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Response of Time History Analysis of Unsymmetrical Concrete Building in SAP

[1]Mr. Saurabh Agrawal, [2]Prof. G. D. Dhawale, [3]Prof. V. A. Kalmegh, [4]Dr. S. G. Makarande

[1] P. G. STUDENT, [2]Professor, [3]Professor, [4] Professor

[1]M. Tech Structural Engineering, Civil Engineering Department
[1] BapuraoDeshmukh College of Engineerinng, Sevagram, Wardha, Maharashtra, India

Abstract: **Masonry infill is often considered as nonstructural element while analyzing structure. To know actual behavior of structure, the effect of masonry infill is need to be incorporated in seismic evaluation. In this work, several research papers were reviewed and the results from different analysis method are compared to study the effect of masonry infill for different storied structure. From review it is seen that, inclusion of masonry infill changes fundamental time period of vibration, story displacement and base shear characteristics.**

Index Terms - **Masonry infill, Base Shear, Displacement, Fundamental Time Period.**

I. Introduction

The Infilled reinforce concrete (RC) frame structures are amongst the most common structural forms for low- to medium-rise buildings. Generally bare frame is considered for structural analysis. However, masonry infill affects drastically during seismic response, mostly it is ignored and considered as non structural element. Though the masonry infill is considered as non structural element but it has its own strength and stiffness. Hence if the effect of masonry considered in analysis and design, considerable increase in strength and stiffness of overall structure may be observed. Many researchers have performed analysis considering the effect of masonry infill as an equivalent diagonal strut. The equivalent width of diagonal strut using empirical formula [1, 2, 3, 4, 5 and7].

$$Wef = 0.175(\lambda 1hcol)^{-0.4}\overline{rinf}$$

$$\lambda 1 = [\frac{Em\ tinf\ sin2\theta}{4\ Efe\ Icol\ hinf}]^{1/4}$$

Where,

Wef = Equivalent Diagonal Width

hcol = Column Height Between Centerlines of Beams hinf = Height of Infill Panel

Efe = Expected Modulus of Elasticity ofFrame Material

Emf = Expected Modulus of Elasticity of Infill Material Icol = Moment of Inertial of Column

rinf = Diagonal Length of Infill Panel

tif = Thickness of Infill Panel and Equivalent Strut

= Angle Whose Tangent is the Infill Height-To-Length Aspect Ratio.

The fundamental time period, storey displacement and base shear characteristics have been changed with the inclusion of masonry infill, isobserved.

In present review, the effect of masonry with and without infill, partially infilled and open ground storey has been seen by analyzing structure, performing Non linear static analysis, equivalent static analysis, Time history analysis, Eigen Value Analysis and Response spectrum analysis [1-10].METHODOLOGY

Mr. V.P, Jamnekar and Dr. P.V. Durge [1] performed pushover analysis in SAP2000 to study the effect of partial infill masonry with base frame. The strength and stiffness were checked for 8 storeyed building with 4 bays in lateral and longitudinal direction in plan. With 40% infill masonry the structure is analyzed for fundamental time period, displacement and base shear in seismic zone V according to IS 1893(part-1) 2002 and result were compared with base frame

Ayman AbdElhamed and Sayed Mahmoud [2] performed Response Spectra analysis using ETABS for 6 storeyed MRF with and without infill masonrywalls

.A model of 5 bays in X direction &3 bays in Y direction with 4 m bay spacing and 19 m height is analyzed to check base shear, displacement and internal forces as per Egyptian code. Result shows that shear carrying capacity and stiffness increases drastically in case of masonryinfill

Ram Krishna Mazumdar et. al. [3] performed a non linear static analysis of 6 storeyedbuilding trapezoidal in plan using software package Seismostrut V7. Base shear and storey displacement is calculated for base frame and frame with infill, subsequently results were compared. It has been observed from pushover analysis that, the bare frame comprises lesser stiffness than frame with masonryinfill.

Geo Davis [4] studied seismic response of masonry brick infill wall in slender structure. A 10 storey structure were considered and 2 models with and without masonry brick infill were analyzed for static analysis modal analysis and time history analysis with the help of ETABsoftware

Haroon Rasheed Tamboli and Umesh N. Karadi [5] studied the seismic response of structure for bare frame masonry infill and first open storey frame 10 storeyed structure with 3.5 m storey height (30 X 20)m rectangular in plan with 5 m bays were modeled and analyzed for zoneIII as per IS 1893 (Part-1) 2002.

VishwajeetDeshmukh and DrShrirangTande [6]studiedtheeffectofmasonryinfillinMulti-storeystructure. 3 models of 4 storeyed with 3 m storey height including bare frame, infill frame without opening and infill frame with opening were modeled and analyzed for seismic zone III as per IS 1893 (Part-1) 2002. Response spectrum analysis has performed by using ETABS and results were compared.

KasimArmaganKorkmaz et al. [7] studied effect of irregular configuration of masonry infill wall on the performance of the structure having 20 m and 15.8 m dimensions in longitudinal and lateral direction with 9 m height the structure is analyzed for non linear pushover analysis in SAP2000. The result obtained for base shear and storey displacement are com with base frame according to Turkish codes

Khan Mahmud Amanat and EkramulHoque [8] studied the influence of fundamental period of vibration of the regular RC framed building having 10 storey with 3.5 m storey height square plan with 24 m in either direction having 4 equal bays. A 3D finite element model is developed and eigen value analysis is performed including masonry infill. Natural time period is calculated in accordance with uniform building code (UBC) and Bangladesh National Building code (BNBC), Indian Standard (IS), Building standard law of Japan (BSLJ), and National Building code (NBC) Canada.

Amar A. Chaker and ArslanCherifati [9] studied the influence of masonry infill panels on the vibration and stiffness characteristics of RC frame. Two adjacent frame with and without brick infill were considered and 4 numerical models developed to find out frequency and displacement pattern by performing eigen valueanalysis

J. Dorji and Thambiratnam [10] performed an analysis of infill frame structure under seismic loads by using finite element Time History analysis under different seismic records Fundamental time period were calculated for infill frame without opening , infill frame with opening and infill frame with soft storey.

TABLE NO. 1.1 RESULTS FROM VARIOUS ANALYSIS METHODS FOR BARE AND INFILL FRAME STRUCTURE

Ref.	No. of Storey	Infill (%)	Analysis Performed	Base Shear (kN)		Displacement (mm)		Fundamental Time period (sec)			
				Bare	Infill	Bare	Infill	Bare		Infill	
								X	Y	X	Y
01	8	40	Pushover Analysis	2000	2750	218.49	145.34	1.468	1.468	1.034	1.034
02	6	100	Response Spectrum Analysis	2400	3000	37	12	0.958	0.937	0.505	0.553
03	6	100	Pushover Analysis	223	340	25.4	12.7	0.7	0.7	0.5	0.5
04	11	100	Time History Analysis	110	200	17.4	7.2	1.1	1.1	0.4	0.4
05	10	100	Linear Static Analysis	673	3412	8.23	2.28	2.812	4.375	0.554	0.693
06	4	100	Response Spectrum Analysis	205	240	4.25	0.2	0.65	0.65	0.13	0.13
07	3	100	Pushover Analysis	450	750	12.5	11.0	-	-	-	-
08	10	20	Eigen Value Analysis	-	-	-	-	2.4	2.4	1.35	1.35
		40	Eigen Value Analysis	-	-	-	-	2.4	2.4	1.1	1.1
		60	Eigen Value Analysis	-	-	-	-	2.4	2.4	1.0	1.0
		80	Eigen Value Analysis	-	-	-	-	2.4	2.4	0.9	0.9
09	4	100	Eigen Value Analysis	-	-	-	-	0.34	0.40	0.145	0.173
10	10	100	Time History Analysis	-	-	-	-	0.825	0.825	0.53	0.53

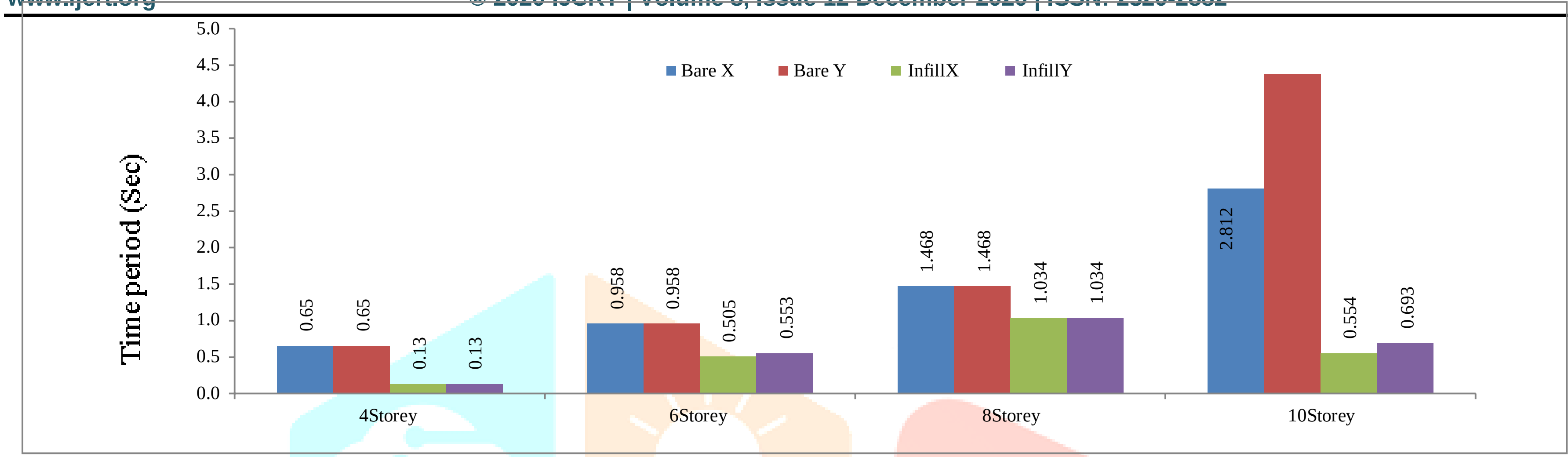

Fig 1.1 Fundamental Time Period in bare and infill frame in X and Y direction

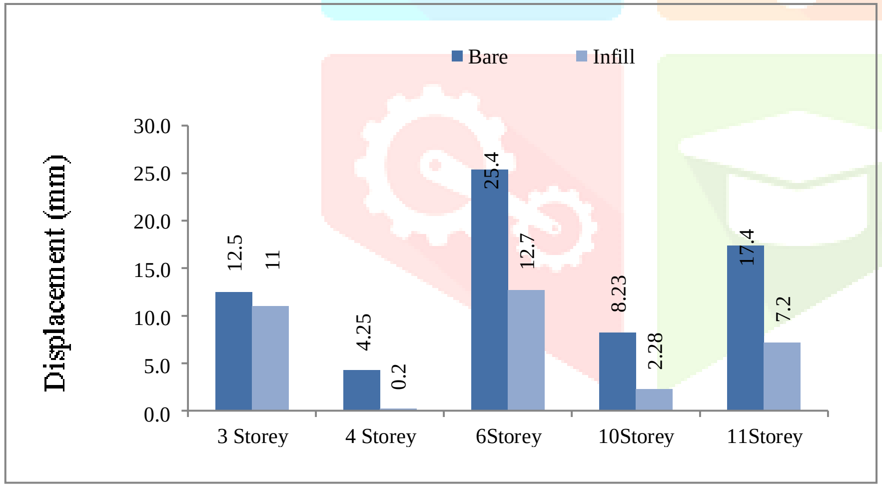

Fig1.2DisplacementinBareandInfillFrameStructures

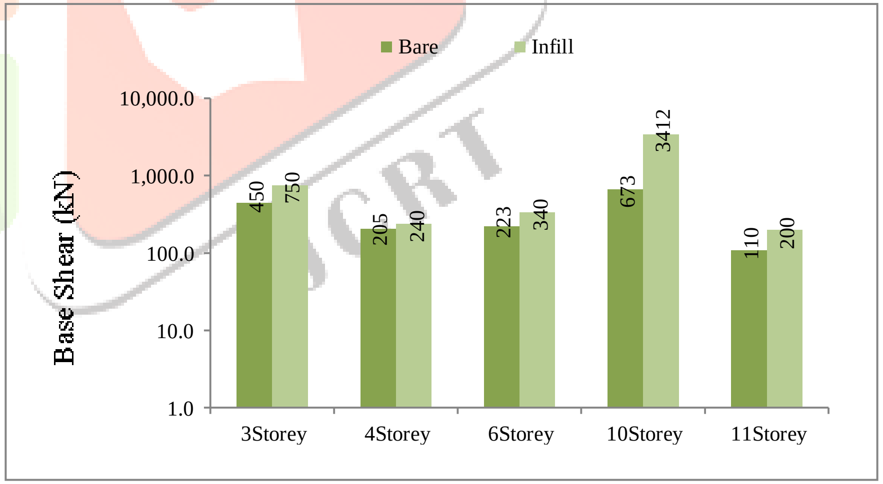

Fig 1.3 Base Shear in Bare and Infill FrameStructures

1. RESULT ANDDISCUSSION

In this review work, 10 research papers were reviewed to study effect of masonry infill which was analyzed for Pushover analysis, Time history analysis, Response Spectrum analysis, Linear Static analysis and Eigen Value analysis and results are shown in Table No.1.1.

It is seen from fig 1.1, fig 1.2 and fig 1.3, with the inclusion of masonry infill, Fundamental time period of vibration and storey displacement is reduced drastically in each analysis. Whereas, the value of Base Shear is seen to be increased in infill frame as compared to bare frame structure.

2. CONCLUSION

Considering masonry infill in structural analysis reduces fundamental time period of vibration, storey displacement and increases base shear for different storeyed structure.

Fundamental time period for high rise building can be reduced up to 80% [5].

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