A Review on Seismic Behavior of Rcc Structure With Different Substructures

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Abstract- *Foundation is the first element of any structure that encounters seismic forces. The various types of seismic waves, reaches and affects the foundations first and then the superstructure. Different types of foundations respond differently to seismic forces. In this research work, RCC structure is analyzed for the seismic behavior of different types of foundations like isolated footings, raft foundations, strap footing etc. Seismic analysis is done in STAAD Pro to compare values of nodal displacement, storey drift, storey and base shear, shear force and moment development. Comments are made considering stability aspects of the structure.*

Keywords- Seismic, Substructures, Isolated Footing, Strap Footing, Raft Footing, Base Shear, Shear Strength, Nodal Displacement, Story Drift, Shear Force, Bending Moment, Earthquake resistant.

I. INTRODUCTION

Earthquake events are natural occurrences, but earthquake-related losses are in large measure the result of social processes and activities that affect the extent to which people and property are placed at risk. Combating the earthquake problem requires in-depth understanding of those social processes and the translation of this understanding into effective action programs. The general public has become more concerned about earthquakes and the great damage they can cause. It is a major challenge to ensure that our constructions are made earthquakes resistant to limit the damages in future.

II. REVIEW OF LITERATURE

Sekhar Chandra Dutta : Studied various types of structures namely framed reinforced concrete (RC) structures with brick infill, unreinforced load bearing masonry buildings (URM), and timber-framed buildings with timber board or bamboo-matting (ekra) in between, that failed in the 2011 Sikkim Earthquake at Eastern Himalayas. Various types of failures reasons were also identified like pounding of buildings, out of plane failure of masonry walls, etc [1]

H.P. Santhosh : In this paper studied various types of base isolators and base isolation techniques. Comparison is made between the results for fixed base building and building with base isolators, which were analyzed by response spectrum method.[2]

R. M. Jenifer Priyanka : analysed multi storeyed building with fixed and flexible base subjected to seismic forces under different soil condition like hard, medium and soft. The buildings were analyzed using Response spectrum method using software STAAD Pro. [3]

Steven G. Wesnousky: studied the geological changes that occurred along the Himalayan frontal fault near Kathmandu, Nepal after the Mw 7.8 Gorkha (Nepal) earthquake of April 25, followed on May 12 by an Mw 7.3 aftershock. Observations stating the size of earthquake, extent of rupture have made.[4]

Shri Krishna Singh: in the paper, studied the earthquake data obtained by the several broadband stations of National Seismological Service (SSN). The Stress regime of the Gulf coast region of Coatzacoalcos - Minatitlan has been prepared and ground motions in the Coatzacoalcos -Minatitlan region from a postulated Mw 6.4 earthquake have been estimated. [5]

Piyoosh Rautela: studied the seismic vulnerability of school, hospital and hotel buildings besides other infrastructure, in the two famous tourist destinations of the Indian Himalaya, Nainital and Mussoorie that are located in the state of Uttarakhand. A total of 8 hospital buildings in Nainital and 13 in Mussoorie together with 103 school buildings in Nainital and 302 in Mussoorie were studied. Also, 46 hotel buildings in Nainital and 320 in Mussoorie were covered under the study. [6]

Joaquín G. Ruiz-Pinilla : in the paper, inspected various RCC structures in the city of Lorca, in Spain, that were affected by the earthquake occurred in May 2011. [7]

Jinkoo Kim: in the paper, carried out the parametric studies for displacement response of a single story plan-wise asymmetric structure were conducted with varying eccentricities between centre of mass and centre of stiffness. Then a procedure was developed to distribute the damper based on the ductility demand of the structure. The procedure was applied to install slit dampers at proper locations of low-rise structures with horizontal and/or vertical irregularities subjected to an earthquake load. [8]

F. Hosseinpour: in the paper, conducted an experimentation in which the buildings were subjected to a suite of ground motion records obtained from the 2010–2011 Christchurch earthquake sequence. Dynamic response history analyses were conducted to investigate the effects of: 1) damage from previous ground motions; 2) earthquake direction; 3) aftershock polarity; and 4) the vertical component of the earthquake. The results presented indicate that earthquake direction (in the irregular building), structure irregularity, and the vertical earthquake component can have a considerable effect on the response of structures subjected to multiple earthquakes. [9]

S. Soleimani: in the paper, conducted an experimentation work in which a set of symmetric and one-way asymmetric RC shear wall buildings were defined as case studies, in which the asymmetric models include both the stiffness and strength eccentricities. The efficiency of the E-MPA was evaluated through seismic assessment of the building models. The obtained results were compared with those of the nonlinear response history analysis (NRHA) as a benchmark solution. [10]

Kiran Kamath: in the paper, studied the performance characteristics of diagrid structures using nonlinear static pushover analysis. The nonlinear behaviour of the elements was modelled using plastic hinges based on moment-curvature relationship as described in FEMA 356 guidelines. Seismic response of structure in terms of base shear and roof displacement corresponding to performance point were evaluated using nonlinear static analysis and the results are compared. [11]

Mohammad Hossein Vafaee: in the paper, presented a new nonlinear static procedure considering the effects of higher modes in structural responses. This approach assigns a contribution factor for each node based on modal shear distribution. The offered contribution factor can be applied for determining the importance of each mode in lateral load pattern formation. In order to verify the results, some other types of pushover-based analysis are also performed and the responses obtained from Seismic Behaviour of RCC Structure with Different Substructures College of Engineering and Technology, Akola | 5 each NSP are compared with those of rigorous non-linear response history analysis (NL-RHA). Results demonstrated the efficiency of the proposed method in accurate prediction of the seismic demands of high-rise buildings. [12]

K. Kaliluthin: studied the behaviour of beam – column joint in RC moment resisting frame according to Indian as well as international codes and explained various factors affecting the strength and failure the joint. The structural properties of joint and the need for ductile detailing are also explained. [13]

Fangyuan Zhou: records the response of a continuous foundation structure supported on partially improved foundation soil during an earthquake. A numerical model considering soil-structure interaction was then established, and the numerical results were compared with the observation data. Using the validated numerical model a parametric study was carried out to investigate the torsional response of a continuous foundation structure with irregular soil foundation system. [14]

Emilios M. Comodromos: investigated the back-analysis of a static pile load test, fitting values for soil shear strength, deformation modulus, and shear strength mobilization at the soil–pile interface. Subsequently, the response of 2 - 2 and 3 - 3 pile group configurations is numerically established and the distribution of the applied load to the raft and the characteristic piles is discussed. Finally, a design strategy for an optimized design of pile raft foundations subjected to non-uniform vertical loading is proposed. [15].

Pallavi Badry: developed the object oriented program in C++ to model the SSI system using the finite element methodology. The seismic soil structure interaction analysis has been carried out for T, L and C types piled raft supported buildings in the recent 25th April 2015 Nepal earthquake (M=7.8). The soil properties had been considered with the appropriate soil data from the Katmandu valley region. It had been studied observed that the shape or geometry of the superstructure governs the response of the superstructure subjected to the same earthquake load. [16].

A. Murali Krishna : studied the seismic design of pile foundations for different ground conditions. Estimation of seismic loads, for a typical multi-storeyed building considered being located in different seismic zones, for different ground conditions according to Indian and European standard are presented. Design considerations based on various theories evolved on pile foundation performance concepts under seismic conditions are discussed. Two different ground conditions (C and D type) are selected as exemplary cases in demonstrating the evaluation of seismic loads and seismic design of pile foundations as per codes of practice. [17]

Yang Lu: paper presents a simplified Nonlinear Sway-Rocking model as a preliminary design tool for seismic soil-structure interaction analysis. The simplified model has been calibrated and validated against results from a series of static push-over and dynamic analyses performed using a more rigorous finite-difference numerical model. [18]

R. M. Jenifer Priyanka: analysed multi storeyed building with fixed and flexible base subjected to seismic forces under different soil condition like hard, medium and soft. The buildings were analysed using Response spectrum method using software STAAD Pro. Various seismic responses were compared for both the type of building frames. [19]

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IV. CONCLUDING REMARKS

From the review of various research papers, it can be stated that less emphasis is given by various researchers to the substructures as compared to the superstructures in their work. So, there is a need to study various types of substructures and their role in making the structure more seismic resistive.

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