

Analysis of Multy Story Building With or With Out infill Wall using push over Analysis Method

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Abstract - Earthquakes are known to produce one of the most destructive forces on earth. It has been seen that during past earthquakes many of the buildings were collapsed. Therefore, realistic method for analysis and design are required. Performance Based Design is the modern approach for earthquake resistant design. It is an attempt to predict the performance of buildings under expected seismic event. A structure designed with Performance Based Design (PBD) concept does not developed undesirable failure mechanism during earthquake. The analysis can be performed on new as well as existing buildings and the performance of buildings in future earthquake can be evaluated. The model has been evaluated using Pushover Analysis, a non-linear static procedure, and linear dynamic analysis which may be considered as a series of static analysis and dynamic analysis carried out to develop a pushover curve and response curve for the building. The model is carried out in Midas Gen software considering M25 grade of concrete and Fe415 steel reinforcement. The pushover curve is generated by pushing the top node of structure to the limiting displacement and setting appropriate performance criteria.

Keywords — Performance based design, Pushover analysis, Capacity curve, Demand curve, Response spectrum, Midas gen.

I. INTRODUCTION

The use of the nonlinear static analysis (pushover analysis) came in to practice in 1970's but the potential of the pushover analysis has been recognized for last 10-15 years. This procedure is mainly used to estimate the strength and drift capacity of existing structure and the seismic demand for this structure subjected to selected earthquake. This procedure can be used for checking the adequacy of new structural design as well. The effectiveness of pushover analysis and its computational simplicity brought this procedure in to several seismic guidelines (ATC 40 and FEMA 356) and design codes (Euro code 8 and PCM 3274) in last few years.

The performance-based seismic design process explicitly evaluates how a building is likely to perform; given the potential hazard it is likely to experience, considering uncertainties inherent in the quantification of potential hazard and uncertainties in assessment of the actual building response [2]

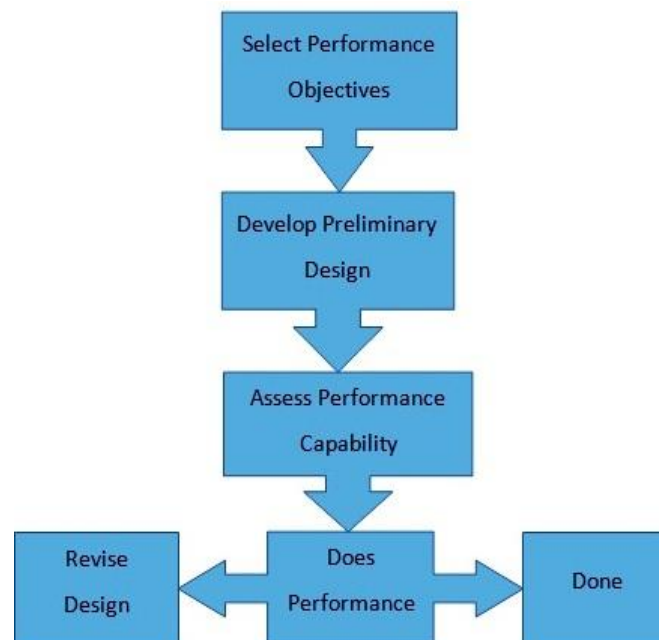


Fig.1 Performance based design

Performance based design is carried out in follow steps:

1. Select the performance level of building in association with architect, structure engineer and client based on site condition are expected.
2. Preliminary design is carried out as per Indian code. The story drift limit is checked as per IS1893 (Part1)-2002.
3. If design is safe than performance based analysis is carried out to meet the performance objective which is interpreted by both quantified hazard level and quantified performance level.
4. If performance point is not meet to objective revise the design by increasing or decreasing percentage of steel or size of member.
5. The process of analysis and design is repeated till expected performance objectives are met. Capacity and demand both change with structural design. Performance based design is iterative in nature compared to one step analysis and design as per IS: 1893(Part1)-2002.

PUSHOVER ANALYSIS

Pushover analysis is a static, nonlinear procedure using simplified nonlinear technique to estimate seismic structural deformations. It is an incremental static analysis used to determine the force-displacement relationship, or the capacity curve, for a structure or structural element. The analysis involves applying horizontal loads, in a prescribed pattern, to the structure incrementally, i.e. pushing the structure and plotting the total applied shear force and associated lateral displacement at each increment, until the structure or collapse condition. In technique a computer model of the building is subjected to a lateral load of a certain shape (i.e., inverted triangular or uniform). The intensity of the lateral load is slowly increased and the sequence of cracks, yielding, plastic hinge formation, and failure of various structural components is recorded. Pushover analysis can provide a significant insight into the weak links in seismic performance of a structure. The performance criteria for pushover analysis are generally established as the desired state of the building given roof-top or spectral displacement amplitude.

Two types of pushover analysis are as:

Force controlled

Used when load is known and structure is desired to support this load. For gravity load on structure force controlled, push over analysis is used.

Displacement controlled

Used when load is unknown but displacement is known and structure is desired to lose their strength and become unstable. For lateral load on structure displacement controlled, pushover analysis is used. [2]

II. COMPUTATION OF MODEL

Analysis of multi-story building (G + 30) with different vertical configuration for a same plan using a different parameters such as drift story, base shear, capacity curve, demand curve, performance point, maximum Displacement, time history as below.

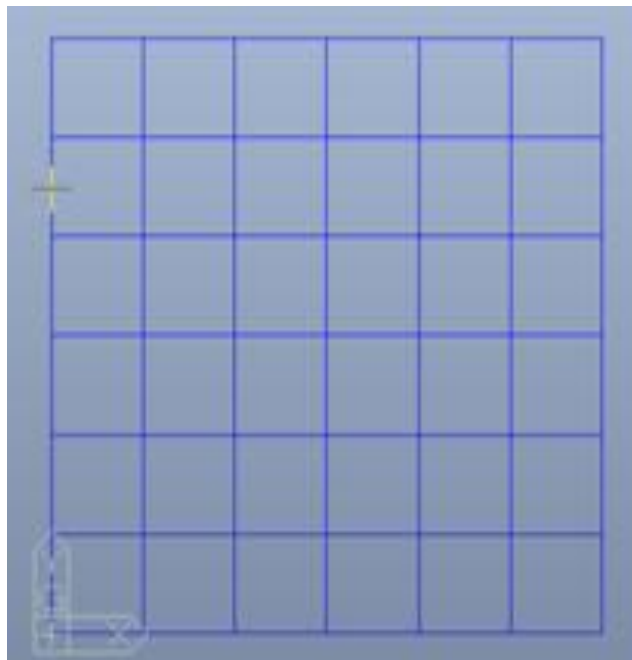


FIG. 2 Plan of all model

TABLE 1 BUILDING DETAILS

Sr. no	Name	Detail of Model
1	Storey height	G + 30
2	Spacing along X direction	2 m
3	Spacing along Y direction	2 m
4	Size of column	500 x 500 mm
5	Size of beam	300 x 300 mm
6	Slab thickness	150 mm
7	live load	4 KN/m ² typical
		1.5 KN/m ² terrace
8	Floor finish	1 KN/m ²
9	water proofing	2 KN/m ²
10	Earthquake	As per IS:1893 2002
11	Type of soil	Type II medium as per IS 1893
12	Seismic zone	Zone III

III.RESULTS

After the modelling and analysis of the structure in the Software MIDAS GEN, the results of different parameters were obtained in the table form.

Response spectrum method:- DISPLACEMENT IN X DIRECTION

TABLE 2 STOREY DISPLACEMENT IN X DIRECTION

Type of structure	Story Displacement (X)				
	G+30	G+25	G+20	G+15	G+10
Without infill	0.4781	0.3056	0.181	0.0962	0.042
shear wall infill	0.05	0.029	0.0163	0.0091	0.005
Brick wall infill	0.05	0.032	0.0199	0.0093	0.0042

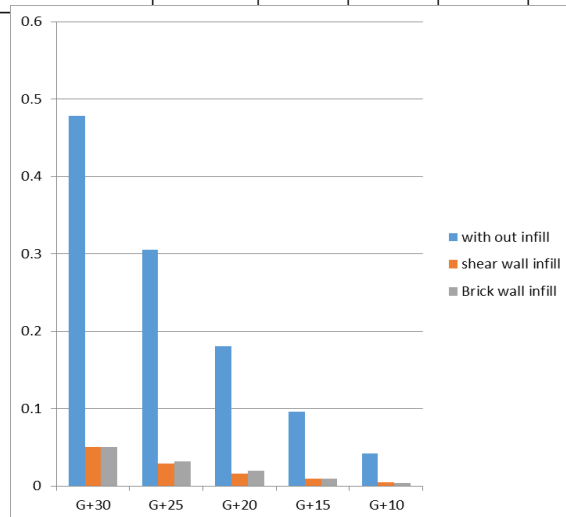


Figure 3. Storey Displacement in X- Direction

DISPLACEMENT IN Y DIRECTION

TABLE 3 STOREY DISPLACEMENT IN Y DIRECTION

Story Displacement (Y)					
Method of Analysis	G+30	G+25	G+20	G+15	G+10
Without infill	0.129	0.0788	0.0446	0.0222	0.0088
shear wall infill	0.05	0.029	0.0163	0.0091	0.005
Brick wall infill	0.035	0.0199	0.0039	0.0093	0.0011

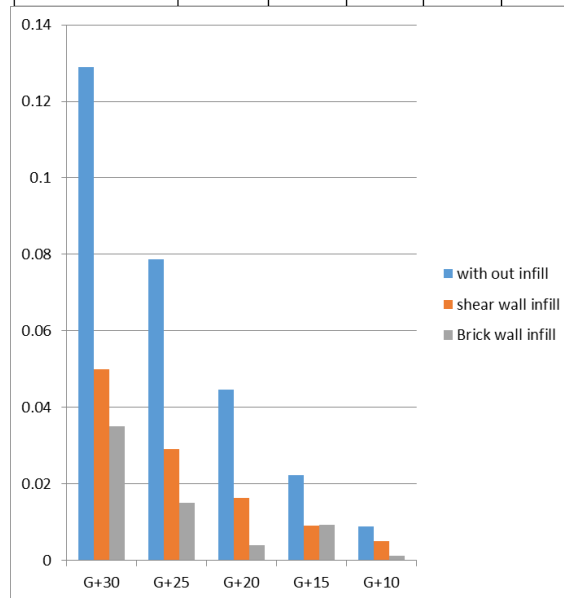


Figure 4. Storey Displacement in Y- Direction

STOREY DRIFT IN X DIRECTION

TABLE 4 STOREY DRIFT IN X DIRECTION

Story Drift (X)					
Method of Analysis	G+30	G+25	G+20	G+15	G+10
bare frame	0.0122	0.0112	0.0095	0.0075	0.0049
with shear wall	0.0014	0.0015	0.001	0.0007	0.0006
with brick wall	0.0015	0.0014	0.001	0.0008	0.00065

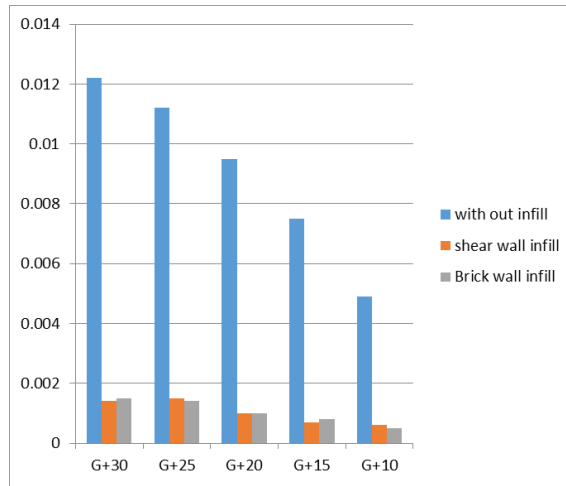


Figure 5. Storey Drift In X Direction

STOREY DRIFT IN Y DIRECTION

TABLE 5 STOREY DRIFT IN Y DIRECTION

Story Drift (Y) (m)					
Method of Analysis	G+30	G+25	G+20	G+15	G+10
bare frame	0.0036	0.0014	0.0031	0.0034	0.0013
with shear wall	0.0014	0.0013	0.001	0.0007	0.0006
with brick wall	0.001	0.0005	0.0004	0.0003	0.0005

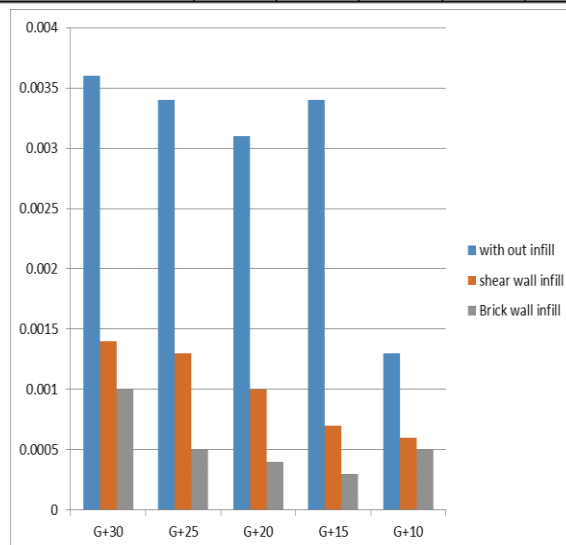


Figure 5. Storey Drift In X Direction

Push over analysis method:-

STORY DISPLACEMENT IN X DIRECTION

TABLE 6 STOREY DISPLACEMENT IN X DIRECTION

Story Displacement (X)					
Method of Analysis	G+30	G+25	G+20	G+15	G+10
Without infill	0.4781	0.3056	0.181	0.0962	0.042
shear wall infill	0.05	0.029	0.0163	0.0091	0.005
Brick wall infill	0.05	0.027	0.0149	0.0093	0.0042

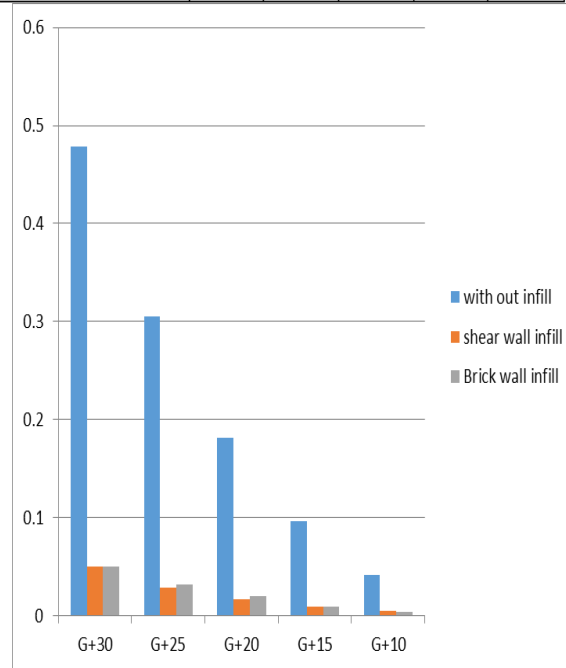


Figure 6. Storey Displacement in X- Direction

STORY DISPLACEMENT IN Y DIRECTION

TABLE 7 STOREY DISPLACEMENT IN Y DIRECTION

Story Displacement (Y)					
Type of structure	G+30	G+25	G+20	G+15	G+10
Without infill	0.129	0.0788	0.0446	0.0222	0.0088
with shear wall	0.05	0.029	0.0163	0.0091	0.005
with brick wall	0.035	0.079	0.0039	0.0093	0.0011

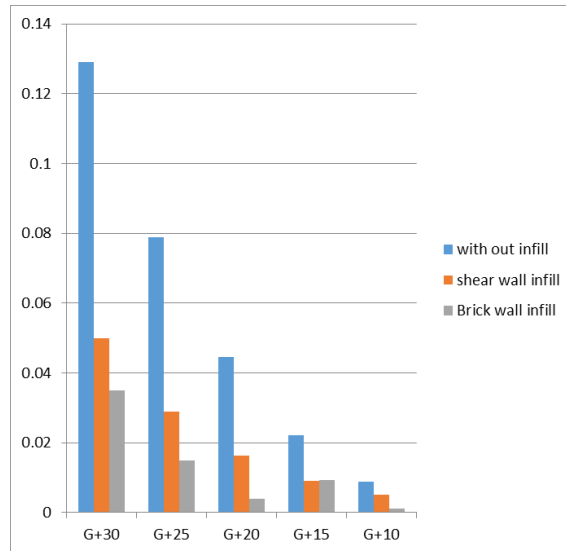


Figure 7. Storey Displacement in Y- Direction

STOREY DRIFT IN X DIRECTION

TABLE 8 STOREY DRIFT IN X DIRECTION

Story Drift (X)					
Method of Analysis	G+30	G+25	G+20	G+15	G+10
Without infill	0.0247	0.024	0.0223	0.02	0.0192
with shear wall	0.0051	0.0015	0.0078	0.009	0.0138
with brick wall	0.0075	0.009	0.0121	0.0152	0.0221

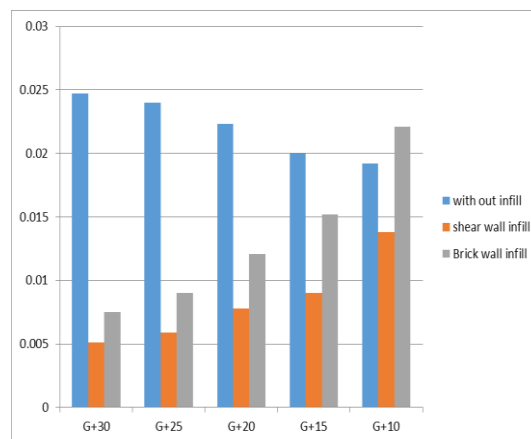


Figure 8. Storey Drift In X Direction

STOREY DRIFT IN Y DIRECTION

TABLE 9 STOREY DRIFT IN Y DIRECTION

Story Drift (Y) (m)					
Method of Analysis	G+30	G+25	G+20	G+15	G+10
Without infill	0.012	0.0102	0.0098	0.0021	0.0013
with shear wall infill	0.0024	0.0015	0.0079	0.0006	0.0004
With brick wall infill	0.001	0.0005	0.0004	0.0003	0.0002

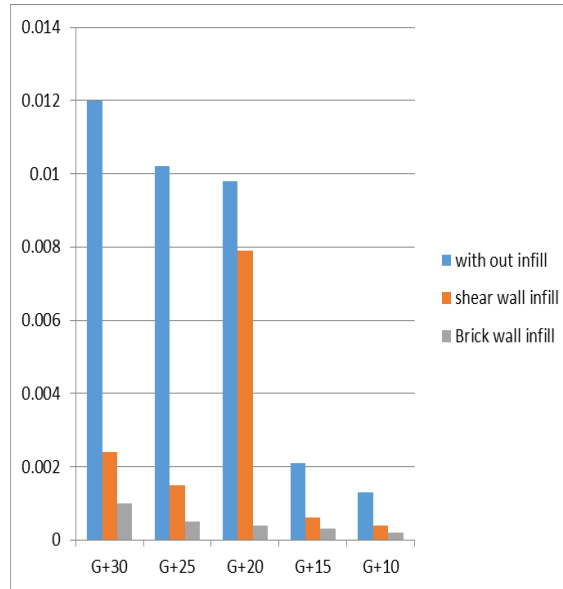


Figure 9. Storey Drift In X Direction

IV. CONCLUSIONS

1. A frame without infill wall have a more storey displacement or more storey drift compare to infill walls.
2. A brick wall also gives noticeable results.
3. In general we are considering brick wall is a not structural element but after this investigation we can conclude a brick wall also work as a shear wall.
4. Building with shear wall infill having more base shear compare to without out infill walls.
5. Direction of the strut in modeling effect on the results also.

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