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DIGITALLY VERIFIED RECORD

Innovative Design
(Structural Consultant)
No.4, KR Garden,Lunan nagar
Edayarpalayam,
Coimbatore-641 025
E-mail – civillogu@gmail.com

Date: 18.07.2025

STABILITY CERTIFICATE

1.The detailed engineering and structure design of the proposed building comprising of **Stilt+5 floors** at (OLD S.No: 194/3pt at Ammapalayam village) **WARD- 'A' BLOCK -12 ,TS No: 15/26** at Jagir Ammapalayam Village ,Salem City municipal Corporation Limit ,Salem District has been done by me/us based on the report of geotechnical investigation (soil test) done by **Surrya Builders. 2024-2025 01/015** dated **19-01-2024** and considering the functional requirement of the building.

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

3. I/We further certify that:

(i) The minimum grade of concrete is M25.

(ii) The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS 875 Part 1&2 and design of earthquake resistant structure as per IS Code 1893 Part 1

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

Stamp and Signature

Encl.: Structural Design Calculation

R. LOGANATHAN M.E.,(Str.) M.I.E.,
Chartered Engineer (M 163362-1)
Coimbatore LPA/SE/GR-I/014/2024
No. 4, K.R. Garden Ext, Luna Nagar,
Edayarpalayam (Post), Coimbatore - 641 025.
Tamilnadu - India.

Client	**MR.SIDESH KUMAR**
Project	PROPOSED APARTMENT BUILDING, Salem.
Structural Consultant	**INNOVATIVE DESIGN Structural Consultants** Coimbatore - 641025
Title :	Design Report

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Chapter 1

1.1 INTRODUCTION:-

The purpose of this report is to outline the design philosophy and loading calculation along with analysis and design of the proposed Apartment building at the Salem.

The building includes the size of 24.81 m x 30.18 m.

1.2 General

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

1.3 Scope

The structure is a slit, ground and four floor for residential area. This report presents details of structural analysis and design of the structure. The sizes and details of the sections of structural elements are based on detailed analysis. This report specifies the details of structural layout, mathematical model, material properties, loads , load combinations and design of members.

Chapter 2

LOADS & LOAD COMBINATIONS

2.1 General

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

2.2.1 Dead load (DL)

This comprises of self-weight of various structural elements indicated below:

- Self-weight of columns and Beam members.of the modeled elements is calculated by STAAD Pro through SELF WEIGHT command.

- Self-weight of slab, floor finish and wall is applied explicitly as floor and member load.

Slab load :-

Slab load (125mm Tk) - 0.125x25 = 3.125 kN/sq.m,

Floor finish = 1.5 kN/sq.m,

Total load = 4.625 kN/sq.m.

2.2.2 Live Loads (LL)

Loads are considered slab area is 2.0 kN/sq.m.

2.3 LOAD COMBINATIONS

2.3.1 LOAD NAME AND COMBINATIONS ADOPTED FOR DESIGN

Number	Name	Type
1	DEAD LOAD	Dead
2	LIVE LOAD	Live Load

Strength combination:-

Comb	Combination L/C Name	Primary	Primary L/C Name	Factor
3	1.5(D.L+L.L)	1	DEAD LOAD	1.5
		2	LIVE LOAD	1.5

Serviceability combination:-

Comb	Combination L/C Name	Primary	Primary L/C Name	Factor
4	1.0(D.L+L.L)	1	DEAD LOAD	1.0
		2	LIVE LOAD	1.0

Chapter 3

ANALYSIS

3.1 General

The analysis of the structure is carried out by mathematical modeling of the structure in STAAD Pro and performing an analysis run.

3.2 Mathematical Modeling of Structure

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

Chapter 4

DESIGN OF MEMBERS

4.1 General

Elements are designed as per IS: 456-2000 for combination of loads in the analysis of STAAD Pro.

Chapter 5

Analysis and Design

STAAD SPACE

START JOB INFORMATION

ENGINEER DATE 07-Oct-24

END JOB INFORMATION

INPUT WIDTH 79

UNIT METER KN

JOINT COORDINATES

1 0 -3 0; 2 2.35 -3 0; 3 7.4 -3 0; 4 13.35 -3 0; 5 16.9 -3 0; 6 2.35 -3 12;

7 7.4 -3 12; 8 13.35 -3 12; 9 16.9 -3 12; 10 0 -3 10.05; 11 -3.4 -3 14.55;

12 -0.9 -3 14.55; 13 4.2 -3 14.55; 14 10.4 -3 14.55; 15 13.4 -3 14.55;

16 10.4 -3 16.65; 17 13.4 -3 16.65; 18 16.9 -3 16.65; 19 4.2 -3 17.65;

20 8.3 -3 17.65; 21 11.7 -3 17.65; 22 4.2 -3 24.7; 23 8.3 -3 28.05;

24 11.7 -3 28.05; 25 16.9 -3 28.05; 26 -3.4 -3 24.7; 27 -0.9 -3 24.7; 28 0 0 0;

29 2.35 0 0; 30 7.4 0 0; 31 13.35 0 0; 32 16.9 0 0; 33 2.35 0 12; 34 7.4 0 12;

35 13.35 0 12; 36 16.9 0 12; 37 0 0 10.05; 38 -3.4 0 14.55; 39 -0.9 0 14.55;

40 4.2 0 14.55; 41 10.4 0 14.55; 42 13.4 0 14.55; 43 10.4 0 16.65;

44 13.4 0 16.65; 45 16.9 0 16.65; 46 4.2 0 17.65; 47 8.3 0 17.65;

48 11.7 0 17.65; 49 4.2 0 24.7; 50 8.3 0 28.05; 51 11.7 0 28.05;

52 16.9 0 28.05; 53 -3.4 0 24.7; 54 -0.9 0 24.7; 55 0 3.2 0; 56 2.35 3.2 0;

57 7.4 3.2 0; 58 13.35 3.2 0; 59 16.9 3.2 0; 60 2.35 3.2 12; 61 7.4 3.2 12;

62 13.35 3.2 12; 63 16.9 3.2 12; 64 0 3.2 10.05; 65 -3.4 3.2 14.55;

66 -0.9 3.2 14.55; 67 4.2 3.2 14.55; 68 10.4 3.2 14.55; 69 13.4 3.2 14.55;

70 10.4 3.2 16.65; 71 13.4 3.2 16.65; 72 16.9 3.2 16.65; 73 4.2 3.2 17.65;

74 8.3 3.2 17.65; 75 11.7 3.2 17.65; 76 4.2 3.2 24.7; 77 8.3 3.2 28.05;

78 11.7 3.2 28.05; 79 16.9 3.2 28.05; 80 -3.4 3.2 24.7; 81 -0.9 3.2 24.7;

82 0 6.4 0; 83 2.35 6.4 0; 84 7.4 6.4 0; 85 13.35 6.4 0; 86 16.9 6.4 0;

87 2.35 6.4 12; 88 7.4 6.4 12; 89 13.35 6.4 12; 90 16.9 6.4 12; 91 0 6.4 10.05;

92 -3.4 6.4 14.55; 93 -0.9 6.4 14.55; 94 4.2 6.4 14.55; 95 10.4 6.4 14.55;

96 13.4 6.4 14.55; 97 10.4 6.4 16.65; 98 13.4 6.4 16.65; 99 16.9 6.4 16.65;

100 4.2 6.4 17.65; 101 8.3 6.4 17.65; 102 11.7 6.4 17.65; 103 4.2 6.4 24.7;

104 8.3 6.4 28.05; 105 11.7 6.4 28.05; 106 16.9 6.4 28.05; 107 -3.4 6.4 24.7;

108 -0.9 6.4 24.7; 109 0 9.6 0; 110 2.35 9.6 0; 111 7.4 9.6 0; 112 13.35 9.6 0;

113 16.9 9.6 0; 114 2.35 9.6 12; 115 7.4 9.6 12; 116 13.35 9.6 12;

117 16.9 9.6 12; 118 0 9.6 10.05; 119 -3.4 9.6 14.55; 120 -0.9 9.6 14.55;

121 4.2 9.6 14.55; 122 10.4 9.6 14.55; 123 13.4 9.6 14.55; 124 10.4 9.6 16.65;

125 13.4 9.6 16.65; 126 16.9 9.6 16.65; 127 4.2 9.6 17.65; 128 8.3 9.6 17.65;

129 11.7 9.6 17.65; 130 4.2 9.6 24.7; 131 8.3 9.6 28.05; 132 11.7 9.6 28.05;

133 16.9 9.6 28.05; 134 -3.4 9.6 24.7; 135 -0.9 9.6 24.7; 136 0 12.8 0;

137 2.35 12.8 0; 138 7.4 12.8 0; 139 13.35 12.8 0; 140 16.9 12.8 0;

141 2.35 12.8 12; 142 7.4 12.8 12; 143 13.35 12.8 12; 144 16.9 12.8 12;

145 0 12.8 10.05; 146 -3.4 12.8 14.55; 147 -0.9 12.8 14.55; 148 4.2 12.8 14.55;

149 10.4 12.8 14.55; 150 13.4 12.8 14.55; 151 10.4 12.8 16.65;

152 13.4 12.8 16.65; 153 16.9 12.8 16.65; 154 4.2 12.8 17.65;

155 8.3 12.8 17.65; 156 11.7 12.8 17.65; 157 4.2 12.8 24.7; 158 8.3 12.8 28.05;

159 11.7 12.8 28.05; 160 16.9 12.8 28.05; 161 -3.4 12.8 24.7;

162 -0.9 12.8 24.7; 163 0 16 0; 164 2.35 16 0; 165 7.4 16 0; 166 13.35 16 0;

167 16.9 16 0; 168 2.35 16 12; 169 7.4 16 12; 170 13.35 16 12; 171 16.9 16 12;

172 0 16 10.05; 173 -3.4 16 14.55; 174 -0.9 16 14.55; 175 4.2 16 14.55;

176 10.4 16 14.55; 177 13.4 16 14.55; 178 10.4 16 16.65; 179 13.4 16 16.65;

180 16.9 16 16.65; 181 4.2 16 17.65; 182 8.3 16 17.65; 183 11.7 16 17.65;

184 4.2 16 24.7; 185 8.3 16 28.05; 186 11.7 16 28.05; 187 16.9 16 28.05;

188 -3.4 16 24.7; 189 -0.9 16 24.7; 190 0 19.2 0; 191 2.35 19.2 0;

192 7.4 19.2 0; 193 13.35 19.2 0; 194 16.9 19.2 0; 195 2.35 19.2 12;

196 7.4 19.2 12; 197 13.35 19.2 12; 198 16.9 19.2 12; 199 0 19.2 10.05;

200 -3.4 19.2 14.55; 201 -0.9 19.2 14.55; 202 4.2 19.2 14.55;

203 10.4 19.2 14.55; 204 13.4 19.2 14.55; 205 10.4 19.2 16.65;

206 13.4 19.2 16.65; 207 16.9 19.2 16.65; 208 4.2 19.2 17.65;

209 8.3 19.2 17.65; 210 11.7 19.2 17.65; 211 4.2 19.2 24.7; 212 8.3 19.2 28.05;

213 11.7 19.2 28.05; 214 16.9 19.2 28.05; 215 -3.4 19.2 24.7;

216 -0.9 19.2 24.7; 219 -0.9 0 12; 221 0 0 12; 222 16.9 0 17.65;

224 11.7 0 16.65; 225 8.8 0 14.55; 226 8.8 0 17.65; 228 -0.9 3.2 12;

230 8.8 3.2 14.55; 231 8.8 3.2 17.65; 232 11.7 3.2 16.65; 233 -1.22 3.2 0;

236 2.35 3.2 10.05; 239 -0.9 3.2 10.05; 240 -2.15 3.2 10.05; 241 0 3.2 6.63;

242 2.35 3.2 6.63; 244 -1.22 3.2 6.63; 245 -2.15 3.2 6.63; 252 0 3.2 5.12;

253 2.35 3.2 5.12; 254 13.35 3.2 5.12; 255 16.9 3.2 5.12; 256 7.4 3.2 5.12;

258 -1.22 3.2 5.12; 259 8.75 3.2 0; 260 8.75 3.2 5.12; 268 18.55 3.2 5.12;

272 16.9 3.2 14.55; 273 18.55 3.2 14.55; 274 18.55 3.2 12; 275 10 3.2 5.12;

276 10 3.2 12; 277 10 3.2 7.12; 278 13.35 3.2 7.12; 279 -4.45 3.2 14.55;

280 -5.65 3.2 24.7; 282 -0.9 3.2 21.1; 283 -3.4 3.2 21.1; 284 -5.65 3.2 21.1;

285 -4.45 3.2 21.1; 286 -2.15 3.2 14.55; 287 -4.45 3.2 13.8;

288 -2.15 3.2 13.8; 290 -0.9 3.2 19.45; 291 -3.4 3.2 19.45;

292 -4.45 3.2 19.45; 293 4.2 3.2 19.75; 294 -0.9 3.2 19.75; 296 0.9 3.2 24.7;

297 0.9 3.2 19.75; 298 0.9 3.2 22.1; 299 -0.9 3.2 22.1; 300 3.2 3.2 24.7;

301 0.9 3.2 25.45; 302 3.2 3.2 25.45; 303 10.4 3.2 17.65; 304 8.3 3.2 23.3;

307 11.7 3.2 23.3; 308 8.3 3.2 24.95; 309 11.7 3.2 24.95; 310 8.3 3.2 28.8;

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315 13.2 3.2 28.8; 316 16.9 3.2 29.6; 317 13.2 3.2 29.6; 318 11.7 3.2 23.8;

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325 7.4 19.2 5.12; 360 16.9 19.2 5.12; 408 7.4 6.4 5.12; 443 16.9 6.4 5.12;

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1048 0.9 19.2 19.75; 1049 0.9 19.2 22.1; 1050 0.9 19.2 24.7;

1051 0.9 19.2 25.45; 1052 2.35 19.2 5.12; 1053 2.35 19.2 6.63;

1054 2.35 19.2 10.05; 1055 3.2 19.2 24.7; 1056 3.2 19.2 25.45;

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1063 8.3 19.2 28.8; 1064 8.75 19.2 0; 1065 8.75 19.2 5.12; 1066 8.3 19.2 23.3;

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1107 -0.9 6.4 10.05; 1108 -1.22 6.4 0; 1109 -1.22 6.4 5.12; 1110 -0.9 6.4 12;

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1123 3.2 6.4 25.45; 1124 4.2 6.4 19.75; 1125 4.2 6.4 12; 1126 8.8 6.4 14.55;

1127 6.9 6.4 24.95; 1128 6.9 6.4 28.8; 1129 8.3 6.4 24.95; 1130 8.3 6.4 28.8;

1131 8.75 6.4 0; 1132 8.75 6.4 5.12; 1133 8.3 6.4 23.3; 1134 8.8 6.4 17.65;

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1142 11.7 6.4 16.65; 1143 13.35 6.4 5.12; 1144 13.35 6.4 7.12;

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1196 8.3 9.6 24.95; 1197 8.3 9.6 28.8; 1198 8.75 9.6 0; 1199 8.75 9.6 5.12;

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1225 18.55 9.6 14.55; 1226 -5.65 12.8 24.7; 1227 -5.65 12.8 21.1;

1228 -4.45 12.8 21.1; 1229 -4.45 12.8 14.55; 1230 -4.45 12.8 13.8;

1231 -4.45 12.8 19.45; 1232 -3.4 12.8 19.45; 1233 -3.4 12.8 21.1;

1234 -2.15 12.8 13.8; 1235 -2.15 12.8 14.55; 1236 -2.15 12.8 6.63;

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1240 -1.22 12.8 6.63; 1241 -0.9 12.8 10.05; 1242 -1.22 12.8 0;

1243 -1.22 12.8 5.12; 1244 -0.9 12.8 12; 1245 -0.9 12.8 19.75;

1246 -0.9 12.8 22.1; 1247 0 12.8 5.12; 1248 0 12.8 6.63; 1249 0.9 12.8 19.75;

1250 0.9 12.8 22.1; 1251 0.9 12.8 24.7; 1252 0.9 12.8 25.45;

1253 2.35 12.8 5.12; 1254 2.35 12.8 6.63; 1255 2.35 12.8 10.05;

1256 3.2 12.8 24.7; 1257 3.2 12.8 25.45; 1258 4.2 12.8 19.75; 1259 4.2 12.8 12;

1260 8.8 12.8 14.55; 1261 6.9 12.8 24.95; 1262 6.9 12.8 28.8;

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START GROUP DEFINITION

FLOOR

_SUNKEN 352 354 355 357 363 364 370 374 375 377 379 380 383 386 387 390 393 -
394 399 416 420 421 423 428 433 435 436 443 444 448 449 451 452 455 456 459 -
462 473 481 482 485 493 495 496 498 504 505 511 515 516 518 520 521 524 527 -
528 531 534 535 540 557 561 562 564 569 574 576 577 584 585 589 590 592 593 -
596 597 600 603 614 622 623 626 634 636 637 639 645 646 652 656 657 659 661 -
662 665 668 669 672 675 676 681 698 702 703 705 710 715 717 718 725 726 730 -
731 733 734 737 738 741 744 755 763 764 767 775 777 778 780 786 787 793 797 -
798 800 802 803 806 809 810 813 816 817 822 839 843 844 846 851 856 858 859 -
866 867 871 872 874 875 878 879 882 885 896 904 905 908 916 918 919 921 927 -
928 934 938 939 941 943 944 947 950 951 954 957 958 963 980 984 985 987 992 -
997 999 1000 1007 1008 1012 1013 1015 1016 1019 1020 1023 1026 1037 1045 -
1046 1049

END GROUP DEFINITION

DEFINE MATERIAL START

ISOTROPIC CONCRETE

E 2.17185e+07

POISSON 0.17

DENSITY 23.5616

ALPHA 1e-05

DAMP 0.05

G 9.28139e+06

TYPE CONCRETE

STRENGTH FCU 27579

END DEFINE MATERIAL

MEMBER PROPERTY

115 TO 138 PRIS YD 0.38 ZD 0.23

300 304 306 312 314 321 332 335 345 346 356 TO 358 373 TO 377 382 TO 384 422 -

423 TO 425 447 TO 452 497 TO 499 514 TO 518 523 TO 525 563 TO 566 588 TO 593 -

638 TO 640 655 TO 659 664 TO 666 704 TO 707 729 TO 734 779 TO 781 -

796 TO 800 805 TO 807 845 TO 848 870 TO 875 920 TO 922 937 TO 941 -

946 TO 948 986 TO 989 1011 TO 1016 1061 TO 1063 1078 TO 1082 1087 TO 1089 -

1127 TO 1130 1152 TO 1157 PRIS YD 0.6 ZD 0.38

301 TO 303 307 308 310 311 313 315 TO 317 322 325 326 329 330 333 334 336 -

337 TO 341 344 347 350 TO 352 359 361 362 369 370 389 TO 391 403 407 413 415 -

418 426 428 432 TO 436 438 440 441 453 457 TO 460 464 467 471 472 475 476 -

484 488 491 TO 493 500 502 503 510 511 530 TO 532 544 548 554 556 559 567 -

569 573 TO 577 579 581 582 594 598 TO 601 605 608 612 613 616 617 625 629 -

632 TO 634 641 643 644 651 652 671 TO 673 685 689 695 697 700 708 710 714 -

715 TO 718 720 722 723 735 739 TO 742 746 749 753 754 757 758 766 770 773 -

774 TO 775 782 784 785 792 793 812 TO 814 826 830 836 838 841 849 851 855 -

856 TO 859 861 863 864 876 880 TO 883 887 890 894 895 898 899 907 911 914 -

915 TO 916 923 925 926 933 934 953 TO 955 967 971 977 979 982 990 992 996 -

997 TO 1000 1002 1004 1005 1017 1021 TO 1024 1028 1031 1035 1036 1039 1040 -

1048 1053 1054 1059 1060 1067 TO 1072 1076 1077 1085 1086 1094 TO 1096 1099 -

1100 1108 1112 1118 1123 1131 1133 1137 TO 1141 1143 1145 1146 1158 1162 -

1163 TO 1165 1169 1176 1177 1180 1181 1189 1191 PRIS YD 0.38 ZD 0.23

1193 1194 1196 1199 1200 1202 1203 1205 TO 1207 PRIS YD 0.38 ZD 0.23

318 TO 320 324 327 328 342 343 348 349 353 TO 355 360 363 TO 368 371 372 378 -

379 TO 381 385 387 388 392 TO 396 402 404 405 410 TO 412 414 419 420 431 437 -

442 454 456 465 466 468 481 486 489 490 494 TO 496 501 504 TO 509 512 513 -
519 TO 522 526 528 529 533 TO 537 543 545 546 551 TO 553 555 560 561 572 -
578 583 595 597 606 607 609 622 627 630 631 635 TO 637 642 645 TO 650 653 -
654 660 TO 663 667 669 670 674 TO 678 684 686 687 692 TO 694 696 701 702 -
713 719 724 736 738 747 748 750 763 768 771 772 776 TO 778 783 786 TO 791 -
794 795 801 TO 804 808 810 811 815 TO 819 825 827 828 833 TO 835 837 842 -
843 854 860 865 877 879 888 889 891 904 909 912 913 917 TO 919 924 -
927 TO 932 935 936 942 TO 945 949 951 952 956 TO 960 966 968 969 974 TO 976 -
978 983 984 995 1001 1006 1018 1020 1029 1030 1032 1045 1050 1058 1065 1073 -
1083 1084 1090 1092 1097 1098 1101 1107 1109 1110 1115 TO 1117 1119 1124 -
1125 TO 1126 1132 1135 1136 1142 1147 1148 1150 1159 1161 1170 1171 -
1173 TO 1175 1186 TO 1188 1195 1198 PRIS YD 0.45 ZD 0.23
305 309 323 331 386 397 429 439 444 446 455 485 487 527 538 570 580 585 587 -
596 626 628 668 679 711 721 726 728 737 767 769 809 820 852 862 867 869 878 -
908 910 950 961 993 1003 1008 1010 1019 1049 1051 1052 1055 TO 1057 1064 -
1066 1074 1075 1091 1102 1120 1134 1144 1149 1151 1160 1172 1190 1192 1197 -
1201 1204 PRIS YD 0.3 ZD 0.23
22 TO 28 71 TO 77 PRIS YD 0.75 ZD 0.38
1 TO 14 50 TO 63 85 TO 98 139 TO 145 154 TO 183 191 TO 211 PRIS YD 0.6 ZD 0.45
15 TO 21 29 TO 49 64 TO 70 78 TO 84 146 TO 153 PRIS YD 0.6 ZD 0.3
99 TO 114 PRIS YD 0.6 ZD 0.23
184 TO 190 PRIS YD 0.45 ZD 0.3
406 547 688 829 970 1093 1111 PRIS YD 0.3 ZD 0.23
398 TO 401 461 TO 463 477 TO 480 539 TO 542 602 TO 604 618 TO 621 680 TO 683 -
743 TO 745 759 TO 762 821 TO 824 884 TO 886 900 TO 903 962 TO 965 -
1025 TO 1027 1041 TO 1044 1103 TO 1106 1166 TO 1168 1182 TO 1184 -
1185 PRIS YD 0.75 ZD 0.38
408 409 416 417 473 474 549 550 557 558 614 615 690 691 698 699 755 756 831 -
832 839 840 896 897 972 973 980 981 1037 1038 1113 1114 1121 1122 1178 -

1179 PRIS YD 0.45 ZD 0.3

421 427 430 443 445 469 470 482 483 562 568 571 584 586 610 611 623 624 703 -

709 712 725 727 751 752 764 765 844 850 853 866 868 892 893 905 906 985 991 -

994 1007 1009 1033 1034 1046 1047 PRIS YD 0.6 ZD 0.23

CONSTANTS

BETA 90 MEMB 1 TO 98 139 TO 211

MATERIAL CONCRETE ALL

SUPPORTS

1 TO 27 753 755 PINNED

MEMBER RELEASE

323 331 347 352 359 361 363 364 370 371 386 389 397 402 406 415 419 428 429 -

433 435 437 444 446 454 TO 456 458 467 485 TO 488 493 500 502 504 505 511 -

512 527 530 538 543 547 556 560 569 570 574 576 578 585 587 595 TO 597 599 -

608 626 TO 629 634 641 643 645 646 652 653 668 671 679 684 688 697 701 710 -

711 715 717 719 726 728 736 TO 738 740 749 767 TO 770 775 782 784 786 787 -

793 794 809 812 820 825 829 838 842 851 852 856 858 860 867 869 877 TO 879 -

881 890 908 TO 911 916 923 925 927 928 934 935 950 953 961 966 970 979 983 -

992 993 997 999 1001 1008 1010 1018 TO 1020 1022 1031 1049 TO 1052 1057 -

1064 1066 1068 1069 1075 1076 1091 1094 1102 1107 1111 1120 1124 1133 1134 -

1138 1140 1142 1149 1151 1159 TO 1161 1163 1172 1190 TO 1192 1197 -

1204 START MP 0.95

307 323 337 347 351 352 359 361 369 370 385 386 394 395 397 415 419 428 429 -

434 TO 437 439 444 455 465 TO 467 485 TO 488 492 493 500 502 510 511 526 -

527 535 536 538 556 560 569 570 575 TO 578 580 585 596 606 TO 608 -

626 TO 629 633 634 641 643 651 652 667 668 676 677 679 697 701 710 711 716 -

717 TO 719 721 726 737 747 TO 749 767 TO 770 774 775 782 784 792 793 808 809 -

817 818 820 838 842 851 852 857 TO 860 862 867 878 888 TO 890 908 TO 911 -

915 916 923 925 933 934 949 950 958 959 961 979 983 992 993 998 TO 1001 -

1003 1008 1019 1029 TO 1031 1049 TO 1052 1056 1057 1064 1066 1074 1075 1090 -

1091 1099 1100 1102 1120 1124 1133 1134 1139 TO 1142 1144 1149 1160 1170 -
1171 TO 1172 1190 TO 1192 1197 1201 END MP 0.95
LOAD 1 LOADTYPE Dead TITLE DEAD LOAD
SELFWEIGHT Y -1
MEMBER LOAD
313 317 318 322 324 326 329 TO 331 333 334 336 347 TO 349 351 TO 355 360 361 -
363 TO 372 378 TO 381 387 388 392 TO 396 404 TO 410 412 TO 423 426 TO 428 -
430 TO 443 445 446 453 456 457 464 466 468 TO 472 476 TO 479 481 TO 490 492 -
493 TO 496 501 502 504 TO 513 519 TO 522 528 529 533 TO 537 545 TO 551 553 -
554 TO 564 567 TO 569 571 TO 584 586 587 594 597 598 605 607 609 TO 613 617 -
618 TO 620 622 TO 631 633 TO 637 642 643 645 TO 654 660 TO 663 669 670 674 -
675 TO 678 686 TO 692 694 TO 705 708 TO 710 712 TO 725 727 728 735 738 739 -
746 748 750 TO 754 758 TO 761 763 TO 772 774 TO 778 783 784 786 TO 795 801 -
802 TO 804 810 811 815 TO 819 827 TO 833 835 TO 846 849 TO 851 853 TO 866 -
868 869 876 879 880 887 889 891 TO 895 899 TO 902 904 TO 913 915 TO 919 924 -
925 927 TO 936 942 TO 945 951 952 956 TO 960 968 TO 974 976 TO 987 -
990 TO 992 994 TO 1007 1009 1010 1017 1020 1021 1028 1030 1032 TO 1036 1040 -
1041 TO 1043 1045 TO 1051 1112 1118 1119 1131 1136 1137 1143 TO 1146 1151 -
1158 1162 1169 UNI GY -15
300 TO 303 305 TO 308 311 314 315 321 325 327 338 339 342 TO 346 351 352 359 -
492 493 500 633 634 641 774 775 782 915 916 923 1052 TO 1054 1056 TO 1058 -
1065 1066 1070 TO 1077 1083 1086 1092 1097 1101 1110 1113 TO 1115 1120 1123 -
1124 TO 1125 1127 1128 1142 1147 1161 1171 1173 1181 TO 1183 1186 -
1189 TO 1196 1198 1199 1203 TO 1207 UNI GY -4.85
313 323 407 429 548 570 689 711 830 852 971 993 1112 1134 UNI GY -23
373 TO 377 385 386 389 390 399 TO 402 410 416 424 442 444 447 TO 452 454 455 -
458 459 461 TO 463 465 468 473 474 479 480 485 514 TO 518 526 527 530 531 -
540 TO 543 551 557 565 583 585 588 TO 593 595 596 599 600 602 TO 604 606 -
609 614 615 620 621 626 655 TO 659 667 668 671 672 681 TO 684 692 698 706 -

724 726 729 TO 734 736 737 740 741 743 TO 745 747 750 755 756 761 762 767 -
796 TO 800 808 809 812 813 822 TO 825 833 839 847 865 867 870 TO 875 877 -
878 881 882 884 TO 886 888 891 896 897 902 903 908 937 TO 941 949 950 953 -
954 963 TO 966 974 980 988 1006 1008 1011 TO 1016 1018 1019 1022 1023 1025 -
1026 TO 1027 1029 1032 1037 1038 1043 1044 1049 1078 TO 1082 1090 1091 1094 -
1095 1104 TO 1107 1115 1121 1129 1147 1149 1152 TO 1157 1159 1160 1163 1164 -
1166 TO 1168 1170 1173 1178 1179 1184 1185 1190 UNI GY -7.5

478 619 760 901 1042 1183 UNI GY -9 1 4.25

ONEWAY LOAD

YRANGE 3.2 19.2 ONE -4.625 XRANGE -1.22 2.35 ZRANGE -0.85 5.12 GY

YRANGE 3.2 19.2 ONE -4.625 XRANGE 5.25 8.75 ZRANGE -0.85 5.12 GY

YRANGE 3.2 19.2 ONE -4.625 XRANGE 13.35 18.55 ZRANGE 0 14.55 GY

YRANGE 3.2 19.2 ONE -4.625 XRANGE -0.99 16.9 ZRANGE 12 14.55 GY

YRANGE 3.2 19.2 ONE -4.625 XRANGE 13.2 16.9 ZRANGE 28.8 29.6 GY

YRANGE 3.2 19.2 ONE -5.25 XRANGE 8.8 10.4 ZRANGE 14.55 17.65 GY

YRANGE 3.2 19.2 ONE -4.625 XRANGE 11.7 13.2 ZRANGE 23.8 28.8 GY

_SUNKEN ONE -1.65 GY

FLOOR LOAD

YRANGE 3.2 19.2 FLOAD -5.25 XRANGE 8.75 13.35 ZRANGE 0 5.12 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE -2.15 2.35 ZRANGE 5.12 12 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE 10 16.9 ZRANGE 5.12 12 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE -5.65 -0.9 ZRANGE 12 24.7 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE 10.4 11.7 ZRANGE 16.65 17.65 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE 6.9 11.7 ZRANGE 17.65 28.8 GY

YRANGE 3.2 19.2 FLOAD -5.25 XRANGE 11.7 16.9 ZRANGE 16.65 23.8 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE 13.4 16.9 ZRANGE 14.55 16.65 GY

YRANGE 3.2 19.2 FLOAD -5.2 XRANGE 2.35 7.4 ZRANGE 0 12 GY

YRANGE 3.2 19.2 FLOAD -5.25 XRANGE -0.9 4.2 ZRANGE 12 19.75 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE -0.9 4.2 ZRANGE 19.75 25.45 GY

YRANGE 3.2 19.2 FLOAD -4.625 XRANGE 13.2 16.9 ZRANGE 23.8 28.8 GY

YRANGE 22.4 22.41 FLOAD -5.25 XRANGE 4.2 13.4 ZRANGE 14.55 17.66 GY

****

LOAD 2 LOADTYPE Live TITLE LIVE LOAD

ONEWAY LOAD

YRANGE 3.2 19.2 ONE -2 XRANGE -1.22 2.35 ZRANGE -0.85 5.12 GY

YRANGE 3.2 19.2 ONE -2 XRANGE 5.25 8.75 ZRANGE -0.85 5.12 GY

YRANGE 3.2 19.2 ONE -2 XRANGE 13.35 18.55 ZRANGE 0 14.55 GY

YRANGE 3.2 19.2 ONE -2 XRANGE -0.99 16.9 ZRANGE 12 14.55 GY

YRANGE 3.2 19.2 ONE -2 XRANGE 13.2 16.9 ZRANGE 28.8 29.6 GY

YRANGE 3.2 19.2 ONE -2 XRANGE 8.8 10.4 ZRANGE 14.55 17.65 GY

YRANGE 3.2 19.2 ONE -2 XRANGE 11.7 13.2 ZRANGE 23.8 28.8 GY

FLOOR LOAD

YRANGE 3.2 19.2 FLOAD -2 XRANGE 8.75 13.35 ZRANGE 0 5.12 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE -2.15 2.35 ZRANGE 5.12 12 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 10 16.9 ZRANGE 5.12 12 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE -5.65 -0.9 ZRANGE 12 24.7 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 10.4 11.7 ZRANGE 16.65 17.65 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 6.9 11.7 ZRANGE 17.65 28.8 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 11.7 16.9 ZRANGE 16.65 23.8 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 13.4 16.9 ZRANGE 14.55 16.65 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 2.35 7.4 ZRANGE 0 12 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE -0.9 4.2 ZRANGE 12 19.75 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE -0.9 4.2 ZRANGE 19.75 25.45 GY

YRANGE 3.2 19.2 FLOAD -2 XRANGE 13.2 16.9 ZRANGE 23.8 28.8 GY

YRANGE 22.4 22.41 FLOAD -2 XRANGE 4.2 13.4 ZRANGE 14.55 17.66 GY

LOAD COMB 3 1.5 D.L+L.L

1 1.5 2 1.5

LOAD COMB 4 1 D.L+L.L

1 1.0 2 1.0

PERFORM ANALYSIS PRINT ALL

LOAD LIST 3

START CONCRETE DESIGN

CODE INDIAN

ENSH 1 ALL

FC 25000 ALL

FYMAIN 500000 ALL

RATIO 4 ALL

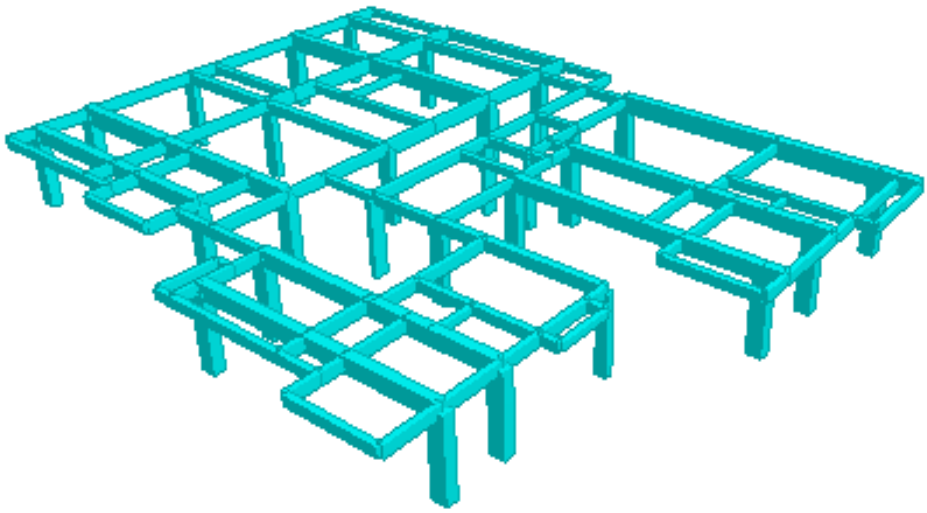
CONCRETE TAKE

DESIGN COLUMN 1 TO 211

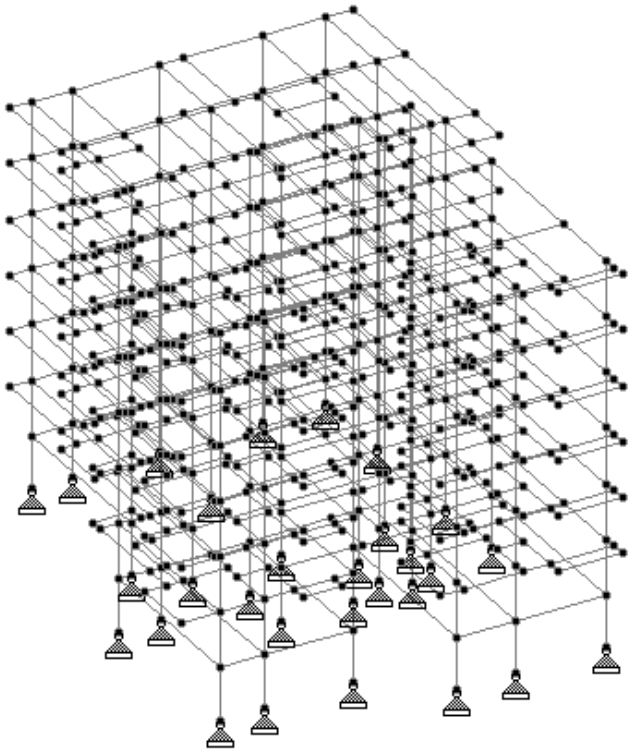
DESIGN BEAM 300 TO 1207

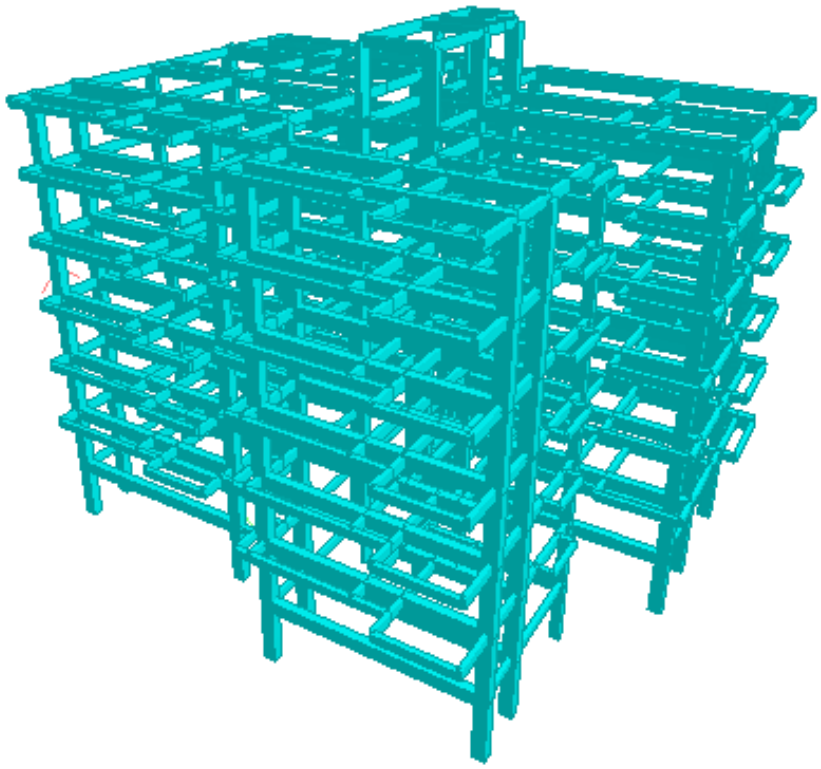
END CONCRETE DESIGN

FINISH



3-D Floor Plan





3-D View

Chapter 7

7.1 Footing Design - F1:-

Factored load on the column	Pu	=	4550	kN	
Safe bearing capacity of soil	SBC	=	300	kN/m2	
Grade of concrete	fck	=	25	N/mm2	
Grade of steel	fy	=	500	N/mm2	
Size of column					
	b	=	380	mm	
	D	=	750	mm	
Area of footing	A	=	11.1	m2	
Footing dimensions	l	=	3.40	m	
	b	=	3.40	m	
Ultimate pressure below foundation		=	393.6	kN/m2	
Depth for Punching shear					
Design shear strength	tc	=	1.25	N/mm2	
		=	d2	d	const
Actual punching shear eqn.			-0.4	-444.77	4437824
Allowable punching shear eqn.		=	d2	d	const
			5.0	2825.0	0
Depth required for punching shear	d	=	653.5	mm	
Depth for Bending moment					
BM about minor axis of column	mu	=	448.7	kN.m	
Depth required for bending moment	d	=	*359.5*	mm	
Depth taken for iteration calculations	D	=	725.0	mm	
Depth for one-way shear					
Iterated Percentage of steel	pt	=	0.18	%	
Design shear strength	tc	=	0.31	N/mm2	

Depth required for One way shear	d	=	*736.8*	mm	
	D	=	800.0	mm	
Governing depth of footing	D	=	*825*	mm	
Size of footing required		=	3.4m x 3.4m x 0.875 m		
			11’3”x11’3”x2’9”		
Area of steel calculation			Ast2	Ast	Const
			8.7	-337125	44872210
	Ast	=	4693	mm2	
Size of footing provide		=	3.5m x 3.5m x 0.95m		
			11’6”x11’6”x3’0”		
Reinforcement required		=	Diameter	Spacing	
			16	135 mm	
Reinforcement provide		=	Diameter	Spacing	
			16	120 mm	
Hence safe					

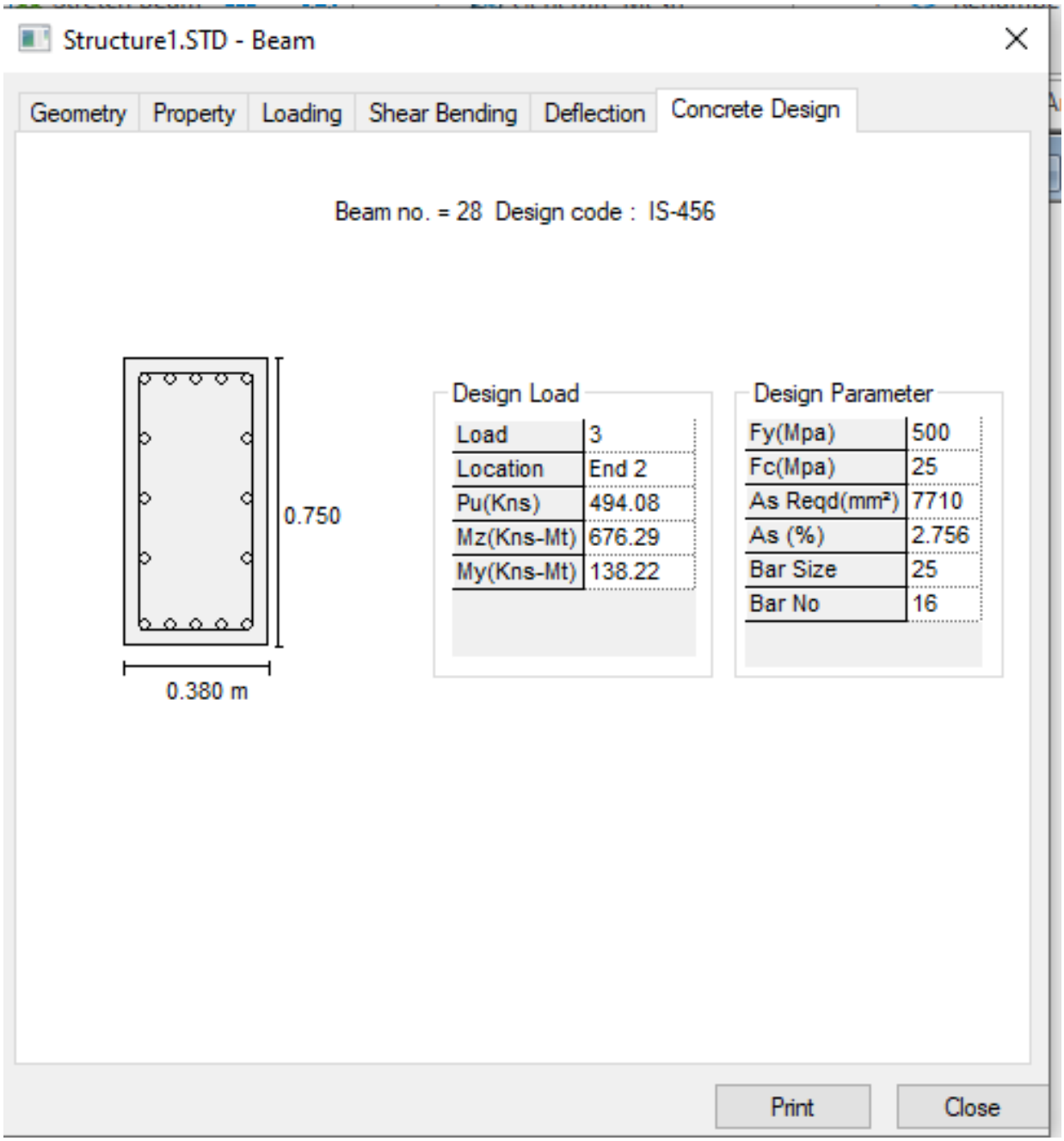
7.2 Column Design- C1 :-

Area of steel required : 7710 mm2

Required Percentage of Reinforcement ; 2.76 %

Area of steel provided : 8042 mm2

Provided Percentage of Reinforcement ; 2.82 %


Structure1.STD - Beam
Geometry
Property
Loading
Shear Bending
Deflection
Concrete Design
Beam no. = 28 Design code : IS-456
0.750
0.380 m
Design Load
Load 3
Location End 2
Pu(Kns) 494.08
Mz(Kns-Mt) 676.29
My(Kns-Mt) 138.22
Design Parameter
Fy(Mpa) 500
Fc(Mpa) 25
As Reqd(mm²) 7710
As (%) 2.756
Bar Size 25
Bar No 16
Print
Close

Hence Safe

7.3 Beam Design :-

Input data :			
Over all Depth		**750**	mm
Breadth(b) mm		**380**	mm
Factored Momemt(Mu) kN.m		850	kNm
Grade of Steel (fy) Mpa		500	N/mm2
Grade of Concrete (fck) Mpa		25	N/mm2
Effective cover Bottom(d')		73	mm
Effective cover Top(dc)		60	mm
Amount of redistribution (%)		20	%
Solution :			
Effective depth		678	mm
Xu.max		309.0	mm
Ku.max		0.5	
Moment		578.8	kNm
Area of steel-1		2424.4	mm2
Area of steel-2		1009.8	mm2
Area of steel required Ast		3434.2	mm2
Percentage of reinforcement Pt		1.3	%
Depth ratio d'/d		0.1	

Stress in compression fsc		353.5	
Area of steel in compression Asc		1242.7	mm2
Result :			
Ast required		**3434.5**	mm2
Ast provided		3-32 Diameter(Ast.1-2412) + 3-32 Diameter(Ast.2-2412)	
Ast pr = Ast.1+ Ast.2		= 2412+2412 = **4825** mm2	
Ast reqired < Ast provided		3434.5< 4825	
Hence safe			
Provided			
Top reinforcement :3-32 diameter + 3-32 diameter			
Bottom reinforcement : 3-32 diameter + 3-32 diameter			
Design for Shear			
Breadth (b)		**380**	mm
Depth (D)		**750**	mm
Effective depth		681	mm
Percentage of reinforcement Pt		1.33	%
Diameter of stirrups		10	mm
No of leg		2	
Shear V		450	kN
Nominal shear stress Tv		1.75	kN/m2
Maximum nominal shear stress tc max		3.10	kN/m2
If tv < tc max		1.75 < 3.10	kN/m2

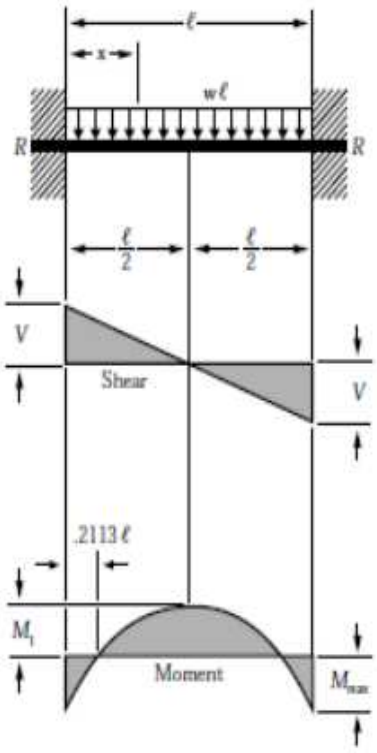
τcmax check	ok	
Permissible nominal shear stress tc	0.69	kN/m2
Total Shear Vus	272744	kN/m2
Spacing		
Reinforcement Required in mm	**140**	mm
Reinforcement Provided in mm	**125**	mm
Hence safe		

Beam Deflection Check - :-

Characteristic comp stress of concrete	f_{ck}	:	**25**	N/mm^2
Characteristic tensile stress of steel	f_y	:	500	N/mm^3
Size of beam width	B	:	**0.38**	mm
Size of beam depth	d	:	**0.75**	mm
Moment of inertia	I	:	13359375000	mm4
Modulus of elasticity of steel	Es	:	200000	M pa
Length of the beam	L	:	**11.9**	m
Spacing ob beam	S	:	4.75	m
Loads				
Dead Load	DL	:	5.25	kN/m2
Live Load	LL	:	2	kN/m2
Total Load	TL	:	7.25	kN/m2
Udl for beam	w	:	34.44	kN/m
Wall Load	WL	:	33.21	kN/m

Self weight of beam	SL	:	7.125	kN/m
Total UDL	W		74.77	kN/m
Moment M max at support	B.M -1	:	**882.33**	kN.m
Moment M from staad	B.M -2	:	**850.00**	kN.m
B.M -1 > B.M -2	**Hence Safe**			
Shear	S.F-1	:	**444.87**	kN
Shear from staad	S.F-2	:	**430.00**	kN
S.F -1 > S.F -2	**Hence Safe**			
Check -1	**23.2.1 The vertical deflection limits may generally be assumed to be satisfied provided that the span to depth ratios are not greater than the values obtained as below:**			
As per is 456:2000	a) **Basic values of span to effective depth ratios for spans up to 10 m:**			
	Cantilever 7 **Simply supported** 20 **Continuous** 26			
	b) **For spans above 10 m, the values in (a) may be multiplied by 10/span in metres, except for cantilever in which case deflection calculations should be made.**			
Span to Depth ratio	SPD	:	20	
If span above 10m multiplied by 10/Span	factor	:	0.84	
Span to Depth ratio	SPD	:	16.81	
Vertical limit for depth	VLimt	:	**708.05**	mm
Provide depth	Dpro	:	**750**	mm
VLimit < Dpro	**Hence Safe**			
Check -2 As per Load	a) **The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members, should not normally exceed span/250.**			
Allowable deflection				
	b) **The deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and the application of finishes should not normally exceed span/350 or 20 mm whichever is less.**			
Allowable deflection				

Span by 250	D allow	:	47.60	mm
Span by 350	D allow	:	34.00	mm
Value	D allow	:	20.00	mm
In above 3 whichever is less				
Allowable deflection	D allow	:	**20.00**	mm



$$R = V \quad \ldots\ldots\ldots\ldots\ldots\ldots = \frac{w\ell}{2}$$

$$V_x \quad \ldots\ldots\ldots\ldots\ldots\ldots = w\left(\frac{\ell}{2} - x\right)$$

$$M_{max}\ (\text{at ends}) \quad \ldots\ldots\ldots\ldots = \frac{w\ell^2}{12}$$

$$M_i\ (\text{at center}) \quad \ldots\ldots\ldots\ldots = \frac{w\ell^2}{24}$$

$$M_x \quad \ldots\ldots\ldots\ldots\ldots\ldots = \frac{w}{12}(6\ell x - \ell^2 - 6x^2)$$

$$\Delta_{max}\ (\text{at center}) \quad \ldots\ldots\ldots\ldots = \frac{w\ell^4}{384EI}$$

$$\Delta_x \quad \ldots\ldots\ldots\ldots\ldots\ldots = \frac{wx^2}{24EI}(\ell - x)^2$$

Actual deflection	D actual	:	**1.46**	mm
D allow < D actual	**Hence Safe**			

Client	**MR.SIDESH KUMAR**
Project	PROPOSED APARTMENT BUILDING, Salem.
Structural Consultant	**INNOVATIVE DESIGN Structural Consultants** Coimbatore - 641025
Title :	Design Report

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3.2	Mathematical modeling of structure	
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4.1	General	
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Chapter 6	**STAAD OUTPUT**	
Chapter 7	**DESIGN REPORT**	
7.1	Footing Design	
7.2	Column Design	
7.3	Beam Design	

Chapter 1

1.1 INTRODUCTION:-

The purpose of this report is to outline the design philosophy and loading calculation along with analysis and design of the proposed Apartment building at the Salem.

The building includes the size of 17.45 m x 23.62 m.

1.2 General

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

1.3 Scope

The structure is a slit, ground and four floor for residential area. This report presents details of structural analysis and design of the structure. The sizes and details of the sections of structural elements are based on detailed analysis. This report specifies the details of structural layout, mathematical model, material properties, loads , load combinations and design of members.

Chapter 2

LOADS & LOAD COMBINATIONS

2.1 General

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

2.2.1 Dead load (DL)

This comprises of self-weight of various structural elements indicated below:

- Self-weight of columns and Beam members.

Self-weight of the modeled elements is calculated by STAAD Pro through SELF WEIGHT command. The self-weight of purlin and Roof sheet is applied explicitly as member load.

Slab load :-

Slab load (150mm Tk) - 0.125x25 = 3.125 kN/sq.m,

Floor finish = 1.5 kN/sq.m,

Total load = 4.625 kN/sq.m.

2.2.2 Live Loads (LL)

Loads are considered slab area is 2.0 kN/sq.m.

2.3 LOAD COMBINATIONS

2.3.1 LOAD NAME AND COMBINATIONS ADOPTED FOR DESIGN

Number	Name	Type
1	DEAD LOAD	Dead
2	LIVE LOAD	Live Load

Strength combination:-

Comb	Combination L/C Name	Primary	Primary L/C Name	Factor
3	1.5(D.L+L.L)	1	DEAD LOAD	1.5
		2	LIVE LOAD	1.5

Serviceability combination:-

Comb	Combination L/C Name	Primary	Primary L/C Name	Factor
4	1.0(D.L+L.L)	1	DEAD LOAD	1.0
		2	LIVE LOAD	1.0

Chapter 3

ANALYSIS

3.1 General

The analysis of the structure is carried out by mathematical modeling of the structure in STAAD Pro and performing an analysis run.

3.2 Mathematical Modeling of Structure

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

Chapter 4

DESIGN OF MEMBERS

4.1 General

Elements are designed as per IS: 456-2000 for combination of loads in the analysis of STAAD Pro.

Chapter 5

Analysis and Design

STAAD SPACE

START JOB INFORMATION

ENGINEER DATE 18-Sep-24

END JOB INFORMATION

INPUT WIDTH 79

UNIT METER KN

JOINT COORDINATES

1 0 -3 0; 2 2.75 -3 0; 3 7.87 -3 0; 4 14.26 -3 0; 5 17.31 -3 0; 6 0 -3 9.94;

7 2.75 -3 9.94; 8 7.87 -3 9.94; 9 14.26 -3 9.94; 10 2.06 -3 12.09;

11 5.46 -3 12.09; 12 10.66 -3 12.09; 13 14.26 -3 13.09; 14 15.53 -3 13.09;

15 17.31 -3 13.09; 16 15.53 -3 15.79; 18 17.76 -3 15.79; 19 14.26 -3 18.69;

20 17.76 -3 18.69; 21 14.26 -3 23.04; 22 17.76 -3 23.04; 23 2.06 -3 23.04;

24 5.46 -3 23.04; 25 10.66 -3 23.04; 26 0 0 0; 27 2.75 0 0; 28 7.87 0 0;

29 14.26 0 0; 30 17.31 0 0; 31 0 0 9.94; 32 2.75 0 9.94; 33 7.87 0 9.94;

34 14.26 0 9.94; 35 2.06 0 12.09; 36 5.46 0 12.09; 37 10.66 0 12.09;

38 14.26 0 13.09; 39 15.53 0 13.09; 40 17.31 0 13.09; 41 15.53 0 15.79;

42 17.76 0 15.79; 43 14.26 0 18.69; 44 17.76 0 18.69; 45 14.26 0 23.04;

46 17.76 0 23.04; 47 2.06 0 23.04; 48 5.46 0 23.04; 49 10.66 0 23.04;

50 0 3.1 0; 51 2.75 3.1 0; 52 7.87 3.1 0; 53 14.26 3.1 0; 54 17.31 3.1 0;

55 0 3.1 9.94; 56 2.75 3.1 9.94; 57 7.87 3.1 9.94; 58 14.26 3.1 9.94;

59 2.06 3.1 12.09; 60 5.46 3.1 12.09; 61 10.66 3.1 12.09; 62 14.26 3.1 13.09;

63 15.53 3.1 13.09; 64 17.31 3.1 13.09; 65 15.53 3.1 15.79; 66 17.76 3.1 15.79;

67 14.26 3.1 18.69; 68 17.76 3.1 18.69; 69 14.26 3.1 23.04; 70 17.76 3.1 23.04;

71 2.06 3.1 23.04; 72 5.46 3.1 23.04; 73 10.66 3.1 23.04; 74 0 6.2 0;

75 2.75 6.2 0; 76 7.87 6.2 0; 77 14.26 6.2 0; 78 17.31 6.2 0; 79 0 6.2 9.94;

80 2.75 6.2 9.94; 81 7.87 6.2 9.94; 82 14.26 6.2 9.94; 83 2.06 6.2 12.09;

84 5.46 6.2 12.09; 85 10.66 6.2 12.09; 86 14.26 6.2 13.09; 87 15.53 6.2 13.09;

88 17.31 6.2 13.09; 89 15.53 6.2 15.79; 90 17.76 6.2 15.79; 91 14.26 6.2 18.69;

92 17.76 6.2 18.69; 93 14.26 6.2 23.04; 94 17.76 6.2 23.04; 95 2.06 6.2 23.04;

96 5.46 6.2 23.04; 97 10.66 6.2 23.04; 98 0 9.3 0; 99 2.75 9.3 0;

100 7.87 9.3 0; 101 14.26 9.3 0; 102 17.31 9.3 0; 103 0 9.3 9.94;

104 2.75 9.3 9.94; 105 7.87 9.3 9.94; 106 14.26 9.3 9.94; 107 2.06 9.3 12.09;

108 5.46 9.3 12.09; 109 10.66 9.3 12.09; 110 14.26 9.3 13.09;

111 15.53 9.3 13.09; 112 17.31 9.3 13.09; 113 15.53 9.3 15.79;

114 17.76 9.3 15.79; 115 14.26 9.3 18.69; 116 17.76 9.3 18.69;

117 14.26 9.3 23.04; 118 17.76 9.3 23.04; 119 2.06 9.3 23.04;

120 5.46 9.3 23.04; 121 10.66 9.3 23.04; 122 0 12.4 0; 123 2.75 12.4 0;

124 7.87 12.4 0; 125 14.26 12.4 0; 126 17.31 12.4 0; 127 0 12.4 9.94;

128 2.75 12.4 9.94; 129 7.87 12.4 9.94; 130 14.26 12.4 9.94;

131 2.06 12.4 12.09; 132 5.46 12.4 12.09; 133 10.66 12.4 12.09;

134 14.26 12.4 13.09; 135 15.53 12.4 13.09; 136 17.31 12.4 13.09;

137 15.53 12.4 15.79; 138 17.76 12.4 15.79; 139 14.26 12.4 18.69;

140 17.76 12.4 18.69; 141 14.26 12.4 23.04; 142 17.76 12.4 23.04;

143 2.06 12.4 23.04; 144 5.46 12.4 23.04; 145 10.66 12.4 23.04; 146 0 15.5 0;

147 2.75 15.5 0; 148 7.87 15.5 0; 149 14.26 15.5 0; 150 17.31 15.5 0;

151 0 15.5 9.94; 152 2.75 15.5 9.94; 153 7.87 15.5 9.94; 154 14.26 15.5 9.94;

155 2.06 15.5 12.09; 156 5.46 15.5 12.09; 157 10.66 15.5 12.09;

158 14.26 15.5 13.09; 159 15.53 15.5 13.09; 160 17.31 15.5 13.09;

161 15.53 15.5 15.79; 162 17.76 15.5 15.79; 163 14.26 15.5 18.69;

164 17.76 15.5 18.69; 165 14.26 15.5 23.04; 166 17.76 15.5 23.04;

167 2.06 15.5 23.04; 168 5.46 15.5 23.04; 169 10.66 15.5 23.04; 170 0 18.6 0;

171 2.75 18.6 0; 172 7.87 18.6 0; 173 14.26 18.6 0; 174 17.31 18.6 0;

175 0 18.6 9.94; 176 2.75 18.6 9.94; 177 7.87 18.6 9.94; 178 14.26 18.6 9.94;

179 2.06 18.6 12.09; 180 5.46 18.6 12.09; 181 10.66 18.6 12.09;

182 14.26 18.6 13.09; 183 15.53 18.6 13.09; 184 17.31 18.6 13.09;

185 15.53 18.6 15.79; 186 17.76 18.6 15.79; 187 14.26 18.6 18.69;

188 17.76 18.6 18.69; 189 14.26 18.6 23.04; 190 17.76 18.6 23.04;

191 2.06 18.6 23.04; 192 5.46 18.6 23.04; 193 10.66 18.6 23.04;

194 17.31 0 9.94; 195 2.75 0 12.09; 196 17.76 0 13.09; 197 14.26 0 15.79;

198 7.87 0 12.09; 199 2.75 3.1 12.09; 200 17.31 3.1 9.94; 201 14.26 3.1 15.79;

202 7.87 3.1 12.09; 203 17.76 3.1 13.09; 204 -0.8 3.1 0; 206 0 3.1 -0.55;

209 17.31 3.1 -0.55; 210 7.87 3.1 -0.55; 211 18.76 3.1 0; 212 -0.8 3.1 -0.55;

213 1.52 3.1 0; 214 1.52 3.1 -0.55; 216 18.76 3.1 12.09; 217 14.26 3.1 12.09;

218 17.31 3.1 12.09; 219 -1.3 3.1 9.94; 220 0 3.1 6.13; 221 2.75 3.1 6.13;

222 -0.8 3.1 6.13; 223 -1.3 3.1 6.13; 224 18.76 3.1 9.94; 225 0 3.1 4.37;

226 2.75 3.1 4.37; 227 14.26 3.1 4.37; 228 17.31 3.1 4.37; 229 7.87 3.1 4.37;

231 18.76 3.1 4.37; 232 -0.8 3.1 4.37; 233 5.67 3.1 0; 234 5.67 3.1 4.37;

235 2.75 3.1 1.9; 236 5.67 3.1 1.9; 237 9.27 3.1 0; 239 9.27 3.1 4.37;

240 5.67 3.1 -0.55; 241 9.27 3.1 -0.55; 242 11.27 3.1 0; 243 11.27 3.1 -0.55;

244 12.77 3.1 0; 245 12.77 3.1 4.37; 246 15.17 3.1 0; 247 15.17 3.1 4.37;

248 14.26 3.1 1.9; 249 15.17 3.1 1.9; 250 12.77 3.1 1.9; 251 15.17 3.1 -0.55;

252 10.62 3.1 4.37; 253 10.62 3.1 9.94; 254 7.87 3.1 7.24; 255 10.62 3.1 7.24;

257 14.26 3.1 6.37; 258 10.62 3.1 6.37; 259 0.66 3.1 23.04; 260 2.06 3.1 19.22;

261 5.46 3.1 19.22; 262 0.66 3.1 19.22; 263 2.06 3.1 16.97; 264 5.46 3.1 16.97;

265 5.46 3.1 24.39; 266 10.66 3.1 24.39; 267 5.46 3.1 20.99;

268 10.66 3.1 20.99; 270 6.96 3.1 24.39; 271 6.96 3.1 20.99;

272 5.46 3.1 17.94; 274 10.66 3.1 17.94; 275 14.26 3.1 17.94;

277 12.16 3.1 17.94; 279 12.16 3.1 12.09; 280 5.46 3.1 14.79;

282 10.66 3.1 14.79; 283 12.16 3.1 14.79; 284 10.06 3.1 12.09;

285 10.06 3.1 14.79; 286 1.52 18.6 0; 287 0 18.6 4.37; 288 2.75 18.6 12.09;

289 2.06 18.6 16.97; 290 2.75 18.6 1.9; 291 14.26 18.6 12.09;

292 17.31 18.6 4.37; 293 14.26 18.6 15.79; 294 14.26 18.6 17.94;

295 15.17 18.6 0; 296 9.27 18.6 0; 297 5.67 18.6 0; 298 17.31 18.6 9.94;

299 10.62 18.6 9.94; 300 7.87 18.6 12.09; 301 17.31 18.6 12.09;

302 17.76 18.6 13.09; 303 7.87 18.6 4.37; 304 10.06 18.6 12.09;

305 14.26 18.6 1.9; 306 5.46 18.6 14.79; 307 10.66 18.6 14.79; 308 -0.8 18.6 0;

309 -0.8 18.6 4.37; 310 -0.8 18.6 -0.55; 311 0 18.6 -0.55;

312 17.31 18.6 -0.55; 313 18.76 18.6 0; 314 1.52 18.6 -0.55;

315 12.16 18.6 12.09; 316 18.76 18.6 4.37; 317 18.76 18.6 12.09;

318 -1.3 18.6 9.94; 319 0 18.6 6.13; 320 2.75 18.6 6.13; 321 -0.8 18.6 6.13;

322 -1.3 18.6 6.13; 323 18.76 18.6 9.94; 324 2.75 18.6 4.37;

325 14.26 18.6 4.37; 326 14.26 18.6 6.37; 327 15.17 18.6 4.37;

328 7.87 18.6 7.24; 329 9.27 18.6 4.37; 330 5.67 18.6 4.37; 331 5.67 18.6 1.9;

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335 5.67 18.6 -0.55; 336 9.27 18.6 -0.55; 337 11.27 18.6 -0.55;

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342 15.17 18.6 -0.55; 343 10.62 18.6 6.37; 344 10.62 18.6 7.24;

345 0.66 18.6 23.04; 346 2.06 18.6 19.22; 347 5.46 18.6 19.22;

348 5.46 18.6 20.99; 349 0.66 18.6 19.22; 350 5.46 18.6 16.97;

351 5.46 18.6 17.94; 352 5.46 18.6 24.39; 353 10.66 18.6 24.39;

354 6.96 18.6 24.39; 355 10.66 18.6 20.99; 356 6.96 18.6 20.99;

357 10.66 18.6 17.94; 358 12.16 18.6 17.94; 359 12.16 18.6 14.79;

360 10.06 18.6 14.79; 361 1.52 6.2 0; 362 0 6.2 4.37; 363 2.75 6.2 12.09;

364 2.06 6.2 16.97; 365 2.75 6.2 1.9; 366 14.26 6.2 12.09; 367 17.31 6.2 4.37;

368 14.26 6.2 15.79; 369 14.26 6.2 17.94; 370 15.17 6.2 0; 371 9.27 6.2 0;

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376 17.31 6.2 12.09; 377 17.76 6.2 13.09; 378 7.87 6.2 4.37;

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382 10.66 6.2 14.79; 383 -0.8 6.2 0; 384 -0.8 6.2 4.37; 385 -0.8 6.2 -0.55;

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397 -1.3 6.2 6.13; 398 18.76 6.2 9.94; 399 2.75 6.2 4.37; 400 14.26 6.2 4.37;

401 14.26 6.2 6.37; 402 15.17 6.2 4.37; 403 7.87 6.2 7.24; 404 9.27 6.2 4.37;

405 5.67 6.2 4.37; 406 5.67 6.2 1.9; 407 11.27 6.2 0; 408 10.62 6.2 4.37;

409 7.87 6.2 -0.55; 410 5.67 6.2 -0.55; 411 9.27 6.2 -0.55;

412 11.27 6.2 -0.55; 413 12.77 6.2 0; 414 12.77 6.2 4.37; 415 12.77 6.2 1.9;

416 15.17 6.2 1.9; 417 15.17 6.2 -0.55; 418 10.62 6.2 6.37; 419 10.62 6.2 7.24;

420 0.66 6.2 23.04; 421 2.06 6.2 19.22; 422 5.46 6.2 19.22; 423 5.46 6.2 20.99;

424 0.66 6.2 19.22; 425 5.46 6.2 16.97; 426 5.46 6.2 17.94; 427 5.46 6.2 24.39;

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446 9.27 9.3 0; 447 5.67 9.3 0; 448 17.31 9.3 9.94; 449 10.62 9.3 9.94;

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550 14.26 12.4 4.37; 551 14.26 12.4 6.37; 552 15.17 12.4 4.37;

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615 12.16 15.5 12.09; 616 18.76 15.5 4.37; 617 18.76 15.5 12.09;

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632 11.27 15.5 0; 633 10.62 15.5 4.37; 634 7.87 15.5 -0.55;

635 5.67 15.5 -0.55; 636 9.27 15.5 -0.55; 637 11.27 15.5 -0.55;

638 12.77 15.5 0; 639 12.77 15.5 4.37; 640 12.77 15.5 1.9; 641 15.17 15.5 1.9;

642 15.17 15.5 -0.55; 643 10.62 15.5 6.37; 644 10.62 15.5 7.24;

645 0.66 15.5 23.04; 646 2.06 15.5 19.22; 647 5.46 15.5 19.22;

648 5.46 15.5 20.99; 649 0.66 15.5 19.22; 650 5.46 15.5 16.97;

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MEMBER INCIDENCES

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START GROUP DEFINITION
FLOOR
_SUNKEN 295 299 300 303 310 311 315 319 321 324 325 328 329 334 335 337 338 -
340 342 343 348 366 369 TO 371 374 380 381 383 385 387 390 394 TO 397 399 -
407 408 413 445 449 450 453 460 461 465 469 471 474 475 478 479 484 485 487 -
488 490 492 493 498 516 519 TO 521 524 530 531 533 535 537 540 544 TO 547 -
549 557 558 563 595 599 600 603 610 611 615 619 621 624 625 628 629 634 635 -
637 638 640 642 643 648 666 669 TO 671 674 680 681 683 685 687 690 -
694 TO 697 699 707 708 713 745 749 750 753 760 761 765 769 771 774 775 778 -
779 784 785 787 788 790 792 793 798 816 819 TO 821 824 830 831 833 835 837 -
840 844 TO 847 849 857 858 863 895 899 900 903 910 911 915 919 921 924 925 -
928 929 934 935 937 938 940 942 943 948 966 969 TO 971 974 980 981 983 985 -
987 990 994 TO 997 999 1007 1008 1013
END GROUP DEFINITION
DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 2.17185e+07
POISSON 0.17
DENSITY 23.5616
ALPHA 1e-05
DAMP 0.05
G 9.28139e+06
TYPE CONCRETE

STRENGTH FCU 27579

END DEFINE MATERIAL

MEMBER PROPERTY

1 TO 8 40 TO 46 68 TO 74 145 TO 151 PRIS YD 0.6 ZD 0.38

166 TO 173 PRIS YD 0.45 ZD 0.3

137 TO 144 174 TO 181 PRIS YD 0.45 ZD 0.23

97 TO 104 113 TO 128 PRIS YD 0.38 ZD 0.23

250 253 255 261 263 267 271 285 286 PRIS YD 0.6 ZD 0.3

251 252 254 257 TO 260 262 265 266 268 TO 270 272 TO 275 279 TO 283 287 292 -

296 298 TO 300 307 TO 312 317 318 324 TO 327 329 342 TO 344 358 TO 361 363 -

364 366 369 371 TO 373 380 381 385 TO 387 389 TO 392 395 406 408 412 TO 414 -

417 TO 419 423 430 437 TO 440 442 446 448 TO 450 457 TO 462 467 468 -

474 TO 477 479 492 TO 494 508 TO 511 513 514 516 519 521 TO 523 530 531 535 -

536 TO 537 539 TO 542 545 556 558 562 TO 564 567 TO 569 573 580 587 TO 590 -

592 596 598 TO 600 607 TO 612 617 618 624 TO 627 629 642 TO 644 658 TO 661 -

663 664 666 669 671 TO 673 680 681 685 TO 687 689 TO 692 695 706 708 712 -

713 TO 714 717 TO 719 723 730 737 TO 740 742 746 748 TO 750 757 TO 762 767 -

768 774 TO 777 779 792 TO 794 808 TO 811 813 814 816 819 821 TO 823 830 831 -

835 TO 837 839 TO 842 845 856 858 862 TO 864 867 TO 869 873 880 887 TO 890 -

892 896 898 TO 900 907 TO 912 917 918 924 TO 927 929 942 TO 944 958 TO 961 -

963 964 966 969 971 TO 973 980 981 985 TO 987 989 TO 992 995 1006 1008 1012 -

1013 TO 1014 1017 TO 1019 1023 1030 1037 TO 1040 1042 1046 1048 TO 1050 1058 -

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1095 1096 1110 TO 1113 1115 1116 1118 1121 1123 TO 1125 1132 1133 -

1137 TO 1139 1141 TO 1144 1147 1158 1160 1164 TO 1166 1169 TO 1171 1175 -

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402 403 410 411 415 420 424 431 TO 433 441 443 TO 445 447 455 456 463 495 -

498 517 529 552 553 560 561 565 570 574 581 TO 583 591 593 TO 595 597 605 -

606 613 645 648 667 679 702 703 710 711 715 720 724 731 TO 733 741 -
743 TO 745 747 755 756 763 795 798 817 829 852 853 860 861 865 870 874 881 -
882 TO 883 891 893 TO 895 897 905 906 913 945 948 967 979 1002 1003 1010 -
1011 1015 1020 1024 1031 TO 1033 1041 1043 TO 1045 1047 1056 1057 1064 1097 -
1100 1119 1131 1154 1155 1162 1163 1167 1172 1176 1183 TO 1185 1197 1201 -
1202 TO 1203 1207 1209 TO 1211 PRIS YD 0.3 ZD 0.23
301 TO 304 314 TO 316 319 TO 323 332 TO 338 350 TO 354 374 TO 378 397 TO 401 -
425 TO 429 1193 1196 PRIS YD 0.47 ZD 0.6
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393 394 396 404 405 407 409 416 421 422 434 TO 436 478 480 481 489 TO 491 -
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557 559 566 571 572 584 TO 586 628 630 631 639 TO 641 646 647 649 -
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38 39 PRIS YD 0.3 ZD 0.3
9 TO 37 47 TO 67 75 TO 88 105 TO 112 152 TO 165 PRIS YD 0.6 ZD 0.45
89 TO 96 129 TO 136 PRIS YD 0.6 ZD 0.3
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601 TO 604 614 TO 616 619 TO 623 632 TO 638 650 TO 654 674 TO 678 -
697 TO 701 751 TO 754 764 TO 766 769 TO 773 782 TO 788 800 TO 804 -
824 TO 828 847 TO 851 901 TO 904 914 TO 916 919 TO 923 932 TO 938 -
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1084 TO 1090 1102 TO 1106 1126 TO 1130 1149 TO 1153 PRIS YD 0.6 ZD 0.38

575 TO 579 725 TO 729 875 TO 879 1025 TO 1029 1177 TO 1181 PRIS YD 0.75 ZD 0.38

CONSTANTS

BETA 90 MEMB 1 TO 96 105 TO 112 129 TO 181

MATERIAL CONCRETE ALL

SUPPORTS

1 TO 16 18 TO 25 PINNED

MEMBER RELEASE

277 291 305 324 329 342 343 345 348 349 355 361 366 367 371 385 387 390 395 -

411 420 455 474 479 492 493 498 499 505 511 516 535 537 540 545 561 605 624 -

629 642 643 648 649 655 661 666 685 687 690 695 711 755 774 779 792 793 798 -

799 805 811 816 835 837 840 845 861 905 924 929 942 943 948 949 955 961 966 -

985 987 990 995 1011 1056 1076 1081 1094 1095 1100 1101 1107 1113 1118 1137 -

1139 1142 1147 1163 1202 START MP 0.95

256 264 280 288 291 295 305 311 323 TO 325 329 341 345 348 354 358 359 361 -

364 366 367 373 381 386 387 391 393 408 414 420 431 435 TO 437 440 445 461 -

473 TO 475 479 491 498 504 508 509 511 514 516 523 531 536 537 541 543 558 -

564 581 585 TO 587 590 595 611 623 TO 625 629 641 648 654 658 659 661 664 -

666 673 681 686 687 691 693 708 714 731 735 TO 737 740 745 761 773 TO 775 -

779 791 798 804 808 809 811 814 816 823 831 836 837 841 843 858 864 881 885 -

886 TO 887 890 895 911 923 TO 925 929 941 948 954 958 959 961 964 966 973 -

981 986 987 991 993 1008 1014 1031 1035 TO 1037 1040 1045 1062 1075 TO 1077 -

1081 1093 1100 1106 1110 1111 1113 1116 1118 1125 1133 1138 1139 1143 1145 -

1160 1166 1183 1187 TO 1189 1192 1209 END MP 0.95

LOAD 1 LOADTYPE Dead TITLE DEAD LOAD

SELFWEIGHT Y -1

MEMBER LOAD

130 273 TO 278 282 TO 284 287 TO 297 299 300 305 306 308 TO 310 312 TO 315 -

317 318 323 326 TO 328 338 339 343 TO 345 349 350 352 353 356 357 -

359 TO 363 365 TO 367 369 TO 372 378 TO 380 384 TO 386 388 389 392 TO 394 -

401 TO 407 410 TO 412 415 417 419 420 423 TO 425 429 TO 434 437 TO 447 449 -
450 455 456 458 TO 460 462 TO 465 467 468 473 476 TO 478 488 489 493 TO 495 -
499 500 502 503 506 507 509 TO 513 515 TO 517 519 TO 522 528 TO 530 -
534 TO 536 538 539 542 TO 544 551 TO 557 560 TO 562 565 567 569 570 -
573 TO 575 579 TO 584 587 TO 597 599 600 605 606 608 TO 610 612 TO 615 617 -
618 623 626 TO 628 638 639 643 TO 645 649 650 652 653 656 657 659 TO 663 -
665 TO 667 669 TO 672 678 TO 680 684 TO 686 688 689 692 TO 694 701 TO 707 -
710 TO 712 715 717 719 720 723 TO 725 729 TO 734 737 TO 747 749 750 755 756 -
758 TO 760 762 TO 765 767 768 773 776 TO 778 788 789 793 TO 795 799 800 802 -
803 806 807 809 TO 813 815 TO 817 819 TO 822 828 TO 830 834 TO 836 838 839 -
842 TO 844 851 TO 857 860 TO 862 865 867 869 870 873 TO 875 879 TO 884 887 -
888 TO 897 899 900 905 906 908 UNI GY -15

909 910 912 TO 915 917 918 923 926 TO 928 938 939 943 TO 945 949 950 952 953 -
956 957 959 TO 963 965 TO 967 969 TO 972 978 TO 980 984 TO 986 988 989 992 -
993 TO 994 1001 TO 1007 1010 TO 1012 1015 1017 1019 1020 1023 TO 1025 1029 -
1030 TO 1034 1037 TO 1040 1052 1058 1061 1068 1070 1071 1155 TO 1158 1162 -
1163 1167 1171 1175 1176 1182 TO 1185 UNI GY -15

304 311 319 TO 322 324 325 329 332 TO 337 340 TO 342 348 355 358 364 373 377 -
381 TO 383 387 390 391 395 396 399 400 408 409 413 414 422 435 454 461 469 -
470 TO 472 474 475 479 482 TO 487 490 TO 492 498 505 508 514 523 527 -
531 TO 533 537 540 541 545 546 549 550 558 559 563 564 572 585 604 611 619 -
620 TO 622 624 625 629 632 TO 637 640 TO 642 648 655 658 664 673 677 -
681 TO 683 687 690 691 695 696 699 700 708 709 713 714 722 735 754 761 769 -
770 TO 772 774 775 779 782 TO 787 790 TO 792 798 805 808 814 823 827 -
831 TO 833 837 840 841 845 846 849 850 858 859 863 864 872 885 904 911 919 -
920 TO 922 924 925 929 932 TO 937 940 TO 942 948 955 958 964 973 977 -
981 TO 983 987 990 991 995 996 999 1000 1008 1009 1013 1014 1022 -
1035 UNI GY -7.5

281 282 418 419 568 569 718 719 868 869 1018 1019 1170 1171 UNI GY -23

250 TO 254 256 257 259 265 268 270 279 285 286 431 TO 433 581 TO 583 -

731 TO 733 881 TO 883 1031 TO 1033 1193 TO 1201 1205 1206 1208 TO 1210 -

1211 UNI GY -4.85

317 384 394 467 534 544 617 684 694 767 834 844 917 984 994 UNI GY -9

314 464 614 764 914 UNI GY -9 1.83 4.88

328 478 628 778 928 UNI GY -9 0 1

FLOOR LOAD

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE -0.8 18.76 ZRANGE -0.55 4.37 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE -1.3 7.87 ZRANGE 4.36 9.94 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 7.87 10.62 ZRANGE 7.24 9.94 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 10.62 17.31 ZRANGE 4.369 9.94 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 14.26 18.76 ZRANGE 9.94 12.09 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 0.59 5.46 ZRANGE 12.09 23.04 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 5.46 10.66 ZRANGE 14.79 24.4 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 10.66 14.26 ZRANGE 17.94 23.04 GY

YRANGE 3.1 18.6 FLOAD -4.625 XRANGE 14.26 17.76 ZRANGE 15.79 18.69 GY

_SUNKEN FLOAD -2.1 GY

YRANGE 21.7 21.7 FLOAD -4.625 XRANGE 0 2.75 ZRANGE 0 5.1 GY

YRANGE 21.7 21.7 FLOAD -4.625 XRANGE 14.26 17.76 ZRANGE 13.09 23.04 GY

ONEWAY LOAD

YRANGE 3.1 18.6 ONE -4.625 XRANGE 17.31 18.76 ZRANGE 4.369 9.94 GY

YRANGE 3.1 18.6 ONE -4.625 XRANGE 2.75 14.26 ZRANGE 9.94 12.09 GY

YRANGE 3.1 18.6 ONE -4.625 XRANGE 10.66 14.26 ZRANGE 12.09 17.94 GY

YRANGE 3.1 18.6 ONE -4.625 XRANGE 10.05 10.66 ZRANGE 12.09 14.79 GY

LOAD 2 LOADTYPE Live TITLE LIVE LOAD

FLOOR LOAD

YRANGE 3.1 18.6 FLOAD -2 XRANGE -0.8 18.76 ZRANGE -0.55 4.37 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE -1.3 7.87 ZRANGE 4.36 9.94 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 7.87 10.62 ZRANGE 7.24 9.94 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 10.62 17.31 ZRANGE 4.369 9.94 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 14.26 18.76 ZRANGE 9.94 12.09 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 0.59 5.46 ZRANGE 12.09 23.04 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 5.46 10.66 ZRANGE 14.79 24.4 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 10.66 14.26 ZRANGE 17.94 23.04 GY

YRANGE 3.1 18.6 FLOAD -2 XRANGE 14.26 17.76 ZRANGE 15.79 18.69 GY

YRANGE 21.7 21.7 FLOAD -10 XRANGE 0 2.75 ZRANGE 0 5.1 GY

YRANGE 21.7 21.7 FLOAD -2 XRANGE 14.26 17.76 ZRANGE 13.09 23.04 GY

ONEWAY LOAD

YRANGE 3.1 18.6 ONE -2 XRANGE 17.31 18.76 ZRANGE 4.369 9.94 GY

YRANGE 3.1 18.6 ONE -2 XRANGE 2.75 14.26 ZRANGE 9.94 12.09 GY

YRANGE 3.1 18.6 ONE -2 XRANGE 10.66 14.26 ZRANGE 12.09 17.94 GY

YRANGE 3.1 18.6 ONE -2 XRANGE 10.05 10.66 ZRANGE 12.09 14.79 GY

LOAD COMB 3 1.5 D.L+L.L

1 1.5 2 1.5

LOAD COMB 4 1.0 D.L+L.L

1 1.0 2 1.0

PERFORM ANALYSIS PRINT ALL

DEFINE ENVELOPE

4 ENVELOPE 1 TYPE SERVICEABILITY

3 ENVELOPE 2 TYPE STRENGTH

END DEFINE ENVELOPE

LOAD LIST ENV 1 2

LOAD LIST 3 4

START CONCRETE DESIGN

CODE INDIAN

ENSH 1 ALL

FC 25000 ALL

FYMAIN 500000 ALL

RATIO 4 ALL

TRACK 2 ALL

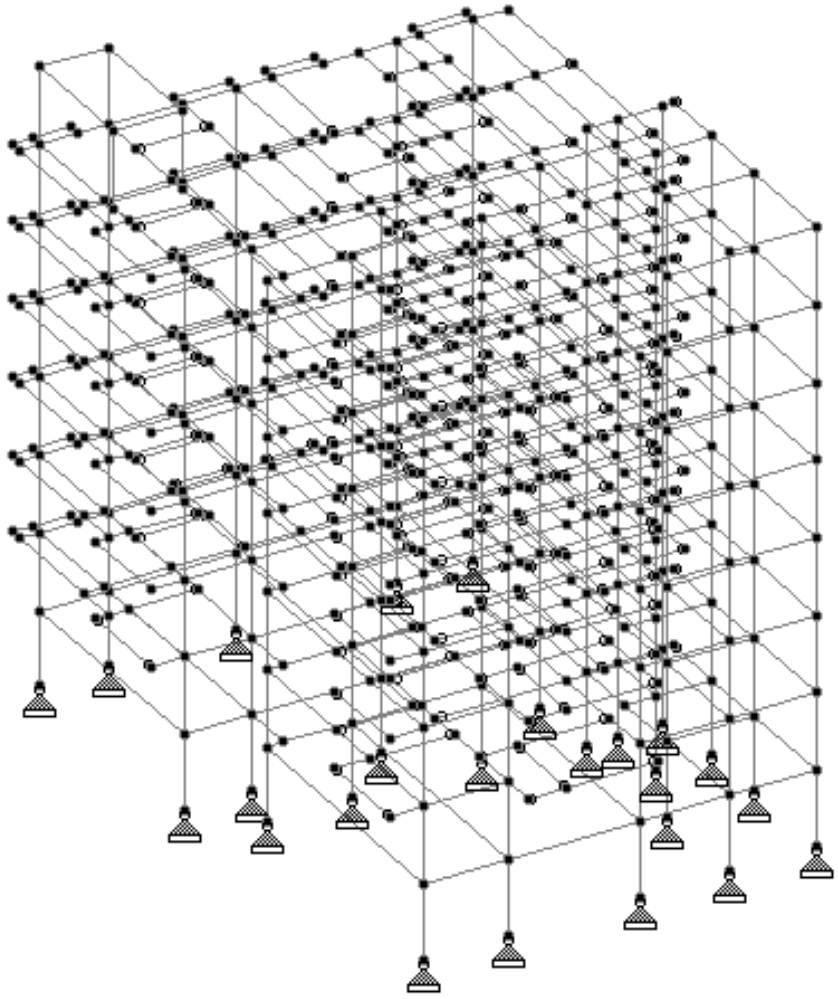
DESIGN BEAM 250 TO 1211

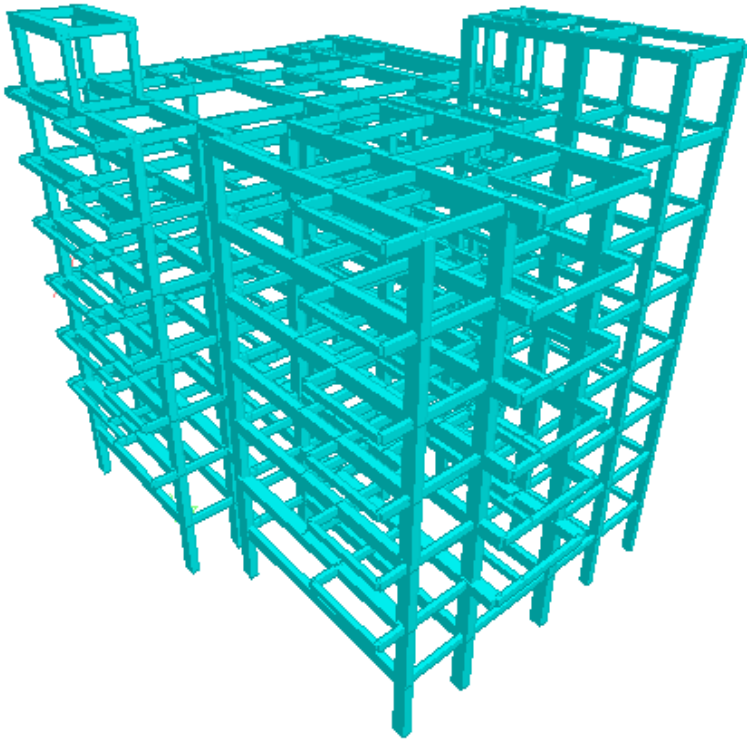
DESIGN COLUMN 1 TO 181

CONCRETE TAKE

END CONCRETE DESIGN

FINISH





3-D View

Chapter 7

7.1 Footing Design - F1:-

Factored load on the column	Pu	=	4400	kN	
Safe bearing capacity of soil	SBC	=	300	kN/m2	
Grade of concrete	fck	=	25	N/mm2	
Grade of steel	fy	=	500	N/mm2	
Size of column					
	b	=	450	mm	
	D	=	600	mm	
Area of footing	A	=	10.8	m2	

Footing dimensions	l	=	3.30	m	
	b	=	3.30	m	
Ultimate pressure below foundation		=	404.0	kN/m2	
Depth for Punching shear					
Design shear strength	tc	=	1.25	N/mm2	
		=	d2	d	const
Actual punching shear eqn.			-0.4	-424.24	4290909
Allowable punching shear eqn.		=	d2	d	const
			5.0	2625.0	0
Depth required for punching shear	d	=	652.5	mm	
Depth for Bending moment					
BM about minor axis of column	mu	=	410.2	kN.m	
Depth required for bending moment	d	=	343.7	mm	
Depth taken for iteration calculations	D	=	725.0	mm	
Depth for one-way shear					
Iterated Percentage of steel	pt	=	0.14	%	
Design shear strength	tc	=	0.28	N/mm2	
Depth required for One way shear	d	=	792.3	mm	
	D	=	850.0	mm	
Governing depth of footing	D	=	875	mm	
Size of footing required		=	3.3m x 3.3m x 0.875 m		
			10’9”x10’9”x2’9”		
Area of steel calculation			Ast2	Ast	Const
			8.7	-358875	4102272
	Ast	=	3883	mm2	

Size of footing provide		=	3.45m x 3.45m x 0.95m	
			11'9"x11'9"x3'0"	
Reinforcement required		=	Diameter	Spacing
			16	160 mm
Reinforcement provide		=	Diameter	Spacing
			16	140 mm
Hence safe				

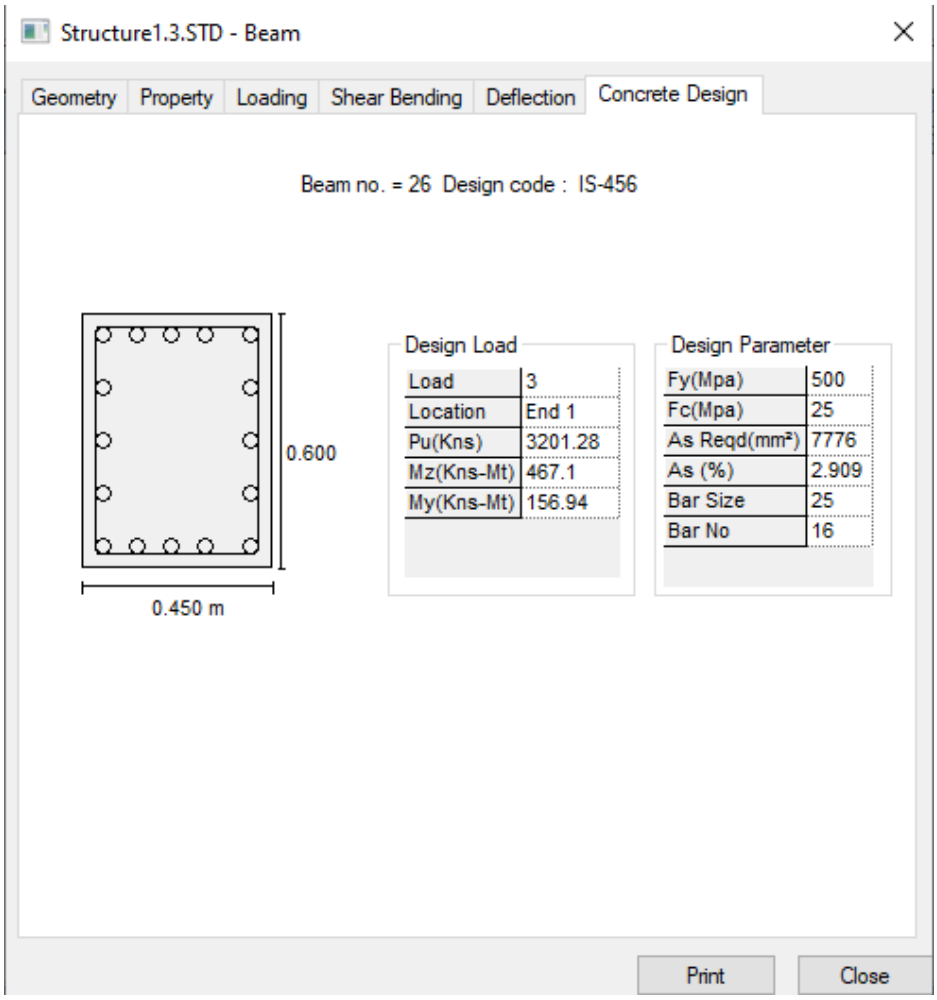
7.2 Column Design- C1 :-

Area of steel required : 7776 mm2

Required Percentage of Reinforcement ; 2.91 %

Area of steel provided : 8397 mm2

Provided Percentage of Reinforcement ; 3.10 %



Hence Safe

7.3 Beam Design - B25 :-

Input data :			
Over all Depth		**750**	mm
Breadth(b) mm		**380**	mm
Factored Momemt(Mu) kN.m		760	kNm
Grade of Steel (fy) Mpa		500	N/mm2

Grade of Concrete (fck) Mpa		25	N/mm2
Effective cover Bottom(d')		69	mm
Effective cover Top(dc)		53	mm
Amount of redistribution (%)		20	%
Solution :			
Effective depth		681	mm
Xu.max		310.6	mm
Ku.max		0.5	
Moment		584.8	kNm
Area of steel-1		2436.9	mm2
Area of steel-2		1263.8	mm2
Area of steel required Ast		**3700.7**	mm2
Percentage of reinforcement Pt		1.4	%
Depth ratio d'/d		0.1	
Stress in compression fsc		353.9	
Area of steel in compression Asc		1553.5	mm2
Result :			
Ast required		**3700.7**	mm2
Ast provided		3-32 Diameter(Ast.1-2412) + 3-32 Diameter(Ast.2-2412)	
Ast pr = Ast.1+ Ast.2		= 2412+2412 = **4825** mm2	
Ast reqired < Ast provided		3700.7< 4825	
Hence safe			

Provided		
Top reinforcement :3-32 diameter + 3-32 diameter		
Bottom reinforcement : 3-32 diameter + 3-32 diameter		
Design for Shear		
Breadth (b)	**380**	mm
Depth (D)	**750**	mm
Effective depth	681	mm
Percentage of reinforcement Pt	1.43	%
Diameter of stirrups	12	mm
No of leg	2	
Shear V	490	kN
Nominal shear stress Tv	1.89	kN/m2
Maximum nominal shear stress tc max	3.10	kN/m2
If tv < tc max	1.89 < 3.10	kN/m2
τcmax check	ok	
Permissible nominal shear stress tc	0.70	kN/m2
Total Shear Vus	307601	kN/m2
Spacing		
Reinforcement Required in mm	**180**	mm
Reinforcement Provided in mm	**150**	mm
Hence safe		

Beam Deflection Check - B25 :-

Characteristic comp stress of concrete	f_{ck}	:	25	N/mm^2
Characteristic tensile stress of steel	f_y	:	500	N/mm^3
Size of beam width	B	:	**380**	mm
Size of beam depth	d	:	**750**	mm
Moment of inertia	I	:	13359375000	mm4
Modulus of elasticity of steel	Es	:	200000	M pa
Length of the beam	L	:	**13.3**	m
Spacing ob beam	S	:	3.025	m
Loads				
Dead Load	DL	:	4.625	kN/m2
Live Load	LL	:	2	kN/m2
Total Load	TL	:	6.625	kN/m2
Udl for beam	w	:	20.04	kN/m
Wall Load	WL	:	20.37	kN/m
Self weight of beam	SL	:	7.125	kN/m
Total UDL	W		47.53	kN/m
Moment M max at support	B.M -1	:	**700.66**	kN.m
Moment M from staad	B.M -2	:	**621.00**	kN.m
B.M -1 > B.M -2	**Hence Safe**			
Shear	S.F-1	:	**316.09**	kN
Shear from staad	S.F-2	:	**315.00**	kN
S.F -1 > S.F -2	**Hence Safe**			
Check -1				
As per is 456:2000				

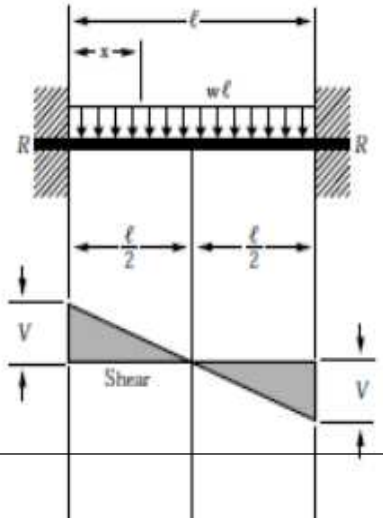
23.2.1 The vertical deflection limits may generally be assumed to be satisfied provided that the span to depth ratios are not greater than the values obtained as below:

a) Basic values of span to effective depth ratios for spans up to 10 m:

Cantilever	7
Simply supported	20
Continuous	26

b) For spans above 10 m, the values in (a) may be multiplied by 10/span in metres, except for cantilever in which case deflection calculations

Span to Depth ratio	SPD	:	26	
If span above 10m multiplied by 10/Span	factor	:	0.75	
Span to Depth ratio	SPD	:	19.55	
Vertical limit for depth	VLimt	:	**680.35**	mm
Provide depth	Dpro	:	**750**	mm
VLimit < Dpro	**Hence Safe**			
Check -2 As per Load	a) **The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members, should not normally exceed span/250.**			
Allowable deflection				
	b) **The deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and the application of finishes should not normally exceed span/350 or 20 mm whichever is less.**			
Allowable deflection				
Span by 250	D allow	:	53.20	mm
Span by 350	D allow	:	38.00	mm
Value	D allow	:	20.00	mm
In above 3 whichever is less				
Allowable deflection	D allow	:	**20.00**	mm



$R = V \quad \ldots\ldots\ldots\ldots\ldots\ldots = \frac{w\ell}{2}$

$V_x \quad \ldots\ldots\ldots\ldots\ldots\ldots = w\left(\frac{\ell}{2} - x\right)$

M_{max} (at ends) $\quad \ldots\ldots\ldots\ldots = \frac{w\ell^2}{12}$

M_i (at center) $\quad \ldots\ldots\ldots\ldots = \frac{w\ell^2}{24}$

$M_x \quad \ldots\ldots\ldots\ldots\ldots\ldots = \frac{w}{12}(6\ell x - \ell^2 - 6x^2)$

Δ_{max} (at center) $\quad \ldots\ldots\ldots\ldots = \frac{w\ell^4}{384EI}$

Actual deflection	D actual	:	**1.45**	mm
D allow < D actual	**Hence Safe**			

7.3.1 Beam Design - B27 :-

Input data :			
Over all Depth		**600**	mm
Breadth(b) mm		**380**	mm
Factored Momemt(Mu) kN.m		900	kNm
Grade of Steel (fy) Mpa		500	N/mm2
Grade of Concrete (fck) Mpa		25	N/mm2
Effective cover Bottom(d')		69	mm
Effective cover Top(dc)		69	mm
Amount of redistribution (%)		20	%
Solution :			
Effective depth		531	mm

Xu.max		242.1	mm
Ku.max		0.5	
Moment		355.5	kNm
Area of steel-1		1900.1	mm2
Area of steel-2		2709.2	mm2
Area of steel required Ast		**4609.4**	mm2
Percentage of reinforcement Pt		2.3	%
Depth ratio d'/d		0.1	
Stress in compression fsc		346.4	
Area of steel in compression Asc		3402.1	mm2
Result :			
Ast required		**4610.0**	mm2
Ast provided		3-32 Diameter(Ast.1-2412) + 3-32 Diameter(Ast.2-2412)	
Ast pr = Ast.1+ Ast.2		= 2412+2412 = **4825 mm2**	
Ast reqired < Ast provided		4610 < 4825	
Hence safe			
Provided			
Top reinforcement :3+2 -32 diameter			
Bottom reinforcement : 3-32 diameter + 3-32 diameter			
Design for Shear			
Breadth (b)		**380**	mm
Depth (D)		**600**	mm

Effective depth	531	mm
Percentage of reinforcement Pt	1.79	%
Diameter of stirrups	12	mm
No of leg	2	
Shear V	450	kN
Nominal shear stress Tv	2.23	kN/m2
Maximum nominal shear stress tc max	3.10	kN/m2
If tv < tc max	2.23 < 3.10	kN/m2
τcmax check	ok	
Permissible nominal shear stress tc	0.76	kN/m2
Total Shear Vus	296948	kN/m2
Spacing		
Reinforcement Required in mm	**140**	mm
Reinforcement Provided in mm	**125**	mm
Hence safe		

Beam Deflection Check Beam - B27 :--

Characteristic comp stress of concrete	f_{ck}	:	25	N/mm^2
Characteristic tensile stress of steel	f_y	:	500	N/mm^2
Size of beam width	B	:	380	mm
Size of beam depth	d	:	600	mm
Moment of inertia	I	:	6840000000	mm4
Modulus of elasticity of steel	Es	:	200000	M pa

Length of the beam	L	:	**10.9**	m
Spacing ob beam	S	:	4.3	m
Loads				
Dead Load	DL	:	4.625	kN/m2
Live Load	LL	:	2.00	kN/m2
Total Load	TL	:	6.625	kN/m2
Udl for beam	w	:	28.49	kN/m
Wall Load	WL	:	26.57	kN/m
Self weight of beam	SL	:	5.7	kN/m
Total UDL	W		60.75	kN/m
Moment M max at support	B.M -1	:	**601.50**	kN.m
Moment M from staad	B.M -2	:	**570.00**	kN.m
B.M -1 > B.M -2	**Hence Safe**			
Shear	S.F-1	:	**331.10**	kN
Shear from staad	S.F-2	:	**280.00**	kN
S.F -1 > S.F -2	**Hence Safe**			
Check -1				
As per is 456:2000				
Span to Depth ratio				
If span above 10m multiplied by 10/Span	factor	:	0.92	
Span to Depth ratio	SPD	:	23.85	

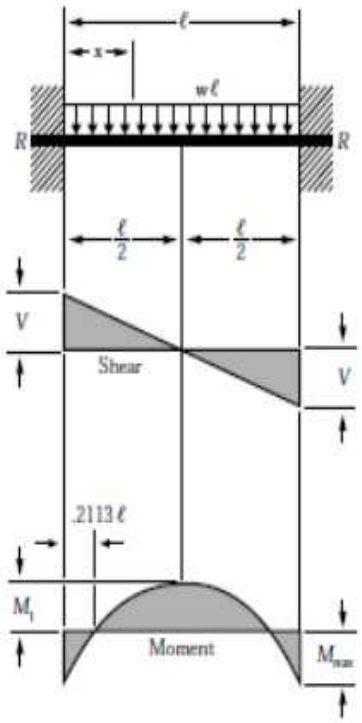
23.2.1 The vertical deflection limits may generally be assumed to be satisfied provided that the span to depth ratios are not greater than the values obtained as below:

a) Basic values of span to effective depth ratios for spans up to 10 m:

Cantilever	7
Simply supported	20
Continuous	26

b) For spans above 10 m, the values in (a) may be multiplied by 10/span in metres, except for cantilever in which case deflection calculations should be made.

Vertical limit for depth	VLimt	:	**456.96**	mm
Provide depth	Dpro	:	**600**	mm
VLimit < Dpro	**Hence Safe**			
Check -2 As per Load				
Allowable deflection	a) **The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members, should not normally exceed span/250.**			
	b) **The deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and the application of finishes should not normally exceed span/350 or 20 mm whichever is less.**			
Allowable deflection				
Span by 250	D allow	:	43.60	mm
Span by 350	D allow	:	31.14	mm
Value	D allow	:	20.00	mm
In above 3 whichever is less				
Allowable deflection	D allow	:	**20.00**	mm



$$R = V \quad \ldots\ldots\ldots\ldots\ldots = \frac{w\ell}{2}$$

$$V_x \quad \ldots\ldots\ldots\ldots\ldots = w\left(\frac{\ell}{2} - x\right)$$

$$M_{max}\ \text{(at ends)} \quad \ldots\ldots\ldots = \frac{w\ell^2}{12}$$

$$M_1\ \text{(at center)} \quad \ldots\ldots\ldots = \frac{w\ell^2}{24}$$

$$M_x \quad \ldots\ldots\ldots\ldots\ldots = \frac{w}{12}(6\ell x - \ell^2 - 6x^2)$$

$$\Delta_{max}\ \text{(at center)} \quad \ldots\ldots\ldots = \frac{w\ell^4}{384EI}$$

$$\Delta_x \quad \ldots\ldots\ldots\ldots\ldots = \frac{wx^2}{24EI}(\ell - x)^2$$

Actual deflection	D actual	:	**1.63**	mm
D allow < D actual	**Hence Safe**			

THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.