak response quantities (for example, member forces, displacements, storey forces, storey shears and base reactions) shall be combined as per Complete Quadratic Combination (CQC) method. It will be tried to keep the first two modes as Translation mode and third mode as rotational mode with sufficient gap between translation and rotational modes in order to have minimum torsion in the building. In load combinations Spectra X and Spectra Y will be substituted for EQX and EQY respectively i.e only dynamic loads will be used in design for combining with dead and live loads.

Q. REFERENCE CODES TO BE FOLLOWED

For the structural design of the building reference is made generally to the following IS Codes:-

- 1) IS 456: 2000 - Code of Practice for Plain & Reinforced Concrete
- 2) SP 16 : Design Aid to IS 456:2000
- 3) IS 13920: 2016 - Ductile Detailing of reinforced Concrete Structures subjected to seismic forces
- 4) IS 4326: 1993 - Code of Practice for Earthquake Resistant Design and Construction of buildings
- 5) IS 875 Part 1, Part 2 & 3-2015: Code of Practice for Design loads (other than Earthquake) for Building and structures
- 6) IS 1893: 2016 - Criteria for Earthquake Resistant Design of structures
- 7) IS 1904: 1986 - Design and Construction of foundation in soils: General Requirements
- 8) IS 8009: 1976 - Calculation of settlement of shallow foundations
- 9) IS 800: 2007 - Code of Practice for General construction in steel
- 10) IS 1786 - Spec for High Strength Deformed steel bars and wires for concrete reinforcement
- 11) IS 8112: 1989 - Specification for 43 Grade Ordinary Portland Cement
- 12) IS 12269: 1987 - Specification for 53 Grade Ordinary Portland Cement
- 13) IS 2950: 1981 - Design and Construction of Raft Foundations





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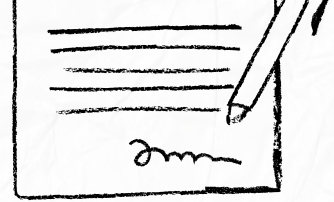
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Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management



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