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A Review Paper on Retrofitting of Multistoried Building using Infills in Open Ground Story

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Abstract-*The objective of this study is to identify an efficient retrofitting method for existing open ground story reinforced concrete frame buildings. Failure of several open ground-stored buildings in the past earthquakes underscores the need to retrofit existing open ground story buildings. A common cause for the collapse of multi-storied buildings is the occurrence of open ground story in the ground floor due to the presence of infill walls in the upper story. During the Bhuj (Gujarat) earthquake of 6thJanuary 2001 several open ground storied building failed there by confirming the vulnerability of such buildings to earthquake loading. This underscores the need to retrofit existing open ground story buildings to prevent their total collapse. The existing building structures, which were designed and constructed according to early codal provisions, do not satisfy requirements of current seismic code and design practices.The building is modeled as a 3D space frame with six degrees of freedom at each node using the software ETAB 2017. A dynamics analysis technique is used to assess the performance of a (G + 15) reinforced concrete buildings, of which the ground story is a parking facility the ground story is 3.5m high while the upper stories giving a total height of 48.5 m. the building is located in Seismic Zone III.The RC frame is retrofitted by three methods namely,*

- *Brick masonry infill in the ground story.(Equivalent diagonal strut method)*
- *Steel braces in the ground story.*
- *R.C. Structural wall in the ground story.*

The study concludes that the building designed as per provisions of IS: 456:2000 using limit state method of design, and analyzed as per existing seismic code IS: 1893-2000 of all these three methods studied the use of structural wall in the ground story panel gave the maximum strength and ductility.

Keywords-*open ground story, brick infill, RC wall Infill.*

I-INTRODUCTION

The presence of walls in upper story makes the building many times stiffer in the upper story than in the open ground story. Thus, the upper story moves almost together as a single block, and most of the horizontal displacement of the building occurs in the open ground story itself. Thus, such buildings swing back-and-forth like inverted pendulums during earthquake shaking, and understandably columns in the open ground story are severely stressed. If the columns are weak (i.e., they do not have the required strength to resist these high stresses), they may be severely damaged or even lead to collapse of the building. Open ground story buildings are called also as building on stilts. Multi-story buildings are being built at a rapid pace in India. Street parking is difficult in many old town areas, where the available road widths are small. Hence, between the municipal authorities and architects, a solution was achieved to take motorized vehicles off the road, and move them to the ground storey of the buildings. Even though it is clear that RC frame buildings with open ground storey are vulnerable, only select owners of these structures are considering retrofitting their buildings.

II-SCOPE/OBJECTIVE

This project report comprises of linear dynamic analysis of R.C. building with symmetrical plan. The conclusion was established considering the following aspects:

- The structure should withstand the moderate earthquakes, which may be expected to occur during the service life of structure with damage within acceptable limits. Such earthquakes are

characterized as Design Basis Earthquakes (DBE).

- To study linear static analysis by using ETABS software.
- To study Equivalent diagonal strut method for the design of infilled frames
- To study dynamic analysis as per IS 1893 (Part 1):2016 for medium soil and zone III.
- To study the performance of a structure with open ground story.
- To develop a method to strengthen and retrofit the open ground story.
- To make a building earthquake resistant.
- Infill walls provide the lateral stiffness to the structure. Its behavior is very different from the bare frame structure.

III-METHOLOGY

The methodology worked out to achieve the above-mentioned objectives is as follows:

i. Review the existing literature and Indian design code provision for designing the OGS building
ii. Study the equivalent diagonal method for representing the effect of infill frames.
iii. Select a G+15 storied building model the case study.
iv. Model the selected building with and without considering infill strength/ stiffness in ETAB 2017 software.
v. Interpretation of results and conclusions
vi. In Indian scenario, the relevant retrofitting schemes are (a) column jacketing, (b) masonry infilling in RC frame, (c) RC structural walls, and (D) cross bracings, considering cost and feasibility of the schemes. Jacketing of columns can be done by steel encasement, steel straps, concrete or mortar or a combination of these methods.

IV- ANALYTICAL STUDY

A (G+15) storied RC frame building with open ground story and brick infilled top story is considered with the story heights as 3m and 3.5m for the top and the ground story respectively. The frame is assumed to be fixed against translation in all directions and rotation about all axes at the bottom nodes. The design lateral force on the infilled frame was estimated using the Indian Seismic Code [IS: 1893, 2016]. The frame was modeled in ETAB 2017 and linear Elastic analysis was carried out under the lateral force. The frame members were designed and detailed for the corresponding stress resultants as per Indian Concrete code [IS 456, 2000]. The details of beam and column are as shown in table1.

Table No. 1- Details of building.

Particulars Details/values	
Type of building	Residential
No. of storeys	G + 15
Each storey height	3m
Open ground storey height	3.5m
Size of columns	250 x 350 mm
Size of beams	250 x 350mm
Grade of concrete	M30
Slab thickness	150mm
Grade of Steel	Fe500
Thickness of brick infill	230mm
Thickness of RC Wall	200mm
Size of steel bracing section	ISMC 300

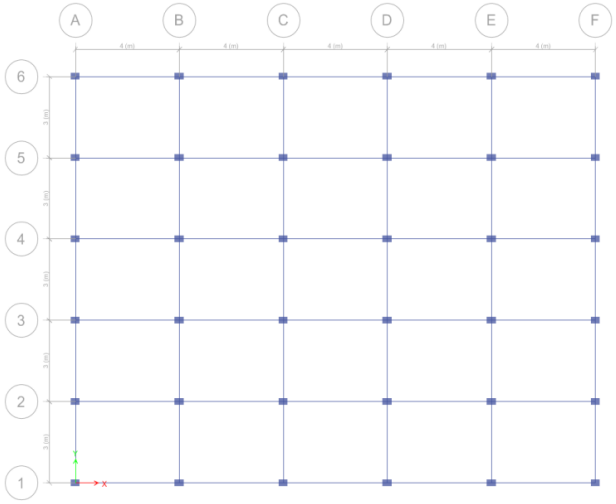

Fig 1*- Plan of G+15 structure*

The model OGS was strengthened by the following retrofitting schemes. Each of them as modeled in ETAB 2016 and subjected to seismic analysis for estimating their limiting characteristics.

1) Brick Masonry Infill:

The open ground story panel was filled with 230mm thick brick masonry. Thus in the model BMI, an additional strut was introduced in the frame in place of ground story panel.

2) Structural Wall:

Basically, the structural wall was introduced in the open panel of the ground story. A single layer of reinforcement was provided for the 200 mm thick RC

structural wall designed as per the Indian standard for ductile detailing [IS13920, 1993].

3) Steel Bracing

The open ground story column beam junction were steel braced by I section of size ISMC300.

V- CONCLUSION

1) This study will few ideas about contribution of lateral stiffness of infill wall, shear wall and bracing in structures
2) Response spectrum method is very useful to find out story drift.

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REFERENCES

[1] *Himalee Rahangadle, S. R. Satone(2013). Design and Analysis of Multistoried Building with Effect of Shear wall. International journal of Engineering Reserch and Applications, Vol 3, Issue 3, pp-223-232, ISSN:2248-9622.*

[2] *Arlekar J. N., Jain S. K. and Murty C. V.R.,(1997). Seismic Response of RC Frame Building with Soft First Storey. proceeding of CBRI Golden Jubliee Conference on Natural Hazards in Urban Habitat, , New Delhi, pp.13-24.*

[3] *Parekh, A. and Thakkar, S. K.,(2003). A Comparative Study of R.C Building Using Steel Bracing and Infill Walls. Workshop on Retrofitting of Structure Oct-10-11,. IIT Roorkee, pp. 158-166*

[4] *Prof. Pravin B. Waghmare, ,(2012). Seismic Evaluation of Framed Structures.International Journal Of Scientific and Engineering Research Volume 3, Issue 8, ISSN-2229-551*

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