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# SHYAMALA ASSOCIATES

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Date : 16.2.2025

## STRUCTURAL DESIGN AND STABILITY CERTIFICATE

Structural Design & Stability of the proposed Residential Building of Stilt + Five Floors at Door No. Old No.4,5,6,&8, Block No.64, Plot No. New Door No.11,13,15,21 & 23, Chengalaneer Pillayar Koil Street, Mylapore, Chennai-600004.

This is to certify that the proposed Residential Building consisting of Stilt + Five floors only. This proposed building the required details like soil report and other particulars have been collected.

The proposed building which have been designed as a RCC structure to withstand the Dead Load, Imposed Load and Wind Load / Earthquake loads ensuring Structural Safety and service ability as per the norms and guidelines prescribed in the following codes of Bureau of Indian Standards.

1. IS: 456-2000 Code of Practice for Plain and Reinforced concrete.
2. IS: 875-1987 Code of Practice for Design loads for Buildings and Structures.
3. IS: 1893-2002 Criteria for Earthquake resistant design of Structures Part-1 general Provisions and Buildings.
4. IS: 4236-1993 Code of Practice for Earthquake resistant design & Construction of Buildings.
5. IS: 13920-1993 Code of Practice for Ductile detailing of concrete structures subjected to seismic forces and
6. National Building code of India – 2005.

It is further certified that the above structures will be constructed from foundation to roof as per structural designs and detailing of reinforcements furnished in our drawings.

Hence, I hereby certify that the Building will be structurally safe and sound for occupation.

Other Loading and Moments on Columns and Design particulars of Foundation, Column, Beam and slab are enclosed.

18/2/25

Signature of the Structural Engineer & Chartered Engineer

Dr. L.RAMAJEYAM
M.E., Ph.D, F.I.E., F.I.V., C.Eng.(Ind),
Registered Structural Engineer & Chartered Engineer
CMDA - Reg. No. SE/GR-I/19/03/023 on 22.03.2019
GCC-Grade-I, Reg.No.RSE100372019 dated 30.09.2019
11, 8th Avenue, Ashok Nagar, Chennai-83.

# Design Data Report :

## Footing Data:

**Soil Parameters :**

| | |
|---|---|
| SBC of soil | = 150.00 kN/m² |
| SBC Increment Factor for Seismic Load | = 1.000 |
| SBC Increment Factor for Wind Load | = 1.000 |
| Angle of friction,(phi) | = 30.00 degrees |
| Cohesion | = 60.00 |
| Permissible factor of safty | = 2.000 |
| Depth From Ground | = 1500 mm |

**Material Properties :**

| | |
|---|---|
| fck | = 20.00 N/mm² |
| fy | = 500.00 N/mm² |

**Footing Parameters :**

| | |
|---|---|
| Minimum steel Percentage | = 0.12 |
| Minimum spacing between bars | = 100 mm |
| Maximum spacing between bars | = 200 mm |
| Diameters of selected bars | = 10 mm , 12 mm . |
| Bottom Cover | = 50 mm |
| End Cover | = 50 mm |
| Minimum Footing Depth | = 300 mm |
| Top Offset | = 50 mm |
| Bottom PCCOffset | = 150 mm |
| Bottom PCCDepth | = 150 mm |
| Pedestal Offset | = 150 mm |
| Pedestal Depth | = 150 mm |
| Size RoundingFactor | = 25 mm |
| Depth RoundingFactor | = 25 mm |

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## Column Data:

**Material Properties :**

| | |
|---|---|
| fck | = 20.00 N/mm² |
| fy | = 500.00 N/mm² |
| fy - Stirrups | = 500.00 N/mm² |

**Column Parameters :**

| | |
|---|---|
| Effective Length Factor (X - Axis) | = 1.00 |
| Effective Length Factor (Y - Axis) | = 1.00 |
| Minimum Eccentricity @ X-Axis | = 20 mm |
| Minimum Eccentricity @ Y-Axis | = 20 mm |
| Clear Cover | = 40 mm |

**Design Considerations :**

Design is done as per IS 456.
IS 13920 provisions are not considered for detailing.
Live Load reduction is not considered.
Minimum steel percentage is based on provided section.

**Reinforcement Details :**

| | |
|---|---|
| Steel Ratio(AstX/AstY) | = 1.00 |
| ReinForcement Placing (on two sides or on four sides) | = 2 |
| Minimum steel Percentage | = 0.80 |
| Maximum steel Percentage | = 4.00 |
| Minimum spacing between main bars | = 50 mm |
| Maximum spacing between main bars | = 300 mm |
| Minimum spacing between Stirrups | = 150 mm |
| Diameters of selected bars | = |

---

## Slab Data:

**Material Properties :**

| | |
|---|---|
| RCC Grade | = M20 |
| Main Steel Grade | = Fe500 |
| Distribution Steel Grade | = Fe500 |

**Slab Parameters :**

| | |
|---|---|
| Effective Cover | = 25 mm |
| Minimum spacing between Main bars | = 100 mm |
| Maximum spacing between Main bars | = 200 mm |
| Minimum spacing between Dist.bars | = 100 mm |
| Maximum spacing between Dist.bars | = 300 mm |
| Maximum Main/Dist. bar Diameter | = 32 mm |
| Minimum Main bar Diameter | = 8 mm |
| Minimum Dist.bar Diameter | = 8 mm |
| Maximum Dimension to be used for Trapizoidal Slab | = Average of two parellel sides |

Use Curtailed bars bars for steel detailing.

---

## Beam Data:

**Shear Design Data :**

| | |
|---|---|
| Minimun Stirrup Dia | = 8 mm |
| Stirrup Legs | = 2 |
| Minimum Stirrups Spacing | = 100 mm |
| Stirrups Steel Grade Name | = Fe415 |

Effect of Concrete in shear considered

**Beam Covers :**

| | |
|---|---|
| Tension Cover | = 33 mm |
| Compression Cover | = 33 mm |
| Side Cover | = 25 mm |

Beam sections are designed as Doubly Reinforced Section

Main Bars Detailing Straight + Curtailed

Detailing provision As per IS 13920 not followed

End Moments are calcultaed at c/c distance of the beam span for design

Torsion Moments are not considered in beam design

| | |
|---|---|
| Anchor bar Dia | = 12 mm |
| Main Steel Grade | = Fe500 |
| No. of division of the beam | = 10 |

16/2/25

Dr. L.RAMAJEYAM
M.E., Ph.D, F.I.E., F.I.V., C.Eng.(Ind),
Registered Structural Engineer & Chartered Engineer
CMDA - Reg. No. SE/GR-I/19/03/023 on 22.03.2019
GCC-Grade-I, Reg.No.RSE100372019 dated 30.09.2019
11, 8th Avenue, Ashok Nagar, Chennai-83.

$= 1.597\ m^2$

Modified area for $M_y$,$(A_{fy})$ $= (P_1/SBC) \times (1 + 6.e_y/L)$

$= (297.83/190.00) \times (1 + 6 \times 0.0017/1.288)$

$= 1.580\ m^2$

Size,(L x B) $= 1.300 \times 1.250$ m

Area provided ,$(A_p)$ $= 1.625\ m^2 > A_f$.

**SBC Check:**

Upward pressure due to axial load,$(P_{r1w})$ $= P1 / (L \times B) = 183.28\ kN/m^2$

Upward pressure due to $M_x$,$(P_{r2w})$ $= WM_x / (L \times B \times B/6) = 3.0975\ kN/m^2$

Upward pressure due to $M_y$,$(P_{r3w})$ $= WM_y / (B \times L \times L/6) = 1.3267\ kN/m^2$

Maximum upward pressure,$(Up_{Maxw})$ $= P_{r1w} + P_{r2w} + P_{r3w} = 187.71\ kN/m^2$

Minimum upward pressure,$(Up_{Minw})$ $= P_{r1w} - P_{r2w} - P_{r3w} = 178.86\ kN/m^2$

$Up_{Maxw}$(187.71 kN/m²) < SBC (190.00 kN/m²),Hence ,safe.

**Pressures for Different Load Combinations :**

| Load Combination | Design Pressures(kN/m²) | | Working Pressures(kN/m²) | |
|---|---|---|---|---|
| | Maximum | Minimum | Maximum | Minimum |
| 1.50 DL + 1.50 LL | 281.56 | 268.29 | 187.71 | 178.86 |

**Bending Moment Calculations :**

As per IS 456: 2000 Clause 34.2.3.2,critical section for checking bending moment in the design of an isolated concrete footing which supports a column shall be a section located at the face of the column or pedestal.

Upward pressure due to axial load,$(P_{r1})$ $= P_{u1} / (L \times B) = 274.92\ kN/m^2$

Upward pressure due to $M_x$,$(P_{r2})$ $= M_x / (L \times B \times B/6) = 4.6462\ kN/m^2$

Upward pressure due to $M_y$,$(P_{r3})$ $= M_y / (B \times L \times L/6) = 1.9901\ kN/m^2$

Maximum upward pressure,$(Up_{Max})$ $= P_{r1} + P_{r2} + P_{r3} = 281.56\ kN/m^2$

Minimum upward pressure,$(Up_{Min})$ $= P_{r1} - P_{r2} - P_{r3} = 268.29\ kN/m^2$

Projection-X,$(X_{proj})$ $= (L - l)/2$

$= (1.300 - 0.300)/2$

$= 0.500$ m

Critical upward pressure,$(Up_{Cr})$ $= Up_{Min} + (L - X_{proj}) \times ((Up_{Max} - Up_{Min})/L)$

$= 268.29 + (1.300 - 0.500) \times ((281.56 - 268.29)/1.300)$

$= 276.45\ kN/m^2$

Upward pressure area,$(Up_{PrArea})$ $= X_{proj} \times (Up_{Cr} + Up_{Max})/2$

$= 0.500 \times (276.45 + 281.56)/2$

$= 139.50$ kN/m

CG distance from column face,$(CG_{Dist})$ $= X_{proj} \times (Up_{Cr} + (2 \times Up_{Max})) / (3 \times (Up_{Cr} + Up_{Max}))$

$= 0.500 \times (276.45 + 2 \times 281.56) / (3 \times (276.45 + 281.56))$

$= 0.251$ m

Design BMx,$(M_{ux})$ $= Up_{PrArea} \times CG_{Dist} \times B$

$= 139.50 \times 0.251 \times 1.250$

$= 43.73$ kN-m

Projection-Y,$(Y_{proj})$ $= (B - b)/2$

$= (1.250 - 0.230)/2$

$= 0.510$ m

Critical upward pressure,$(Up_{Cr})$ $= Up_{Min} + (B - Y_{proj}) \times ((Up_{Max} - Up_{Min})/B)$

$= 268.29 + (1.250 - 0.510) \times ((281.56 - 268.29)/1.250)$

$= 276.14\ kN/m^2$

Upward pressure area,$(Up_{PrArea})$ $= Y_{proj} \times (Up_{Cr} + Up_{Max})/2$

$= 0.510 \times (276.14 + 281.56)/2$

$= 142.21$ kN/m

CG distance from column face,$(CG_{Dist}) = Y_{proj} \times (Up_{Cr} + (2 \times Up_{Max}))$
$/(3 \times (Up_{Cr} + Up_{Max}))$
$= 0.510 \times (276.14 + 2 \times 281.56) / (3 \times (276.14 + 281.56))$
$= 0.256$ m

Design BMy,$(M_{uy})$ $= Up_{PrArea} \times CG_{Dist} \times L$
$= 142.21 \times 0.256 \times 1.300$
$= 47.30$ kN-m

**Depth Calculations :**

Depth required for punching shear :
As per IS 456:2000 Clause 31.6.3.1,the calculated shear stress at the critical section shall not exceed $k_s \times \tau_{auc}$

where,
$k_s = 0.5 + \beta_{ac}$, but not greater than 1,$\beta_{ac}$ being the ratio of short side to the long side of column, and
$\tau_{auc} = 0.25 \times \sqrt{(f_{ck})}$ in limit state method of design.

Depth required for punching shear is calculated by equating the actual stress to permissible stress and by solving the resulting quadratic equation.

Total depth assumed,(D) $= 0.300$ m
Bottom cover $= 0.050$ m

**Effective Depth Calculation :**

Effective depth,$(d_{effx})$ $= 0.235$ m
Effective depth,$(d_{effy})$ $= 0.245$ m
Effective depth,$(d_{eff})$ $= 0.245$ m
Depth || to X axis at critical section,$(d_{punch_x})$ $= 0.245$ m
Depth || to Y axis at critical section,$(d_{punch_y})$ $= 0.245$ m

Resisting area || to X axis,$(A_{rx})$ $= d_{punch_x} \times 2 \times (l + d_{eff})$
$= 0.245 \times 2 \times (0.300 + 0.245)$
$= 0.267$ m²

Resisting area || to Y axis,$(A_{ry})$ $= d_{punch_y} \times 2 \times (b + d_{eff})$
$= 0.245 \times 2 \times (0.230 + 0.245)$
$= 0.233$ m²

Resisting area,$(A_r)$ $= A_{rx} + A_{ry}$
$= 0.500$ m²

Shear force,(V) $= (P / A_p) \times (A_p - ((l + d_{eff}) \times (b + d_{eff})))$
$= (406.14 / 1.625) \times (1.625 - (0.545 \times 0.475))$
$= 341.44$ kN

Actual shear stress $= V / A_r$
$= 341.44 / 0.500$
$= 683.14$ kN/m²

Permissible shear stress $= 0.25 \times \sqrt{(f_{ck})} \times ks$
ks $= 0.5 + betaC$
betaC = short column side/ long column side
$= 0.230 / 0.300 = 0.767$
ks $= 0.5 + 0.767 = 1.267 > 1$ ,ks = 1
Permissible shear stress $= 0.25 \times 4.4721 \times 1.000$
$= 1.118$ N/mm²
$= 1118.03$ kN/m²

Actual shear stress < Permissible shear stress.
Hence,Safe in punching shear.

**Calculation Of Moment Of Resistance :**

**PROJECT : ss**
**PLAN : ji1**
**JOB NO. : 1** **REF. NO. :**
**DATE : 02/23/25** **TIME : 17:54:09**
**Building Version : 1.550** **STRUDS Version : 2.0.0**

# Column Detail Report:

## SPACEFRAME STRUCTURE

## As Per IS 456 : 2000

| Column Group | Columns | Floor-Level | Column size (mm) | Axial Load (kN) | Mx (kN-m) | My (kN-m) | Ast Prov ($mm^2$) | Ast Perct |
|---|---|---|---|---|---|---|---|---|
| CG1 | C1 | pl - Default Level | 300 x 230 | 406.14 | 3.75 | 3.09 | 679 | 0.983 |
| | | ff - Default Level | 300 x 230 | 367.43 | 7.67 | 5.31 | 679 | 0.983 |
| | | sf - Default Level | 300 x 230 | 271.96 | 15.09 | 19.10 | 679 | 0.983 |
| | | tr - Default Level | 300 x 230 | 171.00 | 17.15 | 28.62 | 1030 | 1.493 |
| | | ter - Default Level | 300 x 230 | 57.98 | 17.07 | 33.14 | 1608 | 2.331 |
| CG2 | C2 | pl - Default Level | 300 x 230 | 972.58 | 4.84 | 6.27 | 1885 | 2.732 |
| | | ff - Default Level | 375 x 230 | 905.44 | 8.73 | 20.23 | 1608 | 1.865 |
| | | sf - Default Level | 375 x 230 | 709.25 | 36.13 | 58.99 | 2513 | 2.914 |
| | | tr - Default Level | 450 x 230 | 420.55 | 48.52 | 77.09 | 3142 | 3.035 |
| | | ter - Default Level | 450 x 230 | 141.98 | 41.57 | 76.05 | 2463 | 2.380 |
| CG3 | C3 | pl - Default Level | 375 x 230 | 1254.42 | 11.22 | 8.82 | 2513 | 2.914 |
| | | ff - Default Level | 525 x 230 | 1169.08 | 67.73 | 20.91 | 4398 | 3.642 |
| | | sf - Default Level | 525 x 230 | 855.59 | 86.60 | 47.38 | 4398 | 3.642 |
| | | tr - Default Level | 375 x 230 | 530.12 | 39.77 | 46.78 | 2513 | 2.914 |
| | | ter - Default Level | 375 x 230 | 207.84 | 48.07 | 45.22 | 2513 | 2.914 |
| CG4 | C4 | pl - Default Level | 300 x 230 | 414.44 | 4.29 | 5.53 | 679 | 0.983 |
| | | ff - Default Level | 300 x 230 | 367.43 | 16.08 | 14.00 | 1030 | 1.493 |
| | | sf - Default Level | 300 x 230 | 262.72 | 28.37 | 12.70 | 804 | 1.166 |
| | | tr - Default Level | 300 x 230 | 159.76 | 24.80 | 5.55 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 55.20 | 29.32 | 12.82 | 1206 | 1.748 |
| CG5 | C5 | pl - Default Level | 230 x 300 | 843.78 | 0.43 | 2.23 | 1608 | 2.331 |
| | | ff - Default Level | 230 x 300 | 785.80 | 5.67 | 11.21 | 1885 | 2.732 |
| | | sf - Default Level | 230 x 300 | 638.22 | 9.80 | 14.82 | 679 | 0.983 |
| | | tr - Default Level | 230 x 300 | 383.83 | 11.24 | 44.29 | 1608 | 2.331 |
| | | ter - Default Level | 230 x 300 | 133.67 | 10.04 | 29.58 | 1030 | 1.493 |
| CG6 | C6 | pl - Default Level | 375 x 230 | 1408.26 | 8.46 | 3.51 | 2945 | 3.415 |
| | | ff - Default Level | 450 x 230 | 1278.47 | 18.25 | 76.02 | 3770 | 3.642 |
| | | sf - Default Level | 450 x 230 | 743.99 | 33.81 | 100.30 | 3142 | 3.035 |
| | | tr - Default Level | 300 x 230 | 458.11 | 39.03 | 7.31 | 1433 | 2.076 |
| | | ter - Default Level | 300 x 230 | 168.75 | 35.54 | 4.18 | 1030 | 1.493 |
| CG7 | C8 | pl - Default Level | 375 x 230 | 1077.61 | 1.97 | 15.16 | 1659 | 1.923 |
| | | ff - Default Level | 450 x 230 | 991.66 | 5.06 | 104.43 | 3770 | 3.642 |
| | | sf - Default Level | 450 x 230 | 678.25 | 5.28 | 145.45 | 3770 | 3.642 |
| | | tr - Default Level | 375 x 230 | 408.90 | 1.75 | 106.88 | 2945 | 3.415 |
| | | ter - Default Level | 375 x 230 | 150.81 | 3.04 | 105.11 | 2513 | 2.914 |
| CG8 | C9 | pl - Default Level | 230 x 300 | 396.41 | 3.98 | 4.03 | 679 | 0.983 |
| | | ff - Default Level | 230 x 300 | 351.19 | 13.13 | 17.80 | 1030 | 1.493 |
| | | sf - Default Level | 230 x 300 | 270.09 | 17.44 | 18.77 | 679 | 0.983 |
| | | tr - Default Level | 230 x 300 | 165.02 | 12.50 | 15.19 | 679 | 0.983 |
| | | ter - Default Level | 230 x 300 | 58.02 | 20.97 | 18.53 | 1030 | 1.493 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CG9 | C10 | pl - Default Level | 230 x 375 | 1353.52 | 7.01 | 16.28 | 2945 | 3.415 |
| | | ff - Default Level | 230 x 450 | 1240.67 | 50.75 | 47.46 | 3927 | 3.794 |
| | | sf - Default Level | 230 x 525 | 858.25 | 64.67 | 79.85 | 4398 | 3.642 |
| | | tr - Default Level | 230 x 450 | 529.83 | 19.67 | 80.77 | 3770 | 3.642 |
| | | ter - Default Level | 230 x 450 | 201.09 | 27.38 | 75.08 | 2865 | 2.768 |
| CG10 | C11 | pl - Default Level | 230 x 375 | 1032.91 | 21.81 | 7.84 | 1608 | 1.865 |
| | | ff - Default Level | 230 x 300 | 862.82 | 12.66 | 6.16 | 1963 | 2.846 |
| | | sf - Default Level | 230 x 300 | 631.39 | 4.03 | 7.20 | 679 | 0.983 |
| | | tr - Default Level | 230 x 300 | 402.25 | 1.30 | 13.43 | 679 | 0.983 |
| | | ter - Default Level | 230 x 300 | 162.66 | 10.65 | 14.30 | 679 | 0.983 |
| CG11 | C12 | pl - Default Level | 450 x 230 | 1828.18 | 9.10 | 10.80 | 3927 | 3.794 |
| | | ff - Default Level | 525 x 230 | 1687.80 | 19.17 | 48.24 | 3770 | 3.122 |
| | | sf - Default Level | 450 x 230 | 1270.86 | 47.46 | 82.80 | 3770 | 3.642 |
| | | tr - Default Level | 450 x 230 | 756.40 | 51.04 | 83.97 | 3142 | 3.035 |
| | | ter - Default Level | 450 x 230 | 261.12 | 48.13 | 83.15 | 3142 | 3.035 |
| CG12 | C14 | pl - Default Level | 230 x 375 | 1365.22 | 8.38 | 8.18 | 2945 | 3.415 |
| | | ff - Default Level | 230 x 450 | 1241.64 | 14.59 | 35.10 | 3142 | 3.035 |
| | | sf - Default Level | 230 x 375 | 1014.17 | 14.85 | 42.47 | 2513 | 2.914 |
| | | tr - Default Level | 230 x 300 | 661.39 | 12.77 | 25.40 | 1206 | 1.748 |
| | | ter - Default Level | 230 x 300 | 328.18 | 12.91 | 22.87 | 679 | 0.983 |
| | | hr - Default Level | 230 x 300 | 46.12 | 23.98 | 7.31 | 679 | 0.983 |
| CG13 | C16 | pl - Default Level | 230 x 450 | 1457.79 | 18.00 | 5.96 | 2513 | 2.428 |
| | | ff - Default Level | 230 x 450 | 1347.76 | 60.87 | 26.09 | 3770 | 3.642 |
| | | sf - Default Level | 230 x 525 | 999.16 | 103.82 | 57.04 | 3770 | 3.122 |
| | | tr - Default Level | 230 x 450 | 607.65 | 89.29 | 44.55 | 3142 | 3.035 |
| | | ter - Default Level | 230 x 450 | 224.24 | 90.52 | 49.52 | 3770 | 3.642 |
| CG14 | C17 | pl - Default Level | 230 x 300 | 944.19 | 16.35 | 6.79 | 1885 | 2.732 |
| | | ff - Default Level | 230 x 300 | 758.62 | 14.21 | 7.96 | 1885 | 2.732 |
| | | sf - Default Level | 230 x 300 | 621.57 | 17.93 | 11.55 | 679 | 0.983 |
| | | tr - Default Level | 230 x 300 | 438.79 | 14.66 | 2.47 | 679 | 0.983 |
| | | ter - Default Level | 230 x 300 | 255.10 | 16.11 | 0.84 | 679 | 0.983 |
| | | hr - Default Level | 230 x 300 | 72.95 | 14.37 | 0.23 | 679 | 0.983 |
| CG15 | C18 | pl - Default Level | 230 x 450 | 1622.77 | 3.33 | 15.87 | 3142 | 3.035 |
| | | ff - Default Level | 230 x 525 | 1450.15 | 4.99 | 45.97 | 3770 | 3.122 |
| | | sf - Default Level | 230 x 525 | 1023.92 | 14.15 | 79.10 | 3770 | 3.122 |
| | | tr - Default Level | 230 x 450 | 674.11 | 10.64 | 84.87 | 3770 | 3.642 |
| | | ter - Default Level | 230 x 375 | 325.45 | 12.17 | 74.26 | 2945 | 3.415 |
| | | hr - Default Level | 230 x 300 | 49.76 | 7.48 | 33.65 | 1206 | 1.748 |
| CG16 | C19 | pl - Default Level | 375 x 230 | 1305.13 | 0.87 | 13.39 | 2513 | 2.914 |
| | | ff - Default Level | 375 x 230 | 1155.72 | 0.91 | 32.11 | 2945 | 3.415 |
| | | sf - Default Level | 375 x 230 | 913.24 | 6.31 | 60.68 | 2513 | 2.914 |
| | | tr - Default Level | 300 x 230 | 604.24 | 6.00 | 63.97 | 1963 | 2.846 |
| | | ter - Default Level | 300 x 230 | 297.13 | 6.59 | 57.31 | 1659 | 2.404 |
| | | hr - Default Level | 300 x 230 | 54.86 | 4.68 | 20.03 | 679 | 0.983 |
| CG17 | C20 | pl - Default Level | 230 x 450 | 1453.13 | 18.67 | 9.01 | 2513 | 2.428 |
| | | ff - Default Level | 230 x 450 | 1346.48 | 58.81 | 21.57 | 3142 | 3.035 |
| | | sf - Default Level | 230 x 525 | 1006.92 | 100.16 | 58.39 | 3770 | 3.122 |
| | | tr - Default Level | 230 x 525 | 615.56 | 97.92 | 67.99 | 3770 | 3.122 |
| | | ter - Default Level | 230 x 450 | 223.59 | 91.68 | 64.11 | 3927 | 3.794 |
| CG18 | C21 | pl - Default Level | 300 x 230 | 358.92 | 1.24 | 6.82 | 679 | 0.983 |
| | | ff - Default Level | 300 x 230 | 288.11 | 0.64 | 9.75 | 679 | 0.983 |
| | | sf - Default Level | 300 x 230 | 218.07 | 2.52 | 6.91 | 679 | 0.983 |
| | | tr - Default Level | 300 x 230 | 148.79 | 3.20 | 5.06 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 78.47 | 3.23 | 7.23 | 679 | 0.983 |
| | | hr - Default Level | 300 x 230 | 14.86 | 2.89 | 2.77 | 679 | 0.983 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CG19 | C22 | pl - Default Level | 300 x 230 | 773.44 | 4.56 | 3.88 | 1206 | 1.748 |
| | | ff - Default Level | 300 x 230 | 633.72 | 4.77 | 7.69 | 1206 | 1.748 |
| | | sf - Default Level | 300 x 230 | 492.20 | 7.71 | 3.54 | 679 | 0.983 |
| | | tr - Default Level | 300 x 230 | 355.76 | 7.86 | 1.33 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 219.46 | 7.94 | 3.24 | 679 | 0.983 |
| | | hr - Default Level | 300 x 230 | 71.10 | 6.89 | 6.22 | 679 | 0.983 |
| CG20 | C23 | pl - Default Level | 300 x 230 | 343.21 | 4.13 | 4.57 | 679 | 0.983 |
| | | ff - Default Level | 300 x 230 | 270.96 | 4.64 | 5.57 | 679 | 0.983 |
| | | sf - Default Level | 300 x 230 | 198.13 | 2.74 | 7.23 | 679 | 0.983 |
| | | tr - Default Level | 300 x 230 | 130.61 | 1.64 | 6.41 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 63.91 | 1.60 | 8.64 | 679 | 0.983 |
| | | hr - Default Level | 300 x 230 | 7.93 | 2.58 | 6.15 | 679 | 0.983 |
| CG21 | C24 | pl - Default Level | 300 x 230 | 671.22 | 1.21 | 0.84 | 804 | 1.166 |
| | | ff - Default Level | 300 x 230 | 550.44 | 0.23 | 1.32 | 804 | 1.166 |
| | | sf - Default Level | 300 x 230 | 434.02 | 0.60 | 2.93 | 679 | 0.983 |
| | | tr - Default Level | 300 x 230 | 305.95 | 1.35 | 3.35 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 175.09 | 1.10 | 5.69 | 679 | 0.983 |
| | | hr - Default Level | 300 x 230 | 53.14 | 2.25 | 8.57 | 679 | 0.983 |
| CG22 | C25 | pl - Default Level | 230 x 375 | 1208.47 | 5.07 | 2.34 | 2513 | 2.914 |
| | | ff - Default Level | 230 x 375 | 1079.97 | 4.95 | 11.53 | 2513 | 2.914 |
| | | sf - Default Level | 230 x 300 | 876.12 | 12.29 | 26.67 | 1885 | 2.732 |
| | | tr - Default Level | 230 x 300 | 558.88 | 8.07 | 28.05 | 1030 | 1.493 |
| | | ter - Default Level | 230 x 300 | 246.49 | 11.25 | 24.74 | 679 | 0.983 |
| | | hr - Default Level | 230 x 300 | 19.23 | 7.55 | 8.92 | 679 | 0.983 |
| CG23 | C26 | pl - Default Level | 230 x 300 | 892.68 | 0.79 | 8.81 | 1608 | 2.331 |
| | | ff - Default Level | 230 x 375 | 816.71 | 1.01 | 23.06 | 1608 | 1.865 |
| | | sf - Default Level | 230 x 375 | 639.03 | 2.83 | 52.01 | 2513 | 2.914 |
| | | tr - Default Level | 230 x 375 | 392.47 | 2.64 | 59.12 | 2011 | 2.331 |
| | | ter - Default Level | 230 x 300 | 140.29 | 1.36 | 58.18 | 1963 | 2.846 |
| CG24 | C27 | pl - Default Level | 230 x 300 | 482.95 | 1.33 | 5.52 | 679 | 0.983 |
| | | ff - Default Level | 230 x 300 | 409.87 | 1.99 | 8.22 | 679 | 0.983 |
| | | sf - Default Level | 230 x 300 | 373.78 | 3.51 | 23.67 | 679 | 0.983 |
| | | tr - Default Level | 230 x 300 | 226.40 | 6.87 | 28.94 | 679 | 0.983 |
| | | ter - Default Level | 230 x 300 | 58.50 | 6.93 | 32.00 | 1206 | 1.748 |
| CG25 | C28 | pl - Default Level | 375 x 230 | 1280.25 | 1.08 | 7.62 | 2513 | 2.914 |
| | | ff - Default Level | 450 x 230 | 1214.93 | 16.05 | 53.16 | 3142 | 3.035 |
| | | sf - Default Level | 375 x 230 | 809.83 | 17.14 | 97.30 | 2945 | 3.415 |
| | | tr - Default Level | 375 x 230 | 500.26 | 1.74 | 85.28 | 1659 | 1.923 |
| | | ter - Default Level | 375 x 230 | 220.69 | 4.31 | 93.01 | 1659 | 1.923 |
| CG26 | C30 | pl - Default Level | 375 x 230 | 1225.54 | 0.63 | 6.84 | 2513 | 2.914 |
| | | ff - Default Level | 450 x 230 | 1155.11 | 2.39 | 73.12 | 3142 | 3.035 |
| | | sf - Default Level | 450 x 230 | 848.21 | 1.85 | 127.40 | 3142 | 3.035 |
| | | tr - Default Level | 375 x 230 | 520.07 | 1.79 | 109.47 | 2945 | 3.415 |
| | | ter - Default Level | 375 x 230 | 203.66 | 2.81 | 128.87 | 2945 | 3.415 |
| CG27 | C31 | pl - Default Level | 300 x 230 | 857.26 | 1.52 | 9.80 | 1608 | 2.331 |
| | | ff - Default Level | 450 x 230 | 773.21 | 4.91 | 95.71 | 2513 | 2.428 |
| | | sf - Default Level | 375 x 230 | 505.03 | 7.28 | 111.96 | 2945 | 3.415 |
| | | tr - Default Level | 300 x 230 | 309.31 | 3.12 | 41.22 | 804 | 1.166 |
| | | ter - Default Level | 300 x 230 | 115.81 | 5.87 | 43.97 | 1030 | 1.493 |
| CG28 | C33 | pl - Default Level | 300 x 230 | 906.71 | 2.95 | 7.33 | 1608 | 2.331 |
| | | ff - Default Level | 450 x 230 | 812.84 | 3.16 | 83.71 | 2413 | 2.331 |
| | | sf - Default Level | 375 x 230 | 260.11 | 4.65 | 87.21 | 1659 | 1.923 |
| | | tr - Default Level | 300 x 230 | 174.17 | 11.75 | 2.17 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 72.84 | 12.52 | 2.54 | 679 | 0.983 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CG29 | C34 | pl - Default Level | 300 x 230 | 783.50 | 30.55 | 6.84 | 1885 | 2.732 |
| | | ff - Default Level | 300 x 230 | 620.65 | 23.25 | 16.06 | 1885 | 2.732 |
| | | sf - Default Level | 375 x 230 | 588.40 | 36.23 | 35.91 | 1608 | 1.865 |
| | | tr - Default Level | 300 x 230 | 346.10 | 43.84 | 1.69 | 1433 | 2.076 |
| | | ter - Default Level | 300 x 230 | 117.77 | 39.61 | 8.40 | 1608 | 2.331 |
| CG30 | C35 | pl - Default Level | 300 x 230 | 679.52 | 21.08 | 12.26 | 1030 | 1.493 |
| | | ff - Default Level | 300 x 230 | 551.00 | 19.05 | 19.78 | 1885 | 2.732 |
| | | sf - Default Level | 300 x 230 | 401.55 | 33.04 | 11.92 | 1206 | 1.748 |
| | | tr - Default Level | 300 x 230 | 248.41 | 36.52 | 24.22 | 1659 | 2.404 |
| | | ter - Default Level | 300 x 230 | 88.50 | 34.93 | 19.77 | 1608 | 2.331 |
| CG31 | C36 | pl - Default Level | 230 x 300 | 812.22 | 4.02 | 8.71 | 1206 | 1.748 |
| | | ff - Default Level | 305 x 300 | 742.32 | 9.05 | 39.16 | 1608 | 1.758 |
| | | sf - Default Level | 305 x 300 | 526.01 | 21.26 | 61.80 | 1659 | 1.813 |
| | | tr - Default Level | 230 x 300 | 319.71 | 24.74 | 41.79 | 1963 | 2.846 |
| | | ter - Default Level | 305 x 300 | 118.91 | 23.48 | 48.35 | 1659 | 1.813 |
| CG32 | C37 | pl - Default Level | 230 x 450 | 1562.04 | 0.52 | 10.84 | 3142 | 3.035 |
| | | ff - Default Level | 230 x 450 | 1413.92 | 0.18 | 15.85 | 3142 | 3.035 |
| | | sf - Default Level | 230 x 375 | 1128.69 | 7.76 | 40.69 | 2945 | 3.415 |
| | | tr - Default Level | 230 x 300 | 683.41 | 7.88 | 39.97 | 1963 | 2.846 |
| | | ter - Default Level | 230 x 300 | 252.27 | 12.45 | 47.29 | 1885 | 2.732 |
| CG33 | C38 | pl - Default Level | 230 x 300 | 934.61 | 15.50 | 18.37 | 1659 | 2.404 |
| | | ff - Default Level | 230 x 300 | 763.32 | 14.74 | 22.31 | 1963 | 2.846 |
| | | sf - Default Level | 230 x 300 | 553.78 | 30.20 | 22.48 | 1608 | 2.331 |
| | | tr - Default Level | 230 x 300 | 334.41 | 34.72 | 12.12 | 804 | 1.166 |
| | | ter - Default Level | 230 x 300 | 117.14 | 30.86 | 11.08 | 804 | 1.166 |
| CG34 | C39 | pl - Default Level | 230 x 300 | 314.08 | 3.43 | 4.46 | 679 | 0.983 |
| | | ff - Default Level | 230 x 300 | 273.84 | 10.52 | 8.06 | 679 | 0.983 |
| | | sf - Default Level | 230 x 300 | 204.83 | 16.86 | 9.18 | 679 | 0.983 |
| | | tr - Default Level | 230 x 300 | 126.13 | 17.20 | 14.50 | 679 | 0.983 |
| | | ter - Default Level | 230 x 300 | 37.15 | 21.52 | 16.54 | 1030 | 1.493 |
| CG35 | C40 | pl - Default Level | 230 x 375 | 1189.69 | 11.36 | 4.81 | 2061 | 2.389 |
| | | ff - Default Level | 230 x 375 | 1110.86 | 39.92 | 20.03 | 2945 | 3.415 |
| | | sf - Default Level | 230 x 375 | 789.55 | 52.71 | 31.87 | 2513 | 2.914 |
| | | tr - Default Level | 230 x 375 | 491.06 | 69.83 | 33.97 | 2463 | 2.856 |
| | | ter - Default Level | 230 x 375 | 212.71 | 68.32 | 36.73 | 2945 | 3.415 |
| CG36 | C42 | pl - Default Level | 230 x 375 | 1190.31 | 2.88 | 8.04 | 2061 | 2.389 |
| | | ff - Default Level | 230 x 375 | 1094.28 | 12.02 | 29.14 | 2945 | 3.415 |
| | | sf - Default Level | 230 x 375 | 801.61 | 13.75 | 55.86 | 2945 | 3.415 |
| | | tr - Default Level | 230 x 300 | 487.79 | 7.12 | 45.32 | 1885 | 2.732 |
| | | ter - Default Level | 230 x 300 | 181.28 | 5.50 | 47.94 | 1608 | 2.331 |
| CG37 | C43 | pl - Default Level | 300 x 230 | 883.88 | 30.18 | 3.61 | 1963 | 2.846 |
| | | ff - Default Level | 300 x 230 | 719.76 | 21.76 | 5.32 | 1885 | 2.732 |
| | | sf - Default Level | 300 x 230 | 538.80 | 37.34 | 5.24 | 1608 | 2.331 |
| | | tr - Default Level | 300 x 230 | 324.20 | 42.26 | 7.83 | 1608 | 2.331 |
| | | ter - Default Level | 300 x 230 | 105.34 | 36.84 | 7.27 | 1206 | 1.748 |
| CG38 | C44 | pl - Default Level | 300 x 230 | 426.15 | 5.32 | 14.51 | 679 | 0.983 |
| | | ff - Default Level | 300 x 230 | 337.44 | 6.01 | 16.32 | 679 | 0.983 |
| | | sf - Default Level | 300 x 230 | 243.76 | 7.85 | 17.99 | 679 | 0.983 |
| | | tr - Default Level | 300 x 230 | 150.52 | 8.07 | 20.67 | 679 | 0.983 |
| | | ter - Default Level | 300 x 230 | 55.24 | 9.51 | 20.63 | 679 | 0.983 |
| CG39 | C7 | sf - Default Level | 300 x 230 | 211.84 | 13.22 | 37.70 | 1030 | 1.493 |
| | | tr - Default Level | 375 x 230 | 101.90 | 25.91 | 63.17 | 2513 | 2.914 |
| | | ter - Default Level | 300 x 230 | -21.66 | 22.50 | 43.40 | 679 | 0.983 |
| CG40 | C15 | sf - Default Level | 230 x 300 | 14.44 | 16.82 | 38.12 | 1659 | 2.404 |
| | | tr - Default Level | 230 x 300 | 11.12 | 2.59 | 36.89 | 1257 | 1.821 |
| | | ter - Default Level | 230 x 300 | -24.33 | 4.16 | 34.88 | 679 | 0.983 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CG41 | C29 | sf - Default Level | 300 x 230 | 101.32 | 31.58 | 7.92 | 1030 | 1.493 |
| | | tr - Default Level | 375 x 230 | 62.92 | 65.39 | 12.76 | 2513 | 2.914 |
| | | ter - Default Level | 300 x 230 | -8.12 | 68.47 | 12.92 | 679 | 0.983 |
| CG42 | C32 | sf - Default Level | 230 x 300 | 254.54 | 22.97 | 40.74 | 1885 | 2.732 |
| | | tr - Default Level | 230 x 300 | 121.65 | 53.06 | 3.55 | 1608 | 2.331 |
| | | ter - Default Level | 230 x 300 | 3.02 | 48.16 | 3.90 | 1608 | 2.331 |
| CG43 | C41 | sf - Default Level | 230 x 300 | 86.25 | 35.20 | 23.99 | 1659 | 2.404 |
| | | tr - Default Level | 230 x 375 | 44.82 | 82.88 | 18.27 | 2513 | 2.914 |
| | | ter - Default Level | 230 x 300 | -24.07 | 72.59 | 17.99 | 679 | 0.983 |
| CG44 | C13 | hr - Default Level | 230 x 300 | 19.92 | 27.09 | 13.77 | 1030 | 1.493 |

16/2/25

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**PROJECT : ss**
**PLAN : ji1**
**JOB NO. : 1** **REF. NO. :**
**DATE : 02/23/25** **TIME : 17:54:17**
**Building Version : 1.550** **STRUDS Version : 2.0.0**

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**Terms Used In Calculation :**

In biaxial column design,

$P_u = P_{uc} + P_{us(Total)}$

where,

$P_u$ = external axial compressive load,

$P_{uc}$ = axial compressive resistance offered by concrete,

$P_{us(Total)}$ = total axial compressive resistance offered by steel at different levels in the section.

$M_u = M_{uc} + M_{us(Total)}$

where,

$M_u$ = external moment about centroidal axis,

$M_{uc}$ = moment of resistance offered by concrete in compression,

$M_{us(Total)}$ = total moment of resistance offered by steel at different levels in the section.

i = serial no. of row of reinforcement,

$A_{si}$ = cross-sectional area of reinforcement in the i th row,

$f_{si}$ = stress in the reinforcement in the i th row (compression + ve, tension - ve),

$f_{ci}$ = compressive stress in concrete at the level of i th row of reinforcement,

$e_i$ = strain at the i th row of reinforcement from the stress-strain curve of steel and concrete,

$x_i$ = distance of the bars in the i th row from the centroid of the section

Values of stress in steel :

Design strength in bending compression ($f_{yd}$) = 0.87 $f_y$

(a) Fe 250,

For $e_i >= f_{yd} / E_s$, $f_{si} = f_{yd}$

For $e_i < f_{yd} / E_s$, $f_{si} = e_i \times f_{yd}$

(b) Fe 415,

For $e_i >= 0.8 \times f_{yd} / E_s$, $f_{si}$ = value obtained from stress-strain curve

For $e_i < 0.8 \times f_{yd} / E_s$, $f_{si} = e_i \times f_{yd}$

| Stress | Stress level (N/mmB) | Strain |
|---|---|---|
| 0.800 $f_{yd}$ | 288.7 | 0.00144 |
| 0.850 $f_{yd}$ | 306.7 | 0.00163 |
| 0.900 $f_{yd}$ | 324.8 | 0.00192 |
| 0.950 $f_{yd}$ | 342.8 | 0.00241 |
| 0.975 $f_{yd}$ | 351.8 | 0.00276 |
| 1.000 $f_{yd}$ | 360.9 | 0.00380 |

Values of stress in concrete :

For $e_i >= 0.002$, $f_{ci} = 0.446 f_{ck}$

For $e_i < 0.002$, $f_{ci} = (446.e_i \times (1 - 250.e_i)) \times f_{ck}$

Values of strain :

Values of strain at different levels are obtained by taking maximum strain as 0.0035 as the reference value at the highly compressed edge.

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**Design of CG1 :**

**General Design Parameters :**

Below ter - Default Level at 15.000 m

Column size, (B x D) = 300 x 230 mm Column height,(L) = 2625 mm

From analysis results,loads on column

Axial load,(P) = 57.98 kN

MomentX,($M_x$) = 17.07 kN-m

MomentY,($M_y$) = 33.14 kN-m

$f_{ck}$ = 20.00 N/mmB

$f_y$ = 500.00 N/mmB

Load combination = 1.50 DL + 1.50 LL

| Column Name | Orientation Angle |
|---|---|
| C1 | 0.00 |

**Check For Slenderness :**

Slenderness RatioX = ( $L_o$ x Effective Length FactorX ) / Depth

= ( 2625 x 1.000 ) / 230 = 11.41 <= 12.00,

column is not slender in this direction.

Slenderness RatioY = ( $L_o$ x Effective Length FactorY ) / Width

= ( 2625 x 1.000 ) / 300 = 8.75 <= 12.00,

column is not slender in this direction.

$M_{x_MinEccen}$ = 1.160 kN.m

$M_{y_MinEccen}$ = 1.160 kN.m

$M_x = \max(M_x, M_{x_MinEccen}) + M_{uaddX}$ = 17.071 kN.m

$M_y = \max(M_y, M_{y_MinEccen}) + M_{uaddY}$ = 33.137 kN.m

**Calculation Of Eccentricities :**

As per IS 456: 2000 Clause 25.4,all columns shall be designed for minimum eccentricity equal to the unsupported length of the column/500 plus lateral dimension/30, subject to a minimum of 20 mm.

Actual $eccen_X = Mx / P = 17.07/57.98 = 294$ mm

Actual $eccen_Y = M_y / P = 33.14/57.98 = 571$ mm

$eccen_{XMin}$ = (L/500) + (D/30) = (2625/500) + (230/30) = 13 mm

$eccen_{XMin}$ = max(13,20)= 20 mm

$eccen_{YMin}$ = (L/500) + (B/30) = (2625/500) + (300/30) = 15 mm

$eccen_{YMin}$ = max(15,20) = 20 mm

$eccen_X$ = max(Actual $eccen_X$,$eccen_{XMin}$) = max(294,20) = 294 mm

$eccen_Y$ = max(Actual $eccen_Y$,$eccen_{YMin}$) = max(571,20) = 571 mm

As per IS 456: 2000 Clause 39.3,
when the minimum eccentricity does not exceed 0.05 times the lateral dimension, the column will be designed as an axially loaded column.
eccenX(294 mm) > 0.05 x 300(15 mm)
and eccenY(571 mm) > 0.05 x 230(12 mm)

Hence the column will be designed as a column with biaxial moments.

Provided steel :
Provide #16 - 8 nos. (1608 mmB)

**Biaxial Check Calculations :**

For X axis :

| Row No. (i) | $A_{si}$ (mmB) | $e_i$ | $f_{si}$ (N/mmB) | $f_{ci}$ (N/mmB) | $(f_{si} - f_{ci})$ (N/mmB) | $P_{usi}$ (kN) | $x_i$ (mm) | $M_{usi}$ (kN-m) |
|---|---|---|---|---|---|---|---|---|
| 1 | 804 | 0.00147 | 293.50 | 8.29 | 285.21 | 229.38 | 67 | 15.37 |
| 2 | 804 | -0.00421 | -434.80 | 0.00 | -434.80 | -349.69 | -67 | 23.43 |
| | | | | | Total | -120.31 | | 38.80 |

$x_{ux}$ = 83 mm $P_{uc} = C_1.f_{ck}.B.D$

$C_1$ = 0.36 $k_u$ = 0.36 x 83/230 = 0.129

$P_{uc}$ = 0.129 x 20.00 x 300 x 230

= 178.54 kN

$P_{ux1} = P_{uc} + P_{us(Total)}$

= 178.54 + (-120.31)

= 58.23 kN > P ,hence O.K.

$M_{uc} = P_{uc}.(0.5.D - C_2.D)$

$C_2$ = 0.416 $k_u$ = 0.416 x 83/230

= 0.149

$M_{uc}$ = 178.54 x (0.5 x 230 - 0.149 x 230) = 14.39 kN-m

$M_{ux1} = M_{uc} + M_{us(Total)}$

= 14.39 + (38.80)

= 53.19 kN-m

For Y axis :

| Row No. (i) | $A_{si}$ | $e_i$ | $f_{si}$ | $f_{ci}$ | $(f_{si} - f_{ci})$ | $P_{usi}$ | $x_i$ | $M_{usi}$ |
|---|---|---|---|---|---|---|---|---|

| | (mmB) | | (N/mmB) | (N/mmB) | (N/mmB) | (kN) | (mm) | (kN-m) |
|---|---|---|---|---|---|---|---|---|
| 1 | 402 | 0.00214 | 382.64 | 8.92 | 373.72 | 150.28 | 102 | 15.33 |
| 2 | 402 | 0.00020 | 40.87 | 1.73 | 39.14 | 15.74 | 34 | 0.54 |
| 3 | 402 | -0.00173 | -345.51 | 0.00 | -345.51 | -138.94 | -34 | 4.72 |
| 4 | 402 | -0.00366 | -429.50 | 0.00 | -429.50 | -172.71 | -102 | 17.62 |
| | | | | | Total | -145.63 | | 38.20 |

$x_{uy}$ = 123 mm $P_{uc} = C_1.f_{ck}.B.D$

$C_1$ = 0.36 $k_u$ = 0.36 x 123/300 = 0.148

$P_{uc}$ = 0.148 x 20.00 x 230 x 300

= 204.01 kN

$P_{uy1} = P_{uc} + P_{us(Total)}$

= 204.01 + (-145.63)

= 58.38 kN > P ,hence O.K.

$M_{uc} = P_{uc}.(0.5.B - C_2.B)$

$C_2$ = 0.416 $k_u$ = 0.416 x 123/300

= 0.171

$M_{uc}$ = 204.01 x (0.5 x 300 - 0.171 x 300) = 20.15 kN-m

$M_{uy1} = M_{uc} + M_{us(Total)}$

= 20.15 + (38.20)

= 58.35 kN-m

$P_u/P_{uz}$ = 0.048

For $P_u/P_{uz}$ <= 0.2, $\alpha_n$ = 1.0

For $P_u/P_{uz}$ >= 0.8, $\alpha_n$ = 2.0

For $P_u/P_{uz}$ = 0.048, $\alpha_n$ = 1.000

$((M_{ux} / M_{ux1})^{\alpha_n}) + ((M_{uy}/M_{uy1})^{\alpha_n})$

$= ((17.07/53.19)^{1.000}) + ((33.14/58.35)^{1.000})$

= 0.889 < 1.0,hence O.K.

**Ties Details :**

Load combination for ties design = 1.50 DL + 1.50 LL

**Calculation of diameter of ties :**

As per IS 456: 2000 Clause 26.5.3.2 (c), the diameter of the polygonal links or lateral ties shall be not less than the following

i) one-fourth the diameter of the largest longitudinal bar = 16/4 = 4 mm

ii) in no case less than = 6 mm

Required diameter = maximum of (4, 6) = 6 mm

Provide 8 mm diameter for ties.

**Calculation of spacing of ties :**

As per IS 456: 2000 Clause 26.5.3.2 (c), the pitch of transverse reinforcement shall be not more than the least of the following distances:

i) the least lateral dimension of the compression member = 230 mm

ii) sixteen times the smallest diameter of the longitudinal reinforcement bar to be tied = 16 x 16 = 256 mm

iii) 300 mm

Required spacing = minimum of (230, 256, 300) = 230 mm

# Provide ties 8 @ 230 mm c/c

**SUMMARY :**

CG1 : ter - Default Level at 15.000 m
Provide rectangular section : 300 x 230 mm
Provide #16 - 8 nos. (1608 mmB)
Provide ties #8 @ 230 mm c/c
Provide 2 legged ties along width and
2 legged ties along depth.

---

**General Design Parameters :**

Below tr - Default Level at 12.000 m

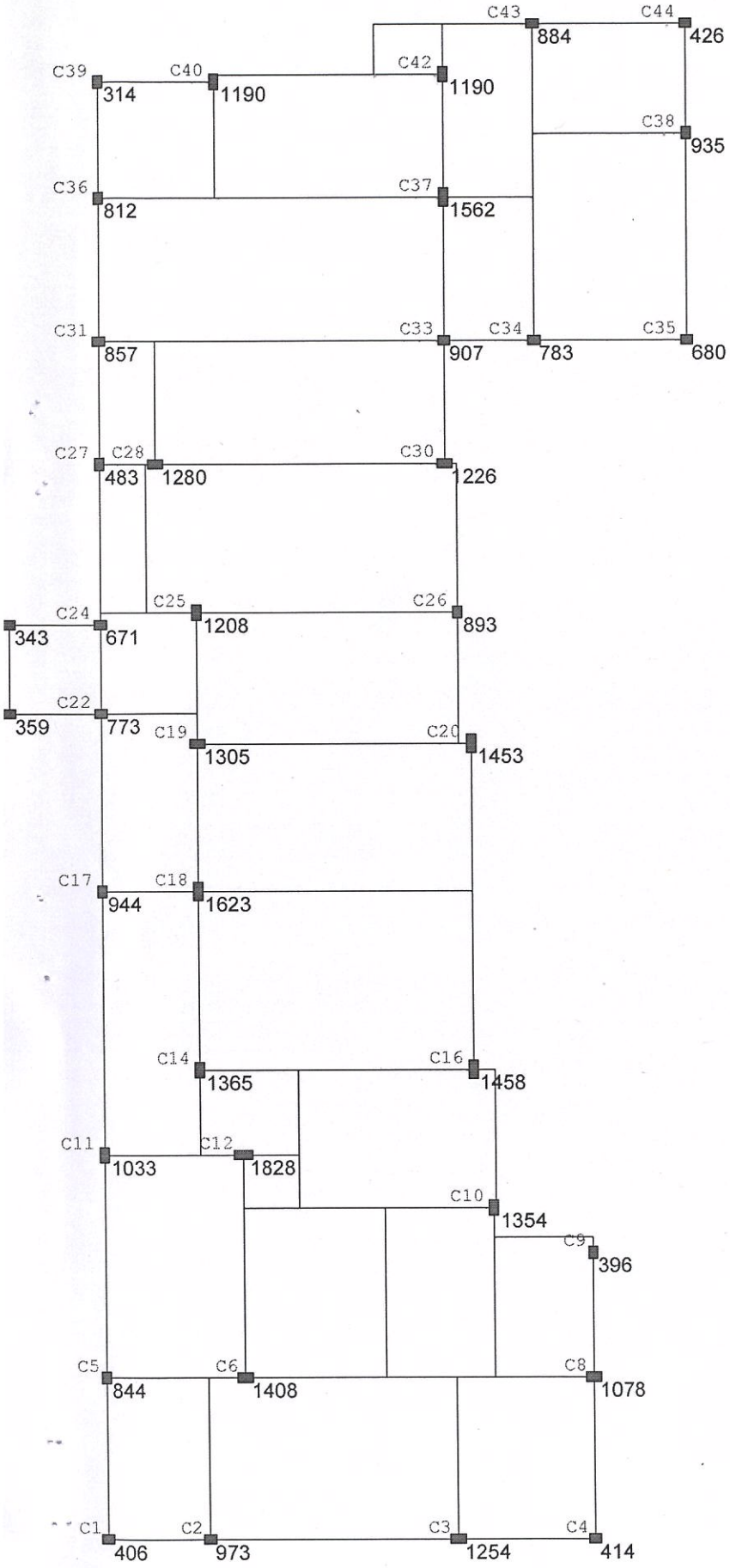
Column size, (B x D) = 300 x 230 mm Column height,(L) = 2625 mm

From analysis results,loads on column

Axial load,(P) = 171.00 kN

MomentX,($M_x$) = 17.15 kN-m

MomentY,($M_y$) = 28.62 kN-m




16/4/20

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CMDA - Reg. No. SE/GR-I/19/03/023 on 22.03.2019
GCC-Grade-I, Reg.No.RSE100372019 dated 30.09.2019
11, 8th Avenue, [illegible]

## Project Information :

**PROJECT : ss**
**PLAN : ji1**
**JOB NO. : 1** **REF. NO. :**
**DATE : 02/23/25** **TIME : 17:54:54**
**Building Version : 1.550** **STRUDS Version : 2.0.0**

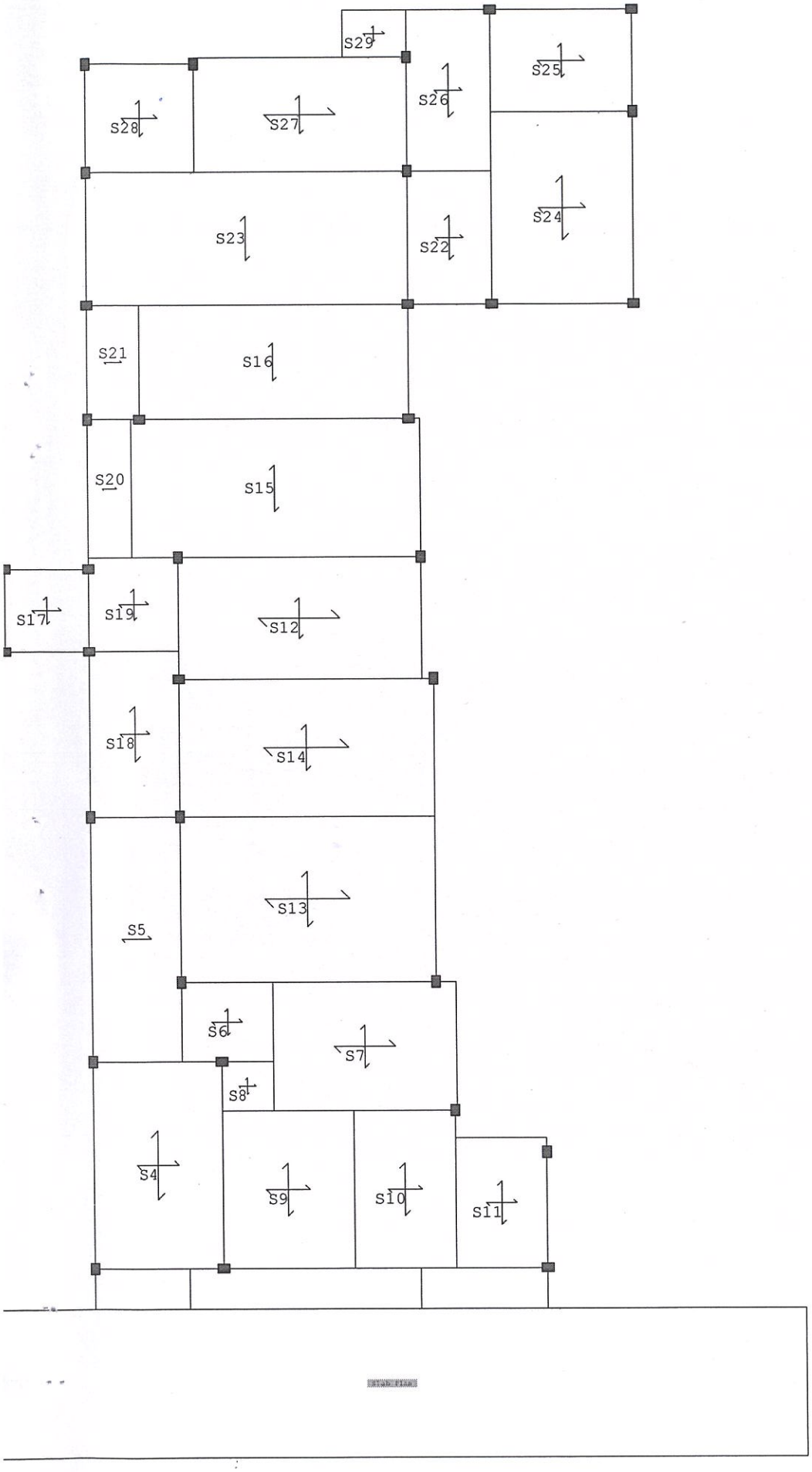
## Slab Schedule Report : (Default Level at 6.00 m)

| Slab Group | Slab ID | Concrete Grade | Thk | Bottom Reinforcement(c/c) | | Top Reinforcement Extra Steel(c/c) | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main | Other | Left | Right | Up | Down | |
| SG1 | S1 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | -- | TwoWay |
| SG2 | S2 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | TwoWay |
| SG3 | S3 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | -- | TwoWay |
| SG4 | S4 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | #8 @ 200 | TwoWay |
| SG5 | S5 | M20 | 125 | #8 @ 200 | #8 @ 300 | --- | #8 @ 200 | --- | --- | OneWay |
| SG6 | S6 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | TwoWay |
| SG7 | S7 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | TwoWay |
| SG8 | S8 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | TwoWay |
| SG9 | S9 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | TwoWay |
| SG10 | S10 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | TwoWay |
| SG11 | S11 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | -- | #8 @ 200 | TwoWay |
| SG12 | S12 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 195 | #8 @ 200 | TwoWay |
| SG13 | S13 | M20 | 135 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | TwoWay |
| SG14 | S14 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | TwoWay |
| SG15 | S15 | M20 | 125 | #8 @ 200 | #8 @ 300 | --- | --- | #8 @ 195 | #8 @ 195 | OneWay |
| SG16 | S16 | M20 | 125 | #8 @ 200 | #8 @ 300 | --- | --- | #8 @ 200 | #8 @ 200 | OneWay |
| SG17 | S17 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | -- | -- | TwoWay |
| SG18 | S18 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | -- | TwoWay |
| SG19 | S19 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 195 | #8 @ 200 | TwoWay |
| SG20 | S20 | M20 | 125 | #8 @ 200 | #8 @ 300 | --- | --- | --- | --- | OneWay |
| SG21 | S21 | M20 | 125 | #8 @ 200 | #8 @ 300 | --- | --- | --- | --- | OneWay |
| SG22 | S22 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | #8 @ 200 | -- | TwoWay |
| SG23 | S23 | M20 | 125 | #8 @ 200 | #8 @ 300 | --- | --- | #8 @ 200 | #8 @ 200 | OneWay |
| SG24 | S24 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | -- | TwoWay |
| SG25 | S25 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | -- | #8 @ 200 | TwoWay |
| SG26 | S26 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | TwoWay |
| SG27 | S27 | M20 | 125 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | #8 @ 200 | TwoWay |
| SG28 | S28 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | -- | #8 @ 200 | TwoWay |
| SG29 | S29 | M20 | 125 | #8 @ 200 | #8 @ 200 | -- | #8 @ 200 | -- | #8 @ 200 | TwoWay |

Notes :
1.Dia of Reinforcement bars is in mm
2.Spacing of Reinforcement bars is in mm
3.Thickness of Slab is in mm

16/4/25

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16/12/2

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**PROJECT : ss**
**PLAN : ji1**
**JOB NO. : 1** **REF. NO. :**
**DATE : 02/23/25** **TIME : 17:55:03**
**Building Version : 1.550** **STRUDS Version : 2.0.0**

# Design Of Slabs : Default Level

Design Method : Limit State Method
Design Code : IS 456:2000

## Design Of Slab

Slab Name : S1
Slab Type : TwoWay Slab
Grade of Concrete :M20
Grade of Steel : Fe500
Dimensions : Lx = 2.450 m ,Ly = 3.800 m ,Thickness= 125 mm
Span Ratio : Longer/Shorter = 1.551
Boundary Condition : One short and one long edge continuous

## Loading on Slab :(Table 1)

Total DL = (1) + (2) + (3)

| Self Weight (1) kN/m² | Floor Finish (2) kN/m² | Sunk Load (3) kN/m² | Total DL (4) kN/m² | Live Load (5) kN/m² | Total LL (6) kN/m² | Total Design Load 1.5 x [(4)+(6)] kN/m² |
|---|---|---|---|---|---|---|
| 3.125 | 1.000 | 0.000 | 4.125 | 2.000 | 2.000 | 9.188 |

## Deflection Check :(Table 2)

As per clause 23.2.1 of IS 456:2000:

| (Span/Depth) Ratio | Modification Factor (a) | Basic Factor (b) | Permissible Ratio (a x b) | Status |
|---|---|---|---|---|
| 24.500 | 1.556 | 32.000 | 49.778 | OK |

## Moment And Steel Calculations :

Coefficients ($\alpha_x$ and $\alpha_y$) are computed as per clause D-1.1 of IS 456:2000:

$M_x = \alpha_x \times W \times L_x \times L_x$:

$M_y = \alpha_y \times W \times L_x \times L_x$:

where

$M_x$,$M_y$ = moments on strips of unit width spanning $L_x$ and $L_y$ respectively,

W = Total Design Load = 9.188 kN/m$^2$

$L_x$ = Shorter span = 2.450 m

| Position | Moment Coeff.$\alpha_x$ or $\alpha_y$ | Moment kN-m | $A_{st_rqd}$ per metre mm² | Steel Detail dia @ spc mm c/c | $A_{st_prv}$ per metre mm² | Remark |
|---|---|---|---|---|---|---|
| MidShort | 0.057 | 3.167 | 74.182 | #8 @ 200 | 251.327 | Main |
| MidLong | 0.035 | 1.930 | 44.875 | #8 @ 200 | 251.327 | Other |
| SuppDown | 0.000 | 0.000 | 0.000 | -- | 0.000 | Extra at Top |
| SuppTop | 0.047 | 2.592 | 60.500 | #8 @ 200 | 251.327 | Extra at Top |
| SuppLeft | 0.000 | 0.000 | 0.000 | -- | 0.000 | Extra at Top |
| SuppRight | 0.077 | 4.237 | 99.907 | #8 @ 200 | 251.327 | Extra at Top |

## Minimum Steel Check :

As per clause 26.5.2.1 of IS 456:2000:

Minimum area of steel For Main Steel = 0.12 x C/S Area

= 150.000 mm$^2$

## Notes :

Extra steel at Top support is computed considering
the bent-ups,if any,coming from the adjoining span.
It is the maximum of the extra steel required
for each slab at that common support.

---

Slab Name : S2

Slab Type : TwoWay Slab
Grade of Concrete :M20
Grade of Steel : Fe500
Dimensions : Lx = 5.800 m ,Ly = 3.800 m ,Thickness= 125 mm
Span Ratio : Longer/Shorter = 1.526
Boundary Condition : One long edge discontinuous

**Loading on Slab :(Table 1)**

Total DL = (1) + (2) + (3)

| Self Weight (1) kN/m² | Floor Finish (2) kN/m² | Sunk Load (3) kN/m² | Total DL (4) kN/m² | Live Load (5) kN/m² | Total LL (6) kN/m² | Total Design Load 1.5 x [(4)+(6)] kN/m² |
|---|---|---|---|---|---|---|
| 3.125 | 1.000 | 0.000 | 4.125 | 2.000 | 2.000 | 9.188 |

**Deflection Check :(Table 2)**

As per clause 23.2.1 of IS 456:2000:

| (Span/Depth) Ratio | Modification Factor (a) | Basic Factor (b) | Permissible Ratio (a x b) | Status |
|---|---|---|---|---|
| 38.000 | 1.496 | 26.000 | 38.889 | OK |

**Moment And Steel Calculations :**

Coefficients ($\alpha_x$ and $\alpha_y$) are computed as per clause D-1.1 of IS 456:2000:

$M_x = \alpha_x \times W \times L_x \times L_x$:

$M_y = \alpha_y \times W \times L_x \times L_x$:

where

$M_x$,$M_y$ = moments on strips of unit width spanning $L_x$ and $L_y$ respectively,

W = Total Design Load = 9.188 kN/m$^2$

$L_x$ = Shorter span = 3.800 m

| Position | Moment Coeff.$\alpha_x$ or $\alpha_y$ | Moment kN-m | $A_{st_rqd}$ per metre mm² | Steel Detail dia @ spc mm c/c | $A_{st_prv}$ per metre mm² | Remark |
|---|---|---|---|---|---|---|
| MidShort | 0.052 | 6.878 | 164.908 | #8 @ 200 | 251.327 | Main |
| MidLong | 0.028 | 3.715 | 87.301 | #8 @ 200 | 251.327 | Other |
| SuppDown | 0.000 | 0.000 | 0.000 | -- | 0.000 | Extra at Top |
| SuppTop | 0.068 | 9.028 | 219.605 | #8 @ 200 | 251.327 | Extra at Top |
| SuppLeft | 0.037 | 4.909 | 116.220 | #8 @ 200 | 251.327 | Extra at Top |
| SuppRight | 0.037 | 4.909 | 116.220 | #8 @ 200 | 251.327 | Extra at Top |

**Minimum Steel Check :**

As per clause 26.5.2.1 of IS 456:2000:

Minimum area of steel For Main Steel = 0.12 x C/S Area

= 150.000 mm$^2$

**Notes :**

Extra steel at Top support is computed considering
the bent-ups,if any,coming from the adjoining span.
It is the maximum of the extra steel required
for each slab at that common support.

---

Slab Name : S3
Slab Type : TwoWay Slab
Grade of Concrete :M20
Grade of Steel : Fe500
Dimensions : Lx = 3.200 m ,Ly = 3.800 m ,Thickness= 125 mm
Span Ratio : Longer/Shorter = 1.188
Boundary Condition : One short and one long edge continuous

**Loading on Slab :(Table 1)**

Total DL = (1) + (2) + (3)

| Self Weight (1) kN/m² | Floor Finish (2) kN/m² | Sunk Load (3) kN/m² | Total DL (4) kN/m² | Live Load (5) kN/m² | Total LL (6) kN/m² | Total Design Load 1.5 x [(4)+(6)] kN/m² |
|---|---|---|---|---|---|---|
| 3.125 | 1.000 | 0.000 | 4.125 | 2.000 | 2.000 | 9.188 |

**Deflection Check :(Table 2)**

As per clause 23.2.1 of IS 456:2000:

**PROJECT : ss**
**PLAN : ji1**
**JOB NO. : 1** **REF. NO. :**
**DATE : 02/23/25** **TIME : 17:52:57**
**Building Version : 1.550** **STRUDS Version : 2.0.0**

## Beam Design Schedule Default Level: 6.000 m

| Beam Name | Size mm | Bottom Steel | | | | Top Steel | | | | | Stirrups | | | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Straight | Bent/Curt | Left At | Right At | Straight | Extra Left | Extra L1,L2 m | Extra Right | Extra L1,L2 m | Left Dia-Spc Nos | Mid Dia-Spc Nos | Right Dia-Spc Nos | |
| B1 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #16 + 1 - #12 | 0.612,1.450<br>0.612,1.450 | -- | #8-@ 250 10Nos (Total) | -- | --- |
| B2 | 230x375 | 5 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #10<br>--- | 2 - #16 + 1 - #12 | 0.612,1.450<br>0.612,1.450 | 2 - #12 + 2 - #10 | 1.450,0.800<br>1.450,0.800 | #8-@ 225 3Nos | #8-@ 250 22Nos | -- | --- |
| B3 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 2 - #12 + 2 - #10 | 1.450,0.800<br>1.450,0.800 | ---<br>--- | ---<br>--- | -- | #8-@ 250 14Nos (Total) | -- | --- |
| B4 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #12 + 1 - #10 | 0.612,0.213<br>0.612,0.213 | -- | #8-@ 250 10Nos (Total) | -- | --- |
| B5 | 230x375 | 3 - #20 + 2 - #12 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #20 + 2 - #12 | 2 - #12 + 1 - #10 | 0.612,0.213<br>0.612,0.213 | 3 - #16 + 3 - #12 | 0.213,0.825<br>0.213,0.825 | -- | #8-@ 125 8Nos (Total) | -- | --- |
| B6 | 230x375 | 4 - #25 + 4 - #16 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #20 + 4 - #12 | 3 - #16 + 3 - #12 | 0.213,0.825<br>0.213,0.825 | 4 - #12<br>--- | 0.825,0.060<br>--- | #12-@ 125 24Nos | #8-@ 0 0Nos | #8-@ 100 4 Nos | --- |
| B7 | 230x375 | 4 - #25 + 4 - #16 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #25 + 4 - #20 | 4 - #12<br>--- | 0.825,0.060<br>--- | ---<br>--- | ---<br>--- | #8-@ 200 2Nos | #8-@ 0 0Nos | #8-@ 225 1 Nos | --- |
| B8 | 230x375 | 8 - #20<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #25 + 4 - #20 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250 2Nos | #8-@ 125 10 Nos | --- |
| B9 | 230x375 | 3 - #20 + 2 - #16 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 125 8Nos (Total) | -- | --- |
| B10 | 230x375 | 3 - #25<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #25<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #10-@ 150 16Nos (Total) | -- | --- |
| B11 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 3 - #8<br>--- | 0.000,0.575<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250 10Nos (Total) | -- | --- |
| B12 | 230x375 | 2 - #12 + 2 - #10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250 6Nos (Total) | -- | --- |
| B13 | 230x375 | 6 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16 + 2 - #12 | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 0.500,0.637<br>--- | -- | #8-@ 250 9Nos (Total) | -- | --- |
| B14 | 230x375 | 2 - #25 + 2 - #16 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #20 + 2 - #12 | 2 - #12<br>--- | 0.500,0.637<br>--- | 2 - #12<br>--- | 0.637,0.013<br>--- | -- | #8-@ 250 2Nos | #8-@ 125 19 Nos | --- |
| B15 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #20 + 2 - #12 | 2 - #12<br>--- | 0.637,0.013<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250 2Nos (Total) | -- | --- |
| B16 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #8<br>--- | 0.575,0.250<br>--- | -- | #8-@ 250 10Nos (Total) | -- | --- |
| B17 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16 + 1 - #12 | 2 - #8<br>--- | 0.575,0.250<br>--- | 4 - #12<br>--- | 0.250,0.325<br>--- | -- | #8-@ 250 5Nos (Total) | -- | --- |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B18 | 230x375 | 3 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #20<br>+ 2 -<br>#12 | 4 - #12<br>--- | 0.250,0.325<br>--- | ---<br>--- | ---<br>--- | #10-@<br>125<br>10Nos | #8-@ 0<br>0Nos | #8-@<br>100<br>2 Nos | --- |
| B19 | 230x375 | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>+ 2 -<br>#10 | 2 - #10<br>--- | 0.000,0.575<br>--- | ---<br>--- | ---<br>--- | #8-@<br>225<br>3Nos | #8-@ 250<br>8Nos | -- | --- |
| B20 | 230x375 | 4 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>14Nos | #8-@<br>200<br>5 Nos | --- |
| B21 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>3Nos<br>(Total) | -- | --- |
| B22 | 230x375 | 4 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #16<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>+ 1 -<br>#12 | 0.575,1.600<br>0.575,1.600 | -- | #8-@ 250<br>10Nos<br>(Total) | -- | --- |
| B23 | 230x450 | 3 - #20<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #16<br>--- | 2 - #16<br>+ 1 -<br>#12 | 0.575,1.600<br>0.575,1.600 | ---<br>--- | ---<br>--- | #8-@<br>125<br>16Nos | #8-@ 300<br>13Nos | #8-@<br>275<br>3 Nos | --- |
| B24 | 230x450 | 3 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 3 - #8<br>--- | 0.000,1.525<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>22Nos<br>(Total) | -- | --- |
| B25 | 230x450 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 150<br>3Nos<br>(Total) | -- | --- |
| B26 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B27 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>10Nos<br>(Total) | -- | --- |
| B28 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B29 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>5Nos<br>(Total) | -- | --- |
| B30 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>6Nos<br>(Total) | -- | --- |
| B31 | 230x450 | 5 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>22Nos<br>(Total) | -- | --- |
| B32 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 0.275,0.058<br>--- | -- | #8-@ 250<br>5Nos<br>(Total) | -- | --- |
| B33 | 230x375 | 2 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 3 -<br>#12 | 2 - #12<br>--- | 0.275,0.058<br>--- | 2 - #12<br>--- | 0.058,0.875<br>--- | -- | #8-@ 225<br>1Nos | #8-@<br>250<br>1 Nos | --- |
| B34 | 230x450 | 2 - #25<br>+ 2 -<br>#20 | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 3 -<br>#12 | 2 - #12<br>--- | 0.058,0.875<br>--- | ---<br>--- | ---<br>--- | #8-@<br>100<br>25Nos | #8-@ 300<br>5Nos | -- | --- |
| B35 | 230x450 | 4 - #20<br>+ 2 -<br>#16 | ---<br>--- | ---<br>--- | ---<br>--- | 6 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>4Nos | #8-@<br>100<br>24 Nos | --- |
| B36 | 230x450 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 6 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>2Nos<br>(Total) | -- | --- |
| B37 | 230x450 | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #16<br>+ 4 -<br>#12 | 2 - #8<br>--- | 0.000,0.453<br>--- | ---<br>--- | ---<br>--- | #8-@<br>125<br>10Nos | #8-@ 0<br>0Nos | #8-@<br>175<br>1 Nos | --- |
| B38 | 230x450 | 4 - #25<br>+ 2 -<br>#16 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #20<br>+ 2 -<br>#16 | ---<br>--- | ---<br>--- | 3 - #10<br>--- | 0.875,0.825<br>--- | #8-@<br>150<br>10Nos | #8-@ 300<br>8Nos | -- | --- |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B39 | 230x450 | 4 - #25<br>+ 2 -<br>#20 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #25<br>+ 4 -<br>#20 | 3 - #10<br>--- | 0.875,0.825<br>--- | 3 - #8<br>--- | 0.825,0.525<br>--- | -- | #10-@ 100<br>34Nos<br>(Total) | -- | --- |
| B40 | 230x375 | 3 - #20<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #25<br>+ 4 -<br>#20 | 3 - #8<br>--- | 0.825,0.525<br>--- | ---<br>--- | ---<br>--- | #8-@<br>125<br>16Nos | #8-@ 0<br>0Nos | #8-@<br>250<br>1 Nos | --- |
| B41 | 230x375 | 2 - #10<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B42 | 230x450 | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #10<br>+ 1 -<br>#12 | 2 - #12<br>+ 2 -<br>#10 | 0.000,0.695<br>0.000,0.695 | ---<br>--- | ---<br>--- | #8-@<br>200<br>5Nos | #8-@ 300<br>7Nos | -- | --- |
| B43 | 230x450 | 3 - #16<br>+ 3 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 6 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>13Nos | #8-@<br>150<br>11 Nos | --- |
| B44 | 230x375 | 3 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 6 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B45 | 230x375 | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #8<br>--- | 0.900,0.000<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B46 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #10<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 0.695,0.000<br>--- | -- | #8-@ 250<br>13Nos<br>(Total) | -- | --- |
| B47 | 230x375 | 3 - #20<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | 2 - #16<br>+ 1 -<br>#12 | 0.000,0.906<br>0.000,0.906 | 2 - #8<br>--- | 0.906,0.906<br>--- | #8-@<br>125<br>14Nos | #8-@ 250<br>2Nos | -- | --- |
| B48 | 230x375 | 3 - #16<br>+ 3 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | 2 - #8<br>--- | 0.906,0.906<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>8Nos<br>(Total) | -- | --- |
| B49 | 230x375 | 2 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>4Nos | #8-@<br>225<br>3 Nos | --- |
| B50 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #10<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | 3 - #8<br>--- | 0.400,0.525<br>--- | -- | #8-@ 250<br>7Nos<br>(Total) | -- | --- |
| B51 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>+ 1 -<br>#10 | 3 - #8<br>--- | 0.400,0.525<br>--- | 2 - #8<br>--- | 0.525,0.900<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B52 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #10<br>--- | 2 - #8<br>--- | 0.525,0.900<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B53 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B54 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 3 - #10<br>--- | 0.950,1.312<br>--- | -- | #8-@ 250<br>16Nos<br>(Total) | -- | --- |
| B55 | 230x375 | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | 3 - #10<br>--- | 0.950,1.312<br>--- | 2 - #12<br>--- | 1.312,1.550<br>--- | -- | #8-@ 250<br>22Nos<br>(Total) | -- | --- |
| B56 | 230x450 | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | 2 - #12<br>--- | 1.312,1.550<br>--- | 2 - #8<br>--- | 1.550,1.055<br>--- | -- | #8-@ 300<br>19Nos | #8-@<br>275<br>3 Nos | --- |
| B57 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | 2 - #8<br>--- | 1.550,1.055<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>18Nos<br>(Total) | -- | --- |
| B58 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B59 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>3Nos<br>(Total) | -- | --- |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B60 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #10<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B61 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #10<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>13Nos<br>(Total) | -- | --- |
| B62 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B63 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>12Nos<br>(Total) | -- | --- |
| B64 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #8<br>--- | 0.875,0.000<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B65 | 230x375 | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>--- | 3 - #10<br>--- | 0.000,0.725<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>13Nos<br>(Total) | -- | --- |
| B66 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 3 - #8<br>--- | 0.500,1.050<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B67 | 230x375 | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 3 - #8<br>--- | 0.500,1.050<br>--- | 3 - #8<br>--- | 1.050,0.875<br>--- | -- | #8-@ 250<br>18Nos<br>(Total) | -- | --- |
| B68 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 3 - #8<br>--- | 1.050,0.875<br>--- | 2 - #8<br>--- | 0.875,0.180<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B69 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #10<br>+ 1 -<br>#12 | 2 - #8<br>--- | 0.875,0.180<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>4Nos<br>(Total) | -- | --- |
| B70 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>10Nos<br>(Total) | -- | --- |
| B71 | 230x375 | 2 - #10<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #8<br>--- | 0.950,0.000<br>--- | -- | #8-@ 250<br>16Nos<br>(Total) | -- | --- |
| B72 | 230x375 | 2 - #12<br>+ 1 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | 2 - #10<br>+ 1 -<br>#12 | 0.688,0.038<br>0.688,0.038 | -- | #8-@ 250<br>12Nos<br>(Total) | -- | --- |
| B73 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>+ 2 -<br>#12 | 2 - #10<br>+ 1 -<br>#12 | 0.688,0.038<br>0.688,0.038 | ---<br>--- | ---<br>--- | -- | #8-@ 100<br>3Nos<br>(Total) | -- | --- |
| B74 | 230x375 | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 4 - #12<br>--- | 0.000,1.000<br>--- | ---<br>--- | ---<br>--- | #8-@<br>225<br>2Nos | #8-@ 250<br>15Nos | -- | --- |
| B75 | 230x375 | 2 - #12<br>+ 2 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 150<br>9Nos<br>(Total) | -- | --- |
| B76 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | 3 - #8<br>--- | 0.313,0.500<br>--- | -- | #8-@ 250<br>6Nos<br>(Total) | -- | --- |
| B77 | 230x375 | 2 - #10<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 1 -<br>#12 | 3 - #8<br>--- | 0.313,0.500<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>9Nos<br>(Total) | -- | --- |
| B78 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>6Nos<br>(Total) | -- | --- |
| B79 | 230x375 | 4 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 1.000,0.000<br>--- | -- | #8-@ 250<br>15Nos | #8-@<br>200<br>2 Nos | --- |
| B80 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | 2 - #8<br>--- | 0.725,0.850<br>--- | -- | #8-@ 250<br>13Nos<br>(Total) | -- | --- |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B81 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 2 - #8<br>--- | 0.725,0.850<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B82 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | 3 - #8<br>--- | 0.725,0.300<br>--- | -- | #8-@ 250<br>13Nos<br>(Total) | -- | --- |
| B83 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 5 - #12<br>--- | 3 - #8<br>--- | 0.725,0.300<br>--- | ---<br>--- | ---<br>--- | #8-@<br>200<br>5Nos | #8-@ 250<br>2Nos | -- | --- |
| B84 | 230x375 | 3 - #20<br>+ 2 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #16<br>+ 1 -<br>#12 | 2 - #16<br>+ 2 -<br>#12 | 0.000,0.950<br>0.000,0.950 | ---<br>--- | ---<br>--- | #8-@<br>125<br>13Nos | #8-@ 250<br>10Nos | -- | --- |
| B85 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #10<br>+ 1 -<br>#12 | 2 - #12<br>+ 1 -<br>#10 | 0.000,0.775<br>0.000,0.775 | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>14Nos<br>(Total) | -- | --- |
| B86 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>15Nos<br>(Total) | -- | --- |
| B87 | 230x450 | 3 - #20<br>+ 3 -<br>#16 | ---<br>--- | ---<br>--- | ---<br>--- | 5 - #12<br>--- | 3 - #16<br>+ 1 -<br>#12 | 0.000,1.050<br>0.000,1.050 | 2 - #10<br>+ 1 -<br>#12 | 1.050,0.906<br>1.050,0.906 | #8-@<br>125<br>17Nos | #8-@ 300<br>8Nos | -- | --- |
| B88 | 230x450 | 3 - #20<br>+ 3 -<br>#16 | ---<br>--- | ---<br>--- | ---<br>--- | 3 - #20<br>+ 2 -<br>#12 | 2 - #10<br>+ 1 -<br>#12 | 1.050,0.906<br>1.050,0.906 | 3 - #8<br>--- | 0.875,0.000<br>--- | -- | #8-@ 300<br>4Nos | #8-@<br>125<br>20 Nos | --- |
| B89 | 230x375 | 3 - #16<br>+ 3 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>+ 1 -<br>#10 | 2 - #8<br>--- | 0.000,0.825<br>--- | 2 - #16<br>+ 1 -<br>#12 | 0.825,0.453<br>0.825,0.453 | -- | #8-@ 250<br>14Nos<br>(Total) | -- | --- |
| B90 | 230x375 | 3 - #16<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #16<br>+ 4 -<br>#12 | 2 - #16<br>+ 1 -<br>#12 | 0.825,0.453<br>0.825,0.453 | ---<br>--- | ---<br>--- | -- | #8-@ 100<br>8Nos<br>(Total) | -- | --- |
| B91 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | 2 - #12<br>+ 1 -<br>#10 | 0.000,0.813<br>0.000,0.813 | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>14Nos<br>(Total) | -- | --- |
| B92 | 230x450 | 2 - #10<br>+ 1 -<br>#12 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 2 - #8<br>--- | 0.000,0.850<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>13Nos<br>(Total) | -- | --- |
| B93 | 230x450 | 4 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>6Nos<br>(Total) | -- | --- |
| B94 | 230x450 | 4 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 4 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 300<br>9Nos<br>(Total) | -- | --- |
| B95 | 230x375 | 2 - #12<br>+ 1 -<br>#10 | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>16Nos<br>(Total) | -- | --- |
| B96 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>13Nos<br>(Total) | -- | --- |
| B97 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>3Nos<br>(Total) | -- | --- |
| B98 | 230x375 | 2 - #16<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 2 - #8<br>--- | 0.000,1.225<br>--- | 2 - #12<br>--- | 1.225,0.650<br>--- | -- | #8-@ 250<br>20Nos<br>(Total) | -- | --- |
| B99 | 230x375 | 2 - #12<br>--- | ---<br>--- | ---<br>--- | ---<br>--- | 2 - #12<br>--- | 2 - #12<br>--- | 1.225,0.650<br>--- | ---<br>--- | ---<br>--- | -- | #8-@ 250<br>12Nos<br>(Total) | -- | --- |

Dr. L.RAMAJEYAM
M.E., Ph.D, F.I.E., F.I.V., C.Eng.(Ind),
Registered Structural Engineer & Chartered Engineer
CMDA - Reg. No. SE/GR-I/19/03/023 on 22.03.2019
GCC-Grade-I, Reg.No.RSE1000220019 dated 30.09.2019
11, 8th Avenue, [illegible]

**PROJECT : ss**
**PLAN : ji1**
**JOB NO. : 1** **REF. NO. :**
**DATE : 02/23/25** **TIME : 17:55:20**
**Building Version : 1.550** **STRUDS Version : 2.0.0**

# Beam Detail Report

## ff - Default Level

**Design load combination : 1.50 DL + 1.50 LL**
**Design of Beam Group : BG1**
Beam : B1

**Material Properties :**
fck = 20.000 N/mmB
fy = 500.000 N/mmB

**1.Design Data :**
1.1)Dimensions:
Beam Type = 'Rectangular Beam'
Width (b) = 230 mm
Total depth (D) = 375 mm
Effective Tension Cover = 33mm
Effective Compression Cover = 33mm
Effective side Cover = 25mm
Effective depth (d) = 342mm
Span (L) = 2.450m

**1.2)Loading on the Beam :**
1.2.1)Self wt. of beam : -2.156 kN/m
1.2.2)Slab Load
Dead Load :
Triangular Load in kN/m
St.Pt 0.000 m L = 2.450 m Max. Value = -5.053 kN/m
LiveLoad
Triangular Load in kN/m
St.Pt 0.000 m L = 2.450 m Max. Value = -2.450 kN/m

1.2.3)Wall Load
UDL in kN/m
St.Pt 0.000 m L = 2.450 m Max. Value = -13.110 kN/m

**2.Computation of Area of steel :**
2.1) Flexural Steel at Top and Bottom
2.1.1)Computation of theoretical steel

| At length | 0.000L | 0.100L | 0.200L | 0.300L | 0.400L | 0.500L | 0.600L | 0.700L | 0.800L | 0.900L | 1.000L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B.M. Hog in kN-m | 21.959 | 19.035 | 12.560 | 7.730 | 4.680 | 3.545 | 4.415 | 7.199 | 11.764 | 17.973 | 20.795 |
| B.M. Sag in kN-m | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Torsion in kN-m | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 | 0.834 |
| Eq.B.M.Hog in kN-m | 21.959 | 19.035 | 12.560 | 7.730 | 4.680 | 3.545 | 4.415 | 7.199 | 11.764 | 17.973 | 20.795 |
| Eq.B.M.Sag in kN-m | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Top $A_{st_req}$ in mmB | 155.268 | 133.625 | 86.823 | 52.848 | 31.779 | 24.010 | 29.959 | 49.161 | 81.169 | 125.847 | 146.610 |
| Bot $A_{st_req}$ in mmB | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Max.Area of steel req. at Top = 155.268 mmB at 0.000L
Max.Area of steel req. at Bottom = 0.000 mmB at 0.000L
2.1.2)Minimum and Maximum Steel Checks :
a)Minimum Steel Check as per IS 456:2000 Clause 26.5.1.1(a)
$A_{st}$ = (0.85 x b x d) / $f_y$
= 133.722 mmB
b)Maximum Steel Check as per IS 456:2000 Clause 26.5.1.1(b)
$A_{st}$ = 0.04 x b x D
= 3450.000 mmB
2.1.3)Provided Steel
2.1.3.1)Provided Bottom Steel :
Straight bars = 2 - #12
BentUp bars = ---
Total Area of Steel at bottom at 0.000L = 226.195 mmB > $A_{st_req.}$ (O.K.)
2.1.3.2)Provided Top Steel :
Straight bars = 2 - #12
Extra bars at Left = ---
Extra bars at Right = 2 - #16 0.612,1.450 +1 - #12 0.612,1.450
Total Area of Steel at Top
At Left Support = 226.195 mmB
At Right Support = 741.416 mmB
2.2)Computation of Shear Reinforcement(Stirrups) :
$\tau_{auc}$ = 0.609 N/mmB
$S_{vmin}$ = 257 mm
Note :
Design Shear = (Equivalent S.F.)-($V_{uc}$)
2.2.1) Computation of Steel

| At length | 0.000L | 0.100L | 0.200L | 0.300L | 0.400L | 0.500L | 0.600L | 0.700L | 0.800L | 0.900L | 1.000L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S.F.in kN | 31.949 | 29.601 | 23.163 | 16.174 | 8.634 | 0.542 | -7.550 | -15.091 | -22.080 | -28.518 | -30.865 |
| $T_u$ in kN-m | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 | -0.834 |
| Vuc in kN | 29.986 | 29.986 | 29.986 | 29.986 | 29.986 | 29.986 | 29.986 | 29.986 | 47.934 | 47.934 | 47.934 |
| Design Shear in kN | 1.963 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Spacing req. in mm for 8 Dia | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 |

2.2.2)Provided Shear Steel (Stirrups) :
Nominal Zone :#8 @ 250 mm c/c from 0.000 to 2.250 .
Note : Nominal zone is where No Shear Reinforcement is needed.
Hence provide minimum Shear Reinforcement of 0.75 d
(As per Clause 26.5.1.5 of IS 456:2000)

**Design of Beam Group : BG2**

Beam : B2

**Material Properties :**

fck = 20.000 N/mmB
fy = 500.000 N/mmB

**1.Design Data :**

1.1)Dimensions:
Beam Type = 'Rectangular Beam'
Width (b) = 230 mm
Total depth (D) = 375 mm
Effective Tension Cover = 33mm
Effective Compression Cover = 33mm
Effective side Cover = 25mm
Effective depth (d) = 342mm



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