

Design And Analysis Of Multistoreied Building With Effect Of Shear Wall

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ABSTRACT

Shear wall system are one of the most commonly used lateral load resisting in high rise building Shear wall has high in plane stiffness and strength which can be used to simultaneously resist large horizontal loads and support gravity loads.

Incorporation of Shear wall has become inevitable in multistory building to resist lateral forces. It is very necessary to determine effective, efficient and ideal location of shear wall.

In this paper Study of G+5 Storey building in Zone IV is presented with some preliminary investigation which is analyzed by changing various position of shear wall with different shapes for determine parameter like axial load and moments. This analysis is done by using Standard package STADD-pro.

Keywords – Shear wall, Seismic loading, lateral loading, drift, axial load.

I. INTRODUCTION

Shear walls are a type of structural system that provides lateral resistance building or structure. Shear walls are vertical elements of the horizontal force resisting system. Shear walls are constructed to counter the effects of lateral load acting on a structure. In residential construction, shear walls are straight external walls that typically form a box which provides all of the lateral support for the building. When shear walls are designed and constructed properly, and they will have the strength and stiffness to resist the horizontal forces. In building construction a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall or vertical truss. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants; create powerful twisting (torsion) forces. These forces can literally tear (shear) a building apart. Reinforcing a frame by attaching or placing a rigid wall inside it maintains the shape of the frame and prevents rotation at the joints. Shear walls are especially important in high-rise buildings subjected to lateral wind and seismic forces. In the last two decades,

shear walls became an important part of mid and high-rise residential buildings. As part of an earthquake resistant building design, these walls are placed in building plans reducing lateral displacements under earthquake loads. So shear-wall frame structures are obtained. Shear wall buildings are usually regular in plan and in elevation. However, in some buildings, lower floors are used for commercial purposes and the buildings are characterized with larger plan dimensions at those floors. In other cases, there are setbacks at higher floor levels. Shear wall buildings are commonly used for residential purposes. Shear wall is wall made to resist lateral forces acting on tall buildings. It is provided ,when the centre of gravity of building area & loads acted on it differs by more than 30%. in order to bring the c.g in range of 30% concrete wall is provided i.e lateral forces may not increase much.

The project describe the analysis of structure with effect of shear wall. In Structural engineering, a shear wall is a wall composed of braced panels (also known as shear panels) to counter the effects of lateral load acting on a structure. Wind and earthquake loads are the most common loads braced wall lines are designed to counteract.

II. Shows the Structural data

- (1)Type of building- Commercial building
- (2)No of Stories – G+5
- (3)Zone – IV
- (4)Height of floor to floor – 3.65 m
- (5)Floor Finish – 1 KN/m²
- (6)Live Load – 4 KN/m²
- (7)Floor Finish – 1 KN/m²
- (8)Grade of concrete – M₂₀
- (9)Grade of Steel - Fe 415
- (10)Length of shear wall - 98.4 m
- (11)Calculation of Dead load and live load
 - (1) D.L. – as per IS 875-ISelf weight of floor by STAAD Pro
 - (i) Self Weight of Slab (125mm) = 0.125×25
= 3.125 KN/m²
 - (ii) Floor Finish Load = 1 KN/m²
Total = 4.125 KN/m²
 - (iii) Wall Load = (230 mm thick)
= $0.23 \times 3.15 \times 20$
= 14.5 KN/m
- (2) Live Load - as per IS 875-II

(12) Seismic load calculation

As per IS Code 1893 (part-1) - 2002

$$A_h = \frac{Z I S_a}{2 R g}$$

Dead load = 4.125 KN/m²

Live Load = 4 KN/m²

Zone = IV

Soil Condition = Medium Soil

Important Factor (I) = 1

Response Factor (R) = 5

Zone Factor (Z) = 0.24

Seismic Weight = Dead load + 0.5 LL

Spectrum SRSS

$$A_h = \frac{0.24 \times 1}{2 \times 5} \times 1 = 0.024$$

(13)Table 1: Shows the Sizes of Column

| Sr. No | Column Name | Size of Column |
|--------|---|----------------|
| 1 | 1, 4,7,10,31,34,37,40 | 400 x 900 |
| 2 | 11,14,17,20,21,24,27,30,41,42,43,44,45,46,47,48,49,50 | 400 x 750 |
| 3 | 2,3,5,6,8,9,12,13,15,16,18,19,22,23,25,26,28,29,32,33,35,36,38,39 | 400 600 |

III. RESULTS AND DISCUSSION

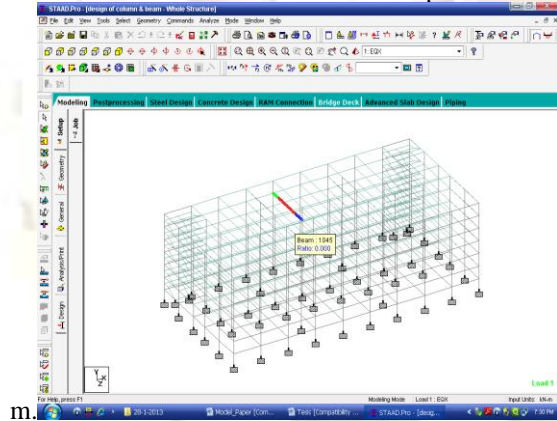
Results obtained from the analysis are recorded in tabular form for the cases of the building separately for four comparison of axial load and moments.

Case No.1 Without Shear wall

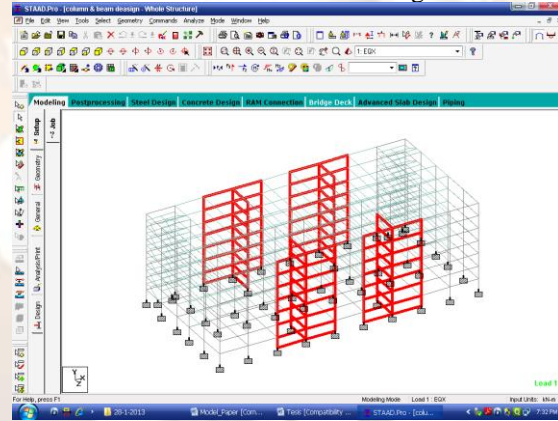
Case No.2 When Shear wall placed at different location of shear wall length is 98.40 m.

Case No.3 When Shear wall placed at different location of shear wall length is 98.40 m.

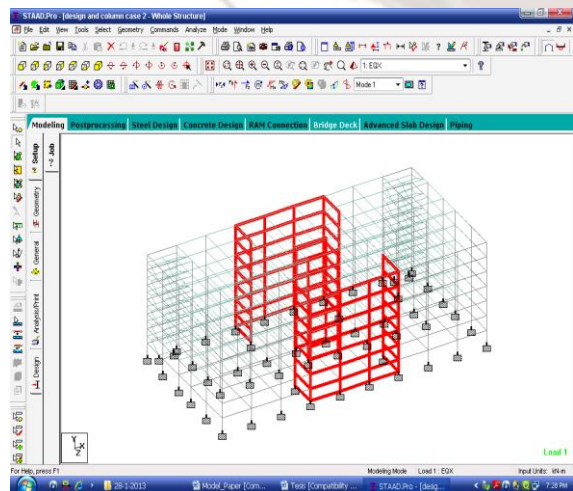
Case No.4 When Shear wall placed at different location of shear wall length is 98.40 m.



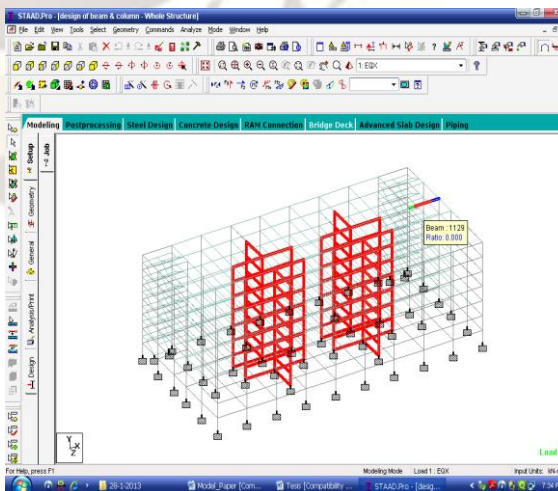
Case No.-1 Without Shear wall



Case No.2 Plan of different location of shear wall



Case No.3 Plan of different location of shear wall



Case No.4 Plan of different location of shear wall

Table No. 2 – Calculation of floor wise axial load and moments of Case-1, Case-2, Case-3 and Case-4 for Group No.1 (Column No. 4,7,34,37)

| CASE-1 | | COLUMN-4 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 6188.325 | 2405.672 | 10334.966 |
| Ground Floor | 5764.608 | 2127.434 | 22434.758 |
| First Floor | 4682.482 | 981.352 | 22002.801 |
| Second Floor | 3624.72 | 1011.466 | 20174.986 |
| Third Floor | 2573.81 | 971.22 | 18047.771 |
| Four Floor | 1533.473 | 783.912 | 15081.08 |
| Fifth Floor | 511.26 | 993.273 | 10625.509 |

| CASE-2 | | COLUMN-4 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1004.711 | 29.341 | 1041.697 |
| Ground Floor | 882.295 | 53.425 | 1212.611 |
| First Floor | 702.817 | 34.676 | 1313.354 |
| Second Floor | 558.375 | 20.856 | 1258.772 |
| Third Floor | 399.16 | 9.65 | 1101.002 |
| Four Floor | 239.609 | 3.9 | 879.034 |
| Fifth Floor | 142.948 | 2.87 | 763.042 |

| CASE-1 | | COLUMN-7 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 6482.18 | 2460.402 | 11653.526 |
| Ground Floor | 6048.045 | 1965.667 | 23905.92 |
| First Floor | 4915.278 | 3266.056 | 21630.861 |
| Second Floor | 3784.139 | 2411.874 | 20265.893 |
| Third Floor | 2671.809 | 2329.6 | 18203.287 |
| Four Floor | 1579.608 | 1828.99 | 15300.564 |
| Fifth Floor | 522.32 | 1605.685 | 10792.288 |

| CASE-2 | | COLUMN-7 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1012.672 | 20.963 | 1039.488 |
| Ground Floor | 894.281 | 45.976 | 1193.032 |
| First Floor | 712.773 | 43.652 | 1270.951 |
| Second Floor | 570.538 | 22.652 | 1189.072 |
| Third Floor | 404.893 | 12.13 | 1004.905 |
| Four Floor | 244.776 | 8.278 | 770.649 |
| Fifth Floor | 152.529 | 4.279 | 634.738 |

| CASE-1 | | COLUMN-34 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 6168.235 | 2607.43 | 33237.309 |
| Ground Floor | 5755.446 | 2627.883 | 23420.783 |
| First Floor | 4678.018 | 1226.622 | 27484.18 |
| Second Floor | 3621.572 | 1193.117 | 25541.541 |
| Third Floor | 2571.764 | 1012.915 | 23251.055 |
| Four Floor | 1532.226 | 904.644 | 19958.998 |
| Fifth Floor | 508.855 | 243.16 | 13189.524 |

| CASE-2 | | COLUMN-34 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 983.147 | 10.581 | 1172.763 |
| Ground Floor | 885.099 | 10.328 | 1352.096 |
| First Floor | 708.536 | 20.269 | 1449.999 |
| Second Floor | 556.927 | 28.363 | 1385.248 |
| Third Floor | 399.31 | 51.567 | 1214.974 |
| Four Floor | 242.005 | 77.412 | 978.999 |
| Fifth Floor | 168.027 | 117.411 | 845.152 |

| CASE-1 | | COLUMN-37 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 6479.167 | 2659.581 | 33317.156 |
| Ground Floor | 6058.333 | 2515.906 | 23358.785 |
| First Floor | 4925.669 | 3630.14 | 27417.154 |
| Second Floor | 3792.135 | 2611.549 | 25498.496 |
| Third Floor | 2678.615 | 2388.141 | 23285.295 |
| Four Floor | 1584.212 | 1959.035 | 19968.959 |
| Fifth Floor | 523.441 | 833.711 | 13240.978 |

| CASE-2 | | COLUMN-37 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 983.744 | 9.211 | 1170.427 |
| Ground Floor | 896.689 | 9.829 | 1321.166 |
| First Floor | 723.909 | 20.82 | 1383.99 |
| Second Floor | 566.886 | 30.079 | 1291.792 |
| Third Floor | 402.877 | 54.282 | 1102.461 |
| Four Floor | 246.162 | 84.81 | 857.885 |
| Fifth Floor | 183.025 | 123.423 | 699.129 |

| CASE-3 | | COLUMN-4 | |
|--------------|----------------|---------------|----------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment -Z KN m |
| Foundation | 1883.628 | 20.097 | 510.411 |
| Ground Floor | 1452.772 | 40.002 | 632.779 |
| First Floor | 1065.535 | 41.754 | 723.377 |
| Second Floor | 749.932 | 42.455 | 716.456 |
| Third Floor | 482.53 | 40.943 | 673.857 |
| Four Floor | 276.774 | 34.954 | 612.686 |
| Fifth Floor | 159.859 | 22.375 | 694.614 |

| CASE -4 | | COLUMN-4 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 5831.192 | 96.608 | 454.446 |
| Ground Floor | 5492.813 | 93.236 | 173.003 |
| First Floor | 4482.592 | 174.42 | 231.596 |
| Second Floor | 3479.269 | 290.012 | 124.969 |
| Third Floor | 2481.239 | 397.253 | 74.592 |
| Four Floor | 1486.59 | 390.137 | 168.724 |
| Fifth Floor | 498.105 | 1007.287 | 104.712 |

| CASE-3 | | COLUMN-7 | |
|--------------|----------------|---------------|----------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment -Z KN m |
| Foundation | 1877.146 | 20.191 | 497.184 |
| Ground Floor | 1438.261 | 40.746 | 197.006 |
| First Floor | 1047.243 | 41.606 | 196.878 |
| Second Floor | 734.07 | 42.344 | 175.785 |
| Third Floor | 470.598 | 40.621 | 140.338 |
| Four Floor | 268.486 | 34.57 | 91.556 |
| Fifth Floor | 154.43 | 22.062 | 75.827 |

| CASE -4 | | COLUMN-7 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 6052.994 | 99.204 | 590.028 |
| Ground Floor | 5707.5 | 90.297 | 89.191 |
| First Floor | 4672.861 | 171.293 | 292.054 |
| Second Floor | 3635.214 | 276.15 | 119.736 |
| Third Floor | 2595.498 | 382.036 | 91.843 |
| Four Floor | 1554.607 | 375.662 | 185.181 |
| Fifth Floor | 515.965 | 991.662 | 174.268 |

| CASE-3 | | COLUMN-34 | |
|--------------|----------------|---------------|----------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment -Z KN m |
| Foundation | 1906.414 | 149.393 | 581.574 |
| Ground Floor | 1463.464 | 192.775 | 638.963 |
| First Floor | 1085.676 | 255.353 | 731.663 |
| Second Floor | 770.598 | 299.202 | 718.809 |
| Third Floor | 497.717 | 328.399 | 670.336 |
| Four Floor | 286.061 | 340.152 | 598.998 |
| Fifth Floor | 150.707 | 344.068 | 683.597 |

| CASE -4 | | COLUMN-34 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 5892.103 | 452.691 | 972.868 |
| Ground Floor | 5549.823 | 406.51 | 241.777 |
| First Floor | 4531.519 | 310.049 | 255.008 |
| Second Floor | 3517.824 | 194.429 | 291.276 |
| Third Floor | 2508.859 | 143.579 | 401.49 |
| Four Floor | 1503.552 | 135.201 | 527.313 |
| Fifth Floor | 503.391 | 135.996 | 481.094 |

| CASE-3 | | COLUMN-37 | |
|--------------|----------------|----------------|---------------|
| Floor | Axial Force KN | Moment -Y KN m | Moment-Z KN m |
| Foundation | 1903.175 | 150.652 | 591.948 |
| Ground Floor | 1455.059 | 194.762 | 215.671 |
| First Floor | 1074.146 | 258.651 | 207.15 |
| Second Floor | 761.173 | 300.694 | 185.348 |
| Third Floor | 491.743 | 329.312 | 146.467 |
| Four Floor | 283.915 | 340.746 | 93.409 |
| Fifth Floor | 153.628 | 344.224 | 76.468 |

| CASE -4 | | COLUMN-37 | |
|--------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 5916.012 | 456.256 | 998.269 |
| Ground Floor | 5573.536 | 405.853 | 242.935 |
| First Floor | 4552.928 | 332.679 | 230.631 |
| Second Floor | 3535.506 | 208.404 | 310.449 |
| Third Floor | 2521.985 | 155.621 | 407.954 |
| Four Floor | 1511.414 | 147.228 | 517.012 |
| Fifth Floor | 505.398 | 150.972 | 484.111 |

Table No. 3 – Calculation of floor wise axial load and moments of Case-1, Case-2, Case-3 and Case-4 for Group No.1 (Column No. 43,44,47,48)

| CASE-1 COLUMN-43 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2210.967 | 2959.74 | 15680.06 |
| Ground Floor | 1913.451 | 3066.212 | 10017.25 |
| First Floor | 1591.38 | 1554.628 | 5093.024 |
| Second Floor | 1254.358 | 1455.141 | 5263.244 |
| Third Floor | 903.514 | 1305.856 | 4756.841 |
| Four Floor | 544.743 | 1051.98 | 4054.291 |
| Fifth Floor | 179.168 | 587.96 | 2450.655 |

| CASE-2 COLUMN-43 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 991.746 | 19.926 | 9914.07 |
| Ground Floor | 783.759 | 4.689 | 6894.411 |
| First Floor | 644.092 | 3.277 | 4323.481 |
| Second Floor | 504.861 | 2.699 | 4892.106 |
| Third Floor | 354.135 | 2.616 | 4259.469 |
| Four Floor | 206.313 | 2.558 | 1962.414 |
| Fifth Floor | 111.365 | 2.694 | 3092.023 |

| CASE-1 COLUMN-44 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2254.112 | 3014.349 | 17590.89 |
| Ground Floor | 1957.241 | 3322.196 | 10999.49 |
| First Floor | 1624.317 | 4526.643 | 4615.577 |
| Second Floor | 1274.013 | 3506.441 | 5912.494 |
| Third Floor | 914.867 | 3194.613 | 5268.091 |
| Four Floor | 550.455 | 2490.93 | 4838.194 |
| Fifth Floor | 181.974 | 1439.19 | 2777.568 |

| CASE-2 COLUMN-44 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1009.05 | 14.012 | 11498.652 |
| Ground Floor | 822.853 | 4.718 | 7460.167 |
| First Floor | 689.23 | 4.985 | 5097.424 |
| Second Floor | 540.448 | 4.808 | 4998.419 |
| Third Floor | 382.305 | 4.569 | 3738.558 |
| Four Floor | 221.896 | 4.519 | 1401.612 |
| Fifth Floor | 117.613 | 4.253 | 3135.354 |

| CASE-1 COLUMN-47 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2213.952 | 2967.543 | 18942.1 |
| Ground Floor | 1913.576 | 3159.779 | 11575.33 |
| First Floor | 1590.641 | 1645.318 | 6074.266 |
| Second Floor | 1253.869 | 1659.47 | 6030.131 |
| Third Floor | 902.907 | 1556.928 | 5596.589 |
| Four Floor | 544.143 | 1310.347 | 4558.278 |
| Fifth Floor | 178.868 | 1002.978 | 2829.587 |

| CASE-2 COLUMN-47 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1050.296 | 17.893 | 10742.677 |
| Ground Floor | 800.463 | 94.661 | 7235.909 |
| First Floor | 638.184 | 149.467 | 4681.703 |
| Second Floor | 498.785 | 193.176 | 5013.153 |
| Third Floor | 351.131 | 229.217 | 4071.973 |
| Four Floor | 202.929 | 265.08 | 1695.448 |
| Fifth Floor | 114.149 | 305.949 | 3155.931 |

| CASE-1 COLUMN-48 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2254.475 | 3021.912 | 20017.21 |
| Ground Floor | 1954.583 | 3365.613 | 11952.01 |
| First Floor | 1621.77 | 4640.898 | 5661.353 |
| Second Floor | 1272.188 | 3737.687 | 6151.703 |
| Third Floor | 913.418 | 3464.871 | 5676.393 |
| Four Floor | 549.383 | 2764.298 | 4559.107 |
| Fifth Floor | 181.33 | 1891.867 | 2701.392 |

| CASE-2 COLUMN-48 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1073.457 | 13.195 | 10776.809 |
| Ground Floor | 823.839 | 92.076 | 7263.474 |
| First Floor | 659.543 | 151.128 | 4745.467 |
| Second Floor | 513.115 | 195.953 | 5087.525 |
| Third Floor | 356.125 | 231.726 | 4097.521 |
| Four Floor | 198.477 | 268.782 | 1652.575 |
| Fifth Floor | 115.064 | 311.978 | 3180.681 |

| CASE-3 COLUMN-43 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1191.543 | 10.814 | 8034.548 |

| CASE-4 COLUMN-43 | | | |
|------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2106.386 | 112.483 | 10768.031 |

| | | | |
|--------------|---------|--------|----------|
| Ground Floor | 937.557 | 35.013 | 5439.026 |
| First Floor | 813.756 | 32.964 | 3678.637 |
| Second Floor | 657.406 | 26.352 | 3867.812 |
| Third Floor | 464.195 | 17.95 | 3073.734 |
| Four Floor | 268.56 | 11.072 | 1220.975 |
| Fifth Floor | 109.161 | 8.86 | 2329.772 |

| | | | |
|--------------|----------|---------|----------|
| Ground Floor | 1580.736 | 137.992 | 7495.702 |
| First Floor | 1177.163 | 187.344 | 4687.053 |
| Second Floor | 831.77 | 224.919 | 5387.591 |
| Third Floor | 515.46 | 254.173 | 4646.924 |
| Four Floor | 244.675 | 278.711 | 2040.485 |
| Fifth Floor | 87.577 | 312.729 | 3406.331 |

| CASE-3 COLUMN-44 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1161.085 | 11.136 | 9339.949 |
| Ground Floor | 917.118 | 34.865 | 5756.007 |
| First Floor | 801.428 | 32.862 | 4215.893 |
| Second Floor | 651.684 | 26.361 | 3472.557 |
| Third Floor | 462.916 | 17.989 | 2288.528 |
| Four Floor | 270.346 | 11.309 | 927.583 |
| Fifth Floor | 110.769 | 9.212 | 2186.928 |

| CASE 4 COLUMN-44 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2204.05 | 110.705 | 10606.693 |
| Ground Floor | 1649.195 | 135.389 | 7587.5 |
| First Floor | 1223.296 | 187.915 | 4943.876 |
| Second Floor | 864.17 | 223.239 | 5739.61 |
| Third Floor | 534.25 | 252.076 | 4918.221 |
| Four Floor | 251.742 | 278.835 | 2018.251 |
| Fifth Floor | 81.667 | 310.181 | 3527.976 |

| CASE-3 COLUMN-47 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1500.774 | 107.868 | 8533.512 |
| Ground Floor | 1137.303 | 271.32 | 5601.271 |
| First Floor | 941.352 | 348.557 | 3873.064 |
| Second Floor | 738.653 | 394.856 | 3787.139 |
| Third Floor | 510.024 | 422.962 | 2855.27 |
| Four Floor | 286.313 | 448.371 | 1112.738 |
| Fifth Floor | 109.692 | 471.847 | 2308.407 |

| CASE -4 COLUMN-47 | | | |
|--------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2065.495 | 162.097 | 9466.02 |
| Ground Floor | 1570.893 | 52.021 | 6674.961 |
| First Floor | 1185.519 | 52.525 | 4311.985 |
| Second Floor | 841.325 | 52.402 | 4838.14 |
| Third Floor | 521.422 | 50.966 | 4225.513 |
| Four Floor | 249.969 | 48.376 | 1868.614 |
| Fifth Floor | 89.471 | 49.484 | 3041.444 |

| CASE-3 COLUMN-48 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1491.078 | 109.142 | 8690.43 |
| Ground Floor | 1135.406 | 273.116 | 5657.556 |
| First Floor | 944.869 | 349.033 | 3993.224 |
| Second Floor | 743.499 | 394.028 | 3781.479 |
| Third Floor | 513.737 | 421.435 | 2805.482 |
| Four Floor | 288.244 | 446.528 | 1137.506 |
| Fifth Floor | 111.113 | 470.369 | 2310.164 |

| CASE -4 COLUMN-48 | | | |
|--------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 2125.358 | 161.539 | 9869.371 |
| Ground Floor | 1636.768 | 54.9 | 6708.479 |
| First Floor | 1245.954 | 56.68 | 4224.615 |
| Second Floor | 886.173 | 57.437 | 4653.773 |
| Third Floor | 554.752 | 56.384 | 3884.262 |
| Four Floor | 273.97 | 54.198 | 1695.423 |
| Fifth Floor | 88.514 | 55.308 | 2971.542 |

Table No. 4 – – Calculation of floor wise axial load and moments of Case-1, Case-2, Case-3 and Case-4 for Group No.1 (Column No. 14,17,24,27)

| CASE-1 COLUMN-14 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7922.993 | 2980.415 | 26120.105 |
| Ground Floor | 7457.15 | 3314.23 | 18616.213 |
| First Floor | 6075.31 | 1706.415 | 29713.713 |
| Second Floor | 4710.895 | 1541.536 | 25702.627 |
| Third Floor | 3355.814 | 1332.481 | 23104.404 |

| CASE-2 COLUMN-14 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7710.275 | 47.275 | 620.009 |
| Ground Floor | 7288.233 | 17.286 | 75.508 |
| First Floor | 5943.642 | 17.575 | 130.907 |
| Second Floor | 4611.19 | 18.984 | 156.648 |
| Third Floor | 3287.976 | 20.121 | 269.892 |

| | | | |
|-------------|---------|----------|-----------|
| Four Floor | 2009.3 | 1033.957 | 19267.02 |
| Fifth Floor | 673.165 | 460.303 | 13593.729 |

| | | | |
|-------------|---------|--------|---------|
| Four Floor | 1971.28 | 18.733 | 366.601 |
| Fifth Floor | 659.26 | 18.903 | 320.313 |

| CASE-1 COLUMN-17 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 8030.551 | 3043.139 | 25963.861 |
| Ground Floor | 7561.014 | 3488.367 | 18491.959 |
| First Floor | 6158.074 | 5071.271 | 29953.408 |
| Second Floor | 4764.843 | 3851.32 | 25713.215 |
| Third Floor | 3386.413 | 3446.042 | 23256.324 |
| Four Floor | 2021.786 | 2633.354 | 19438.738 |
| Fifth Floor | 675.223 | 1299.08 | 13789.678 |

| CASE-2 COLUMN-17 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7712.957 | 46.272 | 628.863 |
| Ground Floor | 7290.605 | 13.541 | 129.677 |
| First Floor | 5945.85 | 27.958 | 119.541 |
| Second Floor | 4613.309 | 28.065 | 184.354 |
| Third Floor | 3289.468 | 26.163 | 316.733 |
| Four Floor | 1972.303 | 32.635 | 412.272 |
| Fifth Floor | 659.585 | 26.573 | 374.816 |

| CASE-1 COLUMN-24 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7908.447 | 2962.924 | 28604.512 |
| Ground Floor | 7447.929 | 3390.447 | 19939.777 |
| First Floor | 6069.762 | 1961.984 | 30756.906 |
| Second Floor | 4706.791 | 2015.479 | 27069.92 |
| Third Floor | 3353.145 | 1948.361 | 24356.969 |
| Four Floor | 2007.969 | 1676.154 | 20349.984 |
| Fifth Floor | 672.639 | 1532.073 | 14162.752 |

| CASE2 COLUMN-24 | | | |
|------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7710.352 | 29.775 | 657.416 |
| Ground Floor | 7288.455 | 145.326 | 96.109 |
| First Floor | 5943.917 | 354.134 | 133.103 |
| Second Floor | 4611.193 | 494.92 | 172.317 |
| Third Floor | 3287.905 | 609.936 | 298.764 |
| Four Floor | 1971.149 | 636.741 | 392.338 |
| Fifth Floor | 659.06 | 1017.755 | 361.038 |

| CASE-1 COLUMN-27 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 8032.163 | 3027.201 | 28552.182 |
| Ground Floor | 7568.572 | 3495.63 | 19827.52 |
| First Floor | 6167.08 | 5276.902 | 30933.121 |
| Second Floor | 4770.711 | 4347.239 | 27066.166 |
| Third Floor | 3390.975 | 4078.729 | 24417.879 |
| Four Floor | 2024.312 | 3289.813 | 20401.057 |
| Fifth Floor | 676.178 | 2496.543 | 14190.497 |

| CASE-2 COLUMN-27 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7711.202 | 29.255 | 669.461 |
| Ground Floor | 7289.225 | 133.832 | 114.849 |
| First Floor | 5944.564 | 377.918 | 132.532 |
| Second Floor | 4611.737 | 510.461 | 176.091 |
| Third Floor | 3288.387 | 620.045 | 304.78 |
| Four Floor | 1971.565 | 660.849 | 408.535 |
| Fifth Floor | 659.409 | 1045.888 | 379.724 |

| CASE-3 COLUMN-14 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7638.595 | 48.109 | 165.811 |
| Ground Floor | 7216.166 | 25.457 | 346.913 |
| First Floor | 5876.105 | 6.864 | 408.64 |
| Second Floor | 4551.93 | 11.323 | 449.807 |
| Third Floor | 3240.11 | 14.743 | 530.347 |
| Four Floor | 1937.134 | 16.457 | 568.309 |
| Fifth Floor | 640.182 | 17.719 | 889.775 |

| CASE -4 COLUMN-14 | | | |
|--------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1450.877 | 120.8 | 1071.735 |
| Ground Floor | 1257.315 | 94.441 | 1317.168 |
| First Floor | 953.872 | 106.625 | 1429.34 |
| Second Floor | 717.658 | 107.264 | 1407.377 |
| Third Floor | 499.227 | 102.256 | 1270.332 |
| Four Floor | 320.995 | 100.666 | 1059.535 |
| Fifth Floor | 184.231 | 111.857 | 956.782 |

| CASE-3 COLUMN-17 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7633.961 | 47.508 | 263.519 |
| Ground Floor | 7211.606 | 24.429 | 107.423 |

| CASE -4 COLUMN-17 | | | |
|--------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1465.674 | 118.184 | 1074.963 |
| Ground Floor | 1279.767 | 96.073 | 1293.28 |

| | | | |
|--------------|----------|--------|--------|
| First Floor | 5872.07 | 5.171 | 56.143 |
| Second Floor | 4548.647 | 10.928 | 28.562 |
| Third Floor | 3237.763 | 13.855 | 13.442 |
| Four Floor | 1935.805 | 15.401 | 29.72 |
| Fifth Floor | 639.886 | 16.48 | 17.568 |

| | | | |
|--------------|---------|---------|----------|
| First Floor | 967.818 | 112.538 | 1372.502 |
| Second Floor | 723.903 | 111.097 | 1313.306 |
| Third Floor | 494.881 | 105.534 | 1147.107 |
| Four Floor | 320.837 | 104.609 | 920.845 |
| Fifth Floor | 178.302 | 121.693 | 794.046 |

| CASE-3 COLUMN-24 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7651.634 | 28.616 | 184.114 |
| Ground Floor | 7228.741 | 107.843 | 349.541 |
| First Floor | 5887.216 | 295.73 | 408.347 |
| Second Floor | 4560.968 | 428.186 | 441.354 |
| Third Floor | 3246.998 | 535.467 | 541.997 |
| Four Floor | 1941.819 | 558.609 | 570.416 |
| Fifth Floor | 642.731 | 918.991 | 875.826 |

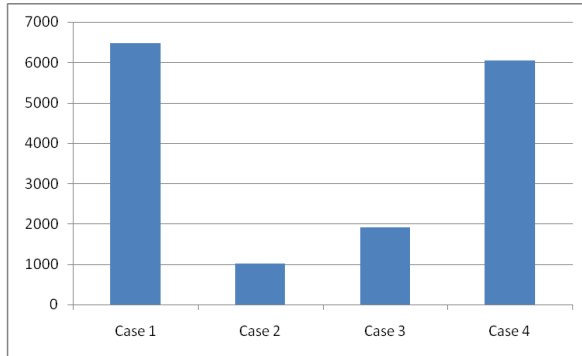
| CASE -4 COLUMN-24 | | | |
|--------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1472.13 | 150.055 | 1226.777 |
| Ground Floor | 1266.311 | 209.222 | 1481.09 |
| First Floor | 954.558 | 215.244 | 1604.518 |
| Second Floor | 720.189 | 189.822 | 1577.151 |
| Third Floor | 494.078 | 160.745 | 1424.547 |
| Four Floor | 314.832 | 121.506 | 1187.999 |
| Fifth Floor | 167.592 | 71.847 | 1040.433 |

| CASE-3 COLUMN-27 | | | |
|-------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 7648.829 | 28.323 | 285.093 |
| Ground Floor | 7225.947 | 108.259 | 97.256 |
| First Floor | 5884.713 | 300.736 | 57.046 |
| Second Floor | 4558.949 | 429.302 | 37.977 |
| Third Floor | 3245.585 | 536.919 | 9.165 |
| Four Floor | 1941.081 | 560.311 | 33.197 |
| Fifth Floor | 642.702 | 922.283 | 34.186 |

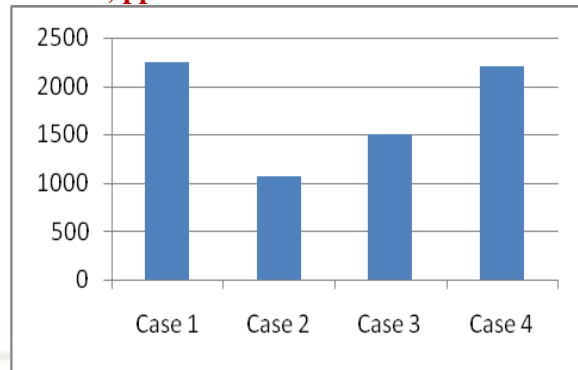
| CASE -4 COLUMN-27 | | | |
|--------------------------|----------------|---------------|---------------|
| Floor | Axial Force KN | Moment-Y KN m | Moment-Z KN m |
| Foundation | 1498.177 | 148.285 | 1226.368 |
| Ground Floor | 1281.29 | 209.037 | 1435.528 |
| First Floor | 962.527 | 229.923 | 1506.321 |
| Second Floor | 725.279 | 201.308 | 1434.566 |
| Third Floor | 496.305 | 172.378 | 1250.391 |
| Four Floor | 308.678 | 134.859 | 996.317 |
| Fifth Floor | 157.419 | 87.212 | 818.84 |

Table No.—5 Maximum axial load on Group Column

| | GROUP-1 (4, 7, 34, 37) | | GROUP-2 (43, 44, 47, 48) | | GROUP-3 (14, 17, 24, 27) | |
|--------|------------------------|------------|--------------------------|------------|--------------------------|------------|
| | Axial load KN | Column No. | Axial load KN | Column No. | Axial load KN | Column No. |
| Case 1 | 6482.18 | 7 | 2254.11 | 44 | 8030.55 | 17 |
| Case 2 | 1012.67 | 7 | 1073.45 | 48 | 7712.95 | 17 |
| Case 3 | 1906.41 | 34 | 1500.77 | 47 | 7651.63 | 24 |
| Case 4 | 6052.99 | 7 | 2204.05 | 44 | 1498.17 | 27 |



Group -1 Column (Max. axial load)



Group -2 Column (Max. axial load)



Group -3 Column (Max. axial load)

IV. ADVANTAGES OF SHEAR WALLS IN BUILDINGS

Properly designed and detailed buildings with shear walls have shown very good performance in past earthquakes. Shear walls in high seismic regions require special detailing. However, in past earthquakes, even buildings with sufficient amount of walls that were not specially detailed for seismic performance (but had enough well-distributed reinforcement) were saved from collapse. Shear wall buildings are a popular choice in many earthquake prone countries, like Chile, New Zealand and USA.

V. CONCLUSION

Different location of shear wall effect on axial load on the column. In absence of shear wall axial load and moments are maximum on column. Case-3 is safe as compare to case-1 and case-2. Shear walls are easy to construct, because reinforcement detailing of walls is relatively straight forward and therefore easily implemented at site. Thus shear walls are one of the most effective building elements in resisting lateral forces during earthquake. By constructing shear walls damages due to effect of lateral forces due to earthquake and high winds can be minimized. Shear walls construction will provide larger stiffness to the

buildings there by reducing the damage to structure and its contents.

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