

Improving Earthquake Resistance of a Structure by Adding Intermediate Beams

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ABSTRACT: The main aim of this paper is to promote that by adding continues intermediate beam on both sill level and lintel level the earthquake resistance of a structure will be improved. We will apply time history function for a structure and analysis the structure for base shear and moment on X, Y and Z axis of a structure. By applying the Time History Function for both Conventional and modified structure, we will compare the results and we can find the improved resistance of the structure.

KEYWORDS: Time History Function, Lintel Level Beam, Sill Level Beam, Base Shear, Base Moment.

I. INTRODUCTION

In this paper, A Space Structure was taken for the analysis purpose. Real time dead and live load were calculated as per IS 875 (Part – 1, Dead Load. Part – 2, Imposed Load). And Time history function was applied for the structure. For creating the time history function we have taken a real time ground motion record from the Pesmos website which is maintained by the Department of Earthquake Engineering, IIT Roorkee.

II. PLAN & STRUCTURAL DETAILS

The purpose of the building is Residential use only and it is designed as framed structure with the area of 132.40 Sq.m (1425 Sq.ft) as two floors. The column are provide with the size of 0.23m x 0.23m, the main beam are provided with the size of 0.23m x 0.4m and Intermediate beam are provided with the size of 0.23m x 0.15m. For all beam and column, M25 Grade of concrete is used and for slab, M30 grade concrete is used. The height of basement is 1 meter, height of a story is 3 meter and total height of the structure is 7 meters with two floors.

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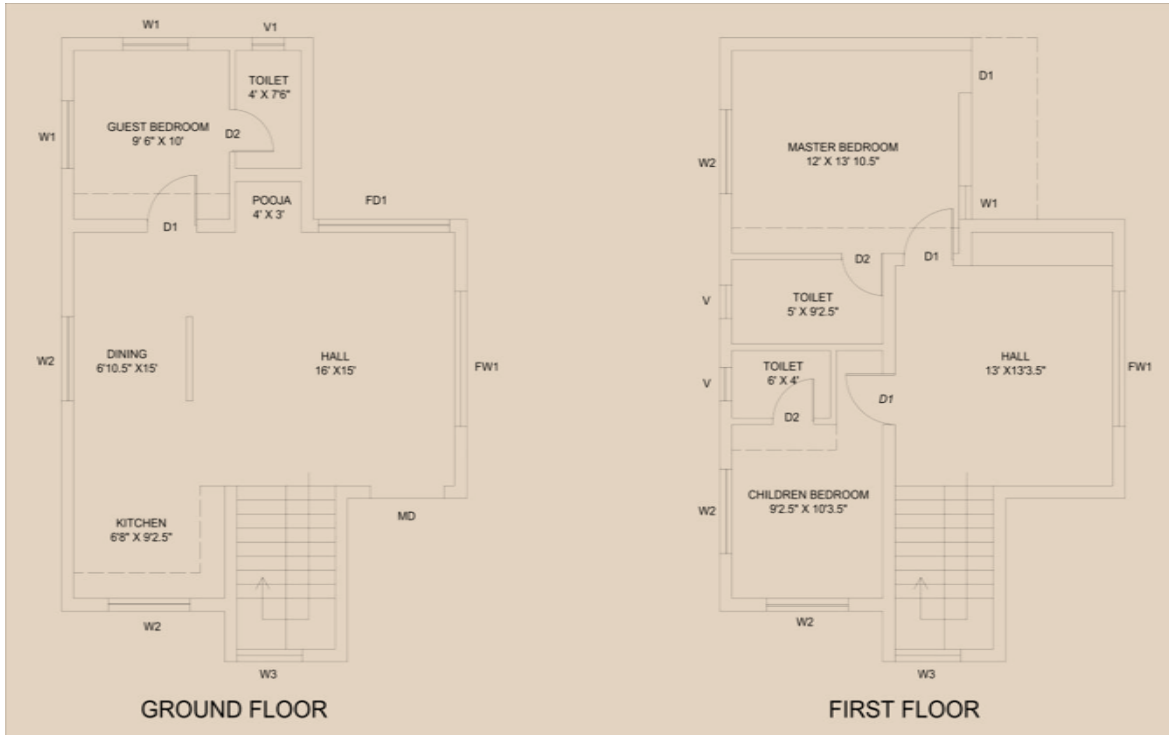
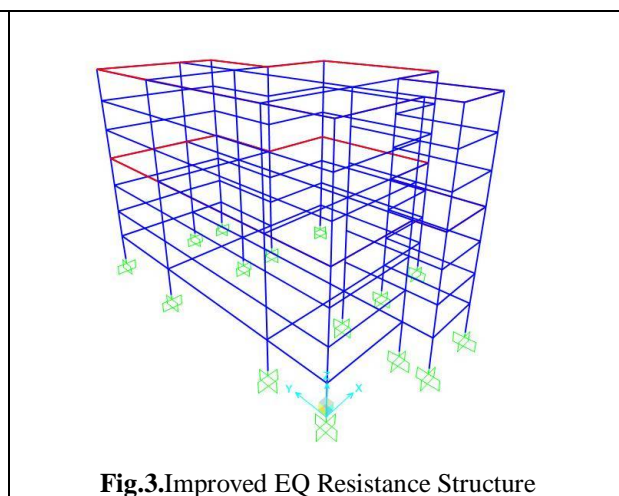
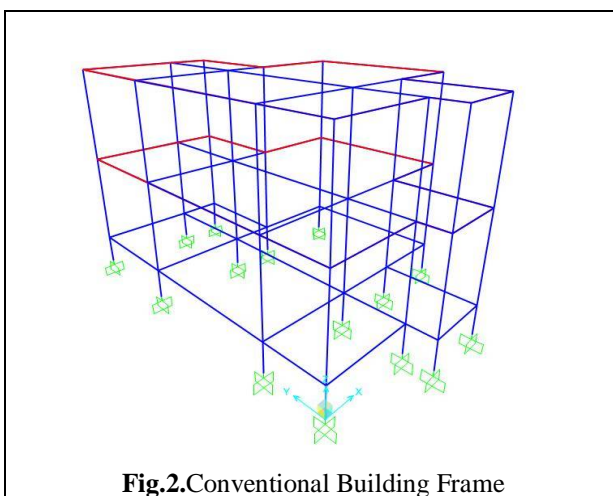


Fig.1. Plan of the Residential Building

Figure 2 & 3 shows the Skelton view of conventional building and improved EQ resistance building. In figure 3, it clearly shows the intermediate beam in a floor at both sill level and lintel level are added in excess when compare with the conventional building.



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III. LOAD CALCULATION

All Loads like dead load, live load, floor load are calculated as per IS 875 Codes (Part-1 & 2). Loads assigned in the structure are tabulated as follows:

Table-1: Load Details

| S.no | For Conventional Building | For Improved Resistance Structure |
|------|------------------------------|--|
| 1 | UDL on Beam 17.5 kn/m (DL) | UDL on Main Beam 17.5 kn/m (DL), where intermediate beam is not provided (Beams Inside the structure). |
| 2 | Imposed Floor Load 3 kn/sq.m | UDL on Intermediate Beam 5.83 kn/m (DL) |
| 3 | ----- | Imposed Floor Load 3 kn/sq.m |
| 4 | Self-Weight (DL) | Self-Weight (DL) |

IV. GROUND MOTION DATA

To perform time history functional analysis it is needed a ground motion data. For analysis, we have considered real time ground motion data, which is obtained from the PESOM website, which is maintained by the Department of the Earthquake Engineering, IIT Roorkee. The details of the ground motion data is tabulated as follows:

Table-2: Ground Motion Data Details

| Origin Details | |
|------------------------|-----------------------|
| Origin Time | 29-01-2013 / 19.42.52 |
| Latitude | 30.0 N |
| Longitude | 81.6 E |
| Depth (Km) | 7.0 |
| Magnitude | 4.0 |
| Region | Nepal |
| Station Details | |
| Station Code | PTH (Pithoragarh) |
| Station Latitude | 29.579 N |
| Station Longitude | 30.207 E |
| Station Height | 1538.0 |
| Site Class | A |
| Direction | |
| East-West | E Positive |
| North-South | N Positive |
| Vertical | Up Positive |

V. RESULT & DISCUSSION

by applying time history function for the structure we obtain base moment and shear for the structure in X, Y and Z axis. We have applied time history function for both conventional and Earth quake Resistance structure for analysis and comparison purpose. As a result we have base moment graphs and base shear graphs in X, Y and Z axis for both models. Result Graphs is plotted for time vs. base moment and shear. And for comparison minimum and maximum, base moment and shear for the structures are compared in chart 1 to 5.

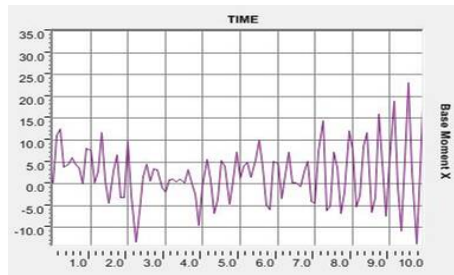
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Graph-1: Base Moment X vs. Time, for Conventional Structure



Graph-2: Base Moment X vs. Time, for EQ Resistance Structure

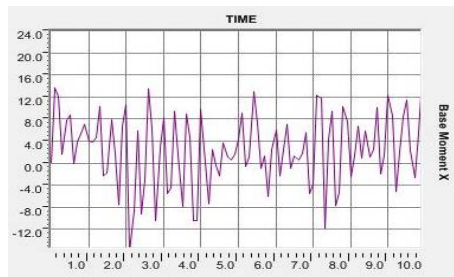
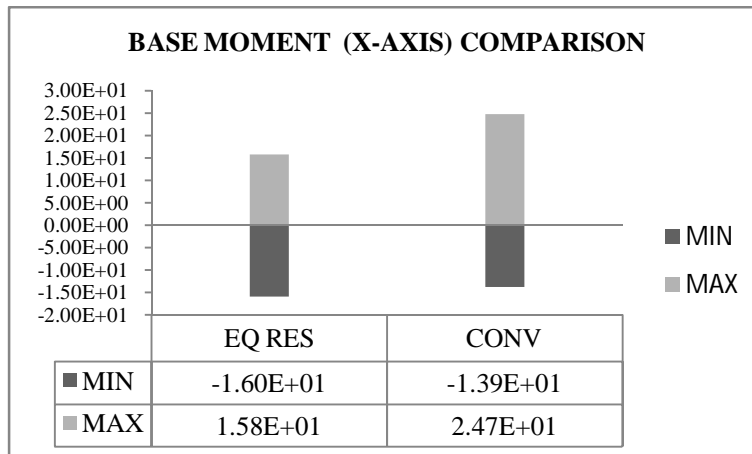


Chart-1: Base Moment (X-Axis) Comparison



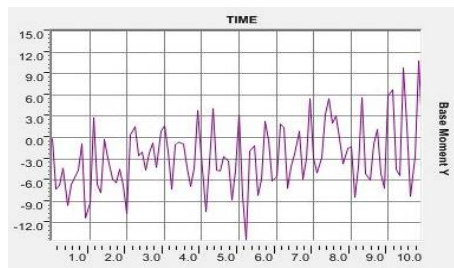
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Graph-3: Base Moment Y vs. Time, for Conventional Structure



Graph-4: Base Moment Y vs. Time, for EQ Resistance Structure

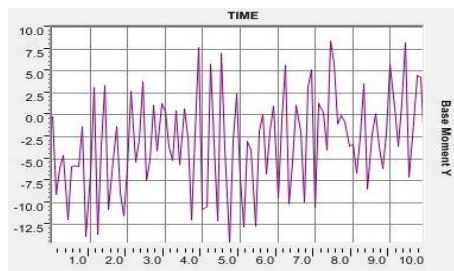
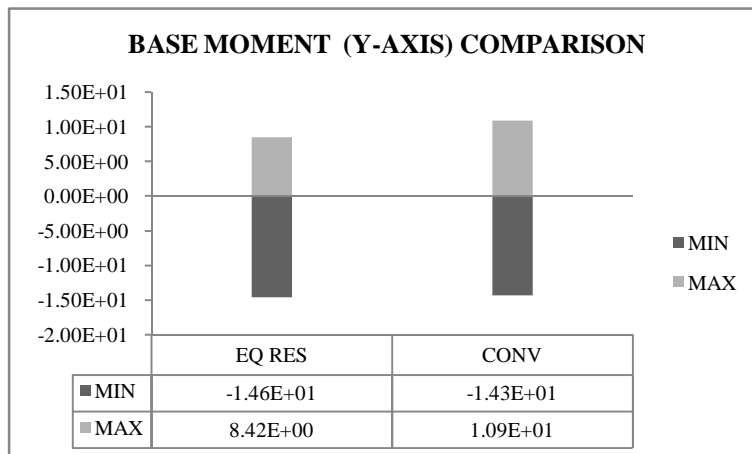


Chart-2: Base Moment (Y-Axis) Comparison



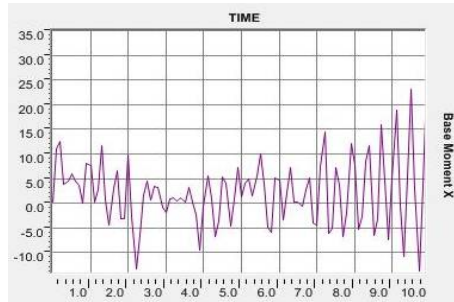
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Graph-5: Base Moment Z vs. Time, for Conventional Structure



Graph-6: Base Moment Z vs. Time, for EQ Resistance Structure

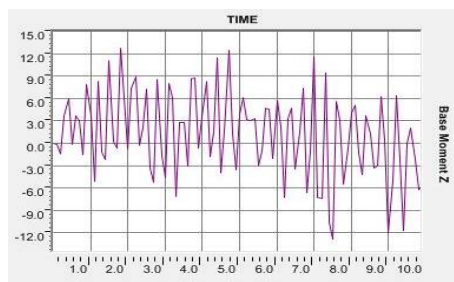
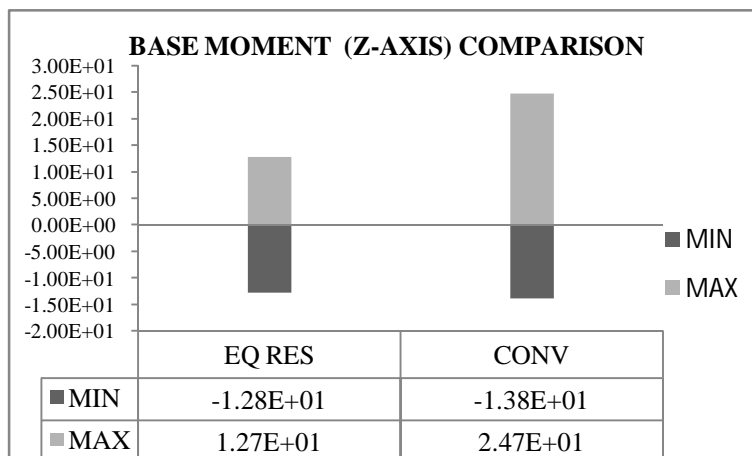


Chart-3: Base Moment (Z-Axis) Comparison



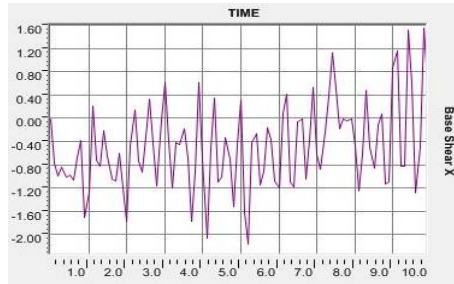
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Graph-7: Base Shear X vs. Time, for Conventional Structure



Graph-8: Base Shear X vs. Time, for EQ Resistance Structure

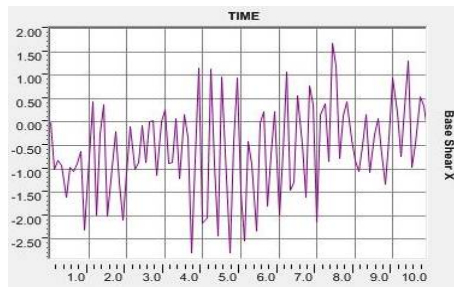
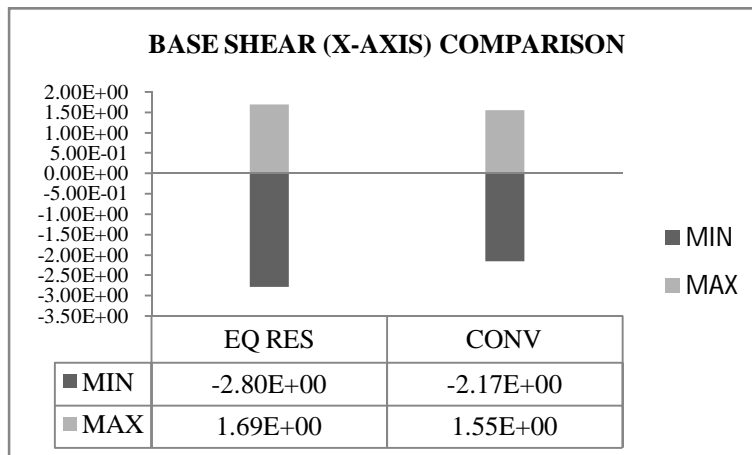


Chart-4: Base Shear (X-Axis) Comparison



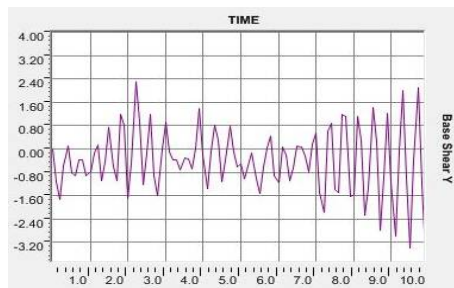
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Graph-9: Base Shear Y vs. Time, for Conventional Structure



Graph-10: Base Shear Y vs. Time, for EQ Resistance Structure

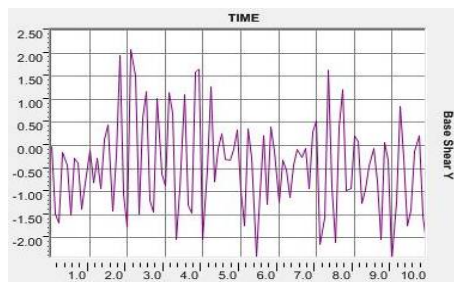
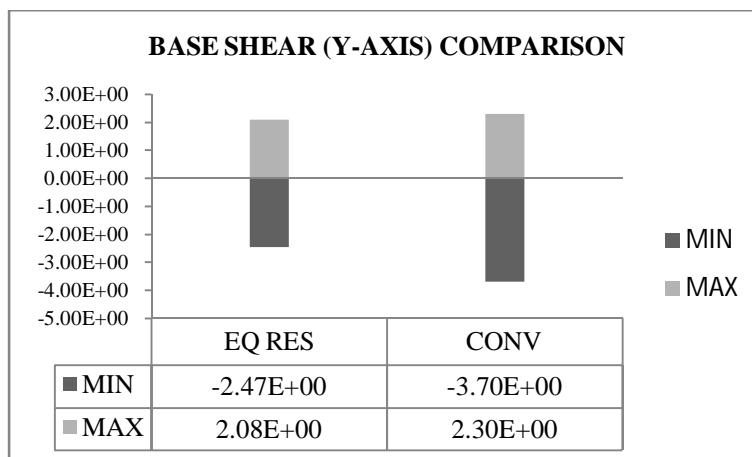


Chart-5: Base Shear (Y-Axis) Comparison



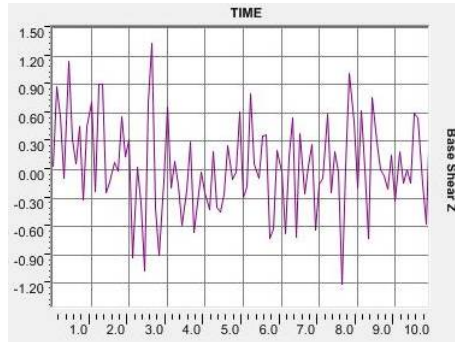
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Graph-11: Base Shear Z vs. Time, for Conventional Structure



Graph-12: Base Shear Z vs. Time, for EQ Resistance Structure

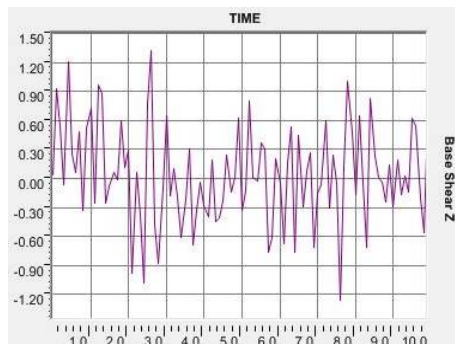
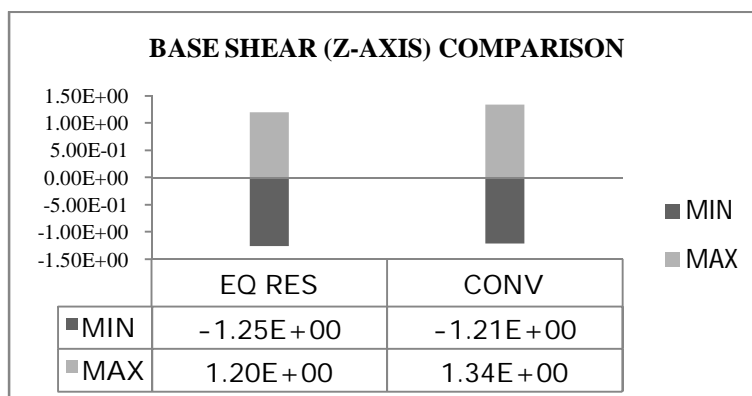


Chart-5: Base Shear (Y-Axis) Comparison



VI. CONCLUSION

From the bar charts 1 to 5, it is clearly we can understand that by providing the intermediated beam for sill level and lintel level, the effects of earthquake can be significantly reduced this can be proved by the result of the comparison bar charts. In comparison the base moment and shear have been reduced when compared with the conventional structures

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with the EQ Resistance structure. Thus the resistance of structure toward the earthquake can be increased by simply providing intermediated beams on both sill and lintel level.

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