

# Base Shear Reduction Techniques: A Review

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**Abstract**— Now India comes under densely populated countries and the land shortage is the common concern in large cities now a days. To decrease this problem, buildings taller in height is the only option available since it provides more suitability in less space. In this study, various papers allied to this topic are intensively reviewed in which an enormous work is done in this field earlier. To make these buildings inexpensive, harmless and suitable it is really important to add new ideas and expertise. One of them is the base shear reduction of the entire structure. By using optimum size of the beam at the top floors of the building the base shear can be easily reduced under earthquake. By the help of this study, various papers are reviewed in which an enormous work has been done associated to this topic. With the help of this literature survey, we came to know the conclusive outcome which forms the research objectives of our further technical study.

**Keywords**— Base Shear Reduction, Beam Concrete Grade, Dual System, Dimension Change, Shear wall

## I. INTRODUCTION

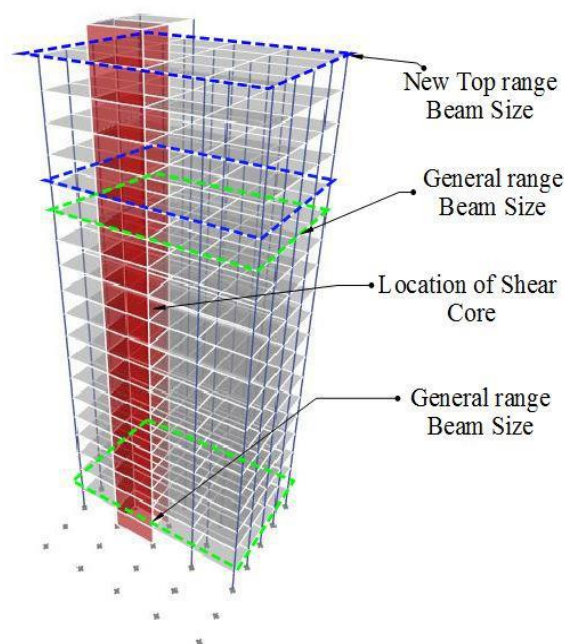
The trend now follows all the financial customs to make cost operative constructions. It only comes with the economic point of view to the stability of the structures which is again a tough task and it loses the above economic trend, since it requires heavy sections. The main criteria in this is that, it needs extra cost to make the structure earthquake free and also needs some additional stiffness resisting members for the same. The basic need of the modern tall structures is shear wall since it not only protects the same from seismic disasters but also stabilizes the tall structures. The heavy R.C.C. additional components that increase the complete weight of the structure on the other hand, it also increases with its base shear.

## II. SHEAR WALL

A structural component added to the multistoried building structure made up of stiff R. C. C. wall, is an additional member used to resist lateral effects on it. This R.C.C. vertical wall starts from foundation base to the top of the building. Ordinary RC structural walls and Ductile RC structural walls are classified by the Indian standardization. As per IS 13920, one doesn't meet the special detailing requirements for ductile behavior is considered as the former one meet the special detailing requirements for ductile behavior is considered as the later.

## III. CRITERIA OF BASE SHEAR REDUCTION

The theory by which base shear of the complete structure can be reduced by lessening the size of members or curtailing the size of the members of the multistoried building. Base shear reduction is important factor in the multistorey buildings under seismic loading. Anything that comes under reduction criteria will reduces the self-weight of the structure.



**Fig. 1:** Structure with Dual Structure Configuration and Base Shear Reduction Techniques

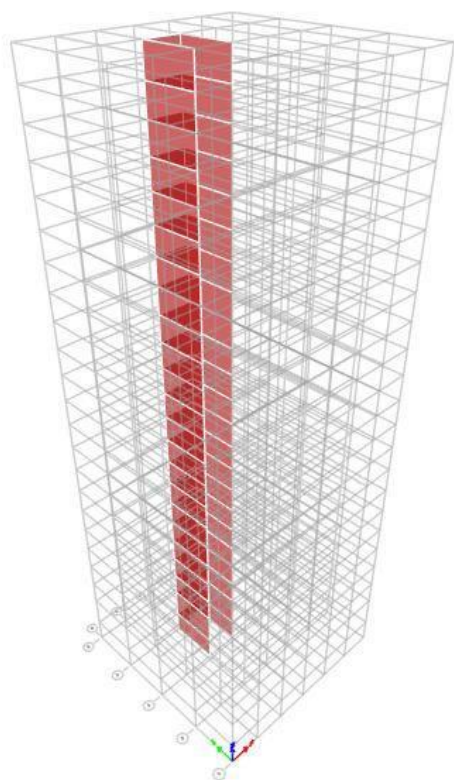


Fig. 2: Structure with shear Wall at Core

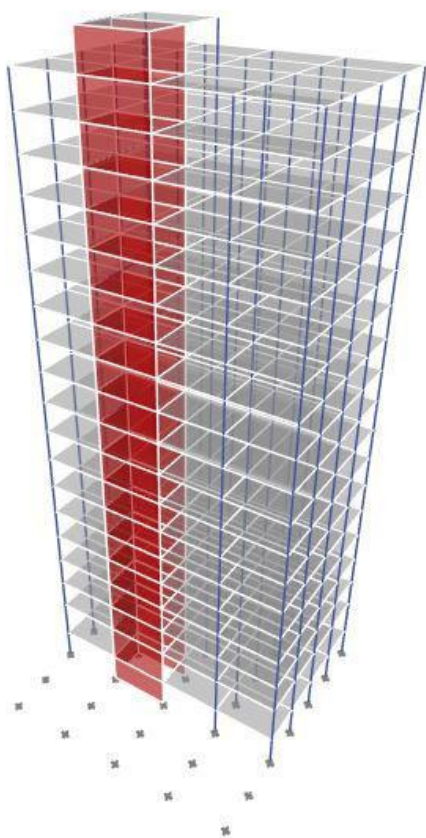


Fig. 3: 3D Sectional View of Structure with basic Base Shear Reduction Techniques

#### IV. REVIEW OF LITERATURE

The main focus on how to deal with lateral forces and counteract with special lateral load resisting elements. Their research work consists of usage of shear wall core type building with wall outrigger, wall belt and truss belt system. They have set the objectives of the study with the determination of different types of output parameters for the comparison and obtain the best case of the multistorey building under seismic loading. Total 7 cases have selected and abbreviated as S1 to S7. Various figures show the different cases easily and can be predicted as well. After the result analysis of various truss belt and wall belt systems, conclusions have been drawn. Last they have proved that wall belt system was proved to be more effective than truss belt system since the coverage area of the stability system is more i.e. Case S4 (Archit Dangi et. al.).

Researchers concentrated on the different ways to make the multistoried building more stable to resist the lateral loading. The special highlight in their research work was to increase the lateral load handling capacity in tall structures. For this, they found an optimum shear wall belt at different heights in 25 storied multistoried building using software approach. Plan of the structure selected was 825 square meter. In introduction part, they have elaborated the current scenario and the implementations of the lateral load handling capacity add on to the building along with its optimization criterion. They firstly proposed various objectives and output parameters such as maximum displacement in all three directions, storey drift, base shear and the applied load case that creates maximum drift. Various input parameters were shown in the methodology and structural modeling section with a view to counteract the seismic forces. Total 16 cases have selected in their research work and abbreviated as CASE A to CASE B14 respectively. After the comparison of the obtained result analysis, they proved the shear wall strip belt was placed optimum at floor 12 with a height of 47.58 m respectively (Neeraj Patel et. al.).

The main attention to relate to the opening area effect of the shear wall in tall structures. Authors in this work clearly proved the ability to resist the lateral forces can be done by shear wall member only. But due to efficiency, the shear wall could be used in such a manner that the area used by the wall was to be minimum throughout the entire height of the building. The work presented by the authors was a technical approach. For that, they first described the current scenario of the land used as per urban infrastructure point of view. They have considered total 5 structure models and abbreviated as SA, SB, SC, SD, and SE respectively. For analyzing the shear wall that was used at

corners and the percentage area coverage of shear wall also was the major part of their study. Clearly, the shear wall deduction area was described in the table provided as per abbreviation. After comparison of the various results, it was clearly shown that whenever the shear wall used at corners, only 20% wall deduction criteria will be accepted and beyond this criteria, the structure will ultimately lose its stiffness (Prafoolla Thakre et. al.).

To deal with the issue of architectural point of view, researchers in this work reveals that floating column criteria can be implemented in a multistoried building. The main aim in their work suggested that there should be criteria of the column elimination so that the structure should maintain its stability and its overall stiffness should also be maintained. On other hand, locations of the floating column have also played an important role in this regard and the same maintained and proved in their work. They have done various reviews of the different approaches related to the same theme. After literature surveying, they have given the conclusions with the outline of their proposed work i.e. technical approach. In conclusive part, they suggested that optimization work on the floating column should be there as per building stories. Since from their work it has been cleared that floating column criteria should be provided as per optimum height of the structure (Gaurav Pandey et. al.).

This work addresses the possibilities of different grades of concrete in wall belt system comprises of dual structural system. The authors have done the parametric approach to prove their work. In introduction part, they simply described the importance of wall belt supported system. When this system combined with the dual structural system, it increases the stability of overall building. They have taken the G+18 storey building with various cases comprises of with and without shear wall belt. As per the objectives of their study, they needed some optimum parametric criteria's to fulfill the needs and prove their research work. They have considered the displacement, base shear, bending moment, shear forces axial forces and torsional values to compare all the cases and find the efficient one. They have abbreviated different cases as Case B0 to Case B9, such that total 10 Cases compared among each other under different parametric heads. For that, M25, M30 and M35 Grade of concrete have selected with 140 mm, 160 mm and 180 mm thickness of the wall belt. All the structures were supposed to be rested over medium soil at seismic zone III having importance factor maintained at 1.2. After comparing the results under various parametric heads, the conclusions have drawn. Their research suggested that Building Case B7 seems to be optimum after comparison among 10 various cases and

should be recommend whenever this type of construction have done (Durgesh Kumar Upadhyay et. al.).

To overcome with the problem of increasing the compressive strength and flexural properties of the concrete, researchers come to grips with the usage of fly ash and the glass powder. They have made an experimental investigation using the replacement criteria of fly ash and glass powder with cement in a particular percentage to enhance the properties of concrete. In introductory part, they have clearly described the recent trend in their times that the construction industries needs the change. After that, they have shown the importance of the waste material can be used as a partial replacement to the costly raw material used in concrete that is cement. For experimental approach, they have taken the basic materials like cement (OPC), sand, natural coarse aggregate and the waste materials such as fly ash and glass powder for making the mixes. They have made total 7 mixes with the combination of different percentages of addition and replacement. The comparative results have drawn after the same. The results of compressive strength test are performed for 7 days, 14 days and 28 days of curing respectively. The same criteria were performed for flexural strength test too. After the comparison of analytical results under each heads, conclusions have drawn suggested that 25 % fly ash in combination of 0% glass powder in replacement of cement proved to be the efficient combination. The abbreviation of the same effective case was Mix second i.e. (M-2) respectively (Sachin Sironiya et. al)

Management in this work is to emphasize the usage of the complete arrangement of telecommunication towers over a multistoried building. Since, we have not previously known if there will be telecommunication tower should be placed over roof top with the complete arrangement of the fixtures. The additional load if applied in future was going to be a disaster to a multistoried building when it will be in the influence of the seismic loading was the main idea of their research. This knowledge was provided in their introductory part. For the same topic, they decided the objectives comprises of different output parameters such as the comparison of shear in beam, bending moments in beam members, torsional moments and dynamic parameters. These output parameters have supposed to be compared for both the translational directions of the horizontal axis respectively. In structural configuration head, several input parameters have decided as the structure have situated in seismic zone IV. Total 5 cases have selected such that the roof was supposed to have different tower positions. The positions was abbreviated as P1 to P5 and the cases in which it was considered, abbreviated as CASE A to CASE E respectively. The

results were also represented as graphically as different graphs for each of the parametric head. The outcomes were shown in conclusions head, proved that there was an efficient case for each parametric head (Suyash Malviya et. al.).

## V. CONCLUSIONS AND OUTLINE OF THE PROPOSED WORK

On analyzing above literatures and after the analysis of the complete theme, I found that no one have discussed this new way to lessening the weight of the structure, no one has ever done this new thing, no one have ever gave the importance of base shear reduction in context to earthquake criteria. Reduction in the size of beams at top floors and the various cases discussed yet on the multistoried building structure. Here we come at conclusion drawn by literature reviews that the position for reducing the sizes of the members at top floors, ultimately under the earthquake effects, reduced the base shear of the structure.

The conclusive outcomes drawn from the study are enlisted below:

1. Conduction of the study for both the directions would be necessary for lateral effect calculation.
2. Different parameters of analysis should be checked and validate as per Indian Standards along within the limits.
3. Soil type should also be checked as per Indian Standardization IS 1893-2016.
4. Seismic zonal analysis should be check to analyze the data for different seismic zones in dual structural configurations.
5. It is always necessary to check the lateral effects in the form of displacements.

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, Ankush Nagar, 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.

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