Seismic Performance of Single Pier Building-A Review

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ABSTRACT

India concentrated to move new technologies to resist earthquake and implement various ideas to build the infra structures. These new technologies should reduce the cost and give durability for the structure. The structural engineers implement various new techniques. Floating column or single pier building is very useful in commercial structure many projects adopted floating columns, especially above the ground floor, where transfer girder are employed, so that large open space is available in the ground floor. These open spaces can be used for assembly hall or parking purpose. During the earthquake failure starts at a point of weak zone. The weakness arises due to discontinuity in mass, stiffness and geometry of structure. The structure having the discontinuity are termed as irregular structures. Vertical irregularities are one of the major reason of failure of structure. The single pier is used it prevented vertical irregularities and prevents the failure of structure. For designing equivalent lateral force procedure is acquired and the Demand Capacity Ratio (DCR) is carried out for beams and columns in order to assess the member for seismic load, live load & dead load.

Keywords--- DCR, Earthquake, ETABS

I. INTRODUCTION

Seismic Analysis is a subset analysis of structure and is the calculation of a structure earthquake. It is the process of design structure, earthquake engineering or structural details and retrofit in regions where earthquakes are prevalent.

The most dangerous earthquakes are happened close to the borders of the main tectonic plates which cover the globe. These plates tends to move relative by one another but are avert by doing so by friction until the stresses occurred in between plates the epicenter point goes of that above suddenly takes place. This is an earthquake. The local shock created waves in the ground which grow over the earth’s surface, creating movement at the basement of building. The principal of waves decreases with the distance from the epicenter. Therefore, the outer regions of the world have more or less seismic risk, determined by their proximity to the boundaries of the main tectonic plates.

The dangerous earthquakes which occurred at tectonic plate boundaries, others have their origin at the inside of the plates at fault lines is called intra plates of earthquakes, these less energy, but can still be destructive in the area of the epicenter.

The action appeal to a structure by an earthquake is a ground movement with horizontal and vertical members. The horizontal motion is the most specific characteristic of earthquake action because of its strength due to structures is designed well to resist gravity than horizontal forces. The horizontal component of the earthquake is normally in the range 50% of the vertical component, except in the region of the epicenter where it can be of the same order.

During an earthquake, failure of structure starts at the zone of weakness. This weakness appears due to discontinuity in mass, stiffness and geometry of structure. The discontinuity of structure are termed as Irregular (diamond shape) structures. It contributes a large portion of urban infrastructure. During earthquakes vertical irregularities are the important reasons of failures of structures. For example structures with soft story were the important remarkable structures which destroyed. So, the effects of vertically irregularities in the seismic performance of structures are really important. Depends up on height the changes in stiffness and mass render the dynamic characteristics of these structures different from the regular structures. IS 1893 is definition of Vertically Irregular Structures.

What is floating column?

A column is a vertical member starting from foundation level and transferring the load to the foundation. It is also a vertical element which (due to site situation or architectural design) at its bottom level rests on a beam which is a horizontal member. The beams transfer the load to other columns presented at below.

Floating columns are widely used in all regions, mostly above the ground floor, where transfer girders are employed. By use these method can able to makes more
open area in the ground floor. These open spaces may be required for parking purpose or assembly hall. The transfer girders have to be designed and detailed properly, mainly in earthquake zones. The column is an important load on the beam which supports it. As far as analysis is disturbed, the column is frequently assumed pinned at the base and is therefore transfer beam is taken as a point load. STAAD Pro, ETABS and SAP2000 are used to do the analysis of this type of structure. Floating columns are capable enough to handled gravity loading but move a girder should be of satisfactory dimensions (Stiffness) with very minimal deflection.

By continue to make buildings interesting rather than tedious. However, this need not be done at the cost of poor bearing and earthquake safety of buildings. Architectural features that are detrimental to earthquake retaliation of structures should be avoided. If not, they must be minimized. When irregular features are presented in buildings, similarly in structural design higher level of engineering effort is required and yet the structure may not be good with simple architectural features.

Hence, structure with these types of discontinuous members are danger in seismic regions. But those structures are not to be demolished, rather take steps to strengthen the structure or some solutions can be suggested. The columns of the first story can be made as stronger, the stiffness of the columns also be increased by retrofitting or by provided with bracing to decrease the lateral deformation.

II. LITERATURE REVIEW

An extensive literature review is carried out on the three subjects
(a) Estimation of Shear Strength of Reinforced Concrete Section,
(b) Estimation of the Shear Deformation capacity of RC section and

A number of literatures are found on the estimation of shear strength for RC sections with and without web reinforcement. Majority of the previous works on shear strength estimations are based on experimental study. However, there is only one published literature found on the estimation of shear displacement capacity of RC section. There is no literature available that demonstrate the pushover analysis of framed building considering shear failure. Following section presents a brief report of the literature review carried out on the above mentioned subjects as part of this project.

Bahrain M. Shahrooz and Jack P. Moehle [1]

Undertook an experimental and analytical study to understand the earthquake response of setback structures. The experimental study involved in Design, Construction and Earthquake simulation testing of a quarter- scaled model of multistory, reinforced concrete and setback frames. The analytical studies involved in design and inelastic analysis of the several multistoried frames having varying degrees of setbacks. Among that issues addressed were:
(1) The influence of the setbacks on dynamic response;
(2) The adequacy of the current static and dynamic design requirement for setback buildings;
(3) Design methods are used to improve response of setback buildings.

Valmundsson, E and Nau, J [2]

It evaluated the earthquake response of 5-, 10-, and 20 story framed structures with non-uniform mass, stiffness, and strength distributions. The response calculated from TH analysis was compared with that predicted by the ELF procedure embodied in UBC. Based on this comparison, the aim was to evaluate the current requirements so that which an structure can be considered regular and the ELF provisions applicable.

Kim, S. J. and Elshasai, A. S. [3]

It observed that buildings that are seismically designed to current codes would have survived during the earthquake. But, the vertical motion would have significantly reduced the shear capacity in vertical members.

Haijuan Duan et.al [4]

According to the numerical results, the structures designed by GB50011 - 2010 provides inelastic behavior and inelastic response meant by the code and had satisfies the inter-storey drift and maximum plastic rotation limits are recommended by ASCE / SEI 41-06. The push-over analysis will indicated the potential for a soft story mechanism under the significant lateral demands.

Poonam, Kumar Anil and Gupta Ashok K [5]

Results of the numerical analysis showed that any storey, especially the first storey, must not be weaker than that of the storey’s above or below. Irregularity in mass distribution also contributes the increased response of buildings. The irregularities, if required to be provided, need to be provided by proper and extensive analysis and the design processes.

Jack P. Moehle [6]

Found that standard limit analysis and static inelastic analysis provides good measures of strength and the deformation characteristics under strong earthquake motions

III. CONCLUSION

Vertical irregularities are one of the major reason of failure of structure. The single pier is used prevented vertical irregularities and prevent the failure of structure. The Demand Capacity Ratio (DCR) is performed for beams and columns in order to evaluate the member for seismic loads. By evaluating structure by this two design procedure will gives effective results. Design-1 by applying only DEAD loads and LIVE loads according to IS 456 : 2000 for estimating the reinforcement present in the building and assuming that this much reinforcement are present. In Design-2 the seismic loads are applied and the demand obtained from design-2 and actual capacity from design -1 that the
DCR is calculated. If demand is more than capacity member fails and vice versa. From the literature it is understood seismic designed building performs well.

REFERENCES