

Comparative Study of Structural Design (By Staadpro) of Two Storeyed Residential Building in Earthquake Zones II And V

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ABSTRACT: - A comparative study of structural design (by staadpro software) of two storeyed residential building in earthquake zone II and V has been done. A two storeyed residential building has been taken for comparison. The building consists of two floors (Ground floor and first floor). The ground floor consists of verandah, drawing room, dining hall, kitchen, one bedroom, two toilets and a staircase. The first floor consists of two balconies, three bedrooms, three toilets, a study room and staircase. The second floor will be terrace floor with mumty for staircase. The structure of the building has been analysed using the staadpro software of version STAAD.Pro CONNECT Edition V22. Two models of the same building have been developed. One model has been analysed for earthquake zone II and second model has been analysed for earthquake zone V. A comparative study of the design results of beams and columns has been made. A summary conclusion has been arrived at.

1.INTRODUCTION

An earthquake is the intense shaking of the Earth's surface caused by a sudden release of energy in the lithosphere, typically resulting from the breaking or shifting of underground rock along a fault. These movements, caused by shifting tectonic plates, generate seismic waves that radiate outward, causing ground motion, potential destruction, and, if underwater, tsunamis. Earthquake comes in various parts of various countries of the world including our country, India. Earthquake causes loss of life and properties. The design engineers are concerned with the earthquake resistant design of structures i.e. the structures are designed to resist the earthquake loads. Our country has been divided into four earthquake zones from zone II to zone V as per IS1893. Area coming under zone II is experiencing

earthquake of minimum intensity and area coming under zone V is experiencing earthquake of maximum intensity.

A comparative study of structural design (by staadpro software) of two storeyed residential building in earthquake zone II and V has been done. A two storeyed residential building has been taken for comparison. The building consists of two floors (Ground floor and first floor).

The ground floor consists of verandah, drawing room, dining hall, kitchen, one bedroom, two toilets and a staircase. The first floor consists of two balconies, three bedrooms, three toilets, a study room and staircase. The second floor consists of terrace floor with mumty for staircase. The structure of the building has been analysed using the staadpro software of version STAAD.Pro CONNECT Edition V22. Two models of the building have been developed. One model has been analysed for earthquake zone II and second model has been analysed for earthquake zone V. A comparative study of the design results of beams and columns has been made. A summary conclusion has been arrived at.

2. METHODOLOGY (MATERIALS AND METHODS)

Residential buildings are widely constructed all over India/world. Here I have taken a two storeyed residential building to study comparison of structural design (by staadpro) of members (beams and columns) in earthquake zone II and V. The materials (equipment) required are as under: -

01.Computer (Laptop or desktop, I will use a laptop)

02.Structural design software i.e. STAAD.Pro CONNECT Edition V22

03.Excel software

04. AUTOCAD software

A drawing of two storeyed building will be made in AutoCAD. In this building, there will be following rooms/areas: -

A. Ground floor: -

01. Verandah 2.555x1.50 m
02. Drawing room 3.10x3.55 m
03. Dining hall 3.10x3.05 m
04. Kitchen 3.10x3.40 m
05. Bedroom 3.60x3.40 m with attached toilet 2.30x1.50 m (common) toilet 2.30 x 1.50 m
06. Staircase 3.90x2.05 m

B. First floor: -

01. Balcony at front 1.20 m wide
 02. Bed room 3.10x3.65 m with attached toilet 2.555x1.50 m and dress 1.10x1.50 m
 03. Study room 3.10x1.85 m
 04. Bed room 3.10x 4.30 m
 05. Bed room 3.60x3.40 with attached toilet 2.60x1.50m
 06. Balcony at rear 1.20 m wide
 07. (Common) toilet 2.60x1.35 m
 08. Staircase 3.90x2.05 m
- ##### C. Terrace
01. Terrace
 02. Mumty 3.70x2.05m

A geometry of above two storeyed building will be made. The following loads will be applied: -

01. Self-weight of the structure
02. Loads due to walls
03. Loads due to slab
04. Live load
05. Earthquake load

There will be two staad models. Earthquake load according to zone II will be applied in the first model. Now first model will be copied and will be made another model i.e. second model. In this second model, earthquake loads according to zone V will be applied. In this way, two designs of the same building will be done. After analysis and design, the

design results of all the member will be compared and a conclusion will be arrived at.

3. DESIGN DATA

Data for analysis and design of structure by STAADPRO): -

01. Concrete mix: - M20
02. Steel: - Tor steel (High yield strength deformed bars- Fe 415)
03. Clear cover to reinforcement: -
 - i. Beams: - 30 mm
 - ii. Columns: - 40 mm
04. Safe bearing capacity: - 150 kN/sqm (Though the design of footings is beyond the scope of this document)
05. Depth of foundation: - 2.0 m
06. Tie beams will be provided at ground.
07. Height of parapet: - 1.00 m
08. The structure has been designed for G+1 storey.
09. Loads: -

Dead loads: -

Self-wt.: - taken automatically by staadpro

Finish: -

- a. Terrace (water proofing): - 2 kN/sqm
- b. Flooring: - 1.00 kN/sqm
- c. Toilet filling: - $0.3 \times 24 = 7.20$ kN/sqm

Live loads: -

- a. roof terrace: - 1.5 kN/sqm (accessible roof)
- b. rooms: - 2 kN/sqm
- c. stair: - 3 kN/sqm
- d. toilet: - 2 kN/sqm

10. Seismic data: -

A. For building in seismic zone II

Zone factor = 0.10 (From table 3 on page no. 10 of

IS1893-2016)

Response reduction factor = 3 (For ordinary

moment resistant frame (OMRF) -From table 9 on page no. 20 of IS1893-2016)

Importance factor = 1 (From table 8 on page no. 19

of IS1893-2016)

Rock and soil site ratio = 2 (For medium and stiff soil- From clause 6.4.2.1 on page no. 9 of IS1893-2016)

Type of structure = 1 (For R.C.C structure)

Damping ratio = 0.05 (From clause 7.2.4 on page no. 19 of IS1893-2016)

Depth of foundation = 2.00

B. For building in seismic zone V

Zone factor = 0.36 {From table 3 on page no. 10 of IS1893 (Part 1)-2016}

Response reduction factor = 3 {For ordinary moment resistant frame (OMRF)-From table 9 on page no. 20 of IS1893 (Part1)-2016}. Actually, Special moment resistant frame (SMRF) should be provided for the structures in zone V. But OMRF has been adopted for similarity of results.

Importance factor = 1 {From table 8 on page no. 19 of

IS1893 (Part1)-2016}

Rock and soil site ratio = 2 {For medium and stiff soil-

From clause 6.4.2.1 on page no. 9 of

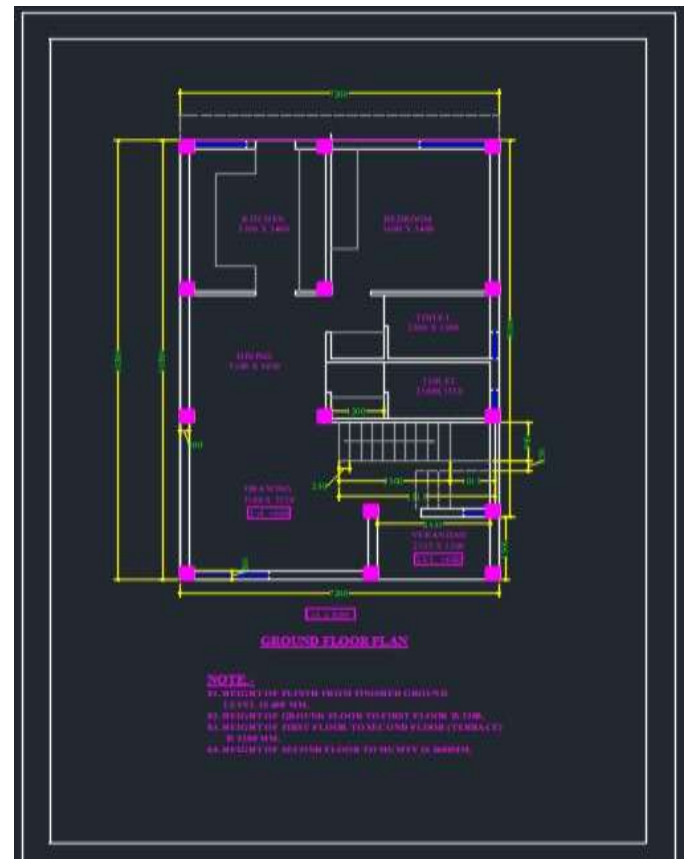
IS1893 (Part1) -2016}

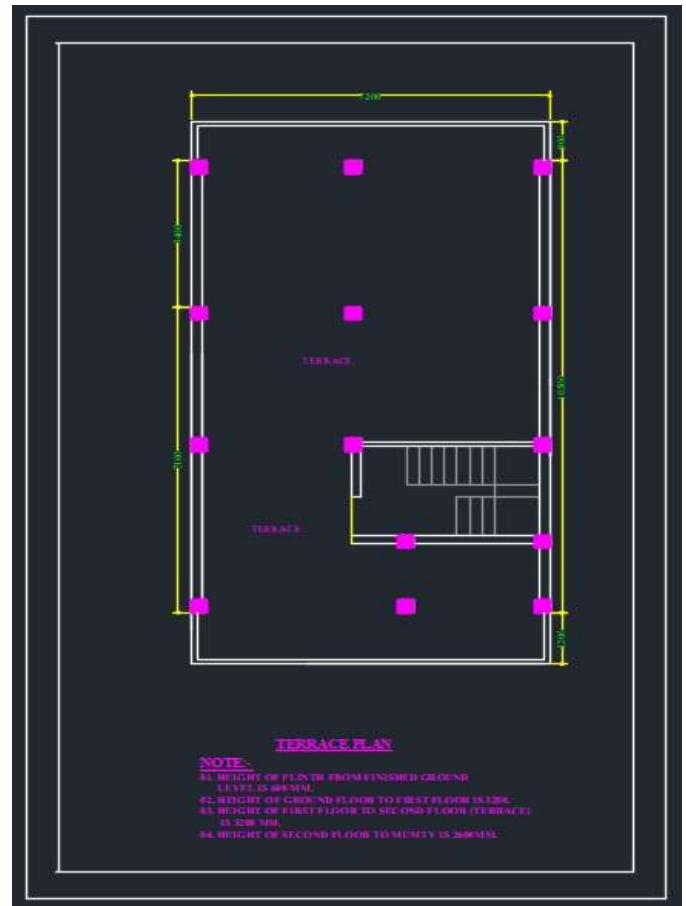
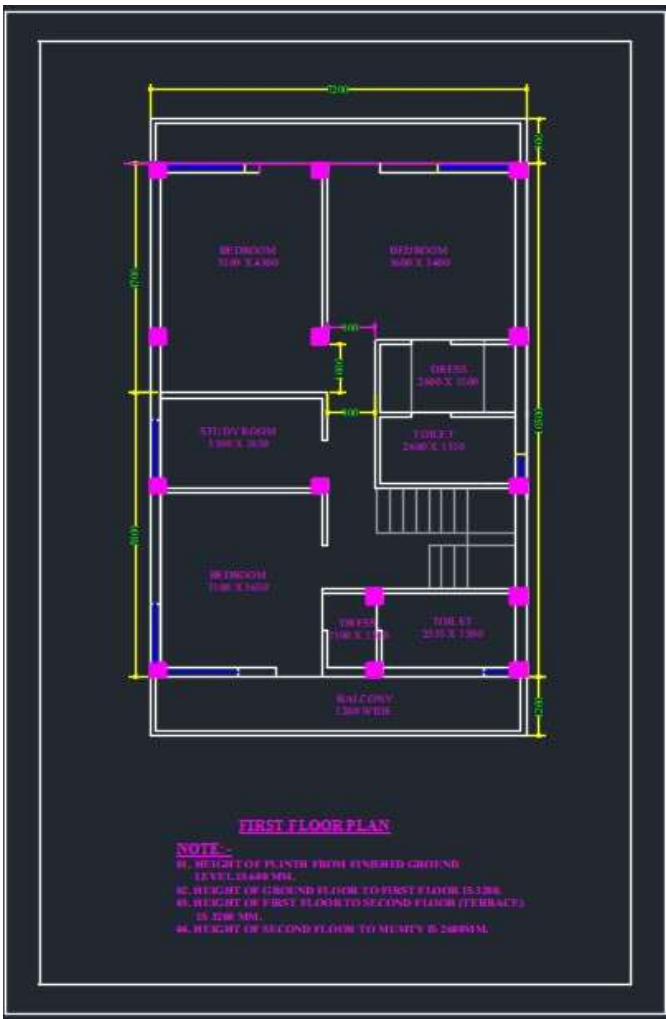
Type of structure = 1 (For R.C.C structure)

Damping ratio = 0.05 {From clause 7.2.4 on page no. 19 of IS1893 (Part1)-2016}

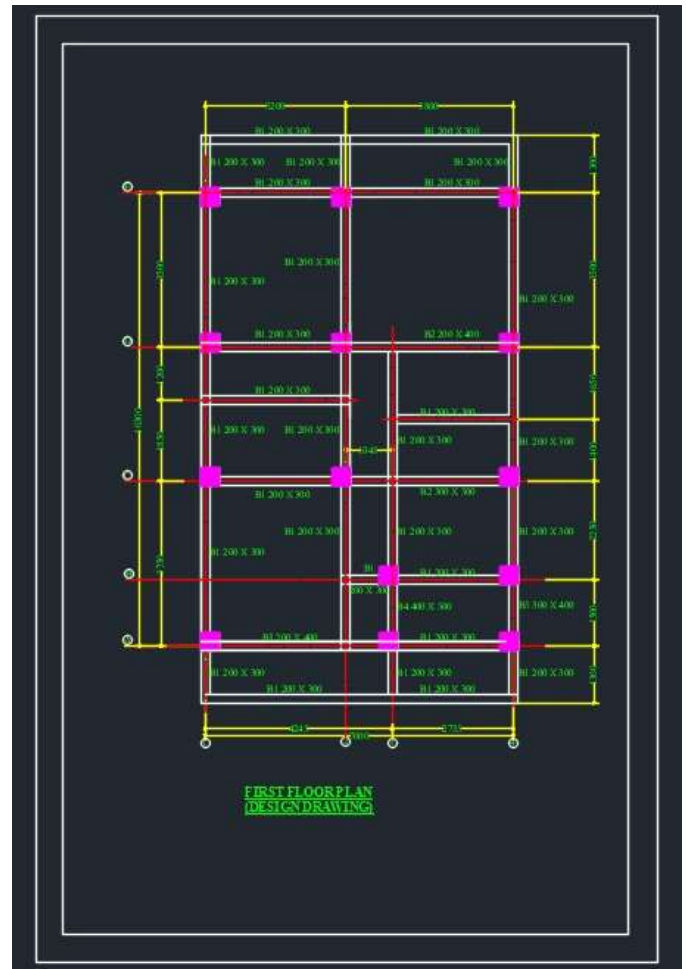
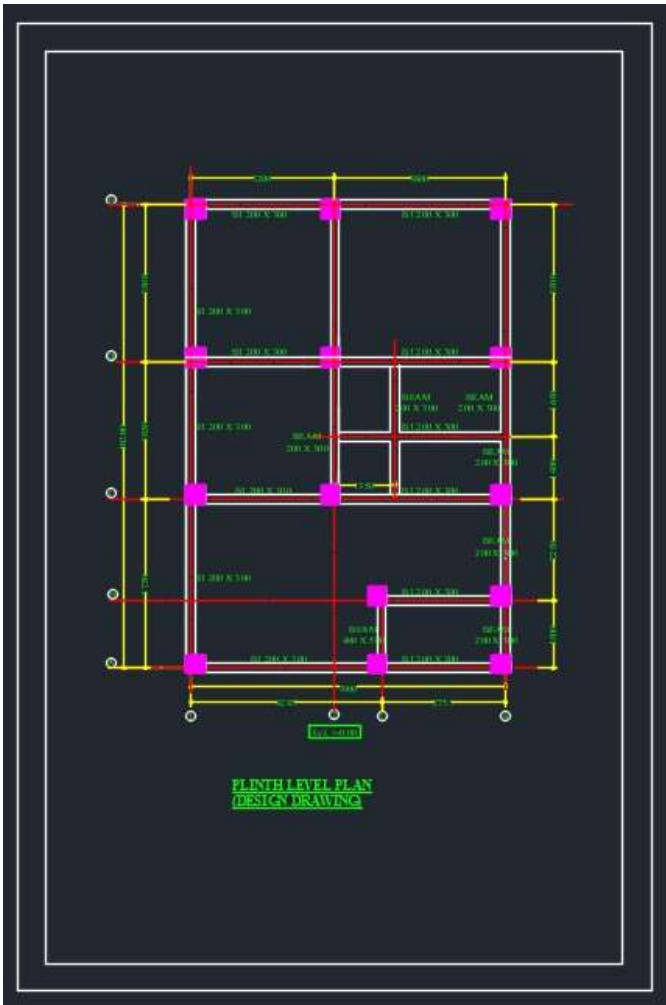
Depth of foundation = 2.00

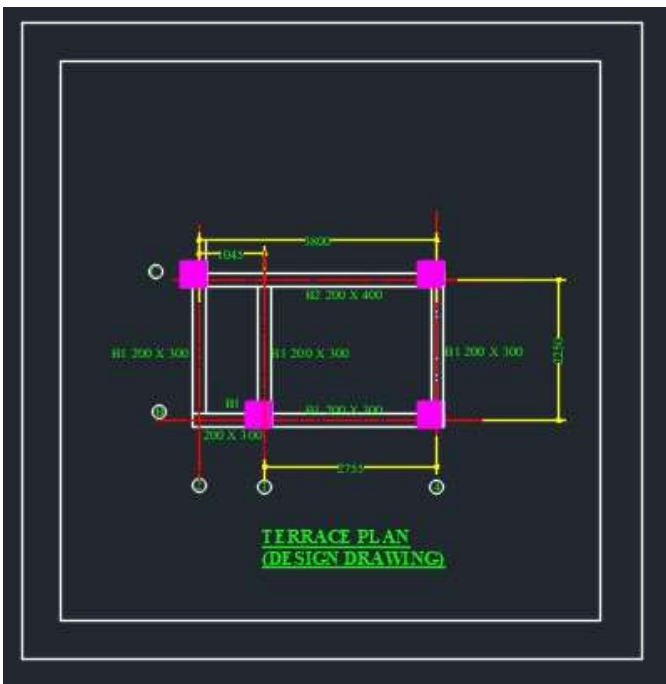
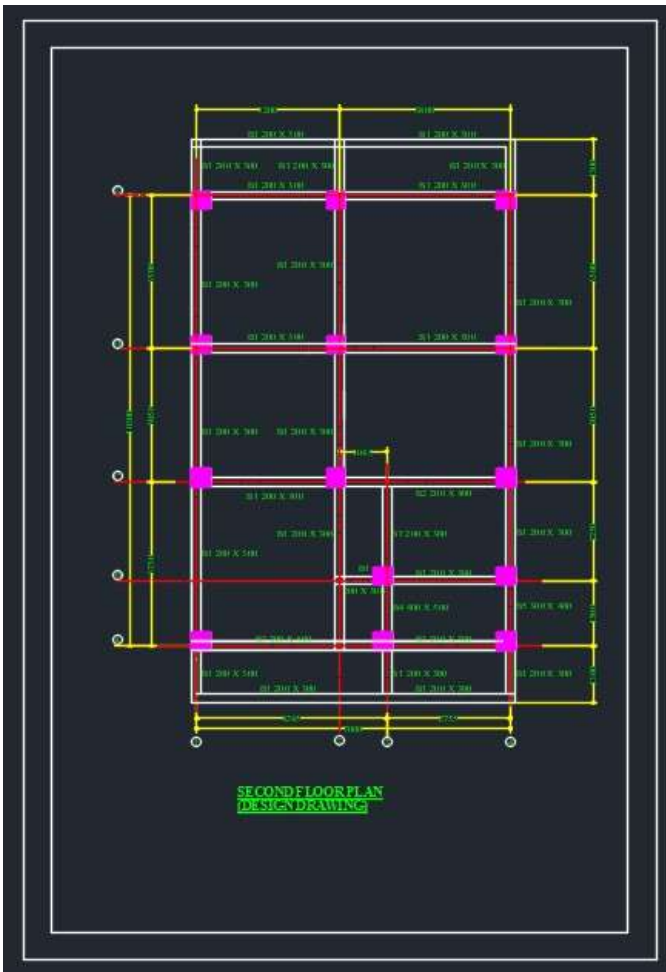
4. ARCHITECTURAL PLANS OF TWO STOREYED RESIDENTIAL BUILDING





5. DESIGN DRAWINGS





6. LOAD CALCULATIONS

01. Calculations of loads at plinth level: - -

A. Plinth beam 300 deep carrying full brick loads of height 3.8 m: -

Depth of beam above = 300 mm

Plinth height = 0.60 m

Floor height = 3.20 m

Total height = 3.80 m

$$\text{Clear Height} = 3.80 - 0.30 = 3.50 \text{ m}$$

Wall thickness = 200 mm

Thickness of plaster = 30 mm (Total thickness of both side plaster)

Total thickness of wall = 230 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$$0.23 \times 3.50 \times 20 = 16.10 \text{ Kn/m}$$

B. Plinth beam 300 deep carrying full brick loads of height 0.60 m: -

Plinth height = 0.60 m

Height of brickwork = 0.60 m

Wall thickness = 200 mm

Thickness of plaster = 30 mm (Total thickness of both side plaster)

Total thickness of wall = 230 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$$0.23 \times 0.60 \times 20 = 2.76 \text{ kN/m}$$

02. Calculation of loads at first floor level: -

A. Floor beam 300 deep carrying full brick loads of height 3.20 m: -

Depth of beam above = 300 mm

Floor height = 3.20 m

$$\text{Clear Height} = 3.20 - 0.30 = 2.90 \text{ m}$$

Wall thickness = 200 mm

Thickness of plaster = 30 mm (Total thickness of

both side plaster)

Total thickness of wall = 230 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$$0.23 \times 2.90 \times 20 = 13.34 \text{ kN /m}$$

$$(6/1000) \times 20 = 0.12$$

Filling in the sunk

$$(200/1000) \times 24 = 4.80$$

$$= 8.42 \text{ kN /sqm}$$

B. Floor beam 300 deep carrying half brick loads of height 1.00 m: -

Height of brickwork = 1.00 m

Wall thickness = 100 mm

Thickness of plaster = 30 mm (Total thickness of both side plaster)

Total thickness of wall = 130 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$$0.13 \times 1.00 \times 20 = 2.60 \text{ kN /m}$$

C. Loads due to self wt. of slab and floor finish: -

Span of the slab = 3.50 m

Thickness of slab = 125 mm

Loads: -

Self-weight

$$(125/1000) \times 25 = 3.125$$

Floor finish = 1.00

Plastering

$$(6/1000) \times 20 = 0.12$$

$$= 4.245 \text{ kN /sqm}$$

D. Loads due to self wt. of slab, floor finish and filling

in sunk portion: -

Span of the slab = 1.50 m

Thickness of slab = 100 mm

Sunk depth = 200 mm

Loads: -

Self-weight

$$(100/1000) \times 25 = 2.50$$

Floor finish = 1.00

Plastering

03. Calculation of loads at second floor level: -

A. Floor beam 300 deep carrying full

brick loads of height 2.60 m: -

Depth of beam above = 300 mm

Floor height = 2.60 m

Clear Height = 2.60 - 0.30 = 2.30 m

Wall thickness = 200 mm

Thickness of plaster = 30 mm (Total thickness of both side plaster)

Total thickness of wall = 230 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$$0.23 \times 2.30 \times 20 = 10.58 \text{ kN /m}$$

$$\text{Load from stair} = 10.994$$

$$= 21.57 \text{ kN /m}$$

B. Floor beam 300 deep carrying full brick loads of height 1.00 m: -

Height of brickwork = 1.00 m

Wall thickness = 200 mm

Thickness of plaster = 30 mm (Total thickness of both side plaster)

Total thickness of wall = 230 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$$0.23 \times 1.00 \times 20 = 4.60 \text{ kN /m}$$

C. Floor beam 300 deep carrying half brick loads of

height 1.00 m: -

Height of brickwork = 1.00 m

Wall thickness = 100 mm

Thickness of plaster = 30 mm (Total thickness of

both side plaster)

Total thickness of wall = 130 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$0.13 \times 1.00 \times 20 = 2.60 \text{ kN/m}$

D. Loads due to self wt. of slab and floor finish: -

Span of the slab = 3.50 m

Thickness of slab = 125 mm

Loads: -

Self-weight

$(125/1000) \times 25 = 3.125$

Water proofing = 2.00

Plastering

$(6/1000) \times 20 = 0.12$

$= 5.245 \text{ kN/sqm}$

04. Calculation of loads at mummy roof level: -

A. Floor beam 300 deep carrying full brick

loads of height 0.45 m: -

Height of brickwork = 0.45 m

Wall thickness = 200 mm

Thickness of plaster = 30 mm (Total
thickness of both side plaster)

Total thickness of wall = 230 mm

Unit weight of masonry = 20 kN/cum

Loads: -

$0.23 \times 0.45 \times 20 = 2.07 \text{ kN/m}$

B. Loads due to self wt. of slab and floor finish: -

Span of the slab = 2.25 m

Thickness of slab = 125 mm

Loads: -

Self-weight

$(125/1000) \times 25 = 3.125$

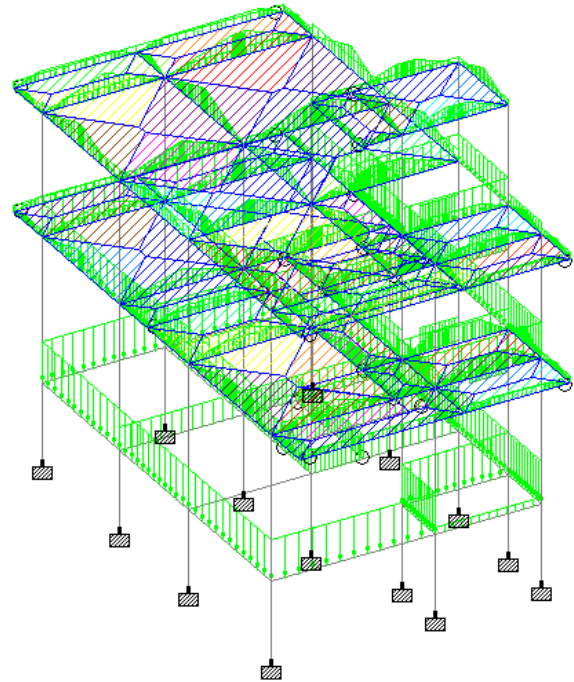
Water proofing = 2.00

Plastering

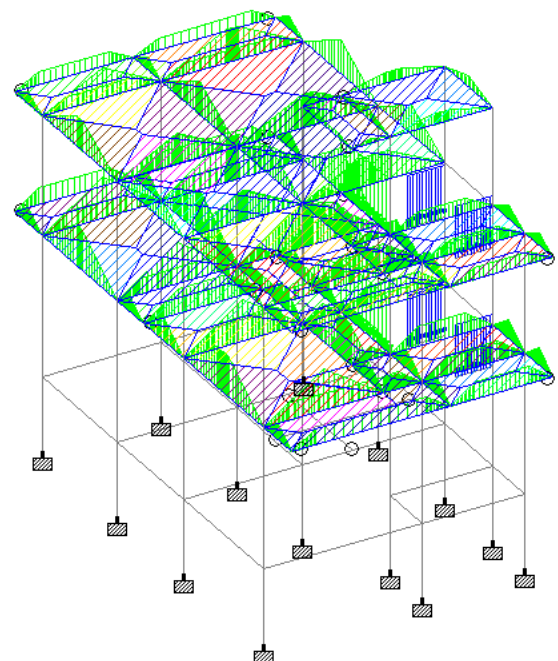
$(6/1000) \times 20 = 0.12$

$= 5.245 \text{ kN/sqm}$

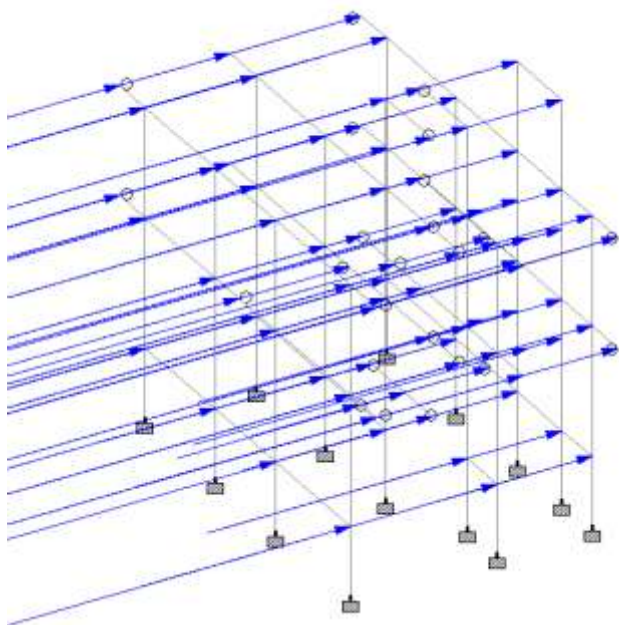
7. LOAD DIAGRAMS IN STAADPRO INPUT FOR SEISMIC ZONE II AND IV



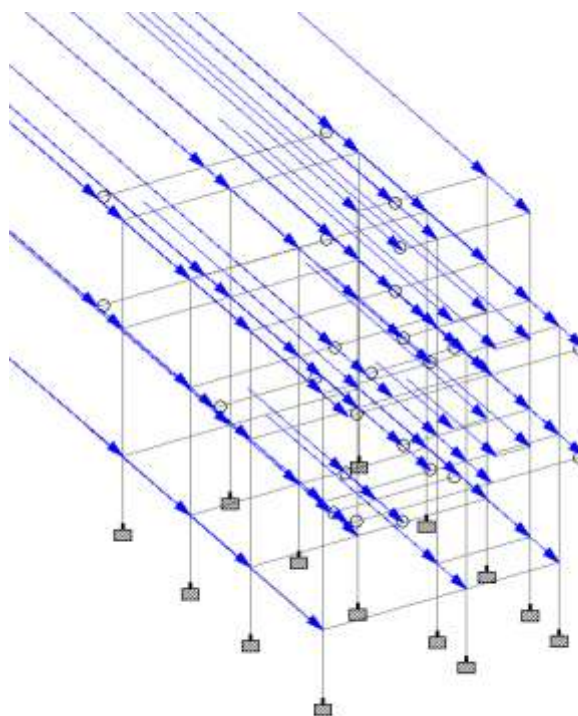
DEAD LOADS



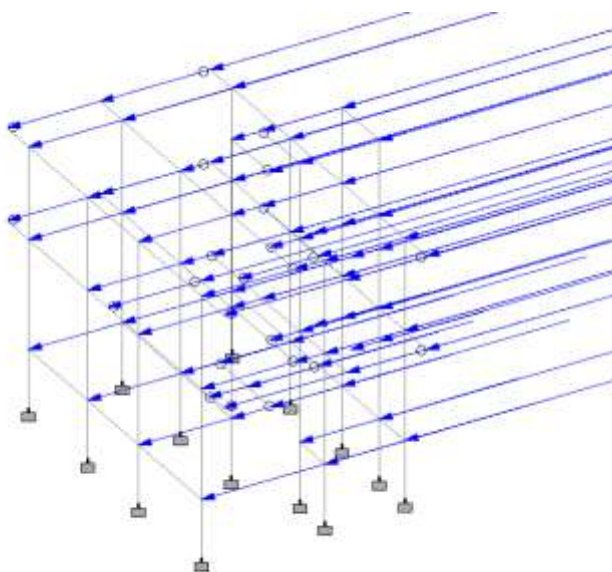
LIVE LOADS



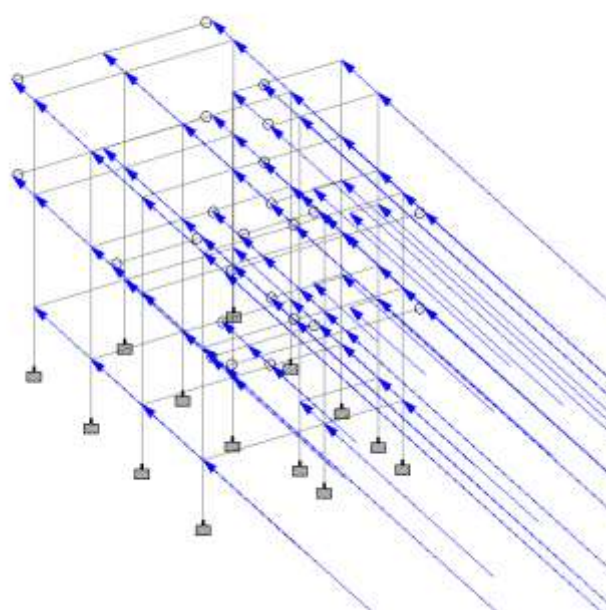
SEISMIC LOADS +X



SEISMIC LOADS +Z



SEISMIC LOADS -X



SEISMIC LOADS -Z

8. STAADPRO INPUT FOR SEISMIC

ZONE II

1. STAAD SPACE RESIDENTIAL BUILDING

2. START JOB INFORMATION

3. ENGINEER DATE 3/5/2026

4. JOB NAME RESIDENTIAL BUILDING IN

ZONE II

5. JOB CLIENT GENERAL

6. JOB REV 0

7. JOB PART 1

8. ENGINEER NAME T.L. SAHU

9. JOB NO 1001

10. JOB REF 1001

11. CHECKER NAME T.L. SAHU

12. APPROVED NAME T.L. SAHU

13. CHECKER DATE 3/7/2026

14. APPROVED DATE 3/7/2026

15. END JOB INFORMATION

16. INPUT WIDTH 79

17. SET ECHO ON

18. SET PRINT 5

19. UNIT METER KN

20. JOINT COORDINATES

21. 1 0 3.2 -1.3; 2 3.2 3.2 -1.3; 3 7 3.2 -1.3; 4 0 6.4

-1.3; 5 3.2 6.4 -1.3

22. 6 7 6.4 -1.3; 7 0 -0.6 0; 8 3.2 -0.6 0; 9 7 -0.6 0;

10 0 -2.6 0; 11 3.2 -2.6 0

23. 12 7 -2.6 0; 13 0 3.2 0; 14 3.2 3.2 0; 15 7 3.2 0;

16 0 6.4 0; 17 3.2 6.4 0

24. 18 7 6.4 0; 19 0 -0.6 3.5; 20 3.2 -0.6 3.5; 21 7 -

0.6 3.5; 22 0 -2.6 3.5

25. 23 3.2 -2.6 3.5; 24 7 -2.6 3.5; 25 0 3.2 3.5; 26

3.2 3.2 3.5; 27 7 3.2 3.5

26. 28 0 6.4 3.5; 29 3.2 6.4 3.5; 30 7 6.4 3.5; 31

4.55 -0.6 3.5; 32 4.245 3.2 3.5

27. 33 0 3.2 4.7; 34 3.2 3.2 4.7; 35 3.2 -0.6 5.15; 36

7 -0.6 5.15

28. 37 4.55 -0.6 5.15; 38 4.245 3.2 5.15; 39 7 3.2

5.15; 40 0 -0.6 6.55

29. 41 3.2 -0.6 6.55; 42 7 -0.6 6.55; 43 0 -2.6 6.55;

44 3.2 -2.6 6.55

30. 45 7 -2.6 6.55; 46 0 3.2 6.55; 47 3.2 3.2 6.55;

48 7 3.2 6.55; 49 0 6.4 6.55

31. 50 3.2 6.4 6.55; 51 7 6.4 6.55; 52 4.55 -0.6

6.55; 53 4.245 3.2 6.55

32. 54 4.245 6.4 6.55; 55 3.2 9 6.55; 56 7 9 6.55; 57

7 1.76 6.55; 58 6 1.76 6.55

33. 59 7 4.96 6.55; 60 6 4.96 6.55; 61 4.245 9 6.55;

62 7 -0.6 8.8

34. 63 4.245 -0.6 8.8; 64 7 -2.6 8.8; 65 4.245 -2.6

8.8; 66 7 3.2 8.8

35. 67 4.245 3.2 8.8; 68 7 6.4 8.8; 69 4.245 6.4 8.8;

70 3.2 6.4 8.8; 71 7 9 8.8

36. 72 4.245 9 8.8; 73 3.2 9 8.8; 74 3.2 3.2 8.8; 75 7

2.08 8.8; 76 6 2.08 8.8

37. 77 7 5.26 8.8; 78 6 5.26 8.8; 79 0 -0.6 10.3; 80

7 -0.6 10.3

38. 81 4.245 -0.6 10.3; 82 0 -2.6 10.3; 83 7 -2.6

10.3; 84 4.245 -2.6 10.3

39. 85 0 3.2 10.3; 86 7 3.2 10.3; 87 4.245 3.2 10.3;

88 0 6.4 10.3; 89 7 6.4 10.3

40. 90 4.245 6.4 10.3; 91 3.2 3.2 10.3; 92 3.2 6.4

10.3; 93 0 3.2 11.6

41. 94 0 6.4 11.6; 95 7 3.2 11.6; 96 4.245 3.2 11.6;

97 7 6.4 11.6

42. 98 4.245 6.4 11.6

43. MEMBER INCIDENCES

44. 1 1 2; 2 2 3; 3 4 5; 4 5 6; 5 13 1; 6 14 2; 7 15 3;

8 16 4; 9 17 5; 10 18 6

45. 11 10 7; 12 7 13; 13 13 16; 14 11 8; 15 8 14; 16

14 17; 17 12 9; 18 9 15

46. 19 15 18; 20 7 8; 21 8 9; 22 13 14; 23 14 15; 24

16 17; 25 17 18; 26 19 7

47. 27 25 13; 28 28 16; 29 20 8; 30 26 14; 31 29

17; 32 21 9; 33 27 15; 34 30 18

48. 35 22 19; 36 19 25; 37 25 28; 38 23 20; 39 20

26; 40 26 29; 41 24 21; 42 21 27

49. 43 27 30; 44 19 20; 45 20 31; 46 25 26; 47 26

32; 48 28 29; 49 29 30; 50 31 21

50. 51 32 27; 52 33 25; 53 34 26; 54 35 20; 55 37

31; 56 36 21; 57 38 32; 58 39 27

51. 59 33 34; 60 30 51; 61 40 19; 62 49 28; 63 50

29; 64 35 37; 65 37 36; 66 38 39

52. 67 46 33; 68 47 34; 69 41 35; 70 42 36; 71 48

39; 72 52 37; 73 53 38; 74 43 40

53. 75 40 46; 76 46 49; 77 44 41; 78 41 47; 79 47

50; 80 45 42; 81 42 57; 82 48 59

54. 83 40 41; 84 41 52; 85 46 47; 86 47 53; 87 49

50; 88 50 54; 89 52 42; 90 53 48

55. 91 54 51; 92 50 55; 93 51 56; 94 55 61; 95 57

48; 96 58 57; 97 59 51; 98 60 59

56. 99 61 56; 100 62 42; 101 67 53; 102 69 54; 103

70 50; 104 71 56; 105 73 55

57. 106 74 47; 107 66 48; 108 68 51; 109 72 61;

110 79 40; 111 85 46; 112 88 49

58. 113 65 63; 114 63 67; 115 67 69; 116 64 62;

117 62 75; 118 66 77; 119 63 62

59. 120 67 66; 121 69 68; 122 70 69; 123 69 72;

124 68 71; 125 73 72; 126 72 71

60. 127 74 67; 128 75 66; 129 76 75; 130 77 68;

131 78 77; 132 81 63; 133 87 67

61. 134 90 69; 135 80 62; 136 86 66; 137 89 68;

138 91 74; 139 92 70; 140 82 79

62. 141 79 85; 142 85 88; 143 84 81; 144 81 87;

145 87 90; 146 83 80; 147 80 86

63. 148 86 89; 149 79 81; 150 85 91; 151 87 86;

152 88 92; 153 90 89; 154 91 87

64. 155 92 90; 156 81 80; 157 93 85; 158 94 88;

159 96 87; 160 95 86; 161 97 89

65. 162 98 90; 163 93 96; 164 94 98; 165 96 95;

166 98 97

66. MEMBER RELEASE

67. 1 3 59 64 66 72 105 122 127 138 139 163 164

START MY MZ

68. 2 4 55 57 59 65 66 102 109 165 166 END MY

MZ

69. DEFINE MATERIAL START

70. ISOTROPIC CONCRETE

71. E 2.17185E+07

72. POISSON 0.17

73. DENSITY 25

74. ALPHA 1E-05

75. DAMP 0.05

76. END DEFINE MATERIAL

77. MEMBER PROPERTY INDIAN

78. 1 TO 10 20 TO 34 44 TO 46 48 TO 50 52 TO

73 83 TO 85 87 89 94 96 98 TO 112 -

79. 119 TO 122 125 TO 127 129 131 134 135 137

TO 139 149 151 153 156 TO 165 -

80. 166 PRIS YD 0.3 ZD 0.2

81. 47 51 88 91 150 152 154 155 PRIS YD 0.4 ZD

0.2

82. MEMBER PROPERTY INDIAN

83. 136 PRIS YD 0.4 ZD 0.3

84. 86 90 PRIS YD 0.5 ZD 0.3

85. MEMBER PROPERTY INDIAN

86. 11 TO 19 35 TO 43 74 TO 82 92 93 95 97 113

TO 118 123 124 128 130 140 TO 147 -

87. 148 PRIS YD 0.4 ZD 0.4

88. MEMBER PROPERTY INDIAN

89. 132 133 PRIS YD 0.5 ZD 0.4

90. CONSTANTS

91. MATERIAL CONCRETE ALL

92. SUPPORTS

93. 10 TO 12 22 TO 24 43 TO 45 64 65 82 TO 84

FIXED

94. DEFINE 1893 LOAD

95. ZONE 0.1 RF 5 I 1 SS 2 ST 1 DM 0.05 DT 2

96. SELFWEIGHT 1

97. MEMBER WEIGHT

98. *DEAD LOADS

99. 20 21 26 32 56 61 70 100 110 119 132 135
149

UNI 16.1

100. 29 44 45 50 54 55 64 65 69 72 84 89 UNI
9.1

101. 96 98 129 131 UNI 9

102. 156 UNI 2.76

103. 22 23 27 33 52 58 67 71 107 111 136 150
151 154 UNI 13.34

104. 30 47 51 53 57 59 66 68 73 85 90 106 120
133 138 UNI 7.54

105. 1 2 5 7 157 160 163 165 UNI 2.6

106. 101 UNI 10.99

107. 91 108 121 UNI 10.58

108. 102 UNI 21.57

109. 28 34 60 62 112 137 UNI 4.6

110. 3 4 8 10 158 161 164 166 UNI 2.6

111. 94 99 104 105 125 126 UNI 2.07

112. *LIVE LOADS

113. 96 98 129 131 UNI 1

114. 101 102 UNI 1.06

115. FLOOR WEIGHT

116. *DEAD LOADS

117. YRANGE 3.2 3.2 FLOAD 4.445
XRANGE 0

3.2 ZRANGE -1.3 10.3 GY

118. YRANGE 3.2 3.2 FLOAD 4.445
XRANGE

3.2 7 ZRANGE -1.3 3.5 GY

119. YRANGE 3.2 3.2 FLOAD 4.445
XRANGE

3.2 4.245 ZRANGE 3.5 10.3 GY

120. YRANGE 3.2 3.2 FLOAD 4.445
XRANGE

4.245 7 ZRANGE 3.5 5.15 GY

121. YRANGE 3.2 3.2 FLOAD 8.62
XRANGE

4.245 7 ZRANGE 5.15 6.55 GY

122. YRANGE 3.2 3.2 FLOAD 8.62
XRANGE

4.245 7 ZRANGE 8.8 10.3 GY

123. YRANGE 3.2 3.2 FLOAD 4.445
XRANGE 0

7 ZRANGE 10.3 11.6 GY

124. YRANGE 6.4 6.4 FLOAD 5.245
XRANGE 0

7 ZRANGE -1.3 6.55 GY

125. YRANGE 6.4 6.4 FLOAD 5.245
XRANGE 0

4.245 ZRANGE 6.55 10.3 GY

126. YRANGE 6.4 6.4 FLOAD 5.245
XRANGE

4.245 7 ZRANGE 8.8 10.3 GY

127. YRANGE 6.4 6.4 FLOAD 5.245
XRANGE 0

7 ZRANGE 10.3 11.6 GY

128. YRANGE 9 9 FLOAD 5.245 XRANGE
3.2 7

ZRANGE 6.55 8.8 GY

129. *LIVE LOADS

130. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE
0 3.2

ZRANGE -1.3 10.3 GY

131. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE
3.2 7

ZRANGE -1.3 3.5 GY

132. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE
3.2

4.245 ZRANGE 3.5 10.3 GY

133. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE 4.245 7 ZRANGE 3.5 5.15 GY	150. 96 98 129 131 UNI GY -9 151. 156 UNI GY -2.76
134. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE 4.245 7 ZRANGE 5.15 6.55 GY	152. 22 23 27 33 52 58 67 71 107 111 136 150 151 154 UNI GY -13.34
135. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE 4.245 7 ZRANGE 8.8 10.3 GY	153. 30 47 51 53 57 59 66 68 73 85 90 106 120 133 138 UNI GY -7.54
136. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE 0 7 ZRANGE 10.3 11.6 GY	154. 1 2 5 7 157 160 163 165 UNI GY -2.6 155. 101 UNI GY -10.99
137. LOAD 1 LOADTYPE SEISMIC TITLE EQ+X (EARTHQUAKE LOAD)	156. 91 108 121 UNI GY -10.58 157. 102 UNI GY -21.57
138. 1893 LOAD X 1	158. 28 34 60 62 112 137 UNI GY -4.6 159. 3 4 8 10 158 161 164 166 UNI GY -2.6
139. LOAD 2 LOADTYPE SEISMIC TITLE EQ- X (EARTHQUAKE LOAD)	160. 94 99 104 105 125 126 UNI GY -2.07 161. FLOOR LOAD
140. 1893 LOAD X -1.	162. YRANGE 3.2 3.2 FLOAD -4.445 XRANGE 0 3.2 ZRANGE -1.3 10.3 GY
141. LOAD 3 LOADTYPE SEISMIC TITLE EQ+Z (EARTHQUAKE LOAD)	163. YRANGE 3.2 3.2 FLOAD -4.445 XRANGE 3.2 7 ZRANGE -1.3 3.5 GY
142. 1893 LOAD Z 1	164. YRANGE 3.2 3.2 FLOAD -4.445 XRANGE 3.2 4.245 ZRANGE 3.5 10.3 GY
143. LOAD 4 LOADTYPE SEISMIC TITLE EQ-Z (EARTHQUAKE LOAD)	165. YRANGE 3.2 3.2 FLOAD -4.445 XRANGE 4.245 7 ZRANGE 3.5 5.15 GY
144. 1893 LOAD Z -1.	166. YRANGE 3.2 3.2 FLOAD -8.62 XRANGE 4.245 7 ZRANGE 5.15 6.55 GY
145. LOAD 11 LOADTYPE DEAD TITLE DL	167. YRANGE 3.2 3.2 FLOAD -8.62 XRANGE 4.245 7 ZRANGE 8.8 10.3 GY
146. SELFWEIGHT Y -1	
147. MEMBER LOAD	
148. 20 21 26 32 56 61 70 100 110 119 132 135 149 UNI GY -16.1	
149. 29 44 45 50 54 55 64 65 69 72 84 89 UNI GY -9.1	

168. YRANGE 3.2 3.2 FLOAD -4.445
XRANGE 0

7 ZRANGE 10.3 11.6 GY

169. YRANGE 6.4 6.4 FLOAD -5.245
XRANGE 0

7 ZRANGE -1.3 6.55 GY

170. YRANGE 6.4 6.4 FLOAD -5.245
XRANGE 0

4.245 ZRANGE 6.55 10.3 GY

171. YRANGE 6.4 6.4 FLOAD -5.245
XRANGE

4.245 7 ZRANGE 8.8 10.3 GY

172. YRANGE 6.4 6.4 FLOAD -5.245
XRANGE 0

7 ZRANGE 10.3 11.6 GY

173. YRANGE 9 9 FLOAD -5.245 XRANGE
3.2 7

ZRANGE 6.55 8.8 GY

174. LOAD 12 LOADTYPE LIVE
REDUCIBLE

TITLE LL

175. MEMBER LOAD

176. 96 98 129 131 UNI GY -3.99

177. 101 102 UNI GY -4.23

178. FLOOR LOAD

179. YRANGE 3.2 3.2 FLOAD -2 XRANGE 0
3.2

ZRANGE -1.3 10.3 GY

180. YRANGE 3.2 3.2 FLOAD -2 XRANGE
3.2 7

ZRANGE -1.3 3.5 GY

181. YRANGE 3.2 3.2 FLOAD -2 XRANGE
3.2

4.245 ZRANGE 3.5 10.3 GY

182. YRANGE 3.2 3.2 FLOAD -2 XRANGE
4.245

7 ZRANGE 3.5 5.15 GY

183. YRANGE 3.2 3.2 FLOAD -2 XRANGE
4.245

7 ZRANGE 5.15 6.55 GY

184. YRANGE 3.2 3.2 FLOAD -2 XRANGE
4.245

7 ZRANGE 8.8 10.3 GY

185. YRANGE 3.2 3.2 FLOAD -2 XRANGE 0
7

ZRANGE 10.3 11.6 GY

186. YRANGE 6.4 6.4 FLOAD -1.5 XRANGE
0 7

ZRANGE -1.3 6.55 GY

187. YRANGE 6.4 6.4 FLOAD -1.5 XRANGE
0

4.245 ZRANGE 6.55 10.3 GY

188. YRANGE 6.4 6.4 FLOAD -1.5 XRANGE

4.245 7 ZRANGE 8.8 10.3 GY

189. YRANGE 6.4 6.4 FLOAD -1.5 XRANGE
0 7

ZRANGE 10.3 11.6 GY

190. YRANGE 9 9 FLOAD -0.75 XRANGE
3.2 7

ZRANGE 6.55 8.8 GY

191. ***LOAD COMBINATION FOR
FOOTING

DESIGN

192. LOAD COMB 101 DL+LL

193. 11 1.0 12 1.0

194. LOAD COMB 102 DL+EQ+X

195. 11 1.0 1 1.0

196. LOAD COMB 103 DL+EQ-X

197. 11 1.0 2 1.0

198. LOAD COMB 104 DL+EQ+Z

199. 11 1.0 3 1.0

200. LOAD COMB 105 DL+EQ-Z

201. 11 1.0 4 1.0

202. LOAD COMB 106 DL+LL+EQ+X

203. 11 1.0 12 1.0 1 1.0

204. LOAD COMB 107 DL+LL+EQ-X

205. 11 1.0 12 1.0 2 1.0

206. LOAD COMB 108 DL+LL+EQ+Z

207. 11 1.0 12 1.0 3 1.0

208. LOAD COMB 109 DL+LL+EQ-Z

209. 11 1.0 12 1.0 4 1.0

210. ***LOAD COMBINATION FOR RCC
DESIGN

211. LOAD COMB 201 1.5DL+1.5LL

212. 11 1.5 12 1.5

213. LOAD COMB 202 1.5DL+1.5EQ+X

214. 11 1.5 1 1.5

215. LOAD COMB 203 1.5DL+1.5EQ-X

216. 11 1.5 2 1.5

217. LOAD COMB 204 1.5DL+1.5EQ+Z

218. 11 1.5 3 1.5

219. LOAD COMB 205 1.5DL+1.5EQ-Z

220. 11 1.5 4 1.5

221. LOAD COMB 206 0.9DL+1.5EQ+X

222. 11 0.9 1 1.5

223. LOAD COMB 207 0.9DL+1.5EQ-X

224. 11 0.9 2 1.5

225. LOAD COMB 208 0.9DL+1.5EQ+Z

226. 11 0.9 3 1.5

227. LOAD COMB 209 0.9DL+1.5EQ-Z

228. 11 0.9 4 1.5

229. LOAD COMB 210
1.2DL+1.2LL+1.2EQ+X

230. 11 1.2 12 1.2 1 1.2

231. LOAD COMB 211 1.2DL+1.2LL+1.2EQ-
X

232. 11 1.2 12 1.2 2 1.2

233. LOAD COMB 212
1.2DL+1.2LL+1.2EQ+Z

234. 11 1.2 12 1.2 3 1.2

235. LOAD COMB 213 1.2DL+1.2LL+1.2EQ-
Z

236. 11 1.2 12 1.2 4 1.2

237. PDELTA ANALYSIS SMALLDELTA

PROBLEM STATISTICS

NUMBER OF JOINTS 98 NUMBER
OF

MEMBERS 166

NUMBER OF PLATES 0 NUMBER
OF

SOLIDS 0

NUMBER OF SURFACES 0 NUMBER
OF

SUPPORTS 14

Using 64-bit analysis engine.

SOLVER USED IS THE IN-CORE
ADVANCED

MATH SOLVER

TOTAL PRIMARY LOAD CASES = 6,

TOTAL DEGREES OF FREEDOM = 504

TOTAL LOAD COMBINATION CASES =
22

SO FAR.

**WARNING: IF THIS UBC/IBC
ANALYSIS

HAS TENSION/COMPRESSION

OR REPEAT LOAD OR RE-ANALYSIS OR

SELECT OPTIMIZE, THEN EACH

UBC/IBC CASE SHOULD BE FOLLOWED
BY

PERFORM ANALYSIS & CHANGE.

* UNITS - KN METE
*

* TIME PERIOD FOR X 1893 LOADING =

0.47142 SEC *

* SA/G PER 1893= 2.500, LOAD
FACTOR=

1.000 *

* FACTOR V PER 1893 AT GL= 0.0250 X

3846.52 *

* FACTOR V PER 1893 AT 30 M= 0.0125
X

3846.52 *

* FACTOR V PER 1893= 0.0242 X
3846.52

* * *

* UNITS - KN METE
*

* TIME PERIOD FOR X 1893 LOADING =
0.47142 SEC *

* SA/G PER 1893= 2.500, LOAD
FACTOR=-1.000 *

* FACTOR V PER 1893 AT GL= 0.0250 X
3846.52 *

* FACTOR V PER 1893 AT 30 M= 0.0125
X

3846.52 *

* FACTOR V PER 1893= 0.0242 X
3846.52

* *

*

++ Adjusting Displacements.

++ Adjusting Displacements.

238. LOAD LIST 201 TO 213

239. START CONCRETE DESIGN

CONCRETE DESIGN

240. CODE INDIAN

241. ELY 1.7 MEMB 117

242. ELY 4.07 MEMB 128

243. ELY 1.86 MEMB 118

244. ELY 3.37 MEMB 130

245. ELZ 1.7 MEMB 117

246. ELZ 4.07 MEMB 128

247. ELZ 1.86 MEMB 118

248. ELZ 3.37 MEMB 130

249. FC 20000 ALL

250. FYMAIN 415000 ALL

251. FYSEC 415000 ALL

252. TRACK 0 ALL

253. TORSION 1 MEMB 1 TO 10 20 TO 34
44 TO

73 83 TO 91 94 96 98 TO 112 119 TO 122

-

254. 125 TO 127 129 131 TO 139 149 TO 166

255. DESIGN BEAM 1 TO 10 20 TO 34 44
TO 73

20 310

83 TO 91 94 96 98 TO 112 119 TO 122 -

256. 125 TO 127 129 131 TO 139 149 TO 166

*** TOTAL= 26287

257. DESIGN COLUMN 11 TO 19 35 TO 43
74

261. FINISH

TO 82 92 93 95 97 113 TO 118 123 124
128 -

*END OF THE STAAD.Pro RUN *****

258. 130 140 TO 148

9. STAADPRO INPUT FOR SEISMIC

259. CONCRETE TAKE

ZONE V

260. END CONCRETE DESIGN

1. STAAD SPACE RESIDENTIAL BUILDING

***** CONCRETE TAKE OFF

2. START JOB INFORMATION

3. ENGINEER DATE 3/5/2026

(FOR BEAMS, COLUMNS AND PLATES
DESIGNED ABOVE)

4. JOB NAME RESIDENTIAL BUILDING IN
ZONE V

NOTE: CONCRETE QUANTITY REPRESENTS
VOLUME OF CONCRETE IN BEAMS, COLUMNS,
AND PLATES DESIGNED ABOVE.

5. JOB CLIENT GENERAL

6. JOB REV 0

REINFORCING STEEL QUANTITY
REPRESENTS REINFORCING STEEL IN BEAMS
AND COLUMNS DESIGNED ABOVE.

7. JOB PART 1

8. ENGINEER NAME T.L. SAHU

REINFORCING STEEL IN PLATES IS NOT
INCLUDED IN THE REPORTED QUANTITY.

9. JOB NO 1001

TOTAL VOLUME OF CONCRETE = 39.2 CU.
METER

10. JOB REF 1001

11. CHECKER NAME T.L. SAHU

12. APPROVED NAME T.L. SAHU

13. CHECKER DATE 3/7/2026

14. APPROVED DATE 3/7/2026

15. END JOB INFORMATION

16. INPUT WIDTH 79

17. SET ECHO ON

BAR DIA WEIGHT

(in mm) (in New)

8 7639

10 5205

12 12649

16 484

18. SET PRINT 5
30. 45 7 -2.6 6.55; 46 0 3.2 6.55; 47 3.2 3.2 6.55; 48 7 3.2
19. UNIT METER KN
6.55; 49 0 6.4 6.55
20. JOINT COORDINATES
31. 50 3.2 6.4 6.55; 51 7 6.4 6.55; 52 4.55 -0.6 6.55; 53
21. 1 0 3.2 -1.3; 2 3.2 3.2 -1.3; 3 7 3.2 -1.3; 4 0 6.4 -1.3; 5
4.245 3.2 6.55
- 3.2 6.4 -1.3
32. 54 4.245 6.4 6.55; 55 3.2 9 6.55; 56 7 9 6.55; 57 7 1.76
22. 6 7 6.4 -1.3; 7 0 -0.6 0; 8 3.2 -0.6 0; 9 7 -0.6 0; 10 0 -2.6
6.55; 58 6 1.76 6.55
- 0; 11 3.2 -2.6 0
33. 59 7 4.96 6.55; 60 6 4.96 6.55; 61 4.245 9 6.55; 62 7 -
23. 12 7 -2.6 0; 13 0 3.2 0; 14 3.2 3.2 0; 15 7 3.2 0; 16 0 6.4 0;
0.6 8.8
- 17 3.2 6.4 0
34. 63 4.245 -0.6 8.8; 64 7 -2.6 8.8; 65 4.245 -2.6 8.8; 66 7
24. 18 7 6.4 0; 19 0 -0.6 3.5; 20 3.2 -0.6 3.5; 21 7 -0.6 3.5;
3.2 8.8
- 22 0 -2.6 3.5
35. 67 4.245 3.2 8.8; 68 7 6.4 8.8; 69 4.245 6.4 8.8; 70 3.2
25. 23 3.2 -2.6 3.5; 24 7 -2.6 3.5; 25 0 3.2 3.5; 26 3.2 3.5; 27 7 3.2 3.5
6.4 8.8; 71 7 9 8.8
26. 28 0 6.4 3.5; 29 3.2 6.4 3.5; 30 7 6.4 3.5; 31 4.55 -0.6
36. 72 4.245 9 8.8; 73 3.2 9 8.8; 74 3.2 3.2 8.8; 75 7 2.08
- 3.5; 32 4.245 3.2 3.5
8.8; 76 6 2.08 8.8
27. 33 0 3.2 4.7; 34 3.2 3.2 4.7; 35 3.2 -0.6 5.15; 36 7 -0.6
37. 77 7 5.26 8.8; 78 6 5.26 8.8; 79 0 -0.6 10.3; 80 7 - 10.3
- 5.15
38. 81 4.245 -0.6 10.3; 82 0 -2.6 10.3; 83 7 -2.6 10.3; 84
28. 37 4.55 -0.6 5.15; 38 4.245 3.2 5.15; 39 7 3.2 5.15; 40 0
4.245 -2.6 10.3
- 0.6 6.55
39. 85 0 3.2 10.3; 86 7 3.2 10.3; 87 4.245 3.2 10.3; 88
29. 41 3.2 -0.6 6.55; 42 7 -0.6 6.55; 43 0 -2.6 6.55; 44 0 6.4
10.3; 89 7 6.4 10.3
- 3.2 -
2.6 6.55

40. 90 4.245 6.4 10.3; 91 3.2 3.2 10.3; 92 3.2 6.4 10.3; 93 0

3.2 11.6

41. 94 0 6.4 11.6; 95 7 3.2 11.6; 96 4.245 3.2 11.6; 97 7 6.4

11.6

42. 98 4.245 6.4 11.6

43. MEMBER INCIDENCES

44. 1 1 2; 2 2 3; 3 4 5; 4 5 6; 5 13 1; 6 14 2; 7 15 3; 8 16 4;

9 17 5; 10 18 6

45. 11 10 7; 12 7 13; 13 13 16; 14 11 8; 15 8 14; 16 14 17;

17 12 9; 18 9 15

46. 19 15 18; 20 7 8; 21 8 9; 22 13 14; 23 14 15; 24 16 17;

25 17 18; 26 19 7

47. 27 25 13; 28 28 16; 29 20 8; 30 26 14; 31 29 17; 32 21

9; 33 27 15; 34 30 18

48. 35 22 19; 36 19 25; 37 25 28; 38 23 20; 39 20 26; 40 26

29; 41 24 21; 42 21 27

49. 43 27 30; 44 19 20; 45 20 31; 46 25 26; 47 26 32; 48 28

29; 49 29 30; 50 31 21

50. 51 32 27; 52 33 25; 53 34 26; 54 35 20; 55 37 31; 56 36

21; 57 38 32; 58 39 27

51. 59 33 34; 60 30 51; 61 40 19; 62 49 28; 63 50 29; 64 35

37; 65 37 36; 66 38 39

52. 67 46 33; 68 47 34; 69 41 35; 70 42 36; 71 48 39; 72 52

37; 73 53 38; 74 43 40

53. 75 40 46; 76 46 49; 77 44 41; 78 41 47; 79 47 50; 80 45

42; 81 42 57; 82 48 59

54. 83 40 41; 84 41 52; 85 46 47; 86 47 53; 87 49 50; 88 50

54; 89 52 42; 90 53 48

55. 91 54 51; 92 50 55; 93 51 56; 94 55 61; 95 57 48; 96 58

57; 97 59 51; 98 60 59

56. 99 61 56; 100 62 42; 101 67 53; 102 69 54; 103 70 50;

104 71 56; 105 73 55

57. 106 74 47; 107 66 48; 108 68 51; 109 72 61; 110 79 40;

111 85 46; 112 88 49

58. 113 65 63; 114 63 67; 115 67 69; 116 64 62; 117 62 75;

118 66 77; 119 63 62

59. 120 67 66; 121 69 68; 122 70 69; 123 69 72; 124 68 71;

125 73 72; 126 72 71

60. 127 74 67; 128 75 66; 129 76 75; 130 77 68; 131 78 77;

132 81 63; 133 87 67

61. 134 90 69; 135 80 62; 136 86 66; 137 89 68; 138 91 74;

139 92 70; 140 82 79

62. 141 79 85; 142 85 88; 143 84 81; 144 81 87; 145 87 90;	79. 119 TO 122 125 TO 127 129 131 134 135 137 TO 139
146 83 80; 147 80 86	149 151 153 156 TO 165 -
63. 148 86 89; 149 79 81; 150 85 91; 151 87 86; 152 88 92;	80. 166 PRIS YD 0.3 ZD 0.2
153 90 89; 154 91 87	81. 47 51 88 91 150 152 154 155 PRIS YD 0.4 ZD 0.2
64. 155 92 90; 156 81 80; 157 93 85; 158 94 88; 159 96 87;	82. 11 TO 19 35 TO 43 74 TO 82 92 93 95 97 113 TO 118
160 95 86; 161 97 89	123 124 128 130 140 TO 147 -
65. 162 98 90; 163 93 96; 164 94 98; 165 96 95; 166 98 97	83. 148 PRIS YD 0.4 ZD 0.4
66. MEMBER RELEASE	84. MEMBER PROPERTY INDIAN
67. 1 3 59 64 66 72 105 122 127 138 139 163 164 START	85. 86 90 133 PRIS YD 0.5 ZD 0.3
MY MZ	86. MEMBER PROPERTY
68. 2 4 55 57 59 65 66 102 109 165 166 END MY MZ	87. 136 PRIS YD 0.4 ZD 0.3
69. DEFINE MATERIAL START	88. 132 PRIS YD 0.5 ZD 0.4
70. ISOTROPIC CONCRETE	89. CONSTANTS
71. E 2.17185E+07	90. MATERIAL CONCRETE ALL
72. POISSON 0.17	91. SUPPORTS
73. DENSITY 25	92. 10 TO 12 22 TO 24 43 TO 45 64 65 82 TO 84 FIXED
74. ALPHA 1E-05	93. DEFINE 1893 LOAD
75. DAMP 0.05	94. ZONE 0.36 RF 3 I 1 SS 2 ST 1 DM 0.05 DT 2
76. END DEFINE MATERIAL	95. SELFWEIGHT 1
77. MEMBER PROPERTY INDIAN	96. MEMBER WEIGHT
78. 1 TO 10 20 TO 34 44 TO 46 48 TO 50 52 TO 73 83 TO	97. *DEAD LOADS
85 87 89 94 96 98 TO 112 -	98. 20 21 26 32 56 61 70 100 110 119 132 135 149 UNI
	16.1
	99. 29 44 45 50 54 55 64 65 69 72 84 89 UNI 9.1

100. 96 98 129 131 UNI 9
101. 156 UNI 2.76
102. 22 23 27 33 52 58 67 71 107 111 136 150 151
154 UNI
- 13.34
103. 30 47 51 53 57 59 66 68 73 85 90 106 120 133
138
- UNI 7.54
104. 1 2 5 7 157 160 163 165 UNI 2.6
105. 101 UNI 10.99
106. 91 108 121 UNI 10.58
107. 102 UNI 21.57
108. 28 34 60 62 112 137 UNI 4.6
109. 3 4 8 10 158 161 164 166 UNI 2.6
110. 94 99 104 105 125 126 UNI 2.07
111. *LIVE LOADS
112. 96 98 129 131 UNI 1
113. 101 102 UNI 1.06
114. FLOOR WEIGHT
115. *DEAD LOADS
116. YRANGE 3.2 3.2 FLOAD 4.445 XRANGE 0 3.2
Z RANGE -1.3 10.3 GY
117. YRANGE 3.2 3.2 FLOAD 4.445 XRANGE 3.2 7
Z RANGE -1.3 3.5 GY
118. YRANGE 3.2 3.2 FLOAD 4.445 XRANGE 3.2
4.245
Z RANGE 3.5 10.3 GY
119. YRANGE 3.2 3.2 FLOAD 4.445 XRANGE
4.245 7
Z RANGE 3.5 5.15 GY
120. YRANGE 3.2 3.2 FLOAD 8.62 XRANGE 4.245
7
Z RANGE 5.15 6.55 GY
121. YRANGE 3.2 3.2 FLOAD 8.62 XRANGE 4.245
7
Z RANGE 8.8 10.3 GY
122. YRANGE 3.2 3.2 FLOAD 4.445 XRANGE 0 7
Z RANGE 10.3 11.6 GY
123. YRANGE 6.4 6.4 FLOAD 5.245 XRANGE 0 7
Z RANGE -1.3 6.55 GY
124. YRANGE 6.4 6.4 FLOAD 5.245 XRANGE 0
4.245
Z RANGE 6.55 10.3 GY
125. YRANGE 6.4 6.4 FLOAD 5.245 XRANGE
4.245 7
Z RANGE 8.8 10.3 GY
126. YRANGE 6.4 6.4 FLOAD 5.245 XRANGE 0 7
Z RANGE 10.3 11.6 GY
127. YRANGE 9 9 FLOAD 5.245 XRANGE 3.2 7
Z RANGE 6.55 8.8 GY
128. *LIVE LOADS
129. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE 0 3.2
Z RANGE -1.3 10.3 GY
130. YRANGE 3.2 3.2 FLOAD 0.5 XRANGE 3.2 7
Z RANGE -1.3 3.5 GY

131. YRANGE 3.2 3.2 FLOAD 0.5 X RANGE 3.2 4.245	147. 20 21 26 32 56 61 70 100 110 119 132 135 149 UNI
ZRANGE 3.5 10.3 GY	GY -16.1
132. YRANGE 3.2 3.2 FLOAD 0.5 X RANGE 4.245 7	148. 29 44 45 50 54 55 64 65 69 72 84 89 UNI GY - 9.1
ZRANGE 3.5 5.15 GY	149. 96 98 129 131 UNI GY -9
133. YRANGE 3.2 3.2 FLOAD 0.5 X RANGE 4.245 7	150. 156 UNI GY -2.76
ZRANGE 5.15 6.55 GY	151. 22 23 27 33 52 58 67 71 107 111 136 150 151 154 UNI
134. YRANGE 3.2 3.2 FLOAD 0.5 X RANGE 4.245 7	GY -13.34
ZRANGE 8.8 10.3 GY	152. 30 47 51 53 57 59 66 68 73 85 90 106 120 133 138
135. YRANGE 3.2 3.2 FLOAD 0.5 X RANGE 0 7	UNI GY -7.54
ZRANGE 10.3 11.6 GY	153. 1 2 5 7 157 160 163 165 UNI GY -2.6
136. LOAD 1 LOADTYPE SEISMIC TITLE EQ+X (EARTHQUAKE LOAD)	154. 101 UNI GY -10.99
137. 1893 LOAD X 1	155. 91 108 121 UNI GY -10.58
138. LOAD 2 LOADTYPE SEISMIC TITLE EQ-X (EARTHQUAKE LOAD)	156. 102 UNI GY -21.57
139. 1893 LOAD X -1.	157. 28 34 60 62 112 137 UNI GY -4.6
140. LOAD 3 LOADTYPE SEISMIC TITLE EQ+Z (EARTHQUAKE LOAD)	158. 3 4 8 10 158 161 164 166 UNI GY -2.6
141. 1893 LOAD Z 1	159. 94 99 104 105 125 126 UNI GY -2.07
142. LOAD 4 LOADTYPE SEISMIC TITLE EQ-Z (EARTHQUAKE LOAD)	160. FLOOR LOAD
143. 1893 LOAD Z -1.	161. YRANGE 3.2 3.2 FLOAD -4.445 X RANGE 0 3.2
144. LOAD 11 LOADTYPE DEAD TITLE DL	ZRANGE -1.3 10.3 GY
145. SELFWEIGHT Y -1	162. YRANGE 3.2 3.2 FLOAD -4.445 X RANGE 3.2 7
146. MEMBER LOAD	ZRANGE -1.3 3.5 GY
	163. YRANGE 3.2 3.2 FLOAD -4.445 X RANGE 3.2 4.245
	ZRANGE 3.5 10.3 GY

164. YRANGE 3.2 3.2 FLOAD -4.445 X RANGE
4.245 7

ZRANGE 3.5 5.15 GY

165. YRANGE 3.2 3.2 FLOAD -8.62 X RANGE 4.245
7

ZRANGE 5.15 6.55 GY

166. YRANGE 3.2 3.2 FLOAD -8.62 X RANGE 4.245
7

ZRANGE 8.8 10.3 GY

167. YRANGE 3.2 3.2 FLOAD -4.445 X RANGE 0 7

ZRANGE 10.3 11.6 GY

168. YRANGE 6.4 6.4 FLOAD -5.245 X RANGE 0 7

ZRANGE -1.3 6.55 GY

169. YRANGE 6.4 6.4 FLOAD -5.245 X RANGE 0
4.245

ZRANGE 6.55 10.3 GY

170. YRANGE 6.4 6.4 FLOAD -5.245 X RANGE
4.245 7

ZRANGE 8.8 10.3 GY

171. YRANGE 6.4 6.4 FLOAD -5.245 X RANGE 0 7

ZRANGE 10.3 11.6 GY

172. YRANGE 9 9 FLOAD -5.245 X RANGE 3.2 7

ZRANGE 6.55 8.8 GY

173. LOAD 12 LOADTYPE LIVE REDUCIBLE
TITLE

LL

174. MEMBER LOAD

175. 96 98 129 131 UNI GY -3.99

176. 101 102 UNI GY -4.23

177. FLOOR LOAD

178. YRANGE 3.2 3.2 FLOAD -2 X RANGE 0 3.2

ZRANGE -1.3 10.3 GY

179. YRANGE 3.2 3.2 FLOAD -2 X RANGE 3.2 7

ZRANGE -1.3 3.5 GY

180. YRANGE 3.2 3.2 FLOAD -2 X RANGE 3.2
4.245

ZRANGE 3.5 10.3 GY

181. YRANGE 3.2 3.2 FLOAD -2 X RANGE 4.245 7

ZRANGE 3.5 5.15 GY

182. YRANGE 3.2 3.2 FLOAD -2 X RANGE 4.245 7

ZRANGE 5.15 6.55 GY

183. YRANGE 3.2 3.2 FLOAD -2 X RANGE 4.245 7

ZRANGE 8.8 10.3 GY

184. YRANGE 3.2 3.2 FLOAD -2 X RANGE 0 7
ZRANGE

10.3 11.6 GY

185. YRANGE 6.4 6.4 FLOAD -1.5 X RANGE 0 7

ZRANGE -1.3 6.55 GY

186. YRANGE 6.4 6.4 FLOAD -1.5 X RANGE 0
4.245

ZRANGE 6.55 10.3 GY

187. YRANGE 6.4 6.4 FLOAD -1.5 X RANGE 4.245
7

ZRANGE 8.8 10.3 GY

188. YRANGE 6.4 6.4 FLOAD -1.5 X RANGE 0 7

ZRANGE 10.3 11.6 GY

189. YRANGE 9 9 FLOAD -0.75 X RANGE 3.2 7

Z RANGE 6.55 8.8 GY

215. 11 1.5 2 1.5

190. ***LOAD COMBINATION FOR FOOTING DESIGN

216. LOAD COMB 204 1.5DL+1.5EQ+Z

217. 11 1.5 3 1.5

191. LOAD COMB 101 DL+LL

218. LOAD COMB 205 1.5DL+1.5EQ-Z

192. 11 1.0 12 1.0

219. 11 1.5 4 1.5

193. LOAD COMB 102 DL+EQ+X

220. LOAD COMB 206 0.9DL+1.5EQ+X

194. 11 1.0 1 1.0

221. 11 0.9 1 1.5

195. LOAD COMB 103 DL+EQ-X

222. LOAD COMB 207 0.9DL+1.5EQ-X

196. 11 1.0 2 1.0

223. 11 0.9 2 1.5

197. LOAD COMB 104 DL+EQ+Z

224. LOAD COMB 208 0.9DL+1.5EQ+Z

198. 11 1.0 3 1.0

225. 11 0.9 3 1.5

199. LOAD COMB 105 DL+EQ-Z

226. LOAD COMB 209 0.9DL+1.5EQ-Z

200. 11 1.0 4 1.0

227. 11 0.9 4 1.5

201. LOAD COMB 106 DL+LL+EQ+X

228. LOAD COMB 210 1.2DL+1.2LL+1.2EQ+X

202. 11 1.0 12 1.0 1 1.0

229. 11 1.2 12 1.2 1 1.2

203. LOAD COMB 107 DL+LL+EQ-X

230. LOAD COMB 211 1.2DL+1.2LL+1.2EQ-X

204. 11 1.0 12 1.0 2 1.0

231. 11 1.2 12 1.2 2 1.2

205. LOAD COMB 108 DL+LL+EQ+Z

232. LOAD COMB 212 1.2DL+1.2LL+1.2EQ+Z

206. 11 1.0 12 1.0 3 1.0

233. 11 1.2 12 1.2 3 1.2

207. LOAD COMB 109 DL+LL+EQ-Z

234. LOAD COMB 213 1.2DL+1.2LL+1.2EQ-Z

208. 11 1.0 12 1.0 4 1.0

235. 11 1.2 12 1.2 4 1.2

209. ***LOAD COMBINATION FOR RCC DESIGN

236. PDELTA ANALYSIS SMALLDELTA

210. LOAD COMB 201 1.5DL+1.5LL

PROBLEM STATISTICS

211. 11 1.5 12 1.5

212. LOAD COMB 202 1.5DL+1.5EQ+X

NUMBER OF JOINTS 98 NUMBER OF

213. 11 1.5 1 1.5

MEMBERS 166

214. LOAD COMB 203 1.5DL+1.5EQ-X

NUMBER OF PLATES 0 NUMBER OF SOLIDS *

0 * FACTOR V PER 1893 AT 30 M= 0.0751 X 3844.65

NUMBER OF SURFACES 0 NUMBER OF SUPPORTS 14 *

Using 64-bit analysis engine. * FACTOR V PER 1893= 0.1450 X 3844.65 *

SOLVER USED IS THE IN-CORE ADVANCED MATH * *

SOLVER *****

TOTAL PRIMARY LOAD CASES = 6, TOTAL * UNITS - KN METE *

DEGREES OF FREEDOM = 504 * TIME PERIOD FOR X 1893 LOADING = 0.47142

TOTAL LOAD COMBINATION CASES = 22 SO FAR. SEC *

**WARNING: IF THIS UBC/IBC ANALYSIS HAS * SA/G PER 1893= 2.500, LOAD FACTOR=-1.000

TENSION/COMPRESSION *

OR REPEAT LOAD OR RE-ANALYSIS OR SELECT * FACTOR V PER 1893 AT GL= 0.1500 X 3844.65

OPTIMIZE, THEN EACH *

UBC/IBC CASE SHOULD BE FOLLOWED BY * FACTOR V PER 1893 AT 30 M= 0.0751 X 3844.65

PERFORM ANALYSIS & CHANGE. *

***** * FACTOR V PER 1893= 0.1450 X 3844.65 *

* UNITS - KN METE *

* TIME PERIOD FOR X 1893 LOADING = 0.47142 SEC *

* SA/G PER 1893= 2.500, LOAD FACTOR= 1.000 * UNITS - KN METE *

* * TIME PERIOD FOR Z 1893 LOADING = 0.47142 SEC

* FACTOR V PER 1893 AT GL= 0.1500 X 3844.65

* * SA/G PER 1893= 2.500, LOAD FACTOR= 1.000 * * FACTOR V PER 1893 AT GL= 0.1500 X 3844.65 * * FACTOR V PER 1893 AT 30 M= 0.0751 X 3844.65 * * FACTOR V PER 1893= 0.1450 X 3844.65 * * ***** * UNITS - KN METE * * TIME PERIOD FOR Z 1893 LOADING = 0.47142 SEC * * SA/G PER 1893= 2.500, LOAD FACTOR=-1.000 * * FACTOR V PER 1893 AT GL= 0.1500 X 3844.65 * * FACTOR V PER 1893 AT 30 M= 0.0751 X 3844.65 * * FACTOR V PER 1893= 0.1450 X 3844.65 * *	***** ***** ++ Adjusting Displacements. ++ Adjusting Displacements. 237. LOAD LIST 201 TO 213 238. START CONCRETE DESIGN —————CONCRETE DESIGN— 239. CODE INDIAN 240. ELY 1.7 MEMB 117 241. ELY 4.07 MEMB 128 242. ELY 1.86 MEMB 118 243. ELY 3.37 MEMB 130 244. ELZ 1.7 MEMB 117 245. ELZ 4.07 MEMB 128 246. ELZ 1.86 MEMB 118 247. ELZ 3.37 MEMB 130 248. FC 20000 ALL 249. FYMAIN 415000 ALL 250. FYSEC 415000 ALL 251. TRACK 0 ALL 252. TORSION 1 MEMB 1 TO 10 20 TO 34 44 TO 73 83 TO 91 94 96 98 TO 112 119 TO 122 - 253. 125 TO 127 129 131 TO 139 149 TO 166 254. DESIGN BEAM 1 TO 10 20 TO 34 44 TO 73 83 TO 91 94 96 98 TO 112 119 TO 122 -
---	---

255. 125 TO 127 129 131 TO 139 149 TO 166
256. DESIGN COLUMN 11 TO 19 35 TO 43 74 TO 82 92

20 7441

25 4563

93 95 97 113 TO 118 123 124 128 -

*** TOTAL= 55905

257. 130 140 TO 148

260. FINISH

258. CONCRETE TAKE

***** END OF THE STAAD.Pro RUN *****

259. END CONCRETE DESIGN

*** CONCRETE TAKE OFF ***

10. 3D VIEW OF STAADPRO FILE FOR SEISMIC ZONE II AND V

(FOR BEAMS, COLUMNS AND PLATES

DESIGNED ABOVE)

NOTE: CONCRETE QUANTITY REPRESENTS

VOLUME OF CONCRETE IN BEAMS, COLUMNS, AND

PLATES DESIGNED ABOVE.

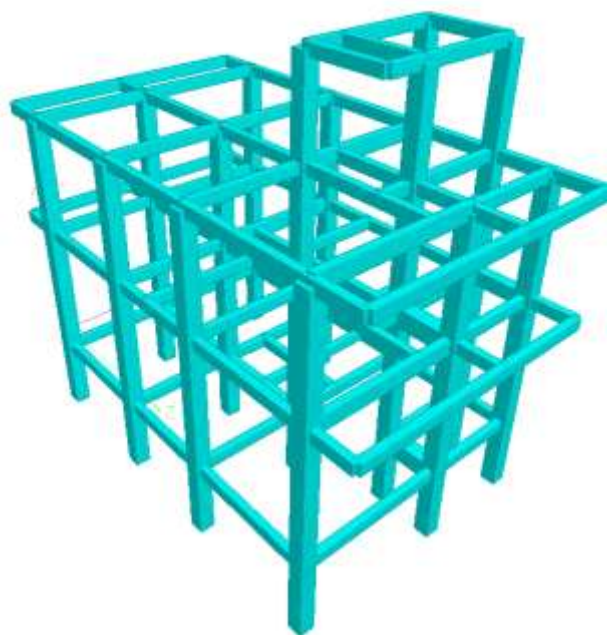
REINFORCING STEEL QUANTITY REPRESENTS

REINFORCING STEEL IN BEAMS AND COLUMNS

DESIGNED ABOVE.

REINFORCING STEEL IN PLATES IS NOT INCLUDED IN THE REPORTED QUANTITY.

TOTAL VOLUME OF CONCRETE = 38.9 CU. METER



BAR DIA WEIGHT

(in mm) (in New)

8 6966

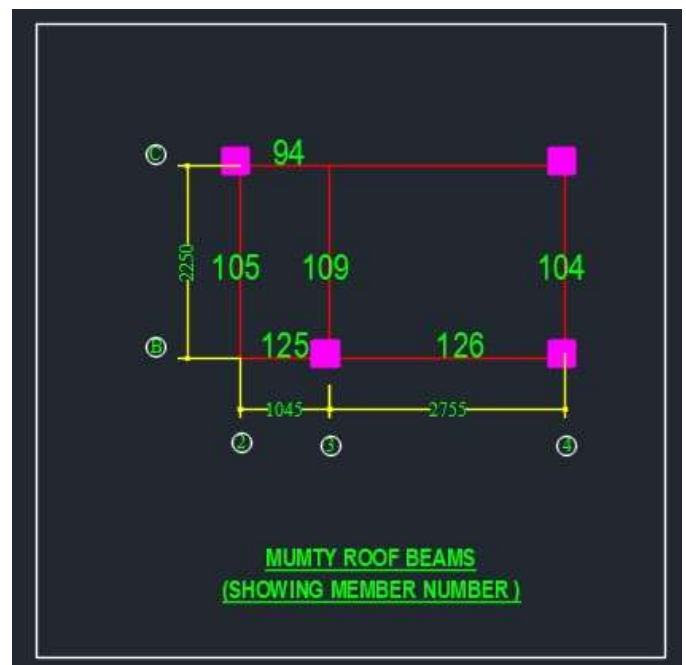
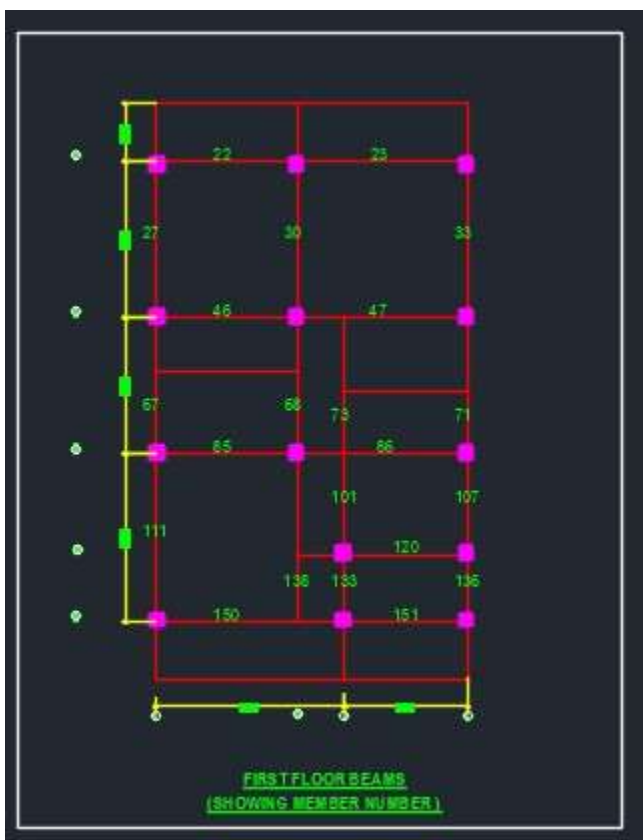
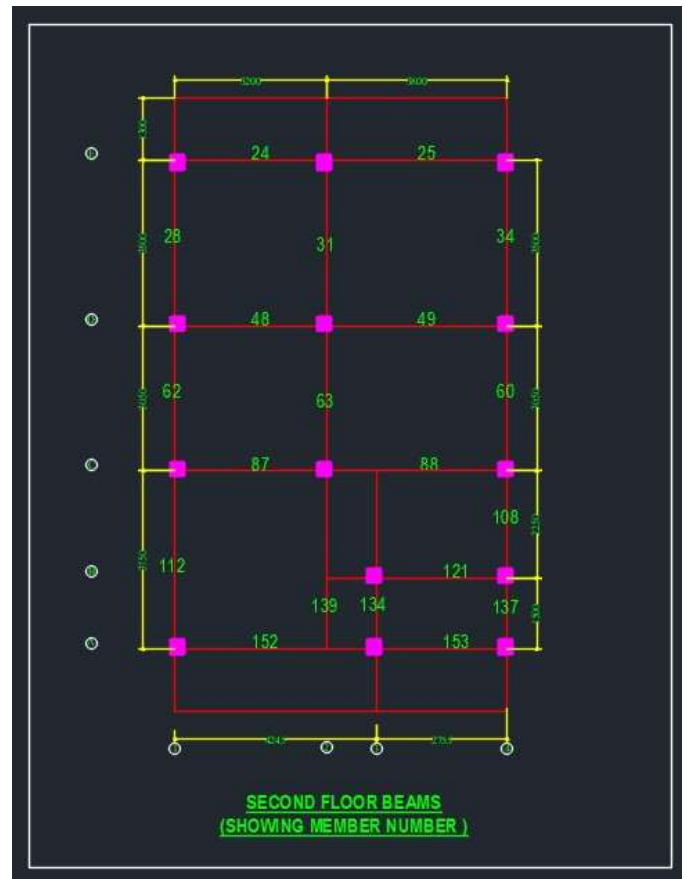
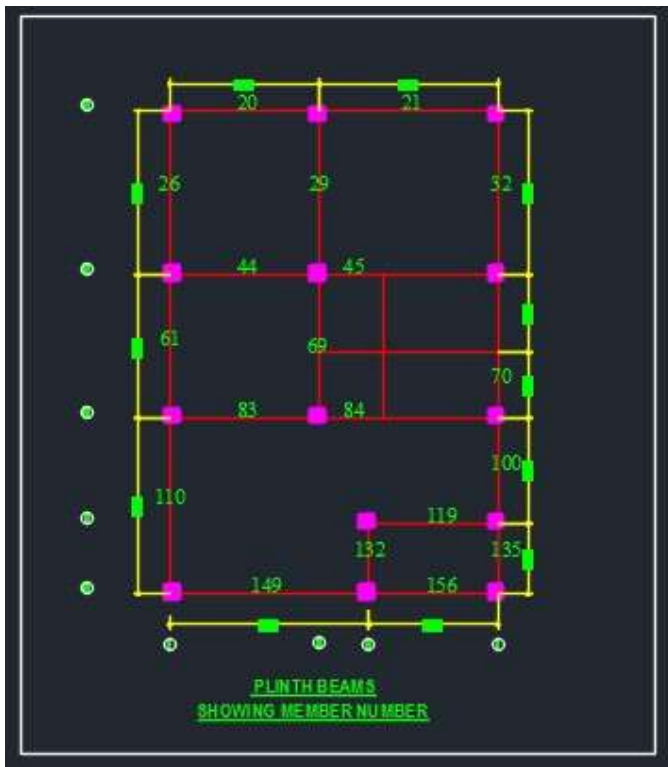
10 2112

12 18477

16 16346

11.PLANS SHOWING MEMBER

NUMBERS IN STAAD FILE



12.COMPARISON OF DESIGN RESULTS OF BEAMS

COMPARISON OF DESIGN RESULTS OF PLINTH BEAMS:-

S.N.	Member no.	Span of the member (m)	Size of member	R/f required for BM at location	Zone no. II		Zone no. V		Ratio		
					At required at top (sqmm-A)	At required at bottom (sqmm-B)	At required at top (sqmm-C)	At required at bottom (sqmm-D)	C/A	D/B	
A BEAMS PARALLEL TO X AXIS:-											
01	20	3.20	200X300	Start	403.36	0.00	1186.73	768.57	2.94	-	
				Middle	0.00	128.32	0.00	137.73	-	1.07	
				End	426.81	0.00	1177.79	751.21	2.76	-	
02	21	3.80	200X300	Start	553.22	70.25	1173.21	746.28	2.12	10.62	
				Middle	0.00	188.51	0.00	197.96	-	1.05	
				End	538.26	54.63	1177.84	751.26	2.19	13.75	
03	44	3.20	200X300	Start	277.85	108.55	1078.77	805.14	3.88	7.42	
				Middle	0.00	108.55	0.00	108.14	-	1.00	
				End	305.24	108.55	1091.02	768.69	3.57	7.08	
04	45	3.80	200X300	Start	578.65	80.98	1262.77	851.29	2.18	10.51	
				Middle	0.00	195.10	0.00	222.02	-	1.14	
				End	499.99	14.66	1162.50	734.74	2.33	50.12	
05	83	3.20	200X300	Start	161.39	119.27	992.69	940.07	6.15	7.88	
				Middle	0.00	108.55	0.00	106.51	-	0.98	
				End	168.61	114.02	996.78	929.99	5.91	8.16	
06	84	3.80	200X300	Start	597.71	104.81	1386.53	1002.31	2.32	9.56	
				Middle	0.00	201.21	0.00	231.06	-	1.15	
				End	521.96	37.53	1282.09	875.96	2.46	23.34	
07	119	2.755	200X300	Start	358.03	108.55	1292.10	941.29	3.61	8.67	
				Middle	0.00	108.55	0.00	108.14	-	1.00	
				End	364.72	108.55	1296.07	934.87	3.55	8.61	
08	149	4.225	200X300	Start	634.63	153.34	1261.49	849.90	1.99	5.54	
				Middle	0.00	240.83	0.00	253.07	-	1.05	
				End	633.16	151.82	1236.24	822.43	1.95	5.42	
09	156	2.755	200X300	Start	206.68	108.55	1089.63	961.04	5.27	8.85	
				Middle	0.00	108.55	0.00	105.48	-	0.97	
				End	185.52	115.99	1080.71	992.69	5.83	8.56	
B BEAMS PARALLEL TO Z AXIS:-											
10	110	3.75	200X300	Start	498.64	13.29	1033.31	580.64	2.07	43.69	
				Middle	0.00	185.65	0.00	195.83	-	1.05	
				End	535.53	51.79	1053.19	601.51	1.97	11.61	
11	61	3.05	200X300	Start	375.05	0.00	998.09	566.43	2.66	-	
				Middle	0.00	108.55	0.00	109.47	-	1.01	
				End	381.54	0.00	1001.88	561.28	2.63	-	
12	26	3.50	200X300	Start	472.09	0.00	1037.13	591.40	2.20	-	
				Middle	0.00	160.52	0.00	169.55	-	1.06	
				End	452.07	0.00	1041.49	596.03	2.30	-	
13	69	3.05	200X300	Start	389.91	0.00	1107.37	675.37	2.84	-	
				Middle	0.00	170.19	0.00	193.86	-	1.14	
				End	387.90	0.00	1048.51	596.60	2.70	-	
14	29	3.50	200X300	Start	310.17	0.00	905.50	514.66	2.92	-	
				Middle	0.00	108.55	0.00	108.14	-	1.00	
				End	264.34	108.55	881.54	569.39	3.33	5.25	
15	132	1.50	400X500	Start	380.96	380.96	2052.30	2090.37	5.39	5.49	
				Middle	0.00	380.96	0.00	376.87	-	0.99	
				End	380.96	380.96	2130.64	2046.75	5.59	5.37	
16	135	1.50	200X300	Start	223.13	128.66	1267.07	1160.55	5.68	9.02	
				Middle	0.00	108.55	107.33	107.33	-	0.99	
				End	213.45	118.36	1198.89	1090.90	5.62	9.22	
17	100	2.25	200X300	Start	247.27	108.55	995.05	770.97	4.02	7.10	
				Middle	0.00	108.55	0.00	108.14	-	1.00	
				End	264.59	108.55	1021.04	771.72	3.86	7.11	
18	70	3.05	200X300	Start	517.90	33.30	1060.62	609.31	2.05	18.30	
				Middle	0.00	217.55	0.00	220.96	-	1.02	
				End	521.98	37.55	1067.62	616.66	2.05	16.42	
19	32	3.50	200X300	Start	484.28	0.00	969.25	513.17	2.00	-	
				Middle	0.00	158.12	0.00	165.51	-	1.05	
				End	424.63	0.00	941.72	479.22	2.22	-	
								Maximum ratio =	6.15	50.12	
								Minimum ratio =	1.95	0.97	

COMPARISON OF DESIGN RESULTS OF FIRST FLOOR BEAMS:-

S.N.	Member no.	Span of the member (m)	Size of member	R/f required for BM at location	Zone no. II		Zone no. V		Ratio	
					At required at top (sqmm-A)	At required at bottom (sqmm-B)	At required at top (sqmm-C)	At required at bottom (sqmm-D)	C/A	D/B
A	BEAMS PARALLEL TO X AXIS:-									
01	22	3.20	200X300	Start	537.13	37.97	1490.49	1085.91	2.77	28.60
				Middle	0.00	198.34	0.00	200.14	-	1.01
				End	557.72	59.40	1456.46	1031.93	2.61	17.37
02	23	3.80	200X300	Start	705.76	233.27	1483.91	1078.75	2.10	4.62
				Middle	0.00	317.83	0.00	321.08	-	1.01
				End	694.23	221.24	1506.46	1103.27	2.17	4.99
03	46	3.20	200X300	Start	269.86	108.55	1170.72	942.12	4.34	8.68
				Middle	0.00	108.55	107.33	106.51	-	0.98
				End	292.63	108.55	1119.41	831.67	3.83	7.66
04	47	3.80	200X400	Start	639.05	0.00	1661.26	1031.31	2.60	-
				Middle	0.00	234.5	0.00	253.05	-	1.08
				End	549.56	149.52	1648.45	1099.59	3.00	7.35
05	85	3.20	200X300	Start	418.79	0.00	1260.43	822.19	3.01	-
				Middle	0.00	155.68	107.33	210.93	-	1.35
				End	417.31	0.00	1107.93	662.00	2.65	-
06	86	3.80	300X500	Start	700.94	285.72	2319.69	1618.00	3.31	5.66
				Middle	0.00	285.72	0.00	298.03	-	1.04
				End	520.19	285.72	2213.17	1803.86	4.25	6.31
07	120	2.755	200X300	Start	424.59	108.55	1445.48	1060.33	3.40	9.77
				Middle	0.00	108.55	0.00	107.33	-	0.99
				End	304.21	108.55	1376.15	1176.09	4.52	10.83
08	150	4.225	200X400	Start	721.27	48.94	1817.36	1219.64	2.52	24.92
				Middle	0.00	284.97	0.00	287.8	-	1.01
				End	697.94	25.08	1633.52	1202.13	2.34	40.68
09	151	2.755	200X300	Start	537.86	54.22	1435.20	1009.17	2.67	18.61
				Middle	0.00	137.40	0.00	158.42	-	1.15
				End	432.40	108.14	1427.96	1053.63	3.30	9.74
B	BEAMS PARALLEL TO Z AXIS:-									
10	111	3.75	200X300	Start	591.17	98.02	1361.54	974.84	2.30	9.95
				Middle	0.00	240.13	0.00	241.25	-	1.00
				End	597.93	105.03	1343.91	955.47	2.25	9.10
11	67	3.05	200X300	Start	553.55	61.74	1413.88	1032.36	2.55	16.72
				Middle	0.00	228.16	0.00	229.22	-	1.00
				End	598.07	105.18	1420.14	1000.83	2.37	9.52
12	27	3.50	200X300	Start	551.18	59.42	1333.67	944.22	2.42	15.89
				Middle	0.00	201.23	0.00	201.23	-	1.00
				End	544.12	52.07	1355.29	967.97	2.49	18.59
13	138	3.75	200X300	Start	0.00	0.00	0.00	0.00	-	-
				Middle	0.00	110.21	133.94	276.60	-	2.51
				End	433.78	0.00	962.20	505.59	2.22	-
14	68	3.05	200X300	Start	416.27	0.00	1198.99	781.90	2.88	-
				Middle	0.00	211.65	0.00	212.61	-	1.00
				End	571.36	73.42	1405.03	1022.64	2.46	13.93
15	30	3.50	200X300	Start	510.29	16.82	1255.08	842.92	2.46	50.11
				Middle	0.00	221.38	0.00	221.38	-	1.00
				End	556.85	65.33	1359.91	973.06	2.44	14.89
16	133	1.50	400X500	Start	436.16	380.96	2320.90	2074.33	5.32	5.45
				Middle	380.96	0.00	378.51	376.87	0.99	-
				End	380.96	380.96	2002.65	1930.48	5.26	5.07
17	136	1.50	300X400	Start	352.75	224.28	1895.49	1728.76	5.37	7.71
				Middle	224.28	224.28	222.43	222.43	0.99	0.99
				End	258.16	224.28	1707.29	1671.41	6.61	7.45
18	107	2.25	200X300	Start	218.15	108.55	945.05	762.94	4.33	7.03
				Middle	0.00	108.55	108.14	108.14	-	1.00
				End	271.09	108.55	1116.24	864.44	4.12	7.96
19	71	3.05	200X300	Start	539.49	55.78	1224.86	810.05	2.27	14.52
				Middle	0.00	277.02	0.00	279.73	-	1.01
				End	578.93	81.47	1275.82	838.36	2.20	10.29
20	33	3.50	200X300	Start	527.67	43.58	1162.10	734.31	2.20	16.85
				Middle	0.00	202.38	0.00	202.38	-	1.00
				End	547.06	63.82	1216.71	801.18	2.22	12.55
								Maximum ratio =	6.61	50.11
								Minimum ratio =	0.99	0.98

13	139	3.75	200X300	Start	0.00	0.00	0.00	0.00	-	-
				Middle	0.00	108.55	108.55	198.07	-	1.82
				End	260.69	0.00	754.24	392.66	2.89	-
14	63	3.05	200X300	Start	216.23	108.55	822.23	582.92	3.80	5.37
				Middle	0.00	108.55	0.00	107.33	-	0.99
				End	290.55	0.00	861.56	489.94	2.97	-
15	31	3.50	200X300	Start	259.87	0.00	744.45	416.21	2.86	-
				Middle	0.00	146.22	0.00	146.22	-	1.00
				End	455.18	0.00	933.18	464.29	2.05	-
16	134	1.50	200X300	Start	307.31	108.55	1124.51	809.30	3.66	-
				Middle	108.55	0.00	107.33	0.00	0.99	-
				End	139.25	108.55	884.89	852.70	6.35	7.86
17	137	1.50	200X300	Start	223.95	108.55	936.95	758.23	4.18	6.99
				Middle	108.55	0.00	108.14	108.14	1.00	-
				End	108.55	108.55	732.46	746.96	6.75	6.88
18	108	2.25	200X300	Start	187.82	108.55	834.54	661.09	4.44	6.09
				Middle	0.00	108.55	0.00	108.14	-	1.00
				End	180.61	108.55	813.28	655.15	4.50	6.04
19	60	3.05	200X300	Start	257.71	0.00	725.64	354.44	2.82	-
				Middle	0.00	108.55	0.00	108.14	-	1.00
				End	188.17	108.55	655.16	413.35	3.48	3.81
20	34	3.50	200X300	Start	243.91	0.00	661.42	298.47	2.71	-
				Middle	0.00	120.07	0.00	120.07	-	1.00
				End	347.81	0.00	785.65	315.89	2.26	-

Maximum ratio = 6.75
Minimum ratio = 2.26

COMPARISON OF DESIGN RESULTS OF MUMTY ROOF BEAMS:-

S.N.	Member no.	Span of the member (m)	Size of member (mmmm)	R/f required for BM at location	Zone no. II At required at top (sqmm-A)	Zone no. II At required at bottom (sqmm-B)	Zone no. V At required at top (sqmm-C)	Zone no. V At required at bottom (sqmm-D)	Ratio C/A	Ratio D/B
A BEAMS PARALLEL TO X AXIS:-										
01	94	3.80	200X300	Start	260.83	0.00	693.36	301.08	2.66	-
				Middle	0.00	108.55	0.00	113.98	-	1.05
				End	214.16	0.00	650.09	350.17	3.04	-
02	126	2.755	200X300	Start	192.32	108.55	675.89	447.80	3.51	-
				Middle	0.00	108.55	0.00	108.55	-	1.00
				End	121.51	108.55	601.61	511.74	4.95	4.71
B BEAMS PARALLEL TO Z AXIS:-										
03	104	2.25	200X300	Start	115.96	108.55	563.25	491.75	4.86	4.53
				Middle	0.00	108.55	0.00	108.55	-	1.00
				End	115.14	108.55	561.81	491.92	4.88	4.53
									4.95	4.71
									2.66	1.00

13.COMPARISON OF DESIGN RESULTS OF COLUMNS

COMPARISON OF DESIGN RESULTS OF COLUMNS FROM FOOTING TO GROUND LEVEL:-

S.N.	Column grid no.	Member no.	Floor height /Length of the member (m)	Size of member (YxZ)	Zone no. II At required (sqmm-A)	Zone no. V At required (sqmm-B)	Ratio B/A
01	A1	140	2.00	400x400	393	2372	6.04
02	A3	143	2.00	400x400	528	4369	8.27
03	A4	146	2.00	400x400	265	3072	11.59
04	B3	113	2.00	400x400	452	4096	9.06
05	B4	116	2.00	400x400	330	2816	8.53
06	C1	74	2.00	400x400	353	3214	9.10
07	C2	77	2.00	400x400	543	3453	6.36
08	C4	80	2.00	400x400	478	2984	6.24
09	D1	35	2.00	400x400	351	2591	7.38
10	D2	38	2.00	400x400	489	2748	5.62
11	D4	41	2.00	400x400	416	2415	5.81
12	E1	11	2.00	400x400	323	2506	7.76
13	E2	14	2.00	400x400	510	2521	4.94
14	E4	17	2.00	400x400	358	2266	6.33
						Maximum ratio = 11.59	
						Minimum ratio = 4.94	

COMPARISON OF DESIGN RESULTS OF COLUMNS FROM GROUND LEVEL TO FIRST FLOOR LEVEL:-

S.N.	Column grid no.	Member no.	Floor height /Length of the member	Size of member (YxZ)	Zone no. II At required (sqmm-A)	Zone no. V At required (sqmm-B)	Ratio B/A
01	A1	141	3.80	400x400	288.00	1942.00	6.74
02	A3	144	3.80	400x400	388.00	4864.00	12.54
03	A4	147	3.80	400x400	278.00	3072.00	11.05
04	B3	114	3.80	400x400	325.00	4608.00	14.18
05	B4	128	3.80	400x400	246	3072.00	12.49
06	C1	75	3.80	400x400	258.00	1919.00	7.44
07	C2	78	3.80	400x400	450.00	4077.00	9.06
08	C4	95	3.80	400x400	324.00	3205.00	9.89
09	D1	36	3.80	400x400	240.00	1955.00	8.15
10	D2	39	3.80	400x400	352.00	2454.00	6.97
11	D4	42	3.80	400x400	281.00	1721.00	6.12
12	E1	12	3.80	400x400	234.00	1810.00	7.74
13	E2	15	3.80	400x400	392.00	2254.00	5.75
14	E4	18	3.80	400x400	262.00	1740.00	6.64
						Maximum ratio = 14.18	
						Minimum ratio = 5.75	

COMPARISON OF DESIGN RESULTS OF COLUMNS FROM FIRST FLOOR LEVEL TO SECOND FLOOR LEVEL:-

S.N.	Column grid no.	Member no.	Floor height /Length of the member (m)	Size of member (YxZ)	Zone no. II At required (sqmm-A)	Zone no. V At required (sqmm-B)	Ratio B/A
01	A1	142	3.20	400x400	553.00	1865.00	3.37
02	A3	145	3.20	400x400	1000.00	3267.00	3.27
03	A4	148	3.20	400x400	393.00	1536.00	3.91
04	B3	115	3.20	400x400	211.00	2497.00	11.83
05	B4	130	3.20	400x400	176.00	1623.00	9.22
06	C1	76	3.20	400x400	366.00	1685.00	4.60
07	C2	79	3.20	400x400	213.00	2554.00	11.99
08	C4	97	3.20	400x400	267.00	1680.00	6.29
09	D1	37	3.20	400x400	293.00	1704.00	5.82
10	D2	40	3.20	400x400	182.00	1714.00	9.42
11	D4	43	3.20	400x400	340.00	1514.00	4.45
12	E1	13	3.20	400x400	266.00	1112.00	4.18
13	E2	16	3.20	400x400	568.00	2511.00	4.42
14	E4	19	3.20	400x400	360.00	1105.00	3.07

Maximum ratio = 11.99
Minimum ratio = 3.07

COMPARISON OF DESIGN RESULTS OF COLUMNS FROM SECOND FLOOR LEVEL TO MUMTY ROOF LEVEL:-

S.N.	Column grid no.	Member no.	Floor height /Length of the member	Size of member (YxZ)	Zone no. II At required (sqmm-A)	Zone no. V At required (sqmm-B)	Ratio B/A
01	B3	123	2.60	400x400	121.00	1280.00	10.58
02	B4	124	2.60	400x400	158.00	1280.00	8.10
03	C2	92	2.60	400x400	369.00	1280.00	3.47
04	C4	93	2.60	400x400	277.00	1280.00	4.62
						Maximum ratio = 10.58	
						Minimum ratio = 3.47	

COMPARISON OF QUANTITIES:-

S.N.	Items	Zone no. II	Zone no. V	Ratio
		(A)	(B)	B/A
01	RCC in CUM	39.20	39.20	1.00
02	Reinforcement in Kg	2628.7	5625.90	2.14

14.CONCLUSION OF COMPARISON OF DESIGN RESULTS

A. OBSERVATIONS ON COMPARISON OF DESIGN

RESULTS OF BEAMS: -

1.Reinforcements required at some sections are zero either

for one seismic zone or for both the seismic zones.

Hence the results with zero values are excluded from comparison.

2. Zone factor for seismic zone II is 0.10 and zone factor for

seismic zone V is 0.36. Other values for calculation of

seismic forces has been taken same for both the zones. So

that comparison can be possible

3.From the formula for calculation of design horizontal seismic coefficient, the horizontal seismic coefficient

is directly proportional to zone factor. Hence, the stress

resultants (Bending moments and shear forces)

should be proportional to zone factor.

Reinforcement for bending moment is also proportional to

bending moment. Ratio of zone factor is $0.36/0.1 = 3.6$.

B. CONCLUSION ON COMPARISON OF DESIGN

RESULTS OF BEAMS: -

1. Reinforcement required for the building in zone II is

always less that the reinforcement requirement for

the building in zone V.

2. Minimum ratio of reinforcements required for plinth

beams is 0.97 and maximum ratio is 50.12.

3. Minimum ratio of reinforcements required for first

floor beams is 0.98 and maximum ratio is 50.11.

4. Minimum ratio of reinforcements required for second

floor beams is 1.00 and maximum ratio is 6.88.

5. Minimum ratio of reinforcements required for

mumty roof beams is 1.00 and maximum ratio is

4.95.

6. Ratio of zone factor is 3.60. But ratios of reinforcements are not in the same pattern. Hence

any rational conclusion could not be made.

B. CONCLUSION ON COMPARISON OF DESIGN

RESULTS OF COLUMNS: -

1. Reinforcement required for the building in zone II is

always less that the reinforcement requirement for the building in zone V.

2. Minimum ratio of reinforcements required for

columns from footing to ground level is 4.94 and

maximum ratio is 11.59.

3. Minimum ratio of reinforcements required for

Columns from ground level to first floor level is 5.75 and maximum ratio is 14.18.

4. Minimum ratio of reinforcements required for

Columns from first floor level to second floor level is 3.07 and maximum ratio is 11.99.

5. Minimum ratio of reinforcements required for columns

from second floor level to mummy roof level is 3.47 and maximum ratio is 10.58.

6. Ratio of zone factor is 3.60. But ratios of reinforcements are not in the same pattern. Hence any rational conclusion could not be made.

C. CONCLUSION ON COMPARISON OF QUANTITIES: -

1. Reinforcement required for the building in zone II is

less than the reinforcement requirement for the building in zone V.

2. Ratio of zone factor is 3.60. But ratio of reinforcements

is not in the same pattern. Hence any rational conclusion could not be made.

3. Ratio of quantities of RCC is 1. This is due to the reason that same sections have been provided in both

the zones for ease of comparison.

15. REFERENCES

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