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PUSHOVER ANALYSIS OF MULTI STORIED BUILDING WITH INFILL MASONRY

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ABSTRACT

In the recent past the Masonry Infills are commonly used in RC Multi Storey Buildings. Masonry Infills are used as Equivalent Diagonal Strut.

In the present study attempt has been made to study the effect of seismic loading in placing the Infill wall as Equivalent Diagonal Strut for the frame. In this study G+3,G+6,G+9 buildings with 4x4,5x5 and 6x6 Bays with Symmetrical Bay size and Unsymmetrical Bay size are been analysed. All these models are been analysed. All these models are been analysed for 3 conditions: Bare Frame, Frame with Full Masonry Infill, Frame with Soft Storey Infill. All these models are analysed for Seismic Zone III and Special Moment Resisting Frame is considered. Pushover Analysis are performed on these models to evaluate the seismic demand.

Structural Analysis is Carried out by using Extended Three Dimensional Analysis of Building Systems (ETABs) Version 9.6.0

I. INTRODUCTION

Earthquake is the result of the sudden movement of tectonic plates in the crust. Since time immemorial, nature is influencing the very existence of human beings on earth. An earthquake is defined as "a wave – like motion generated by forces in constant turmoil under the surface layer of the earth, travelling through the earth's crust".

Most reinforced concrete (RC) frame buildings in developing countries are infilled with masonry Infill walls. The Seismic design of these Masonry Infill is handled in many different ways. They are:

i. Non Structural parts.
ii. Structural parts.

II OBJECTIVE

The Objectives of the study are

i. To analyse the building by non- linear pushover analysis.
ii. To determine the performance point of the building.
iii. To determine the displacement of the building.
iv. To analyse the building with equivalent diagonal strut for the whole frame
v. To analyse the building with equivalent diagonal strut for soft storey frame.
vi. To analyse the building by varying the number of stories and by varying the number of bays.

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III METHODOLOGY FOR EVALUATION

3.1 Non Linear Static Analysis (Pushover Analysis)

Pushover analysis is a non-linear static procedure. Evaluation of seismic performance of the building can be estimated. Pushover analysis includes applying horizontal loads and pushing the structure and plotting the total shear force and lateral displacement, until the structure reaches the collapse condition. Pushover analysis is a performance based analysis. The performance level describes the limiting damage condition.

IV. MODELLING AND ANALYSIS

4.1 Pushover Analysis

Assign the default hinge properties available in ETABs Non linear version software. For beams M3 hinge is assigned, for column PM2M3 hinge is assigned and for equivalent diagonal strut P hinge is assigned.

V BUILDING DESCRIPTION

Parameters	**G+3. 4x4,5x5, 6x6 Bay**	**G+6. 4x4,5x5,6x6 Bay**	**G+9. 4x4,5x5,6x6 Bay**
Seismic Zone	**III**	**III**	**III**
Seismic Zone Factor	**0.16**	**0.16**	**0.16**
Response Reduction Factor	**5**	**5**	**5**
Height of Building	12 m	21 m	30 m
Each Storey Height	3 m	3 m	3 m
Thickness of Infill Wall	.3 m	.3 m	.3 m
Thickness of Slab	.15 m	.15 m	.15 m
Beam Size	.3x.45 m^2	.3x.45 m^2	.3x.5 m^2
Column Size (Regular) (Irregular)	.35x.7 m^2 .35x.7 m^2	.4x..8m^2, .35x.7m^2	.4x.8 m^2 .4x.8 m^2
Live Load Intensities			
Roof	1.0 kN/m^2	1.0 kN/m^2	1.0 kN/m^2
Floor	3.0 kN/m^2	3.0 kN/m^2	3.0 kN/m^2
Dead Load Intensities			
Roof Finish	1.5 kN/m^2	1.5 kN/m^2	1.5 kN/m^2
Floor Finish	1.0 kN/m^2	1.0 kN/m^2	1.0 kN/m^2
Material Properties			
Concrete Properties	M 25 Grade of Concrete	M25 Grade of Concrete	M 25 Grade of Concrete
Steel Properties	Fe 415 Grade of Steel	Fe 415 Grade of Steel	Fe 415 Grade of Steel

Parameters Considered for the Study

VI RESULTS AND DISCUSSIONS

General

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The effectiveness of providing Infill Wall as Equivalent Diagonal Strut on buildings for varying number of stories and for varying number of bays with the help of different models, G+3,G+6,G+9 Buildings with 4x4,5x5,6x6 bays are analysed into 4 parts.

Part I: Regular Buildings with symmetrical Bay Size

Part II: Irregular Buildings with symmetrical Bay Size

Part III: Regular Buildings with unsymmetrical Bay Size

Part IV: Irregular Buildings with unsymmetrical Bay Size

Pushover analysis results

Regular Building with Symmetrical Bay Size

Pushover results of Part I Buildings

Storey	Performance Point (in kN)	Displacement (in m)
G+3 (4x4) Bay (BF)	6958.95	0.139
G+3 (4x4)Bay (FI)	31375.96	0.069
G+3 (4X4) Bay(SSI)	22488.52	0.078
G+3(5x5)Bay(BF)	9781.39	0.117
G+3(5X5) Bay (FI)	37274.12	0.064
G+3(5X5)Bay(SSI)	25403.42	0.073
G+3(6X6)Bay(BF)	12735.05	0.105
G+3(6X6)Bay(FI)	39367.94	0.078
G+3(6X6)Bay (SSI)	27805.87	0.085
G+6 (4x4) Bay (BF)	7752.40	0.222
G+6 (4x4)Bay (FI)	25651.07	0.099
G+6 (4X4) Bay(SSI)	17804.25	0.115
G+6(5x5)Bay(BF)	10569.92	0.192
G+6(5X5) Bay (FI)	32903.54	0.106
G+6(5X5)Bay(SSI)	28402.33	0.117
G+6(6X6)Bay(BF)	13709.71	0.171
G+6(6X6)Bay(FI)	41425.10	0.101

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G+6(6X6)Bay (SSI)	34089.42	0.114
G+9(4x4) Bay (BF)	7305.77	0.284
G+9 (4x4)Bay (FI)	22936.83	0.163
G+9 (4X4) Bay(SSI)	16056.43	0.175
G+9(5x5)Bay(BF)	10570.69	0.277
G+9(5X5) Bay (FI)	33575.08	0.156
G+9(5X5)Bay(SSI)	24574.68	0.167
G+9(6X6)Bay(BF)	13662.28	0.245
G+9(6X6)Bay(FI)	34856.38	0.132
G+9(6X6)Bay (SSI)	21034.56	0.144

VII .CONCLUSION

The performance point is more for Bare Frame when compared to Frame with full infill and soft storey infill has less performance point than the full infill frame.The displacement also varies from frame to frame.

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