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24.08.2024

TO WHOMSOEVER IT MAY CONCERN

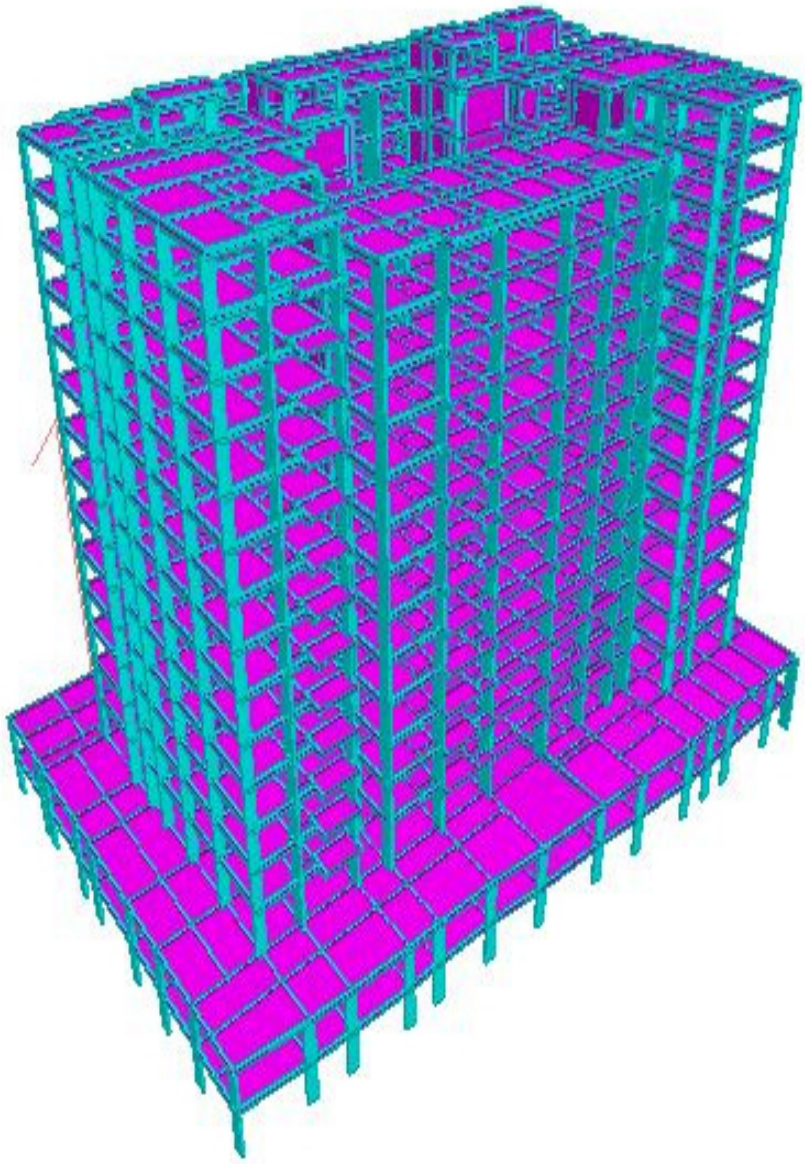
This is to certify that Proposed Construction of High Rise building Extended Double Basement Floor + Stilt Floor(Part) Cum Ground floor (Part)+12 Floors +13th Floors (Part) Consisting of 74 Dwelling Units and Multi-Function Hall, Gym & Swimming Pool in 13th Floor (Part) Residential Building availing with Premium FSI at New Door No.34 (Part), Velachery Road, Guidy, Chennai, R.S.No.76/2 (Part), 77 (Part), T.S.No.9/1,pt Block No.16 of Velachery Village, Velachery Taluk, Chennai-600032, within the Limit of Greater Chennai Corporation Division 174, Zone XIII.

"The proposed structure is safe and sound".

S. PADMANABHAN
Registered Structural Engineer
Grade - I (SE)
Regn. No. SE/GR-I/19/05/123

PROPOSED MULTISTORIED RESIDENTIAL APPARTMENTS – MALKOHA - AT GUINDY, CHENNAI.

STRUCTURAL DESIGN BRIEF REPORT



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1.1 FOREWORD

1.1.1 - Description of Project

MALKOHA Multistoried Residential Apartments Building at Guindy, Chennai, Tamilnadu. Project is Structural. Engineering by M/s Jayam consultant Pvt. Ltd., Chennai.

Project consists of Basement +2 Ground + 13 floors.

1.1.2 – Objective of the Report

The objective of the report is to identify and record all the pertinent input requirements, analysis & design criteria for structural design of the various buildings. It is aimed at consolidating the basis of the work that the structural designer is going to carry out in delivering the structural framework of the buildings which will be compatible with the architectural theme, satisfy the functional needs, adhering to the building norms and Indian Standards provisions and which will be safe, stable, strong and yet optimally economical. Since the parameters adopted in this report are going to be the basis of the structural design calculations, it is expected that the planning and design team members – architects, services consultants and project management team – give their feedback and approval to the parameters, suggestions, recommendations and queries mentioned in the report. This report covers the minimum design requirement to establish the unified design basis that will form the overall design philosophy to be adopted in the structural design.

The design basis will aim to achieve:

- Structural & functional integrity.
- Desirable Structural performance under characteristic service design loadings.
- Ability to sustain design basis loads due to natural phenomena such as wind, earthquakes, seasonal
- Variation in ground water table and thermal effects.
- Structural durability & maintainability.

1.1.3 – Scope of the Report

The Structural Report covers the complete Structural Elements design methodology with model analysis.

1.2 CODES, STANDARDS AND REFERENCES

Statutory Requirements:

The design of structural and other building services will comply with the following requirements:

- National Building Code
- The Building Regulations
- The Environmental Protection Act in liaison with the Environmental Agency.
- Fire prevention and detection in compliance with the local Fire Regulation.

DESIGN STANDARDS:

Specific applicable codes and standards will be identified and adopted in the design philosophies as appropriate to the structural elements. The latest editions of the Codes and Standards will be used in designs. All design work shall be based on Indian Standards and Codes with latest revision, with amendments if any, as on date.

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 (All parts)

RCC:

IS:456 -2000 Code of Practice for plain and reinforced concrete

IS:16700 -2017 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(part 2)-1995Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement

IS: 6313(part II)-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)

Material :

IS: 269 -1998 Specification for Ordinary, rapid hardening and low heat Portland cement.

IS: 455 -1995 Specification for Portland blast furnace slag cement.

IS: 1489-1991 Specification for Portland pozzolana cement

IS: 4031-1991 Method of physical tests for Portland cement.

IS: 383 - 1997 Specification for coarse and fine aggregates from natural sources for concrete.

IS: 516 – 1999 Method of test for strength of concrete.

IS: 1199-1999 Method of sampling and analysis of concrete.

IS: 1566-2000 Specification for plain hard drawn steel wire fabric for concrete reinforcement.

IS: 4990-1998 Specification for plywood for concrete shuttering works.

IS: 2645-1999 Specification for integral cement water proofing compounds.

1.3 – DESCRIPTION OF STRUCTURE

1.3.1 – Location

MALKOHA- at Guindy, Chennai, Tamilnadu.

1.3.2 – Building Description.

Project consists of:

Basement+2 + Ground + 13floors

FLOORS	DETAILS
Basement Floors	Parking, STP, sump
Ground Floors	Parking, DG, Lobby
Typical Floors	Residential Flats
13^{th} Floor	Residential Flats, Swimming Pool, Fitness centre
Terrace Floor	Staircase Head room, Lift Machine Room, Overhead water tank.

1.3.3 – Structural Arrangement:

- The Structural System for the MALKOHA comprises of RCC slabs supported by RC shear walls, columns & beams. Floor slabs are considered to act as a rigid diaphragm to transfer the lateral forces to the lateral load resisting elements.
- The cutouts in slab are based on the provisions given in Clause 31.8 of IS 456-2000. Core cutting/sleeves, cutouts shall be considered to accommodate utility services if any. Staircases are provided with mid-landing between the floors as per architectural layout.

	DESCRIPTION	MALKOHA
a.	Column grids	Varies as per Architectural drawing.
b.	Structural System	Reinforced Concrete Shear walls, columns, beams & slabs
c.	Slab Thickness	125/150/175/200mm (Varies as per design requirement)
d.	Beams	200/300/350/450mm x 450/600/1200mm (Varies as per design requirement)
e.	Column size/ Wall thickness	Varies as per design requirement

1.3.4 – Water Proofing:

As per BOQ Specifications.

1.4 DESIGN APPROACH:

1.4.1 Site Survey Plan:

1.4.2 Design Brief:

This structure has physical interface with almost all the disciplines like Geotechnical, MEP Services and Landscape etc. The Structure proposed is of cast in-situ concrete construction with walls/columns suitably placed. The Structural design of the proposed project is based on Indian Standard Codes and is analyzed for Dead, Live, Wind and Seismic Load conditions taking into relevant load combinations recommended by the codes. The Vertical Loads including the dead and super imposed loads are transferred to the soil through columns, RC walls and footings. Footings are sized with consideration to the safe bearing capacity of soil at the level of transfer of load recommended by specialist soil investigation consultants. The Lateral loads due to wind and seismic forces are dissipated to soil through the proposed Reinforced Concrete columns.

1.4.3 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 / refurbishment is required for all replaceable material for longer life.

1.4.4 Material Properties.

Materials specified will confirm to the latest edition of the relevant Indian Standard or other accepted standard. Specifications for materials will include sampling and testing as stipulated in the design standards. Detailed material specifications will be included in the Technical Specification.

Concrete:

- All structural concrete shall have cube crushing strength of M50 to M30 N/sq.mm at 28 days.
- Plain cement concrete shall have cube crushing strength of 15 N/sq.mm (M15) at 28 days. Concrete Mix:

Concrete Items	Grade
Foundation	M30
Column	M50
Shear Wall	M50
Beams & Slabs	M30

Note: Grade of concrete for beam/column junction shall be same as column concrete grade.

Minimum grade of concrete requirement in Column – Slab/Beam joint:

As per cl: 5.7.1.2 & Annex-B of IS-16700:2017, Grade of concrete used in slabs/beams junction shall not be less than 70% of that used in columns. And if, the grade of concrete used in slab/ beams is less than 70% of the column concrete grade, puddling of the concrete shall be done in such a way that column concrete is placed in slab – column junction also for a minimum of 600mm from face of the column and this concrete is well integrated with slab concrete.

Reinforcement steel:

- All reinforcement shall confirm to IS: 1786 – 2008 having minimum yield strength of 550 N/sq.mm.

Mechanical Splicing Material:

Moment Coupler of threaded type as per IS-16172 Shall be used for diameter of reinforcement 16mm and higher size for extending the bars. If lapping of the bars is required in exceptional case, relevant clauses of IS-13920 shall be followed.

1.4.5 Foundation:

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 consultants Raft foundation(900mm THK) are designed for foundation using STAAD.Pro.V8i Soil bearing capacity of 400 kN/m² at a depth of 7m from NGL, And sub grade modulus of 200000 kN/m³.

1.4.6 Design loads:

Dead loads:

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.
- Floor finish :150 kg/sq.m (1.5kN/sq.m)
- Self-weight of RCC : 2500 kg/cu.m (25 kN/cu.m)
- Light weight block masonry : 700 kg/cu.m (7 kN/cu.m)
- Water : 1000 kg/cu.m (10 kN/cu.m)

Live loads:

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)-1987.

Following live loads are considered while designing the structural elements apart from the dead loads as per codes.

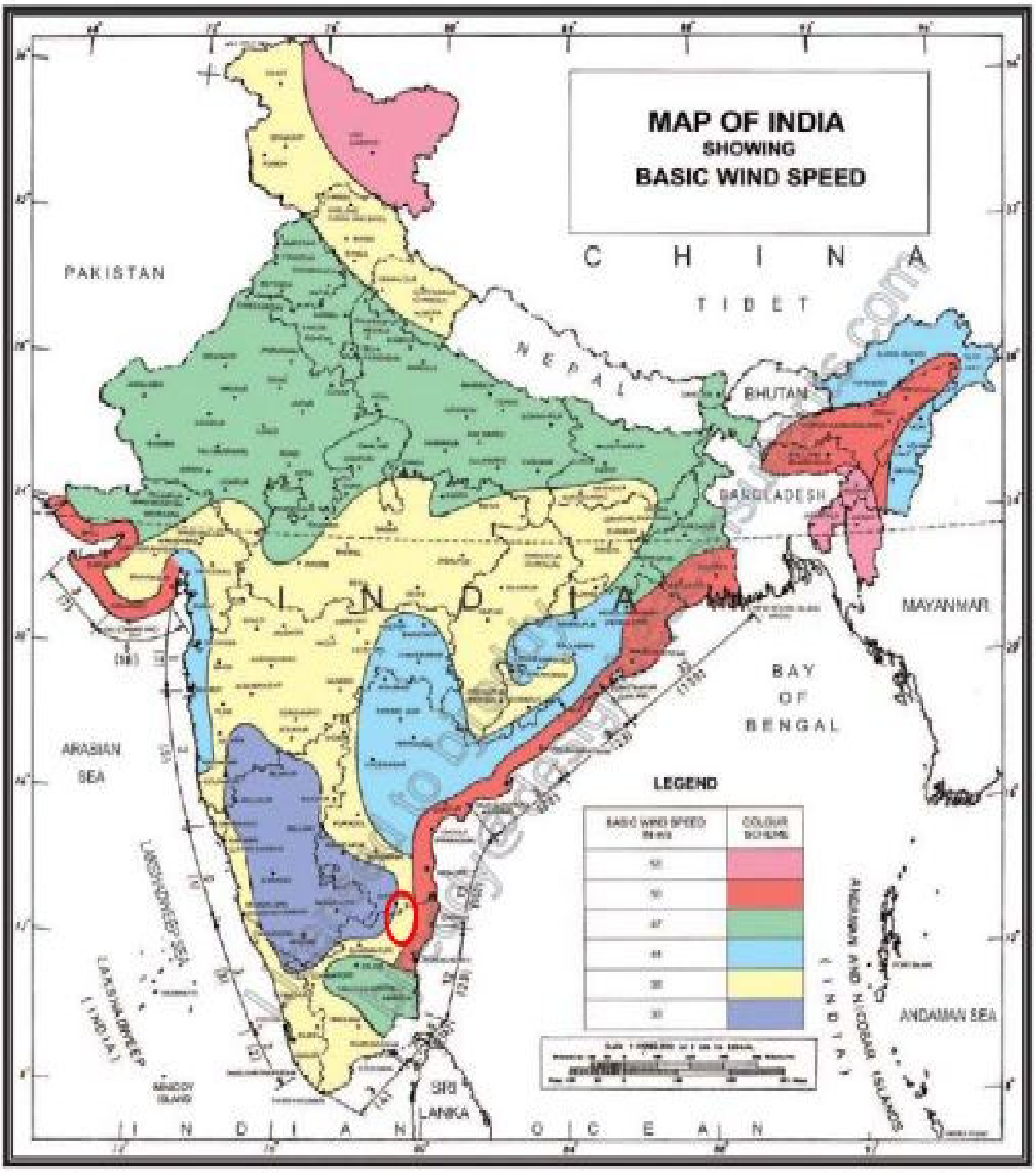
- Residential areas : 200 kg/sq.m (2.0 kN/sq.m) (Living, dining and bedroom areas)
- Stairs : 300 kg/sq.m (3.0 kN/sq.m)
- Corridors / Balcony/Utility : 300 kg/sq.m (3.0 kN/sq.m)
- Toilets : 200 kg/sq.m (2.0 kN/sq.m)
- Lift Machine room : 1000 kg/ sq.m.
- Parking areas : 1000 kg/ sq.m
- Terrace :150 kg/sq.m

Actual loading due to lifts loads shall be ascertained and design live loads are suitably modified (if required) and considered. The following reductions in total live load on floors are made in designing of columns, walls and foundation as per IS-875(part-2)-1987.

No. of floors (including the roof) to be carried by member under consideration	Reduction in total distributed live load on all floors to be carried by member under consideration (percent)
Upto 3nd floor	0
3rd to 7th floor	10
7th to 9th	20
9th to 11th	30
11th to 13th	40
13th to Head Room	50

Wind Loads:

The Wind pressure shall be calculated in accordance with IS: 875 (Part-3)-2015.
Basic wind speed for Vellore is 50m/s.
Basic Wind Speed Vb : 50 m/s
Terrain Category : 2
Risk Coefficient k1 : 1.00 (k1 corresponds to 50 years Mean Probable Design Life of Structure)
Factor k2 : Variation of wind speed with heights in different terrains as per Table -02.
Topography factor k3 : 1.00
Importance factor Cyclone region k4 : 1.00
Design wind speed Vz: $Vb \times k1 \times k2 \times k3 \times k4$
Design wind pressure pz: $0.6 \times Vz^2$



Based upon Survey of India Outline Map printed in 1998.

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The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.
Responsibility for correctness of internal details shown on the map rests with the publisher.
The state boundaries between Uttaranchal & Uttar Pradesh, Bihar & Jharkhand and Chhattisgarh & Madhya Pradesh have not been verified by Governments concerned.

FIG. 1 BASIC WIND SPEED IN M/S (BASED ON 50-YEARS RETURN PERIOD)

Seismic Forces:

Vellore falls under seismic zone III as per IS 1893-2016 (Part 1) and has the following factors to be considered for designs. Ductile detailing is required. (Please refer attached map)

Seismic Zone : III

Seismic Zone factor, Z : 0.16 (As per Table 3-IS: 1893-2016)

Design horizontal seismic coefficient (Ah) : (Z/2)*(S a /g)*(I/R)

I -Importance factor : 1.2 (Ref Table 8-IS: 1893-2016)

Response reduction Factor : 5(Building with ordinary RC structural columns)

Soil type : II (Weighted average of N value of all soil layers along the depth is considered)

Damping Ratio for RCC : 5 %

R as per Table 9 of IS: 1893-2016 is based on building with ductile RC structural walls.

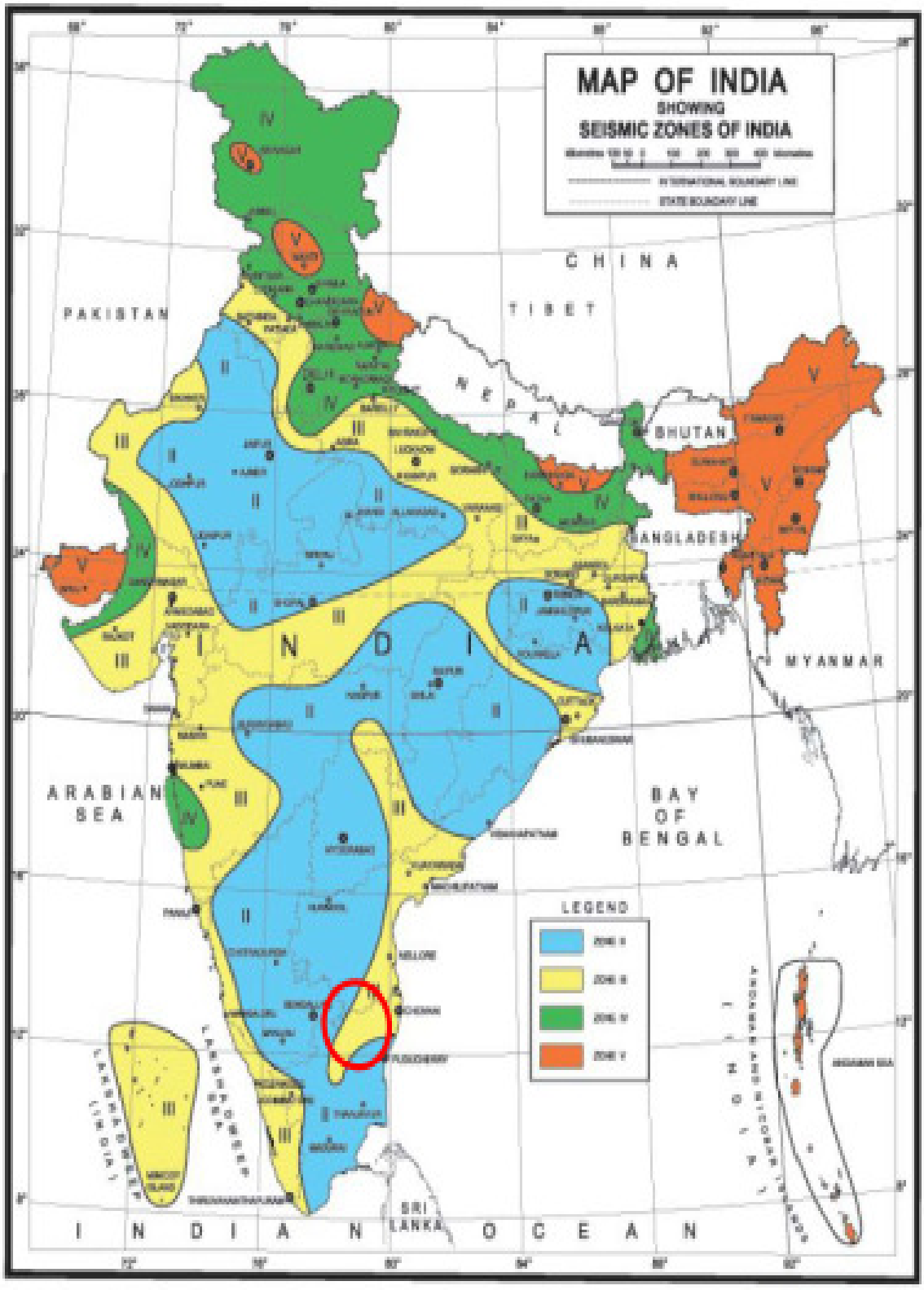
Sa/g – Design acceleration coefficient for soil type as per Fig.2 of IS: 1893-2016 and it is arrived based on appropriate fundamental natural period of structure using program calculated time period.

Design horizontal seismic coefficient (A h) : (Z/2)*(I/R)*(S a /g)

: (0.16/2)*(1.2/5) * (S a /g)

A h : 0.024 * (S a /g)

Design seismic base shear, V b : Ah * W where, W - seismic weight of building Dynamic Analysis : Considered in the analysis.



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Table No 3:

Zone Factor Z

Seismic Zone	II	III	IV	V
Z	0.10	0.16	0.24	0.36

1.4.7 Durability Considerations:

Environmental conditions, Corrosion and Fire protection for concrete and structural steel

- Environment : Moderate
- Exposure conditions : Concrete surfaces sheltered from severe rain or freezing whilst wet environment.
- Minimum grade of concrete for RCC : Moderate exposure – M25
- Minimum grade of concrete for PCC : Moderate exposure – M15
- Nominal cover to reinforcement : For moderate Exposure Nominal cover should not be less than 40 mm for columns & 50mm for footings.

1.4.8 Fire Rating: Nominal covers for 2 hr fire resistance:

Nominal Cover				
Beams		Slabs		Columns
Simply supported	Continuous	Simply supported	Continuous	
mm	mm	mm	mm	mm
40	30	35	25	40

Minimum dimensions of all structural RCC members will be followed as per IS-456: 2000 for 2 hours fire resistance.

1.5 ANALYSIS METHODOLOGY:

This structure has physical interface with almost all the disciplines like Geotechnical, MEP Services and Landscape etc. The Structure proposed is of cast in-situ concrete construction with Columns suitably placed. The Structural design of the proposed project is based on Indian Standard Codes and is analyzed for Dead, Live, Wind and Seismic Load conditions taking into relevant load combinations recommended by the codes. The Vertical Loads including the dead and super imposed loads are transferred to the soil through slabs, beams, columns, and footings. Footings are sized with consideration to the safe bearing capacity of soil at the level of transfer of load recommended by specialist soil investigation consultants. The Lateral loads due to wind and seismic forces are dissipated to soil through the proposed Reinforced Concrete columns.

1.5.1 Assumptions:

- The structure is idealized as 3D space frame and analyzed using STAADPro software package (V8i Select Series 5) for both vertical and lateral loads.
- The structure is analyzed for specific loads like dead load, live load, wind and seismic loads and for the load combinations as given in the relevant codes.

1.5.2 Mathematical model:

Mass Modelling:

Mass Source as per IS: 1893_2016 is considered as follows.

(i) Mass source considered for LL <= 3 kN/m2 is

Mass source = DL+ 0.25LL

(ii) Mass source considered for LL > 3 kN/m2 is

Mass source = DL+ 0.5LL

Where DL - Dead Load &Super Imposed Dead Load;

LL - Live Load

Stiffness Modelling:

Cracked cross section properties as per Table: 6 of IS-16700:2017 shall be considered for computer modelling.

Table 6 Cracked RC Section Properties
(Clause 7.2)

Sl No.	Structural Element	Un-factored Loads		Factored Loads	
		Area	Moment of Inertia	Area	Moment of Inertia
(1)	(2)	(3)	(4)	(5)	(6)
i)	Slabs	1.0 A_g	0.35 I_g	1.00 A_g	0.25 I_g
ii)	Beams	1.0 A_g	0.7 I_g	1.00 A_g	0.35 I_g
iii)	Columns	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g
iv)	Walls	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g

1.5.3 Static Analysis:

Following Static loads cases are considered in the analysis

DL - Dead Load: Includes self-weight of the structure, Finishes, wall Loads, Soil filling loads etc...

LL - Live Load: Includes Live loads based on functionality as per IS: 875 (Part-2).

1.5.4 Dynamic Analysis:

1.5.4.1 Earthquake:

Response spectrum method of Dynamic Analysis is considered. Following are the details pertaining to dynamic analysis.

Base Shear Enhancement : Initial Scale factor of Ig/2R is used to enhance the base shear.

Number of modes Considered : Number of modes considered should be enough to obtain 90% mass participation in each principle plan direction.

Modal Combination Method Used : Complete Quadratic combination (CQC).

Spatial Combination Method used : Square root of the sum of Square (SRSS).

Modal case type : Ritz vector Method

Orthogonal directional seismic effect : Not applicable

Accidental torsion considered : 5% of the building plan dimension

Missing mass correction : Missing mass correction is taken care with Ritz vector method.

1.5.4.2 Wind:

Dynamic wind response – Along wind response (Gust Factor Analysis) and Across wind response as per

Clause 10 of IS 875 (part 3)-2015 shall be followed. If

Case (i) – Ratio of height of the building to minimum lateral dimension is exceeding 5

Case (ii) – Fundamental natural frequency in first mode is less than 1.0Hz

For the given building heights & size, Dynamic Effects of wind need not be considered in the analysis. Also, Time period is marginally exceeding the above frequency limit, hence it is ok.

1.6 LOAD COMBINATIONS:

Load combinations Used for Strength, Serviceability are tabulated below:

Load Combination	Limit state of collapse							Limit state of serviceability		
	DL	LL					WL/ SL	DL	LL	WL/SL
DL+LL	1.5	1.5	1.35	1.2	1.05	0.9	-	1	1	-
DL±WL(X/Y)	1.5	-					1.5	1	-	1
DL±SL(X/Y)	1.5	-					1.5	1	-	1
DL+LL±WL(X/Y)	1.5	1.2	1.08	0.96	0.84	0.72	1.2	1	1	1
DL+LL±SL(X/Y)	1.5	1.2	1.08	0.96	0.84	0.72	1.2	1	1	1

The various loads are combined in accordance with the stipulations in IS: 875 (Part 5)-1987; whichever combination produces the most unfavorable effect in the building foundation or structural member concerned may be adopted.

*This value is to be considered when stability against overturning and stress reversal is critical where DL/LL/WL/EL denotes,DL - Dead Load; LL - Live Load; TL - Temperature Load; WL - Wind Load;

EL - Earthquake Load

Wind load and earthquake loads are considered for both x & y directions. Whenever imposed load is combined with earthquake load, the appropriate part of imposed load as specified in IS: 1893-2016 / Clause 7.3.1 of seismic code will be used both for evaluating earthquake effect and for combined load neffects used in such combination. Load combinations with suitable live load reduction factors as per IS: 875(Part-2) will be used for design of columns &foundations.

1.7 DESIGN METHODOLOGY:

- All R.C.C structures shall be designed according to the Limit State Method as specified in IS: 456 – 2000.
- Forces and moments from the 3D analysis output for the worst combinations are used for the design of the structure.
- The foundations are designed for critical load combination.
- The structure is analyzed for specific loads like dead load, live load, wind and seismic loads and for the load combinations as given in the relevant codes.
- The slab is analyzed as two-way and one-way slabs.
- Design of special members like retaining wall, water tanks will be done in accordance with the relevant IS Codes.

1.8 ACCEPTANCE CRITERIA:

1.8.1 Deflection Limits:

For Reinforced concrete works:

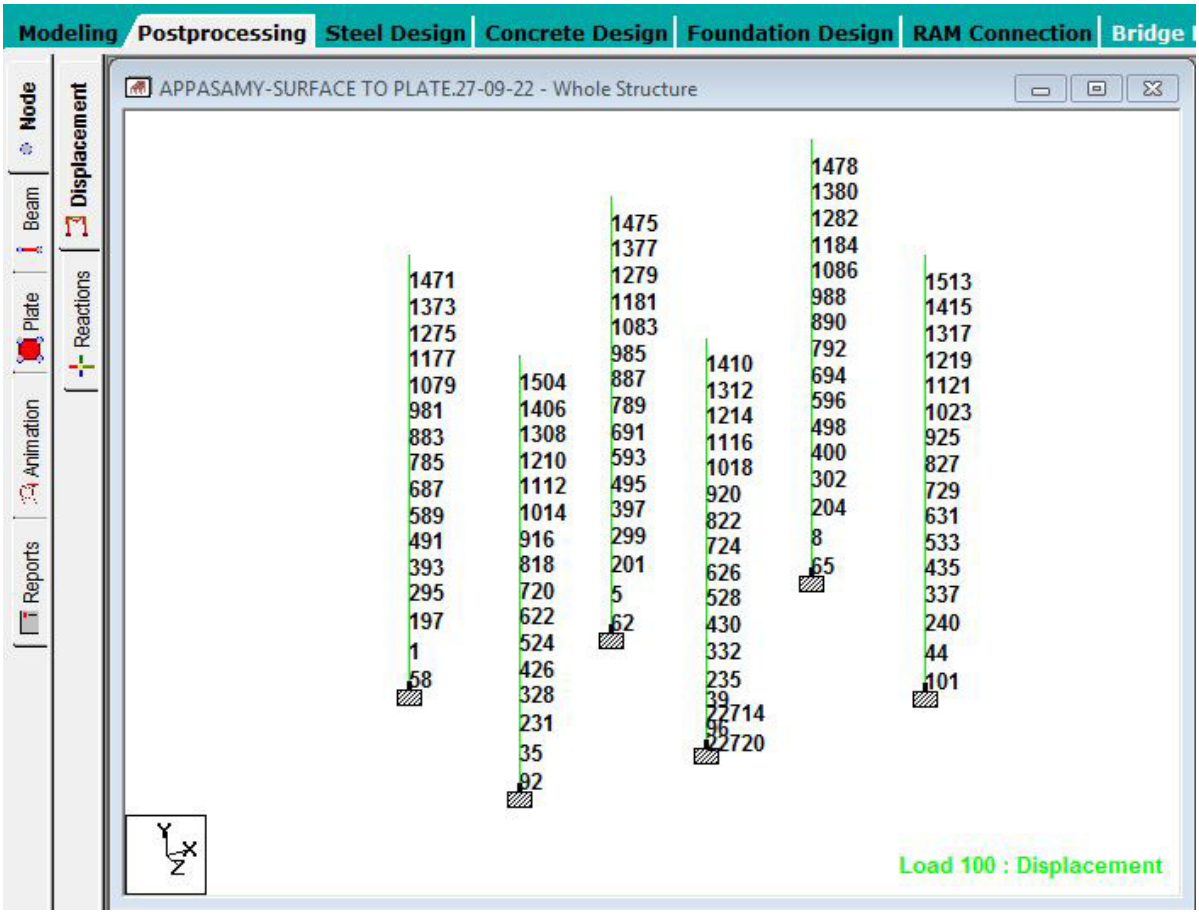
- Limiting values of deflection (Short and Long term) as per clause 35.3 of IS: 456-2000 is followed in the design.
- Limiting value for total long-term deflection is considered as span/250 and for the long-term deflection after erection of partitions & finishes is considered as span/350 or 20mm whichever less as per IS 456 –2000.

1.8.2 Cracking Limits:

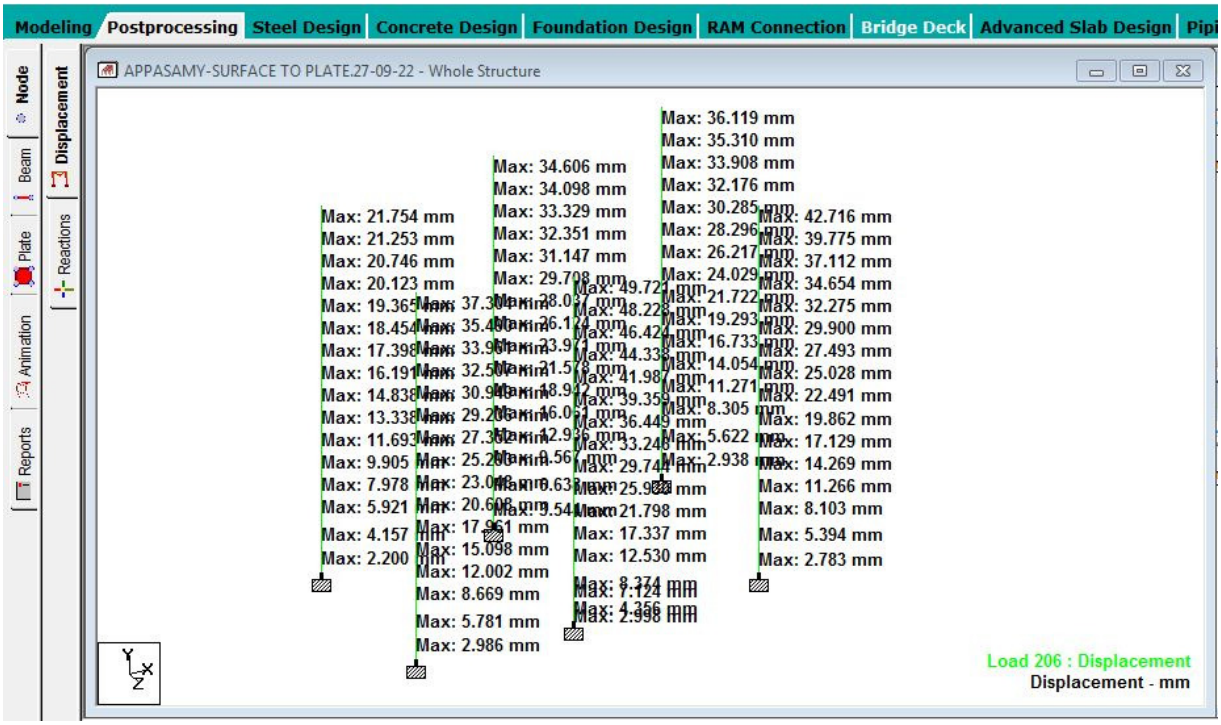
- Limiting values of crack width as per clause 35.3 of IS: 456-2000 is followed in the design.
- In general, for slabs and beams, the crack width is limited to 0.3mm.
- For basement retaining wall and water retaining structures, crack width is limited to 0.2mm.

1.8.3 Column Results :

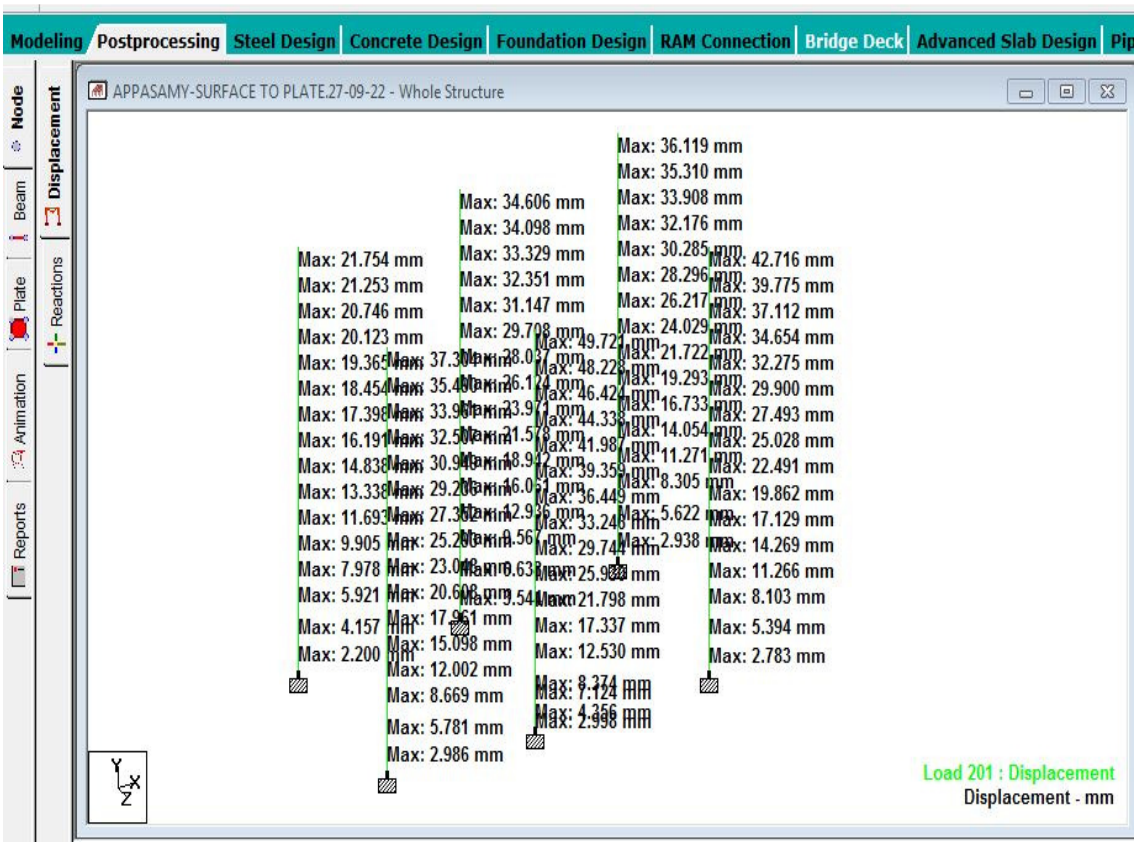
Member of column- number in StaadPro.



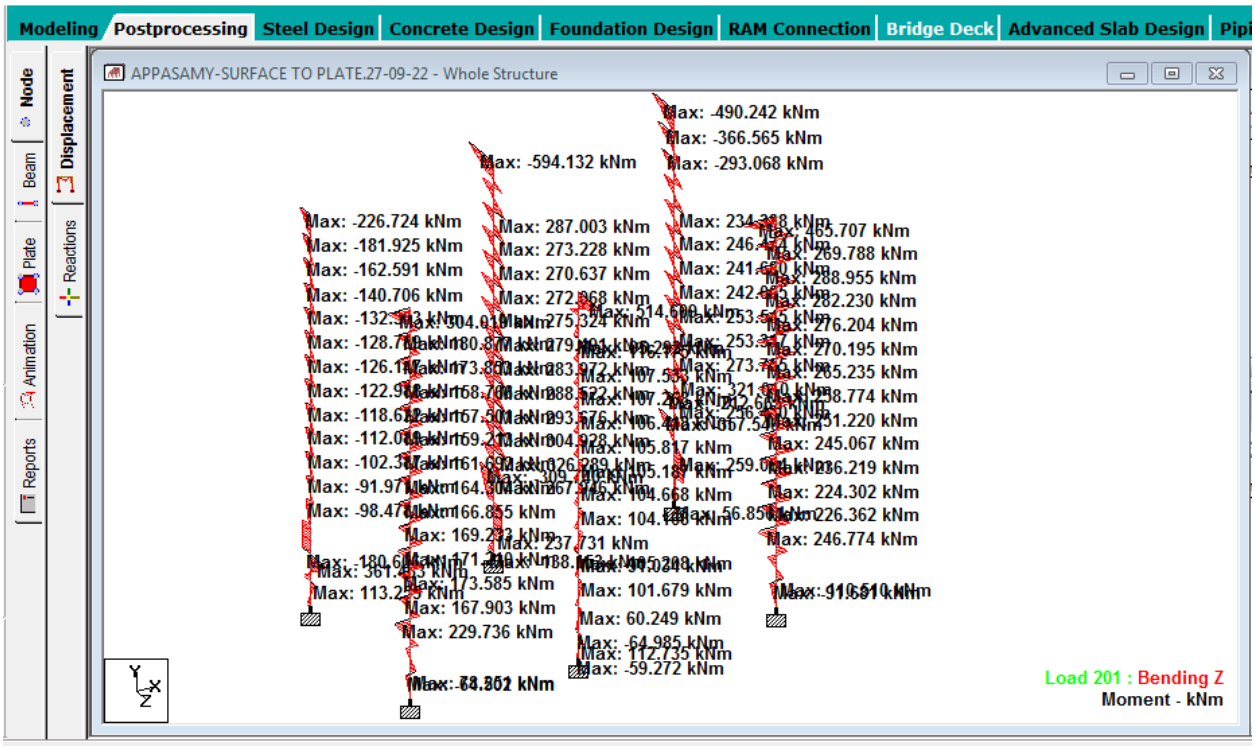
Maximum Column displacement in DL+LL+WLX+



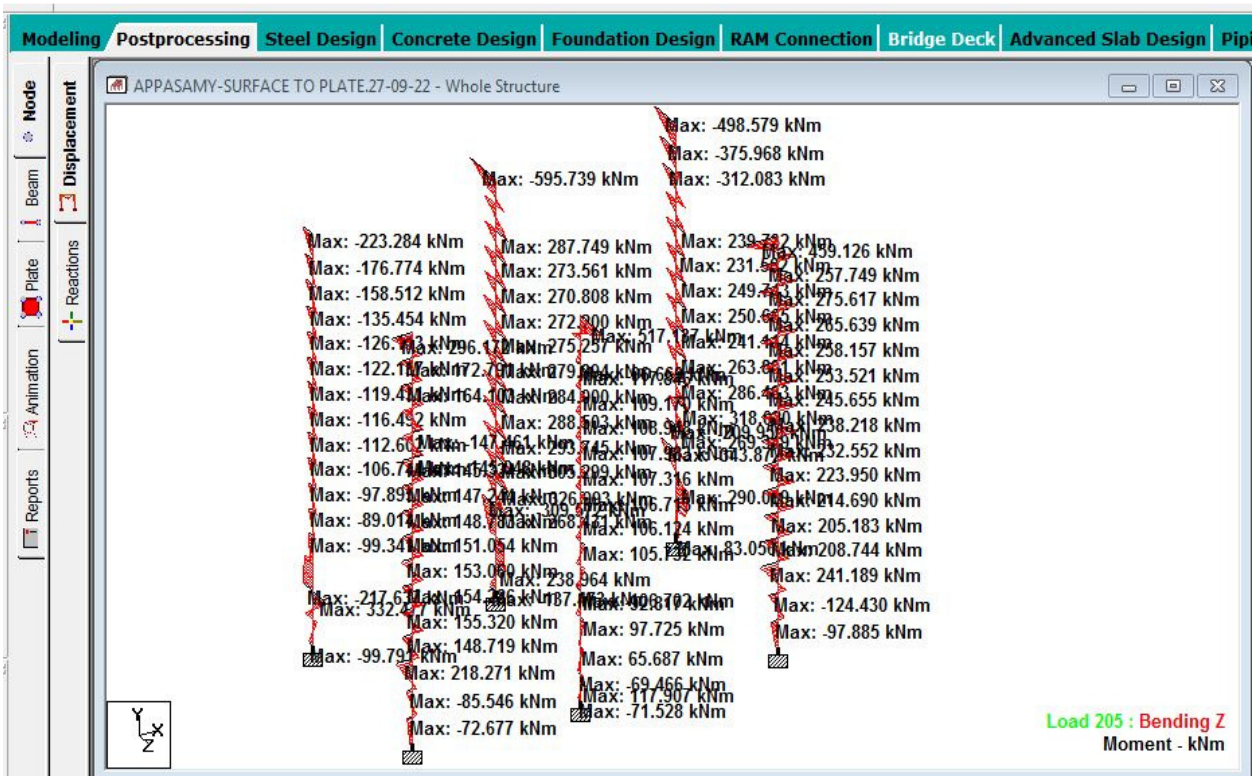
Maximum Column displacement in DL+LL+SLX+



Maximum Column moment in DL+LL+WLX+

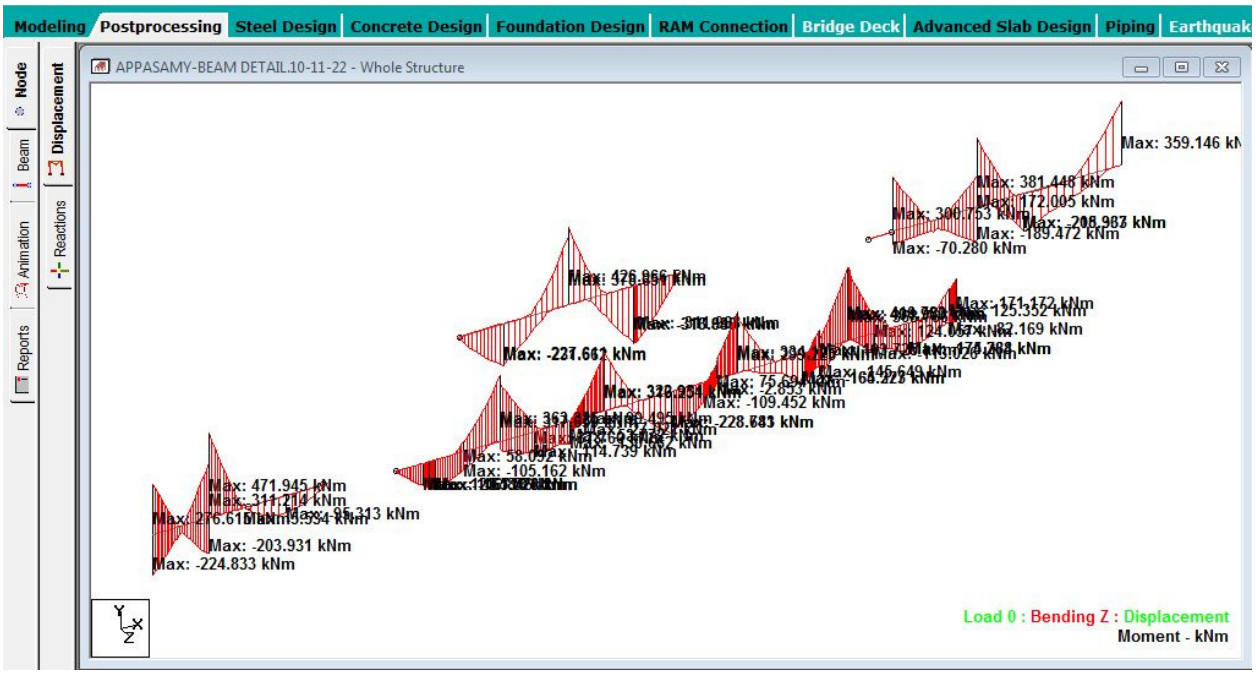


Maximum Column moment in DL+LL+WLX+

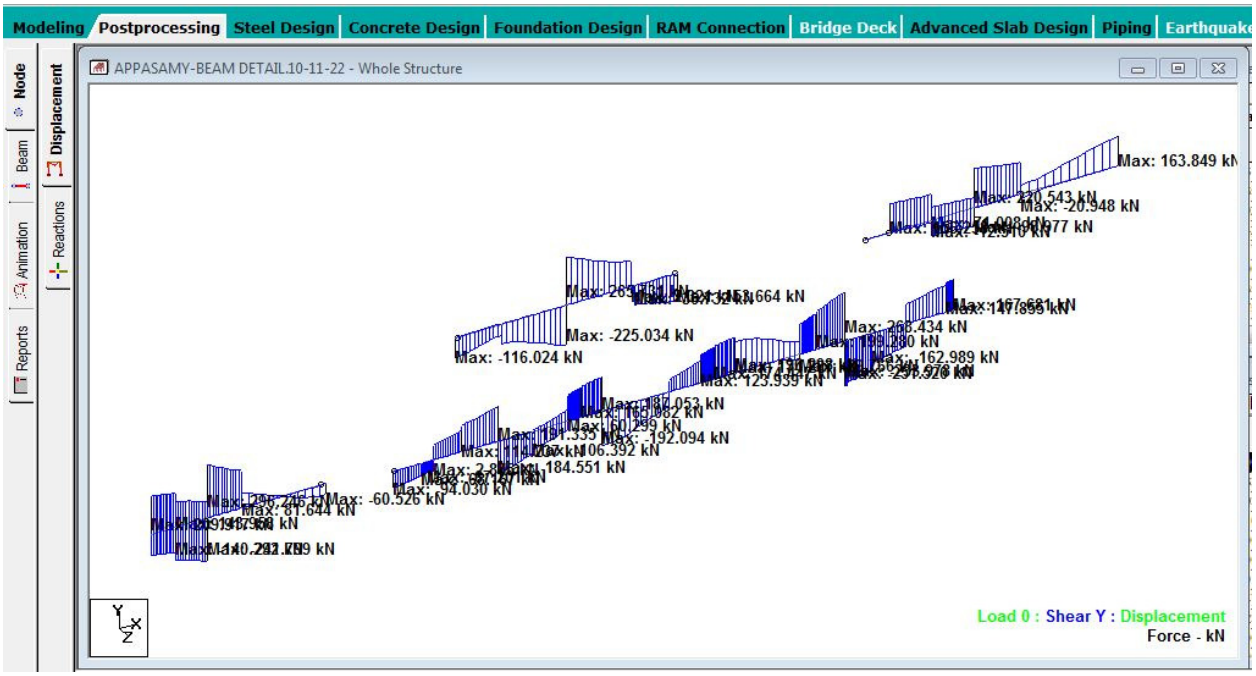


1.8.4 Beam Results :

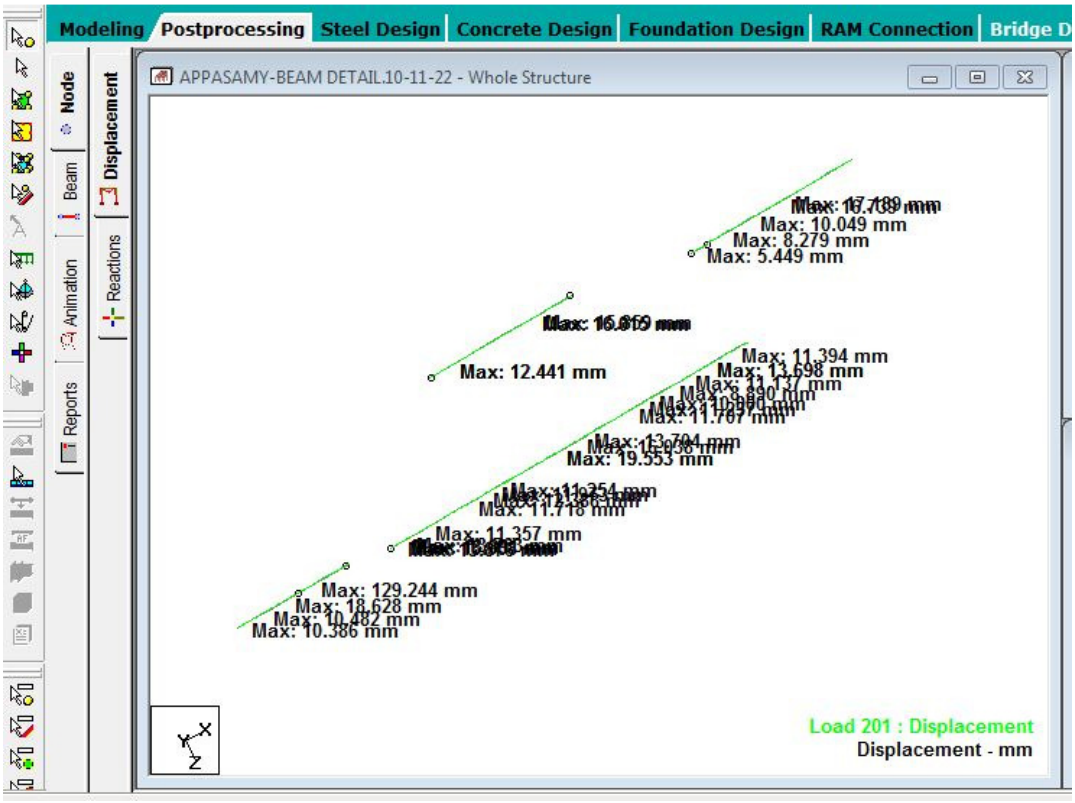
Maximum moment in Beam:



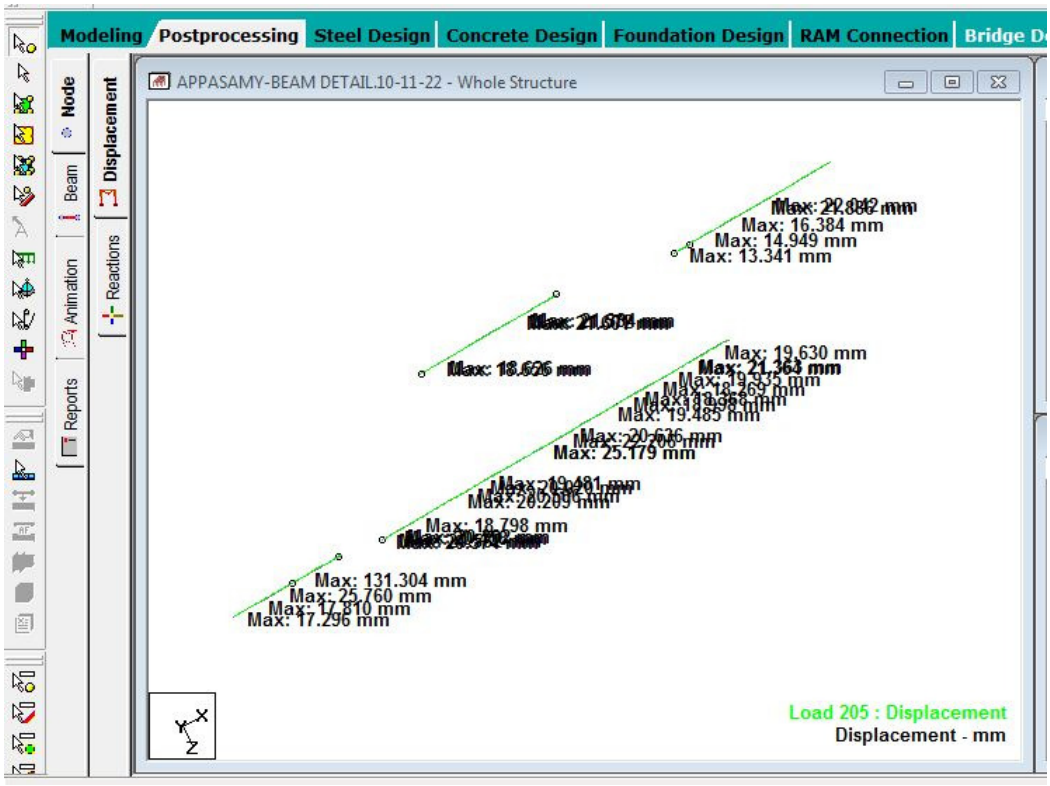
Maximum shear in beam:



Maximum deflection of beam in (DL+LL+WLX+):



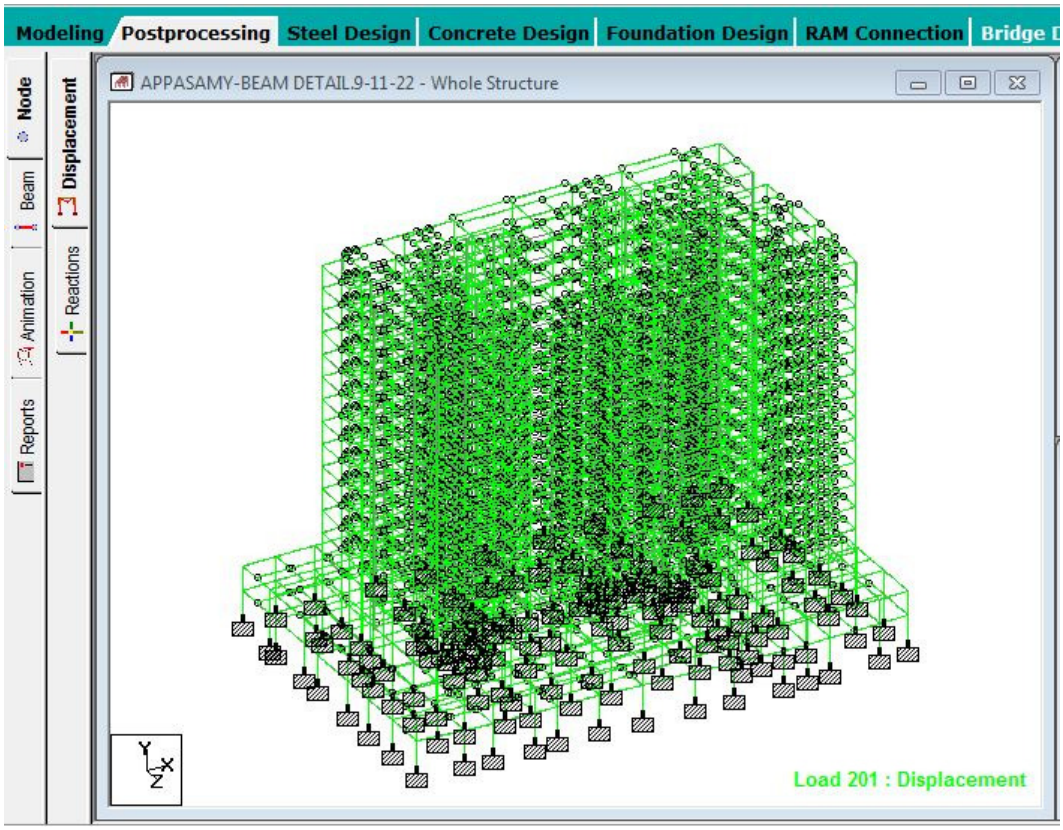
Maximum deflection of beam in (DL+LL+SLX+):



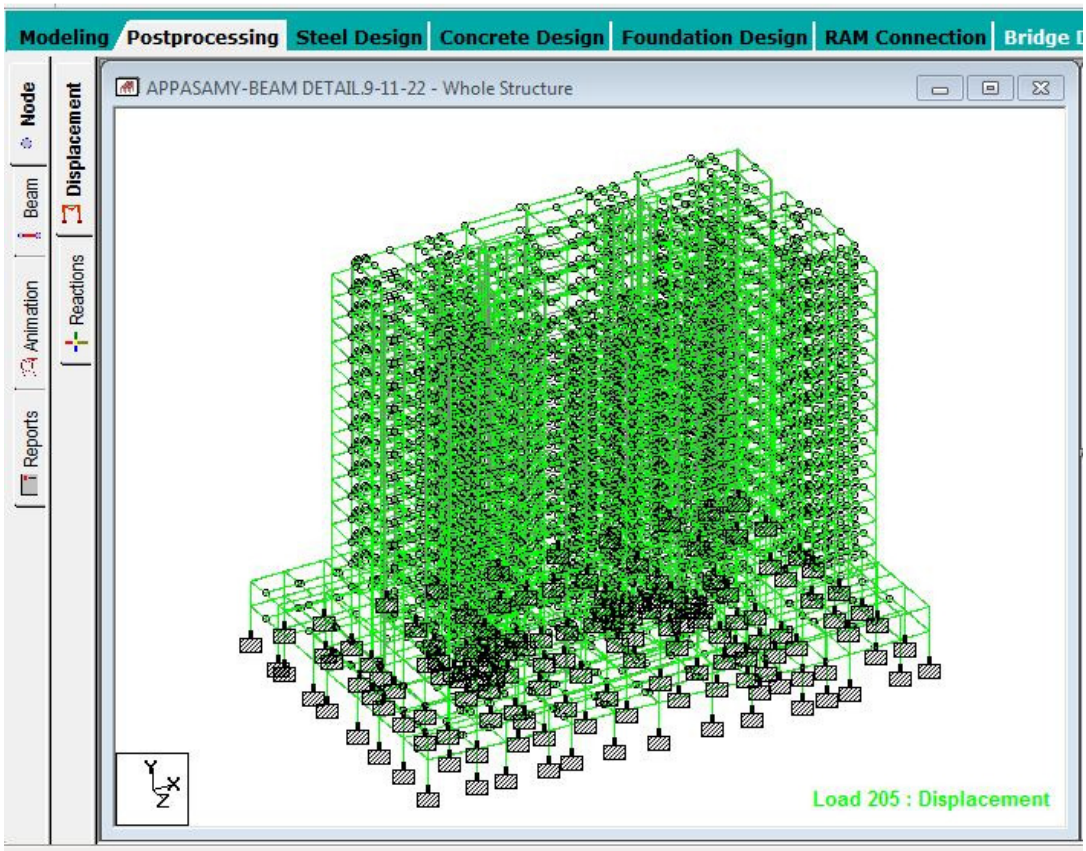
1.8.5 STRUCTURE STABILITY:

Storey displacement:

Maximum displacement of building in (DL+LL+WLX+):



Maximum displacement of building in (DL+LL+SLX+):



1.8.6 Soil data:

Foundations are designed based on Geo Technical investigation report and will dissipate all the vertical and horizontal loads safely to the soil below. Considering the soil strata at site and as per the soil investigations report received from GEO MARINE CONSULTANTSPRIVATE LIMITED, (Report number: GT- 2398, Dated: July2022). As per the report, SBC of 150.0 T/m2. But we have taken 40.0T/m2 in the design of raft footings with allowable settlement of 25mm with foundation resting at a depth of around 7.5m below NGL. In case of lateral forces increase in allowable bearing pressure for footing proportioning shall be done in accordance with the relevant IS codes.

1.9 Detailing Requirements:

Detailing for the structural members shall be done in accordance with IS: 456, SP: 34, IS: 1893-2016, IS: 13920-2016 taking R=5.

1.10 Value Engineering Exercise:

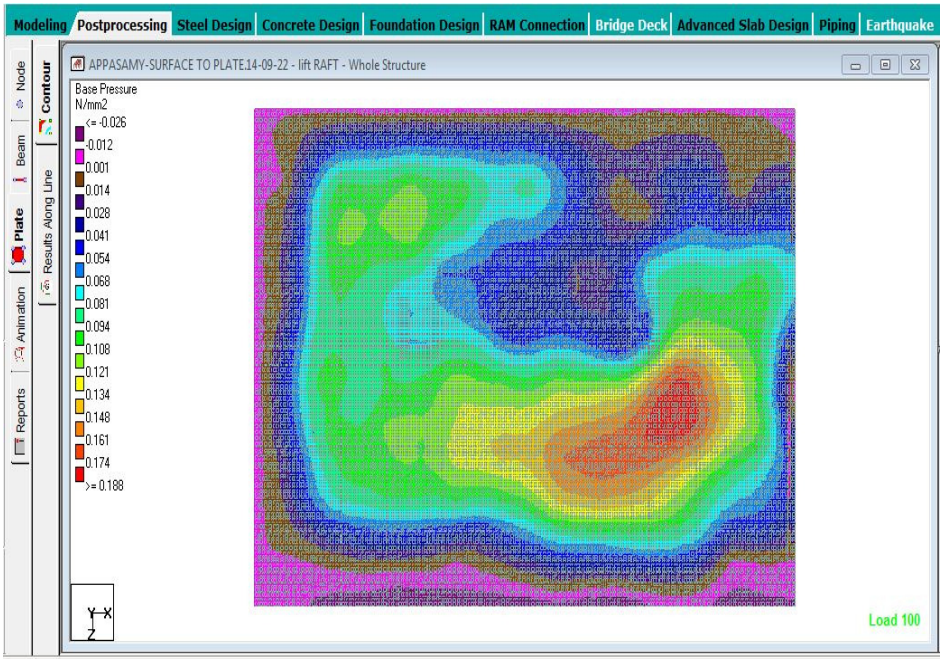
In order to optimize the material consumption, sample analysis and design exercises were undertaken with different combinations of member sizes and the required reinforcement and formwork. In short,

these studies were undertaken to identify and analyze various options for a particular solution opportunity.

1.11 ANNEXURE: Kindly refer Cad drawings for all floors framing plans.

1.12 CONTOUR MAP OF BASE RAFT:

Base pressure in raft:



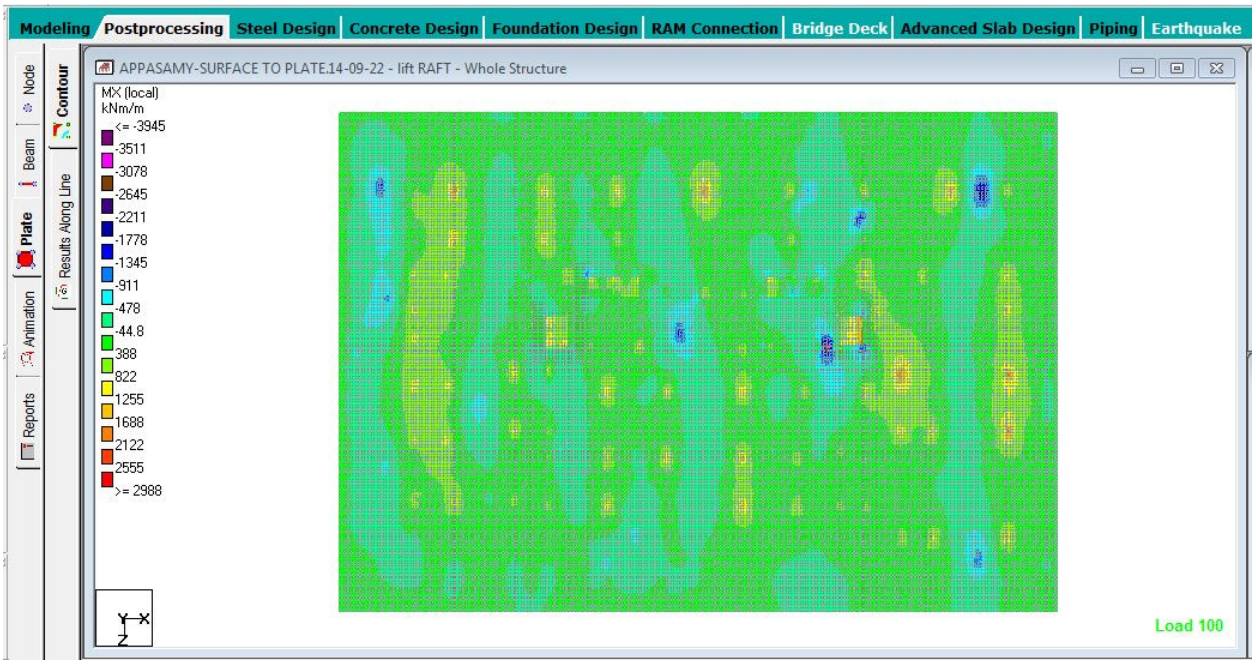
Shear in raft SQX:



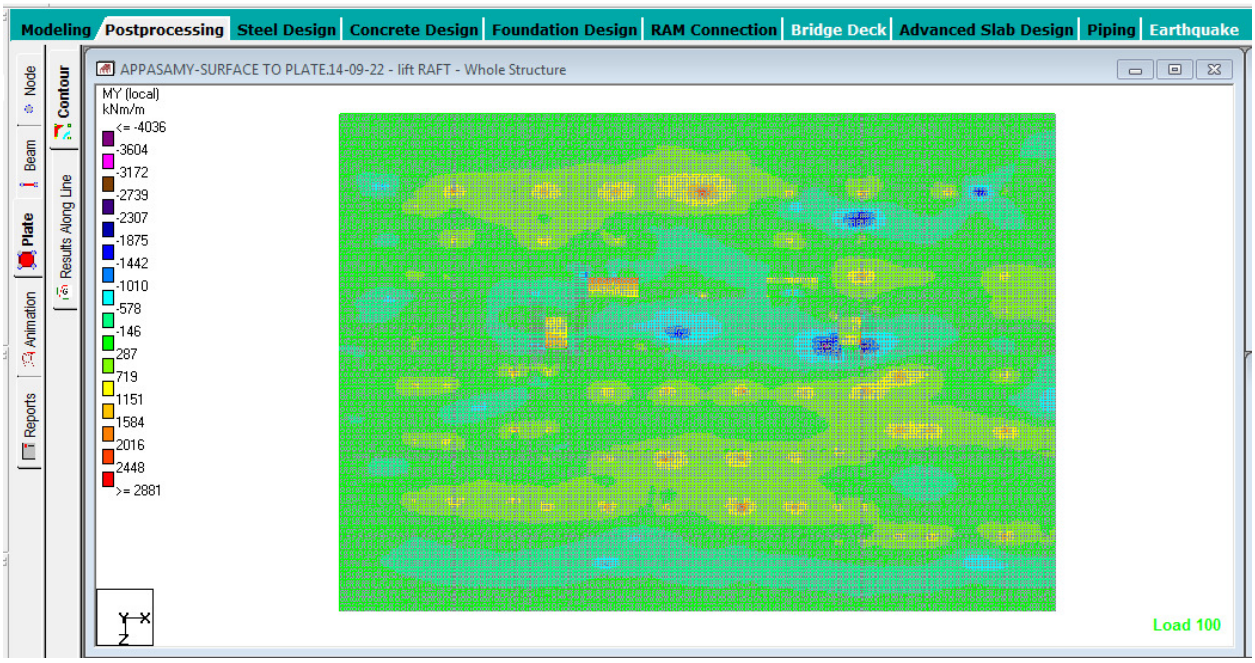
Shear in raft SQX:



Moment in raft MX:



Moment in raft MY:



1.13 RCC BEAM DESIGNS:

1.13 RCC SLAB DESIGNS:

1.14 RCC COLUMN DESIGNS:

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IS 456 - 2000 C O L U M N D E S I G N R E S U L T S

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IS-456 L I M I T S T A T E D E S I G N

C O L U M N N O. 1471 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1800.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 7904.98 Sq.mm
C O L U M N N O. 1472 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 363.98 Sq.mm.
IS-456 L I M I T S T A T E D E S I G N
C O L U M N N O. 1473 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1100.0 mm COVER: 40.0 mm ** REQUIRED STEEL AREA = 265.10 Sq.mm.

C O L U M N N O. 1474 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1800.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1565.06 Sq.mm.
C O L U M N N O. 1475 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1800.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 925.82 Sq.mm.
C O L U M N N O. 1476 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1800.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 718.83 Sq.mm.
C O L U M N N O. 1477 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1800.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1698.44 Sq.mm.
C O L U M N N O. 1478 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1800.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1714.77 Sq.mm.
C O L U M N N O. 1479 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 2983.82 Sq.mm.
C O L U M N N O. 1480 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 6383.90 Sq.mm.
C O L U M N N O. 1481 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm ** REQUIRED STEEL AREA = 1205.61 Sq.mm.
C O L U M N N O. 1482 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 2155.37 Sq.mm.
C O L U M N N O. 1483 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1153.04 Sq.mm.
C O L U M N N O. 1484 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm ** REQUIRED STEEL AREA = 693.85 Sq.mm.

C O L U M N N O. 1485 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1476.06 Sq.mm.
** SECTION IS NOT ADEQUATE
WARNING:Unable to accommodate required reinforcement
C O L U M N N O. 1486 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1542.95 Sq.mm.
C O L U M N N O. 1488 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 2400.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1136.47 Sq.mm.
C O L U M N N O. 1490 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1072.44 Sq.mm.
C O L U M N N O. 1491 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 326.13 Sq.mm.
C O L U M N N O. 1492 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
C O L U M N N O. 1493 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 3676.31 Sq.mm.
C O L U M N N O. 1494 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1002.05 Sq.mm.
C O L U M N N O. 1495 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 102.40 Sq.mm.
C O L U M N N O. 1496 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 149.05 Sq.mm.
C O L U M N N O. 1501 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm

** REQUIRED STEEL AREA = 1248.55 Sq.mm.
C O L U M N N O. 1502 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 177.91 Sq.mm.
C O L U M N N O. 1503 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 517.30 Sq.mm.
C O L U M N N O. 1504 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 935.30 Sq.mm.
C O L U M N N O. 1512 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 3161.20 Sq.mm.
C O L U M N N O. 1513 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 2681.04 Sq.mm.
C O L U M N N O. 1514 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 3747.95 Sq.mm.
** SECTION IS NOT ADEQUATE
C O L U M N N O. 1515 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm** REQUIRED STEEL AREA = 1348.87 Sq.mm.
C O L U M N N O. 1516 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm ** REQUIRED STEEL AREA = 1525.65 Sq.mm.
C O L U M N N O. 1517 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 870.03 Sq.mm.
C O L U M N N O. 1524 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 904.26 Sq.mm.
C O L U M N N O. 1525 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)

LENGTH: 3200.0 mm CROSS SECTION: 400.0 mm X 600.0 mm COVER: 40.0 mm
** GUIDING LOAD CASE: 200 END JOINT: 1624 SHORT COLUMN
REQD. STEEL AREA : 1610.72 Sq.mm.
REQD. CONCRETE AREA: 238389.28 Sq.mm.
MAIN REINFORCEMENT : Provide 12 - 16 dia. (1.01%, 2412.74 Sq.mm.) (Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 255 mm c/c
C O L U M N N O. 1526 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 4116.52 Sq.mm.
C O L U M N N O. 1531 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1041.57 Sq.mm.
C O L U M N N O. 1532 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 58.43 Sq.mm.
C O L U M N N O. 1533 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 58.08 Sq.mm.
C O L U M N N O. 1534 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 56.91 Sq.mm.
C O L U M N N O. 1535 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 54.58 Sq.mm.
C O L U M N N O. 1536 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 441.96 Sq.mm.
C O L U M N N O. 1537 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 77.57 Sq.mm.
C O L U M N N O. 1538 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm ** REQUIRED STEEL AREA = 115.84 Sq.mm.
C O L U M N N O. 1539 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)

LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 467.06 Sq.mm.
C O L U M N N O. 1541 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 127.52 Sq.mm.
C O L U M N N O. 1542 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 76.01 Sq.mm.
C O L U M N N O. 1543 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 587.63 Sq.mm.
C O L U M N N O. 1544 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 93.83 Sq.mm.
C O L U M N N O. 1545 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 798.81 Sq.mm.
C O L U M N N O. 1546 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 128.36 Sq.mm.
C O L U M N N O. 1547 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm ** REQUIRED STEEL AREA = 2455.19 Sq.mm.
C O L U M N N O. 1548 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 269.27 Sq.mm.
C O L U M N N O. 1549 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 118.05 Sq.mm.
C O L U M N N O. 1550 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)

LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 54.41 Sq.mm.
C O L U M N N O. 1551 D E S I G N R E S U L T S

M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 53.37 Sq.mm.
C O L U M N N O. 1552 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 55.69 Sq.mm.
C O L U M N N O. 1553 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 73.24 Sq.mm.
C O L U M N N O. 1554 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 206.40 Sq.mm.
C O L U M N N O. 1555 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 2065.73 Sq.mm.
C O L U M N N O. 1556 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 398.49 Sq.mm.
C O L U M N N O. 1557 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 83.08 Sq.mm.
C O L U M N N O. 1559 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 21.36 Sq.mm.
C O L U M N N O. 1560 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 114.40 Sq.mm.
C O L U M N N O. 1561 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 702.13 Sq.mm.
C O L U M N N O. 1562 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 172.99 Sq.mm.
C O L U M N N O. 1563 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm

** REQUIRED STEEL AREA = 679.16 Sq.mm.
C O L U M N N O. 1564 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 148.79 Sq.mm.
C O L U M N N O. 1565 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 261.17 Sq.mm.
C O L U M N N O. 1566 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 147.11 Sq.mm.
C O L U M N N O. 1567 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 703.84 Sq.mm.
C O L U M N N O. 1568 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1200.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1456.57 Sq.mm.
C O L U M N N O. 11951 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 450.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 3622.16 Sq.mm.
C O L U M N N O. 11952 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 450.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 3206.07 Sq.mm.
C O L U M N N O. 11953 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 257.76 Sq.mm.
C O L U M N N O. 11954 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 110.01 Sq.mm.
C O L U M N N O. 11955 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 415.70 Sq.mm.
C O L U M N N O. 11956 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 39.47 Sq.mm.
C O L U M N N O. 11957 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 36.88 Sq.mm.
C O L U M N N O. 11958 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)

LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 901.42 Sq.mm.
C O L U M N N O. 11959 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 47.94 Sq.mm.
C O L U M N N O. 11960 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 577.01 Sq.mm.
C O L U M N N O. 11961 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 84.04 Sq.mm.
C O L U M N N O. 11962 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 139.92 Sq.mm.
C O L U M N N O. 11963 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 30.20 Sq.mm.
C O L U M N N O. 11964 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 490.90 Sq.mm.
C O L U M N N O. 11965 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 43.12 Sq.mm.
C O L U M N N O. 11966 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 257.63 Sq.mm.
C O L U M N N O. 11967 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1221.60 Sq.mm.
C O L U M N N O. 11968 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 729.58 Sq.mm.
C O L U M N N O. 11969 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 450.0 mm COVER: 40.0 mm
** GUIDING LOAD CASE: 203 END JOINT: 6569 TENSION COLUMN
REQD. STEEL AREA : 385.96 Sq.mm.
REQD. CONCRETE AREA: 89614.04 Sq.mm.
MAIN REINFORCEMENT : Provide 8 - 16 dia. (1.79%, 1608.50 Sq.mm.)
(Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 200 mm c/c

C O L U M N N O. 11970 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 450.0 mm COVER: 40.0 mm
** GUIDING LOAD CASE: 211 END JOINT: 6585 SHORT COLUMN
REQD. STEEL AREA : 154.52 Sq.mm.
REQD. CONCRETE AREA: 89845.48 Sq.mm.
MAIN REINFORCEMENT : Provide 8 - 16 dia. (1.79%, 1608.50 Sq.mm.)(Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 200 mm c/c
SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
C O L U M N N O. 11971 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 450.0 mm COVER: 40.0 mm
** GUIDING LOAD CASE: 211 END JOINT: 6586 SHORT COLUMN
REQD. STEEL AREA : 129.93 Sq.mm.
REQD. CONCRETE AREA: 89870.07 Sq.mm.
MAIN REINFORCEMENT : Provide 8 - 16 dia. (1.79%, 1608.50 Sq.mm.)(Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 200 mm c/c
SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
C O L U M N N O. 11972 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
** GUIDING LOAD CASE: 212 END JOINT: 6616 SHORT COLUMN
REQD. STEEL AREA : 153.75 Sq.mm.
REQD. CONCRETE AREA: 89846.26 Sq.mm.
MAIN REINFORCEMENT : Provide 8 - 16 dia. (1.79%, 1608.50 Sq.mm.)
(Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 200 mm c/c
C O L U M N N O. 11973 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 450.0 mm COVER: 40.0 mm
** GUIDING LOAD CASE: 212 END JOINT: 6617 SHORT COLUMN
REQD. STEEL AREA : 205.56 Sq.mm.
REQD. CONCRETE AREA: 89794.45 Sq.mm.
MAIN REINFORCEMENT : Provide 8 - 16 dia. (1.79%, 1608.50 Sq.mm
(Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 200 mm c/c
C O L U M N N O. 12025 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 2400.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 64.45 Sq.mm.
C O L U M N N O. 12686 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1007.87 Sq.mm.
C O L U M N N O. 12688 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 2107.13 Sq.mm.
C O L U M N N O. 12732 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 900.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 1512.02 Sq.mm.

C O L U M N N O. 12763 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 110.43 Sq.mm.
C O L U M N N O. 12764 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 485.16 Sq.mm.
C O L U M N N O. 12795 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 101.63 Sq.mm.
C O L U M N N O. 21441 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 138.23 Sq.mm.
C O L U M N N O. 21457 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 135.17 Sq.mm.
C O L U M N N O. 21621 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 210.08 Sq.mm.
C O L U M N N O. 21639 D E S I G N R E S U L T S
M50 Fe550 (Main) Fe550 (Sec.)
LENGTH: 3200.0 mm CROSS SECTION: 200.0 mm X 1000.0 mm COVER: 40.0 mm
** REQUIRED STEEL AREA = 803.40 Sq.mm.

Plate	L/C	SQX N/mm	SQY N/mm	MX kNm/m	MY kNm/m	MXY kNm/m	SX N/mm2	SY N/mm2	SXY N/mm2			
54595	104	0.081	0.104	118.75	136.96	21.926	0	0	0	sx	x+xy	y+xy
55153	104	0.105	0.192	195.86	464.72	-66.723	0	0	0	sy		
63221	102	0.025	0.043	154.304	269.839	40.526	0	0	0	mx	194.83	310.365
64202	111	0.068	0.033	-79.763	-79.738	157.3	0	0	0	my	237.063	237.038
94775	100	0.04	0.028	-168.845	-89.866	-23.897	0	0	0	mxy	192.742	113.763
		0.081	0.104							M	310.365	
		0.105	0.192							S	0.192	

RAFT DESIGN

PROJECT:	MALKOHA	REV
CLIENT:	APPASWAMY REAL ESTATES	0

FROM STAAD OUTPUT:

Plate	L/C	SQX N/mm2	SQY N/mm2	MX kNm/m	MY kNm/m	MXY kNm/m
54595	104	0.081	0.104	118.75	136.96	21.926
55153	104	0.105	0.192	195.86	464.72	-66.723
63221	102	0.025	0.043	154.304	269.839	40.526
64202	111	0.068	0.033	-79.763	-79.738	157.3
94775	100	0.04	0.028	-168.845	-89.866	-23.897

σcbc	=	30	N/mm2			
σst	=	500	N/mm2			
l	=	1.0	m			
b	=	1	m			
D	=	0.9	m			
cover	=	50	mm			
bar dia	=	20	mm			
d	=	0.84	m			
max m	=	310.365	kNm/m			
min st	=	0.12	%			
Ast	=	1008	mm2			
Mom capacity for min st	=	384.99728				
M	=	384.99728	kNm/m	384.99728	>	310.365
Ast	=	$\frac{M}{j*d*\sigma st}$				
	=	1008	mm2			
	Y 20 @	311.50794	mm c/c			
	say	125	mm c/c			
Ast provided	=	2512	mm2			
max shear stress , tv	=	0.192	N/mm2			
Per shear stress ,tc	=	0.386	N/mm2			
for 0.299						

HENCE STIRRUPS NOT REQD

PROJECT	AREL-GUINDY-2
SUBJECT	DESIGN OF BASEMENT RC WALL

INPUT

Wall thickness		=	500	mm
COVER		=	30	mm
Effective thickness		=	464	mm
Unit wt of water/with surcharge		=	12	KN/m3
Height of wall		=	6.7	m
Moment from STAAD		=	68	KNm
Retaining wall considered as bottom fixed with raft slab and top hined with roof slab				
Submerged soil density		=	12	KN/m3
Depth of soil pressure on retaining wall		=	6.7	m
Uniformly varying load on wall		=	12 x 6.7	
			80.4	KN/m
Surcharge load		=	15	KN/m²
Uniformly distributed load on wall		=	15 x 0.333	
		=	5.00	KN/m
Moment from STAAD		=	68.00	KNm

Design Constants

Grade of Concrete (M)		=	**30**	N/mm²
Grade of steel (fy)		=	**500**	N/mm²
Concrete				
Allowable permissible stress in compression (Bending)	σcb	=	**10**	N/mm²
Allowable permissible stress in tension (Direct)	σct	=	**8**	N/mm²
HYSD Bars				
Permissible stresses (near water face)	σst	=	**130.000**	N/mm²
Permissible stresses (away from water face)	σst	=	**230.000**	N/mm²
Permissible stresses in tension due to bending in concrete				
Cracking Consideration	σct	=	**2.000**	N/mm²
	m	=	9.33	
	n or k	=	0.42	
	j	=	0.86	
	Q	=	1.81	

CHECK FOR DEPTH

Required d = $\sqrt{\frac{M}{Q.B}}$

= 194.0419 mm

Provided d = 464 mm

SAFE

AREA OF STEEL REQUIRED

Ast = $\frac{\text{Bending moment}}{\sigma st \text{ X } j \text{ X } d}$

= $\frac{68000000}{130X0.86X464}$

Ast reqd = 1310.84 mm²

Minimum Ast required = 0.12%

= 600.00 mm²

	Ast reqd	Dia of bar	Spacing	Ast pro		
	mm²	mm	mm	mm²		
Vertical reinforcement	1310.84	12	85	1330.56	mm²	SAFE
Horizontal reinforcement(distributor)	300.00	10	250	314.16	mm²	SAFE

CALCULATION OF CRACK WIDTH

DATA REQUIRED

Tensile stress(For M30 Grade), Fs	=	3.6	N/mm^2	(As per IS 3370 AND IS 456)
Modulus of elasticity, Es	=	200000	N/mm^2	
Width of section, b	=	1000	mm	
Depth of section, h	=	500	mm	
Depth of neutral axis, x	=	0.48d		
	=	209.1057	mm	
Distance form comp. face to crack width , a=		435.64	mm	
Effective depth, d	=	435.64	mm	
Diameter of rod used	=	12	mm	
Clear cover, Cmin	=	30	mm	
Area of reinforcement, Ast	=	1330.56	mm^2	
Distance form point to surface ,acr	=	58.36	mm	

Tensile strain, E_1 = Fs/Es

= 0.000018

(ANNEXE F PAGE NO ; 95 IS 456)

Average steel strain, Em = E_1 - ((b(h-x) (a-x))/3EsAs(d-x)

= -0.00035

= 0.000346

Design surface crack width (W_{cr}) =

(ANNEXE F PAGE NO ; 95 IS 456)

$$\frac{3 \times a_{cr} \times E_m}{\left(1 + \frac{2 \times (a_{cr} - C_{min})}{(h - x)}\right)}$$

0.051 < 0.2 **HENCE SAFE**

PROJECT	AREL-GUINDY-2
SUBJECT	DESIGN OF BASEMENT RC WALL

INPUT

Wall thickness		=	350	mm
COVER		=	30	mm
Effective thickness		=	314	mm
Unit wt of water/with surcharge		=	12	KN/m3
Height of wall		=	6.7	m
Moment from STAAD		=	46	KNm
Retaining wall considered as bottom fixed with raft slab and top hined with roof slab				
Submerged soil density		=	12	KN/m3
Depth of soil pressure on retaining wall		=	6.7	m
Uniformly varying load on wall		=	12 x 6.7	
			80.4	KN/m
Surcharge load		=	15	KN/m²
Uniformly distributed load on wall		=	15 x 0.333	
		=	5.00	KN/m
Moment from STAAD		=	46.00	KNm

Design Constants

Grade of Concrete (M)		=	**30**	N/mm²
Grade of steel (fy)		=	**500**	N/mm²
Concrete				
Allowable permissible stress in compression (Bending)	σcb	=	**10**	N/mm²
Allowable permissible stress in tension (Direct)	σct	=	**8**	N/mm²
HYSD Bars				
Permissible stresses (near water face)	σst	=	**130.000**	N/mm²
Permissible stresses (away from water face)	σst	=	**230.000**	N/mm²
Permissible stresses in tension due to bending in concrete				
Cracking Consideration	σct	=	**2.000**	N/mm²
	m	=	9.33	
	n or k	=	0.42	
	j	=	0.86	
	Q	=	1.81	

CHECK FOR DEPTH

Required d = $\sqrt{\frac{M}{Q.B}}$

= 159.5953 mm

Provided d = 314 mm

SAFE

AREA OF STEEL REQUIRED

Ast = $\frac{\text{Bending moment}}{\sigma st \times j \times d}$

$$= \frac{46000000}{130X0.86X314}$$

Ast reqd = 1310.35 mm²

Minimum Ast required = 0.12%

= 420.00 mm²

	Ast reqd mm²	Dia of bar mm	Spacing mm	Ast pro mm²		
Vertical reinforcement	1310.35	12	85	1330.56	mm²	SAFE
Horizontal reinforcement(distributor)	210.00	10	350	224.40	mm²	SAFE

CALCULATION OF CRACK WIDTH

DATA REQUIRED

Tensile stress(For M30 Grade), Fs	=	3.6	N/mm^2	(As per IS 3370 AND IS 456)
Modulus of elasticity, Es	=	200000	N/mm^2	
Width of section, b	=	1000	mm	
Depth of section, h	=	350	mm	
Depth of neutral axis, x	=	0.48d		
	=	137.1057	mm	
Distance form comp. face to crack width , a=		285.64	mm	
Effective depth, d	=	285.64	mm	
Diameter of rod used	=	12	mm	
Clear cover, Cmin	=	30	mm	
Area of reinforcement, Ast	=	1330.56	mm^2	
Distance form point to surface ,acr	=	58.36	mm	

Tensile strain, E_1 = Fs/Es

= 0.000018

(ANNEXE F PAGE NO ; 95 IS 456)

Average steel strain, Em = E_1 - ((b(h-x) (a-x))/3EsAs(d-x)

= -0.00025

= 0.000249

Design surface crack width (W_{cr}) =

(ANNEXE F PAGE NO ; 95 IS 456)

$$\frac{3 \times a_{cr} \times E_m}{\left(1 + \frac{2 \times (a_{cr} - C_{min})}{(h - x)}\right)}$$

0.034	< 0.2	**HENCE SAFE**

PROJECT	AREL-GUINDY-2
SUBJECT	DESIGN OF BASEMENT RC WALL

INPUT

Wall thickness		=	500	mm
COVER		=	30	mm
Effective thickness		=	465	mm
Unit wt of water/with surcharge		=	12	KN/m3
Height of wall		=	6.7	m
Moment from STAAD		=	33	KNm
Retaining wall considered as bottom fixed with raft slab and top hined with roof slab				
Submerged soil density		=	12	KN/m3
Depth of soil pressure on retaining wall		=	6.7	m
Uniformly varying load on wall		=	12 x 6.7	
			80.4	KN/m
Surcharge load		=	15	KN/m²
Uniformly distributed load on wall		=	15 x 0.333	
		=	5.00	KN/m
Moment from STAAD		=	33.00	KNm

Design Constants

Grade of Concrete (M)		=	**30**	N/mm²
Grade of steel (fy)		=	**500**	N/mm²
Concrete				
Allowable permissible stress in compression (Bending)	σcb	=	**10**	N/mm²
Allowable permissible stress in tension (Direct)	σct	=	**8**	N/mm²
HYSD Bars				
Permissible stresses (near water face)	σst	=	**130.000**	N/mm²
Permissible stresses (away from water face)	σst	=	**230.000**	N/mm²
Permissible stresses in tension due to bending in concrete				
Cracking Consideration	σct	=	**2.000**	N/mm²
	m	=	9.33	
	n or k	=	0.42	
	j	=	0.86	
	Q	=	1.81	

CHECK FOR DEPTH

Required d = $\sqrt{\frac{M}{Q.B}}$

= 135.1755 mm

Provided d = 465 mm

SAFE

AREA OF STEEL REQUIRED

Ast = $\frac{\text{Bending moment}}{\sigma st \times j \times d}$

$$= \frac{33000000}{130X0.86X465}$$

Ast reqd = 634.77 mm²

Minimum Ast required = 0.12%

= 600.00 mm²

	Ast reqd mm²	Dia of bar mm	Spacing mm	Ast pro mm²		
Vertical reinforcement	634.77	10	90	872.66	mm²	SAFE
Horizontal reinforcement(distributor)	300.00	10	250	314.16	mm²	SAFE

CALCULATION OF CRACK WIDTH

DATA REQUIRED

Tensile stress(For M30 Grade), Fs	=	3.6	N/mm^2	(As per IS 3370 AND IS 456)
Modulus of elasticity, Es	=	200000	N/mm^2	
Width of section, b	=	1000	mm	
Depth of section, h	=	500	mm	
Depth of neutral axis, x	=	0.48d		
	=	208.7002	mm	
Distance form comp. face to crack width , a=		434.79	mm	
Effective depth, d	=	434.79	mm	
Diameter of rod used	=	10	mm	
Clear cover, Cmin	=	30	mm	
Area of reinforcement, Ast	=	872.66	mm^2	
Distance form point to surface ,acr	=	60.21	mm	

Tensile strain, E_1 = Fs/Es

= 0.000018

(ANNEXE F PAGE NO ; 95 IS 456)

Average steel strain, Em = E_1 - ((b(h-x) (a-x))/3EsAs(d-x)

= -0.00054

= 0.000538

Design surface crack width (W_{cr}) =

(ANNEXE F PAGE NO ; 95 IS 456)

$$\frac{3 \times a_{cr} \times E_m}{\left(1 + \frac{2 \times (a_{cr} - C_{min})}{(h - x)}\right)}$$

0.081	< 0.2	**HENCE SAFE**

PROJECT	AREL-GUINDY-2
SUBJECT	DESIGN OF BASEMENT RC WALL

INPUT

Wall thickness		=	350	mm
COVER		=	30	mm
Effective thickness		=	315	mm
Unit wt of water/with surcharge		=	12	KN/m3
Height of wall		=	6.7	m
Moment from STAAD		=	15	KNm
Retaining wall considered as bottom fixed with raft slab and top hined with roof slab				
Submerged soil density		=	12	KN/m3
Depth of soil pressure on retaining wall		=	6.7	m
Uniformly varying load on wall		=	12 x 6.7	
			80.4	KN/m
Surcharge load		=	15	KN/m²
Uniformly distributed load on wall		=	15 x 0.333	
		=	5.00	KN/m
Moment from STAAD		=	15.00	KNm

Design Constants

Grade of Concrete (M)		=	**30**	N/mm²
Grade of steel (fy)		=	**500**	N/mm²
Concrete				
Allowable permissible stress in compression (Bending)	σcb	=	**10**	N/mm²
Allowable permissible stress in tension (Direct)	σct	=	**8**	N/mm²
HYSD Bars				
Permissible stresses (near water face)	σst	=	**130.000**	N/mm²
Permissible stresses (away from water face)	σst	=	**230.000**	N/mm²
Permissible stresses in tension due to bending in concrete				
Cracking Consideration	σct	=	**2.000**	N/mm²
	m	=	9.33	
	n or k	=	0.42	
	j	=	0.86	
	Q	=	1.81	

CHECK FOR DEPTH

Required d = $\sqrt{\frac{M}{Q.B}}$

= 91.13533 mm

Provided d = 315 mm

SAFE

AREA OF STEEL REQUIRED

Ast = $\frac{\text{Bending moment}}{\sigma st \times j \times d}$

$$= \frac{15000000}{130X0.86X315}$$

Ast reqd = 425.93 mm²

Minimum Ast required = 0.12%
= 420.00 mm²

	Ast reqd mm²	Dia of bar mm	Spacing mm	Ast pro mm²		
Vertical reinforcement	425.93	10	180	436.33	mm²	SAFE
Horizontal reinforcement(distributor)	210.00	10	350	224.40	mm²	SAFE

CALCULATION OF CRACK WIDTH

DATA REQUIRED

Tensile stress(For M30 Grade), Fs	=	3.6	N/mm^2	(As per IS 3370 AND IS 456)
Modulus of elasticity, Es	=	200000	N/mm^2	
Width of section, b	=	1000	mm	
Depth of section, h	=	350	mm	
Depth of neutral axis, x	=	0.48d		
	=	118.3255	mm	
Distance form comp. face to crack width , a=		246.51	mm	
Effective depth, d	=	246.51	mm	
Diameter of rod used	=	10	mm	
Clear cover, Cmin	=	30	mm	
Area of reinforcement, Ast	=	436.33	mm^2	
Distance form point to surface ,acr	=	98.49	mm	

Tensile strain, E_1 = Fs/Es

= 0.000018

(ANNEXE F PAGE NO ; 95 IS 456)

Average steel strain, Em = E_1 - ((b(h-x) (a-x))/3EsAs(d-x)

= -0.00087

= 0.000867

Design surface crack width (W_{cr}) =

(ANNEXE F PAGE NO ; 95 IS 456)

$$\frac{3 \times a_{cr} \times E_m}{\left(1 + \frac{2 \times (a_{cr} - C_{min})}{(h - x)}\right)}$$

0.161	< 0.2	**HENCE SAFE**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (LOWER BASEMENT)

Characteristic strength of concre fck = 25 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	AD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	$p_{t\,reqd}$	$p_{c\,reqd}$	tension	compn	First Tension				second layer		For comp		second la		$p_{t\,prov.}$	$p_{c\,prov.}$	leg	stirrups	τv	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks			Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
B5																																																								
	1		Support	350	600	25	53	288	538	8.500	667	195	667	195	6.3692	**1.722**	**0.82**	**3298**	**1567**	16	3	32	6			32	3	0	0	2.8	1.3	2	12	1.019	1.024	0.912	3.1	ok	275.9	100.0	**100.0**	**o.k**	**176.16**	**0.9**	**0.9**	16.71	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	725	**1045**	**1045.00**
			Midspan	350	600	25	53	288	538	8.500	450	100	450	100	4.297	**1.196**	**0.26**	**2290**	**502.4**	32	6	0	0			16	3			2.5	0.3	2	12	0.522	1.152	0.880	3.1	ok	300.0	100.0	**100.0**	**o.k**	**137.6**	**1.1**	**1.1**	14.28	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	350	600	25	53	288	538	8.500	667	350	667	350	6.3692	**1.722**	**0.82**	**3298**	**1567**	16	3	32	6			32	3			2.8	1.3	2	12	1.828	1.024	0.912	3.1	ok	153.7	100.0	ok	**o.k**	**176.16**	**0.9**	**0.9**	16.71	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	725	**1045**	**1045.00**
	2		Support	350	600	25	53	288	538	3.400	667	350	667	350	6.3692	**1.734**	**0.83**	**3320**	**1590**	32	6	0	0	0	0	32	3	0	0	2.5	1.3	2	12	1.828	1.152	0.880	3.1	ok	153.7	100.0	ok	**o.k**	**199.53**	**0.9**	**0.9**	6.95	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1770.00**
			Midspan	350	600	25	53	288	538	3.400	160	100	160	100	1.5278	**0.380**	**0.00**	**728**	**0**	32	3	32	3			16	3	0	0	2.5	0.3	2	12	0.522	1.152	0.880	3.1	ok	300.0	100.0	ok	**o.k**	**43.736**	**1.6**	**1.6**	3.83	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	350	600	25	85	288	538	3.400	540	280	540	280	5.8172	**1.621**	**0.74**	**2922**	**1338**	16	3	32	3	25	3	32	3	0	0	2.5	1.3	2	12	1.553	1.166	0.877	3.1	ok	180.9	100.0	ok	**o.k**	**188.8**	**0.9**	**0.9**	7.13	safe	safe	306.43	ok	432.6	ok	ok	ok	ok	725	**1045**	**1045.00**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (LOWER BASEMENT)

Characteristic strength of concre fck = 25 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	ADD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	First Tension						second layer			For comp		second la																				Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		$p_{t\,reqd}$	$p_{c\,reqd}$	tension	compn	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	$p_{t\,prov.}$	$p_{c\,prov.}$	leg	stirrups	τv	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks					
																%	%	Ast	Asc																								k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
	3		Support	350	600	25	85	288	538	3.400	540	280	540	280	5.8172	**1.621**	**0.74**	**2922**	**1338**	16	3	32	3	25	3	32	3	0	0	2.5	1.3	2	12	1.553	1.166	0.877	3.1	ok	180.9	100.0	ok	o.k	**188.8**	**0.9**	**0.9**	7.13	safe	safe	306.43	ok	432.6	ok	ok	ok	ok	725	**1045**	**1045.00**
			Midspan	350	600	25	53	288	538	3.400	195	120	195	120	1.8621	**0.473**	**0.00**	**905**	**0**	32	3	25	3			16	3	0	0	2.0	0.3	2	12	0.627	1.430	0.822	3.1	ok	300.0	100.0	ok	o.k	**67.555**	**1.6**	**1.6**	3.94	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	350	600	25	45	288	538	3.400	100	280	100	280	0.9276	**0.223**	**0.00**	**434**	**0**	16	3	0	0			32	3	25	3	0.3	2.0	2	12	1.441	9.348	0.401	3.1	ok	194.9	100.0	ok	o.k	**208.45**	**1.7**	**1.7**	3.55	safe	safe	330.23	ok	466.2	ok	ok	ok	ok	725	**885**	**1045.00**
B33A																																																				
	1		Support	300	600	25	53	238	538	6.400	325	290	325	290	3.6207	**1.019**	**0.08**	**1673**	**124.8**	20	3	32	3			25	3	0	0	2.0	0.9	2	12	1.767	1.420	0.824	3.1	ok	185.5	125.0	**100.0**	o.k	**144.59**	**1.1**	**1.1**	10.35	safe	safe	278.97	ok	393.84	ok	ok	ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	300	600	25	49.5	238	538	6.400	415	200	415	200	4.5647	**1.261**	**0.33**	**2083**	**547.4**	25	3	25	3			20	3			1.8	0.6	2	12	1.211	1.628	0.787	3.1	ok	270.7	125.0	**100.0**	o.k	**205.1**	**1.0**	**1.0**	12.12	safe	safe	280.76	ok	396.36	ok	ok	ok	ok	1132.8	**1382.8**	**1332.81**
			Support	300	600	25	53	238	538	6.400	683	390	683	390	7.609	**2.044**	**1.16**	**3354**	**1900**	20	3	32	3	0	0	25	6			2.0	1.8	2	12	2.377	1.420	0.824	3.1	ok	137.9	125.0	ok	o.k	**289.88**	**0.7**	**0.7**	15.83	safe	safe	278.97	ok	393.84	ok	ok	ok	ok	906.25	**1226.3**	**1156.25**
	2		Support	300	600	25	53	238	538	3.400	683	390	683	390	7.609	**2.044**	**1.16**	**3354**	**1900**	20	3	32	3	0	0	32	3	0	0	2.0	1.5	2	12	2.377	1.420	0.824	3.1	ok	137.9	100.0	ok	o.k	**289.88**	**0.7**	**0.7**	8.41	safe	safe	278.97	ok	393.84	ok	ok	ok	ok	906.25	**1226.3**	**1226.25**
			Midspan	300	600	25	53	238	538	3.400	300	140	300	140	3.3421	**0.948**	**0.00**	**1555**	**0.897**	32	3	32	3			16	3	0	0	2.9	0.4	2	12	0.853	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**93.478**	**1.2**	**1.2**	5.09	safe	safe	278.97	ok	393.84	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	300	600	25	85	238	538	3.400	100	110	100	110	1.2568	**0.308**	**0.00**	**476**	**0**	16	3	32	3	25	3	32	3	0	0	2.9	1.6	2	12	0.712	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**30.732**	**1.6**	**1.6**	4.05	safe	safe	262.65	ok	370.8	ok	ok	ok	ok	725	**1045**	**1045.00**
B7																																																			
	1		Support	200	600	25	51	140	540	6.500	200	200	200	200	3.3178	**0.939**	**0.00**	**1031**	**0**	20	2	32	2			25	2	0	0	2.0	0.9	2	10	1.821	1.425	0.823	3.1	ok	187.5	125.0	ok	o.k	**133.69**	**1.2**	**1.2**	10.05	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	200	600	25	47.5	140	540	6.500	275	100	275	100	4.5044	**1.245**	**0.31**	**1375**	**347**	25	2	20	2			20	2			1.5	0.6	2	10	0.905	1.992	0.735	3.1	ok	300.0	125.0	ok	o.k	**247.74**	**0.9**	**0.9**	13.23	safe	safe	187.85	ok	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1332.81**
			Support	200	600	25	51	140	540	6.500	390	250	390	250	6.4698	**1.748**	**0.85**	**1920**	**928.5**	20	2	32	2			25	2			2.0	0.9	2	10	2.277	1.425	0.823	3.1	ok	150.0	125.0	ok	o.k	**248.87**	**0.8**	**0.8**	14.44	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
	2		Support	200	600	25	51	140	540	2.400	390	250	390	250	6.4698	**1.748**	**0.85**	**1920**	**928.5**	20	2	32	2	0	0	25	2	0	0	2.0	0.9	2	10	2.277	1.425	0.823	3.1	ok	150.0	125.0	ok	o.k	**248.87**	**0.8**	**0.8**	5.33	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	200	600	25	47.5	140	540	2.400	200	100	200	100	3.2759	**0.924**	**0.00**	**1021**	**0**	25	2	20	2			20	2	0	0	1.5	0.6	2	10	0.905	1.992	0.735	3.1	ok	300.0	125.0	ok	o.k	**183.85**	**1.1**	**1.1**	3.99	safe	safe	187.85	ok	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1332.81**
			Support	200	600	25	51	140	540	2.400	300	220	300	220	4.9768	**1.366**	**0.44**	**1500**	**485.5**	20	2	32	2	0	0	25	2	0	0	2.0	0.9	2	10	2.004	1.425	0.823	3.1	ok	170.4	125.0	ok	o.k	**194.48**	**1.0**	**1.0**	4.57	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
	3		Support	200	600	25	51	140	540	6.800	300	220	300	220	4.9768	**1.366**	**0.44**	**1500**	**485.5**	20	2	32	2	0	0	25	2	0	0	2.0	0.9	2	10	2.004	1.425	0.823	3.1	ok	170.4	125.0	ok	o.k	**194.48**	**1.0**	**1.0**	12.94	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	200	600	25	47.5	140	540	6.800	150	120	150	120	2.457	**0.649**	**0.00**	**717**	**0**	25	2	20	2			20	2	0	0	1.5	0.6	2	10	1.086	1.992	0.735	3.1	ok	300.0	125.0	ok	o.k	**129.19**	**1.3**	**1.3**	9.15	safe	safe	187.85	ok	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1332.81**
			Support	200	600	25	51	140	540	6.800	310	250	310	250	5.1427	**1.409**	**0.49**	**1547**	**534.7**	20	2	32	2			25	2	25	3	2.0	2.2	2	10	2.277	1.425	0.823	3.1	ok	150.0	125.0	ok	o.k	**200.52**	**0.9**	**0.9**	13.18	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (UPPER BASEMENT)

Characteristic strength of concre fck = 25 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	AD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	$p_{t\,reqd}$	$p_{c\,reqd}$	tension	compn	First Tension				second layer		For comp		second la		$p_{t\,prov}$	$p_{c\,prov}$	leg	stirrups	τv	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks			Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
B5																																																								
	1		Support	350	600	25	53	288	538	8.500	667	195	667	195	6.3692	**1.722**	**0.82**	**3298**	**1567**	16	3	32	6			32	3	0	0	2.8	1.3	2	12	1.019	1.024	0.912	3.1	ok	275.9	100.0	**100.0**	**o.k**	**176.16**	**0.9**	**0.9**	16.71	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	725	**1045**	**1045.00**
			Midspan	350	600	25	53	288	538	8.500	450	100	450	100	4.297	**1.196**	**0.26**	**2290**	**502.4**	32	6	0	0			16	3			2.5	0.3	2	12	0.522	1.152	0.880	3.1	ok	300.0	100.0	**100.0**	**o.k**	**137.6**	**1.1**	**1.1**	14.28	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	350	600	25	53	288	538	8.500	667	350	667	350	6.3692	**1.722**	**0.82**	**3298**	**1567**	16	3	32	6			32	3			2.8	1.3	2	12	1.828	1.024	0.912	3.1	ok	153.7	100.0	ok	**o.k**	**176.16**	**0.9**	**0.9**	16.71	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	725	**1045**	**1045.00**
	2		Support	350	600	25	53	288	538	3.400	667	350	667	350	6.3692	**1.734**	**0.83**	**3320**	**1590**	32	6	0	0	0	0	32	3	0	0	2.5	1.3	2	12	1.828	1.152	0.880	3.1	ok	153.7	100.0	ok	**o.k**	**199.53**	**0.9**	**0.9**	6.95	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1770.00**
			Midspan	350	600	25	53	288	538	3.400	160	100	160	100	1.5278	**0.380**	**0.00**	**728**	**0**	32	3	32	3			16	3	0	0	2.5	0.3	2	12	0.522	1.152	0.880	3.1	ok	300.0	100.0	ok	**o.k**	**43.736**	**1.6**	**1.6**	3.83	safe	safe	325.47	ok	459.48	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	350	600	25	85	288	538	3.400	540	280	540	280	5.8172	**1.621**	**0.74**	**2922**	**1338**	16	3	32	3	25	3	32	3	0	0	2.5	1.3	2	12	1.553	1.166	0.877	3.1	ok	180.9	100.0	ok	**o.k**	**188.8**	**0.9**	**0.9**	7.13	safe	safe	306.43	ok	432.6	ok	ok	ok	ok	725	**1045**	**1045.00**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (UPPER BASEMENT)

Characteristic strength of concre fck = 25 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	ADD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	First Tension						second layer			For comp		second la																				Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
	3		Support	350	600	25	85	288	538	3.400	540	280	540	280	5.8172	**1.621**	**0.74**	**2922**	**1338**	16	3	32	3	25	3	32	3	0	0	2.5	1.3	2	12	1.553	1.166	0.877	3.1	**ok**	180.9	100.0	**ok**	**o.k**	**188.8**	**0.9**	**0.9**	7.13	**safe**	**safe**	306.43	**ok**	432.6	ok	ok	ok	ok	725	**1045**	**1045.00**
			Midspan	350	600	25	53	288	538	3.400	195	120	195	120	1.8621	**0.473**	**0.00**	**905**	**0**	32	3	25	3			16	3	0	0	2.0	0.3	2	12	0.627	1.430	0.822	3.1	**ok**	300.0	100.0	**ok**	**o.k**	**67.555**	**1.6**	**1.6**	3.94	**safe**	**safe**	325.47	**ok**	459.48	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	350	600	25	45	288	538	3.400	100	280	100	280	0.9276	**0.223**	**0.00**	**434**	**0**	16	3	0	0			32	3	25	3	0.3	2.0	2	12	1.441	9.348	0.401	3.1	**ok**	194.9	100.0	**ok**	**o.k**	**208.45**	**1.7**	**1.7**	3.55	**safe**	**safe**	330.23	**ok**	466.2	ok	ok	ok	ok	725	**885**	**1045.00**
B33A																																																						
	1		Support	300	600	25	53	238	538	6.400	325	290	325	290	3.6207	**1.019**	**0.08**	**1673**	**124.8**	20	3	32	3			25	3	0	0	2.0	0.9	2	12	1.767	1.420	0.824	3.1	**ok**	185.5	125.0	**100.0**	**o.k**	**144.59**	**1.1**	**1.1**	10.35	**safe**	**safe**	278.97	**ok**	393.84	ok	ok	ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	300	600	25	49.5	238	538	6.400	415	200	415	200	4.5647	**1.261**	**0.33**	**2083**	**547.4**	25	3	25	3			20	3			1.8	0.6	2	12	1.211	1.628	0.787	3.1	**ok**	270.7	125.0	**100.0**	**o.k**	**205.1**	**1.0**	**1.0**	12.12	**safe**	**safe**	280.76	**ok**	396.36	ok	ok	ok	ok	1132.8	**1382.8**	**1332.81**
			Support	300	600	25	53	238	538	6.400	683	390	683	390	7.609	**2.044**	**1.16**	**3354**	**1900**	20	3	32	3	0	0	25	6			2.0	1.8	2	12	2.377	1.420	0.824	3.1	**ok**	137.9	125.0	**ok**	**o.k**	**289.88**	**0.7**	**0.7**	15.83	**safe**	**safe**	278.97	**ok**	393.84	ok	ok	ok	ok	906.25	**1226.3**	**1156.25**
	2		Support	300	600	25	53	238	538	3.400	683	390	683	390	7.609	**2.044**	**1.16**	**3354**	**1900**	20	3	32	3	0	0	32	3	0	0	2.0	1.5	2	12	2.377	1.420	0.824	3.1	**ok**	137.9	100.0	**ok**	**o.k**	**289.88**	**0.7**	**0.7**	8.41	**safe**	**safe**	278.97	**ok**	393.84	ok	ok	ok	ok	906.25	**1226.3**	**1226.25**
			Midspan	300	600	25	53	238	538	3.400	300	140	300	140	3.3421	**0.948**	**0.00**	**1555**	**0.897**	32	3	32	3			16	3	0	0	2.9	0.4	2	12	0.853	1.000	0.918	3.1	**ok**	300.0	100.0	**ok**	**o.k**	**93.478**	**1.2**	**1.2**	5.09	**safe**	**safe**	278.97	**ok**	393.84	ok	ok	ok	ok	1450	**1770**	**1610.00**
			Support	300	600	25	85	238	538	3.400	100	110	100	110	1.2568	**0.308**	**0.00**	**476**	**0**	16	3	32	3	25	3	32	3	0	0	2.9	1.6	2	12	0.712	1.000	0.918	3.1	**ok**	300.0	100.0	**ok**	**o.k**	**30.732**	**1.6**	**1.6**	4.05	**safe**	**safe**	262.65	**ok**	370.8	ok	ok	ok	ok	725	**1045**	**1045.00**
B7																																																						
	1		Support	200	600	25	51	140	540	6.500	200	200	200	200	3.3178	**0.939**	**0.00**	**1031**	**0**	20	2	32	2			25	2	0	0	2.0	0.9	2	10	1.821	1.425	0.823	3.1	**ok**	187.5	125.0	**ok**	**o.k**	**133.69**	**1.2**	**1.2**	10.05	**safe**	**safe**	186.66	**ok**	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	200	600	25	47.5	140	540	6.500	275	100	275	100	4.5044	**1.245**	**0.31**	**1375**	**347**	25	2	20	2			20	2			1.5	0.6	2	10	0.905	1.992	0.735	3.1	**ok**	300.0	125.0	**ok**	**o.k**	**247.74**	**0.9**	**0.9**	13.23	**safe**	**safe**	187.85	**ok**	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1332.81**
			Support	200	600	25	51	140	540	6.500	390	250	390	250	6.4698	**1.748**	**0.85**	**1920**	**928.5**	20	2	32	2			25	2			2.0	0.9	2	10	2.277	1.425	0.823	3.1	**ok**	150.0	125.0	**ok**	**o.k**	**248.87**	**0.8**	**0.8**	14.44	**safe**	**safe**	186.66	**ok**	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
	2		Support	200	600	25	51	140	540	2.400	390	250	390	250	6.4698	**1.748**	**0.85**	**1920**	**928.5**	20	2	32	2	0	0	25	2	0	0	2.0	0.9	2	10	2.277	1.425	0.823	3.1	**ok**	150.0	125.0	**ok**	**o.k**	**248.87**	**0.8**	**0.8**	5.33	**safe**	**safe**	186.66	**ok**	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	200	600	25	47.5	140	540	2.400	200	100	200	100	3.2759	**0.924**	**0.00**	**1021**	**0**	25	2	20	2			20	2	0	0	1.5	0.6	2	10	0.905	1.992	0.735	3.1	**ok**	300.0	125.0	**ok**	**o.k**	**183.85**	**1.1**	**1.1**	3.99	**safe**	**safe**	187.85	**ok**	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1332.81**
			Support	200	600	25	51	140	540	2.400	300	220	300	220	4.9768	**1.366**	**0.44**	**1500**	**485.5**	20	2	32	2	0	0	25	2	0	0	2.0	0.9	2	10	2.004	1.425	0.823	3.1	**ok**	170.4	125.0	**ok**	**o.k**	**194.48**	**1.0**	**1.0**	4.57	**safe**	**safe**	186.66	**ok**	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
	3		Support	200	600	25	51	140	540	6.800	300	220	300	220	4.9768	**1.366**	**0.44**	**1500**	**485.5**	20	2	32	2	0	0	25	2	0	0	2.0	0.9	2	10	2.004	1.425	0.823	3.1	**ok**	170.4	125.0	**ok**	**o.k**	**194.48**	**1.0**	**1.0**	12.94	**safe**	**safe**	186.66	**ok**	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**
			Midspan	200	600	25	47.5	140	540	6.800	150	120	150	120	2.457	**0.649**	**0.00**	**717**	**0**	25	2	20	2			20	2	0	0	1.5	0.6	2	10	1.086	1.992	0.735	3.1	**ok**	300.0	125.0	**ok**	**o.k**	**129.19**	**1.3**	**1.3**	9.15	**safe**	**safe**	187.85	**ok**	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1332.81**
			Support	200	600	25	51	140	540	6.800	310	250	310	250	5.1427	**1.409**	**0.49**	**1547**	**534.7**	20	2	32	2			25	2	25	3	2.0	2.2	2	10	2.277	1.425	0.823	3.1	**ok**	150.0	125.0	**ok**	**o.k**	**200.52**	**0.9**	**0.9**	13.18	**safe**	**safe**	186.66	**ok**	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1156.25**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (STILT ROOF)

Characteristic strength of concre fck = 25 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	AD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	$p_{t\ reqd}$	$p_{c\ reqd}$	tension	compn	First Tension				second layer		For comp		second la		$p_{t\ prov}$	$p_{c\ prov}$	leg	stirrups	τv	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks			Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
B5																																																								
	1		Support	200	600	25	47.5	140	540	8.600	400	160	400	160	6.5519	**1.761**	**0.86**	**1946**	**949.2**	16	2	25	4			25	2	0	0	2.1	0.9	2	10	1.448	1.356	0.836	3.1	ok	235.8	100.0	ok	o.k	**238.54**	**0.8**	**0.8**	18.67	safe	safe	187.85	ok	265.2	ok	ok	not ok	ok	725	**975**	**975.00**
			Midspan	200	600	25	47.5	140	540	8.600	250	100	250	100	4.0949	**1.140**	**0.20**	**1260**	**224.9**	25	4	0	0			16	2			1.8	0.4	2	10	0.905	1.634	0.786	3.1	ok	300.0	100.0	ok	o.k	**186.07**	**1.0**	**1.0**	15.26	safe	safe	187.85	ok	265.2	ok	ok	not ok	ok	1132.8	**1382.8**	**1292.81**
			Support	200	600	25	47.5	140	540	8.600	450	180	450	180	7.3709	**1.968**	**1.08**	**2175**	**1191**	16	2	25	4			25	4			2.1	1.8	2	10	1.629	1.356	0.836	3.1	ok	209.6	100.0	ok	o.k	**266.64**	**0.8**	**0.8**	20.08	unsafe	safe	187.85	ok	265.2	ok	ok	not ok	ok	725	**975**	**975.00**
	2		Support	200	600	25	45.5	142	542	6.800	450	180	450	180	7.3178	**1.951**	**1.06**	**2164**	**1175**	16	2	25	4	0	0	32	3	0	0	2.1	2.2	2	8	1.623	1.361	0.835	3.1	ok	134.6	100.0	ok	o.k	**265.28**	**0.8**	**0.8**	15.76	safe	safe	188.53	ok	266.16	ok	ok	not ok	ok	725	**975**	**1045.00**
			Midspan	200	600	25	45.5	142	542	6.800	175	100	175	100	2.8458	**0.774**	**0.00**	**858**	**0**	25	4	0	0			16	2	0	0	1.8	0.4	2	8	0.902	1.640	0.786	3.1	ok	242.4	100.0	ok	o.k	**126.78**	**1.3**	**1.3**	9.67	safe	safe	188.53	ok	266.16	ok	ok	not ok	ok	1132.8	**1382.8**	**1292.81**
			Support	200	600	25	45.5	142	542	6.800	225	175	225	175	3.6589	**1.028**	**0.08**	**1140**	**94.2**	16	2	25	4	0	0	25	2	0	0	2.1	0.9	2	8	1.578	1.361	0.835	3.1	ok	138.5	100.0	ok	o.k	**139.73**	**1.1**	**1.1**	10.80	safe	safe	188.53	ok	266.16	ok	ok	not ok	ok	725	**975**	**975.00**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (STILT ROOF)

Characteristic strength of concre fck = 25 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	ADD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	$p_{t\,reqd}$	$p_{c\,reqd}$	tension	compn	First Tension				second layer		For comp		second la		$p_{t\,prov}$	$p_{c\,prov}$	leg	stirrups	τV	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks			Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
B19																																																									
	1		Support	200	1200	25	53	138	1138	2.000	325	290	325	290	1.2352	**0.302**	**0.00**	**693**	**0**	32	10	0	0			32	10	0	0	3.5	3.5	2	12	1.264	1.000	0.918	3.1	ok	300.0	125.0	ok	o.k	**24.999**	**1.5**	**1.5**	1.13	safe	safe	389.98	ok	550.56	ok	not ok	not ok	ok	1450	**1770**	**1770.00**
			Midspan	200	1200	25	53	138	1138	2.000	415	200	415	200	1.5772	**0.394**	**0.00**	**903**	**0**	32	10	0	0			32	10			3.5	3.5	2	12	0.872	1.000	0.918	3.1	ok	300.0	125.0	ok	o.k	**32.554**	**1.5**	**1.5**	1.17	safe	safe	389.98	ok	550.56	ok	not ok	not ok	ok	1450	**1770**	**1770.00**
			Support	200	1200	25	53	138	1138	2.000	683	390	683	390	2.5958	**0.693**	**0.00**	**1589**	**0**	32	10	0	0	0	0	32	10			3.5	3.5	2	12	1.700	1.000	0.918	3.1	ok	289.2	125.0	ok	o.k	**57.298**	**1.3**	**1.3**	1.31	safe	safe	389.98	ok	550.56	ok	not ok	not ok	ok	1450	**1770**	**1770.00**
	2		Support	450	1200	25	53	388	1138	6.000	3200	3200	3200	3200	5.4052	**1.451**	**0.52**	**7489**	**2661**	32	25	0	0	0	0	32	25	0	0	3.9	3.9	6	12	6.200	1.000	0.918	3.1	ok	105.8	100.0	ok	o.k	**108.02**	**1.1**	**1.1**	4.93	safe	safe	877.46	ok	1238.8	ok	ok	ok	ok	1450	**1770**	**1770.00**
			Midspan	450	1200	25	53	388	1138	6.000	7870	1500	7870	1500	13.293	**3.375**	**2.48**	**17420**	**12825**	32	25	0	0			32	25	0	0	3.9	3.9	6	12	2.906	1.000	0.918	3.1	ok	225.6	100.0	ok	o.k	**251.26**	**0.7**	**0.7**	7.34	safe	safe	877.46	ok	1238.8	ok	ok	ok	ok	1450	**1770**	**1770.00**
			Support	450	1200	25	53	388	1138	6.000	3500	1700	3500	1700	5.9119	**1.575**	**0.64**	**8127**	**3314**	32	25	0	0	0	0	32	25	0	0	3.9	3.9	6	12	3.294	1.000	0.918	3.1	ok	199.1	100.0	ok	o.k	**117.23**	**1.0**	**1.0**	5.08	safe	safe	877.46	ok	1238.8	ok	ok	ok	ok	1450	**1770**	**1770.00**
B15A																																																								
	1		Support	200	800	25	43	142	742	9.000	330	150	330	150	2.8793	**0.785**	**0.00**	**1189**	**0**	20	2	20	2	0	0	25	2	0	0	0.8	0.6	2	8	0.991	3.497	0.598	3.1	ok	220.6	100.0	ok	o.k	**274.36**	**0.9**	**0.9**	12.58	safe	safe	257.38	ok	363.36	ok	not ok	not ok	ok	906.25	**1106.3**	**1156.25**
			Midspan	200	800	25	43	142	742	9.000	275	150	275	150	2.3994	**0.631**	**0.00**	**956**	**0**	20	2	20	2			25	2	25	2	0.8	1.3	2	8	0.991	3.497	0.598	3.1	ok	220.6	100.0	ok	o.k	**220.57**	**1.1**	**1.1**	10.52	safe	safe	257.38	ok	363.36	ok	not ok	not ok	ok	906.25	**1106.3**	**1156.25**
			Support	200	800	25	43	142	742	9.000	330	150	330	150	2.8793	**0.785**	**0.00**	**1189**	**0**	20	2	20	2			25	2	0	0	0.8	0.6	2	8	0.991	3.497	0.598	3.1	ok	220.6	100.0	ok	o.k	**274.36**	**0.9**	**0.9**	12.58	safe	safe	257.38	ok	363.36	ok	not ok	not ok	ok	906.25	**1106.3**	**1156.25**
B15																																																								
	1		Support	200	600	25	51	140	540	2.400	560	195	560	195	9.2899	**2.470**	**1.61**	**2712**	**1765**	20	2	32	4			32	4	0	0	3.5	2.9	2	10	1.776	1.000	0.918	3.1	ok	192.3	100.0	ok	o.k	**204.53**	**0.8**	**0.8**	5.35	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1226.25**
			Midspan	200	600	25	51	140	540	2.400	450	100	450	100	7.4651	**2.015**	**1.13**	**2212**	**1238**	32	2	32	2			32	4			2.9	2.9	2	10	0.911	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**199.43**	**0.9**	**0.9**	5.07	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	1450	**1770**	**1770.00**
			Support	200	600	25	51	140	540	2.400	200	350	200	350	3.3178	**0.939**	**0.00**	**1031**	**0**	20	2	32	4			32	4			3.5	2.9	2	10	3.188	1.000	0.918	3.1	ok	107.1	100.0	ok	o.k	**77.765**	**1.2**	**1.2**	3.57	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1226.25**
	2		Support	200	600	25	51	140	540	3.400	200	350	200	350	3.3178	**0.939**	**0.00**	**1031**	**0**	20	2	32	4	0	0	32	4	0	0	3.5	2.9	2	10	3.188	1.000	0.918	3.1	ok	107.1	100.0	ok	o.k	**77.765**	**1.2**	**1.2**	5.05	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1226.25**
			Midspan	200	600	25	51	140	540	3.400	285	120	285	120	4.7279	**1.306**	**0.38**	**1435**	**416.3**	32	2	32	2			32	4	0	0	2.9	2.9	2	10	1.093	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**129.32**	**1.1**	**1.1**	5.78	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	1450	**1770**	**1770.00**
			Support	200	600	25	51	140	540	3.400	200	120	200	120	3.3178	**0.939**	**0.00**	**1031**	**0**	20	2	32	4	0	0	32	4	0	0	3.5	2.9	2	10	1.093	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**77.765**	**1.2**	**1.2**	5.05	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1226.25**
	3		Support	200	600	25	51	140	540	3.400	200	120	200	120	3.3178	**0.939**	**0.00**	**1031**	**0**	20	2	32	4	0	0	32	4	0	0	3.5	2.9	2	10	1.093	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**77.765**	**1.2**	**1.2**	5.05	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1226.25**
			Midspan	200	600	25	51	140	540	3.400	195	120	195	120	3.2349	**0.909**	**0.00**	**998**	**0**	32	3	25	3			32	4	0	0	3.5	2.9	2	10	1.093	1.000	0.918	3.1	ok	300.0	100.0	ok	o.k	**74.484**	**1.2**	**1.2**	5.00	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	1450	**1770**	**1770.00**
			Support	200	600	25	51	140	540	3.400	590	280	590	280	9.7876	**2.597**	**1.74**	**2852**	**1913**	20	2	32	4			32	4	0	0	3.5	2.9	2	10	2.550	1.000	0.918	3.1	ok	133.9	100.0	ok	o.k	**215.07**	**0.8**	**0.8**	7.79	safe	safe	186.66	ok	263.52	ok	ok	not ok	ok	906.25	**1226.3**	**1226.25**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (TYPICAL FLOOR)

Characteristic strength of concre fck = 30 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	ADBEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	$p_{t\,reqd}$	$p_{c\,reqd}$	tension	compn	First Tension				second layer		For comp		second la		$p_{t\,prov}$	$p_{c\,prov}$	leg	stirrups	τv	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks			Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
B5																																																								
	1		Support	200	600	25	47.5	140	540	8.600	400	160	400	160	6.5519	**1.781**	**0.68**	**1968**	**751.8**	16	2	25	4			25	2	0	0	2.1	0.9	2	10	1.448	1.627	0.863	3.5	ok	235.8	100.0	ok	o.k	**241.28**	**0.8**	**0.8**	18.81	safe	safe	187.85	ok	290.51	ok	ok	not ok	ok	725	**975**	**975.00**
			Midspan	200	600	25	47.5	140	540	8.600	250	100	250	100	4.0949	**1.159**	**0.02**	**1281**	**25.85**	25	4	0	0			16	2			1.8	0.4	2	10	0.905	1.960	0.810	3.5	ok	300.0	100.0	ok	o.k	**189.15**	**1.0**	**1.0**	15.41	safe	safe	187.85	ok	290.51	ok	ok	not ok	ok	1132.8	**1382.8**	**1292.81**
			Support	200	600	25	47.5	140	540	8.600	450	180	450	180	7.3709	**1.989**	**0.90**	**2197**	**993.8**	16	2	25	4			25	4			2.1	1.8	2	10	1.629	1.627	0.863	3.5	ok	209.6	100.0	ok	o.k	**269.38**	**0.8**	**0.8**	20.22	unsafe	safe	187.85	ok	290.51	ok	ok	not ok	ok	725	**975**	**975.00**
	2		Support	200	600	25	45.5	142	542	6.800	450	180	450	180	7.3178	**1.972**	**0.88**	**2187**	**978.1**	16	2	25	4	0	0	32	3	0	0	2.1	2.2	2	8	1.623	1.633	0.862	3.5	ok	134.6	100.0	ok	o.k	**268.11**	**0.8**	**0.8**	15.87	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	725	**975**	**1045.00**
			Midspan	200	600	25	45.5	142	542	6.800	175	100	175	100	2.8458	**0.747**	**0.00**	**829**	**0**	25	4	0	0			16	2	0	0	1.8	0.4	2	8	0.902	1.967	0.809	3.5	ok	242.4	100.0	ok	o.k	**122.4**	**1.3**	**1.3**	9.49	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	1132.8	**1382.8**	**1292.81**
			Support	200	600	25	45.5	142	542	6.800	225	175	225	175	3.6589	**1.012**	**0.00**	**1122**	**0**	16	2	25	4	0	0	25	2	0	0	2.1	0.9	2	8	1.578	1.633	0.862	3.5	ok	138.5	100.0	ok	o.k	**137.55**	**1.1**	**1.1**	10.71	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	725	**975**	**975.00**

APPASAMY - MULTISTORIED RESIDENTIAL APPARMENTMENT (TYPICAL FLOOR)

Characteristic strength of concre fck = 30 N/mm²
Yield strength of steel fy = 500 N/mm²

SHEAR DESIGN

DUCTILE DETAILING

BEAM MKD	BAY NO	ADD BEAM	End condition	b	D	cover	cover	b1	d1	l	Moment	shear	Mue	Vue	Mu/bd²	$p_{t\ reqd}$	$p_{c\ reqd}$	tension	compn	First Tension				second layer		For comp		second la		$p_{t\ prov}$	$p_{c\ prov}$	leg	stirrups	τv	β	tc	tc max	tc<tcmax	sv rqd	sv prov	sv	pt & pc	fs	MF		Modified	Deflection check		Min	Min	Ast checks		Ductile detailing checks			Development length(Ld+10*dia of reinnforcement)		
As per drg				mm	mm	mm	mm	c/c of stps	c/c of stps	m	kN.m	kN	kn.m	kn		%	%	Ast	Asc	dia	no.	dia 2	no.	dia	no	dia	no.	dia 2	nos	%	%	No	mm	N/mm²		N/mm²	N/mm²	check	mm	mm	check	check		k	kcorr	l/d ratio	SS	continuous	Ast	Ast chk	Min Ast	Ast check	b/d>0.3	b>200	D<L/4	Ld	tension	compression
B4																																																							
	1		Support	200	600	25	45.5	142	542	2.000	400	160	400	160	6.5047	**1.767**	**0.67**	**1959**	**737.8**	16	2	25	4			25	2	0	0	2.1	0.9	2	8	1.443	1.633	0.862	3.5	ok	151.5	100.0	ok	o.k	**240.21**	**0.8**	**0.8**	4.34	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	725	**975**	**975.00**
			Midspan	200	600	25	45.5	142	542	2.000	250	100	250	100	4.0654	**1.151**	**0.02**	**1277**	**17.06**	25	4	0	0			16	2			1.8	0.4	2	8	0.902	1.967	0.809	3.5	ok	242.4	200.0	ok	o.k	**188.59**	**1.0**	**1.0**	3.56	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	1132.8	**1382.8**	**1292.81**
			Support	200	600	25	45.5	142	542	2.000	450	160	450	160	7.3178	**1.972**	**0.88**	**2187**	**978.1**	16	2	25	4	0	0	25	4			2.1	1.8	2	8	1.443	1.633	0.862	3.5	ok	151.5	100.0	ok	o.k	**268.11**	**0.8**	**0.8**	4.67	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	725	**975**	**975.00**
	2		Support	200	600	25	45.5	142	542	6.000	450	180	450	180	7.3178	**1.972**	**0.88**	**2187**	**978.1**	16	2	25	4	0	0	25	4	0	0	2.1	1.8	6	8	1.623	1.633	0.862	3.5	ok	300.0	100.0	ok	o.k	**268.11**	**0.8**	**0.8**	14.00	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	725	**975**	**975.00**
			Midspan	200	600	25	45.5	142	542	6.000	175	100	175	100	2.8458	**0.747**	**0.00**	**829**	**0**	25	4	0	0			16	2	0	0	1.8	0.4	6	8	0.902	1.967	0.809	3.5	ok	300.0	100.0	ok	o.k	**122.4**	**1.3**	**1.3**	8.38	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	1132.8	**1382.8**	**1292.81**
			Support	200	600	25	45.5	142	542	6.000	215	175	215	175	3.4963	**0.956**	**0.00**	**1060**	**0**	16	2	25	4	0	0	25	4	0	0	2.1	1.8	6	8	1.578	1.633	0.862	3.5	ok	300.0	100.0	ok	o.k	**129.98**	**1.2**	**1.2**	9.19	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	725	**975**	**975.00**
B15																																																						
	1		Support	200	800	25	47.5	140	740	4.700	330	190	330	190	2.9139	**0.768**	**0.00**	**1156**	**0**	16	2	25	2	0	0	20	2	0	0	0.9	0.4	2	10	1.262	3.788	0.635	3.5	ok	270.5	100.0	ok	o.k	**242.28**	**1.0**	**1.0**	6.14	safe	safe	255.85	ok	395.67	ok	not ok	not ok	ok	725	**975**	**925.00**
			Midspan	200	800	25	45	140	740	4.700	150	100	150	100	1.3157	**0.319**	**0.00**	**482**	**0**	20	2	20	2			16	2	0	0	0.8	0.3	2	10	0.662	4.186	0.611	3.5	ok	300.0	100.0	ok	o.k	**111.33**	**1.9**	**1.9**	3.32	safe	safe	256.70	ok	396.99	ok	not ok	not ok	ok	906.25	**1106.3**	**1066.25**
			Support	200	800	25	47.5	140	740	4.700	330	190	330	190	2.9139	**0.768**	**0.00**	**1156**	**0**	16	2	25	2			20	2	0	0	0.9	0.4	2	10	1.262	3.788	0.635	3.5	ok	270.5	100.0	ok	o.k	**242.28**	**1.0**	**1.0**	6.14	safe	safe	255.85	ok	395.67	ok	not ok	not ok	ok	725	**975**	**925.00**
B27A																																																					
	1		Support	200	600	25	45.5	142	542	2.400	100	165	100	165	1.6262	**0.401**	**0.00**	**444**	**0**	20	2	25	2			25	2	0	0	1.5	0.9	2	8	1.488	2.399	0.754	3.5	ok	146.9	125.0	ok	o.k	**80.015**	**1.7**	**1.7**	2.53	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	906.25	**1156.3**	**1156.25**
			Midspan	200	600	25	45.5	142	542	2.400	100	100	100	100	1.6262	**0.401**	**0.00**	**444**	**0**	25	2	20	2			25	2	20	2	1.5	1.5	2	8	0.902	2.399	0.754	3.5	ok	242.4	125.0	ok	o.k	**80.015**	**1.7**	**1.7**	2.53	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	1132.8	**1382.8**	**1382.81**
			Support	200	600	25	45.5	142	542	2.400	300	165	300	165	4.8785	**1.357**	**0.23**	**1505**	**258.2**	20	2	25	2			25	2			1.5	0.9	2	8	1.488	2.399	0.754	3.5	ok	146.9	125.0	ok	o.k	**271.12**	**0.8**	**0.8**	5.19	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	906.25	**1156.3**	**1156.25**
	2		Support	200	600	25	45.5	142	542	7.200	300	165	300	165	4.8785	**1.357**	**0.23**	**1505**	**258.2**	20	2	25	2	0	0	25	2	0	0	1.5	0.9	2	8	1.488	2.399	0.754	3.5	ok	146.9	125.0	ok	o.k	**271.12**	**0.8**	**0.8**	15.57	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	906.25	**1156.3**	**1156.25**
			Midspan	200	600	25	45.5	142	542	7.200	150	100	150	100	2.4393	**0.626**	**0.00**	**694**	**0**	25	2	20	2			25	2	20	2	1.5	1.5	2	8	0.902	2.399	0.754	3.5	ok	242.4	200.0	ok	o.k	**125.06**	**1.4**	**1.4**	9.46	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	1132.8	**1382.8**	**1382.81**
			Support	200	600	25	45.5	142	542	7.200	270	150	270	150	4.3907	**1.234**	**0.10**	**1368**	**113.4**	20	2	25	2	0	0	25	2	0	0	1.5	0.9	2	8	1.353	2.399	0.754	3.5	ok	161.6	125.0	ok	o.k	**246.43**	**0.9**	**0.9**	14.54	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	906.25	**1156.3**	**1156.25**
	3		Support	200	600	25	45.5	142	542	5.100	270	150	270	150	4.3907	**1.234**	**0.10**	**1368**	**113.4**	20	2	25	2	0	0	25	2	0	0	1.5	0.9	2	8	1.353	2.399	0.754	3.5	ok	161.6	125.0	ok	o.k	**246.43**	**0.9**	**0.9**	10.30	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	906.25	**1156.3**	**1156.25**
			Midspan	200	600	25	45.5	142	542	5.100	180	120	180	120	2.9271	**0.772**	**0.00**	**856**	**0**	25	2	20	2			25	2	20	2	1.5	1.5	2	8	1.082	2.399	0.754	3.5	ok	202.0	200.0	ok	o.k	**154.27**	**1.2**	**1.2**	7.57	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	1132.8	**1382.8**	**1382.81**
			Support	200	600	25	45.5	142	542	5.100	210	140	210	140	3.415	**0.929**	**0.00**	**1030**	**0**	20	2	25	2			25	2	0	0	1.5	0.9	2	8	1.262	2.399	0.754	3.5	ok	173.1	125.0	ok	o.k	**185.54**	**1.1**	**1.1**	8.49	safe	safe	188.53	ok	291.56	ok	ok	not ok	ok	906.25	**1156.3**	**1156.25**

DESIGN OF TWO WAY SLAB S3 LOWER BASEMENT

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	2.80	m
Longer Span		Ly	=	4.60	m
Assuming Depth of Slab		D	=	150	mm
Assuming Dia of reinf.			=	8	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	126	mm
Eff.Shorter Span		l_x	=	2.93	m
Eff. Longer Span		l_y	=	4.73	m

Load Calculations:

Self weight of slab	=	3.75	kN/m²	
Finishing load	=	1.50	kN/m²	
Pipe load	=	0.00	kN/m²	
Live load	=	10.00	kN/m²	
Fillingt load	=	0.00	kN/m²	
Total load	=	15.25	kN/m²	
Load Factor	=	1.50		
Factored Load	=	22.88	kN/m²	
Span Ratio	ℓ_y/ℓ_x	=	4.73 / 2.93	
		=	1.62	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.094	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

<u>Shorter Span:</u>

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 2.93^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.094 \times 22.88 \times 2.93^2$
		=	18.423 kN.m

<u>Longer Span :</u>

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 2.93^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 22.88 \times 2.93^2$
		=	10.967 kN.m

Reinforcement:

	Reinf Required		Reinf Provided
Required in Shorter Span			
Support	8Ø @ 330mm c/c	-	8 dia @ 125 mm c/c
Mid span	8Ø @ 140mm c/c	-	8 dia @ 125 mm c/c
Required in Longer Span			
Support	8Ø @ 330mm c/c	-	8 dia @ 100 mm c/c
Mid span	8Ø @ 240mm c/c	-	8 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$	
Maximum Shear Force	Vu	=	0.00 x 2.926 x 22.88	
		=	0.000 kN	
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$	
		=	0.46 x 2.926 x 22.88 =	31.045kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$	
		=	0.00 x 2.926 x 22.88 =	0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$	
		=	0.33 x 2.926 x 22.88 =	22.088kN
S.F for continuous edge in short direction	Vu	=	31.045 kN	
Design Shear stress τv	Vu/bd	=	31045 / (1000 x 126)	
		=	0.246 N/mm²	
Reinforcement provided in the slab is		-	8Ø @ 125 mm c/c	
% of reinforcement provided	pt	=	0.32	
IS:456 Table 19				
Allowable shear stress	τc	=	0.41 N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30	
Design shear stress for concrete	k x τc	=	1.30 x 0.405	
		=	0.527 N/mm²	
Actual Shear Stress < Design Shear Stress		0.246 < 0.527		**SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.319	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.312	
Modification factor for Tension reinf.	F1	=	1.34	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.34 x 1.00	
		=	**34.72**	
Actual span/depth ratio		=	2926 / 126	
		=	**23.22**	
Actual span/depth ratio < Modified span/depth ratio		23.22 < 34.72		**SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.239**	**%**
Min Ast		=	**359.039**	**mm2**
Length to be provided		=	**585.2**	**x-direc**
			945.2	**y-direc**

DESIGN OF ONE WAY SLAB S2 LOWER BASEM Simply Supported

Data:

Concrete	M25	fck	=	25	N/mm²	
Steel	Fe500	fy	=	500	N/mm²	
Span of the slab		ℓ	=	3.15	m	
Assuming Depth of Slab		D	=	150	mm	
Assuming Dia of reinforcement			=	10	mm	
Clear cover			=	20	mm	
Effective Depth of Slab			=	125	mm	
Effective Span of slab		ℓ_x	=	3.28	m	

Load Calculations:

Self weight of slab		=	3.75	kN/m²	
Finishing load		=	1.50	kN/m²	
Pipe load		=	0.00	kN/m²	
Live load		=	10.00	kN/m²	
Filling load		=	0.00	kN/m²	
Total load		=	15.25	kN/m²	
Load Factor		=	1.50		
Factored Load		=	22.88	kN/m²	

Bending Moment & Reinforcement Calculation:

Span Moment

Maximum Negative moment	Msup.	=	Wlx²/8		
		=	22.88 x 3.28² / 8		
		=	30.67	kN.m	
	Msup./bd²	=	30668584 / (1000 x 125²)		
		=	1.96		
Percentage of reinforcement required	pt	=	0.50		**ok**
Required spacing of 10mm dia bars		=	125	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.63	%	
	n				

Support Moment

Maximum Positive moment	Mspan	=	Wlx²/10		
		=	22.88 x 3.28² / 10		
		=	24.53	kN.m	
	Mspan/bd²	=	24534867 / (1000 x 125²)		
		=	1.57		
Percentage of reinforcement required	pt	=	0.39	%	**ok**
Required spacing of 10mm dia bars		=	160	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.63		

Distribution Reinforcement:

Minimum distribution reinforcement percentage for slab		=	0.12		
Diameter of bar		=	10	mm	
Required spacing of 10mm dia bars		=	436	mm	
Provided spacing of 10mm dia bars		=	200	mm	**ok**
Check for Shear:					
Maximum Shear Force at support	Vu	=	$W\ell_x/2$		
		=	22.875 x 3.28/2		
		=	37.46	kN	
Actual Shear Stress	τv	=	Vu/bd		
		=	37458 / (1000 x 125)		
		=	0.30	N/mm²	
% of tension reinforcement provided in support	pt	=	0.63		
IS:456 - 2000 Table 19					
Allowable shear stress	τc	=	0.54	N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		=	1.30		
Design shear stress for concrete	k x τc	=	1.30 x 0.536		
		=	0.70	N/mm²	
Actual Shear Stress < Design Shear Stress		0.300 < 0.697			**SAFE**
Check for Deflection:					
Allowable span / depth Ratio	l/d	=	26		
% of Tension reinforcement	pt	=	0.63		
Steel stress of service loads	fs	=	0.58 fy (Ast reqd./ Ast prov.)		
		=	231.48	N/mm²	
Corresponding Compression reinf.	Bar dia	=	10	mm	
	spacing	=	200	mm	
% of Compression reinforcement	pc	=	0.31		
Modification factor for Tension reinf.	F1	=	1.185	(Fig 4 in IS 456 - 2000)	
Modification factor for Comp. reinf.	F2	=	1.00	(Fig 5 in IS 456 - 2000)	
Modified span/depth ratio		=	l/d x F1 x F2		
		=	26 x 1.18 x 1.00		
		=	**30.80**		
Actual span/depth ratio		=	3275/125		
		=	**26.20**		
Actual span/depth ratio < Modified span/depth ratio		26.20 < 30.80			**SAFE**
Check for Punching Shear (Fire vehicle wheel load)					
Maximum Force on single wheel for fire vehicle (As per IRC)		=	80	KN	
Critical Wheel base size (As per IRC)		=	0.19	0.51 M	
Punching shear stress		=	0.505	N/mm²	
Allowable shear stress		=	1.091	N/mm²	
		=	**OK**		

DESIGN OF TWO WAY SLAB S5 LOWER BASEMENT

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	3.30	m
Longer Span		Ly	=	5.80	m
Assuming Depth of Slab		D	=	150	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	125	mm
Eff.Shorter Span		l_x	=	3.43	m
Eff. Longer Span		l_y	=	5.93	m

Load Calculations:

Self weight of slab	=	3.75	kN/m²
Finishing load	=	1.50	kN/m²
Pipe load	=	0.00	kN/m²
Live load	=	10.00	kN/m²
Fillingt load	=	0.00	kN/m²
Total load	=	15.25	kN/m²
Load Factor	=	1.50	
Factored Load	=	22.88	kN/m²
Span Ratio	ℓ_y/ℓ_x	=	5.93 / 3.43	
		=	1.73	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.099	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

<u>Shorter Span:</u>

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.43^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.099 \times 22.88 \times 3.43^2$
		=	26.597 kN.m

<u>Longer Span :</u>

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.43^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 22.88 \times 3.43^2$
		=	15.027 kN.m

Reinforcement:

	Reinf Required		Reinf Provided
Required in Shorter Span			
Support	10Ø @ 375mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 145mm c/c	-	10 dia @ 100 mm c/c
Required in Longer Span			
Support	10Ø @ 375mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 270mm c/c	-	10 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 3.425 x 22.88
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.48 x 3.425 x 22.88 = 37.418kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 3.425 x 22.88 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 3.425 x 22.88 = 25.854kN
S.F for continuous edge in short direction	Vu	=	37.418 kN
Design Shear stress τv	Vu/bd	=	37418 / (1000 x 125)
		=	0.299 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.63
IS:456 Table 19			
Allowable shear stress	τc	=	0.54 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30
Design shear stress for concrete	k x τc	=	1.30 x 0.536
		=	0.697 N/mm²

Actual Shear Stress < Design Shear Stress 0.299 < 0.697 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.628	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.314	
Modification factor for Tension reinf.	F1	=	1.35	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.35 x 1.00	
		=	**35.00**	
Actual span/depth ratio		=	3425 / 125	
		=	**27.40**	

Actual span/depth ratio < Modified span/depth ratio 27.40 < 35.00 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.471 %**	
Min Ast		=	**706.858 mm2**	
Length to be provided		=	**685**	**x-direc**
			1185	**y-direc**

DESIGN OF TWO WAY SLAB S4 LOWER BASEMENT

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	3.70	m
Longer Span		Ly	=	4.60	m
Assuming Depth of Slab		D	=	150	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	125	mm
Eff.Shorter Span		l_x	=	3.83	m
Eff. Longer Span		l_y	=	4.73	m

Load Calculations:

Self weight of slab	=	3.75	kN/m²	
Finishing load	=	1.50	kN/m²	
Pipe load	=	0.00	kN/m²	
Live load	=	10.00	kN/m²	
Fillingt load	=	0.00	kN/m²	
Total load	=	15.25	kN/m²	
Load Factor	=	1.50		
Factored Load	=	22.88	kN/m²	
Span Ratio	ℓ_y/ℓ_x	=	4.73 / 3.83	
		=	1.24	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.074	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.83^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.074 \times 22.88 \times 3.83^2$
		=	24.923 kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.83^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 22.88 \times 3.83^2$
		=	18.742 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	10Ø @ 375mm c/c	-	10 dia @ 125 mm c/c
Mid span	10Ø @ 155mm c/c	-	10 dia @ 125 mm c/c
Required in Longer Span			
Support	10Ø @ 375mm c/c	-	10 dia @ 175 mm c/c
Mid span	10Ø @ 210mm c/c	-	10 dia @ 175 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 3.825 x 22.88
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.40 x 3.825 x 22.88 = 34.741kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 3.825 x 22.88 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 3.825 x 22.88 = 28.874kN
S.F for continuous edge in short direction	Vu	=	34.741 kN
Design Shear stress τv	Vu/bd	=	34741 / (1000 x 125)
		=	0.278 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 125 mm c/c
% of reinforcement provided	pt	=	0.50
IS:456 Table 19			
Allowable shear stress	τc	=	0.49 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30
Design shear stress for concrete	k x τc	=	1.30 x 0.490
		=	0.637 N/mm²

Actual Shear Stress < Design Shear Stress 0.278 < 0.637 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.503	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.314	
Modification factor for Tension reinf.	F1	=	1.26	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.26 x 1.00	
		=	**32.85**	
Actual span/depth ratio		=	3825 / 125	
		=	**30.60**	

Actual span/depth ratio < Modified span/depth ratio 30.60 < 32.85 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.377**	**%**
Min Ast		=	**565.487**	**mm2**
Length to be provided		=	**765**	**x-direc**
			945	**y-direc**

DESIGN OF TWO WAY SLAB S8 UPPER BASEMENT

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	3.10	m
Longer Span		Ly	=	4.80	m
Assuming Depth of Slab		D	=	175	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	150	mm
Eff.Shorter Span		l_x	=	3.25	m
Eff. Longer Span		l_y	=	4.95	m

Load Calculations:

Self weight of slab	=	4.38	kN/m²
Finishing load	=	1.50	kN/m²
Pipe load	=	0.00	kN/m²
Live load	=	10.00	kN/m²
Fillingt load	=	8.00	kN/m²
Total load	=	23.88	kN/m²
Load Factor	=	1.50	
Factored Load	=	35.81	kN/m²
Span Ratio	ℓ_y/ℓ_x	=	4.95 / 3.25	
		=	1.52	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.090	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 35.81 \times 3.25^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.090 \times 35.81 \times 3.25^2$
		=	34.050 kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 35.81 \times 3.25^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 35.81 \times 3.25^2$
		=	21.183 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	10Ø @ 435mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 135mm c/c	-	10 dia @ 100 mm c/c
Required in Longer Span			
Support	10Ø @ 435mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 230mm c/c	-	10 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 3.250 x 35.81
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.45 x 3.250 x 35.81 = 52.698kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 3.250 x 35.81 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 3.250 x 35.81 = 38.409kN
S.F for continuous edge in short direction	Vu	=	52.698 kN
Design Shear stress τv	Vu/bd	=	52698 / (1000 x 150)
		=	0.351 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.52
IS:456 Table 19			
Allowable shear stress	τc	=	0.50 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.25
Design shear stress for concrete	k x τc	=	1.25 x 0.498
		=	0.623 N/mm²

Actual Shear Stress < Design Shear Stress 0.351 < 0.623 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.524	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.262	
Modification factor for Tension reinf.	F1	=	1.35	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.35 x 1.00	
		=	**35.08**	
Actual span/depth ratio		=	3250 / 150	
		=	**21.67**	

Actual span/depth ratio < Modified span/depth ratio 21.67 < 35.08 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.393**	**%**
Min Ast		=	**687.223**	**mm2**
Length to be provided		=	**650**	**x-direc**
			990	**y-direc**

DESIGN OF ONE WAY SLAB S10 UPPER BASEM Simply Supported

Data:

Concrete	M25	fck	=	25	N/mm²	
Steel	Fe500	fy	=	500	N/mm²	
Span of the slab		ℓ	=	2.50	m	
Assuming Depth of Slab		D	=	175	mm	
Assuming Dia of reinforcement			=	10	mm	
Clear cover			=	20	mm	
Effective Depth of Slab			=	150	mm	
Effective Span of slab		ℓ_x	=	2.65	m	

Load Calculations:

Self weight of slab		=	4.38	kN/m²	
Finishing load		=	1.50	kN/m²	
Pipe load		=	0.00	kN/m²	
Live load		=	10.00	kN/m²	
Filling load		=	8.00	kN/m²	
Total load		=	23.88	kN/m²	
Load Factor		=	1.50		
Factored Load		=	35.81	kN/m²	

Bending Moment & Reinforcement Calculation:

Span Moment

Maximum Negative moment	Msup.	=	Wlx²/8		
		=	35.81 x 2.65² / 8		
		=	31.44	kN.m	
	Msup./bd^2	=	31436660 / (1000 x 150²)		
		=	1.40		
Percentage of reinforcement required	pt	=	0.34		**ok**
Required spacing of 10mm dia bars		=	152	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.52	%	
	n				

Support Moment

Maximum Positive moment	Mspan	=	Wlx²/10		
		=	35.81 x 2.65² / 10		
		=	25.15	kN.m	
	Mspan/bd^2	=	25149328 / (1000 x 150²)		
		=	1.12		
Percentage of reinforcement required	pt	=	0.27	%	**ok**
Required spacing of 10mm dia bars		=	193	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.52		

Distribution Reinforcement:

Minimum distribution reinforcement percentage for slab		=	0.12		
Diameter of bar		=	10	mm	
Required spacing of 10mm dia bars		=	374	mm	
Provided spacing of 10mm dia bars		=	200	mm	**ok**
Check for Shear:					
Maximum Shear Force at support	Vu	=	$W\ell_x/2$		
		=	35.813 x 2.65/2		
		=	47.45	kN	
Actual Shear Stress	τv	=	Vu/bd		
		=	47452 / (1000 x 150)		
		=	0.32	N/mm²	
% of tension reinforcement provided in support	pt	=	0.52		
IS:456 - 2000 Table 19					
Allowable shear stress	τc	=	0.50	N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		=	1.25		
Design shear stress for concrete	k x τc	=	1.25 x 0.498		
		=	0.62	N/mm²	
Actual Shear Stress < Design Shear Stress		0.316 < 0.623			**SAFE**
Check for Deflection:					
Allowable span / depth Ratio	l/d	=	26		
% of Tension reinforcement	pt	=	0.52		
Steel stress of service loads	fs	=	0.58 fy (Ast reqd./ Ast prov.)		
		=	191.08	N/mm²	
Corresponding Compression reinf.	Bar dia	=	12	mm	
	spacing	=	200	mm	
% of Compression reinforcement	pc	=	0.38		
Modification factor for Tension reinf.	F1	=	1.505	(Fig 4 in IS 456 - 2000)	
Modification factor for Comp. reinf.	F2	=	1.00	(Fig 5 in IS 456 - 2000)	
Modified span/depth ratio		=	l/d x F1 x F2		
		=	26 x 1.50 x 1.00		
		=	**39.12**		
Actual span/depth ratio		=	2650/150		
		=	**17.67**		
Actual span/depth ratio < Modified span/depth ratio		17.67 < 39.12			**SAFE**
Check for Punching Shear (Fire vehicle wheel load)					
Maximum Force on single wheel for fire vehicle (As per IRC)		=	80	KN	
Critical Wheel base size (As per IRC)		=	0.19	0.51 M	
Punching shear stress		=	0.400	N/mm²	
Allowable shear stress		=	1.091	N/mm²	
		=	**OK**		

DESIGN OF TWO WAY SLAB S5 UPPER BASEMENT

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	3.20	m
Longer Span		Ly	=	5.80	m
Assuming Depth of Slab		D	=	150	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	125	mm
Eff.Shorter Span		l_x	=	3.33	m
Eff. Longer Span		l_y	=	5.93	m

Load Calculations:

Self weight of slab	=	3.75	kN/m²
Finishing load	=	1.50	kN/m²
Pipe load	=	0.00	kN/m²
Live load	=	10.00	kN/m²
Fillingt load	=	0.00	kN/m²
Total load	=	15.25	kN/m²
Load Factor	=	1.50	
Factored Load	=	22.88	kN/m²
Span Ratio	ℓ_y/ℓ_x	=	5.93 / 3.33	
		=	1.78	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.101	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.33^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.101 \times 22.88 \times 3.33^2$
		=	25.516 kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.33^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 22.88 \times 3.33^2$
		=	14.162 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	10Ø @ 375mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 150mm c/c	-	10 dia @ 100 mm c/c
Required in Longer Span			
Support	10Ø @ 375mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 285mm c/c	-	10 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 3.325 x 22.88
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.48 x 3.325 x 22.88 = 36.703kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 3.325 x 22.88 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 3.325 x 22.88 = 25.100kN
S.F for continuous edge in short direction	Vu	=	36.703 kN
Design Shear stress τv	Vu/bd	=	36703 / (1000 x 125)
		=	0.294 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.63
IS:456 Table 19			
Allowable shear stress	τc	=	0.54 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30
Design shear stress for concrete	k x τc	=	1.30 x 0.536
		=	0.697 N/mm²

Actual Shear Stress < Design Shear Stress 0.294 < 0.697 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.628	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.314	
Modification factor for Tension reinf.	F1	=	1.39	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.39 x 1.00	
		=	**36.04**	
Actual span/depth ratio		=	3325 / 125	
		=	**26.60**	

Actual span/depth ratio < Modified span/depth ratio 26.60 < 36.04 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.471 %**	
Min Ast		=	**706.858 mm2**	
Length to be provided		=	**665**	**x-direc**
			1185	**y-direc**

DESIGN OF TWO WAY SLAB S4 UPPER BASEMENT

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	3.70	m
Longer Span		Ly	=	4.60	m
Assuming Depth of Slab		D	=	150	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	125	mm
Eff.Shorter Span		l_x	=	3.83	m
Eff. Longer Span		l_y	=	4.73	m

Load Calculations:

Self weight of slab	=	3.75	kN/m²	
Finishing load	=	1.50	kN/m²	
Pipe load	=	0.00	kN/m²	
Live load	=	10.00	kN/m²	
Fillingt load	=	0.00	kN/m²	
Total load	=	15.25	kN/m²	
Load Factor	=	1.50		
Factored Load	=	22.88	kN/m²	
Span Ratio	ℓ_y/ℓ_x	=	4.73 / 3.83	
		=	1.24	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.074	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.83^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.074 \times 22.88 \times 3.83^2$
		=	24.923 kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 22.88 \times 3.83^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 22.88 \times 3.83^2$
		=	18.742 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	10Ø @ 375mm c/c	-	10 dia @ 125 mm c/c
Mid span	10Ø @ 155mm c/c	-	10 dia @ 125 mm c/c
Required in Longer Span			
Support	10Ø @ 375mm c/c	-	10 dia @ 175 mm c/c
Mid span	10Ø @ 210mm c/c	-	10 dia @ 175 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 3.825 x 22.88
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.40 x 3.825 x 22.88 = 34.741kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 3.825 x 22.88 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 3.825 x 22.88 = 28.874kN
S.F for continuous edge in short direction	Vu	=	34.741 kN
Design Shear stress τv	Vu/bd	=	34741 / (1000 x 125)
		=	0.278 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 125 mm c/c
% of reinforcement provided	pt	=	0.50
IS:456 Table 19			
Allowable shear stress	τc	=	0.49 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30
Design shear stress for concrete	k x τc	=	1.30 x 0.490
		=	0.637 N/mm²

Actual Shear Stress < Design Shear Stress 0.278 < 0.637 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.503	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.314	
Modification factor for Tension reinf.	F1	=	1.26	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.26 x 1.00	
		=	**32.85**	
Actual span/depth ratio		=	3825 / 125	
		=	**30.60**	

Actual span/depth ratio < Modified span/depth ratio 30.60 < 32.85 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.377**	**%**
Min Ast		=	**565.487**	**mm2**
Length to be provided		=	**765**	**x-direc**
			945	**y-direc**

DESIGN OF TWO WAY SLAB S12

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	7.40	m
Longer Span		Ly	=	8.60	m
Assuming Depth of Slab		D	=	225	mm
Assuming Dia of reinf.			=	12	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	199	mm
Eff.Shorter Span		l_x	=	7.60	m
Eff. Longer Span		l_y	=	8.80	m

Load Calculations:

Self weight of slab	=	5.63	kN/m²	
Finishing load	=	1.50	kN/m²	
Pipe load	=	0.00	kN/m²	
Live load	=	2.00	kN/m²	
Fillingt load	=	0.00	kN/m²	
Total load	=	9.13	kN/m²	
Load Factor	=	1.50		
Factored Load	=	13.69	kN/m²	
Span Ratio	ℓ_y/ℓ_x	=	8.80 / 7.60	
		=	1.16	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.069	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 13.69 \times 7.60^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.069 \times 13.69 \times 7.60^2$
		=	54.246 kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 13.69 \times 7.60^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 13.69 \times 7.60^2$
		=	44.261 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	12Ø @ 450mm c/c	-	12 dia @ 100 mm c/c
Mid span	12Ø @ 165mm c/c	-	12 dia @ 100 mm c/c
Required in Longer Span			
Support	12Ø @ 450mm c/c	-	12 dia @ 100 mm c/c
Mid span	12Ø @ 205mm c/c	-	12 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 7.599 x 13.69
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.38 x 7.599 x 13.69 = 39.251kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 7.599 x 13.69 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 7.599 x 13.69 = 34.324kN
S.F for continuous edge in short direction	Vu	=	39.251 kN
Design Shear stress τv	Vu/bd	=	39251 / (1000 x 199)
		=	0.197 N/mm²
Reinforcement provided in the slab is		-	12Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.57
IS:456 Table 19			
Allowable shear stress	τc	=	0.51 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.15
Design shear stress for concrete	k x τc	=	1.15 x 0.515
		=	0.592 N/mm²

Actual Shear Stress < Design Shear Stress 0.197 < 0.592 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.568	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.197	
Modification factor for Tension reinf.	F1	=	1.57	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.57 x 1.00	
		=	**40.78**	
Actual span/depth ratio		=	7599 / 199	
		=	**38.19**	

Actual span/depth ratio < Modified span/depth ratio 38.19 < 40.78 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.426**	**%**
Min Ast		=	**959.054**	**mm2**
Length to be provided		=	**1519.8**	**x-direc**
			1759.8	**y-direc**

DESIGN OF ONE WAY SLAB S10 STILT ROOF Simply Supported

Data:

Concrete	M25	fck	=	25	N/mm²	
Steel	Fe500	fy	=	500	N/mm²	
Span of the slab		ℓ	=	3.75	m	
Assuming Depth of Slab		D	=	150	mm	
Assuming Dia of reinforcement			=	10	mm	
Clear cover			=	20	mm	
Effective Depth of Slab			=	125	mm	
Effective Span of slab		ℓ_x	=	3.88	m	

Load Calculations:

Self weight of slab		=	3.75	kN/m²	
Finishing load		=	1.50	kN/m²	
Pipe load		=	0.00	kN/m²	
Live load		=	2.00	kN/m²	
Filling load		=	2.00	kN/m²	
Total load		=	9.25	kN/m²	
Load Factor		=	1.50		
Factored Load		=	13.88	kN/m²	

Bending Moment & Reinforcement Calculation:

Span Moment

Maximum Negative moment	Msup.	=	Wlx²/8		
		=	13.88 x 3.88² / 8		
		=	26.04	kN.m	
	Msup./bd²	=	26042725 / (1000 x 125²)		
		=	1.67		
Percentage of reinforcement required	pt	=	0.42		**ok**
Required spacing of 10mm dia bars		=	150	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.63	%	
	n				

Support Moment

Maximum Positive moment	Mspan	=	Wlx²/10		
		=	13.88 x 3.88² / 10		
		=	20.83	kN.m	
	Mspan/bd²	=	20834180 / (1000 x 125²)		
		=	1.33		
Percentage of reinforcement required	pt	=	0.33	%	**ok**
Required spacing of 10mm dia bars		=	192	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.63		

Distribution Reinforcement:

Minimum distribution reinforcement percentage for slab		=	0.12		
Diameter of bar		=	12	mm	
Required spacing of 12mm dia bars		=	628	mm	
Provided spacing of 12mm dia bars		=	200	mm	**ok**
Check for Shear:					
Maximum Shear Force at support	Vu	=	$W\ell_x/2$		
		=	13.875 x 3.88/2		
		=	26.88	kN	
Actual Shear Stress	τv	=	Vu/bd		
		=	26883 / (1000 x 125)		
		=	0.22	N/mm²	
% of tension reinforcement provided in support	pt	=	0.63		
IS:456 - 2000 Table 19					
Allowable shear stress	τc	=	0.54	N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		=	1.30		
Design shear stress for concrete	k x τc	=	1.30 x 0.536		
		=	0.70	N/mm²	
Actual Shear Stress < Design Shear Stress		0.215 < 0.697			**SAFE**
Check for Deflection:					
Allowable span / depth Ratio	l/d	=	26		
% of Tension reinforcement	pt	=	0.63		
Steel stress of service loads	fs	=	0.58 fy (Ast reqd./ Ast prov.)		
		=	192.98	N/mm²	
Corresponding Compression reinf.	Bar dia	=	12	mm	
	spacing	=	200	mm	
% of Compression reinforcement	pc	=	0.45		
Modification factor for Tension reinf.	F1	=	1.388	(Fig 4 in IS 456 - 2000)	
Modification factor for Comp. reinf.	F2	=	1.00	(Fig 5 in IS 456 - 2000)	
Modified span/depth ratio		=	l/d x F1 x F2		
		=	26 x 1.39 x 1.00		
		=	**36.10**		
Actual span/depth ratio		=	3875/125		
		=	**31.00**		
Actual span/depth ratio < Modified span/depth ratio		31.00 < 36.10			**SAFE**
Check for Punching Shear (Fire vehicle wheel load)					
Maximum Force on single wheel for fire vehicle (As per IRC)		=	80	KN	
Critical Wheel base size (As per IRC)		=	0.19	0.51 M	
Punching shear stress		=	0.505	N/mm²	
Allowable shear stress		=	1.091	N/mm²	
		=	**OK**		

DESIGN OF TWO WAY SLAB S7 STILT ROOF

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	4.90	m
Longer Span		Ly	=	9.30	m
Assuming Depth of Slab		D	=	175	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	150	mm
Eff.Shorter Span		l_x	=	5.05	m
Eff. Longer Span		l_y	=	9.45	m

Load Calculations:

Self weight of slab		=	4.38	kN/m²
Finishing load		=	1.50	kN/m²
Pipe load		=	0.00	kN/m²
Live load		=	2.00	kN/m²
Fillingt load		=	0.00	kN/m²
Total load		=	7.88	kN/m²
Load Factor		=	1.50	
Factored Load		=	11.81	kN/m²
Span Ratio	ℓ_y/ℓ_x	=	9.45 / 5.05	
		=	1.87	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.103	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$	
		=	$0.000 \times 11.81 \times 5.05^2$	
		=	0.000	kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$	
		=	$0.103 \times 11.81 \times 5.05^2$	
		=	31.148	kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$	
		=	$0.000 \times 11.81 \times 5.05^2$	
		=	0.000	kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$	
		=	$0.056 \times 11.81 \times 5.05^2$	
		=	16.870	kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	10Ø @ 435mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 150mm c/c	-	10 dia @ 100 mm c/c
Required in Longer Span			
Support	10Ø @ 435mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 290mm c/c	-	10 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 5.050 x 11.81
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.49 x 5.050 x 11.81 = 29.212kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 5.050 x 11.81 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 5.050 x 11.81 = 19.686kN
S.F for continuous edge in short direction	Vu	=	29.212 kN
Design Shear stress τv	Vu/bd	=	29212 / (1000 x 150)
		=	0.195 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.52
IS:456 Table 19			
Allowable shear stress	τc	=	0.50 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.25
Design shear stress for concrete	k x τc	=	1.25 x 0.498
		=	0.623 N/mm²

Actual Shear Stress < Design Shear Stress 0.195 < 0.623 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.524	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.262	
Modification factor for Tension reinf.	F1	=	1.49	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.49 x 1.00	
		=	**38.70**	
Actual span/depth ratio		=	5050 / 150	
		=	**33.67**	

Actual span/depth ratio < Modified span/depth ratio 33.67 < 38.70 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.393**	**%**
Min Ast		=	**687.223**	**mm2**
Length to be provided		=	**1010**	**x-direc**
			1890	**y-direc**

DESIGN OF TWO WAY SLAB S4 STILT ROOF

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	4.00	m
Longer Span		Ly	=	4.80	m
Assuming Depth of Slab		D	=	125	mm
Assuming Dia of reinf.			=	8	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	101	mm
Eff.Shorter Span		l_x	=	4.10	m
Eff. Longer Span		l_y	=	4.90	m

Load Calculations:

Self weight of slab			=	3.13	kN/m²
Finishing load			=	1.50	kN/m²
Pipe load			=	0.00	kN/m²
Live load			=	2.00	kN/m²
Fillingt load			=	0.00	kN/m²
Total load			=	6.63	kN/m²
Load Factor			=	1.50	
Factored Load			=	9.94	kN/m²
Span Ratio		ℓ_y/ℓ_x	=	4.90 / 4.10	
			=	1.20	

Bending Moment Calculation:

Support Condition	**9**	Four Edges Discontinuous		
From IS 456-2000 Table 26		α_{Nx}	=	0.000
		α_{Px}	=	0.072
		α_{Ny}	=	0.000
		α_{Py}	=	0.056

<u>Shorter Span:</u>

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 9.94 \times 4.10^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.072 \times 9.94 \times 4.10^2$
		=	11.968 kN.m

<u>Longer Span :</u>

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 9.94 \times 4.10^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 9.94 \times 4.10^2$
		=	9.359 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	8Ø @ 300mm c/c	-	8 dia @ 100 mm c/c
Mid span	8Ø @ 170mm c/c	-	8 dia @ 100 mm c/c
Required in Longer Span			
Support	8Ø @ 300mm c/c	-	8 dia @ 150 mm c/c
Mid span	8Ø @ 225mm c/c	-	8 dia @ 150 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$	
Maximum Shear Force	Vu	=	0.00 x 4.101 x 9.94	
		=	0.000 kN	
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$	
		=	0.39 x 4.101 x 9.94 =	15.834kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$	
		=	0.00 x 4.101 x 9.94 =	0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$	
		=	0.33 x 4.101 x 9.94 =	13.449kN
S.F for continuous edge in short direction	Vu	=	15.834 kN	
Design Shear stress τv	Vu/bd	=	15834 / (1000 x 101)	
		=	0.157 N/mm²	
Reinforcement provided in the slab is		-	8Ø @ 100 mm c/c	
% of reinforcement provided	pt	=	0.50	
IS:456 Table 19				
Allowable shear stress	τc	=	0.49 N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30	
Design shear stress for concrete	k x τc	=	1.30 x 0.488	
		=	0.634 N/mm²	
Actual Shear Stress < Design Shear Stress		0.157 < 0.634		**SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.498	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.389	
Modification factor for Tension reinf.	F1	=	1.71	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.71 x 1.00	
		=	**44.45**	
Actual span/depth ratio		=	4101 / 101	
		=	**40.60**	
Actual span/depth ratio < Modified span/depth ratio		40.60 < 44.45		**SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.373 %**	
Min Ast		=	**466.573 mm2**	
Length to be provided		=	**820.2**	**x-direc**
			980.2	**y-direc**

DESIGN OF TWO WAY SLAB S12

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	7.40	m
Longer Span		Ly	=	8.60	m
Assuming Depth of Slab		D	=	225	mm
Assuming Dia of reinf.			=	12	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	199	mm
Eff.Shorter Span		l_x	=	7.60	m
Eff. Longer Span		l_y	=	8.80	m

Load Calculations:

Self weight of slab	=	5.63	kN/m²	
Finishing load	=	1.50	kN/m²	
Pipe load	=	0.00	kN/m²	
Live load	=	2.00	kN/m²	
Fillingt load	=	0.00	kN/m²	
Total load	=	9.13	kN/m²	
Load Factor	=	1.50		
Factored Load	=	13.69	kN/m²	
Span Ratio	ℓ_y/ℓ_x	=	8.80 / 7.60	
		=	1.16	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.069	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$
		=	$0.000 \times 13.69 \times 7.60^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$
		=	$0.069 \times 13.69 \times 7.60^2$
		=	54.246 kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$
		=	$0.000 \times 13.69 \times 7.60^2$
		=	0.000 kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
		=	$0.056 \times 13.69 \times 7.60^2$
		=	44.261 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	12Ø @ 450mm c/c	-	12 dia @ 100 mm c/c
Mid span	12Ø @ 165mm c/c	-	12 dia @ 100 mm c/c
Required in Longer Span			
Support	12Ø @ 450mm c/c	-	12 dia @ 100 mm c/c
Mid span	12Ø @ 205mm c/c	-	12 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 7.599 x 13.69
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.38 x 7.599 x 13.69 = 39.251kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 7.599 x 13.69 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 7.599 x 13.69 = 34.324kN
S.F for continuous edge in short direction	Vu	=	39.251 kN
Design Shear stress τv	Vu/bd	=	39251 / (1000 x 199)
		=	0.197 N/mm²
Reinforcement provided in the slab is		-	12Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.57
IS:456 Table 19			
Allowable shear stress	τc	=	0.51 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.15
Design shear stress for concrete	k x τc	=	1.15 x 0.515
		=	0.592 N/mm²

Actual Shear Stress < Design Shear Stress 0.197 < 0.592 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.568	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.197	
Modification factor for Tension reinf.	F1	=	1.57	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.57 x 1.00	
		=	**40.78**	
Actual span/depth ratio		=	7599 / 199	
		=	**38.19**	

Actual span/depth ratio < Modified span/depth ratio 38.19 < 40.78 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.426**	**%**
Min Ast		=	**959.054**	**mm2**
Length to be provided		=	**1519.8**	**x-direc**
			1759.8	**y-direc**

DESIGN OF ONE WAY SLAB S10 TYPICAL FLOC Simply Supported

Data:

Concrete	M25	fck	=	25	N/mm²
Steel	Fe500	fy	=	500	N/mm²
Span of the slab		ℓ	=	3.75	m
Assuming Depth of Slab		D	=	150	mm
Assuming Dia of reinforcement			=	10	mm
Clear cover			=	20	mm
Effective Depth of Slab			=	125	mm
Effective Span of slab		ℓ_x	=	3.88	m

Load Calculations:

Self weight of slab		=	3.75	kN/m²
Finishing load		=	1.50	kN/m²
Pipe load		=	0.00	kN/m²
Live load		=	2.00	kN/m²
Filling load		=	2.00	kN/m²
Total load		=	9.25	kN/m²
Load Factor		=	1.50	
Factored Load		=	13.88	kN/m²

Bending Moment & Reinforcement Calculation:

Span Moment

Maximum Negative moment	Msup.	=	Wlx²/8		
		=	13.88 x 3.88² / 8		
		=	26.04	kN.m	
	Msup./bd²	=	26042725 / (1000 x 125²)		
		=	1.67		
Percentage of reinforcement required	pt	=	0.42		**ok**
Required spacing of 10mm dia bars		=	150	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.63	%	
	n				

Support Moment

Maximum Positive moment	Mspan	=	Wlx²/10		
		=	13.88 x 3.88² / 10		
		=	20.83	kN.m	
	Mspan/bd²	=	20834180 / (1000 x 125²)		
		=	1.33		
Percentage of reinforcement required	pt	=	0.33	%	**ok**
Required spacing of 10mm dia bars		=	192	mm	
Provided spacing of 10mm dia bars		=	100	mm	**ok**
% of reinf. Provided	p_{tp}	=	0.63		

Distribution Reinforcement:

Minimum distribution reinforcement percentage for slab		=	0.12		
Diameter of bar		=	12	mm	
Required spacing of 12mm dia bars		=	628	mm	
Provided spacing of 12mm dia bars		=	200	mm	**ok**
Check for Shear:					
Maximum Shear Force at support	Vu	=	$W\ell_x/2$		
		=	13.875 x 3.88/2		
		=	26.88	kN	
Actual Shear Stress	τv	=	Vu/bd		
		=	26883 / (1000 x 125)		
		=	0.22	N/mm²	
% of tension reinforcement provided in support	pt	=	0.63		
IS:456 - 2000 Table 19					
Allowable shear stress	τc	=	0.54	N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		=	1.30		
Design shear stress for concrete	k x τc	=	1.30 x 0.536		
		=	0.70	N/mm²	
Actual Shear Stress < Design Shear Stress		0.215 < 0.697			**SAFE**
Check for Deflection:					
Allowable span / depth Ratio	l/d	=	26		
% of Tension reinforcement	pt	=	0.63		
Steel stress of service loads	fs	=	0.58 fy (Ast reqd./ Ast prov.)		
		=	192.98	N/mm²	
Corresponding Compression reinf.	Bar dia	=	12	mm	
	spacing	=	200	mm	
% of Compression reinforcement	pc	=	0.45		
Modification factor for Tension reinf.	F1	=	1.388	(Fig 4 in IS 456 - 2000)	
Modification factor for Comp. reinf.	F2	=	1.00	(Fig 5 in IS 456 - 2000)	
Modified span/depth ratio		=	l/d x F1 x F2		
		=	26 x 1.39 x 1.00		
		=	**36.10**		
Actual span/depth ratio		=	3875/125		
		=	**31.00**		
Actual span/depth ratio < Modified span/depth ratio		31.00 < 36.10			**SAFE**
Check for Punching Shear (Fire vehicle wheel load)					
Maximum Force on single wheel for fire vehicle (As per IRC)		=	80	KN	
Critical Wheel base size (As per IRC)		=	0.19	0.51 M	
Punching shear stress		=	0.505	N/mm²	
Allowable shear stress		=	1.091	N/mm²	
		=	**OK**		

DESIGN OF TWO WAY SLAB S12 TYPICAL FLOOR

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	4.90	m
Longer Span		Ly	=	9.30	m
Assuming Depth of Slab		D	=	175	mm
Assuming Dia of reinf.			=	10	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	150	mm
Eff.Shorter Span		l_x	=	5.05	m
Eff. Longer Span		l_y	=	9.45	m

Load Calculations:

Self weight of slab	=	4.38	kN/m²
Finishing load	=	1.50	kN/m²
Pipe load	=	0.00	kN/m²
Live load	=	2.00	kN/m²
Fillingt load	=	0.00	kN/m²
Total load	=	7.88	kN/m²
Load Factor	=	1.50	
Factored Load	=	11.81	kN/m²
Span Ratio	ℓ_y/ℓ_x	=	9.45 / 5.05	
		=	1.87	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx} = 0.000

α_{Px} = 0.103

α_{Ny} = 0.000

α_{Py} = 0.056

Shorter Span:

Negative Moment (Support) $M_{Nx} = \alpha_{Nx} \times w_u \times l_x^2$

$= 0.000 \times 11.81 \times 5.05^2$

$= 0.000$ kN.m

Positive Moment (Mid span) $M_{Px} = \alpha_{Px} \times w_u \times l_x^2$

$= 0.103 \times 11.81 \times 5.05^2$

$= 31.148$ kN.m

Longer Span :

Negative Moment (Support) $M_{Ny} = \alpha_{Ny} \times w_u \times l_x^2$

$= 0.000 \times 11.81 \times 5.05^2$

$= 0.000$ kN.m

Positive Moment (Mid span) $M_{Py} = \alpha_{Py} \times w_u \times l_x^2$

$= 0.056 \times 11.81 \times 5.05^2$

$= 16.870$ kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	10Ø @ 435mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 150mm c/c	-	10 dia @ 100 mm c/c
Required in Longer Span			
Support	10Ø @ 435mm c/c	-	10 dia @ 100 mm c/c
Mid span	10Ø @ 290mm c/c	-	10 dia @ 100 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.00 x 5.050 x 11.81
		=	0.000 kN
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$
		=	0.49 x 5.050 x 11.81 = 29.212kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$
		=	0.00 x 5.050 x 11.81 = 0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$
		=	0.33 x 5.050 x 11.81 = 19.686kN
S.F for continuous edge in short direction	Vu	=	29.212 kN
Design Shear stress τv	Vu/bd	=	29212 / (1000 x 150)
		=	0.195 N/mm²
Reinforcement provided in the slab is		-	10Ø @ 100 mm c/c
% of reinforcement provided	pt	=	0.52
IS:456 Table 19			
Allowable shear stress	τc	=	0.50 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.25
Design shear stress for concrete	k x τc	=	1.25 x 0.498
		=	0.623 N/mm²

Actual Shear Stress < Design Shear Stress 0.195 < 0.623 **SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.524	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.262	
Modification factor for Tension reinf.	F1	=	1.49	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.49 x 1.00	
		=	**38.70**	
Actual span/depth ratio		=	5050 / 150	
		=	**33.67**	

Actual span/depth ratio < Modified span/depth ratio 33.67 < 38.70 **SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.393**	**%**
Min Ast		=	**687.223**	**mm2**
Length to be provided		=	**1010**	**x-direc**
			1890	**y-direc**

DESIGN OF TWO WAY SLAB S4 TYPICAL FLOOR

Data:

Concrete	M30	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	4.00	m
Longer Span		Ly	=	4.80	m
Assuming Depth of Slab		D	=	125	mm
Assuming Dia of reinf.			=	8	mm
Clear Cover			=	20	mm
Eff. Depth of Slab		d	=	101	mm
Eff.Shorter Span		l_x	=	4.10	m
Eff. Longer Span		l_y	=	4.90	m

Load Calculations:

Self weight of slab		=	3.13	kN/m²
Finishing load		=	1.50	kN/m²
Pipe load		=	0.00	kN/m²
Live load		=	2.00	kN/m²
Fillingt load		=	0.00	kN/m²
Total load		=	6.63	kN/m²
Load Factor		=	1.50	
Factored Load		=	9.94	kN/m²
Span Ratio	ℓ_y/ℓ_x	=	4.90 / 4.10	
		=	1.20	

Bending Moment Calculation:

Support Condition **9** Four Edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.000	
α_{Px}	=	0.072	
α_{Ny}	=	0.000	
α_{Py}	=	0.056	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$	
		=	$0.000 \times 9.94 \times 4.10^2$	
		=	0.000	kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$	
		=	$0.072 \times 9.94 \times 4.10^2$	
		=	11.968	kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$	
		=	$0.000 \times 9.94 \times 4.10^2$	
		=	0.000	kN.m
Positive Moment (Mid span)	M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$	
		=	$0.056 \times 9.94 \times 4.10^2$	
		=	9.359	kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	8Ø @ 300mm c/c	-	8 dia @ 100 mm c/c
Mid span	8Ø @ 170mm c/c	-	8 dia @ 100 mm c/c
Required in Longer Span			
Support	8Ø @ 300mm c/c	-	8 dia @ 150 mm c/c
Mid span	8Ø @ 225mm c/c	-	8 dia @ 150 mm c/c

Check for Shear:

As per IS Shear coefficients

Max Shear coeff. for continuous edge in short direction γcx = 0.00

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$	
Maximum Shear Force	Vu	=	0.00 x 4.101 x 9.94	
		=	0.000 kN	
S.F for discontinuous edge in short direction		Vdcx =	$\gamma dcx * \ell x * W$	
		=	0.39 x 4.101 x 9.94 =	15.834kN
S.F for continuous edge in long direction		Vcy =	$\gamma cy * \ell x * W$	
		=	0.00 x 4.101 x 9.94 =	0.000kN
S.F for discontinuous edge in long direction		Vdcy =	$\gamma dcy * \ell x * W$	
		=	0.33 x 4.101 x 9.94 =	13.449kN
S.F for continuous edge in short direction	Vu	=	15.834 kN	
Design Shear stress τv	Vu/bd	=	15834 / (1000 x 101)	
		=	0.157 N/mm²	
Reinforcement provided in the slab is		-	8Ø @ 100 mm c/c	
% of reinforcement provided	pt	=	0.50	
IS:456 Table 19				
Allowable shear stress	τc	=	0.49 N/mm²	
As per IS:456 cl. 40.2.1.1 k value for slab		-	1.30	
Design shear stress for concrete	k x τc	=	1.30 x 0.488	
		=	0.634 N/mm²	
Actual Shear Stress < Design Shear Stress		0.157 < 0.634		**SAFE**

CHECK FOR DEFLECTION

Allowable span / depth Ratio	l/d	=	26	
% of Tension reinforcement	pt	=	0.498	
Corresponding Compression reinf.	Bar dia	=	10	mm
	spacing	=	200	mm
% of Compression reinforcement	pc	=	0.389	
Modification factor for Tension reinf.	F1	=	1.71	(From Fig 4 in IS 456 - 2000)
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)
Modified span/depth ratio		=	l/d x F1 x F2	
		=	26 x 1.71 x 1.00	
		=	**44.45**	
Actual span/depth ratio		=	4101 / 101	
		=	**40.60**	
Actual span/depth ratio < Modified span/depth ratio		40.60 < 44.45		**SAFE**

TORSIONAL REINFORCEMENT provided at discontinuous edge

Min pt	0.75*pt	=	**0.373 %**	
Min Ast		=	**466.573 mm2**	
Length to be provided		=	**820.2**	**x-direc**
			980.2	**y-direc**



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Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

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We're honored to be part of your real estate journey

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