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Stability Increment Practices using Wall Outrigger Members: A Review

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Abstract: ***Reduction in less living land has become the problem in urban areas due to increase in population. The solution in this regard is the introduction of high rise structures let several countries comes under their goal to attain the sustainability criteria. Multistoried building consumes lesser land area and could be built over a lesser space area is the introduction of conversion of the city into metropolitan one.***
The investments are also generated that makes it comes under foremost city across the country, if any city comes under the huge construction. The delivering of more correctness in lesser space consumption, the multistoried high rise buildings are the only possibility offered to capture the investments.
In this study, various research articles associated in this regard are intensively studied in which a vast work was finished in this field before. To make these buildings inexpensive, harmless and suitable it is really important to add new ideas and expertise. Among them, stability increment techniques by introducing the Outrigger Wall systems are now demand in the field of structural engineering.
By the help of this study, one can easily understand the easily understand the criteria of previous researches done and use of the Outrigger wall system in various locations of the multistoried building. With the help of this literature survey, we came to recognize the conclusive outcome that forms the research objectives of our technical aspects of the supplementary study.
Keywords: Concrete Grade, Dual system, Dimension change, Plinth Level, Shear wall, Wall Outrigger System

I. INTRODUCTION

To use the lesser land area, the main and the elementary requirement of the current living world is introduction of the tall and high rise constructions. From lateral effects, since from seismic tragedies, the main attentiveness now is to use a dual structural configuration that stabilizes the structures.
The trend that follows the expansion in construction industry follows all the financial customs to make cost operative constructions. It only comes with the financial and commercial point of view to the stability of the structures which is again a tough task and since it entails heavy structural components, loses the above financial trend.
Extra cost that makes the structure earthquake free in this is that, it requires some supplementary stiffening members. The additional heavyweight R.C.C. components other than actual members increase the complete mass of the structure, further it also surges its base shear. Hence it is essential to create the structure as light as possible.
Criteria of Stability Increment techniques:-
The structure's stability could be controlled by altering the structural configuration by specific characteristics without disturbing the whole structure is a generalized theory of stability. As per this theory, numerous researches done in this field demonstrated and proved if stability would escalate with and without adding the additional component. If anything that derives in response reduction criteria, reduces the self-weight of the structure too could be a part of structural stability increament technique.

Practices that stability escalates can be done by:-

A. Via changing the size of the structural components.
B. By means of eliminating the structural components.
C. Thru reducing the weight of the structure.
D. Via changing the grade of concrete.
E. By implementing some stability improvement structural components that resist the lateral and vertical loads.

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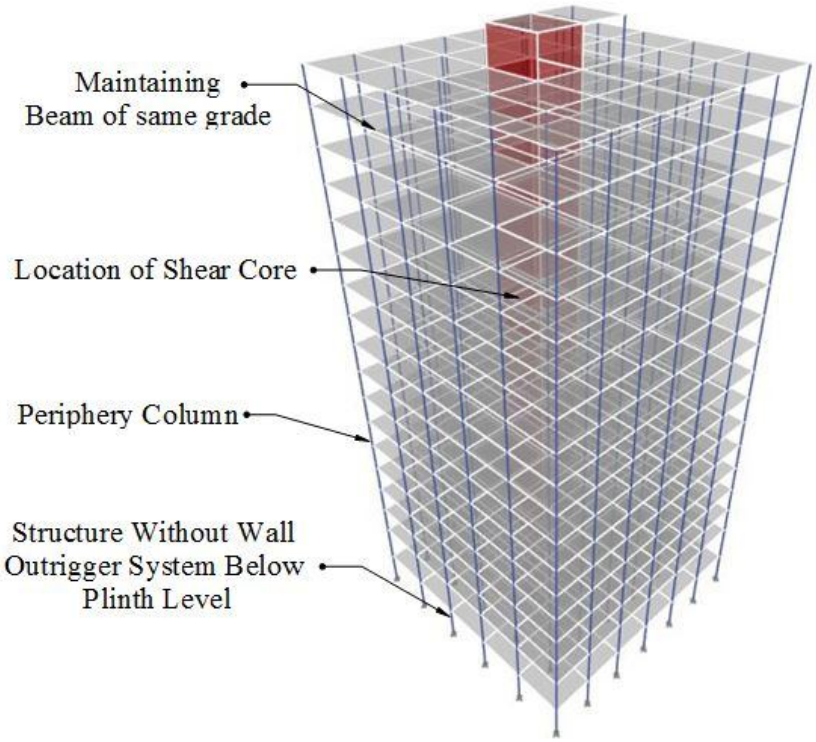


Fig. 1: Structure with Dual Structure Configuration without Wall Outrigger System

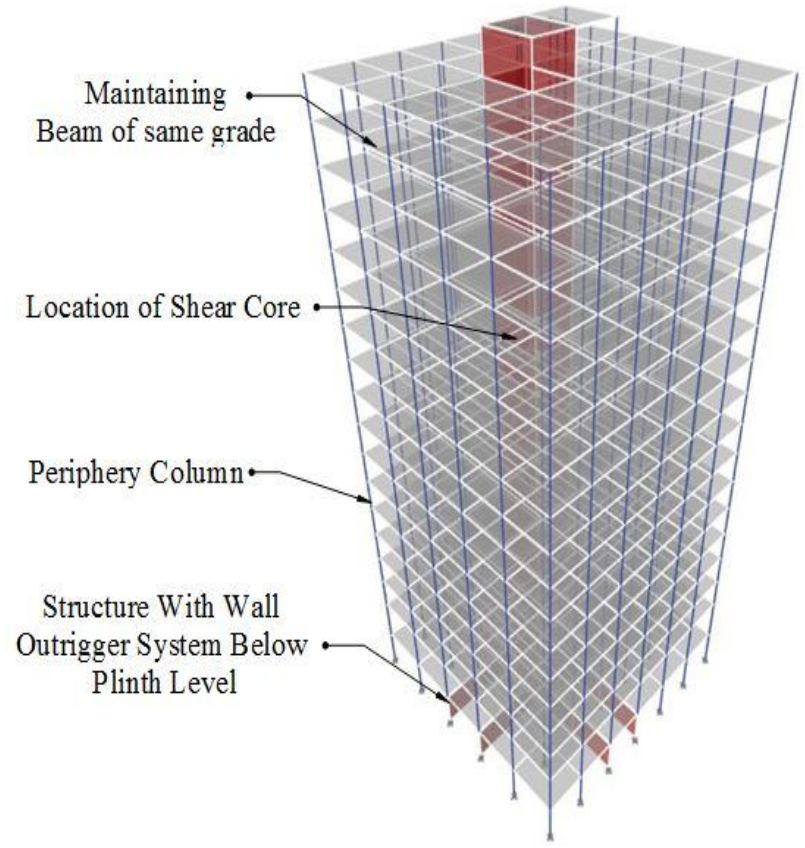


Fig. 2: Structure with Dual Structure Configuration with Wall Outrigger System below Plinth Level

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II. REVIEW OF LITERATURE

The stability increment system by opening effect of core type shear wall had been become a main criteria in structural engineering, emphasize given on it by the researchers. They made a theory to prove the opening area effect of shear wall for both single core shear wall and core type shear wall. They have taken total eleven cases to prove shear wall usage area. From Core 1 to Core 5, single core usages have selected and from Dual core 1 to Dual core 6, dual core usages have selected as per shear wall usage area. All these eleven cases are supposed to have rested over medium soil under earthquake zone III. By the help of software approach, they made all these buildings by providing the input parameters and under each head, results have drawn. In conclusions, single core case 5 obtained as the best case for singe core usage. On the other hand, dual core case 6 obtained as the best case for dual core usage (Gagan Yadav et. al.). Research revealed that the interaction of shear wall in connection with the multistoried building under seismic loading was the main criteria of the research. They have described the various possibilities of the location of the shear wall along with the criteria of shear wall type. This increases the stability of the structure with only shear wall at a particular location. The research done with the aim of taking G+9, G+18, G+27 and G+36 storied models conducted over a software approach. They have selected 20m x 20m plan area just to perform the analysis with frames abbreviated as Frame 1 to Frame 12 in each storey. Firstly they showed that what are the actual meaning of shear wall with its types. Total 48 frames have been constructed and all the structures are supposed to be rested over medium soil at earthquake zone V. After the analysis, conclusions have been drawn. The result proves that the frame 10 i.e. + shaped shear wall at centre with flab slab proves to be the best of all (Sagar Jamle et. al.).

The main attention that relates the opening area effect of the shear wall in tall structures under the stability increment techniques. 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 analysing 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 loose its stiffness (Prafoolla Thakre et. al.). Stability increment by the possibilities of the usage of wall belt supported system in this work used in multistoried building the authors cope with it sincerely. As per review done, the various possibilities of the demand and supply of stability improvement system, the work compared the same. The main criteria in this work were to show the lateral load handling capacity. With total 14 cases with the usage of RSA will be used under Zone V with zone factor 0.36 respectively, they secretly exposed in their upcoming work. The main idea of their research was the Shear wall at corners with belt connecting over its periphery column members. They conclude that their main focus will be shear strip which was the modified part of the concrete wall system, after reviewing the various researchers and then outline of the proposed work were pointed out. If the height at which the shear strip behaves effective and out if the width and thickness were kept fixed will be their optimum case, they pointed out (Neeraj Patel et. al.).

Researchers in this research work points out the reviewed approach on the effect of the different concrete grade in outrigger and wall belt supported dual structural system that increases the stability of the structure and lessening the effect of seismic activities. Since same grade approach has been a major part of the work now a days but this kind of approach have been proved the numerous possibilities of the research work in different grades of concrete. Firstly they have shown the concept of multistoried buildings in the urban areas. Then they described the value of outrigger system and after than the belt supported system and the combined effective approach to the general building as per stability point of view. They have conducted numerous literature review related to the same topic and after than conclusions have drawn. The conclusion part has combined with an approach to the outline of the proposed work. They proposed that grade change in outrigger and wall belt supported system will become the major technical part of their study and will going to be major research work (Mohammad Bilal Rasheed et. al.).

Researchers in structural engineering field 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

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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.).

In stability of the tall building, this particular work brings out the review effort drafted on shear wall opening criteria of a multistoried building. In introduction, the author described the criteria's to fulfil the earthquake requirements is to make a dual system building which was considered in Indian Standardization too. Shear wall description with its types have also been discussed. The main emphasize has done to classify the core type shear wall viz. single core shear wall and dual core shear wall. Then he clearly described the types of opening in shear wall provided with figuratively approach. After then the numerous reviews on the shear wall usage, its importance and the opening criteria of shear wall was discussed. Lastly, they draw the conclusions and outline of the proposed work, that there should be a criterion describing the percentage deduction of the shear wall area and the percentage usage of the wall area. Their technical work will show the percentage elimination of the same (Gagan Yadav et. al.).

The main focus in stability improvement techniques in structural engineering that 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.). The authors suggested the optimum location of rooftop telecommunication tower along with its various fixtures and attachments that the structure sustains itself under the disaster seismic effects. The Exposure of extra load beyond the calculated load over the multistoried building under seismic loading was the worst case taken in their analysis. In introduction, they have suggested the importance of rooftop telecommunication tower in urban areas. Since the working approach was technical findings, they have discussed and set an aim by the various objectives consist of Base shear, axial forces, shear forces, moments and displacements. These parameters selected for both X and Z direction. Then they have described the methodology adopted for seismic analysis. After than the structure modeling has performed with total 5 cases selected and abbreviated as CASE A to CASE E with different telecommunication tower location. G+ 12 storied residential apartments have selected and all the structures have rested over medium soil at seismic zone 4. After the results, conclusions have been drawn suggested that on comparing all the cases, case D shows optimum amongst all (Suyash Malviya et. al.).

Importance given to the dual configuration under analytical approach of multistorey building when shear wall is used at different locations and also for different heights. Authors in this work firstly show why we have to implant the structural stability feature when different height of the structure used. UBC analysis was also described in it. Also, they described the importance of providing the shear walls with stiffness and aspect ratios. Advantages of shear wall have also discussed. In methodology section, they provided various input parameters that were used in their work. There were basically three structures viz. G+10, G+20 and G+26 structures rested over medium soil for the analysis. Finite element approach in calculation of stresses of only shear wall have discussed in their approach. Different approached were found out and finally future scope has provided (Priyanka Soni et. al.).

The paper presented in this work are the highlights of the insight of concrete which can cure itself where the shortage of the water in such areas. The agent used in their research work was polyethylene glycol abbreviated as PEG 400. This particular chemical was replaced by the percentage of cement in their research by 0%, 0.8%, 1.5%, 2.4% and 3.2%. The grade of concrete chosen was M20 and M25 grade of concrete. Both compressive and flexural strength test have been performed since this research work has done first in lab then the results were computed in tabular form and represented by graphical form. The work specially emphasize on 28 days curing results. Total 5 types of replacement mixed have made by replacement of cement and abbreviated as Mix-1 to Mix-5. They have concluded that For M25, 1.6% PEG Mix is efficient and for M20 Grade, 2.4% PEG Mix suited the best (Prakash Mandiwal et. al.).

III.CONCLUSIONS AND OUTLINE OF PROPOSED WORK

After the analysis of above literature reviews and after the analysis of the complete theme of the current work, we personally initiated that no researcher would have discussed this new way of stabilization of the structure by introducing the outrigger system below the plinth level. Since, no one has ever thought of this approach, no one has ever given the significance of stability enhancement criteria under various heads. As per seismic effects, it is essential to also an attention to the stability improving components too. Since we have also gone through IS codes, stating various fixed criteria's related to this field and the current head of the work.

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The conclusive outcomes drawn from the study are enlisted below:

A. Observation of seismic zone before any projected work to get the final dual structural configurations for that particular site.
B. For the calculation of lateral effects, the study for both the directions would be necessary for various aspects.
C. Soil type should also be checked as per Indian Standardization IS 1893-2016.
D. Various analysis of earthquake parameters should be checked and validate for outrigger system implementation as per Indian Standards along within the limits.
E. It is always necessary to check the lateral effects in the form of displacements.

The final work in this field after the conduction of literature review is that there should be an approach to increase the stability of the building by implementing outrigger system below the plinth level and that has going to be a major study for forthcoming proposed work.

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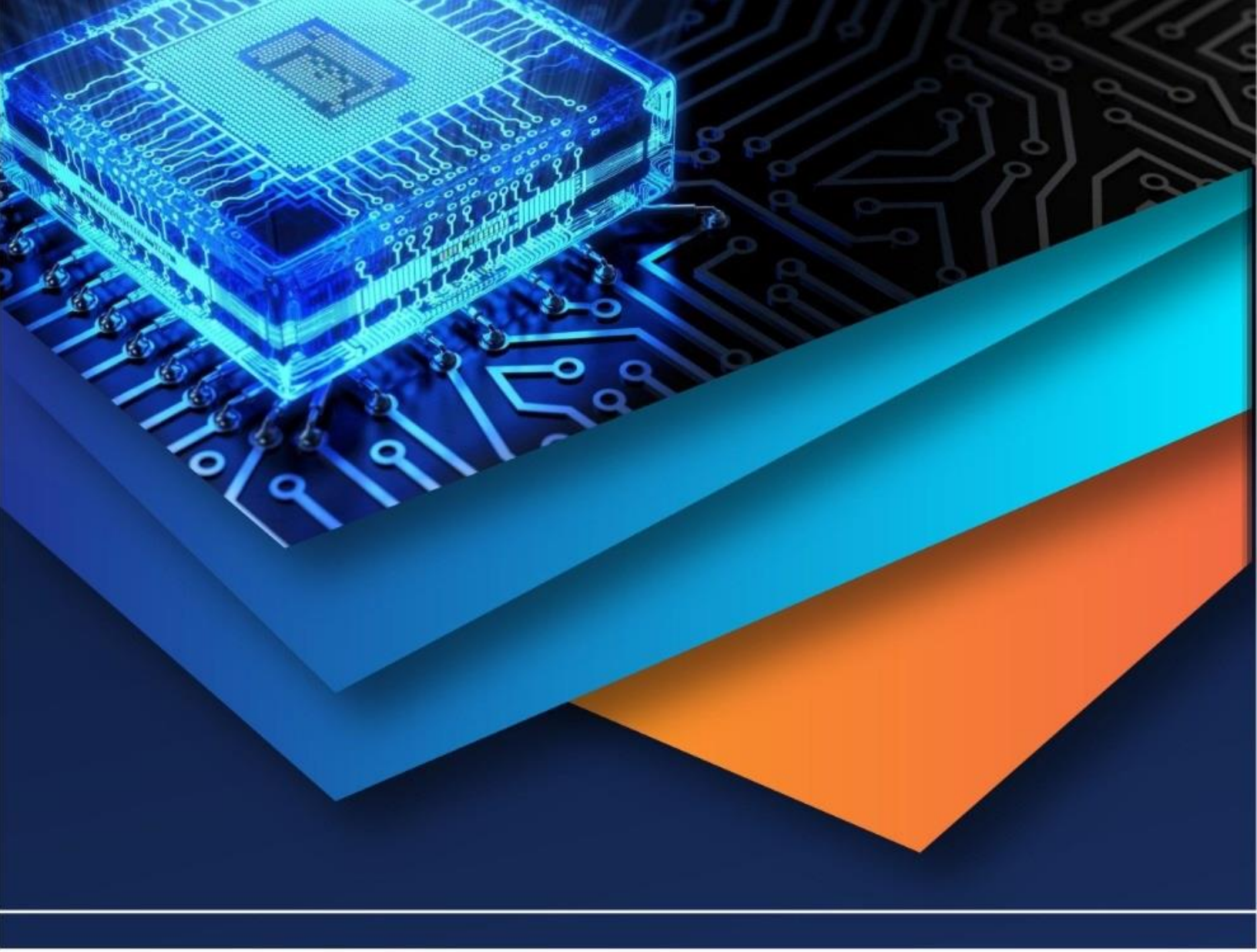
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