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Effective Position of Shear Wall in a Multi-Story Building with Re-Entrant Corners Taking Volume into Consideration

Praveen J.V, Sanjith J, Jayachandra

Assistant Professor, Department of Civil Engineering, Sri Siddhartha Institute of Technology, Tumkur,
Karnataka, India

Assistant Professor, Department of Civil Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru,
Karnataka, India

Assistant Professor, School of Civil Engineering, REVA University, Rukmini Knowledge Park, Kattegenahalli,
Yelahanka, Bengaluru, Karnataka, India

ABSTRACT: In construction, a shear wall is like a dedicated panel with the task of resisting all types of horizontal movement parallel to only one plane. Shear Wall is a Structural Member which have very high in plane stiffness and strength, this can be used to resist both large horizontal loads (like earthquakes forces) and support gravity. Specialized Structural walls are designed for shear resisting in buildings to carry the loads due to wind, earthquake and other forces. They are primarily flexural members and provided in high rise buildings to prevent the collapse of whole building due to seismic forces. In the current project, analysis of 25 storeys building in zone V with some investigation which is analysed by moving different position of shear wall for a time- period.

KEYWORDS: Text detection, Inpainting, Morphological operations, Connected component labelling.

I. INTRODUCTION

RC multi-story frame buildings are designed such that they resist both the vertical and horizontal load. Earthquakes are the event which occur frequently all over the world. Some past earthquakes have shown that RC buildings have either damaged or collapsed during an earthquake. It is difficult to predict the intensity, size or the time at which the earthquake occurs. The buildings which are designed considering dead, live, snow loads etc may not be adequate in resisting the lateral loads. The design and detail approach for RCC in Indian code is IS 456. Provision for ductile detailing in Indian code are specified in IS 13920. The structures designed as per considering IS 1893 poses at least lateral strength to earthquakes of small to moderate intensities that are occurring frequently with minor or no damages to the structures and aims at resisting the building to collapse at major earthquakes.

Shear walls are most extensively used to resist lateral loads in addition to resisting the lateral loads they are also effective in resisting gravity loads. Shear walls are reinforced concrete structures which start at the foundation and extend up to top of the structure. The structure which are properly designed and detailed with shear walls have shown good performance in resisting earthquakes. shear walls provide large lateral strength and stiffness which resist both lateral loads and gravity loads. Shear wall are usually provided at the lifts, corner of the building, edges of the building. The strength may vary depending on the position orientation of the shear wall in the structure. Since they carry large lateral force overturning moments are large, so they must be placed symmetrically in plan to reduce the ill effects on building, they resist lateral forces and transfer them to the elements below them and to the foundation, Thus they reduce lateral sway in the structure. To study the effect of shear wall in different locations of the structure G+10 story, building is modelled using ETABS. six models were modelled with same floor plan but with different positions of shear wall, the fifth model was same as the fourth model but with comparatively less volume of shear wall than the fourth model. The first model consisted of G+10 story with 3m floor to floor height but with no shear wall. The second model was similar to that of the first model but with shear wall at the core, in the third and fourth model shear wall was at edge and at the corners respectively. The fifth model was same as fourth but with lesser volume compared to the later. With

changing in position of the shear wall the performance of the structure as well as the volume of the shear wall changes, sometimes the volume at the core may be more than that of edges or corner, maybe volume at corner may be more than that of other locations. So, the structure should be designed such that the efficiency of shear wall should be more with comparatively less volume. the plan and elevation of all the models are shown in the figure:1

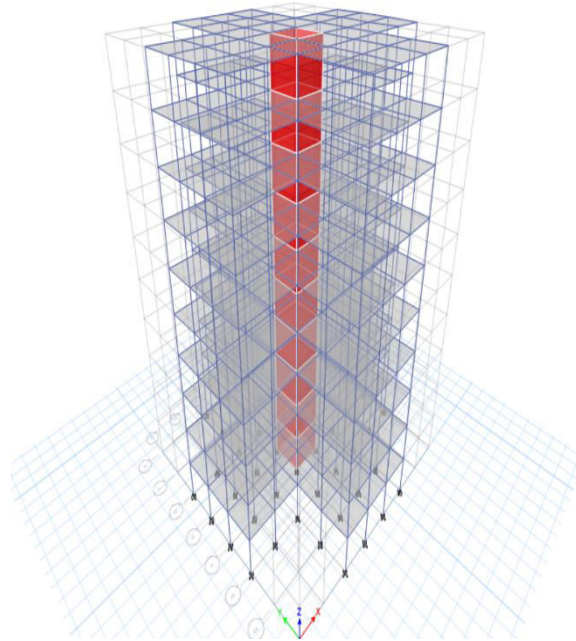


Figure.1: Elevation of all the models

II. OBJECTIVES

- To analyse the effective location of shear wall in multi-story frame structure.
- To study parameters such as lateral displacement, Base shear, storey drifts of multi-story Frame structure.
- To analyse the models using ETABS software.
- To compare the results of models with different locations of shear wall.

III. METHODOLOGY

Following methods are adopted for analysis of building for design earthquake loads.

1. Static Method.
 - a) Equivalent Static Method.
 2. Dynamic Methods.
 - b) Response Spectrum Method
- The structures considered will have different locations and volume of shear wall in the analysis.
 - Modelling of 6 G+10 storey plus shaped buildings in ETABS software by changing the positions and volume of shear wall. Analysing the structure for seismic loading using IS 1893 code.
 - To interpret the optimum position of shear wall in structures with re-entrant corner from the results obtained. Comparing base shear, storey displacement, storey drift and story stiffness.

The plan of the building assumed is of plus shape, with 3m spacing between the supports. It is assumed to be special moment resisting frame structure located in zone v resting on medium soil having importance factor 1.5 and all the other assumed details are

1. Spacing between columns in each direction
2. Height of floor = 3m

3. Size of column = 230x450mm
4. Size of beam = 300x500mm
5. Thickness of slab =150mm
6. Grade of concrete for beam = M25
7. Grade of concrete for column = M30
8. Grade of concrete for slab = M25
9. Grade of rebar = FE500
10. Seismic zone = ZONE V
11. Type of soil = II
12. Importance factor = 1
13. Number of stories = G+10
14. Thickness of wall =150mm
15. Thickness of shear wall= 250mm
16. Live load = 2.5KN/m²
17. Floor finish = 1KN/m²

Earthquake in X and Y directions are considered

MODELS

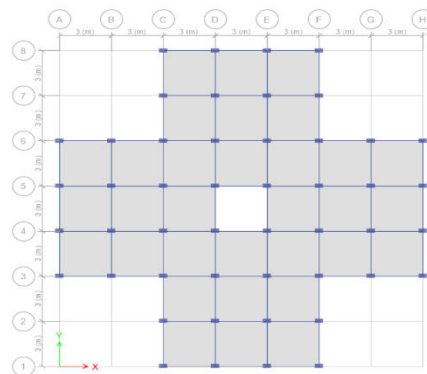


Figure.2 structure with no shear wall

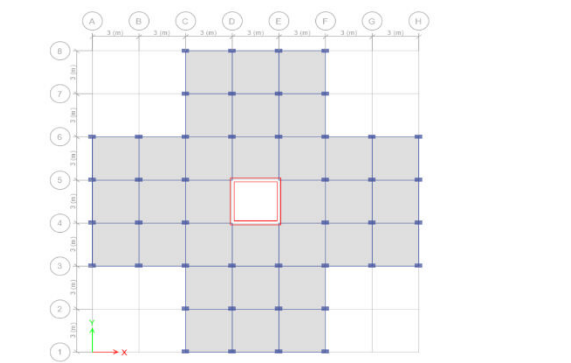


Figure.3: shear wall at core of building.

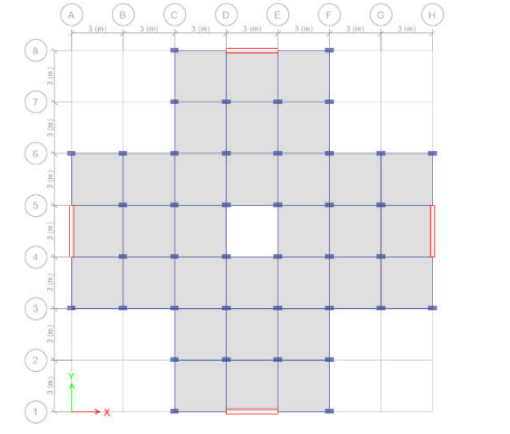


Figure.4: Shear Wall at Wedges of Building

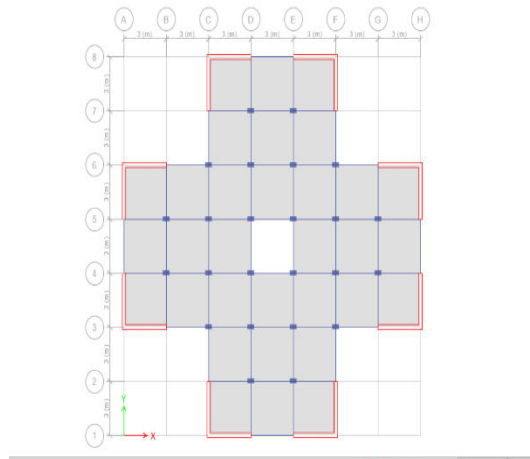


Figure.5: shear wall at corner of building.

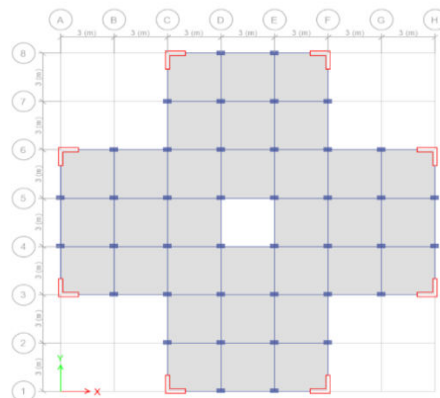


Figure.6: shear wall at corner with less volume

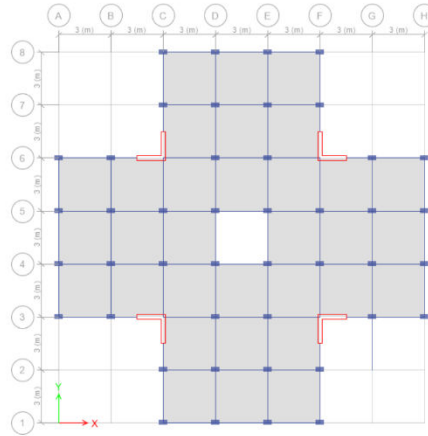


Figure.7: shear wall at re-entrant corners.

Volume Consideration

Model 1 to model 5 show different location of shear wall in the structure and with different volumes of shear wall. Volumes are compared with respect to volume at core(V), volume at edge(Ve), volume at corner(Vc), volume at corner with small volume(Vcs).

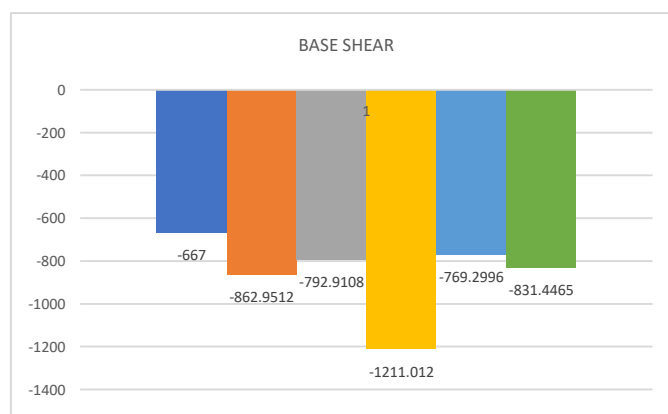
Volume at core is same as the volume at edges, $V=V_e$, volume at corner (Vc) is 4 times or 400% more than that provided at core. $V_c = 4V$, $V_{cs} = 1.4V$, that is fifth model is 1.4 times that of second model.

Volume at re-entrant corner is same as the volume at edges and core.

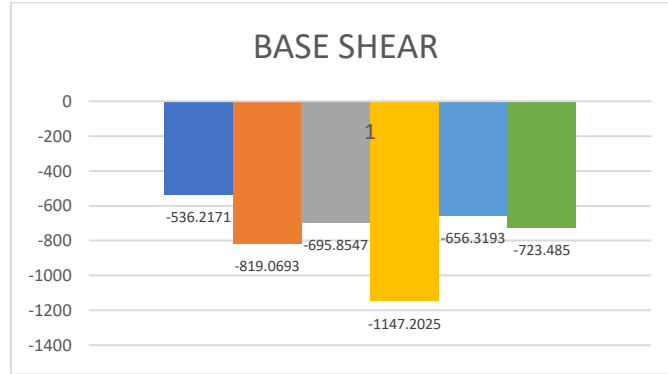
After modelling and checking of errors the models are analysed and displacements, base shear, story stiffness and drifts are compared to evaluate the performance of structures with different locations of shear and with different volumes

IV. RESULTS AND DISCUSSIONS

BASE SHEAR



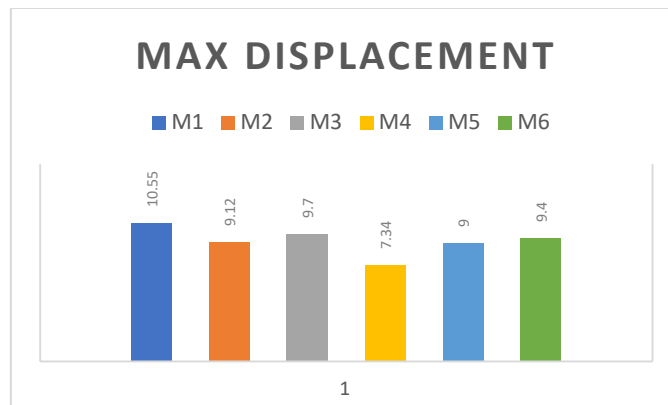
Graph.1: Base shear for EQX



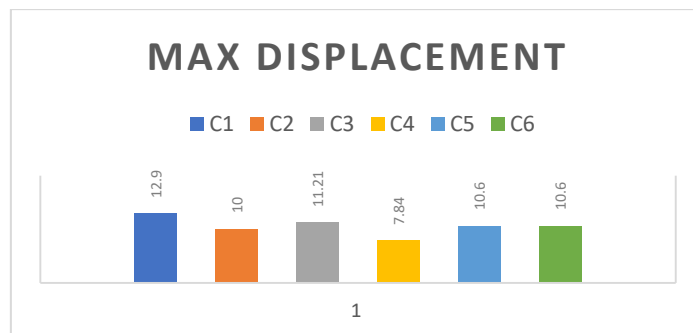
Graph.2: Base shear for EQY

Base shear for different models are shown in the graph, flexible building will have higher natural period it is hard to excite when compared to stiff building. Moment resisting building will have lesser base shear when compared to building with shear wall, this applies to the first model as it has no shear wall it has less base shear compared to other models, m⁴ has the highest base shear due its higher volume of shear wall which increases its stiffness. Though m² and m³ have same volume of shear wall m³ has lesser base shear with respect to m².

DISPLACEMENTS

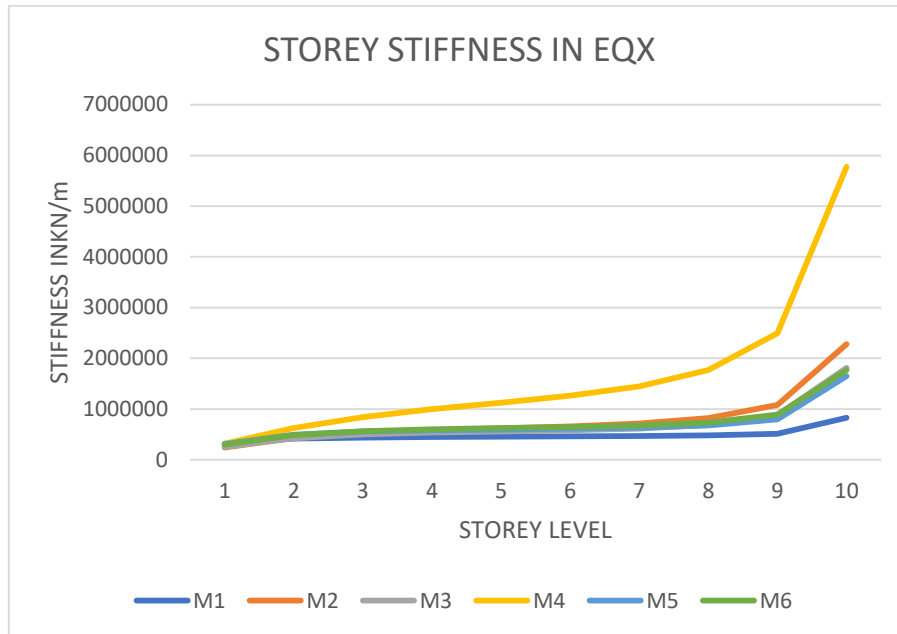


Graph.3: Max displacement EQX direction

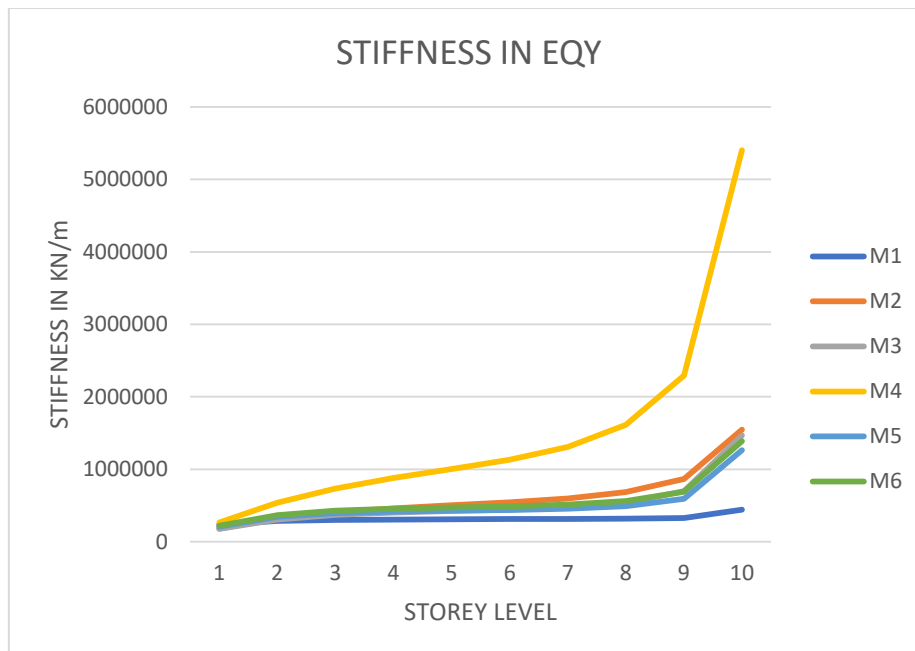


Graph.4: Max displacement EQY direction

STORY STIFFNESS

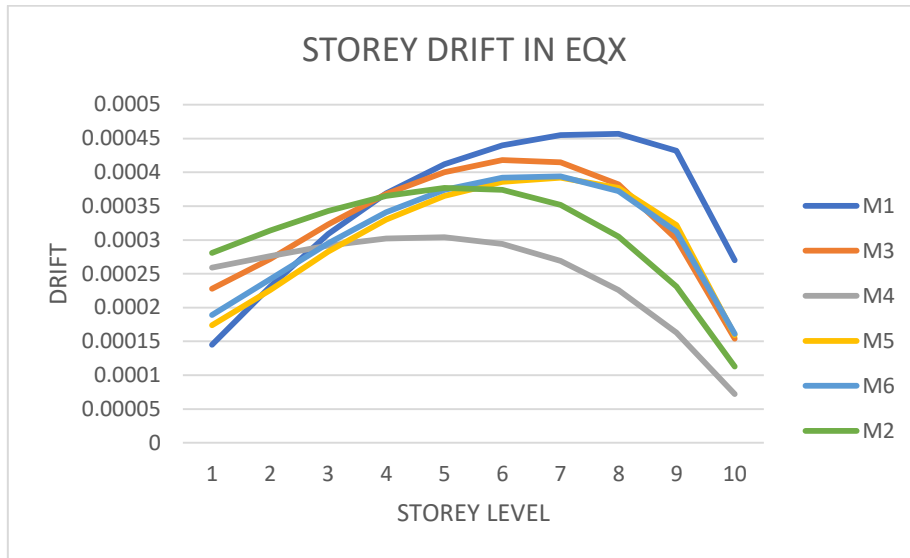


Graph.5: Storey Stiffness in EQX direction

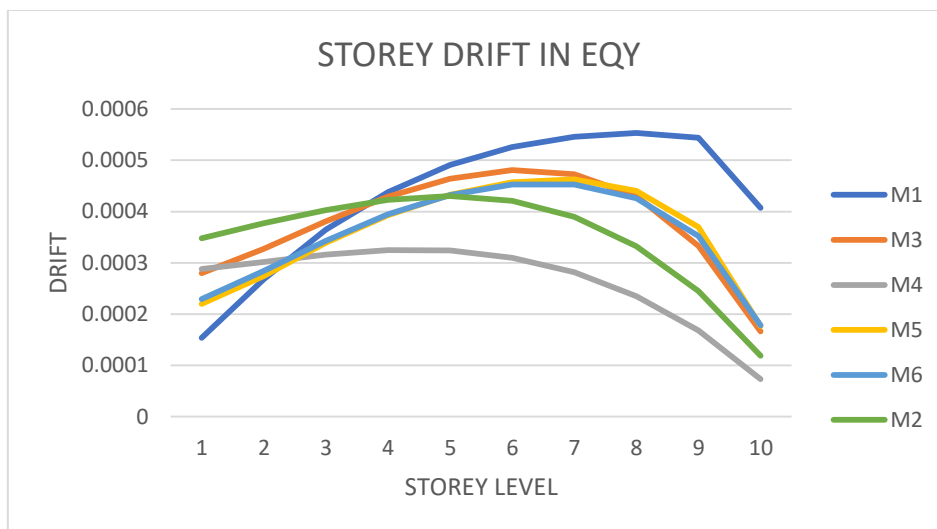


Graph.6: Storey Stiffness in EQY direction

STORY DRIFT



Graph.7: Storey Drift in EQX direction



Graph.8: Storey Drift in EQY direction

- Stiffness refers to rigidity of a structure. in general terms, this means the extent to which the element is able to resist deformation or deflection under the application of applied force.
- Structure with high stiffness is likely to be more rigid with high base shear, minimum displacement. But should be avoided as it acts more brittle than to be ductile.

V. CONCLUSION

- In the above results case 4 that is structure with shear wall at the corner with volume 4V has high base shear, min displacement, min storey drift and has max story stiffness than the other cases.
- Case 1 with no shear wall has low base shear, max displacement, max storey drift and has min stiffness.

- Case 2 with shear wall at the core with volume V has relatively high base shear, min displacement less, min storey drift and it is more flexible than the other cases.
- Case 3 with shear wall at edges has volume V has relatively high base shear, high storey drift, high displacement and it is moderately stiffer than the other cases.
- Case 5 with shear wall at corners with volume 1.4V has relatively low base shear, min. displacement, min. storey drift and stiff.
- Case 6 with shear wall at re-entrant corner has volume V same as case 2 and case3 but behaves relatively better than case 5.
- Structure with shear wall at the re-entrant corner perform well during earthquakes
- Structures with shear wall at the core also perform well as in the case of structures with regular and simple plan geometry.
- Structures with shear wall at the edges perform moderately well but not as the others with sw at core and re-entrant corners.

REFERENCES

1. Bryan Stafford Smith and Alex Coull "Tall Building Structures: Analysis And Design" A Wiley-interseince publication, New York 1991.
2. Kasliwal Sagar K. and Anantwad Shirish, "Effects of number and position of shear walls on seismic behavior of multi-storey structure" ISSN: 2278-7844, University of Pune .
3. P. S. Kumbhare, A. C. Saoji, "Effectiveness of changing of RC shear wall location in multi-storey building", International Journal of Engineering Research and Applications Vol. 2, Issue 5, pp.1072-1076 Sant Gadge Baba Amravati University, Amravati, Maharashtra.
4. Anuj Chandiwala, "Earthquake Analysis of Building Configuration with Different Position of Shear Wall", International Journal of Emerging Technology and Advanced Engineering ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 2, Issue 12, December 2012, Adhoc Lecturer in Sarvajanic College of Engineering & Technology, Athvalines, Surat, Gujarat, India.
5. B. L. Brueggen, C. W. French, N. Jung, and S. D. Nakaki, "rectangular reinforced concrete shear walls" ACI Committee 318, 2002. Building Code Requirements for Structural Concrete, University of Minnesota, Minneapolis, MN 55414
6. Reddy, Y. Ramalinga, et al. "Symbiotic impact of carbon quantum dots on microstructural development and mechanical behaviour of cement mortars." Case Studies in Construction Materials 20 (2024): e03042.
7. Jayachandra, S. J., & Kiran, C. G. (2020). Static Analysis Structure using E-Tabs of Braced Tube. GRD Journals- Global Research and Development Journal for Engineering, 5(11), 38-42.
8. Roopa, M., & Venugopal, H. (2022). J, Nagara M (2022) Soil Structure Interaction Analysis of a Single Layer Latticed Geodesic Dome. Indian Journal of Science and Technology, 15(7), 292-299.
9. Yashwanth, H. J., Reddy, Y. R., & Sanjith, J. (2022, September). Strengthening of Cement mortar by Reinforcing Carbon Based Nano Material. In IOP Conference Series: Materials Science and Engineering (Vol. 1255, No. 1, p. 012018). IOP Publishing.
10. Ground, R. O. F. (2016). Seismic Analysis of Multi-Storey Building Resting On Flat Ground and Sloping Ground. International Journal of Innovative Research in Science, Engineering and Technology.



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