International Journal of Advanced Technology in Civil Engineering

Volume 2 | Issue 2 Article 3

April 2013

PARAMETRIC STUDY OF PRELIMINARY SEISMIC EVALUATION OF EXISTING BUILDING STRUCTURES

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PARAMETRIC STUDY OF PRELIMINARY SEISMIC EVALUATION OF EXISTING BUILDING STRUCTURES

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Abstract—Soft tool has been developed for preliminary seismic evaluation of existing building. This initial evaluation will be decisive for detail seismic evaluation and retrofit methodology of existing building. Parametric study has been done using developed soft tool for number of frames participating for lateral load resistance and cross sectional area of columns.

Keywords*- Preliminary Seismic Evaluation; Parametric Study; Shear and Axial Stress; Soft Tool*

I. INTRODUCTION

Seismic evaluation of the existing building is the only decisive tool for its seismic retrofit scope and methodology. This evaluation can be eye inspection or engineered. Building of importance such as administrative building, hospitals, building of national security needs a detail evaluation whereas for the other buildings a preliminary seismic evaluation will suffix the purpose of evaluation.

In developing countries such as India where large amount of existing building are much vulnerable for seismic loads because of preliminary two reasons. First reason is that the buildings are not designed for seismic loads as a matter of negligence. Second reason is that these buildings are designed for preceding version of seismic codes.

Thus a large amount of effort is to be done for updating these exiting building for latest hazard level. First step of effort will be evaluation. As building units are in huge numbers, evaluation scope and methodology should be decided. For non engineered building, an eye inspection will be sufficient .Where as for non important building preliminary seismic evaluation will fix its purpose.

In present study a soft tool in term of spreadsheet in excel program has been developed based on the report on seismic evaluation of existing building which is a part of IITK-GSDA project on developing building codes[1].

This soft tool will helpful in deciding the need of detail seismic evaluation and retrofit methodology.

II. METHODOLGY FOR PRELIMINARY SEISMIC EVALUATION OF MOMENT RESISTING FRAME BUILDINGS

The design seismic base shear is modified considering the existing condition and life of the structure. Hence the modified base shear is given as,

$V_{bm} = A_{hm} * W$

Where, V_{bm} is Modified Base Shear, A_{hm} is modified design horizontal seismic coefficient.

A_{hm} is reduced by certain factor to compensate the existing useful life and condition of the structure. The report suggest the reduction factor as 0.67.

The modified base shear, V_{bm} will generate the modified story shear, $V_{J,}$ where j represents the level of storey. The shear stress in the moment resisting frame columns can be given by

$$\tau_{col} = \frac{(N_c * V_j)}{(N_c - N_f) * A_c}$$

Where τ_{col} is shear stress in columns due to modified storey shear at level j, Nc is Number of columns considered for resisting the lateral seismic load at level j, Nf is Number of frame considered for lateral load resistance in evaluation and Ac is summation of cross sectional area of columns considered at that storey level j. This shear stress should me less than 0.4MPA

The axial force in moment resisting frame columns due to modified storey shear can be given as

$$F_o = \left(\frac{2 * N_c * H}{3 * N_f * L} \right)$$

Where Fo is axial stress in the moment resisting columns due to modified storey shear at bottom storey, H is total height of the building structure, L is the total width of the building structures in the direction of the seismic load.

$$S = \frac{Fo}{Aec}$$

Where σ is the axial stress in individual column which should be less than the 25% of the characteristic strength of the concrete.

III. CASE STUDY FOR PRELIMINARY SEISMIC EVALUATION

IV. PROPERTIS OF FRAME

Column Size (mm)	800*800
Beam Size (mm)	800*1500
Grade of Concrete	M25
Grade of Steel	Fe415
Seismic Zone	V
Importance Factor	1
Response Reduction Factor	3
Average Dead Load on Roof (KN/m2)	7
Average Dead Load o Floor (KN/m2)	8
Live Load (KN/m2)	3
Soil Type	Hard Rock
Damping (%)	5

Parametric study is done on (i) Number of frame considered for the lateral load resistance (ii) Crossed sectional area of column.

Figure 3 shows shear stress generated in the columns in respective storey level due to modified storey shear for different number of frames considered for lateral load reistance.

At first only two external frames are considered to resist the total seismic load. This will give shear stress far greater than the permissible in all storey levels. As we increase the number of frame considered for lateral load resistance (i.e. 4,6) the shear stress generated goes on reducing but still it is not in the region of permissible limits. Finally, when all 8 frames considered for lateral load resitance then the shear stress generated are in set permissible limits at all storey levels.

Figure 4 shows axial stress generated in the columns at bottom storeyr in respective number of frames considered for lateral load reistance.From Figure 4 it is clear that the all case the axial stress due to lateral loads are well within the pset permissible limits.

This shows that shear stress is much more critical than the axial stress for seismic evaluation.

Figure 5 shows the cross sectional area individual column required for shear and axial stress to be within set permissible limits under different number of frames considered for lateral load resistance.

From Figure 5 it is clear that as we increase number of frames considered for lateral load resistance the required cross sectional area of individual column goes on reducing.

V. CONCLUSION

Following conclusion can be drawn from the analysis of the results

- As the number of frame considered for lateral load resistance increases the shear stress generated goes on reducing .
- Shear stress is much more critical than the axial stress for seismic evaluation.
- As number of frames considered for lateral load resistance increases the required cross sectional area of individual column goes on reducing.

REFERENCES

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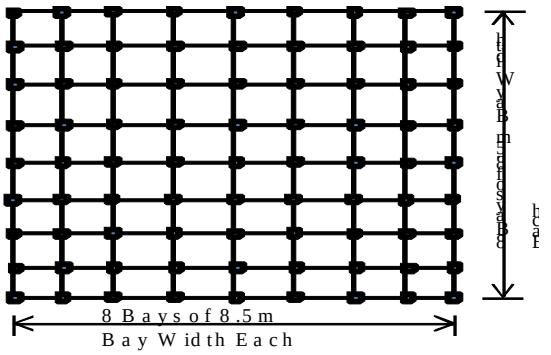

Figure 1: Plan of the Building Structure

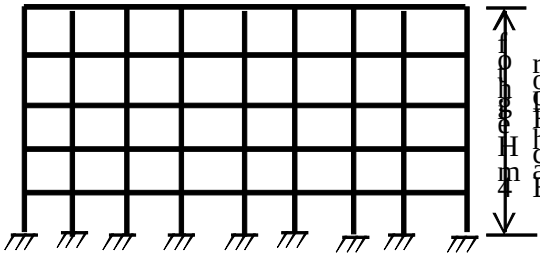

Figure 2: Elevation of Building Structure

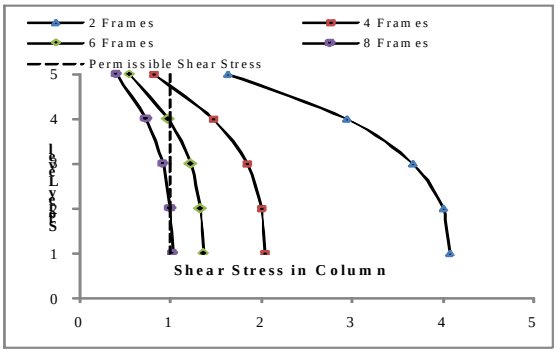

Figure 3: Shear Stress in Columns due to modifited storey shear

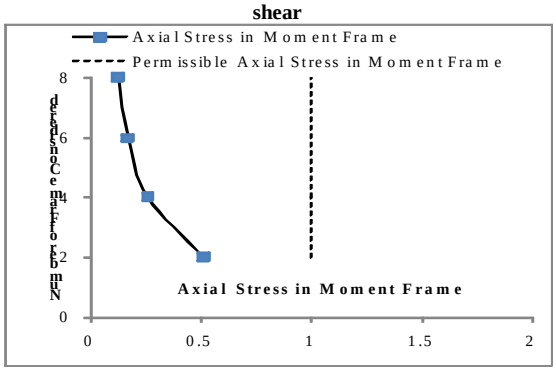

Figure 4: Axial Stress in column s due to modified storey shear

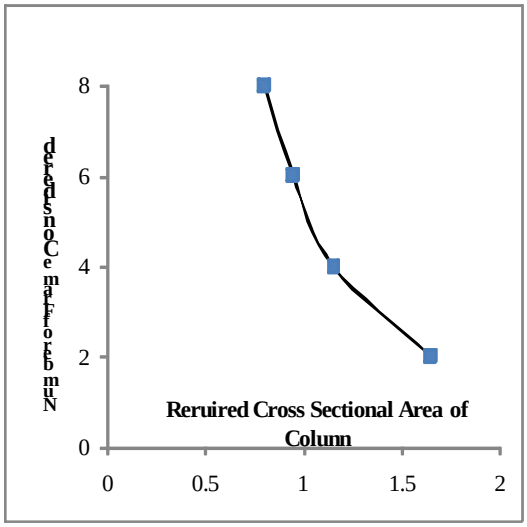

Figure 5: Required Cross sectional Area of individual Column for different number of frames considered for lateral load resistance