© 2015 IJEDR | Volume 3, Issue 2 | ISSN: 2321-9939

Evaluation of Strength and Stiffness of Infilled RC Frame with Reentrant Corner

[1]Dharmesh Singh, [2]Ashish Prajapati,
[1]Student, [2]Asst. Professor,
[1]Strucutral Eningeering,
[1]Parul Institute of Engineering & Technology, Vadodara, India

***Abstract* - In this paper, the Seismic behavior of in-filled Reinforced concrete frame having re- entrant corner is evaluated. Plan configuration of these space frames contain reentrant corner, where both projections of the structure beyond a reentrant corner is 33 percent of the plan dimension of the structure in the given direction. Bare and Infilled frames are considered. It is found that infill had beneficial effect in R.C. frame having reentrant corner.**

***Index Terms* - Infill, Asymmetry, Diagonal Strut, SAP 2000**

I. INTRODUCTION

Structural irregularities are commonly found in structures. The existence of an asymmetry in the plan is usually leading to an increase in stresses of certain elements that consequently results in a significant destruction. Furthermore, unreinforced masonry infill panels (MI panels) are widely used throughout the world, including seismically active regions. They are usually used as interior partitions and external walls in concrete frames, but they are treated as nonstructural elements and not included in the analysis and design procedure. Such a simplified design approach does not consider the initial beneficial effects on the strength capacity of the concrete frames, does not predict the level at which the damage in the infill panel occurs, and it does nottake in consideration the effect of the infill arrangement on irregularities of the building (Fardis, 2000; Bachmann, 2002; Hashemi & Mosalam,2006).

II. LITERATURE REVIEW

The first set of nonlinear static procedure comprises the capacity spectrum method (csm),introduced by freeman (freeman et. al., 1975). in 1981, nonlinear dynamic analyses on an equivalent sdof system had been proposed (.saiidi & sozen, 1981). based on this idea, the n2 method has been suggested (fajfar & fischinger, 1988). these first proposals are characterized by their simplicity and usually consider the first mode in computation ofthe pushover/capacity curve, and consequently have been limited to planar structural models.

The first study to use pushover analysis for irregular buildings was carried out in 1996 (moghadam & tso, 1996). moghadam's study was then extended to cover plan-eccentric buildings and taken the three-dimensional torsional effect into account. in this later work, an elastic spectrum analysis of the building was used (moghadam & tso, 2000). later on, many theoretical contributions had been made to improve the performance of the analysis and had been reviewed by themelis (themelis, 2008). furthermore, many authors had dealt with the practical aspects of plan irregularities (.faella et. al., 2004; yu et. al., 2004; ambrisi et. al., 2008; pinho et. al. 2008; herrera & soberón, 2008).

III. MODELING AND ANALYSIS

In the present study lateral load analysis as per the seismic code IS: 1893-2002 is carried out for Symmetric and asymmetric buildings having re-entrant corner and an effort is made to study the effect of seismic loads. The plan layout of the reinforced concrete ordinary moment resisting frame building of Five storied Building without and with consideration of stiffness of walls is as shown in Fig. 2, with open ground storey and Unreinforced masonry infill walls in the upper storeys are chosen. The bottom storey height is kept 3.1m and a Height of 3.1m is kept for all the other storeys, bay dimensions in both x and y directions are kept as 4m and 4m respectively. Projection of the building beyond a re-entrant corner is 33% of the plan dimension of the structure in given direction. This makes the Model considered is five storied as bare frame and with infill.

The equation for Calculation of equivalent diagonal strut width is considered from Kasim Armagon et al[11] paper.The width is given by

$$W_{ef} = 0.175\,(\lambda_h H)^{-0.4}\ \sqrt{H^2 + L^2}$$

where

$$\lambda_h = \sqrt[4]{\frac{E_i t \sin 2\theta}{4 E_c I_c H_i}}$$

H and L are the height and length of the frame, Ec, and Ei are the elastic moduli of the column and of The infill panel, t is the thickness of the infill panel, q is the angle defining diagonal strut, Ic is the modulus of Inertia of the column and Hi is the height of the infill panel.

Concrete frame elements are classified as beam and column elements. Columns and beams are Modelled using three dimensional frame elements. Slabs are modelled as rigid diaphragms. The beam column Joints are assumed to be rigid.

The following building models is used in the study.

Model: The building is G+4 asymmetric in plan and also in distribution of storey stiffness & mass, both in plan and Along height. Building has no walls in the first storey and brick masonry walls in the upper storeys. Two forms of this model are studied, one in which the stiffness of walls is ignored and the other in which stiffness of infill walls is considered.

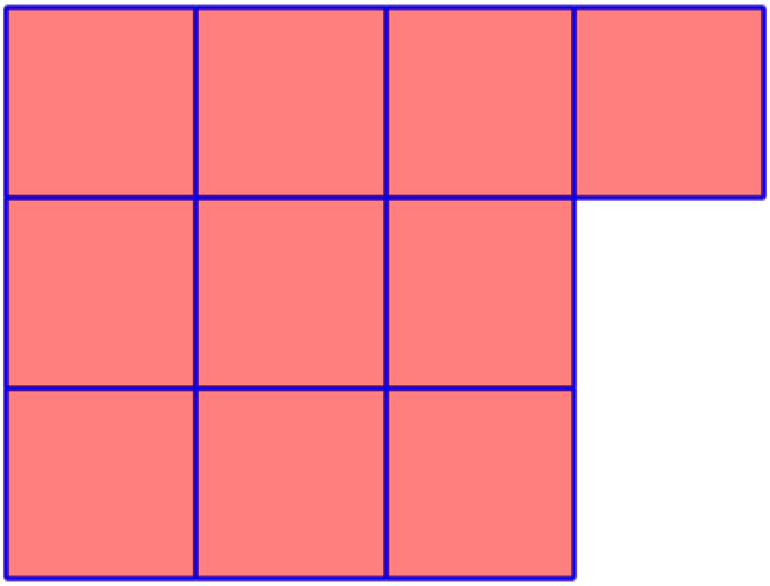

Fig. 1 Plan of Building

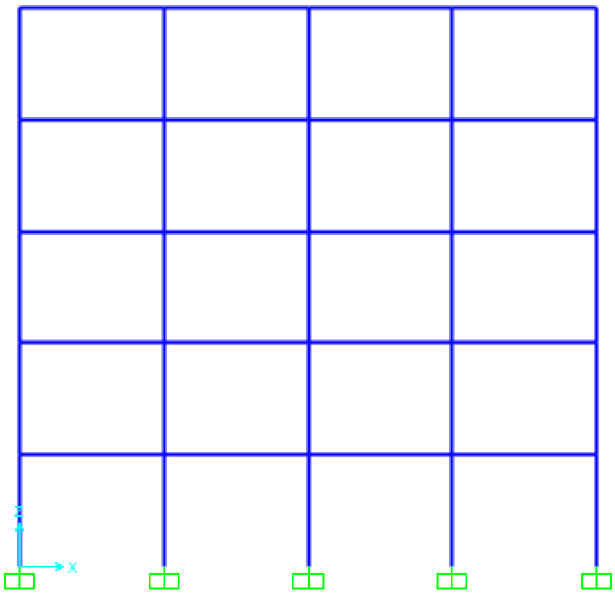

Fig. 2 Elevation of bare frame Building

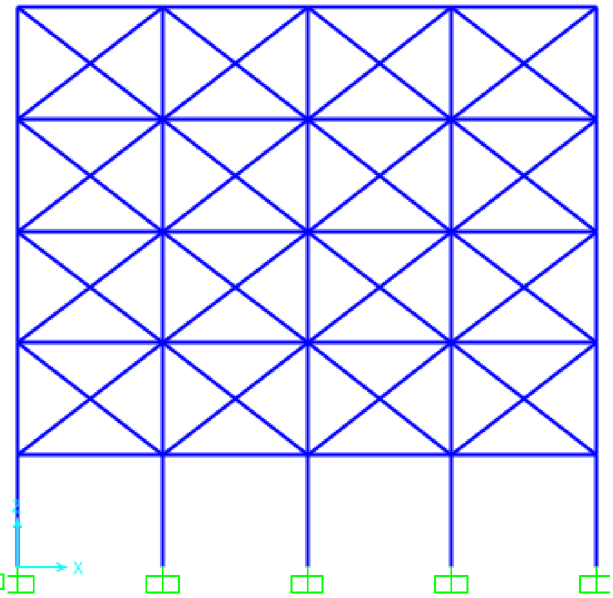

Fig.3 Elevation of Infilled building

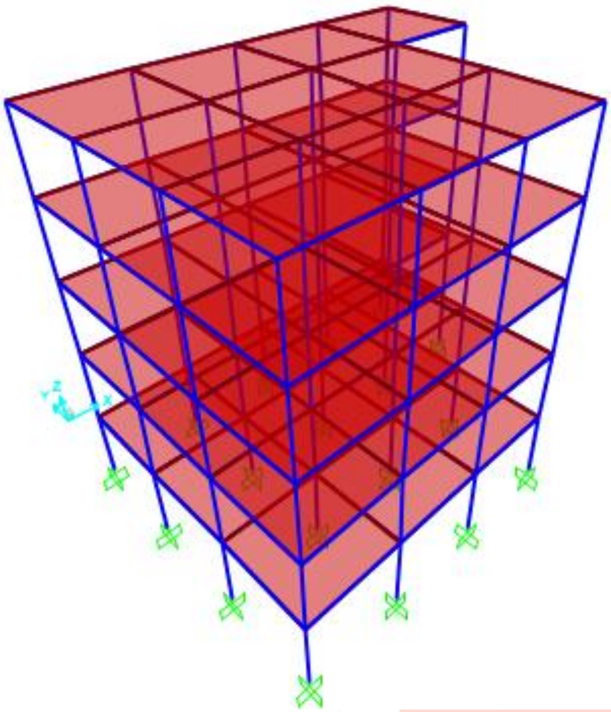

Fig. 4 3-D view of Bare R.C. Frame

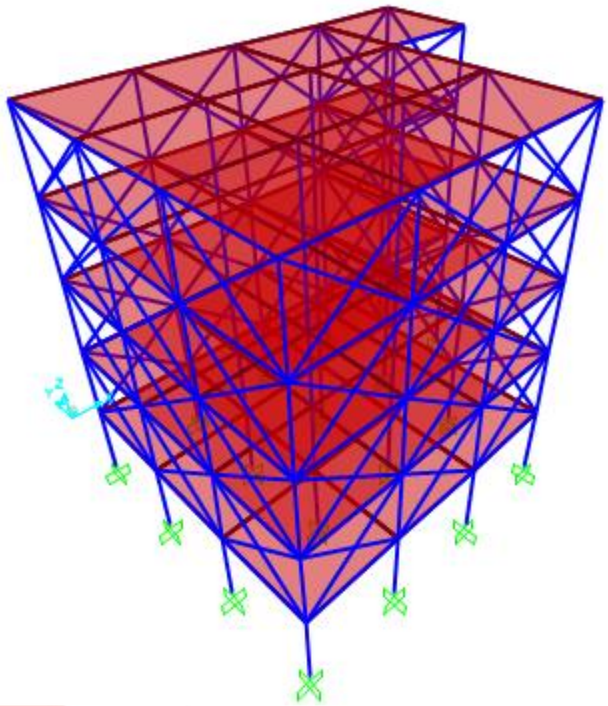

Fig. 5 3-D view of Infill R.C Frame

IV. RESULTS

TABLE I: Time Period of R.C Frame Building

Sr No.	Model	Time Period (Sec)
1	Symmetric	.67
2	Asymmetric	.42

TABLE II: Base Shear of R.C Frame Building

Sr No.	Model	Base Shear (kN)
1	Symmetric	960
2	Asymmetric	1135

TABLE III: Storey Displacement of R.C Frame Building

FLOOR	SYMMETRIC (MM)	ASYMMETRIC (MM)
O.G.S	1.57	1.57
1	3.94	2.52
2	6.056	3.21
3	7.614	3.73
4	8.50	4.03

V. CONCLUSION

Infilled R.C Frame and Bare frame showed equal displacement at Open ground storey.

Displacement at top floor got reduced by 102 %.

Time period got reduced by 25% in Infilled R.C frame making structure stiffer.

Base Shear got increased with Infilled R.C Frame showing that IS 1893:2002 codal proviosion do not provide proper guidelines for calculating base shear in building with re-entrant corner having infill

REFERENCES

[1] Ambrisi AD, De Stefano M, Viti S (2008). Seismic performance of irregular 3D RC frames.The 14th World Conference on Earthquake Engineering.Beijing, China, Paper 05-01-0116.

[2] ATC (1996). Seismic evaluation and retrofit of concrete buildings. ATC-40.Applied Technology Council, Redwood City.
[3] Building& Housing Research Center(1999). Iranian code of practice for seismic resistant design of buildings. Standard No.2800. BHRC-PN 374, Tehran
[4] Deierlein GG, Reinhorn AM, Willford MR (2010). Nonlinear structural analysis for seismic design, a guide for practicing engineers. NEHRP Seismic Design Technical Brief No. 4, NIST GCR 10-917-5.
[5] Federal Emergency Federal Agency, FEMA-356, Pre-standard and Commentary for Seismic Rehabilitation of Buildings , Washington DC, 2000.
[6] Faella G, Giordano A, and Mezzi M (2004). Definition of suitable bilinear pushover curves in nonlinear static analyses. The 13th World Conference on Earthquake Engineering, Vancouver, Canada, Paper No. 1626.
[7] Fajfar P, Fischinger M (1988). N2 A method for non-linear seismic analysis of regular buildings. The Ninth World Conference in Earthquake Engineering, Tokyo-Kyoto, Japan, Vol. 5, pp. 111-116.
[8] Fardis MN (2000). Design provisions for masonry-infilled RC frames. The 12th World Conference on Earthquake Engineering, Auckland, NZ, Paper No. 2553.
[9] IS: 1893 – 2002 (Part 1), Criteria for Earthquake Resistant Design of Structures, part 1-General provisions and buildings, fifth revision, Bureau of Indian Standard, New Delhi, India
[10] IS: 456-2000, Code of Practice For Plain and Reinforced Concrete, Bureau of Indian Standard, New Delhi, India.
[11] Freeman SA, Nicoletti JP, Tyrell JV (1975). Evaluation of existing buildings for seismic risk a case study of Puget Sound Naval Shipyard. Bremerton, Washington, Proceedings of U.S. National Conference on Earthquake Engineering, Berkley, pp. 113-122.
[12] A. Kadid and A. Boumrkik, Pushover Analysis of Reinforced Concrete Frame Structures, Asian Journal of Civil Engineering (Building and Housing) Vol. 9, No 1, 2008, pp. 75-83.
[13] Hashemi A and Mosalam KM (2006). Shake-table experiment on reinforced concrete structure containing masonry infill wall. Earthquake Engineering and Structural Dynamics, Vol.35, pp. 1827-1852.
[14] Saiidi M and Sozen MA (1981). Simple nonlinear analysis of RC structures. ASCE, ST Division, Vol. 107, pp. 937-951.
[15] Negro P and Verzeletti G (1996). Effect of Infills on the Global Behaviour of R/C Frames: Energy considerations from pseudo dynamic tests. Earthquake Engineering and Structural Dynamics, Vol. 25, pp. 753-773.