

Use of different Grades of Concrete in Shear Wall: A Comprehensive Review

Manoj Patidar¹, Sagar Jamle²

¹ M. Tech. Scholar, Department of Civil Engineering, Oriental University, Indore (M. P.), India

² Assistant Professor, Department of Civil Engineering, Oriental University, Indore (M. P.), India

Abstract— The main focus in present era is to use a dual system in a multistoried structure, since the major focus is to reduce the lateral loads acting on it. The research topic to reduce the lateral load in the current trend has increasing day by day. This trending expansion leads to the result in safe high rise structures. To contribute something in this, the current work shows the survey of the work in shear wall usage in dual structures as per Indian Standards. This study deals with the comparative analysis of the research trend on the current topic and after the survey, comprehensive outcomes are provided in conclusions that forms the objectives of the additional study.

Keywords— Concrete Grade, Dual system, Lateral load capacity, Optimization, Shear Wall.

I. INTRODUCTION

Optimization of the structures has now been the new and latest ways to make the structure efficient. The trend follows all the economic customs to make cost effective structures. Stability of the structures is a tough task and it loose the above economic trend, since it requires heavy sections, it needs some additional stiffness resisting members and also need extra cost to make the same seismic free. Shear wall is the basic need of the modern tall structures. It not only stabilizes the tall structures but also protect the same from seismic disasters; on the other hand, it is a heavy R.C.C. additional component that increases the overall weight of the structure along with its base shear. Overall project cost ultimately increases with the usage of shear wall.

Shear Wall

An additional structural component used to resist lateral force effects on a structure consist of a stiff R. C. C. wall. This R.C.C. vertical wall starts from foundation base to the top of the building. As per Indian Standard, the Shear wall is classified into two types viz. Ordinary RC structural walls and Ductile RC structural walls. The former one doesn't meet the special detailing requirements for ductile behavior as per IS 13920 and the later one meet the special detailing requirements for ductile behavior as per IS 13920.

Types of Shear Wall

There are various types of shear wall each of them has its own importance. The various types of shear wall are as follows:-

1. Simple rectangular type shear wall
2. Coupled shear wall
3. Rigid frame shear wall
4. Framed walls with infill frame
5. Column supported shear wall
6. Core type shear wall

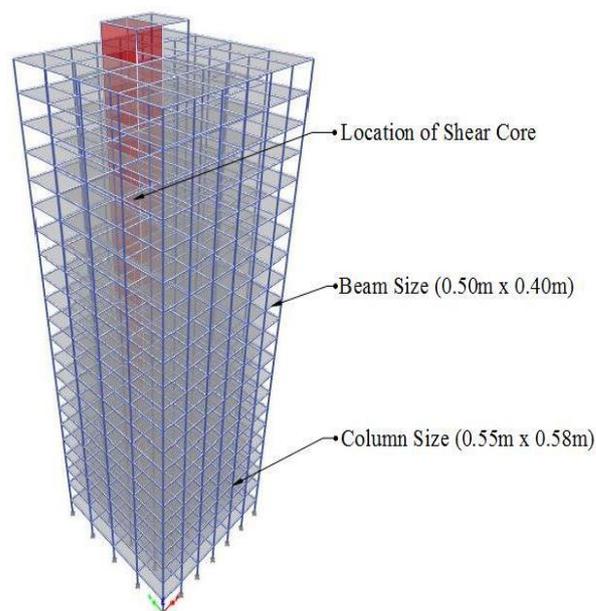


Fig. 1: Structure with Dual Structure Configuration

II. REVIEW OF LITERATURE

An Experimental Approach was performed by the researchers by the usage of Polyethylene Glycol in their work as self-curing agent in the concrete that cures itself. Polyethylene Glycol was replaced by cement in 0% to 3.2%. Only 28 days curing have discussed in this approach with total 5 mixes of concrete. M20 and M25 grade concrete have used and mix were abbreviated as Mix-1 to Mix-5. Flexural strength found out best at 2.4% replacement for M25 grade concrete and 1.6% for M20 grade concrete. Similarly, for compressive test results, strength found out best at 2.4% replacement for M25 grade concrete and 1.6% for M20 grade concrete. The main function of Polyethylene Glycol is to increase the self-curing property, one the other hand,, it will increase the strength too. The recommendations show it can also be replaced within the limit (Prakash Mandiwal et. al.).

The following work suggested the value of silica fume in concrete and has created a great effort in the field of structural engineering. The authors have conducted an experimental approach by replacing the binding particle. The cement itself has the ability to bind the concrete, but the introduction of the silica fume in the replacement of cement has a major part of their study. Cement has replaced by 0% to 25% with silica fume to increase its strength. The experimental tests have performed on 7, 14 and 28 days of each percent replacement by casting a cube. Results shows maximum compressive strength has achieved on 15 percent cement replacement (Prabhulal Chouhan et. al.).

The experimental approach was done on M25 grade concrete with replacing glass powder along with fly ash. These two materials selected such that the same had been a waste material from different manufacturing industries and are free of cost. Cement, on the other hand, a costly binding material used in concrete, A partial replacement have done by using both the glass powder and fly ash. They are abbreviated for glass powder as GP and for fly ash as FA. Compressive and flexural strength have performed on the same with total seven mixes on 7, 14 and 28 days of curing. Results shown that by using 75% cement with 25% Fly ash, both flexural properties and compressive properties of concrete have increased. By replacing glass powder with fine aggregate, there was a decrease in strength. The Mix 2 performs well among all mixes (Sachin Sironiya et. al.).

Following work has accomplished with the use of Self Curing property of Concrete by the usage of PEG-400. This chemical was used in the form of liquid or in powder form. The main approach in their study was, they replaced

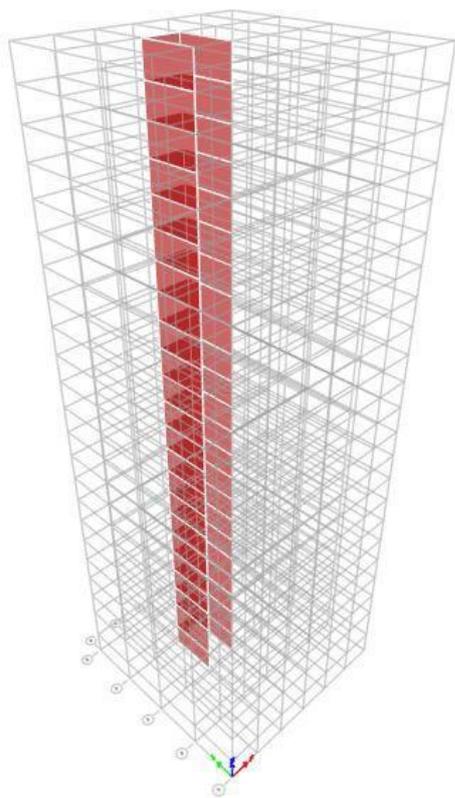


Fig. 2: Structure with shear Wall at Core

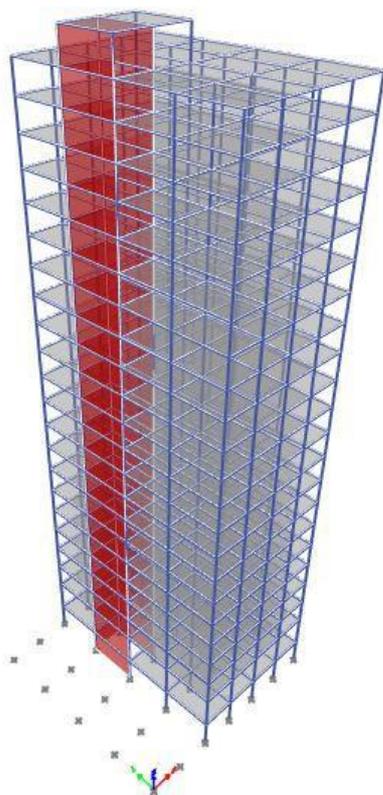


Fig. 3: 3D Sectional View of Structure with Shear Wall at Core

the cement amount and substitute it with the Poly Ethylene Glycol – 400 chemical. Total 6 batch mix have prepared by them and after than they performed durability test and split tensile test. They recommended that optimum tensile strength was achieved by the use of PEG-400 and was found out for M25 to be 2.4 % for M20 1.6%. From the experimental result analysis, they also found out that without the usage of PEG-400, for M25 grade, about 12.24% loss in compressive strength was observed and for M20 grade, about 11.35% loss in compressive strength was observed. For acid venerability, concrete with PEG chemical was observed more durable (Prakash Mandiwal et. al.).

Again the works on silica fume has done by the authors and have suggested the importance of flexural and split tensile strength of the concrete. The replacement of concrete had done for M25 grade concrete by replacement of cement from 0 %, 5%, 7.5%, 12.5%, 15%, 20% and 25%. The water cement ratio is maintained at 0.42 units. For flexural test, beam of size 10cm x 10cm x 50cm have casted by different percent replaced mix abbreviated as M1 to M7. Results show that 15% replacement will be the optimum ratio for flexural test. Again for split tensile test, cylinders of size 15cm in diameter x 30cm have casted by different percent replaced mix abbreviated as M1 to M7. Result shows that 20% replacement will be the optimum ratio for split tensile test (Prabhulal Chouhan et. al.).

III. CONCLUSIONS AND OUTLINE OF PROPOSED WORK

The conduction of the literature survey has done by reviewing and learning data objectives of various research papers it has now cleared that there should be a proper analysis before going further in any topic to find out the current research done. The current trend has also been obtained in dual configuration structures. Therefore it is necessary to increase the stiffness at particular locations in the building to make an optimized one to resist the same from lateral loading.

The conclusive outcomes drawn from the study are enlisted below:

1. Dual structural configurations should be necessary to overcome the lateral effects in the form of displacements.
2. Soil type should also be checked as per Indian Standardization IS 1893-2016 (part 1).
3. Seismic zonal analysis should be check to analyze the data for different seismic zones.

4. The study is conducted for both the directions viz. lateral and longitudinal direction.
5. Different parameters of analysis should be checked and validate as per Indian Standards along within the limits.

The main focus is to check the dual system with different grades of concrete that has going to be a major study for upcoming proposed work.

ACKNOWLEDGEMENTS

I, Manoj Patidar, M. Tech. Scholar, would like to thank **Mr. Sagar Jamle**, Assistant Professor, Department of Civil Engineering Oriental University Indore, for his valuable guidance from the commencement of the work up to the completion of the work along with his encouraging thoughts.

REFERENCES

- [1] Sagar Jamle, Dr. M.P. Verma, Vinay Dhakad, (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.
- [2] Neeraj Patel, Sagar Jamle, (2019), "Use of Shear Wall Belt at Optimum Height to Increase Lateral Load Handling Capacity in Multistory Building: A Review", *International Journal of Advanced Engineering Research and Science*, (ISSN : 2349-6495(P) | 2456-1908(O)), vol. 6, no. 4, pp. 310-314, <https://dx.doi.org/10.22161/ijaers.6.4.36>
- [3] Sachin Sironiya, Sagar Jamle, M. P. Verma, (2017), "Experimental Investigation On Fly Ash & Glass Powder As Partial Replacement Of Cement For M-25 Grade Concrete", *IJSART - Volume 3 Issue 5*, ISSN- 2395-1052, pp. 322-324.
- [4] Prabhulal Chouhan, Sagar Jamle, M.P. Verma, (2017), "Effect of Silica Fume on Strength Parameters of Concrete as a Partial Substitution of Cement", *IJSART - Volume 3 Issue 5*, ISSN- 2395-1052.
- [5] Sagar Jamle, Dr. M.P. Verma, Vinay Dhakad, (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.
- [6] Taha A. Ansari, Sagar Jamle, (2019), "Performance Based Seismic Analysis of Regular R.C. Building", *International Journal of Management, Technology And Engineering*, ISSN: 2249-7455, Vol. 09, no. 07, pp. 342-351, DOI:16.10089.IJMTE.2019.V9I7.19.28639
- [7] Prakash Mandiwal, Sagar Jamle, (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.
- [8] Surendra Chaurasiya, Sagar Jamle, (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>
- [9] Archit Dangi, Sagar Jamle, (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, <https://dx.doi.org/10.22161/ijaers.5.9.36>
- [10] Mohd. Arif Lahori, Sagar Jamle, (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, <https://dx.doi.org/10.22161/ijaers.5.8.35>
- [11] Gaurav Pandey, Sagar Jamle, (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.
- [12] Suyash Malviya, Sagar Jamle, (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, <https://dx.doi.org/10.22161/ijaers.6.2.9>
- [13] Neeraj Patel, Sagar Jamle, (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: 10.18231/2454-9150.2018.1372
- [14] Taha A. Ansari, Sagar Jamle, (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, <https://dx.doi.org/10.22161/ijaers.6.6.89>
- [15] 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.
- [16] 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>
- [17] Pankaj Kumar Dhakad, Sagar Jamle, (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. 170-178. <https://dx.doi.org/10.22161/ijaers.74.20>
- [18] Gagan Yadav, Sagar Jamle, (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>
- [19] Surendra Chaurasiya, Sagar Jamle, (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, <https://dx.doi.org/10.22161/ijaers.6.4.38>
- [20] Archit Dangi, Sagar Jamle, (2019), Stability Enhancement of Optimum Outriggers and Belt Truss Structural System", *International Research Journal of Engineering and Technology*, (ISSN: 2395-0072(P), 2395-0056(O)), vol. 6, no. 2, pp. 772-780.
- [21] Durgesh Kumar Upadhyay, Sagar Jamle, (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>
- [22] Mohd. Arif Lahori, Sagar Jamle, (2019), "Response of Multistory Building Located on 20⁰ and 30⁰ Sloping Ground under Seismic Loading", *International Research Journal of Engineering and Technology*, (ISSN: 2395-0072(P), 2395-0056(O)), vol. 6, no. 1, pp. 1063-1069.
- [23] Romesh Malviya, Sagar Jamle, (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>
- [24] 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.
- [25] Mohit Kumar Prajapati, Sagar Jamle, (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>
- [26] Gagan Yadav, Sagar Jamle, (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>
- [27] Durgesh Kumar Upadhyay, Sagar Jamle, (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>

- [28] Pankaj Kumar Dhakad, Sagar Jamle, (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>
- [29] Manoj Patidar, Sagar Jamle, (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>