iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** XII **Month of publication:** December 2021

DOI: https://doi.org/10.22214/ijraset.2021.39681

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

Criteria of Using Optimum Size Approach for Reduction of Axial Forces in Column in Multi Storied Building under Seismic Zone III

Sandeep Haritwal[1], Shweta Chouhan[2]
[1]P.G. Student, Department of Civil Engineering, Maharishi Arvind International Institute of Technology, Kota, Rajasthan, India.
[2]Assistant Professor, Department of Civil Engineering, Maharishi Arvind International Institute of Technology, Kota, Rajasthan, India.

Abstract: In India, every industry has its own importance to make the country shift towards its future goal. The construction industry plays a very significant role with the introduction of high-rise structures that has been increasing regularly. Beside this, the structure should be strong enough that each element should be economic and strong. The criteria of using optimum size approach for reduction of axial forces in column in multi storied building under seismic zone is a new idea. It reduces the size of beams and columns at the different levels of the building. On other hand, the structural weight should be minimized when the self-weight of the same will be reduced and proved to be an economic structure.
In this project a G+13 Storey structure is analyzed using six different cases named as AFR Case A to AFR Case F assumed to be situated in seismic Zone III. The plinth area is in use as 625 m^2 and all the cases have compared with each parameter. The project concluded that efficient Case is AFR Case C on comparing 6 maximum axial force reduction cases that ultimately reduce the overall cost of the project.
Keywords: Axial forces, Columns, Strength, Durability, Software Models, High-Rise Structures

I. INTRODUCTION

In India, Multistorey building construction is at its peak in big cities because land cost for the construction is going high day by day in large cities of India. The land is minimum against population in the large cities therefore to reduce these problems multistory buildings are the only option where minimum land is caused and provide more convenience and safety to the people. To reduce the chances of failure and provide more stability to multistorey structures under seismic and wind forces many methods and analysis are in trend.

A. Axial Force

If the load on a column is applied through the center of gravity of its cross section, it is called an axial load. Axial force is the compression or tension force acting in a member. If the axial force acts through the centroid of the member it is called concentric loading. If the force is not acting through the centroid it's called eccentric loading. Eccentric loading produces a moment in the beam as a result of the load being a distance away from the centroid.

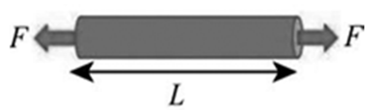


Fig. 1: Forces applied on a member of length L

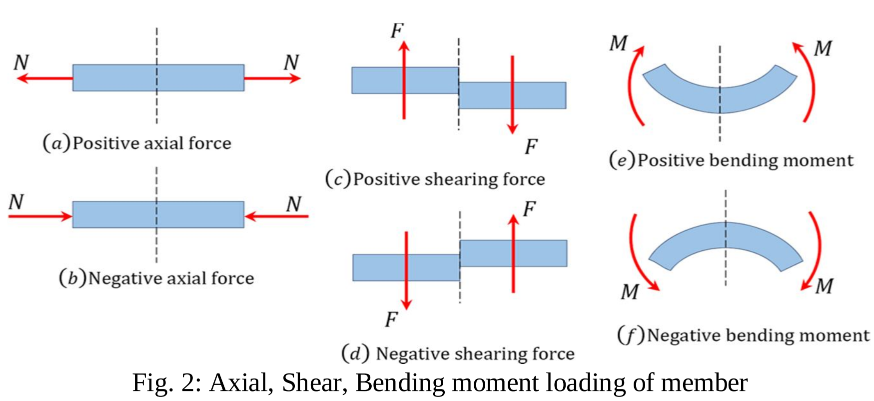


Fig. 2: Axial, Shear, Bending moment loading of member

II. MODELING OF STRUCTURE AND ASSIGNING PROPERTY

The space frame has been modeled using software approach. The descriptions of the structure and different beam and column sizes are listed in Table 1.

Table 1: Description of parameters taken for analysis

Building configuration	G + 13
Building type	Semi - commercial building
Total plinth area	625 m^2
Building Length	5m @ 5 bays = 25m
Building Width	5m @ 5 bays = 25m
Height of building from Foundation level	57 m
Height of each floor	3.5 m
Depth of footing	4 m
Beam dimensions 1	550 mm x 400 mm
Beam dimensions 2	550 mm x 350 mm
Beam dimensions 3	500 mm x 350 mm
Beam dimensions 4	500 mm x 300 mm
Column dimensions 1	650 mm x 600 mm
Column dimensions 2	600 mm x 500 mm
Column dimensions 3	600 mm x 450 mm
Slab thickness	135 mm
Staircase waist slab	135 mm
Shear wall thickness	130 mm
Material properties	Concrete (M30), Steel (Fe 500)

Table 2: List of models framed with assigned abbreviation

S. No.	Abbreviation	Models framed for analysis		
		Column Size	Beam Size	Applied Storey
1.	AFR Case A	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 13
2.	AFR Case B	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 12
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13
3.	AFR Case C	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 11
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13
4.	AFR Case D	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 10
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13
5.	AFR Case E	0.65m x 0.60m	0.55m x 0.40m	Up to G + 4
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 9
		0.60m x 0.45m	0.50m x 0.30m	Up to G + 13
6.	AFR Case F	0.65m x 0.60m	0.55m x 0.40m	Up to G + 4
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 8
		0.60m x 0.45m	0.50m x 0.30m	Up to G + 13

Note: Here AFR means Axial Force Reduction case.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

III.DETAILS OF THE MODELS

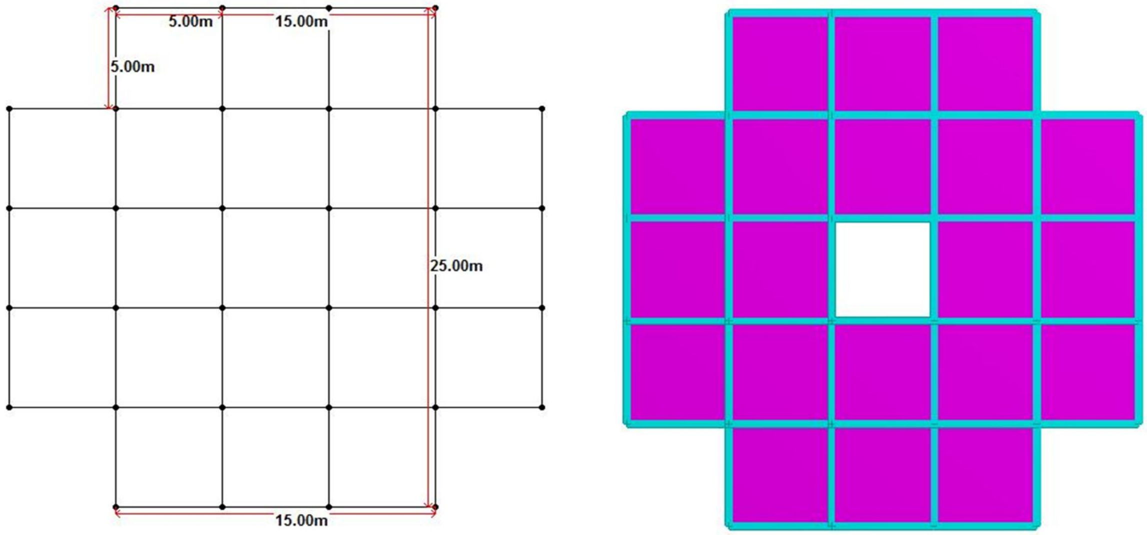


Fig. 3: 2D and 3D Plan of the Structure

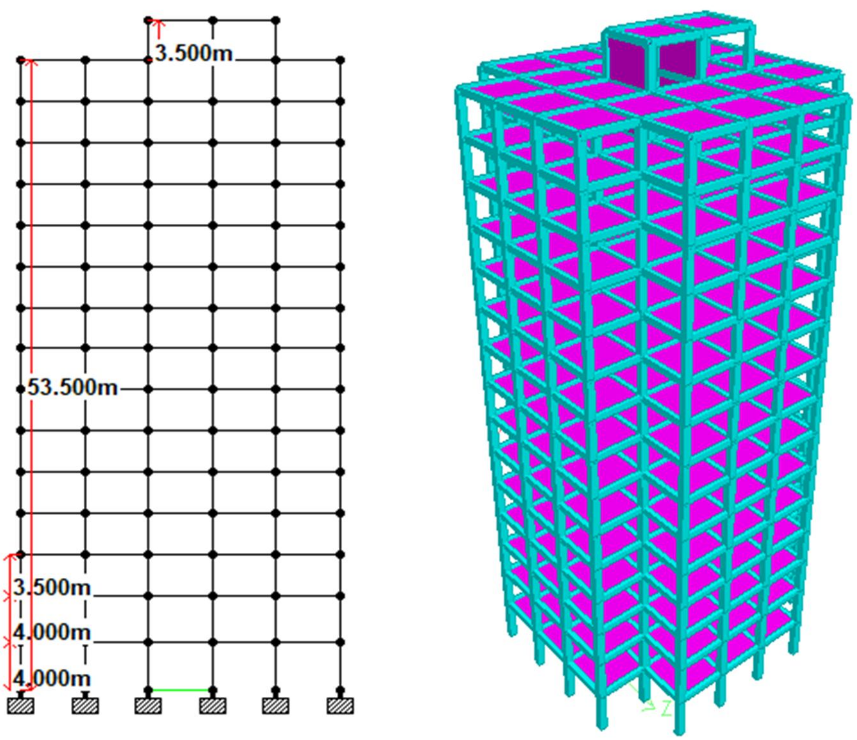


Fig. 4: Front View and 3D view of the Structure

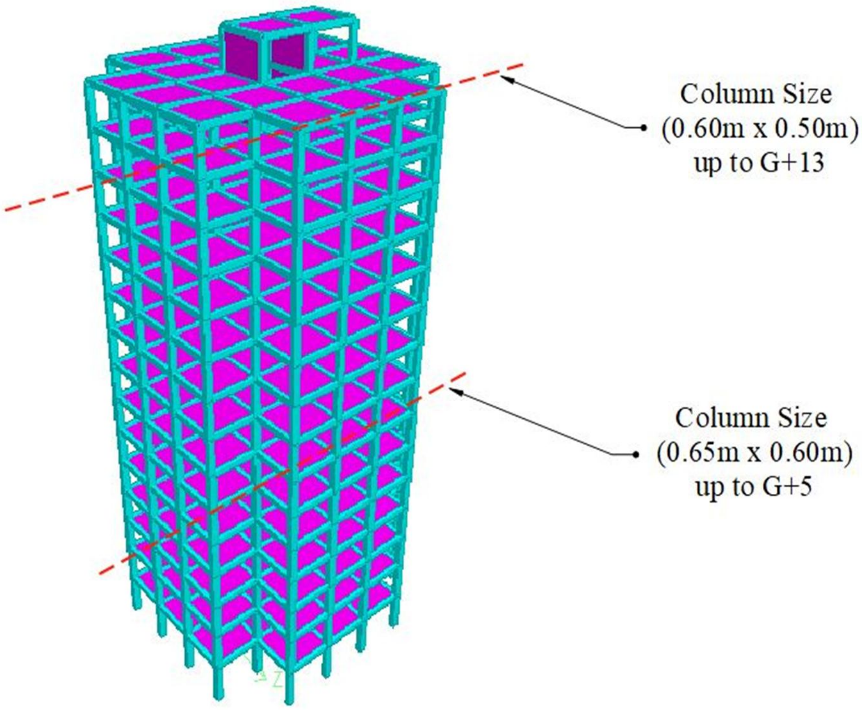


Fig. 5: Figure of Axial Force Reduction Case – AFR Case A

Table 3: Details of Axial Force Reduction Case – AFR Case A

Column Size	Beam Size	Applied Storey
0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
0.60m x 0.50m	0.55m x 0.35m	Up to G + 13

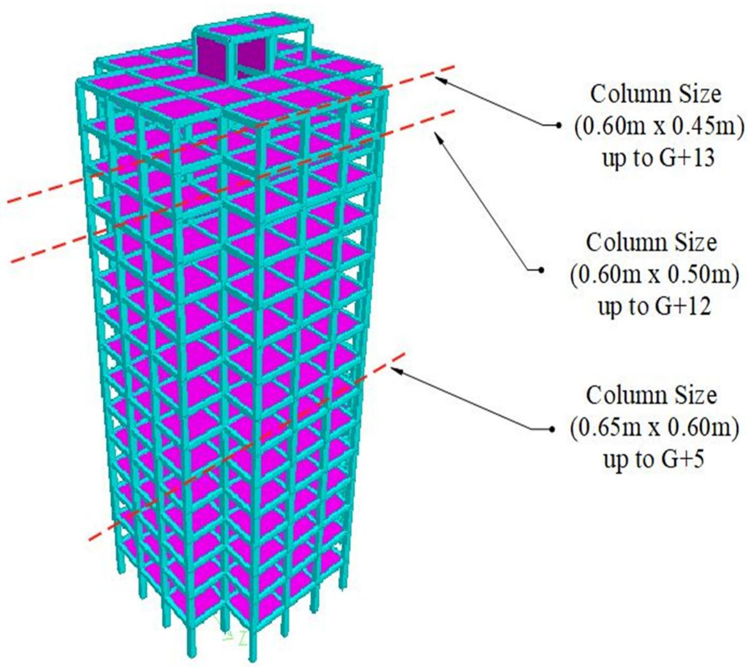


Fig. 6: Figure of Axial Force Reduction Case – AFR Case B

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

Table 4: Details of Axial Force Reduction Case – AFR Case B

Column Size	Beam Size	Applied Storey
0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
0.60m x 0.50m	0.55m x 0.35m	Up to G + 12
0.60m x 0.45m	0.50m x 0.35m	Up to G + 13

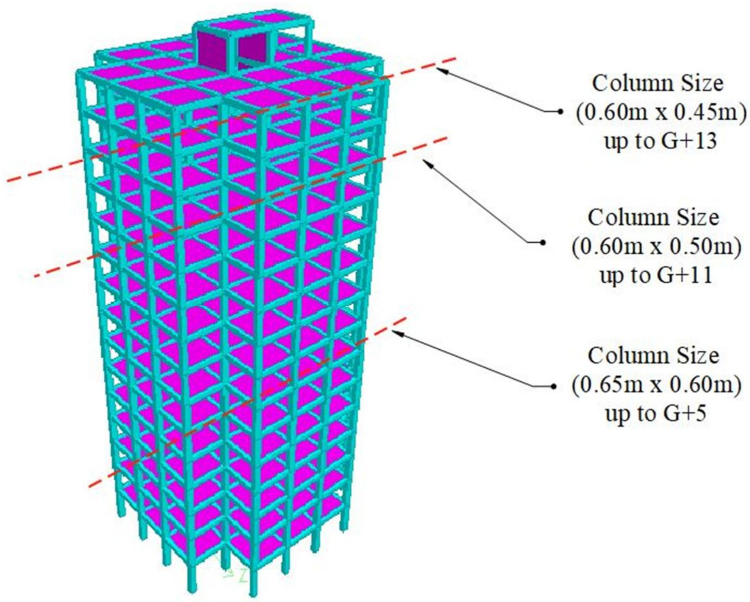


Fig. 7: Figure of Axial Force Reduction Case – AFR Case C

Table 5: Details of Axial Force Reduction Case – AFR Case C

Column Size	Beam Size	Applied Storey
0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
0.60m x 0.50m	0.55m x 0.35m	Up to G + 11
0.60m x 0.45m	0.50m x 0.35m	Up to G + 13

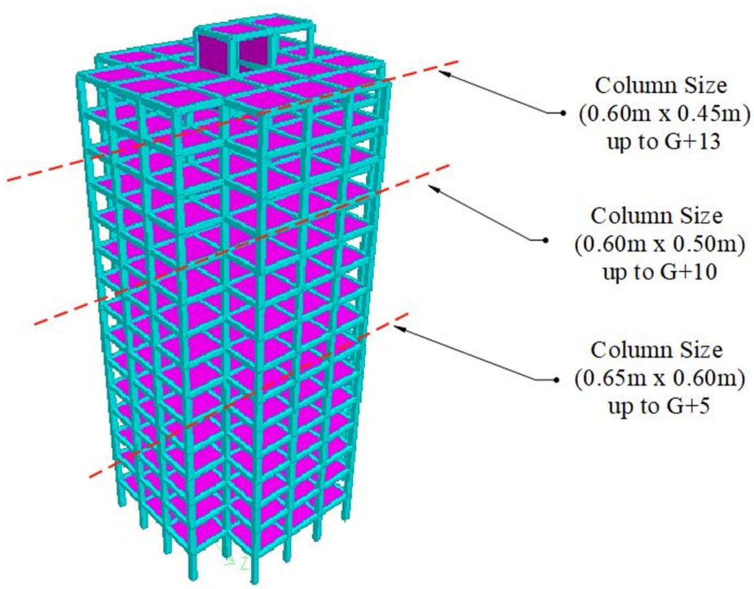


Fig. 8: Figure of Axial Force Reduction Case – AFR Case D

Table 6: Details of Axial Force Reduction Case – AFR Case D

Column Size	Beam Size	Applied Storey
0.65m x 0.60m	0.55m x 0.40m	Up to G + 5
0.60m x 0.50m	0.55m x 0.35m	Up to G + 10
0.60m x 0.45m	0.50m x 0.35m	Up to G + 13

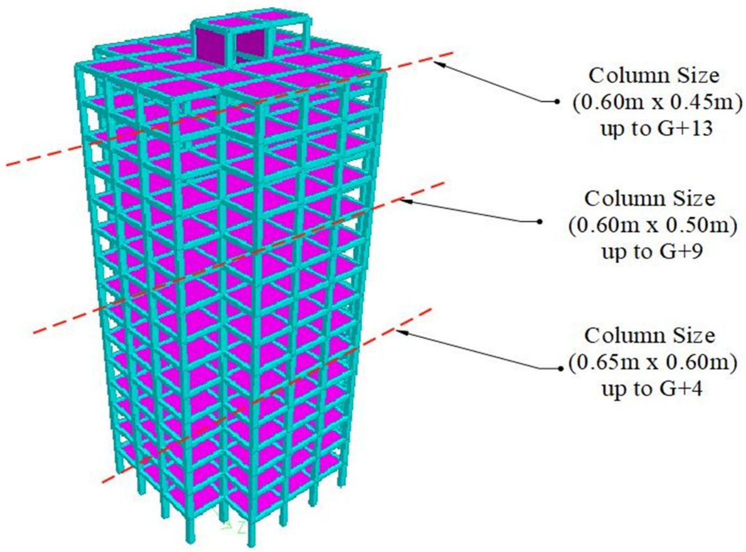


Fig. 9: Figure of Axial Force Reduction Case – AFR Case E

Table 7: Details of Axial Force Reduction Case – AFR Case E

Column Size	Beam Size	Applied Storey
0.65m x 0.60m	0.55m x 0.40m	Up to G + 4
0.60m x 0.50m	0.55m x 0.35m	Up to G + 9
0.60m x 0.45m	0.50m x 0.30m	Up to G + 13

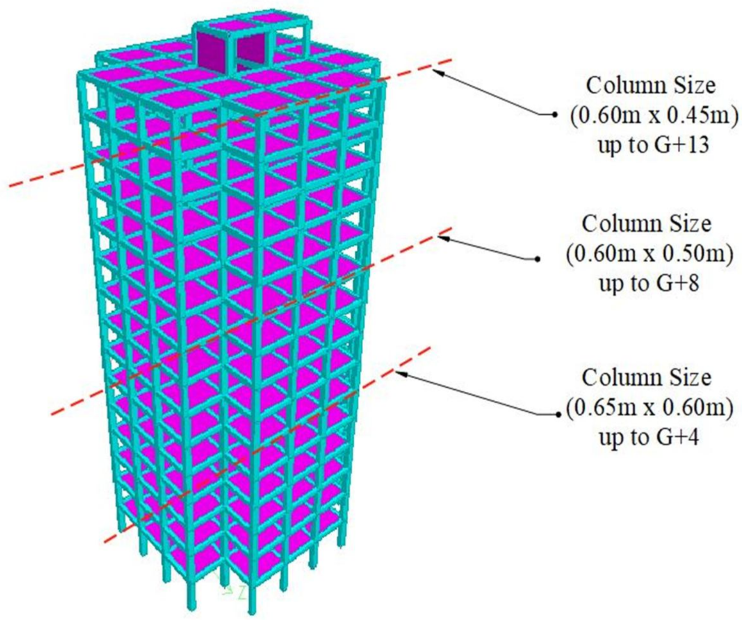


Fig. 10: Figure of Axial Force Reduction Case – AFR Case F

Table 8: Details of Axial Force Reduction Case – AFR Case F

Column Size	Beam Size	Applied Storey
0.65m x 0.60m	0.55m x 0.40m	Up to G + 4
0.60m x 0.50m	0.55m x 0.35m	Up to G + 8
0.60m x 0.45m	0.50m x 0.30m	Up to G + 13

Table 9: Seismic parameters on the structure

Importance factor I	1.2
Fundamental natural period of vibration (T_a)	$0.09*h/(d)^{0.5}$ $Ta_x = Ta_z$
Fundamental natural period (Ta_x) for X direction	1.026 seconds
Fundamental natural period (Ta_z) for Z direction	1.026 seconds
Response reduction factor R	4
Damping ratio	5%
Zone factor	0.16
Zone	III
Soil type	Medium soil

IV. POINT OF COMPARISON

Following heads shows the point of comparison of result parameters between various models during earthquake forces for building and its various cases. They are as follows:-

1) To determine Base shear response when seismic forces are applied in X and Z direction to the structure when size of beams and columns changes at different floor levels.
2) To find member Shear Forces and Bending Moment values in beams with efficient case among all 6 axial force reduction cases.
3) To examine Shear Forces and Bending Moment values in columns with efficient case among all 6 axial force reduction cases.
4) To determine and compare member Torsion values in beams parallel to X and Z directions with efficient case among all 6 axial force reduction cases.
5) To examine column Axial Forces with efficient case among all 6 axial force reduction cases.
6) To find Storey drift values in with efficient case among all 6 axial force reduction cases.
7) To analyze the maximum nodal displacement in X and Z horizontal plane direction with most efficient case that provides more stability among 6 axial force reduction cases.

The main theme of the current work is to demonstrate and recommend the efficiency of semi commercial apartment by using the reduced axial forces approach by changing the size of beam member and column member at different floor levels.

V. RESULTS AND DISCUSSION

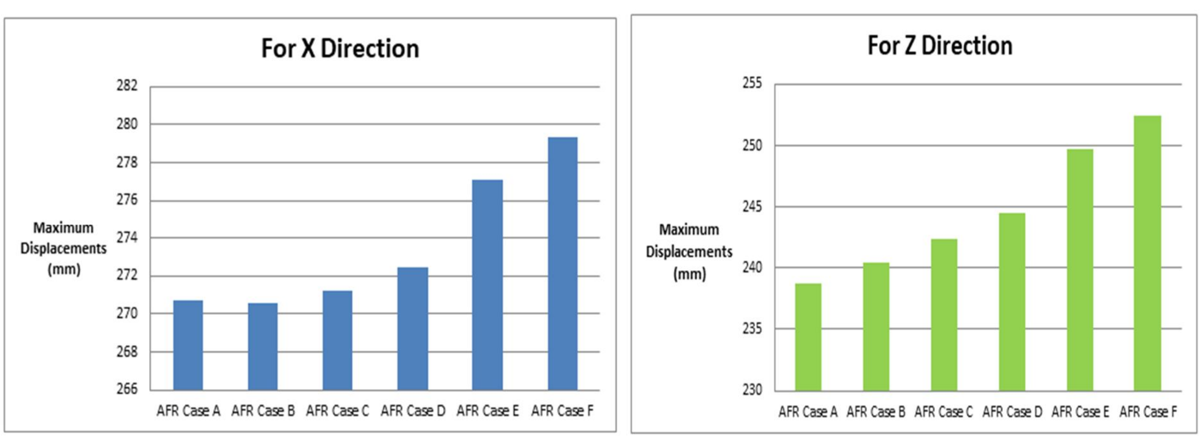


Fig. 11: Graphical Representation of Maximum Displacement in X and Z directions for all Axial Force Reduction cases

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

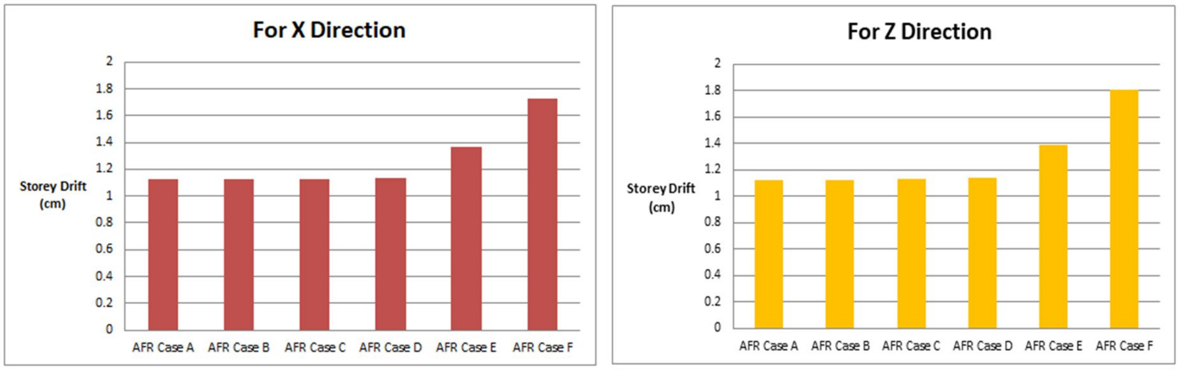


Fig. 12: Graphical Representation of Storey Drift in X and Z directions for all Axial Force Reduction cases

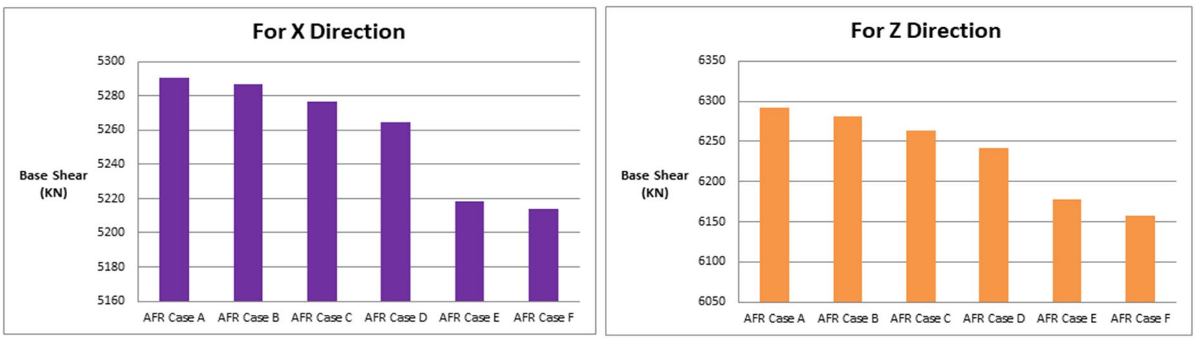


Fig. 13: Graphical Representation of Base Shear in X and Z directions for all Axial Force Reduction cases

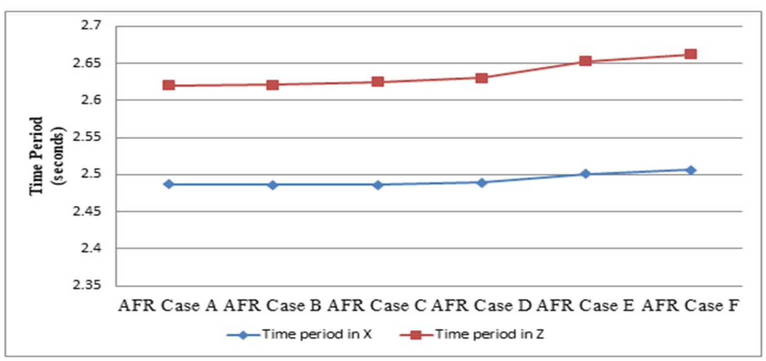


Fig. 14: Graphical Representation of Time Period Time Period for all Axial Force Reduction cases

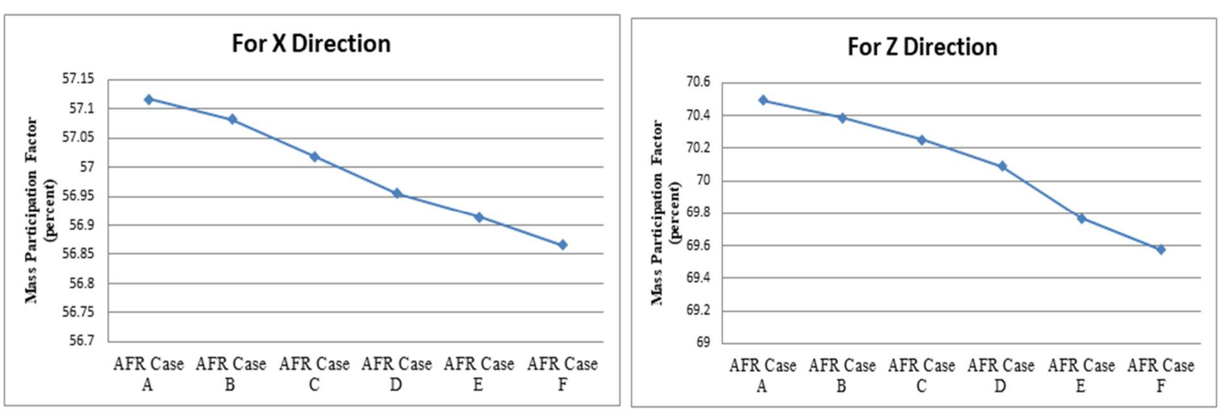


Fig. 15: Graphical Representation of Mass Participation Factor in X direction for all Axial Force Reduction cases

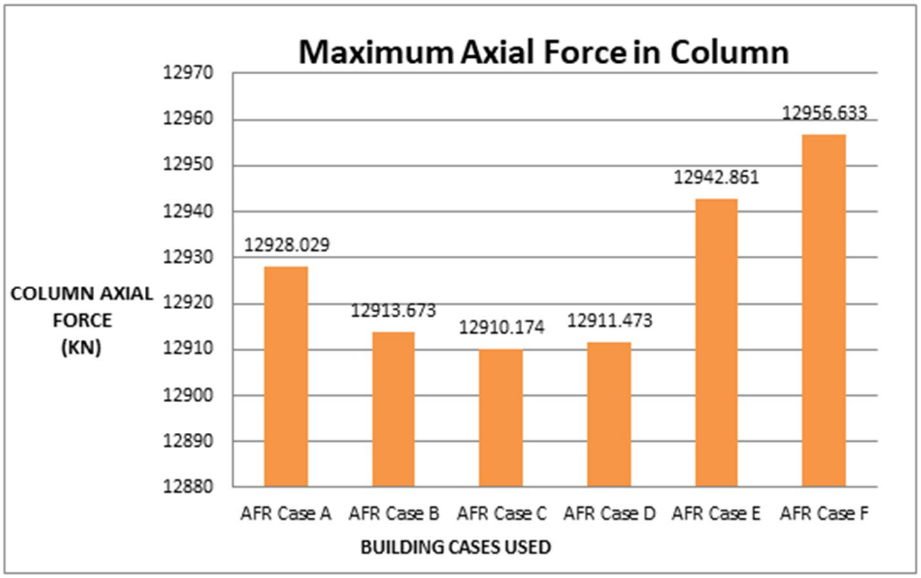


Fig. 16: Graphical Representation of Maximum Axial Forces in Column for all Axial Force Reduction cases

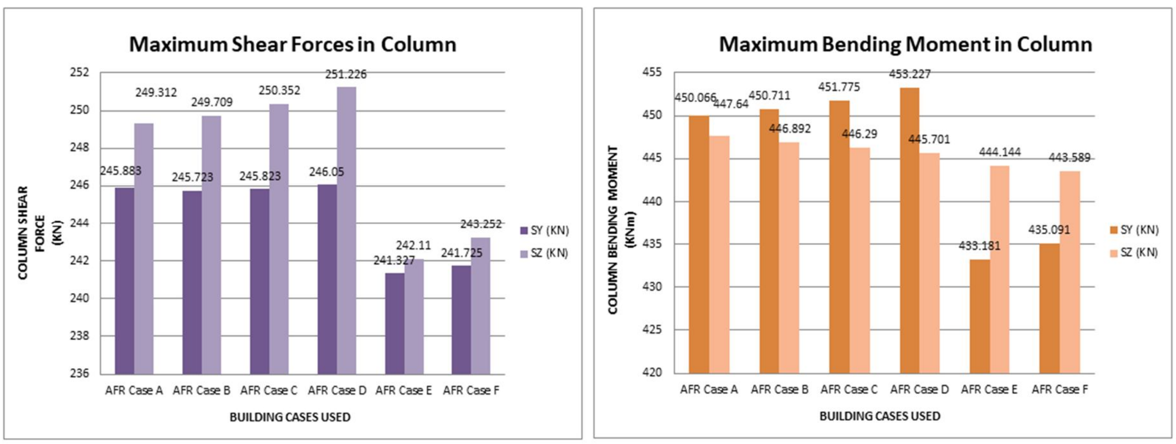


Fig. 17: Graphical Representation of Maximum Shear Force and Maximum Bending Moment in Columns for all Axial Force Reduction cases

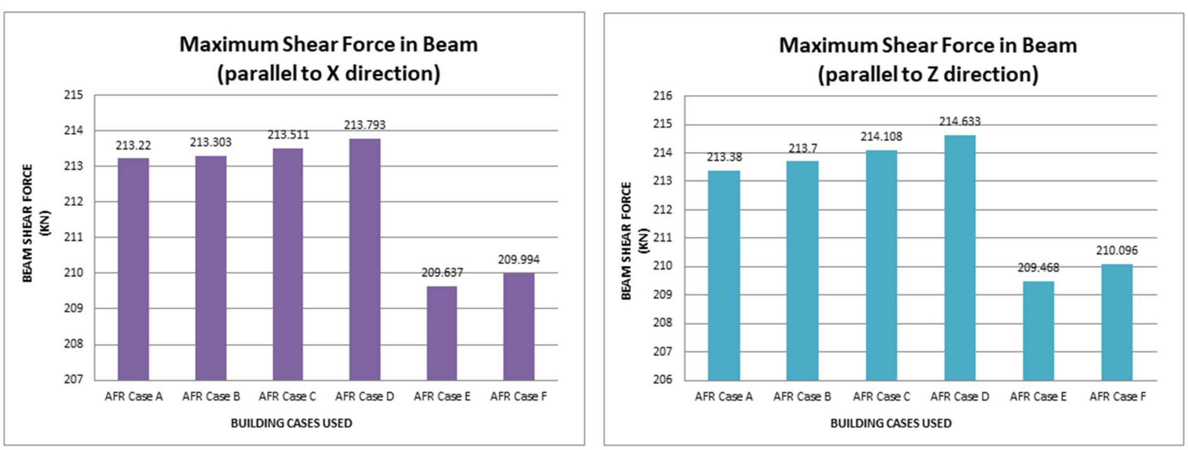


Fig. 18: Graphical Representation of Maximum Shear Forces in beams parallel to X and Z directions for all Axial Force Reduction cases

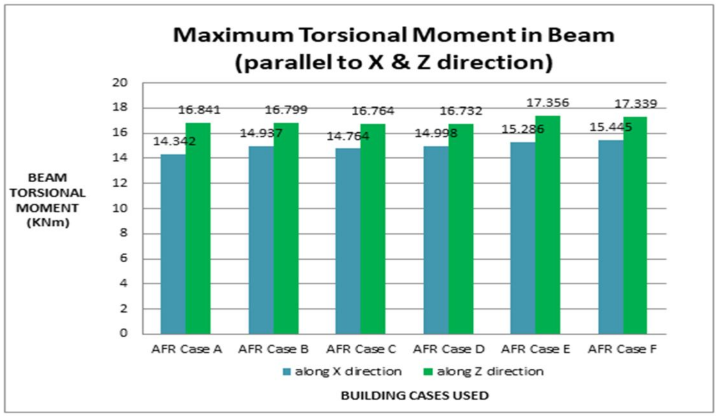


Fig. 19: Graphical Representation of Maximum Torsional Moment in beams along X and Z direction for all Axial Force Reduction cases

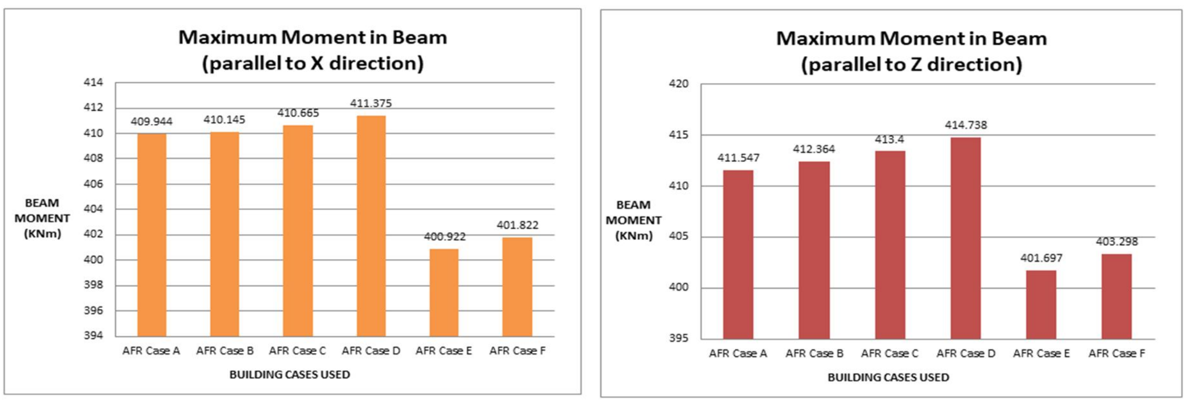


Fig. 20: Graphical Representation of Maximum Bending Moment in beams parallel to X and Z directions for all Axial Force Reduction cases

Table 10: Final conclusive outcomes

S. No.	Abbreviation	Models framed for analysis			Member Status
		Column Size	Beam Size	Applied Storey	
7.	AFR Case A	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5	Passed
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 13	
8.	AFR Case B	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5	Passed
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 12	
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13	
9.	AFR Case C	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5	Passed
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 11	
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13	
10.	AFR Case D	0.65m x 0.60m	0.55m x 0.40m	Up to G + 5	Passed
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 10	
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13	
11.	AFR Case E	0.65m x 0.60m	0.55m x 0.40m	Up to G + 4	Passed
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 9	
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13	
12.	AFR Case F	0.65m x 0.60m	0.55m x 0.40m	Up to G + 4	Fail
		0.60m x 0.50m	0.55m x 0.35m	Up to G + 8	
		0.60m x 0.45m	0.50m x 0.35m	Up to G + 13	

VI. CONCLUSION

Reduction of Axial Forces in Columns in Multistoried Building under seismic loading, as we investigate concerning the decrease of axial force of six different model made in Staad Pro software and here is such a sort of conclusion regarding each models for find out the minimum axial force in the structure. In term of given models subsequent outcome are take out from this proportional study.

A. On comparing all six models it has been concluded that the maximum displacement in AFR Case B in X and AFR Case A in Z direction found minimum among all.
B. On comparing all six models it has been concluded that the maximum Storey Drift in AFR Case B in X and Z direction found minimum among all.
C. As per comparative results in Base Shear, AFR Case F is very effective than other models in both X and Z.
D. As per comparative results in Time period and Mass Participation Factor, AFR Case F is very effective than other models in both X and Z.
E. As per comparative outcome in axial force, AFR Case C is very effective than other models.
F. Comparing the column shear force for all models, AFR Case E is the optimum than other models respectively in X and Z direction.
G. As per comparative results in column bending moment, AFR Case E is the optimum than other models respectively in X and Z direction.
H. Comparing the beam shear force in X direction all models, AFR Case E is the effective than other models.
I. Comparing the beam shear force in Z direction all models, AFR Case F is the effective than other models.
J. Comparing the Beam Bending Moment in X direction all models, AFR Case E is the effective than other models.
K. Comparing the Beam Bending Moment in Z direction all models, AFR Case E is the effective than other models.
L. On analyzing the Torsional Moment in beams along X direction and Z direction AFR Case C and AFR Case D is efficient respectively.

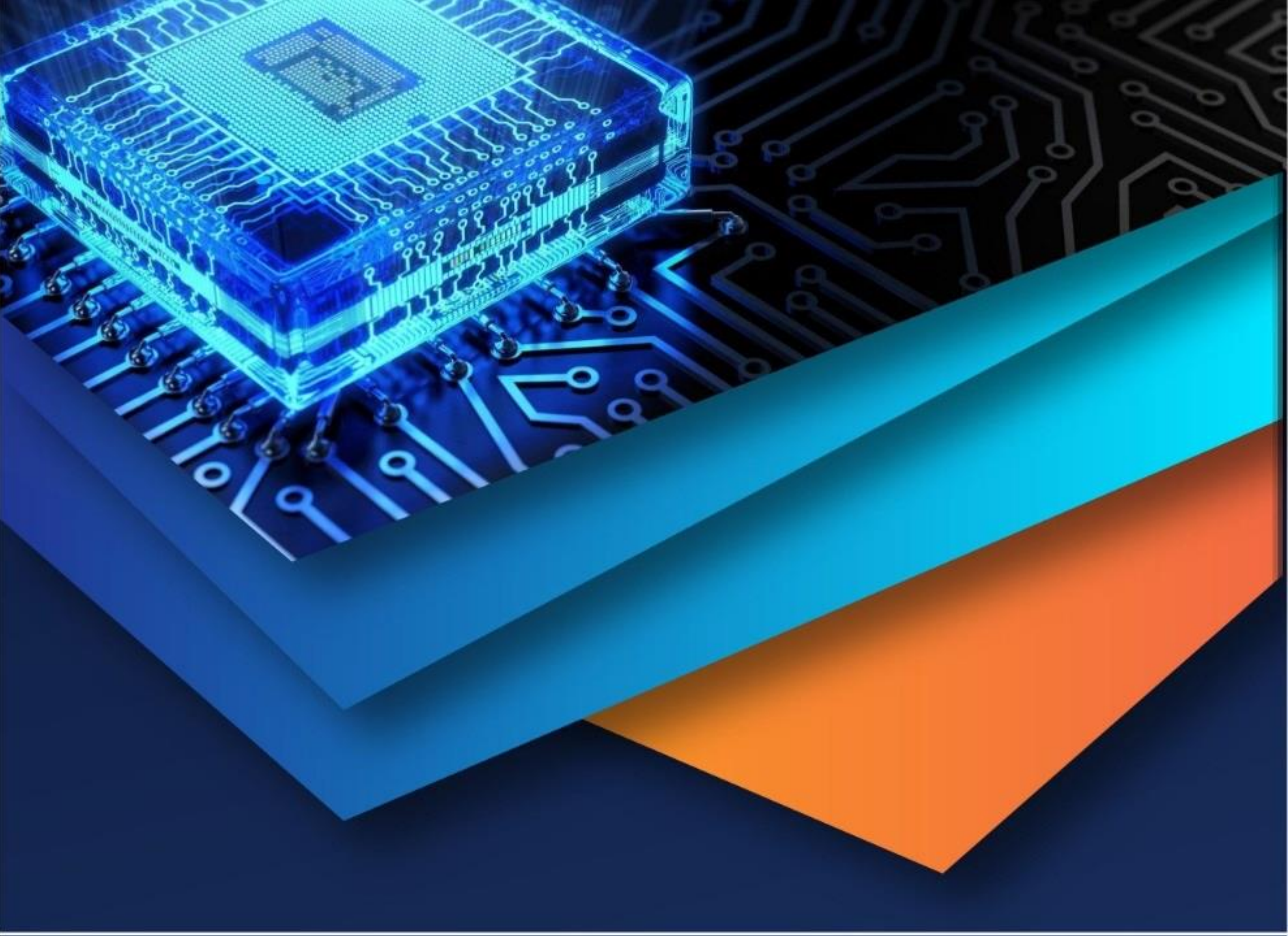
As far as concern the reduction of Axial Forces in Columns in Multistoried Building under seismic loading with different size of members in different top floors concluded that AFR Case C is very effective in axial force comparing AFR Case A to F the axial forces are decreased and AFR Case C is identified the least axial force. AFR Case F has failed in structural components when analysis has done and its axial force is higher than other cases.
As per the above analysis states that mention above all the cases AFR Case C is very effective and safe case among all and can be recommended when this type of construction will take place.

REFERENCES

[1] Albert Philip and Dr. S. Elavenil(2017), Seismic Analysis of High Rise Buildings with Plan Irregularity. International Journal of Civil Engineering and Technology, 8(4), 2017, pp. 1365–1375.
[2] Sagar Jamle, et. al., (2017), “Flat Slab Shear Wall Interaction for Multistoried Building under Seismic Forces”, International Journal of Software & Hardware Research in Engineering (IJSHRE), ISSN: 2347-4890, Vol.-05, Issue-3, pp. 14-31.
[3] Prakash Mandiwal, et. al., (2018), "Use of Polyethylene Glycol as Self Curing Agent in Self Curing Concrete - An Experimental Approach", International Research Journal of Engineering and Technology, (ISSN: 2395-0072(P), 2395-0056(O)), vol. 5, no. 11, pp. 916-918.
[4] Surendra Chaurasiya, et. al., (2018), “Determination of Efficient Twin Tower High Rise Building Subjected to Seismic Loading”, International Journal of Current Engineering and Technology, INPRESSCO, E-ISSN 2277 – 4106, P-ISSN 2347 – 5161, Vol. 8, No. 5, pp. 1200 – 1203, DOI: https://doi.org/10.14741/ijcet/v.8.5.1.
[5] Archit Dangi, et. al., (2018), "Determination of Seismic parameters of R.C.C. Building Using Shear Core Outrigger, Wall Belt and Truss Belt Systems". International Journal of Advanced Engineering Research and Science(ISSN : 2349-6495(P) | 2456-1908(O)),vol. 5, no. 9, pp.305-309 AI Publications, https://dx.doi.org/10.22161/ijaers.5.9.36
[6] Sagar Jamle and Shirish Kumar Kanungo, (2020), “Determination of Stable Underground Storage Reservoir System- Recent Advancements in Structural Engineering Volume 1”, LAP LAMBERT Academic Publishing, Mauritius, ISBN: 978-620-2-51435-4.
[7] Mohd. Arif Lahori, et. al., (2018), "Investigation of Seismic Parameters of R.C. Building on Sloping Ground", International Journal of Advanced Engineering Research and Science, (ISSN: 2349-6495(P), 2456-1908(O)), vol. 5, no. 8, pp.285-290 AI Publications, https://dx.doi.org/10.22161/ijaers.5.8.35
[8] Gaurav Pandey, et. al., (2018), "Review on Optimum Location of Floating Column In Multistorey Building With Seismic Loading", IJSART, (ISSN: 2395-1052(O)), vol. 4, no. 10, pp. 222-225.
[9] Prof. Mohit Kumar Prajapati and Er. Sagar Jamle, (2021), “Irregular Step-up Structure Analysis with Damping in High Seismic Zone- Recent Advancements in Structural Engineering Volume III”, LAP LAMBERT Academic Publishing, Mauritius, ISBN: 978-620-0-32628-7.
[10] Gaurav Pandey, et. al., (2018), "Optimum Location of Floating Column in Multistorey Building with Seismic Loading", International Research Journal of Engineering and Technology, (ISSN: 2395-0072(P), 2395-0056(O)), vol. 5, no. 10, pp. 971-976.

[11] Vasu Shekhar Tanwar, et. al., (2018), “Analytic Study of Box Culvert to Reduce Bending Moment and Displacement Values”, International Journal of Current Engineering and Technology, IJCET, Vol. 8, no. 3, pp. 762-764, DOI: https://doi.org/10.14741/ijcet/v.8.3.33
[12] Suyash Malviya, et. al., (2019) ,“Determination of Optimum Location of Rooftop Telecommunication Tower over Multistory Building under Seismic Loading”, International Journal of Advanced Engineering Research and Science(ISSN : 2349-6495(P) | 2456-1908(O)),vol. 6, no. 2, 2019, pp. 65-73, AI Publications, https://dx.doi.org/10.22161/ijaers.6.2.9
[13] Sagar Jamle, et. al., (2017), “Flat Slab Shear Wall Interaction for Multistoried Building Analysis When Structure Length is greater than width under seismic Forces”, International Journal of Software & Hardware Research in Engineering (IJSHRE) ISSN: 2347-4890 Vol.-05, Issue-3, pp. 32-53.
[14] Neeraj Patel, et. al., (2019), “Use of Shear Wall Belt at Optimum Height to Increase Lateral Load Handling Capacity in Multistory Building”, International Journal for Research in Engineering Application & Management (ISSN : 2454-9150),vol. 4, no. 10, pp. 596-603, doi: https://10.18231/2454-9150.2018.1372
[15] Mariyam and et. al. (2020), “Wind Analysis of Flat Slab Multistoried Building Construction: “Recent Advancements in Structural Engineering”: Volume II, LAP LAMBERT Academic Publishing, Mauritius.
[16] Taha A. Ansari, et. al., (2019), “ Performance Based Analysis of RC Buildings with Underground Storey Considering Soil Structure Interaction”, International Journal of Advanced Engineering Research and Science (ISSN: 2349-6495(P) | 2456-1908(O)),vol. 6, no. 6, pp. 767-771, AI Publications, https://dx.doi.org/10.22161/ijaers.6.6.89
[17] Surendra Chaurasiya, et. al., (2019), “Twin Tower High Rise Building Subjected To Seismic Loading: A Review". International Journal of Advanced Engineering Research and Science (ISSN : 2349-6495(P) | 2456-1908(O)), vol. 6, no. 4, pp. 324-328, AI Publications, https://dx.doi.org/10.22161/ijaers.6.4.38
[18] Sagar Jamle and Roshan Patel, (2020), “Analysis and Design of Box Culvert- A Manual Approach in Structural Engineering”, LAP LAMBERT Academic Publishing, Mauritius, ISBN: 978-620-0-78760-6.
[19] Romesh Malviya, et. al., (2020), "Increasing Stability of Multistoried Building using Different Grades of Concrete in Column Member Sets at Different Locations", International Journal of Current Engineering and Technology, (ISSN: 2277-4106 (O), 2347-5161(P)), vol. 10, no. 2, pp. 208-213. https://doi.org/10.14741/ijcet/v.10.2.3
[20] Mohit Kumar Prajapati, et. al., (2020), "Strength irregularities in multistoried building using base isolation and damper in high Seismic zone: A theoretical Review", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 3, pp. 235-238. https://dx.doi.org/10.22161/ijaers.73.37
[21] Gagan Yadav, et. al., (2020), "Opening Effect of Core Type Shear Wall Used in Multistoried Structures: A Technical Approach in Structural Engineering", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 3, pp. 344-351. https://dx.doi.org/10.22161/ijaers.73.50
[22] Durgesh Kumar Upadhyay, et. al., (2020), "A Review on Stability Improvement with Wall Belt Supported Dual Structural System Using Different Grades of Concrete", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 3, pp. 293-296. https://dx.doi.org/10.22161/ijaers.73.43
[23] Gagan Yadav, et. al., (2020), "Use of Shear Wall with Opening in Multistoried Building: A Factual Review", International Journal of Current Engineering and Technology, (ISSN: 2277-4106 (O), 2347-5161(P)), vol. 10, no. 2, pp. 243-246. https://doi.org/10.14741/ijcet/v.10.2.9
[24] Durgesh Kumar Upadhyay et. al., (2020), "Stability Enhancement in Wall Belt Supported Dual Structural System using Different Grades of Concrete", International Journal of Current Engineering and Technology, (ISSN: 2277-4106 (O), 2347-5161(P)), vol. 10, no. 2, pp. 237-242. https://doi.org/10.14741/ijcet/v.10.2.8
[25] Pankaj Kumar Dhakad, et. al., (2020), "Base Shear Reduction by using Optimum Size of Beams with same Grade of Concrete: An Informative Review", International Journal of Current Engineering and Technology, (ISSN: 2277-4106 (O), 2347-5161(P)), vol. 10, no. 2, pp. 259-262. https://doi.org/10.14741/ijcet/v.10.2.12
[26] Manoj Patidar, et. al., (2020), "Optimization of Stability of Multistoried Structure by Changing Grades of Concrete in Shear Wall Member", Journal of Xi'an University of Architecture & Technology, ISSN: 1006-7930, vol. 12, no. 4, pp. 2479-2497. https://doi.org/10.37896/JXAT12.04/979
[27] Pankaj Kumar Dhakad, et. al., (2020), "Base Shear Reduction by Using Optimum Size of Beams in Top Floors with Different Grades in Multistoried Building at Different Levels", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 4, pp. 293-296. https://dx.doi.org/10.22161/ijaers.74.20
[28] Sagar Jamle, Nirmal Delmiya, Rahul Singh, (2020), "Efficient Use of UPV Meter: A Non Destructive Test of Concrete by Fragmentation Analysis", Journal of Xi'an University of Architecture & Technology, ISSN: 1006-7930, vol. 12, no. 4, pp. 3385-3394. https://doi.org/10.37896/JXAT12.04/1078
[29] Manoj Patidar, et. al., (2020), "Use of different Grades of Concrete in Shear Wall: A Comprehensive Review", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 4, pp. 355-359. https://dx.doi.org/10.22161/ijaers.74.44
[30] Mohammad Bilal Rasheed, et. al., (2020), "Conceptual Approach on Effect of Various Concrete Grade in Outrigger and Wall Belt Supported System: A Perceptional Review", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 5, pp. 100-104. https://dx.doi.org/10.22161/ijaers.75.14
[31] Mohammad Bilal Rasheed, et. al., (2020), "An Efficient Approach to Determine the Effects of Different Grades of Concrete in Outrigger and Wall Belt Supported System", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321 - 9653, vol. 8, no. 7, pp. 1833-1842.
[32] Bhagwat Mahajan, et. al., (2020), “Analytical Approach in Stability Enhancement Techniques by Altering Beam Members at Different Levels”, International Journal of Advanced Engineering Research and Science (IJAERS), ISSN: 2349-6495(P) | 2456-1908(O), vol. 7, no. 6, pp. 301-308. https://dx.doi.org/10.22161/ijaers.76.37
[33] Shahdab Khan, et. al., (2020), "Use of Shear Wall Member at Corners to Enhance the Stability Using Different Grades: An Immense Review", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 5, pp. 396-400. https://dx.doi.org/10.22161/ijaers.75.47
[34] Ankush Nagar, et. al., (2020), "Base Shear Reduction Techniques: A Review", International Journal of Advanced Engineering Research and Science, (ISSN: 2456-1908 (O), 2349-6495(P)), vol. 7, no. 5, pp. 466-471. https://dx.doi.org/10.22161/ijaers.75.57

[35] Bhagwat Mahajan, et. al., (2020), "Stability Increment Techniques by Altering Beam Members: A Review", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653, vol. 8, no. 6, pp. 1403-1407. http://doi.org/10.22214/ijraset.2020.6227
[36] Ankush Nagar, et. al., (2020), "An Analytical Approach to Determine Base Shear Reduction Effects in Multistoried Building", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653, vol. 8, no. 6, pp. 1395-1402. http://doi.org/10.22214/ijraset.2020.6226
[37] Sakshi Goyal, et. al., (2020), "Stability Increment Practices using Wall Outrigger Members: A Review", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653, vol. 8, no. 6, pp. 1656-1661. http://doi.org/10.22214/ijraset.2020.6270
[38] Sakshi Goyal, et. al., (2020), "Analytical Practices to Obtain Efficient Concrete Grade in Outrigger Walls below Plinth Level in Multistorey Building”, International Journal of Advanced Engineering Research and Science, vol. 7, no. 7, pp. 367 - 374. https://dx.doi.org/10.22161/ijaers.77.41
[39] Zamran Khan, et. al., (2020), " Optimization of Stability of Building based on Variation in Shear Wall & Concrete Grade Parameters: A Review", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653, vol. 8, no. 9, pp. 444-450. https://doi.org/10.22214/ijraset.2020.31489
[40] Zamran Khan, et. al. (2020), " Optimization of Stability of Building by Changing Thickness of Shear Wall at Corners for Same Concrete Grade”, International Journal of Advanced Engineering Research and Science, vol. 7, no. 9, pp. 378 - 386. https://dx.doi.org/10.22161/ijaers.77.44



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY