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sankar & associates
architecture . engineering . interior design

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STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed Construction of Building **SHRIRAM GREEN MEADOWS - PHASE 2, Comprising of Ground floor + 6 Floors Tower No - 10 - 48 Dwelling Units and Ground floor + 6 Floors, Tower No – 14 - 72 Dwelling Units (Totally - 120 Units);** at Survey No's-16/4A, 16/4B, 65/4A, 65/5A, 65/5B, 76/4, 76/5, 77/1A, 77/1B, 77/2B, 77/2C1A, 77/2C1B, 77/2C1C, 77/2C1D, 77/2C1E, 77/2C1F, 77/2C2, 77/3A, 77/3B, 78/1, 78/2, 79/1, 79/2, 80/1, 80/2, 81/1, 81/2, 82, 83, 85, 86/1B, 86/1C, 86/2A, 86/2B, 87/1A, 87/1B1, 87/1B2, 87/2A, 87/2B, 87/2C, 88/1, 88/2, 88/3, 89/2, 89/3A, 89/3B, 89/3C, 89/4A, 89/4B, 90, 95/4A, Perumattunallur village, Vandalur Taluk, Chengalpattu District has been done by us based on the report of geotechnical investigation (soil test) done by **GEO MARINE CONSULTANTS (P) LTD.** Report No. **GM- SHRIPROP STRUCTURES PVT LTD – GUDUVANCHERI – JC - GT-2202, Dated-18.02.2014** and considering the functional requirement of the building.

It is certified that among other factors, the proposed building has been designed to resist earthquake. We have checked various parameters and found that the proposed building would be safe.

We 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 Codes No IS-875 Pat I, II and design of earthquake resistant structure as per IS Code No IS 456.

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

Coimbatore
04.06.2026

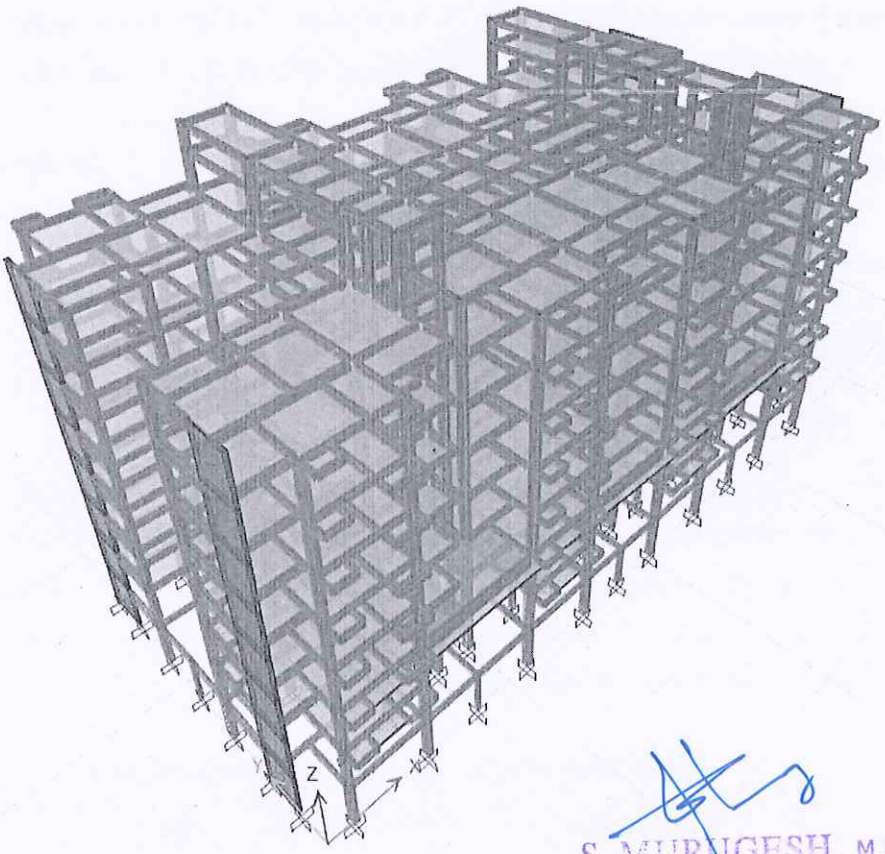
For Sankar & Associates

S. MURUGESH, M.E.,FIE.,
Chartered Engineer F-1279323
Structural Engineer Grade-I
CMDA/SE/GR-I/2022/05/320

Encl.: Structural Design Calculation

STRUCTURAL DESIGN REPORT

"THE BUILDING UNDER CONSTRUCTION IN S.F. No's:- SF.Nos. 16/4A, 16/4B, 65/4, 65/5A, 65/5B, 76/4, 76/5, 77/1A, 77/1B, 77/2B, 77/2C1[A,B,C,D,E,F], 77/2C2, 77/3A, 77/3B, 78/1, 78/2, 79/1, 79/2, 80/1, 80/2, 81/1, 81/2, 82, 83, 85, 86/1B, 86/1C, 86/2A, 86/2B, 87/1A, 87/1B1, 87/1B2, 87/2A, 87/2B, 87/2C, 88/1, 88/2, 88/3, 89/2, 89/3A, 89/3B, 89/3C, 89/4A, 89/4B, 90 & 95/4 Perumattunallur Village, Chengalpattu Taluk, Kanchipuram District."



TOWER 10

S. MURUGESH, M.E.,FIE.,
Chartered Engineer F-1279323
Structural Engineer Grade-I
CMDA/SE/GR-I/2022/05/320

SANKAR & ASSOCIATES, ARCHITECTS & PLANNERS, COIMBATORE-641 009

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

sankar & associates
architecture engineering interior design

Name of Project:		Name of the Structure:
SHRIRAM SHANKARI APARTMENT		RESIDENTIAL BUILDING -TOWER 10
Report by:	**Checked by:**	**Approved by:**
P.VETRIVELAVAN	S.MURUGESH	V.P.PONNUSWAMI

I. DESCRIPTION OF THE PROJECT:

The Proposed structure belongs to "M/S. SHRIPROP STRUCTURES PVT. LTD. at Perumattunallur - Chennai." Coimbatore. Purpose of this structure is to house "SHRIRAM SHANKARI APARTMENTS TOWER10". The structure is designed for Stilt + 6 typical floors. The location of the proposed structure is in Seismic zone III {As per IS1893: (Part 1)–2016-(annex-E)} in India. The structural design was carried out as per IS456-2000. The dead load and live load are calculated based on IS 875: Part I & II. Seismic loads are considered as per IS 1893:2016. The structure was analyzed using the software- ETABS..

II. MATERIALS:

- **CONCRETE**

Concrete used for structural purpose shall be of grade M25 and comply with the relevant provisions of IS: 456 - 2000. Normal coarse aggregates shall be used for all concrete works. Ordinary Portland cement - Grade 43/53 (conforming to IS 8112/12269), Portland Pozzolana Cement (conforming to IS: 1489 (Part 1) shall be used in all structural concrete works.

Structural Elements	Grade of concrete
Foundation	M25
Upto Stilt Roof for Column / Walls	M25
Above Stilt Roof for Column / Walls	M25
Beam and Slab	M25

S. MURUGESH, M.E.,FIE.,
Chartered Engineer F-1279323
Structural Engineer Grade-I
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- **REINFORCEMENT**

Steel reinforcement shall be Grade Fe500. It shall confirm to IS: 1786-2008.Elongation percentage shall be 16%.as per IS-1786-2008

- **STRUCTURAL DESIGN STANDARDS**

Latest revisions of all applicable codes shall be mentioned below, Unless otherwise mentioned:

Loads:

- IS:875 -1997 Code of Practice for design loads for Buildings and structure (Part- 1, 2, 4 & 5).
- IS:875 -2015 Code of Practice for design loads for Buildings and structure (Part- 3 - Wind Loads).
- IS: 1893-2016 Criteria for earthquake resistant design of structure (Part-1).

Foundations:

- IS:1080-1997 Code of Practice for design and construction of shallow Foundations on soils (other than raft, ring and shell).
- IS:1904-1995 Code of Practice for design and construction of foundations In soils general requirement.
- IS:2950-1998 Code of Practice for design and construction of raft Foundations.
- IS:2974-1998 Code of Practice for design and construction of machine Foundations (All parts)
- IS:8009-1998 Code of Practice for calculation of settlement of Foundations.

RCC:

- IS: 456 -2000 Code of Practice for plain and reinforced concrete.
- IS: 16700 -2023 Criteria for structural safety of tall concrete buildings.
- IS: 458 -1988 Specification for precast concrete pipes.
- IS:3370-2009 Code of Practice for concrete structures for the storage of Liquids: (All parts)

- IS:4326-1993 Code of Practice for earthquake resistant design and Construction of buildings.
- IS:5525-1999 Recommendation for detailing of reinforced concrete works
- IS:1786-2008 Specification for high strength deformed steel bars and Wires for concrete reinforcement.
- IS: 10262-1999 Recommended guidelines for concrete mix design.
- IS:13920-2016 Code of Practice for ductile design & detailing of Reinforced concrete structures subjected to seismic forces.

Structural steel:

- IS:800 -2007 Code of Practice for general construction in steel
- IS:802 -1995 Code of Practice for use of structural steel in overhead Transmission line towers: (All parts)
- IS:806 -1996 Code of Practice for use of steel tubes in general Building construction
- IS:808 -1989 Dimensions for hot rolled steel beam, column channel and Angle section
- IS:816 -1998 Code of Practice for use of metal arc welding for general Construction in mild steel
- IS:1161-1998 Steel tubes for structural purposes
- IS:4000-1998 High Strength bolts in steel structures – Code of Practice
- IS:7215 -1995 Tolerances for fabrication of steel structures

Miscellaneous:

- IS: 432(PII)-1995 Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement
- IS: 6313(PII)-2001 Standards for anti-termite treatment
- IS:1905-1998 Code of Practice for structural use of unreinforced masonry
- IS:3067-1995 Code of Practice for general design details and preparatory Works for damp proofing and water proofing of buildings

- SP:6 -1998 Handbook for structural engineers (All parts)
- SP:7 -2016 National Building Code of India
- SP:16-1999 Design Aids for reinforced concrete to IS:456-1978
- SP:22-1982 Explanatory handbook on codes for earthquake engineering (IS: 1982-1975 and IS: 4326-1976)
- SP:24-1983 Explanatory handbook on Indian Standard code of Practice For plain and reinforced concrete
- SP:34-1987 Handbook of concrete reinforcement and detailing (SCIP)

Note: Only latest revisions of the codes, unless otherwise mentioned, shall be referred to for the purpose of this tender.

III. LOADS

Structures shall be designed for structural stability and integrity to resist safely and effectively all loads and effects of load combinations that may reasonably be expected during the lifetime of the structure. The design loads used for the structures, buildings and foundations shall conform to the requirements of the governing codes and specifications. As a minimum the design loads shall include dead load, super-imposed dead load, live load, wind load and seismic load.

DEAD LOAD:

Dead load shall include weight of all structural and Architectural components. Self-weight of the materials shall be calculated on the basis of unit weights given in IS: 875.

Material Density:

1. Unit weight of Plain concrete : 24.0 kN/m^3
2. Unit weight of Reinforced concrete : 25.0 kN/m^3
3. Unit weight of Block masonry (with plaster) : 22.0 kN/m^3
4. Unit weight of Brick masonry : 20.0 kN/m^3

5. Unit weight of Aerocon Block masonry : 6.0 kN/m^3
6. Unit weight of Steel : 78.50 kN/m^3
7. Unit Weight of Light Weight Filling : 10.00 kN/m^3
8. Unit weight of sunken filling : 18.80 kN/m^3
9. Unit weight of Terrace Garden filling load : 18.00 kN/m^3

Area Loads:

1. Self-weight of slab (Assumed as 110mm Tk.) : 2.750 kN/m^2
2. Self-weight of slab (Assumed as 120mm Tk.) : 3.000 kN/m^2
3. Floor finish (1kN/ m^2) + Service load(0.5kN/ m^2) : 1.500 kN/m^2
4. Terrace weathering course (SDL) : 2.000 kN/m^2
5. Partitions Load : 1.500 kN/m^2
6. Glazing, Louvers Load Per meter high : 1.800 kN/m
7. Unit wt. of Rc wall * Tk of wall * Ht of wall
   (22 x 0.20 x (2.95-0.45) : 11 kN/m
   (22 x 0.100 x (2.95-0.45) : 5.5 kN/m

LIVE LOAD:

The superimposed loads shall be calculated in accordance with IS: 875(Part-2) based on Occupancy classification. For multiple occupancies of use in the building shall be referred with the other appropriate comparable occupancy classification as per Table.1 of IS 875(Part-2)

1. RCC - Live load - 2 KN/m2
2. For Corridor and Staircase - 3 KN/m

SEISMIC PARAMETERS: (As per IS 1893-(Part 1)-2016)

1. Zone considered : Zone III
2. Zone factor : 0.16
3. Soil type : Medium
4. Response reduction factor : 3.0
5. Importance factor : 1.2
6. Damping ratio : 0.05
7. Fundamental Natural Period : 0.09 h/√d
   - X – Axis : 0.282
   - Y – Axis : 0.392

Note: Seismic masses are computed based on the following:

- 100% dead load, super-imposed dead loads.
- Suitable percentage of live loads to be considered as per IS: 1893 (Part1) :2016

WIND PARAMETERS: (As per IS 875-(Part 3)-2015)

1. Basic Wind Speed V_b : 50 m/s **(Chennai)**
2. Terrain Category : 2
3. Risk Coefficient k_1 : 1 (k1 corresponds to 50 years Mean Probable Design Life of Structure)
4. Factor k_2 : Terrain Category -2 Variation of wind speed with In different terrains as per Table-2.
5. Topography factor k_3 : 1.00
6. Design wind speed V_z : $V_b \times k_1 \times k_2 \times k_3$
7. Design wind pressure Pz : $0.6 \times Vz^2$
8. Wind directionality factor (K_d) : 1.0
9. Area Averaging factor (K_a) : 1.0

10. Reduction factor for clad building (K_c) : 0.9

11. Design Wind Pressure (P_d) : $Pz \times K_d \times K_a \times K_c$

Note:

- Application of wind load and External pressure-wind coefficients considered shall be as adopted as per IS 875 (Part 3) -2015.

ENVIRONMENTAL CONDITIONS

- Environment/Exposure - Moderate
- Fire protection - Thickness of the structural elements as per Relevant codes – 2 hours fire rating
- Nominal cover to reinforcement - Not less than 35 mm
- Nominal covers for 2 hr. fire resistance

Cover to be adopted to the outermost link:

- Footing Bottom - 50 mm
- Footing Top - 30 mm
- Footing Side - 75 mm
- Columns - 40 mm
- RC Wall - 30 mm
- Beams - 25 mm
- Slabs - 20 mm

TEMPERATURE LOADS

The effect of temperature will be considered wherever applicable (in podium slab) in accordance with relevant Indian Codes. The coefficient for thermal expansion and contraction will be in accordance with IS: 456 for concrete. The Temperature load has been assigned as 15° C.

EXCEPTIONAL LOADS

Loads due to the following catastrophe scenarios are not considered in the design.

- Exceptional loads due to terrorist attacks (Explosions) ·
- Accidental loads (Falling of aircraft on the building) ·
- Accidental collision of vehicle on to the façade of the building ·
- Snow load
- Auto sequence construction load case is added.

IV. STRUCTURAL DESIGN ANALYSIS

The entire structure is analyzed using software ETABS which is internationally accepted. 3D model of structure is prepared. Column and beams are modeled as members, a column is from the foundation level and the support is considered as fixed. Slabs are modeled using elements. Modifiers are provided. Moment of Inertia to be taken as

- Columns - 0.70
- Beams - 0.35
- Slabs - 0.25
- Walls - 0.70

The Structural System comprises Conventional beam slab system supported by RC structural columns/walls for tower and clubhouse respectively. The Towers in general has the conventional system in typical floor system and transfer girder system for the stilt floor. Floor slabs and beams are considered to act as rigid diaphragm to transfer the lateral forces to the supporting walls. Toilet is sunk by 100 mm. Staircases are provided with mid-landing between the floors as per architectural layout.

Various loadings are applied and analyzed for various load combinations as per IS -875-(part- 5)1897. The results of all load combinations are reviewed and members are designed for maximum forces developed.

Forces and moments from the 3 dimensional analysis output for the worst combination are used for the design of the structure. Response spectrum method is used for earthquake dynamic analysis. The super structure members are designed for actual flexure, shear and other forces for the worst load combinations.

BUILDING RESPONSE LIMITS:

Deflection Limits:

For Reinforced concrete works: Limiting values of deflection (Short and Long term) as per clause 35.3 of IS: 456-2000 is followed in the design. · Limiting value for short term deflection is considered as span/250 and for the long term deflection is considered as span/350 or 20mm whichever less as per IS 456 - 2000.

LOAD COMBINATIONS:

Load combinations shall be as per IS 1893:2016 (Part I) using Limit State Design (LSD) approach. Partial Safety Factors for Loads for Limit States of strength and serviceability shall be as follows;

Load Combinations to be considered for strength and serviceability checks

Load Combination	*Limit Sate of Collapse*			*Limit Sate of Serviceability*		
	DL	*LL*	*WL/EL*	*DL*	*LL*	*WL/EL*
DL+LL	1.5	1.5	-	1.0	1.0	-
DL+LL+/- WL	1.2	1.2	1.2	1.0	1.0	1.0
DL+LL+/- EL	1.2	1.2	1.2	1.0	1.0	1.0
DL+/- WL	1.5 / 0.9	-	1.2	1.0	-	1.0
DL+/- EL	1.5 / 0.9	-	1.5	1.0	-	1.0
DL+LL+/- WL	1.2	1.2	0.6	-	-	-

Note: * This value is to be considered when stability against overturning or stress reversal is critical

Additional Design Load Combinations to be considered ONLY when Clause 6.3.3 is applicable.

Load Combination to account for Design Vertical Earthquake effects

Load Combination	*DL*	*LL*	*EQx*	*EQz*	*EQy*
DL+/- EL	1.5	-	1	0.3	0.3
DL+/- EL	1.5	-	0.3	1	0.3
DL+LL+/- EL	1.2	1.2	1	0.3	0.3
DL+LL+/- EL	1.2	1.2	0.3	1	0.3
DL+/- EL	0.9	-	1	0.3	0.3
DL+/- EL	0.9	-	0.3	1	0.3

Note:

These load combinations should not be considered for serviceability checks.

Where;

- DL = Dead Load,
- LL = Live Load,
- WLx & WLy = Wind Load in X and Y direction,
- ELx & ELy = Seismic Load in X and Y **horizontal** direction and

V. FOUNDATION SYSTEM:

Foundations are designed depending upon Geo technical investigation report and will dissipate all the vertical and horizontal loads safely to the soil. As per the soil investigation report received from geotechnical consultant, the following are their recommendations,

- ❖ Soil Investigation Report - Geotech Consultancy
- ❖ Foundation Type - Isolated Footings
- ❖ Safe Bearing Capacity - 400 kN/sq.m.

- ❖ P.C.C (1:4:8) bed below foundation -150mm
- ❖ Any deviation if observed during execution other than that available as per bore log may be brought to the notice for further suggestions.

VI. DESIGN PHILOSOPHY

The designs of the RCC elements are made using the limit state method with appropriate load factors as per IS 456:2000 and IS 13920:2016

The detailing of the structural elements shall generally confirm as per IS 13920:2016. Lapping in the columns/vertical elements shall be within the middle third portion of the floor height as per the ductile detailing.

VII. DESIGN LIFE:

The design life of the building is assumed as 50 years. This requirement is applicable only for concrete works and not applicable to replaceable finishing materials, water proofing membrane and thermal insulations (if any). Hence periodic maintenance is required for all replaceable material for longer life.

PERMISSIBLE DRIFT LIMIT:

- **INTER-STOREY DRIFT**

As per IS1893 (Part1) :2016 & IS 16700 : 2023, Storey drift in any storey due to minimum specified design seismic lateral force shall not exceed 0.002 times the storey height or hi/250.

- **OVERALL DRIFT**

Lateral sway due to wind load should not exceed H/500 (H is the total height of structure).

TABLE: Story Drifts						
Story	Output Case	Direction	Drift	Building Height	H/500 or 0.002	Check
TERRACE	DConS1	X	0.000491	20.8	0.0416	OK
TERRACE	DConS1	Y	0.000352	20.8	0.0416	OK
TERRACE	DConS2	X	0.000593	20.8	0.0416	OK
TERRACE	DConS2	Y	0.000401	20.8	0.0416	OK
TERRACE	DConS3	X	0.001271	20.8	0.0416	OK
TERRACE	DConS3	Y	0.00039	20.8	0.0416	OK
TERRACE	DConS4	X	0.001368	20.8	0.0416	OK
TERRACE	DConS4	Y	0.000433	20.8	0.0416	OK
TERRACE	DConS5	Y	0.001074	20.8	0.0416	OK
TERRACE	DConS6	Y	0.001671	20.8	0.0416	OK
TERRACE	DConS7	X	0.001509	20.8	0.0416	OK
TERRACE	DConS7	Y	0.000452	20.8	0.0416	OK
TERRACE	DConS8	X	0.001607	20.8	0.0416	OK
TERRACE	DConS8	Y	0.000494	20.8	0.0416	OK
TERRACE	DConS9	Y	0.001389	20.8	0.0416	OK
TERRACE	DConS10	Y	0.00204	20.8	0.0416	OK
TERRACE	DConS11	X	0.00135	20.8	0.0416	OK
TERRACE	DConS11	Y	0.000328	20.8	0.0416	OK
TERRACE	DConS12	X	0.001411	20.8	0.0416	OK
TERRACE	DConS12	Y	0.00037	20.8	0.0416	OK
TERRACE	DConS13	Y	0.001513	20.8	0.0416	OK
TERRACE	DConS14	Y	0.001899	20.8	0.0416	OK
TERRACE	DConS15	X	0.002184	20.8	0.0416	OK
TERRACE	DConS15	X	0.002056	20.8	0.0416	OK
TERRACE	DConS15	Y	0.000639	20.8	0.0416	OK
TERRACE	DConS16	X	0.002142	20.8	0.0416	OK
TERRACE	DConS16	X	0.002267	20.8	0.0416	OK
TERRACE	DConS16	Y	0.000715	20.8	0.0416	OK
TERRACE	DConS17	Y	0.003216	20.8	0.0416	OK
TERRACE	DConS17	X	0.00084	20.8	0.0416	OK
TERRACE	DConS17	Y	0.002398	20.8	0.0416	OK
TERRACE	DConS18	Y	0.002911	20.8	0.0416	OK
TERRACE	DConS18	Y	0.003732	20.8	0.0416	OK
TERRACE	DConS19	X	0.00265	20.8	0.0416	OK
TERRACE	DConS19	X	0.00249	20.8	0.0416	OK
TERRACE	DConS19	Y	0.000763	20.8	0.0416	OK
TERRACE	DConS20	X	0.002575	20.8	0.0416	OK

TERRACE	DConS20	X	0.002731	20.8	0.0416	OK
TERRACE	DConS20	Y	0.000845	20.8	0.0416	OK
TERRACE	DConS21	Y	0.004054	20.8	0.0416	OK
TERRACE	DConS21	X	0.000948	20.8	0.0416	OK
TERRACE	DConS21	Y	0.003032	20.8	0.0416	OK
TERRACE	DConS22	Y	0.003603	20.8	0.0416	OK
TERRACE	DConS22	Y	0.004629	20.8	0.0416	OK
TERRACE	DConS23	X	0.002492	20.8	0.0416	OK
TERRACE	DConS23	X	0.002332	20.8	0.0416	OK
TERRACE	DConS23	Y	0.000638	20.8	0.0416	OK
TERRACE	DConS24	X	0.002379	20.8	0.0416	OK
TERRACE	DConS24	X	0.002535	20.8	0.0416	OK
TERRACE	DConS24	Y	0.000704	20.8	0.0416	OK
TERRACE	DConS25	Y	0.004167	20.8	0.0416	OK
TERRACE	DConS25	X	0.000814	20.8	0.0416	OK
TERRACE	DConS25	Y	0.003145	20.8	0.0416	OK
TERRACE	DConS26	Y	0.003483	20.8	0.0416	OK
TERRACE	DConS26	Y	0.004505	20.8	0.0416	OK
TERRACE	DConS27	X	0.001862	20.8	0.0416	OK
TERRACE	DConS27	X	0.001949	20.8	0.0416	OK
TERRACE	DConS27	Y	0.000587	20.8	0.0416	OK
TERRACE	DConS28	X	0.000556	20.8	0.0416	OK
TERRACE	DConS28	Y	0.002356	20.8	0.0416	OK
TERRACE	DConS28	X	0.000783	20.8	0.0416	OK
TERRACE	DConS28	Y	0.002875	20.8	0.0416	OK
TERRACE	DConS29	X	0.002248	20.8	0.0416	OK
TERRACE	DConS29	X	0.002333	20.8	0.0416	OK
TERRACE	DConS29	Y	0.000685	20.8	0.0416	OK
TERRACE	DConS30	X	0.000699	20.8	0.0416	OK
TERRACE	DConS30	Y	0.00298	20.8	0.0416	OK
TERRACE	DConS30	X	0.000876	20.8	0.0416	OK
TERRACE	DConS30	Y	0.003558	20.8	0.0416	OK
TERRACE	DConS31	X	0.00209	20.8	0.0416	OK
TERRACE	DConS31	X	0.002137	20.8	0.0416	OK
TERRACE	DConS31	Y	0.000545	20.8	0.0416	OK
TERRACE	DConS32	X	0.000696	20.8	0.0416	OK
TERRACE	DConS32	Y	0.003093	20.8	0.0416	OK
TERRACE	DConS32	X	0.000689	20.8	0.0416	OK
TERRACE	DConS32	Y	0.003433	20.8	0.0416	OK



CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN: Stilt +6 Floors	sankar & associates architecture · engineering · interior design
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

STOREY FORCES:

Base Reactions

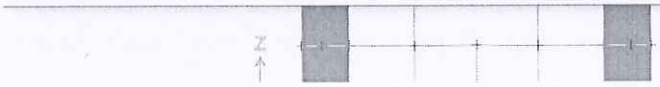
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Units: As Noted Hidden Columns: No Sort: None Base Reactions

Filter: ([Output Case] = 'EQX' OR [Output Case] = 'EQY' OR [Output Case] = 'RSX' OR [Output Case] = 'RSY')

Output Case	Case Type	Step Type	Step Number	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m
EQX	LinStatic	Step By Step	1	-1348.2455	0	0	12.7853	-29773.8959	16010.3847
EQX	LinStatic	Step By Step	2	-1348.2455	0	0	23.5302	-29779.5992	17536.7786
EQX	LinStatic	Step By Step	3	-1348.2455	0	0	2.0404	-29767.8925	14483.9909
EQY	LinStatic	Step By Step	1	0	-2206.8646	0	44256.804	6.7073	-53984.2717
EQY	LinStatic	Step By Step	2	0	-2206.8646	0	44226.6362	23.2832	-58307.939
EQY	LinStatic	Step By Step	3	0	-2206.8646	0	44286.9897	-9.8686	-49660.6044
RSX	LinRespSpec	Max		1348.2466	18.2857	0	331.2247	24145.7948	16697.0846
RSY	LinRespSpec	Max		18.4269	2206.8639	0	33758.1488	225.0737	58361.3034

Record: << < 1 > >> of 8 Add Tables... Done



From the above tables, it is observed that scale factor values are matched in both the axis.

Story Stiffness and Strength (Soft Story Check):

As PER 16700: 2023 Parameters influencing stiffness and strength of the building should be so proportioned, that the following are maintained:

a. Lateral translational stiffness of any story shall not be less than 70 percent of that of the story above.

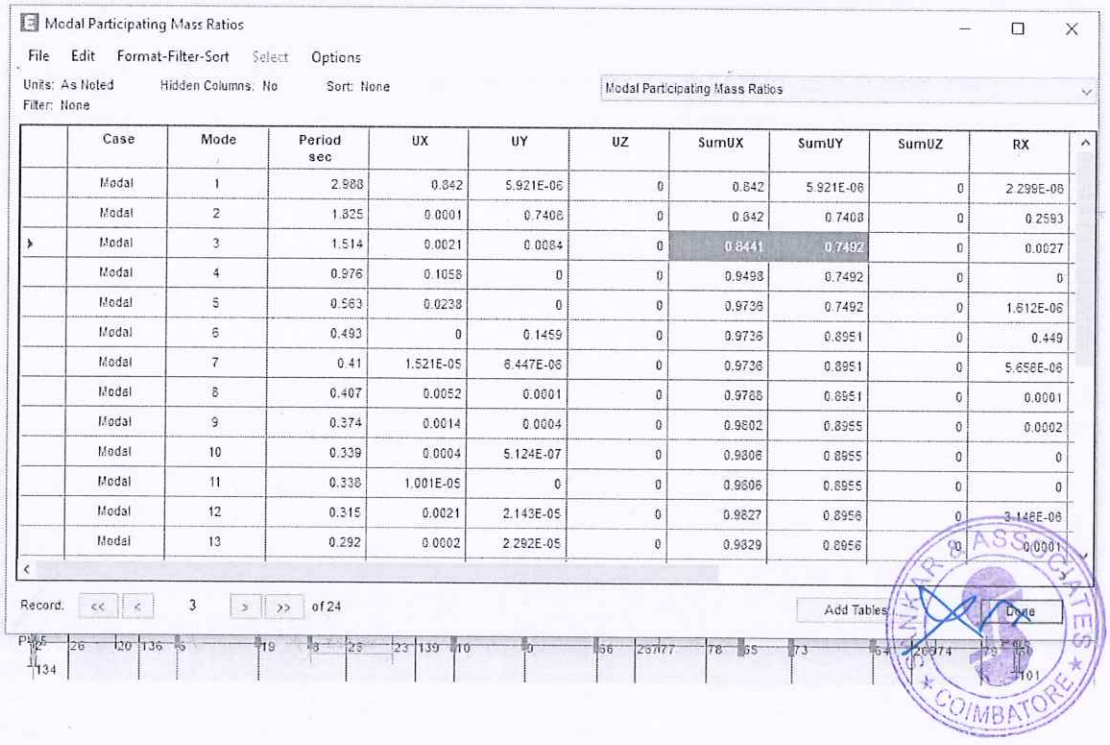
b. Lateral translational strength of any story shall not be less than that of the story above.

Story	Output Case	Stiff X kN/m	Stiff Y kN/m	Check (%)	Required	Status
TERRACE	EQX	116931.378	0	114.395399	70	OK
6TH FLOOR	EQX	133764.117	0	98.4315659	70	OK
5TH FLOOR	EQX	131666.115	0	97.6994529	70	OK
4TH FLOOR	EQX	128637.074	0	102.62502	70	OK
3RD FLOOR	EQX	132013.823	0	120.137391	70	OK
2ND FLOOR	EQX	158597.963	0	101.748787	70	OK

1ST FLOOR	EQX	161371.504	0	154.514666	70	OK
PLINTH	EQX	249342.64	0	0		
TERRACE	EQY	0	124077.151	165.462177	70	OK
6TH FLOOR	EQY	0	205300.755	126.910393	70	OK
5TH FLOOR	EQY	0	260547.995	114.902794	70	OK
4TH FLOOR	EQY	0	299376.927	114.246704	70	OK
3RD FLOOR	EQY	0	342028.271	122.385031	70	OK
2ND FLOOR	EQY	0	418591.404	137.309658	70	OK
1ST FLOOR	EQY	0	574766.425	214.867232	70	OK
PLINTH	EQY	0	1234984.70	0		

Modal Participating Mass Ratio:

As per IS1893 (Part1) :2016, In Buildings located in seismic Zone II and III, it should be ensured that the three significant modes together contribute 65 percent mass participation factor in each principal plan direction and total modal mass participation ratio should be greater than 90 percent. Table Below shows Modal Participating Mass Ratio of Proposed Building.


Modal Participating Mass Ratios

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None

Filter: None

Modal Participating Mass Ratios

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX
Modal	1	2.988	0.842	5.921E-06	0	0.842	5.921E-06	0	2.299E-06
Modal	2	1.825	0.0001	0.7408	0	0.842	0.7408	0	0.2593
Modal	3	1.514	0.0021	0.0084	0	0.8441	0.7492	0	0.0027
Modal	4	0.976	0.1058	0	0	0.9498	0.7492	0	0
Modal	5	0.563	0.0238	0	0	0.9736	0.7492	0	1.612E-06
Modal	6	0.493	0	0.1459	0	0.9736	0.8951	0	0.449
Modal	7	0.41	1.521E-05	6.447E-06	0	0.9736	0.8951	0	5.658E-06
Modal	8	0.407	0.0052	0.0001	0	0.9788	0.8951	0	0.0001
Modal	9	0.374	0.0014	0.0004	0	0.9802	0.8955	0	0.0002
Modal	10	0.339	0.0004	5.124E-07	0	0.9806	0.8955	0	0
Modal	11	0.338	1.001E-05	0	0	0.9806	0.8955	0	0
Modal	12	0.315	0.0021	2.143E-05	0	0.9827	0.8956	0	3.148E-06
Modal	13	0.292	0.0002	2.292E-05	0	0.9829	0.8956	0	0.0001

Record: << < 3 > >> of 24 Add Tables Done

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Torsional Irregularity Check:

As per 1893: 2016, in torsional irregular buildings, when the ratio of maximum horizontal displacement at one end and the minimum horizontal displacement at the other end is in range of 1.5-2.0, the building configuration shall be revised. But here the ratio is within limits so no need of revision.

Story Max Over Avg Displacements

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Story Max Over Avg Displacements

Filter: ([Story] = '1ST FLOOR' OR [Story] = '2ND FLOOR' OR [Story] = '3RD FLOOR' OR [Story] = '4TH FLOOR' OR [Story] = '5TH FLOOR' OR [Story] = '6TH FLOOR' OR [Story] = 'TERRACE') AND ([Output Case] = 'RSX' OR [Output Case] = 'RSY')

Story	Output Case	Case Type	Step Type	Step Number	Direction	Maximum mm	Average mm	Ratio
TERRACE	RSX	LinRespSpec	Max		X	57.936	56.207	1.031
6TH FLOOR	RSX	LinRespSpec	Max		X	54.986	53.475	1.028
5TH FLOOR	RSX	LinRespSpec	Max		X	50.173	48.925	1.026
4TH FLOOR	RSX	LinRespSpec	Max		X	43.492	42.501	1.023
3RD FLOOR	RSX	LinRespSpec	Max		X	35.115	34.389	1.021
2ND FLOOR	RSX	LinRespSpec	Max		X	25.649	25.175	1.019
1ST FLOOR	RSX	LinRespSpec	Max		X	16.751	16.52	1.014
TERRACE	RSY	LinRespSpec	Max		Y	44.658	39.122	1.142
6TH FLOOR	RSY	LinRespSpec	Max		Y	38.464	33.914	1.134
5TH FLOOR	RSY	LinRespSpec	Max		Y	31.952	28.41	1.125
4TH FLOOR	RSY	LinRespSpec	Max		Y	25.2	22.626	1.114
3RD FLOOR	RSY	LinRespSpec	Max		Y	18.384	16.679	1.101
2ND FLOOR	RSY	LinRespSpec	Max		Y	11.799	10.867	1.086
1ST FLOOR	RSY	LinRespSpec	Max		Y	6.13	5.713	1.073

Record: << < 1 > >> of 14 Add Tables... Done



FOOTING DESIGN:

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

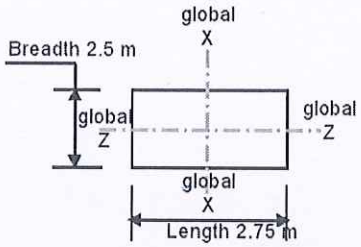
Building Name TOWER 10
Footing Number: **F12**
Node number **108**

COLUMN

Length (l, dim. || Z axis) =	750	mm
Breadth (b, dim. || X axis) =	300	mm

FOOTING

Foot length (L, dim. || Z axis) =	2.75	m
Foot Breadth (B, dim. || X axis) =	2.50	m
Thickness of footing (t) =	800	mm
Clear cover of footing =	50	mm
Main bar dia of footing =	16	mm
Effective depth of footing =	**742**	mm
Selfweight of the footing =	**137.50**	KN
Area of Footing(A) =	**6.88**	m^2
Sect mod of foot about Z axis (Zz) =	**2.86**	m^3
Sec mod of foot about X axis (Zx) =	**3.15**	m^3



Footing Dimensions

MATERIALS OF CONSTRUCTION

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2

CHECK FOR GROSS BEARING PRESSURE

Safe **NET** bearing pressure =	400	KN/m^2
Safe gross bearing pr. =	**462.70**	KN/m^3 (net pr. + depth of foot * soil unit wt)
Unfactored load case number =	0	
Axial load from output (P1) =	2691.73	KN
Moment about Z axis (M_z) =	5.02	KN-m
Moment about X axis (M_x) =	3.19	KN-m
Depth of top of foot. from ground =	2.5	m
Unit wt of soil =	19	KN/m^3
Weight of soil retained above foot =	**315.88**	KN
P = (P1+soil+foot self wt) =	**3145.10**	KN
Maximum bearing pressure =	**460.24**	KN/m^2
Minimum bearing pressure =	**454.70**	**KN/m^2**

$$\frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x}$$

Hence footing is safe against max gross bearing pr.

DESIGN FORCES

Factored load comb. no.	0	
Axial load:(P_u) =	4037.589	**KN**
Moment about Z axis (M_{uz}) =	7.53675	**KN-m**
Moment about X axis (M_{ux}) =	4.7871	**KN-m**

Maximum effective soil pressure $p_{e\,max}$
(Pu/Area+ Muz/Zz + Mux/Zx) = **591.44 KN/m^2**
Minimum effective soil pressure $p_{e\,min}$
(Pu/Area - Muz/Zz - Mux/Zx) = **583.14 KN/m^2**
Design of footing is done using above maximum effective soil pressure



CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

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architecture engineering interior design

CALCULATION FOR BOTTOM STEEL

Mu about X1 X1 = (pe max x length^2/2)= **295.72** KN-m per meter

Mulimit = **1830.97** KN-m per meter

The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_n}{f_{ck} b d^2}}\right] bd$$

Hence, Ast = **940.487** mm^2

Min Ast = **890.400** mm^2 (0.12 % for slab, cl 26.5.2.1)

Spacing = **213.78** mm (considering max of above two calculated values of Ast)

pt provided = **0.13** %

Hence provide 16 mm dia bar @ 213 mm c/c parellel to length of footing (|| to Z)

Mu about N1 N1 = (pe max x length^2/2)= **357.82** KN-m per meter

Calc. Ast = **1144.445** mm^2 The section is singly reinforced

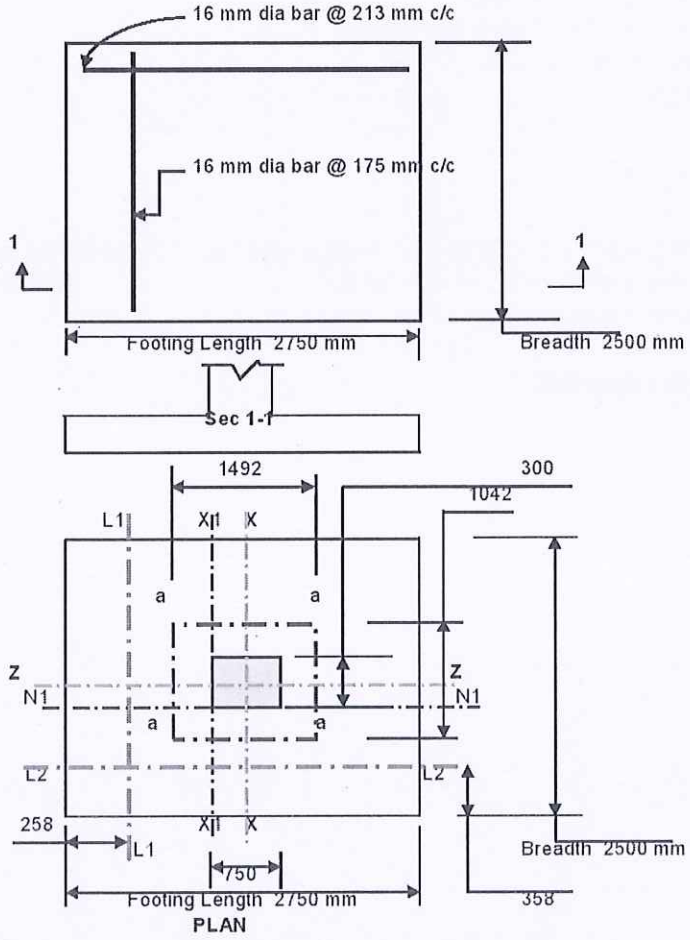
Min Ast = **890.4** mm^2 (0.12 % for slab, cl 26.5.2.1)

Spacing = **175.69** mm (considering max of above two calculated values of Ast)

pt provided = **0.15423786** %

Hence provide 16 mm dia bar @ 175 mm c/c parellel to breadth of footing (|| to X)

Arrangement of bottom reinforcement as per above design is shown below



CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN: Stilt +6 Floors	sankar & associates
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

CHECK FOR ONE WAY SHEAR :

One way shear at critical section L1- L1

Distance of critical sec. from edge of footing = **0.258** m

Shear force Vs =pe max x 0.258 x 1m width of footing = **152.590** KN

Shear stress τ_v = Vs/bd = **0.206** N/mm^2

τ_c = **0.27** N/mm^2

tv < tc hence O.K.

One way shear at critical section L2- L2

Distance of critical sec. from edge of footing = **0.358** m

Shear force Vs =pe max x 0.358 x 1m width of footing = **211.734** KN

Shear stress τ_v = Vs/bd = **0.285** N/mm^2

τ_c = **0.29** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Ref. cl 34.2.4 and cl.31.6.3 of IS 456 : 2000

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.6** >1

Hence, k_s= **1**

$\tau_c = 0.25\ (fck)^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable} = k_s \times \tau_c$ = **1.25** N/mm^2

Shear force Vs = 591.435 (2.75 x 2.5 - 1.492 x 1.042) = **3146.64** KN

Length of critical section = 2 x (1492 + 1042) = **5068** mm

Area of the critical section (length of critical sec x eff. d) = **3760456** mm^2

Hence shear stress τ_v = **0.837** N/mm^2

tv < allowable hence O.K.



COLUMN DESIGN:

COLUMN DESIGN

Input Data

Breadth		b	=	300.00 mm
Depth		D	=	750.00 mm
Clear cover		cc	=	40.00 mm
Effective cover		d'	=	60.50 mm
Effective Breadth		b'	=	239.50 mm
Effective Depth		D'	=	689.50 mm
Length of column		L	=	2.95 m
Depth of Beam/Slab framing into coln (Major)		Bd	=	0.60 m
Depth of Beam/Slab Framing into coln (Minor)		Bd	=	0.45 m
Clear length in major axis		Lc or Lo	=	2.35 m
Clear height in minor axis		Lc or Lo	=	2.50 m
Effective length factor		β	=	1.20
Effective length of column		Leff (x-dir)	=	2.82 m
Effective length of column		Leff (y-dir)	=	3.00 m
Axial Load (Factored)		N	=	3670.54 KN
Moment about major axis (Factored)		Mx	=	7.54 KN-m
Moment about minor axis (Factored)		My	=	4.79 KN-m
Characteristic strength of concrete		fck	=	25.00 N/mm^2
Characteristic strength of steel		fy	=	500 N/mm^2

Design Calculations:

Step1:	Check for Slenderness ratio :		Leff/D	=	3.76 <12
	Check for Slenderness ratio :		Leff/b	=	10.00 <12
		Design a Short Column			
			eax	=	0.00 mm
			eay	=	0.00 mm
	Slenderness limits for column	Lo < 60 b	2.50 m	<	18.00 m

Step:2 Check for moment due to minimum eccentricity

Minimum Eccentricity (L/500 + d or b/30) or 20 (whichever is		ex	=	20.00 mm
		ey	=	15.00 mm
	A.) Moments due to Min eccentricity	Mex	=	73.41 KN-m
		Mey	=	55.06 KN-m

Step:3 Calculation of Additional Moments

Assume Percentage of Reinforcement		p	=	2.79 %
Reinforcement Equally Distributed on	Four Face			
		Puz	=	4885.31 KN
	d'/d along x-dir		=	0.10
	d'/b along y-dir		=	0.20
	Along x-direction			
		k1	=	0.207
		k2	=	0.425



CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
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Along y-direction

		k1	=	0.184
		k2	=	0.04
	Pb=(k1 + k2 p/Fck)Fck b d)	Pbx	=	1431.17 KN
		Pby	=	1060.11 KN
	k = (Puz - Pu)/(Puz - Pb)	Kx	=	0.35
		Ky	=	0.32
	B.) Additional Moments	Max	=	0.00 KN-m
		May	=	0.00 KN-m

Step:4 Total Moments for which the column is to be designed are

	D.) Final Moment	**Mux**	**=**	**73.41** KN-m
		Muy	**=**	**55.06** KN-m

Step:5

Pu / Fck bD			=	0.65
p/Fck			=	0.11

*Refer CHART 48 From SP 16 : 1980 for red values

Pu / Fck bD= 0.65 p/Fck= 0.1116 d'/D = 0.10

		Mux1 / Fck bD^2	=	0.095
		Mux1	=	**400.78** KN-m

*Refer CHART 50 From SP 16 : 1980 for red values

Pu / Fck 0.65 p/Fck= 0.1116 d'/b = 0.20

		Muy1 / Fck bD^2	=	0.075
		Muy1	=	**126.56** KN-m
		Mux/Mux1	=	0.18
		Muy/Muy1	=	0.44
		Pu/Puz	=	0.75
		αn	=	1.92
	(Mux/Mux1)^αn + (Muy/Muy1)^αn		**=**	**0.24** **<1**

Step:6 Longitudinal Reinforcemei Area of steel Required Asc = 6277.50 mm^2

Larger dia			**Smaller dia**		
Select Bar dia	25 mm		Select Bar dia	=	16 mm
No. of bars Req	12.8		No. of bars Req	=	1.9
No. of bars Prov	12		No. of bars Prov	=	2
Area Prov.	5890.49		Area Prov.	=	402

Area of Steel Provided Asc (pro) = 6292.61 mm^2

Percentage of Steel Provided = 2.80 %

Provide 12Y25+ 2Y16 as longitudinal reinforcement

Step:7 Lateral Ties

1. Pitch: (take whichever is lesser)

i. 16x smaller dia of main steel		=	250.00 mm
ii. 200 mm		=	200.00 mm
	Pi	=	200.00 mm

2. Diameter (whichever is greater)

i. 1/4 x largest dia of main steel		=	6.25 mm
ii. 8mm		=	8.00 mm
	Dia	=	8.00 mm

Therefore provide Y8 @200c/c as Lateral ties.

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CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture . engineering . interior design
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

BEAM DESIGN:

SANKAR AND ASSOCIATES				SHRIRAM SHANKARI APARTMENT			
				Client	M/S.SHRIRAM SHANKARI		
				Job No		Date	09-03-2026
Page Type	Calculation Sheet -TOWER 11			Prepared By	MS	Revision	-
Section	Design of Beam as per IS 456	Beam No	B15	Checked By	NA	Date Revised	-

SECTION DETAILS — Floor Level : First Floor — B350

Width of the beam	B	=	300.00	mm
Depth of the beam	D	=	600.00	mm
Clear cover of the beam	C_v	=	25	mm
Grade of concrete	f_{ck}	=	25	N/mm^2
Grade of steel	Fy	=	500	N/mm^2
Effective length of the beam	L	=	6	m

FORCE DETAILS FROM ETAB :

Max sagging moment of the beam	=	169.57	kN m
LHS Support moment of the beam	=	231.23	kN m
RHS Support moment of the beam	=	212.18	KN m
Torsional Moment	=	0.39	KN m
Shear force at LHS of the beam	=	240.18	KN
Shear force at RHS of the beam	=	230.79	KN
Shear force at concentrated load location	=	0.00	KN

Design of beam at LHS section

Tension Reinf.

Bending Mt (M_u)x	=	231.91	kN m
Breath of the beam (B	=	300	mm
Effective cover (d')x	=	55.9	mm
Effective depth (d)x	=	544.14	mm
x_u max/d	=	0.4560	
K_x= M_{ux}/(bd^2f_{ck})	=	0.1044	(2.611)
K'x	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	43.0	mm
A_{st} lim	=	1549	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	1139	mm^2

Layer	1st	2nd	3rd
Dia of reinf	20	16	12
Reqd No.	3.7	0.98	0
Provided	3	2	0
Ast prov.	942	402	0

$A_{st\,provided}$ = 1345 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	672	mm^2

Layer	1st	2nd	3rd
Dia of reinf	20	16	12
Reqd No	2.2	0	0
Provided	3	0	0
Ast prov.	942	0	0

$A_{st\,provided}$ = 942 mm^2

Shear Check

Shear force V_{ux}	=	240.18	kN
τ_v = V_{ux}/bd	=	1.47	N/mm^2
% of reinf provided	=	0.82	%
Design Stress	=	0.60	N/mm^2
τ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf

Reqd stirrup spac	=	166.53	mm
Provd stirrup spac	=	125	mm

Design of beam at Max sagging section

Tension Reinf.

Bending Mt (M_u)x	=	169.57	kN m
Breath of the beam (B	=	300	mm
Effective cover (d')x	=	43.0	mm
Effective depth (d)x	=	557.00	mm
x_u max/d	=	0.4560	
K_x= M_{ux}/(bd^2f_{ck})	=	0.0729	(1.822)
K'x	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	55.9	mm
A_{st} lim	=	1585	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	771	mm^2

Layer	1st	2nd	3rd
Dia of reinf	20	16	12
Reqd No.	2.5	0	0
Provided	3	0	0
Ast prov.	942	0	0

$A_{st\,provided}$ = 942 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	392	mm^2

Layer	1st	2nd	3rd
Dia of reinf	20	16	12
Reqd No	1.3	0	0
Provided	3	2	0
Ast prov.	942	0	0

$A_{st\,provided}$ = 942 mm^2

Torsional Reinforcement

Torsional Moment	=	0.39	kNm
τ_{ve}	=	1.48	N/mm^2
τ_c max	=	3.10	N/mm^2
M_t	=	0.69	kNm
M_{t1}	=	0.00	kNm
Stirrup spacing reqd	=	164.11	mm
Sideface Reinf reqd	=	0.00	mm^2
Provide 2 Nos of		12	mm on EVF
Ast prov	=	452.4	mm^2

Design of beam at RHS section

Tension Reinf.

Bending Mt (M_u)x	=	212.87	kN m
Breath of the beam (B	=	300	mm
Effective cover (d')x	=	55.9	mm
Effective depth (d)x	=	544.14	mm
x_u max/d	=	0.4560	
K_x= M_{ux}/(bd^2f_{ck})	=	0.0959	(2.397)
K'x	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	43.0	mm
A_{st} lim	=	1549	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	1029	mm^2

Layer	1st	2nd	3rd
Dia of reinf	20	16	12
Reqd No.	3.3	0.44	0
Provided	3	2	0
Ast prov.	942	402	0

$A_{st\,provided}$ = 1345 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	672	mm^2

Layer	1st	2nd	3rd
Dia of reinf	20	20	12
Reqd No	2.2	0	0
Provided	3	0	0
Ast prov.	942	0	0

$A_{st\,provided}$ = 942 mm^2

Shear Check

Shear force V_{ux}	=	230.79	kN
τ_v = V_{ux}/bd	=	1.41	N/mm^2
% of reinf provided	=	0.82	%
Design Stress	=	0.60	N/mm^2
τ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf

Reqd stirrup spac.	=	173.25	mm
Provd stirrup spac	=	125	mm

CHECK FOR DEFLECTION : As per IS 456

Provided area of reinforcement	=	942	
Mu/bd^2	=	1.82	
Actual Span / Effective depth Ratio	=	11.02	
Support Condition	=	Continuous	
Design service stress	=	237.25	
Modification factor - Tension reinf	=	1.28	
Modification factor - Comp. reinf.	=	1.16	
Allowable Span /Effective depth Ratio	=	33.67	

Hence SAFE in Deflection

Beam No	Size	Bottom steel		Top steel			Stirrups		Side Face Reinf
		Straight	Curtail	Middle	LHS	RHS	Ends	Mid	
B15	300 x 600	3Y20	---	3Y20	3Y20+2Y16	3Y20+2Y16	2L Y8/125	2L Y8/175	2Y12 EVF

SANKAR & ASSOCIATES COIMBATORE

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

sankar & associates
architecture engineering interior design

SANKAR AND ASSOCIATES				SHRIRAM SHANKARI APARTMENT			
				Client	M/S.SHRIRAM SHANKARI		
				Job No		Date	10-03-2026
Page Type	Calculation Sheet -TOWER 10			Prepared By	MS	Revision	-
Section	Design of Beam as per IS 456	Beam No	B16	Checked By	NA	Date Revised	-

SECTION DETAILS — Floor Level : First Floor

Width of the beam	B	=	200.00	mm
Depth of the beam	D	=	600.00	mm
Clear cover of the beam	C_v	=	25	mm
Grade of concrete	f_{ck}	=	25	N/mm^2
Grade of steel	Fy	=	500	N/mm^2
Effective length of the beam	L	=	6	m

FORCE DETAILS FROM ETAB : B273

Max sagging moment of the beam		=	105.84	kN m
LHS Support moment of the beam		=	150.94	kN m
RHS Support moment of the beam		=	141.71	kN m
Torsional Moment		=	0.00	kN m
Shear force at LHS of the beam		=	166.76	kN
Shear force at RHS of the beam		=	163.48	kN
Shear force at concentrated load location		=	0.00	kN

Design of beam at LHS section

Tension Reinf.

Bending Mt (M_u)L	=	150.94	kN m
Breath of the beam (B	=	200	mm
Effective cover (d')L	=	64.0	mm
Effective depth (d)L	=	535.96	mm
x_u max/d	=	0.4560	
K_L= M_{uL}/(bd^2f_{ck})	=	0.1051	(2.628)
K'L	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	45.5	mm
A_{st} lim	=	1017	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	753	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1.6	0	0
Provided	2	2	0
Ast prov	982	0	0

A_{st} provided = 982 mm^2

Compression Reinf.

A_{st} reqd = 0 mm^2

$A_{st\,min}$ = 491 mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1	0	0
Provided	2	0	0
Ast prov	982	0	0

A_{st} provided = 982 mm^2

Shear Check

Shear force V_{uL}	=	166.76	kN
ζ_v = V_{uL}/bd	=	1.56	N/mm^2
% of reinf provided	=	0.92	%
Design Stress	=	0.62	N/mm^2
ζ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf

Reqd. stirrup spac	=	233.83	mm
Proived stirrup spac	=	125	mm

Design of beam at Max sagging section

Tension Reinf.

Bending Mt (M_u)M	=	105.84	kN m
Breath of the beam (B	=	200	mm
Effective cover (d')M	=	45.5	mm
Effective depth (d)M	=	554.50	mm
x_u max/d	=	0.4560	
K_M= M_{uM}/(bd^2f_{ck})	=	0.0688	(1.722)
K'M	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	64.0	mm
A_{st} lim	=	1052	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	491	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1	0	0
Provided	2	0	0
Ast prov	982	0	0

A_{st} provided = 982 mm^2

Compression Reinf.

A_{st} reqd = 0 mm^2

$A_{st\,min}$ = 257 mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	0.6	0	0
Provided	2	2	0
Ast prov	982	0	0

A_{st} provided = 982 mm^2

Torsional Reinforcement

Torsional Moment	=	0.00	kNm
ζ_{ve}	=	0.00	N/mm^2
ζ_c max	=	3.10	N/mm^2
M_t	=	0.00	kNm
M_{t1}	=	0.00	kNm
Stirrup spacing reqd	=	300.00	mm
Sideface Reinf reqd	=	0.00	mm^2
Provide 2 Nos of		12	mm on EVF
Ast prov	=	452.4	mm^2

Design of beam at RHS section

Tension Reinf.

Bending Mt (M_u)R	=	141.71	kN m
Breath of the beam (B	=	200	mm
Effective cover (d')R	=	64.0	mm
Effective depth (d)R	=	535.96	mm
x_u max/d		0.4560	
K_R= M_{uR}/(bd^2f_{ck})	=	0.0987	(2.467)
K'R	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	45.5	mm
A_{st} lim	=	1017	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	699	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1.5	0	0
Provided	2	2	0
Ast prov	982	0	0

A_{st} provided = 982 mm^2

Compression Reinf.

A_{st} reqd = 0 mm^2

$A_{st\,min}$ = 491 mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1	0	0
Provided	2	0	0
Ast prov	982	0	0

A_{st} provided = 982 mm^2

Shear Check

Shear force V_{uR}	=	163.48	kN
ζ_v = V_{uR}/bd	=	1.53	N/mm^2
% of reinf provided	=	0.92	%
Design Stress	=	0.62	N/mm^2
ζ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf

Reqd. stirrup spac	=	241.74	mm
Proived stirrup spac	=	125	mm

CHECK FOR DEFLECTION : As per IS 456

Provided area of reinforcement	=	982	Design service stress	=	145.00
Mu/bd^2	=	1.72	Modification factor - Tension reinf.	=	1.61
Actual Span / Effective depth Ratio	=	11.67	Modification factor - Comp. reinf.	=	1.23
Support Condition	=	Continuous	Allowable Span /Effective depth Ratio	=	51.25

>>>>>> Hence SAFE in Deflection <<<<<<

Beam No	Size	Bottom steel		Top steel			Stirrups		Side Face Reinf
		Straight	Curtail	Middle	LHS	RHS	Ends	Mid	
B16	200 x 600	2Y25	---	2Y25	2Y25	2Y25+2Y20	2L Y8@125	2L Y8@175	2Y12 EVF

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture engineering interior design
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

SLAB DESIGN:

SANKAR AND ASSOCIATES		SHRIRAM SHANKARI APARTMENT			
		Client	M/S.SHRIRAM SHANKARI		
		Job No		Date	10-03-2026
Page Type	Calculation Sheet - TOWER 10	Prepared By	SM	Revision	-
Section	Design of Slab as per IS 456	Checked By	NA	Date Revised	-

Slab Number : S1 Floor level : First Floor Reference grid : F113

SPANS :

Shorter span c/c w.r.to beam	B	=	3.20	m
Longer span c/c w.r.to beam	L	=	3.50	m
Width of support - shorter span - Left	bxl	=	200	mm
Width of support - shorter span - Right	bxr	=	200	mm
Width of support - longer span - Left	byl	=	200	mm
Width of support - longer span - Right	byr	=	200	mm
Clear Cover of slab	cv	=	20	mm
Ratio Ly / Lx	ly/lx	=	1.10	< 2

LOAD CALCULATION :

Assume the thickness of the slab	=	120.00	mm	
Effective Depth of the of the slab	=	95.00	mm	
Self Weight of slab	=	3.000	KN / m^2	
Weathering course / Floor finishing	=	1.500	KN / m^2	
Wall load	=	0.000	KN / m^2	
Live Load	=	2.000	KN / m^2	
D L+L L	=	6.500	KN / m^2	
1.5D L+1.5L.L	=	9.750	KN / m^2	

DESIGN AS TWO WAY SLAB

Support Condition : TWO ADJACENT EDGES DISCONTINUOUS

EFFECTIVE SPANS :

Shorter span: (Lx)

Clear span + effective depth	=	3.10	m
Center to centre of supports	=	3.20	m
Effective span	=	3.20	m

Longer span: (Ly)

Clear span + effective depth	=	3.40	m
Center to centre of supports	=	3.50	m
Effective span	=	3.50	m
Aspect Ratio Ly / Lx	=	1.09	< 2

As per IS 456

+ ve Alpha - x	=	0.042
- ve Alpha - x	=	0.056
+ ve Alpha - y	=	0.034
- ve Alpha - y	=	0.046

Compressive Stength of Concrete	=	25.00	N/mm^2
Grade of steel	=	500.00	N/mm^2

BENDING MOMENTS:

EFFECTIVE DEPTH OF SLAB

Positive moment along Shorter dir.	Mx +ve =	4.19	KNm / m	dx+	=	95.00	mm	Kx+	=	0.019	Zx+	=	90.250 mm
Negative moment along Shorter dir.	Mx -ve =	5.59	KNm / m	dx-	=	95.00	mm	Kx-	=	0.025	Zx-	=	90.250 mm
Positive moment along Longer dir.	My +ve =	3.39	KNm / m	dy+	=	85.00	mm	Ky+	=	0.019	Zy+	=	80.750 mm
Negative moment along Longer dir.	My -ve =	4.59	KNm / m	dy-	=	95.00	mm	Ky-	=	0.026	Zy-	=	90.250 mm

REQUIRED AREA OF STEEL :

Ast req. at midspan along x- dir	ast +ve x =	103.74	mm^2
Ast req. at midspan along y- dir.	ast +ve y =	93.89	mm^2
Ast req. at support along x- dir.	ast -ve x =	139.39	mm^2
Ast req. at support along y- dir.	ast -ve y =	113.87	mm^2
Minimum Ast required	ast min =	144.00	mm^2

REQUIRED SPACING OF STEEL:

10	mm dia at midspan along x- dir.	=	545 mm c/c
10	mm dia at midspan along y- dir.	=	545 mm c/c
10	mm dia at support along x- dir.	=	545 mm c/c
10	mm dia at support along y- dir.	=	545 mm c/c
8	mm dia for distribution steel	=	349 mm c/c
0	mm dia for top of mid span	=	100 mm c/c

PROVIDED SPACING OF STEEL

Bottom reinforcement along x- dir.	Y	8	140	mm c/c
Bottom reinforcement along y- dir.	Y	8	140	mm c/c
Top reinforcement along x- dir.	Y	8	140	mm c/c
Top reinforcement along y- dir.	Y	8	140	mm c/c
Distribution Steel	Y	8	200	mm c/c

CHECK FOR DEFLECTION :

Provided Ast (Bottom)	=	359.04	mm^2
Provided Ast (Top)	=	0.00	mm^2
Mu/bd^2	=	0.46	
Actual Span / Effective depth Ratio	=	33.68	
Design service stress	=	83.79	
Modification factor - Tension reinf	=	2.00	
Modification factor - Comp. reinf.	=	1.00	
Allowable Span /Effective depth Ratio	=	46.00	

Hence SAFE in Deflection

SANKAR & ASSOCIATES COIMBATORE

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

sankar & associates architecture engineering interior design

SANKAR AND ASSOCIATES		SHRIRAM SHANKARI APARTMENT			
		Client	M/S.SHRIRAM SHANKARI		
		Job No		Date	04-03-2026
Page Type	Calculation Sheet - TOWER 10	Prepared By	SM	Revision	-
Section	Design of Slab as per IS 456	Checked By	NA	Date Revised	-

Slab Number : **S3** Floor level : **First Floor** Reference grid : **F4**

SPANS :

Shorter span c/c w.r to beam	B	=	3.64	m
Longer span c/c w.r to beam	L	=	4.85	m
Width of support - shorter span - Left	bxl	=	200	mm
Width of support - shorter span - Right	bxr	=	200	mm
Width of support - longer span - Left	byl	=	200	mm
Width of support - longer span - Right	byr	=	200	mm
Clear Cover of slab	cv	=	20	mm
Ratio Ly / Lx	ly/lx	=	1.34	< 2

LOAD CALCULATION :

Assume the thickness of the slab	=	120.00	mm	
Effective Depth of the of the slab	=	95.00	mm	
Self Weight of slab	=	3.000	KN / m^2	
Weathering course / Floor finishing	=	1.500	KN / m^2	
Wall load	=	0.000	KN / m^2	
Live Load	=	2.000	KN / m^2	
D L+L L	=	6.500	KN / m^2	
1.5D L+1.5L L	=	9.750	KN / m^2	

DESIGN AS TWO WAY SLAB

Support Condition : TWO ADJACENT EDGES DISCONTINUOUS

EFFECTIVE SPANS :

Shorter span: (Lx)

Clear span + effective depth	=	3.54	m
Center to centre of supports	=	3.64	m
Effective span	=	3.64	m

Longer span: (Ly)

Clear span + effective depth	=	4.75	m
Center to centre of supports	=	4.85	m
Effective span	=	4.85	m
Aspect Ratio Ly / Lx	=	1.33	< 2

As per IS 456

+ ve Alpha - x	=	0.053
- ve Alpha - x	=	0.071
+ ve Alpha - y	=	0.034
- ve Alpha - y	=	0.046

Compresnve Stength of Concrete	=	25.00	N/mm^2
Grade of steel	=	500.00	N/mm^2

BENDING MOMENTS:

Positive moment along Shorter dir.	Mx +ve =	6.85	KNm / m	dx+	=	95.00	mm	Kx+	=	0.030	Zx+	=	90.250 mm
Negative moment along Shorter dir.	Mx -ve =	9.17	KNm / m	dx-	=	95.00	mm	Kx-	=	0.041	Zx-	=	90.250 mm
Positive moment along Longer dir.	My +ve =	4.39	KNm / m	dy+	=	85.00	mm	Ky+	=	0.024	Zy+	=	80.750 mm
Negative moment along Longer dir.	My -ve =	5.94	KNm / m	dy-	=	95.00	mm	Ky-	=	0.026	Zy-	=	90.250 mm

EFFECTIVE DEPTH OF SLAB

REQUIRED AREA OF STEEL :

Ast req at midspan along x- dir.	ast +ve x =	171.91	mm^2
Ast req at midspan along y- dir.	ast +ve y =	122.32	mm^2
Ast req at support along x- dir.	ast -ve x =	233.44	mm^2
Ast req at support along y- dir.	ast -ve y =	148.45	mm^2
Minimum Ast required	ast min =	144.00	mm^2

REQUIRED SPACING OF STEEL:

10	mm dia at midspan along x- dir	=	457 mm c/c
10	mm dia at midspan along y- dir	=	545 mm c/c
10	mm dia at support along x- dir	=	336 mm c/c
10	mm dia at support along y- dir	=	529 mm c/c
8	mm dia for distribution steel	=	349 mm c/c
0	mm dia for top of mid span	=	100 mm c/c

PROVIDED SPACING OF STEEL

Bottom reinforcement along x- dir.	Y	8	130	mm c/c
Bottom reinforcement along y- dir.	Y	8	170	mm c/c
Top reinforcement along x- dir.	Y	8	130	mm c/c
Top reinforcement along y- dir.	Y	8	170	mm c/c
Distribution Steel	Y	8	200	mm c/c

CHECK FOR DEFLECTION :

Provided Ast (Bottom)	=	386.66	mm^2
Provided Ast (Top)	=	0.00	mm^2
Mu/bd^2	=	0.76	
Actual Span / Effective depth Ratio	=	38.32	
Design service stress	=	128.94	
Modification factor - Tension reinf	=	2.00	
Modification factor - Comp reinf	=	1.00	
Allowable Span /Effective depth Ratio	=	46.00	

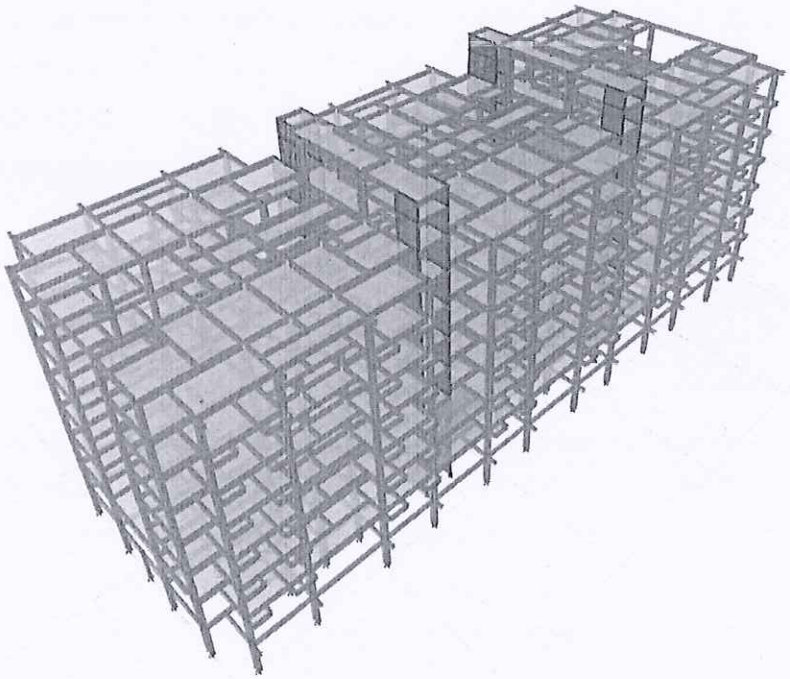
>>>>>> Hence SAFE in Deflection <<<<<<

SANKAR & ASSOCIATES COIMBATORE

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture engineering interior design
STRUCTURE NAME :	TOWER 10	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

STRUCTURAL DESIGN REPORT

"THE BUILDING UNDER CONSTRUCTION IN S.F. No's:- SF.Nos. 16/4A, 16/4B, 65/4, 65/5A, 65/5B, 76/4, 76/5, 77/1A, 77/1B, 77/2B, 77/2C1[A,B,C,D,E,F], 77/2C2, 77/3A, 77/3B, 78/1, 78/2, 79/1, 79/2, 80/1, 80/2, 81/1, 81/2, 82, 83, 85, 86/1B, 86/1C, 86/2A, 86/2B, 87/1A, 87/1B1, 87/1B2, 87/2A, 87/2B, 87/2C, 88/1, 88/2, 88/3, 89/2, 89/3A, 89/3B, 89/3C, 89/4A, 89/4B, 90 & 95/4 Perumattunallur Village, Chengalpattu Taluk, Kanchipuram District."



TOWER 14

S. MURUGESH, M.E.,FIE.,
Chartered Engineer F-1279323
Structural Engineer Grade-I
CMDA/SE/GR-I/2022/05/320

SANKAR & ASSOCIATES, ARCHITECTS & PLANNERS, COIMBATORE-641 009

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture engineering interior design
STRUCTURE NAME :	TOWER 14	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

Name of Project:		Name of the Structure:
SHRIRAM SHANKARI APARTMENT		RESIDENTIAL BUILDING -TOWER 14
Report by:	**Checked by:**	**Approved by:**
P.VETRIVELAVAN	S.MURUGESH	V.P.PONNUSWAMI

I. DESCRIPTION OF THE PROJECT:

The Proposed structure belongs to "M/S. SHRIPROP STRUCTURES PVT. LTD. at Perumattunallur - Chennai." Coimbatore. Purpose of this structure is to house "SHRIRAM SHANKARI APARTMENTS TOWER 14". The structure is designed for Stilt + 6 typical floors. The location of the proposed structure is in Seismic zone III {As per IS1893: (Part 1)–2016-(annex-E)} in India. The structural design was carried out as per IS456-2000. The dead load and live load are calculated based on IS 875: Part I & II. Seismic loads are considered as per IS 1893:2016. The structure was analyzed using the software- ETABS.

II. MATERIALS:

- **CONCRETE**

Concrete used for structural purpose shall be of grade M25 and comply with the relevant provisions of IS: 456 - 2000. Normal coarse aggregates shall be used for all concrete works. Ordinary Portland cement - Grade 43/53 (conforming to IS 8112/12269), Portland Pozzolana Cement (conforming to IS: 1489 (Part 1) shall be used in all structural concrete works.

Structural Elements	Grade of concrete
Foundation	M25
Upto Stilt Roof for Column / Walls	M25
Above Stilt Roof for Column / Walls	M25
Beam and Slab	M25

S. MURUGESH, M.E.,FIE.,
Chartered Engineer F-1279323
Structural Engineer Grade-I
CMD/ /SE/GR-I/2022/05/320

- **REINFORCEMENT**

Steel reinforcement shall be Grade Fe500. It shall confirm to IS: 1786-2008.Elongation percentage shall be 16%.as per IS-1786-2008

- **STRUCTURAL DESIGN STANDARDS**

Latest revisions of all applicable codes shall be mentioned below, Unless otherwise mentioned:

Loads:

- IS:875 -1997 Code of Practice for design loads for Buildings and structure (Part- 1, 2, 4 & 5).
- IS:875 -2015 Code of Practice for design loads for Buildings and structure (Part- 3 - Wind Loads).
- IS: 1893-2016 Criteria for earthquake resistant design of structure (Part-1).

Foundations:

- IS:1080-1997 Code of Practice for design and construction of shallow Foundations on soils (other than raft, ring and shell).
- IS:1904-1995 Code of Practice for design and construction of foundations In soils general requirement.
- IS:2950-1998 Code of Practice for design and construction of raft Foundations.
- IS:2974-1998 Code of Practice for design and construction of machine Foundations (All parts)
- IS:8009-1998 Code of Practice for calculation of settlement of Foundations.

RCC:

- IS: 456 -2000 Code of Practice for plain and reinforced concrete.
- IS: 16700 -2023 Criteria for structural safety of tall concrete buildings.
- IS: 458 -1988 Specification for precast concrete pipes.
- IS:3370-2009 Code of Practice for concrete structures for the storage of Liquids: (All parts)

- IS:4326-1993 Code of Practice for earthquake resistant design and Construction of buildings.
- IS:5525-1999 Recommendation for detailing of reinforced concrete works
- IS:1786-2008 Specification for high strength deformed steel bars and Wires for concrete reinforcement.
- IS: 10262-1999 Recommended guidelines for concrete mix design.
- IS:13920-2016 Code of Practice for ductile design & detailing of Reinforced concrete structures subjected to seismic forces.

Structural steel:

- IS:800 -2007 Code of Practice for general construction in steel
- IS:802 -1995 Code of Practice for use of structural steel in overhead Transmission line towers: (All parts)
- IS:806 -1996 Code of Practice for use of steel tubes in general Building construction
- IS:808 -1989 Dimensions for hot rolled steel beam, column channel and Angle section
- IS:816 -1998 Code of Practice for use of metal arc welding for general Construction in mild steel
- IS:1161-1998 Steel tubes for structural purposes
- IS:4000-1998 High Strength bolts in steel structures – Code of Practice
- IS:7215 -1995 Tolerances for fabrication of steel structures

Miscellaneous:

- IS: 432(PII)-1995 Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement
- IS: 6313(PII)-2001 Standards for anti-termite treatment
- IS:1905-1998 Code of Practice for structural use of unreinforced masonry
- IS:3067-1995 Code of Practice for general design details and preparatory Works for damp proofing and water proofing of buildings

- SP:6 -1998 Handbook for structural engineers (All parts)
- SP:7 -2016 National Building Code of India
- SP:16-1999 Design Aids for reinforced concrete to IS:456-1978
- SP:22-1982 Explanatory handbook on codes for earthquake engineering (IS: 1982-1975 and IS: 4326-1976)
- SP:24-1983 Explanatory handbook on Indian Standard code of Practice For plain and reinforced concrete
- SP:34-1987 Handbook of concrete reinforcement and detailing (SCIP)

Note: Only latest revisions of the codes, unless otherwise mentioned, shall be referred to for the purpose of this tender.

III. LOADS

Structures shall be designed for structural stability and integrity to resist safely and effectively all loads and effects of load combinations that may reasonably be expected during the lifetime of the structure. The design loads used for the structures, buildings and foundations shall conform to the requirements of the governing codes and specifications. As a minimum the design loads shall include dead load, super-imposed dead load, live load, wind load and seismic load.

DEAD LOAD:

Dead load shall include weight of all structural and Architectural components. Self-weight of the materials shall be calculated on the basis of unit weights given in IS: 875.

Material Density:

1. Unit weight of Plain concrete : 24.0 kN/m^3
2. Unit weight of Reinforced concrete : 25.0 kN/m^3
3. Unit weight of Block masonry (with plaster) : 22.0 kN/m^3
4. Unit weight of Brick masonry : 19.0 kN/m^3

5. Unit weight of Aerocon Block masonry : 6.0 kN/m^3
6. Unit weight of Steel : 78.50 kN/m^3
7. Unit Weight of Light Weight Filling : 10.00 kN/m^3
8. Unit weight of sunken filling : 18.80 kN/m^3
9. Unit weight of Terrace Garden filling load : 18.00 kN/m^3

Area Loads:

1. Self-weight of slab (Assumed as 110mm Tk.) : 2.750 kN/m^2
2. Self-weight of slab (Assumed as 120mm Tk.) : 3.000 kN/m^2
3. Floor finish (1kN/ m^2) + Service load(0.5kN/ m^2) : 1.500 kN/m^2
4. Terrace weathering course (SDL) : 2.000 kN/m^2
5. Partitions Load : 1.500 kN/m^2
6. Glazing, Louvers Load Per meter high : 1.800 kN/m
7. Unit wt. of Rc wall * Tk of wall * Ht of wall
   (22 x 0.20 x (2.95-0.35) : 11.44 kN/m
   (22 x 0.100 x (2.95-0.35) : 5.72 kN/m

LIVE LOAD:

The superimposed loads shall be calculated in accordance with IS: 875(Part-2) based on Occupancy classification. For multiple occupancies of use in the building shall be referred with the other appropriate comparable occupancy classification as per Table.1 of IS 875(Part-2)

1. RCC - Live load - 2 KN/m2
2. For Corridor and Staircase - 3 KN/m

SEISMIC PARAMETERS: (As per IS 1893-(Part 1)-2016)

1. Zone considered : Zone III
2. Zone factor : 0.16
3. Soil type : Medium

4. Response reduction factor : 3.0
5. Importance factor : 1.2
6. Damping ratio : 0.05
7. Fundamental Natural Period : 0.09 h/√d
   - X – Axis : 0.234
   - Y – Axis : 0.388

Note: Seismic masses are computed based on the following:

- 100% dead load, super-imposed dead loads.
- Suitable percentage of live loads to be considered as per IS: 1893 (Part1) :2016

WIND PARAMETERS: (As per IS 875-(Part 3)-2015)

1. Basic Wind Speed V_b : 50 m/s **(Chennai)**
2. Terrain Category : 2
3. Risk Coefficient k_1 : 1.00 (k1 corresponds to 50 years Mean Probable Design Life of Structure)
4. Factor k_2 : Terrain Category -2 Variation of wind speed with In different terrains as per Table-2.
5. Topography factor k_3 : 1.00
6. Design wind speed V_z : $V_b \times k_1 \times k_2 \times k_3$
7. Design wind pressure Pz : $0.6 \times Vz^2$
8. Wind directionality factor (K_d) : 1.0
9. Area Averaging factor (K_a) : 1.0
10. Reduction factor for clad building (K_c) : 0.9
11. Design Wind Pressure (P_d) : Pz x K_d x K_a x K_c

Note:

- Application of wind load and External pressure-wind coefficients considered shall be as adopted as per IS 875 (Part 3) -2015.

ENVIRONMENTAL CONDITIONS

- Environment/Exposure - Moderate
- Fire protection - Thickness of the structural elements as per Relevant codes – 2 hours fire rating
- Nominal cover to reinforcement - Not less than 35 mm
- Nominal covers for 2 hr. fire resistance

Cover to be adopted to the outermost link:

- Footing Bottom - 50 mm
- Footing Top - 30 mm
- Footing Side - 75 mm
- Columns - 40 mm
- RC Wall - 30 mm
- Beams - 25 mm
- Slabs - 20 mm

TEMPERATURE LOADS

The effect of temperature will be considered wherever applicable (in podium slab) in accordance with relevant Indian Codes. The coefficient for thermal expansion and contraction will be in accordance with IS: 456 for concrete. The Temperature load has been assigned as 15° C.

EXCEPTIONAL LOADS

Loads due to the following catastrophe scenarios are not considered in the design.

- Exceptional loads due to terrorist attacks (Explosions) ·
- Accidental loads (Falling of aircraft on the building) ·
- Accidental collision of vehicle on to the façade of the building ·
- Snow load
- Auto sequence construction load case is added.

IV. STRUCTURAL DESIGN ANALYSIS

The entire structure is analyzed using software ETABS which is internationally accepted. 3D model of structure is prepared. Column and beams are modeled as members, a column is from the foundation level and the support is considered as fixed. Slabs are modeled using elements. Modifiers are provided. Moment of Inertia to be taken as

- Columns - 0.70
- Beams - 0.35
- Slabs - 0.25
- Walls - 0.70

The Structural System comprises Conventional beam slab system supported by RC structural columns/walls for tower and clubhouse respectively. The Towers in general has the conventional system in typical floor system and transfer girder system for the stilt floor. Floor slabs and beams are considered to act as rigid diaphragm to transfer the lateral forces to the supporting walls. Toilet is sunk by 100 mm. Staircases are provided with mid-landing between the floors as per architectural layout.

Various loadings are applied and analyzed for various load combinations as per IS -875-(part- 5)1897. The results of all load combinations are reviewed and members are designed for maximum forces developed.

Forces and moments from the 3 dimensional analysis output for the worst combination are used for the design of the structure. Response spectrum method is used for earthquake dynamic analysis. The super structure members are designed for actual flexure, shear and other forces for the worst load combinations.

BUILDING RESPONSE LIMITS:

Deflection Limits:

For Reinforced concrete works: Limiting values of deflection (Short and Long term) as per clause 35.3 of IS: 456-2000 is followed in the design. · Limiting value for short term deflection is considered as span/250 and for the long term deflection is considered as span/350 or 20mm whichever less as per IS 456 - 2000.

LOAD COMBINATIONS:

Load combinations shall be as per IS 1893:2016 (Part I) using Limit State Design (LSD) approach. Partial Safety Factors for Loads for Limit States of strength and serviceability shall be as follows;

Load Combinations to be considered for strength and serviceability checks

Load Combination	*Limit Sate of Collapse*			*Limit Sate of Serviceability*		
	DL	*LL*	*WL/EL*	*DL*	*LL*	*WL/EL*
DL+LL	1.5	1.5	-	1.0	1.0	-
DL+LL+/- WL	1.2	1.2	1.2	1.0	1.0	1.0
DL+LL+/- EL	1.2	1.2	1.2	1.0	1.0	1.0
DL+/- WL	1.5 / 0.9	-	1.2	1.0	-	1.0
DL+/- EL	1.5 / 0.9	-	1.5	1.0	-	1.0
DL+LL+/- WL	1.2	1.2	0.6	-	-	-

Note: * This value is to be considered when stability against overturning or stress reversal is critical

Additional Design Load Combinations to be considered ONLY when Clause 6.3.3 is applicable.

Load Combination to account for Design Vertical Earthquake effects

Load Combination	*DL*	*LL*	*EQx*	*EQz*	*EQy*
DL+/- EL	1.5	-	1	0.3	0.3
DL+/- EL	1.5	-	0.3	1	0.3
DL+LL+/- EL	1.2	1.2	1	0.3	0.3
DL+LL+/- EL	1.2	1.2	0.3	1	0.3
DL+/- EL	0.9	-	1	0.3	0.3
DL+/- EL	0.9	-	0.3	1	0.3

Note:

These load combinations should not be considered for serviceability checks.

Where;

- DL = Dead Load,
- LL = Live Load,
- WLx & WLy = Wind Load in X and Y direction,
- ELx & ELy = Seismic Load in X and Y **horizontal** direction and

V. FOUNDATION SYSTEM:

Foundations are designed depending upon Geo technical investigation report and will dissipate all the vertical and horizontal loads safely to the soil. As per the soil investigation report received from geotechnical consultant, the following are their recommendations,

- ❖ Soil Investigation Report - Geotech Consultancy
- ❖ Foundation Type - Isolated Footings
- ❖ Safe Bearing Capacity - 400 kN/sq.m.
- ❖ P.C.C (1:4:8) bed below foundation -150mm
- ❖ Any deviation if observed during execution other than that available as per bore log may be brought to the notice for further suggestions.

VI. DESIGN PHILOSOPHY

The designs of the RCC elements are made using the limit state method with appropriate load factors as per IS 456:2000 and IS 13920:2016

The detailing of the structural elements shall generally confirm as per IS 13920:2016. Lapping in the columns/vertical elements shall be within the middle third portion of the floor height as per the ductile detailing.

VII. DESIGN LIFE:

The design life of the building is assumed as 50 years. This requirement is applicable only for concrete works and not applicable to replaceable finishing materials, water proofing membrane and thermal insulations (if any). Hence periodic maintenance is required for all replaceable material for longer life.

PERMISSIBLE DRIFT LIMIT:

- **INTER-STOREY DRIFT**

As per IS1893 (Part1) :2016 & IS 16700 : 2023, Storey drift in any storey due to minimum specified design seismic lateral force shall not exceed 0.002 times the storey height or hi/250.

- **OVERALL DRIFT**

Lateral sway due to wind load should not exceed H/500 (H is the total height of structure).

TABLE: Story Drifts

Story	Output Case	Direction	Drift	Building Height	H/500 or 0.002	Check
TERRACE	DConS1	Y	0.000233	20.8	0.0416	OK
TERRACE	DConS2	Y	0.000273	20.8	0.0416	OK
TERRACE	DConS3	X	0.00051	20.8	0.0416	OK
TERRACE	DConS3	Y	0.000239	20.8	0.0416	OK
TERRACE	DConS4	X	0.000482	20.8	0.0416	OK
TERRACE	DConS4	Y	0.000211	20.8	0.0416	OK
TERRACE	DConS5	Y	0.000628	20.8	0.0416	OK
TERRACE	DConS6	Y	0.001039	20.8	0.0416	OK
TERRACE	DConS7	X	0.000631	20.8	0.0416	OK
TERRACE	DConS7	Y	0.000267	20.8	0.0416	OK
TERRACE	DConS8	X	0.000599	20.8	0.0416	OK
TERRACE	DConS8	Y	0.000229	20.8	0.0416	OK
TERRACE	DConS9	Y	0.000818	20.8	0.0416	OK
TERRACE	DConS10	Y	0.00126	20.8	0.0416	OK
TERRACE	DConS11	X	0.000617	20.8	0.0416	OK
TERRACE	DConS11	Y	0.000187	20.8	0.0416	OK
TERRACE	DConS12	X	0.000595	20.8	0.0416	OK
TERRACE	DConS12	Y	0.000146	20.8	0.0416	OK
TERRACE	DConS13	Y	0.000901	20.8	0.0416	OK
TERRACE	DConS14	Y	0.00117	20.8	0.0416	OK
TERRACE	DConS15	X	0.001118	20.8	0.0416	OK
TERRACE	DConS15	X	0.001062	20.8	0.0416	OK
TERRACE	DConS15	Y	0.000314	20.8	0.0416	OK
TERRACE	DConS16	X	0.001029	20.8	0.0416	OK
TERRACE	DConS16	Y	0.000198	20.8	0.0416	OK
TERRACE	DConS16	X	0.001072	20.8	0.0416	OK
TERRACE	DConS16	Y	0.000284	20.8	0.0416	OK
TERRACE	DConS17	Y	0.001688	20.8	0.0416	OK

TERRACE	DConS17	X	0.000285	20.8	0.0416	OK
TERRACE	DConS17	Y	0.001376	20.8	0.0416	OK
TERRACE	DConS18	Y	0.001754	20.8	0.0416	OK
TERRACE	DConS18	Y	0.002121	20.8	0.0416	OK
TERRACE	DConS19	X	0.001391	20.8	0.0416	OK
TERRACE	DConS19	X	0.001321	20.8	0.0416	OK
TERRACE	DConS19	Y	0.00036	20.8	0.0416	OK
TERRACE	DConS20	X	0.001288	20.8	0.0416	OK
TERRACE	DConS20	X	0.001344	20.8	0.0416	OK
TERRACE	DConS20	Y	0.000327	20.8	0.0416	OK
TERRACE	DConS21	Y	0.002149	20.8	0.0416	OK
TERRACE	DConS21	X	0.000362	20.8	0.0416	OK
TERRACE	DConS21	Y	0.001753	20.8	0.0416	OK
TERRACE	DConS22	Y	0.002157	20.8	0.0416	OK
TERRACE	DConS22	Y	0.002612	20.8	0.0416	OK
TERRACE	DConS23	X	0.001377	20.8	0.0416	OK
TERRACE	DConS23	X	0.001306	20.8	0.0416	OK
TERRACE	DConS23	Y	0.00028	20.8	0.0416	OK
TERRACE	DConS24	X	0.001286	20.8	0.0416	OK
TERRACE	DConS24	X	0.001349	20.8	0.0416	OK
TERRACE	DConS24	Y	0.000263	20.8	0.0416	OK
TERRACE	DConS25	Y	0.002242	20.8	0.0416	OK
TERRACE	DConS25	X	0.000374	20.8	0.0416	OK
TERRACE	DConS25	Y	0.001831	20.8	0.0416	OK
TERRACE	DConS26	X	0.000411	20.8	0.0416	OK
TERRACE	DConS26	Y	0.002073	20.8	0.0416	OK
TERRACE	DConS26	Y	0.002519	20.8	0.0416	OK
TERRACE	DConS27	X	0.000925	20.8	0.0416	OK
TERRACE	DConS27	Y	0.000197	20.8	0.0416	OK
TERRACE	DConS27	X	0.000889	20.8	0.0416	OK
TERRACE	DConS27	Y	0.000253	20.8	0.0416	OK
TERRACE	DConS28	X	0.000225	20.8	0.0416	OK
TERRACE	DConS28	Y	0.001135	20.8	0.0416	OK
TERRACE	DConS28	Y	0.001529	20.8	0.0416	OK
TERRACE	DConS29	X	0.00115	20.8	0.0416	OK
TERRACE	DConS29	Y	0.000209	20.8	0.0416	OK
TERRACE	DConS29	X	0.001108	20.8	0.0416	OK
TERRACE	DConS29	Y	0.000282	20.8	0.0416	OK
TERRACE	DConS30	X	0.000269	20.8	0.0416	OK
TERRACE	DConS30	Y	0.001452	20.8	0.0416	OK
TERRACE	DConS30	Y	0.001876	20.8	0.0416	OK
TERRACE	DConS31	X	0.001136	20.8	0.0416	OK
TERRACE	DConS31	X	0.001108	20.8	0.0416	OK
TERRACE	DConS31	Y	0.000202	20.8	0.0416	OK
TERRACE	DConS32	X	0.000246	20.8	0.0416	OK
TERRACE	DConS32	Y	0.001533	20.8	0.0416	OK
TERRACE	DConS32	Y	0.00179	20.8	0.0416	OK

STOREY FORCES:

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions

Filter: ([Output Case] = 'EqX' OR [Output Case] = 'EqY' OR [Output Case] = 'RSX' OR [Output Case] = 'RSY')

Output Case	Case Type	Step Type	Step Number	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m
EqX	LinStatic	Step By Step	1	-1948.5552	0	0	6.0287	-42055.3424	21730.4013
EqX	LinStatic	Step By Step	2	-1948.5552	0	0	9.7383	-42052.4662	23916.8306
EqX	LinStatic	Step By Step	3	-1948.5552	0	0	2.3191	-42058.2187	19544.122
EqY	LinStatic	Step By Step	1	0	-3689.5597	0	71821.7193	-11.7115	-116541.3328
EqY	LinStatic	Step By Step	2	0	-3689.5597	0	71803.6118	-25.7451	-127279.9368
EqY	LinStatic	Step By Step	3	0	-3689.5597	0	71839.8269	2.3222	-105802.729
RSX	LinRespSpec	Max		1948.5542	10.6433	0	133.4759	34834.7298	21237.1007
RSY	LinRespSpec	Max		11.6033	3689.5592	0	58960.0643	141.6207	121019.2426

Record: << < 1 > >> of 8 Add Tables... Done

From the above tables, it is observed that scale factor values are matched in both the axis.

Story Stiffness and Strength (Soft Story Check):

As PER 16700: 2023 Parameters influencing stiffness and strength of the building should be so proportioned, that the following are maintained:

a. Lateral translational stiffness of any story shall not be less than 70 percent of that of the story above.

b. Lateral translational strength of any story shall not be less than that of the story above.

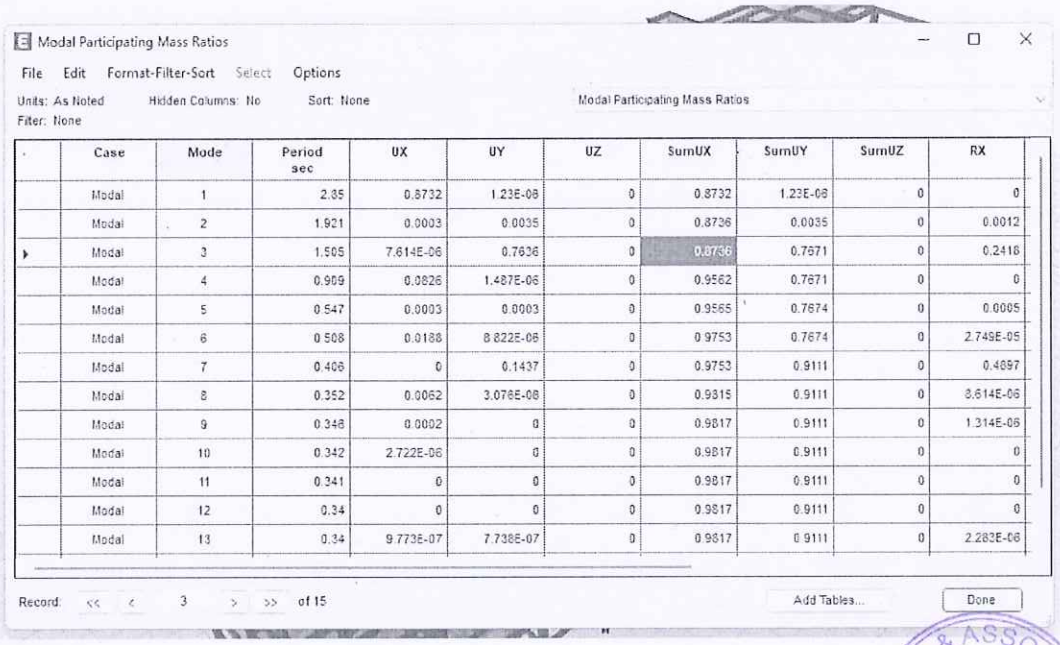
TABLE: Story Stiffness

Story	Output Case	Stiff X kN/m	Stiff Y kN/m	Check (%)	Required	Status
TERRACE	EQX	210186.563	0	112.962983	70	OK
6TH FLOOR	EQX	237433.012	0	98.026213	70	OK
5TH FLOOR	EQX	232746.59	0	97.2095149	70	OK
4TH FLOOR	EQX	226251.831	0	99.7449117	70	OK
3RD FLOOR	EQX	225674.689	0	103.31632	70	OK
2ND FLOOR	EQX	233158.783	0	90.7665018	70	OK
1ST FLOOR	EQX	211630.071	0	158.720808	70	OK
PLINTH	EQX	335900.959	0	0		

TERRACE	EQY	0	284346.322	159.251479	70	OK
6TH FLOOR	EQY	0	452825.724	115.285831	70	OK
5TH FLOOR	EQY	0	522043.901	111.880317	70	OK
4TH FLOOR	EQY	0	584064.372	112.676508	70	OK
3RD FLOOR	EQY	0	658103.339	124.193672	70	OK
2ND FLOOR	EQY	0	817322.703	130.72673	70	OK
1ST FLOOR	EQY	0	1068459.243	202.675096	70	OK
PLINTH	EQY	0	2165500.796	0		

Modal Participating Mass Ratio:

As per IS1893 (Part1) :2016, In Buildings located in seismic Zone II and III, it should be ensured that the three significant modes together contribute 65 percent mass participation factor in each principal plan direction and total modal mass participation ratio should be greater than 90 percent. Table Below shows Modal Participating Mass Ratio of Proposed Building.



Modal Participating Mass Ratios

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Modal Participating Mass Ratios

Filter: None

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX
Modal	1	2.35	0.8732	1.23E-08	0	0.8732	1.23E-08	0	0
Modal	2	1.921	0.0003	0.0035	0	0.8736	0.0035	0	0.0012
Modal	3	1.505	7.614E-06	0.7636	0	0.8736	0.7671	0	0.2418
Modal	4	0.909	0.0826	1.487E-06	0	0.9562	0.7671	0	0
Modal	5	0.547	0.0003	0.0003	0	0.9565	0.7674	0	0.0005
Modal	6	0.508	0.0188	8.822E-06	0	0.9753	0.7674	0	2.749E-05
Modal	7	0.406	0	0.1437	0	0.9753	0.9111	0	0.4097
Modal	8	0.352	0.0062	3.076E-06	0	0.9815	0.9111	0	8.614E-06
Modal	9	0.348	0.0002	0	0	0.9817	0.9111	0	1.314E-06
Modal	10	0.342	2.722E-06	0	0	0.9817	0.9111	0	0
Modal	11	0.341	0	0	0	0.9817	0.9111	0	0
Modal	12	0.34	0	0	0	0.9817	0.9111	0	0
Modal	13	0.34	9.773E-07	7.738E-07	0	0.9817	0.9111	0	2.282E-06

Record: << < 3 > >> of 15 Add Tables... Done

SANKAR & ASSOCIATES COIMBATORE

Torsional Irregularity Check:

As per 1893: 2016, in torsional irregular buildings, when the ratio of maximum horizontal displacement at one end and the minimum horizontal displacement at the other end is in range of 1.5-2.0, the building configuration shall be revised. But here the ratio is within limits so no need of revision.

Story Max Over Avg Displacements

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None

Filter: ([Output Case] = 'RSX' OR [Output Case] = 'RSY')

Story Max Over Avg Displacements

Story	Output Case	Case Type	Step Type	Step Number	Direction	Maximum mm	Average mm	Ratio
HR	RSX	LinRespSpec	Max		X	44.423	43.945	1.011
TANK BASE	RSX	LinRespSpec	Max		X	43.91	43.747	1.004
TERRACE	RSX	LinRespSpec	Max		X	42.986	42.524	1.011
6TH FLOOR	RSX	LinRespSpec	Max		X	41.338	40.915	1.01
5TH FLOOR	RSX	LinRespSpec	Max		X	38.409	38.037	1.01
4TH FLOOR	RSX	LinRespSpec	Max		X	34.145	33.837	1.009
3RD FLOOR	RSX	LinRespSpec	Max		X	28.635	28.395	1.008
2ND FLOOR	RSX	LinRespSpec	Max		X	22.122	21.954	1.008
1ST FLOOR	RSX	LinRespSpec	Max		X	14.903	14.802	1.007
HR	RSY	LinRespSpec	Max		Y	30.746	29.712	1.035
TANK BASE	RSY	LinRespSpec	Max		Y	29.292	28.354	1.033
TERRACE	RSY	LinRespSpec	Max		Y	28.478	28.285	1.083
6TH FLOOR	RSY	LinRespSpec	Max		Y	25.997	23.943	1.086
5TH FLOOR	RSY	LinRespSpec	Max		Y	22.581	20.708	1.089

Record: << < 1 > >> of 18 Add Tables... Done



FOOTING DESIGN:

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

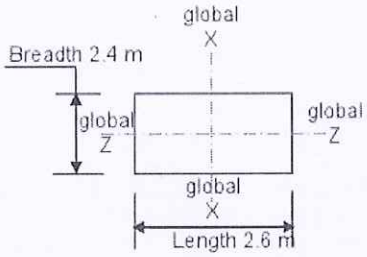
Building Name TOWER 14
Footing Number: **F12**
Node number **45**

COLUMN

Length (l, dim. || Z axis) =	750	mm
Breadth (b, dim. || X axis) =	300	mm

FOOTING

Foot length (L, dim. || Z axis) =	2.60	m
Foot Breadth (B, dim. || X axis) =	2.40	m
Thickness of footing (t) =	800	mm
Clear cover of footing =	50	mm
Main bar dia of footing =	16	mm
Effective depth of footing =	**742**	mm
Selfweight of the footing =	**124.80**	KN
Area of Footing(A) =	**6.24**	m^2
Sect mod of foot about Z axis (Zz) =	**2.50**	m^3
Sec mod of foot about X axis (Zx) =	**2.70**	m^3



Footing Dimensions

MATERIALS OF CONSTRUCTION

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2

CHECK FOR GROSS BEARING PRESSURE

Safe NET bearing pressure =	400	KN/m^2	
Safe gross bearing pr. =	**462.70**	KN/m^3	(net pr. + depth of foot * soil unit wt)
Unfactored load case number =	0		
Axial load from output (P1) =	2309.73	KN	
Moment about Z axis (M_z) =	3.99	KN-m	
Moment about X axis (M_x) =	-0.38	KN-m	
Depth of top of foot. from ground =	2.5	m	
Unit wt of soil =	19	KN/m^3	
Weight of soil retained above foot =	**285.71**	KN	
P = (P1+soil+foot self wt) =	**2720.25**	KN	
Maximum bearing pressure =	**437.40**	KN/m^2	$\frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x}$
Minimum bearing pressure =	**434.48**	KN/m^2	

Hence footing is safe against max gross bearing pr.

DESIGN FORCES

Factored load comb. no.	0	
Axial load:(P_u) =	3464.6	**KN**
Moment about Z axis (M_{uz}) =	5.98665	**KN-m**
Moment about X axis (M_{ux}) =	-0.5628	**KN-m**

Maximum effective soil pressure $p_{e\,max}$
(Pu/Area+ Muz/Zz + Mux/Zx) = **557.41 KN/m^2**
Minimum effective soil pressure $p_{e\,min}$
(Pu/Area - Muz/Zz - Mux/Zx) = **553.03 KN/m^2**
Design of footing is done using above maximum effective soil pressure



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CALCULATION FOR BOTTOM STEEL

Mu about X1 X1 = (pe max x length^2/2)= **238.47** KN-m per meter

Mulimit = **1830.97** KN-m per meter

The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

Hence, Ast = **754.535** mm^2

Min Ast = **890.400** mm^2 (0.12 % for slab, cl 26.5.2.1)

Spacing = **225.81** mm (considering max of above two calculated values of Ast)

pt provided = **0.12** %

Hence provide 16 mm dia bar @ 225 mm c/c parellel to length of footing (|| to Z)

Mu about N1 N1 = (pe max x length^2/2)= **307.27** KN-m per meter

Calc. Ast = **978.265** mm^2 The section is singly reinforced

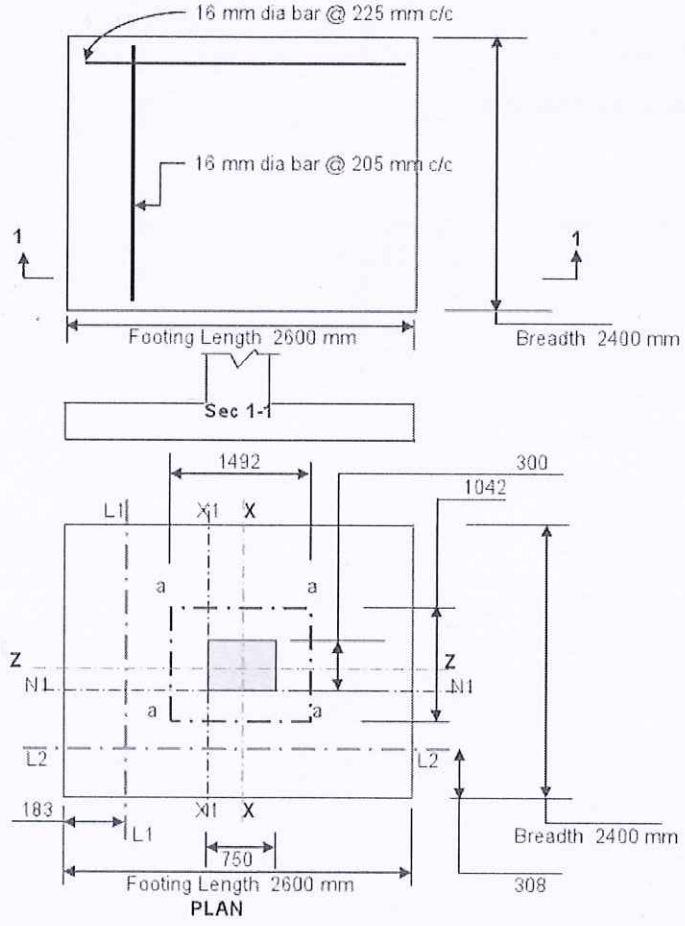
Min Ast = **890.4** mm^2 (0.12 % for slab, cl 26.5.2.1)

Spacing = **205.53** mm (considering max of above two calculated values of Ast)

pt provided = **0.13184158** %

Hence provide 16 mm dia bar @ 205 mm c/c parellel to breadth of footing (|| to X)

Arrangement of bottom reinforcement as per above design is shown below



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CHECK FOR ONE WAY SHEAR :

One way shear at critical section L1- L1

Distance of critical sec. from edge of footing = **0.183** m

Shear force Vs =pe max x 0.183 x 1m width of footing = **102.007** KN

Shear stress τ_v = Vs/bd = **0.137** N/mm^2

τ_c = **0.26** N/mm^2

tv < tc hence O.K.

One way shear at critical section L2- L2

Distance of critical sec. from edge of footing = **0.308** m

Shear force Vs =pe max x 0.308 x 1m width of footing = **171.684** KN

Shear stress τ_v = Vs/bd = **0.231** N/mm^2

τ_c = **0.27** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Ref. cl 34.2.4 and cl.31.6.3 of IS 456 : 2000

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.58333** >1

Hence, k_s = **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Shear force Vs = 557.414 (2.6 x 2.4 - 1.492 x 1.042) = **2611.68** KN

Length of critical section = 2 x (1492 + 1042) = **5068** mm

Area of the critical section (length of critical sec x eff. d) = **3760456** mm^2

Hence shear stress τ_v = **0.695** N/mm^2

tv < allowable hence O.K.

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PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

COLUMN DESIGN:

COLUMN DESIGN

Input Data

Breadth	b	=	300.00	mm
Depth	D	=	750.00	mm
Clear cover	cc	=	40.00	mm
Effective cover	d'	=	60.50	mm
Effective Breadth	b'	=	239.50	mm
Effective Depth	D'	=	689.50	mm
Length of column	L	=	2.95	m
Depth of Beam/Slab framing into coln (Major)	Bd	=	0.35	m
Depth of Beam/Slab Framing into coln (Minor)	Bd	=	0.60	m
Clear length in major axis	Lc or Lo	=	2.60	m
Clear height in minor axis	Lc or Lo	=	2.35	m
Effective length factor	β	=	1.20	
Effective length of column	Leff (x-dir)	=	3.12	m
Effective length of column	Leff (y-dir)	=	2.82	m
Axial Load (Factored)	N	=	3131.90	KN
Moment about major axis (Factored)	Mx	=	13.88	KN-m
Moment about minor axis (Factored)	My	=	4.37	KN-m
Characteristic strength of concrete	fck	=	25.00	N/mm^2
Characteristic strength of steel	fy	=	500	N/mm^2

Design Calculations:

Step1: Check for Slenderness ratio : Leff/D = 4.16 <12

Check for Slenderness ratio : Leff/b = 9.40 <12

Design as Short Column

eax = 0.00 mm

eay = 0.00 mm

Slenderness limits for column Lo < 60 b 2.60 m < 18.00 m

Step:2 Check for moment due to minimum eccentricity

Minimum Eccentricity (L/500 + d or b/30) or 20 (whichever is· ex = 20.00 mm

ey = 14.70 mm

A.) Moments due to Min eccentricity Mex = 62.64 KN-m

Mey = 46.04 KN-m

Step:3 Calculation of Additional Moments

Assume Percentage of Reinforcement p = 2.04 %

Reinforcement Equally Distributed on Four Face

Puz = 4252.50 KN

d'/d along x-dir = 0.10

d'/b along y-dir = 0.20

Along x-direction

k1 = 0.207

k2 = 0.425

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Along y-direction

	k1	=	0.184	
	k2	=	0.04	
Pb=(k1 + k2 p/Fck)Fck b d)	Pbx	=	1359.45	KN
	Pby	=	1053.36	KN
k = (Puz - Pu)/(Puz - Pb)	Kx	=	0.39	
	Ky	=	0.35	
B.) Additional Moments	Max	=	0.00	KN-m
	May	=	0.00	KN-m

Step:4 Total Moments for which the column is to be designed are

D.) Final Moment	**Mux**	=	**62.64**	KN-m
	Muy	=	**46.04**	KN-m

Step:5

Pu / Fck bD = 0.56

p/Fck = 0.08

*Refer CHART 48 From SP 16 : 1980 for red values

Pu / Fck bD= 0.56 p/Fck= 0.0816 d'/D = 0.10

Mux1 / Fck bD^2	=	0.09		
Mux1	=	**379.69**	KN-m	

*Refer CHART 50 From SP 16 : 1980 for red values

Pu / Fck 0.56 p/Fck= 0.0816 d'/b = 0.20

Muy1 / Fck bD^2	=	0.08		
Muy1	=	**135.00**	KN-m	
Mux/Mux1	=	0.16		
Muy/Muy1	=	0.34		
Pu/Puz	=	0.74		
αn	=	1.89		
(Mux/Mux1)^αn + (Muy/Muy1)^αn	=	**0.16**	**<1**	

Step:6 Longitudinal Reinforcemer Area of steel Required Asc = 4590.00 mm^2

Larger dia		**Smaller dia**		
Select Bar dia	25 mm	Select Bar dia	=	20 mm
No. of bars Req	9.4	No. of bars Req	=	5.2
No. of bars Prov	6	No. of bars Prov	=	6
Area Prov.	2945.24	Area Prov.	=	1885

Area of Steel Provided Asc (pro) = 4830.20 mm^2

Percentage of Steel Provided = 2.15 %

Provide 6Y25+ 6Y20 as longitudinal reinforcement

Step:7 Lateral Ties

1. Pitch: (take whichever is lesser)

i. 16x smaller dia of main steel		=	300.00	mm
ii. 200 mm		=	200.00	mm
	Pi	=	200.00	mm

2. Diameter (whichever is greater)

i. 1/4 x largest dia of main steel		=	6.25	mm
ii. 8mm		=	8.00	mm
	Dia	=	8.00	mm

Therefore provide Y8 @200c/c as Lateral ties.

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CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
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PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

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BEAM DESIGN:

SANKAR AND ASSOCIATES				SHRIRAM SHANKARI APARTMENT			
				Client:	M/S SHRIRAM SHANKARI		
				Job No:		Date:	17-03-2026
Page Type:	Calculation Sheet -TOWER 14			Prepared By:	MS	Revision:	-
Section:	Design of Beam as per IS:456	Beam No:	B20	Checked By:	NA	Date Revised:	-

SECTION DETAILS — Floor Level : **Third floor**

Width of the beam	B	=	300.00	mm
Depth of the beam	D	=	600.00	mm
Clear cover of the beam	C	=	25	mm
Grade of concrete	f_{ck}	=	25	N/mm^2
Grade of steel	Fy	=	500	N/mm^2
Effective length of the beam	L	=	7	m

FORCE DETAILS FROM ETAB : B274

Max. sagging moment of the beam		=	140.24	kN m
LHS Support moment of the beam		=	195.57	kN m
RHS Support moment of the beam		=	191.56	kN m
Torsional Moment		=	0.00	kN m
Shear force at LHS of the beam		=	200.12	kN
Shear force at RHS of the beam		=	203.13	kN
Shear force at concentrated load location		=	0.00	kN

Design of beam at LHS section

Tension Reinf.

Bending Mt (ΔM_u)	=	195.57	kN m
Breath of the beam (B	=	300	mm
Effective cover (d')	=	59.7	mm
Effective depth (d)	=	540.29	mm
x_u max/d	=	0.4560	
K_u= M_u/(bd^2f_{ck})	=	0.0893	(2.234)
K_2	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	45.5	mm
A_{st} lim	=	1538	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	942	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	2	0	0
Provided	3	2	0
Ast prov.	1473	0	0

$A_{st\,provided}$ = 1473 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	736	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1.5	0	0
Provided	3	0	0
Ast prov.	1473	0	0

$A_{sc\,provided}$ = 1473 mm^2

Shear Check

Shear force Vu	=	200.12	kN
ζ_v = Vu/bd	=	1.23	N/mm^2
% of reinf provided	=	0.91	%
Design Stress	=	0.62	N/mm^2
ζ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf.

Reqd. stirrup spac.	=	236.66	mm
Provied stirrup spac	=	125	mm

Design of beam at Max sagging section

Tension Reinf.

Bending Mt (ΔM_u)	=	140.24	kN m
Breath of the beam (B	=	300	mm
Effective cover (d')	=	45.5	mm
Effective depth (d)	=	554.50	mm
x_u max/d	=	0.4560	
K_u= M_u/(bd^2f_{ck})	=	0.0609	(1.521)
K_2	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	59.7	mm
A_{st} lim	=	1573	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	736	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No.	1.5	0	0
Provided	3	0	0
Ast prov.	1473	0	0

$A_{st\,provided}$ = 1473 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	389	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No.	0.3	0	0
Provided	3	2	0
Ast prov.	1473	0	0

$A_{sc\,provided}$ = 1473 mm^2

Torsional Reinforcement

Torsional Moment	=	0.00	kNm
ζ_{ve}	=	0.00	N/mm^2
ζ_c max	=	3.10	N/mm^2
M_1	=	0.00	kNm
M_2	=	0.00	kNm
Stirrup spacing reqd	=	300.00	mm
Sideface Reinf reqd	=	0.00	mm^2.

Provide 2 Nos of 12 mm on EVF

Ast prov. = 452.4 mm^2

Design of beam at RHS section

Tension Reinf.

Bending Mt (ΔM_u)	=	191.56	kN m
Breath of the beam (B	=	300	mm
Effective cover (d')	=	59.7	mm
Effective depth (d)	=	540.29	mm
x_u max/d	=	0.4560	
K_u= M_u/(bd^2f_{ck})	=	0.0875	(2.188)
K_2	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	45.5	mm
A_{st} lim	=	1538	mm^2
ΔA_{st}	=	0	mm^2
fsc	=	0.0	N/mm^2
A_{st} reqd	=	919	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No.	1.9	0	0
Provided	3	2	0
Ast prov	1473	0	0

$A_{st\,provided}$ = 1473 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	736	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1.5	0	0
Provided	3	0	0
Ast prov	1473	0	0

$A_{sc\,provided}$ = 1473 mm^2

Shear Check

Shear force Vu	=	203.13	kN
ζ_v = Vu/bd	=	1.25	N/mm^2
% of reinf provided	=	0.91	%
Design Stress	=	0.62	N/mm^2
ζ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf.

Reqd. stirrup spac.	=	229.73	mm
Provied stirrup spac	=	125	mm

CHECK FOR DEFLECTION : As per IS 456

Provided area of reinforcement	=	1473	
Mu/bd^2	=	1.52	
Actual Span / Effective depth Ratio	=	11.90	
Support Condition	=	Continuous	
Design service stress	=	145.00	
Modification factor - Tension reinf	=	1.69	
Modification factor - Comp. reinf.	=	1.23	
Allowable Span /Effective depth Ratio	=	54.05	

Hence SAFE in Deflection

Beam No	Size	Bottom steel		Top steel			Stirrups		Side Face Reinf.
		Straight	Curtail	Middle	LHS	RHS	Ends	Mid	
B20	300 x 600	3Y25	---	3Y25	3Y25	3Y25+2Y20	2L Y8/125	2L Y8/175	2Y12 EVF

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture engineering interior design
STRUCTURE NAME :	TOWER 14	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

SANKAR AND ASSOCIATES				SHRIRAM SHANKARI APARTMENT			
				Client	M/S SHRIRAM SHANKARI		
				Job No		Date	17-03-2026
Page Type	Calculation Sheet -TOWER 14			Prepared By	MS	Revision	-
Section	Design of Beam as per IS 456	Beam No	B16	Checked By	NA	Date Revised	-

SECTION DETAILS — Floor Level : **First Floor** — **B171**

Width of the beam	B	=	200.00	mm
Depth of the beam	D	=	500.00	mm
Clear cover of the beam	C_c	=	25	mm
Grade of concrete	f_{ck}	=	25	N/mm^2
Grade of steel	F_y	=	500	N/mm^2
Effective length of the beam	L	=	6	m

FORCE DETAILS FROM ETAB :

Max sagging moment of the beam	=	124.37	kN m
LHS Support moment of the beam	=	150.18	kN m
RHS Support moment of the beam	=	134.24	KN m
Torsional Moment	=	0.00	KN m
Shear force at LHS of the beam	=	142.33	KN
Shear force at RHS of the beam	=	113.68	KN
Shear force at concentrated load location	=	0.00	KN

Design of beam at LHS section

Tension Reinf.

Bending Mt (M_{Ulx})	=	150.18	kN m
Breath of the beam (B)	=	200	mm
Effective cover (d')	=	64.0	mm
Effective depth (d)	=	435.96	mm
x_u max/d	=	0.4560	
$K_u = M_{ulx}/(bd^2 f_{ck})$	=	0.1580	(3.951)
K_{u1}	=	0.1338	

Hence Comp. reinf. Reqd.

Eff. Cover d'(Comp)	=	45.5	mm
A_{st} lim	=	827	mm^2
ΔA_{st}	=	136	mm^2
f_{sc}	=	410.0	N/mm^2
A_{st} reqd	=	963	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	2	0	0
Provided	2	2	0
Ast prov	982	0	0

$A_{st\,provided}$ = 982 mm^2

Compression Reinf.

$A_{st\,required}$	=	169	mm^2
$A_{st\,min}$	=	491	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No.	1	0	0
Provided	2	0	0
Ast prov.	982	0	0

$A_{st\,provided}$ = 982 mm^2

Shear Check

Shear force V_{us}	=	142.33	kN
$\zeta_v = V_{us}/bd$	=	1.63	N/mm^2
% of reinf provided	=	1.13	%
Design Stress	=	0.67	N/mm^2
ζ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf.

Reqd. stirrup spac.	=	227.24	mm
Provd stirrup spac.	=	125	mm

Design of beam at Max sagging section

Tension Reinf.

Bending Mt (M_{Ulx})	=	124.37	kN m
Breath of the beam (B)	=	200	mm
Effective cover (d')	=	45.5	mm
Effective depth (d)	=	454.50	mm
x_u max/d	=	0.4560	
$K_u = M_{ulx}/(bd^2 f_{ck})$	=	0.1204	(3.011)
K_{u1}	=	0.1338	

Hence comp. reinf. NOT reqd.

Eff. Cover d'(Comp)	=	64.0	mm
A_{st} lim	=	862	mm^2
ΔA_{st}	=	0	mm^2
f_{sc}	=	0.0	N/mm^2
A_{st} reqd	=	754	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1.6	0	0
Provided	2	0	0
Ast prov	982	0	0

$A_{st\,provided}$ = 982 mm^2

Compression Reinf.

$A_{st\,required}$	=	0	mm^2
$A_{st\,min}$	=	245	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	0.5	0	0
Provided	2	2	0
Ast prov.	982	0	0

$A_{st\,provided}$ = 982 mm^2

Torsional Reinforcement

Torsional Moment	=	0.00	kNm
ζ_{tu}	=	0.00	N/mm^2
ζ_c max	=	3.10	N/mm^2
M_t	=	0.00	kNm
M_{t2}	=	0.00	kNm
Stirrup spacing reqd	=	300.00	mm
Sideface Reinf reqd	=	0.00	mm^2

Provide 0 Nos of 12 mm on EVF

Ast prov. = 0.0 mm^2

Design of beam at RHS section

Tension Reinf.

Bending Mt (M_{Ulx})	=	134.24	kN m
Breath of the beam (B)	=	200	mm
Effective cover (d')	=	64.0	mm
Effective depth (d)	=	435.96	mm
x_u max/d		0.4560	
$K_u = M_{ulx}/(bd^2 f_{ck})$	=	0.1413	(3.532)
K_{u1}	=	0.1338	

Hence Comp. reinf. Reqd.

Eff. Cover d'(Comp)	=	64.0	mm
A_{st} lim	=	827	mm^2
ΔA_{st}	=	44	mm^2
f_{sc}	=	396.1	N/mm^2
A_{st} reqd	=	871	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No	1.8	0	0
Provided	2	2	0
Ast prov	982	0	0

$A_{st\,provided}$ = 982 mm^2

Compression Reinf.

$A_{st\,required}$	=	175	mm^2
$A_{st\,min}$	=	491	mm^2

Layer	1st	2nd	3rd
Dia of reinf	25	20	12
Reqd No.	1	0	0
Provided	2	2	0
Ast prov.	982	0	0

$A_{st\,provided}$ = 982 mm^2

Shear Check

Shear force V_{us}	=	113.68	kN
$\zeta_v = V_{us}/bd$	=	1.30	N/mm^2
% of reinf provided	=	1.13	%
Design Stress	=	0.67	N/mm^2
ζ_c max	=	3.10	N/mm^2

2 Legged 8 mm Dia stirrups

Design Shear reinf

Reqd. stirrup spac.	=	300.00	mm
Provd stirrup spac.	=	125	mm

CHECK FOR DEFLECTION : As per IS 456

Provided area of reinforcement	=	982	
Mu/bd^2	=	3.01	
Actual Span / Effective depth Ratio	=	14.24	
Support Condition	=	Continuous	
Design service stress	=	222.81	
Modification factor - Tension reinf.	=	1.09	
Modification factor - Comp. reinf.	=	1.26	
Allowable Span /Effective depth Ratio	=	35.90	

==<<< Hence SAFE in Deflection >>>==

Beam No	Size	Bottom steel		Top steel			Stirrups		Side Face Reinf.
		Straight	Curtail	Middle	LHS	RHS	Ends	Mid	
B16	200 x 500	2Y25	---	2Y25	2Y25	2Y25+2Y20	2L Y8@125	2L Y8@175	

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CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors
STRUCTURE NAME :	TOWER 14	TITLE: REPORT ON STRUCTURAL DESIGN.	
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM		

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SLAB DESIGN:

SANKAR AND ASSOCIATES		SHRIRAM SHANKARI APARTMENT			
		Client	M/S.SHRIRAM SHANKARI		
		Job No		Date	17-03-2026
Page Type	Calculation Sheet - TOWER 14	Prepared By	SM	Revision	-
Section	Design of Slab as per IS 456	Checked By	NA	Date Revised	-

Slab Number : S3 Floor level : First Floor Reference grid : F167

SPANS :

Shorter span c/c w.r.to beam	B	=	3.25	m
Longer span c/c w.r.to beam	L	=	5.20	m
Width of support - shorter span - Left	bxl	=	200	mm
Width of support - shorter span - Right	bxr	=	200	mm
Width of support - longer span - Left	byl	=	200	mm
Width of support - longer span - Right	byr	=	200	mm
Clear Cover of slab	cv	=	20	mm
Ratio Ly / Lx	ly/lx	=	1.60	< 2

LOAD CALCULATION :

Assume the thickness of the slab	=	120.00	mm	
Effective Depth of the of the slab	=	95.00	mm	
Self Weight of slab	=	3.000	KN / m^2	
Weathering course / Floor finishing	=	1.500	KN / m^2	
Wall load	=	0.000	KN / m^2	
Live Load	=	2.000	KN / m^2	
D.L+L.L	=	6.500	KN / m^2	
1.5D.L+1.5L.L	=	9.750	KN / m^2	

DESIGN AS TWO WAY SLAB

Support Condition : TWO LONG EDGES DISCONTINUOUS

EFFECTIVE SPANS :

Shorter span: (Lx)

Clear span + effective depth	=	3.15	m
Center to centre of supports	=	3.25	m
Effective span	=	3.15	m

Longer span: (Ly)

Clear span + effective depth	=	5.10	m
Center to centre of supports	=	5.20	m
Effective span	=	5.20	m
Aspect Ratio Ly / Lx	=	1.65	< 2

As per IS 456

+ve Alpha - x	=	0.037
- ve Alpha - x	=	0.000
+ve Alpha - y	=	0.034
- ve Alpha - y	=	0.046

Compressive Stength of Concrete	=	25.00	N/mm^2
Grade of steel	=	500.00	N/mm^2

BENDING MOMENTS:

Positive moment along Shorter dir.	Mx +ve =	8.39	KNm / m	dx+	=	95.00	mm	Kx+	=	0.037	Zx+	= 90.250 mm
Negative moment along Shorter dir.	Mx -ve =	0.00	KNm / m	dx-	=	95.00	mm	Kx-	=	0.000	Zx-	= 90.250 mm
Positive moment along Longer dir.	My +ve =	3.28	KNm / m	dy+	=	85.00	mm	Ky+	=	0.018	Zy+	= 80.750 mm
Negative moment along Longer dir.	My -ve =	4.44	KNm / m	dy-	=	95.00	mm	Ky-	=	0.020	Zy-	= 90.250 mm

EFFECTIVE DEPTH OF SLAB

REQUIRED AREA OF STEEL :

Ast req. at midspan along x- dir.	ast +ve x =	212.55	mm^2
Ast req. at midspan along y- dir.	ast +ve y =	90.62	mm^2
Ast req. at support along x- dir	ast -ve x =	0.00	mm^2
Ast req. at support along y- dir.	ast -ve y =	109.90	mm^2
Minimum Ast required	ast min =	144.00	mm^2

REQUIRED SPACING OF STEEL:

10	mm dia at midspan along x- dir. =	370	mm c/c
10	mm dia at midspan along y- dir. =	545	mm c/c
10	mm dia at support along x- dir =	545	mm c/c
10	mm dia at support along y- dir. =	545	mm c/c
8	mm dia for distribution steel =	349	mm c/c
0	mm dia for top of mid span =	100	mm c/c

PROVIDED SPACING OF STEEL

Bottom reinforcement along x- dir	Y	S	130	mm c/c
Bottom reinforcement along y- dir	Y	S	170	mm c/c
Top reinforcement along x- dir.	Y	S	130	mm c/c
Top reinforcement along y- dir.	Y	S	170	mm c/c
Distribution Steel	Y	S	200	mm c/c

CHECK FOR DEFLECTION :

Provided Ast (Bottom)	=	386.66	mm^2
Provided Ast (Top)	=	0.00	mm^2
Mu/bd^2	=	0.93	
Actual Span / Effective depth Ratio	=	33.11	
Design service stress	=	159.42	
Modification factor - Tension reinf.	=	2.00	
Modification factor - Comp. reinf.	=	1.00	
Allowable Span /Effective depth Ratio	=	40.00	

>>>>>>>> Hence SAFE in Deflection <<<<<<<<

SANKAR & ASSOCIATES COIMBATORE

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture engineering interior design
STRUCTURE NAME :	TOWER 14	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

SANKAR AND ASSOCIATES		SHRIRAM SHANKARI APARTMENT			
		Client:	M/S.SHRIRAM SHANKARI		
		Job No:		Date:	17-03-2026
Page Type:	Calculation Sheet - TOWER 14	Prepared By:	SM	Revision:	-
Section:	Design of Slab as per IS 456	Checked By:	NA	Date Revised:	-

Slab Number : S6 Floor level : Third Floor Reference grid : F87

SPANS :

Shorter span c/c w.r.to beam	B	=	2.20	m
Longer span c/c w.r.to beam	L	=	6.47	m
Width of support - shorter span - Left	bxl	=	200	mm
Width of support - shorter span - Right	bxr	=	200	mm
Width of support - longer span - Left	byl	=	200	mm
Width of support - longer span - Right	byr	=	200	mm
Clear Cover of slab	cv	=	20	mm
Ratio Ly / Lx	lyflx	=	2.95	> 2

LOAD CALCULATION :

Assume the thickness of the slab	=	120.00	mm	
Effective Depth of the of the slab	=	95.00	mm	
Self Weight of slab	=	3.000	KN / m^2	
Weathering course / Floor finishing	=	1.500	KN / m^2	
Wall load	=	0.000	KN / m^2	
Live Load	=	3.000	KN / m^2	
D L+L L	=	7.500	KN / m^2	
1.5D L+1.5L L	=	11.250	KN / m^2	

DESIGN AS ONE WAY SLAB

Support Condition SIMPLY SUPPORTED

EFFECTIVE SPANS :

Shorter span: (Lx)

Clear span + effective depth	=	2.10	m
Center to centre of supports	=	2.20	m
Effective span	=	2.10	m

Longer span: (Ly)

Clear span + effective depth	=	6.37	m
Center to centre of supports	=	6.47	m
Effective span	=	6.37	m
Aspect Ratio Ly / Lx	=	3.04	> 2

+ve Alpha - x	=	0.125
- ve Alpha - x	=	0.000
+ve Alpha - y	=	0.000
- ve Alpha - y	=	0.000

Compressive Stength of Concrete	=	25.00	N/mm^2
Grade of steel	=	500.00	N/mm^2

BENDING MOMENTS:

Positive moment along Shorter dir	Mx +ve =	6.17	KNm / m	dx+	=	95.00	mm	Kx+	=	0.037	Zx+	=	90.250 mm
Negative moment along Shorter dir.	Mx -ve =	0.00	KNm / m	dx-	=	95.00	mm	Kx-	=	0.000	Zx-	=	90.250 mm
Positive moment along Longer dir.	My +ve =	0.00	KNm / m	dy+	=	85.00	mm	Ky+	=	0.000	Zy+	=	80.750 mm
Negative moment along Longer dir	My -ve =	0.00	KNm / m	dy-	=	95.00	mm	Ky-	=	0.000	Zy-	=	90.250 mm

EFFECTIVE DEPTH OF SLAB

REQUIRED AREA OF STEEL :

Ast req. at midspan along x- dir.	ast +ve x =	154.38	mm^2
Ast req. at midspan along y- dir.	ast +ve y =	0.00	mm^2
Ast req. at support along x- dir	ast -ve x =	0.00	mm^2
Ast req. at support along y- dir	ast -ve y =	0.00	mm^2
Minimum Ast required	ast min =	144.00	mm^2

REQUIRED SPACING OF STEEL:

10 mm dia at midspan along x- dir.	=	509	mm c/c
10 mm dia at midspan along y- dir	=	545	mm c/c
10 mm dia at support along x- dir.	=	545	mm c/c
10 mm dia at support along y- dir.	=	545	mm c/c
8 mm dia for distribution steel	=	349	mm c/c
0 mm dia for top of mid span	=	100	mm c/c

PROVIDED SPACING OF STEEL

Bottom reinforcement along x- dir.	Y	8	130	mm c/c
Bottom reinforcement along y- dir.	Y	8	170	mm c/c
Top reinforcement along x- dir.	Y	8	130	mm c/c
Top reinforcement along y- dir.	Y	8	170	mm c/c
Distribution Steel	Y	8	200	mm c/c

CHECK FOR DEFLECTION :

Provided Ast (Bottom)	=	386.66	mm^2
Provided Ast (Top)	=	0.00	mm^2
Mu/bd^2	=	0.68	
Actual Span / Effective depth Ratio	=	22.05	
Design service stress	=	115.79	
Modification factor - Tension reinf	=	2.00	
Modification factor - Comp reinf	=	1.00	
Allowable Span /Effective depth Ratio	=	40.00	



==== Hence SAFE in Deflection >>>===

CLIENT:	SHRIRAM SHANKARI APARTMENT	DESIGN:	Stilt +6 Floors	sankar & associates architecture engineering interior design
STRUCTURE NAME :	TOWER 14	TITLE: REPORT ON STRUCTURAL DESIGN.		
PLACE:	CHENGALPETTU TALUK, KANCHIPURAM			

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.