Literature Survey of Analyses of Reinforced Concrete Considering Shear Wall

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ABSTRACT

In recent decades, shear walls and tube structures are the most appropriate structural forms, which have caused the height of concrete buildings to be soared. So, recent RC tall buildings would have more complicated structural behavior than before. Therefore, studying the structural systems and associated behavior of these types of structures would be very interesting. Here in this paper; we will study the structural aspects of one of the tallest RC buildings, located in the high seismic zone, with different stories. In this Tower, shear wall system with irregular openings are utilized under both lateral and gravity loads, and may result some especial issues in the behavior of structural elements such as shear walls, coupling beams etc. To have a seismic evaluation of the Tower, a lot of analyses were performed to verify its behavior with the most prevalent retrofitting guidelines. In this work, some especial aspects of the tower and the assessment of its seismic load bearing system with considering some important factors will be discussed. Finally, after a general study of ductility levels in shear walls; we will conclude the optimality and conceptuality of the tower design. Finally, having some technical information about the structural behavior of the case would be very fascinating and useful for designers.

Keywords: *Reinforced concrete, Shear wall, Seismic Load, Wind Load, Multi Storey*.

I. INTRODUCTION

In many respects concrete is an ideal building material, combining economy, versatility of form and function, and noteworthy resistance to fire and the ravages of time. The raw materials are available in practically every country, and the manufacturing of cement is relatively simple. It is little wonder that in this century it has become a universal building material.

Fig 1. Multi-storey building

Tall buildings are the most complex built structures since there are many conflicting requirements and complex building systems to integrate. Today's tall buildings are becoming more and more slender, leading to the possibility of more sway in comparison with earlier high-rise buildings. Thus, the impact of wind and seismic forces acting on them becomes an important aspect of the design. Improving the structural systems of tall buildings can control their dynamic response.

In Turkey, a considerable number of buildings have reinforced concrete structural systems. This is due to economic reasons. Reinforced concrete building structures can be classified as [2]:

(a) **Structural Frame Systems:** The structural system consists of frames. Floor slabs, beams and columns are the basic elements of the structural system. Such frames can carry gravity loads while providing adequate stiffness.
(b) **Structural Wall Systems:** In this type of structures, all the vertical members are made of structural walls, generally called shear walls.
(c) **Shear Wall–Frame Systems (Dual Systems):** The system consists of reinforced concrete frames interacting with reinforced concrete shear walls.

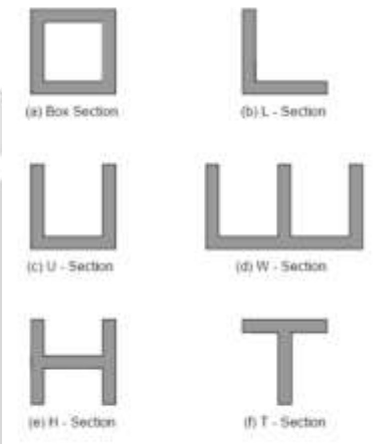

Fig 2. Typical Shear Wall Sections

II. LITERATURE REVIEW

Palermo & Varyani [2002] described about shear walled buildings under horizontal loads. Considering in his design "Reinforced concrete framed buildings are adequate for resisting both the vertical and the horizontal loads acting on shear walls of a building". In his 2nd edition 2002 of "Design of structures". He gave rigidity of shear wall, torsional rigidity and shear center of a building in a detailed description.

Esmaili & Epackachi [2008] has been study the "Study of Structural RC Shear Wall System in a 56-Story RC Tall Building". In recent decades, shear walls and tube structures are the most appropriate structural forms, which have caused the height of concrete buildings to be soared. So, recent RC tall buildings would have more complicated structural behavior than before. Therefore, studying the structural systems and associated behavior of these types of structures would be very interesting. Here in this paper; we will study the structural aspects of one of the tallest RC buildings, located in the high seismic zone, with 56 stories. In this Tower, shear wall system with irregular openings are utilized under both lateral and gravity loads, and may result some especial issues in the behavior of structural elements such as shear walls, coupling beams and etc. To have a seismic evaluation of the Tower, a lot of non-linear analyses were performed to verify its behavior with the most prevalent retrofitting guidelines like FEMA 356. In this paper; some especial aspects of the tower and the assessment of its seismic load bearing system with considering some important factors will be discussed. Finally, after a general study of ductility levels in shear walls; we will conclude the optimality and conceptuality of the tower design. Finally, having some technical information about the structural behavior of the case would be very fascinating and useful for designers.
Hamdy & Ahmed [2010] has been investigate that "Role of shear walls in high rise buildings". The slender high-rise buildings are wide spreading in Egypt and no probabilistic assessment procedures have been proposed or developed for seismic risk evaluation of these special buildings. So, the objective of this study is to numerically investigate the role of both edge shear walls and raft foundation projection out of the boundary of building in the seismic resistant of such structures. Several three-dimension models were developed including the subgrade modulus as a variable and the multipurpose commercial finite element program SAP2000 [6] was utilized for all runs in the current study. The loading is considered using acceleration time history with a peak ground acceleration of 0.25g provided in the new Egyptian code (ECOL2008) [2] for seismic loads on structures and building works. The results conclude that the slender high-rise buildings provided with edge shear walls and raft projection insure significant improvement in the induced base shear and internal forces in the raft foundation. On the contrary, the study shows the large values of base shear in the corner

columns under seismic loads in a projected raft foundation building. The results give a wide vision that can be used as an aid to the engineer for dealing with such slender high buildings.

Venkata & Surendra [2010] was review the "Different Shear walls". Shear walls are structural systems which provide stability to structures from lateral loads like wind, seismic loads. These structural systems are constructed by reinforced concrete, plywood/timber unreinforced masonry, reinforced masonry at which these systems are sub divided into coupled shear walls, shear wall frames, shear panels and staggered walls. The present paper work was made in the interest of studying various research works involved in enhancement of shear walls and their behaviour towards lateral loads. As shear walls resists major portions of lateral loads in the lower portion of the buildings and the frame supports the lateral loads in the upper portions of building which is suited for soft storey high rise building, building which are similar in nature constructed in India, As in India base floors are used for parking and garages or officers and upper floors are used for residential purposes.

Greeshma & Rajesh [2012] has been search that the "Seismic behaviour of shear wall – slab joint under lateral cyclic loading". In this work aims to study the seismic performance of exterior shear wall - slab joint with non-conventional reinforcement detailing. Four joint sub assemblages were tested under reverse cyclic loading applied at the end of the slab. The specimens were sorted into two types based on the joint reinforcement detailing. Type 1 model comprises of two joint assemblages having joint detailing as per the conventional detailing of slab bars at the joint. The second set of models (Type 2) comprises of two specimens having additional cross bracing reinforcements for the joints detailed as per the provisions given for beam – column joint in IS 13920:1993. Analytical investigations were employed to compare the experimental results. The experimental results and analytical studies indicate that additional cross bracing reinforcements improves the seismic performance.

Jawad & Vidyadhar [2013] was research that "Wind Analysis and Design of Multi Bay Multi Storey 3D RC Frame". Any Tall building can vibrate in both the directions of along wind and across wind caused by the flow of wind. Modern Tall buildings designed to satisfy lateral drift requirements, still may oscillate excessively during wind storm. These oscillations can cause some threats to the tall building as buildings with more and more height becomes more vulnerable to oscillate at high speed winds. This paper presents the study of wind analysis on buildings with different number of storeys using ETABS. The research work includes a total number of forty-five models of multi storey buildings. The models are categorised based on aspect ratio of the building. With an aspect ratio of 1, fifteen models are used with five storeys, fifteen storeys and thirty-five storey heights. Five different case are used in the model with five storeys as mentioned, bare frame with wall loads, shear wall in X and Y direction, RC double diagonal bracing in X and Y direction. Similarly, the fifteen and thirty-five storey models were analyzed. Also, the same numbers of models were analyzed with aspect ratios of 1.5 and 2.0. A comparison of lateral displacements and maximum storey drifts in X and Y directions are made for all the models.

Kulkarni & Kore [2013] has investigate an "Analysis of Multi-storey Building Frames Subjected to Gravity and Seismic Loads with Varying Inertia", An elastic seismic response of reinforced concrete frames with 3 bays, 5 bays and 7 bay 9 storey structures which have been analyzed for gravity as well as seismic forces and their response is studied as the geometric parameters varying from view point of predicting behaviour of similar structures subjected to similar loads or load combinations. The structural response of various members when geometry changes either physically, as in case of linear haunches provided beyond the face of columns at beam column joints or step variations as in case of purported T-section due to monolithic action in between beams and slabs, when the slab is available in compression zone of the beam was also studied. Every attempt has been made to describe the things in dimensionless forms. Results, if is expected, can be readily extended and/or extrapolated for other structures too. For the sake of clarity various types and kinds of structures analyzed and results so obtained have been grouped into various categories. This paper also highlighted on response of reinforced concrete frames for variation of axial force for spread of haunch and storey drift.

Prakash & Dubey [2013] has been found that "Static and Dynamic Behavior of Reinforced Concrete Framed Building: A Comparative Study". Reinforced concrete frame buildings are most common type of construction in urban India, which is subjected to several types of forces during their life time such as static forces and dynamic forces due to wind and earthquakes. The static loads are constant with time, while dynamic loads are time varying, causing considerable inertia effects. It depends mainly on location of building, importance of its use and size of the building. Its consideration in analysis makes the solution more complicated and time consuming and its negligence may sometimes become the cause of disaster during earthquake.

Pavan Kumar & Naresh [2014] has been study that "Earthquake Analysis of Multi Storied Residential Building - A Case Study". Earthquake occurred in multistoried building shows that if the structures are not well designed and constructed with and adequate strength it leads to the complete collapse of the structures. To ensure safety against seismic forces of multi-storied building hence, there is need to study of seismic analysis to design earthquake resistance structures. In seismic analysis the response reduction was considered for two cases both Ordinary moment resisting frame and Special moment resisting frame. The main objective this paper is to study the seismic analysis of structure for static and dynamic analysis in ordinary moment resisting frame and special moment resisting frame. Equivalent static analysis and response spectrum analysis are the methods used in structural seismic analysis. We considered the residential building of G+ 15 storied structure for the seismic analysis and it is in zone II. The total structure was analyzed by computer with using STAAD.PRO software. We observed the response reduction of cases ordinary moment resisting frame and special moment resisting frame values with deflection diagrams in static and dynamic analysis. The special moment of resisting frame structured is good in resisting the seismic loads.

III. CONCLUSION

Designer should recognize the presence of time-dependent effects, and provide for them in the design. Having concrete structural elements with different longitudinal stiffness makes the tower to be more sensitive to differential displacements due to concrete time dependency. A level of ductility for seismic bracing systems, conceptually, should be provided for energy absorption but axial loads have an adverse effect on their acceptable performance and this fact should be considered exactly. As is proofed here, using shear walls for both gravity and bracing system is unacceptable neither conceptually nor economically. Not only main walls are assumed to carry seismic loads, but also, they are going to bear a significant percentage of gravity loads.

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