COMPARATIVE STUDY OF BEHAVIOR OF COMMERCIAL BUILDING IN VARIOUS SEISMIC ZONES - A REVIEW

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Abstract- The objective of this study is to scrutinize the seismic behavior of the structure i.e. Ordinary moment resisting frame (OMRF), Ordinary Moment Resisting Frame with bracing (OMRF with bracing) & Special R C moment Resisting frame (SMRF). In this investigation, four diverse seismic zones are deliberated as well three unalike types of structures are used which are plaza frame structure , bare frame structure, and stepped frame structure along with two types of moment resisting frames (OMRF and SMRF). Hence, a total of 36 cases had been studied. For this subject regular and irregular structure were sculpted and exploration was done using STAAD-Pro software and using the Indian codes for investigation namely IS 1893:2002, IS 456: 2000. The study presumed that the buildings were situated in seismic zone II, III, IV and V. Results in expressions of bending moment, shear force, nodal displacement and storey displacement are booked. Relevant conclusions are drawn.

Keywords— Seismic Behaviour, OMRF, SMRF, model, analysis, staad.pro

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I. INTRODUCTION

The selection of a particular type of framing system depends upon two important parameters i.e. seismic risk of the region and the economical. The lateral forces performing on any structure are circulated rendering to the flexural firmness of individual components. Indian Codes divide the entire country into four seismic zones (II, III, IV & V) depending on the seismic risks. Ordinary moment resisting frame (OMRF) is undoubtedly the most commonly accepted type of frame in lower seismic regions. Though with increase in the seismic risks, it becomes inadequate and special moment resisting frame (SMRF) frames need to be adopted. A rigid frame in structural engineering is the load resisting skeleton fabricated with straight or curved members interlocked by mostly rigid contacts which resist movements prompted at the joints of members. Its members can take shear, bending moment, and axial loads. They are of two varieties: Rigid-framed structures & Braced-frames structures The two collective conventions as to the performance of a building frame are that its beams are free to rotate at their contacts and that its members are so coupled that the slants, they make with each other don’t alter under load. Moment-resisting frames are rectilinear assemblages of beams and columns, with the beams rigidly connected to shear, amount of reinforcement etc. Moment frames have been extensively used for seismic resisting systems due to their greater deformation and energy dissipation capabilities. A moment frame comprises of beams and columns, which are tightly connected. The constituents of a moment frame must resist together gravity and lateral load. Lateral forces are circulated according to the flexural rigidity of each part.

II. OVERVIEW OF WORK

With the improvement in arena of high-rise construction, numerous types of frame engagements have been emerged. Regular bare frame, Irregular plaza frame and Irregular stepped frame existence examples of the recent high-rise types are expedient in terms of aesthetic and structural functioning. Seismic appraisal will provide a broad idea about the building performance during an earthquake. In this study Special Moment Resisting Frame, Ordinary Moment Resisting Frame with bracing and Ordinary Moment Resisting Frame are considering as structural frame and comparison are made for seismic load.

The objective of this study is to scrutinize the seismic behavior of the structure i.e. Ordinary moment resisting frame (OMRF), Ordinary Moment Resisting Frame with bracing (OMRF with bracing) & Special R C moment Resisting frame (SMRF). In this investigation, four diverse seismic zones are deliberated as well three unalike types of structures are used which are plaza frame structure , bare frame structure, and stepped frame structure along with two types of moment resisting frames (OMRF and SMRF). Hence, a total of 36 cases had been studied. For this subject regular and irregular structure were sculpted and exploration was done using STAAD-Pro software and using the Indian codes for investigation namely IS 1893:2002, IS 456: 2000. The study presumed that the buildings were situated in seismic zone II, III, IV and V. Results in expressions of bending moment, shear force, nodal displacement and storey displacement are booked. Relevant conclusions are drawn.

Fig. 1.1: Collapse of building due to earthquake

It is seen from past seismic tremors that the structures on inclines serve more harm and crumple happens. Earthquakes cause authentic damage to structures, for instance, frustration of people in the building and if the force of tremor is high it prompts breakdown of the structure. In late years population has been extended unquestionably and as a result of which urban zones and towns started spreading out. In light of this
2
reason various structures are being inherent inclining zones. India has an extensive shoreline forefront which is secured with mountains and slants. The Himalayan run moreover has considerable mountains and various towns are spread over these mountains. Numerous resorts are being created in irregular zones to give passages of action to the guests. The constructions in these regions are produced on inclining grounds. A enormous part of the coarse ranges in India go in the seismic zone II, III and IV zones in such case building in view of inclined grounds are exceptionally frail against seismic quake. This is outcome of the method that the helpings in the ground floor contrast in their physiques as revealed by the inclination of the ground. Fragments toward one side are short and on flip side are long, on account of which they are exceedingly frail.

III. LITERATURE REVIEW

Thus it has been studied and observed from literature that Ordinary moment resisting frames (OMRF) structures and Special moment resisting frame (SMRF) structures are part of ductility of structure. Special moment resisting frame (SMRF) structures behave well in earthquake than Ordinary moment resisting frames (OMRF) structures hence response reduction factor is playing major role. From past work it is observed that comparison of OMRF and SMRF is executed but strengthening and increasing stiffness of OMRF is not done.
Anupam S. Hirapure et. al. (2017) In this study behaviour of the structure having various structural configurations like Ordinary moment resisting frames (OMRF), Special moment resisting frames. The deprived performance of Ordinary moment resisting frame (OMRF) in previous tremors suggested that, the distinctive

design and particularizing is required for elastic behavior in seismic zones of high earthquake (zone III, IV & V). For this purpose, a G+7 storey Reinforced concrete cement (R.C.C.) regular building are analyzed for Ordinary moment resisting concrete frames (OMRCF), Special moment resisting concrete frame (SMRCF) framing configurations in seismic zone II, III & IV according to Indian codes. For Ordinary moment resisting frame (OMRF) edifices the escort lines of I.S. 456-2000 and the design, detailing of reinforcement are executed as per which make the structure less tough and ductile in comparison of Special moment resisting frame (SMRF) structures. The earthquake resilient design should be grounded on lateral strength as well as deformability and ductility ability of structure. For adequate toughness and ductility to resist the severe earthquake shocks without collapse, in the Special moment resisting frame (SMRF) structures beams, columns, and beam-column joints are proportioned and detailed as per IS: 13920 (2002). Thus it has been studied and observed that Special moment resisting frame (SMRF) constructions perform well in earthquake than Ordinary moment resisting frames (OMRF) structures.

Although, failure occurred at the loaded corners in most cases, Sneha Meshram et. al. (2016) Reinforced concrete special moment resisting frames are used as a part of seismic force-resisting organizations in structures that are deliberated to resist quakes. columns ,Beams, and beam-column joins in moment frames are proportional and detailed to hold flexural, axial and shearing activities that consequence as a building sways over multiple dislocation cycles in strong earthquake, ground shaking, Exceptional proportioning and detailing necessities result in a structure proficient of resisting strong upheaval shaking without noteworthy loss of 8 toughness or strength, these moment resisting casings are called " Special Moment Resisting Frames" because of these added requirements, which increase the seismic resistance in contrast with less inflexibly detailed Intermediary and Ordinary moment resisting frames. The design measures for Special moment resisting frames (SMRF) constructions are specified in IS: 13920 (2002). In this study, the edifices are considered both as Special moment resisting frames (SMRF) and Ordinary moment resisting frames (OMRF), and their recital is compared. For this, the houses are molded and pushover investigation is performed in Structural analysis program 2000 (SAP 2000). The pushover arcs are plotted from the examination results and the performance of buildings as premeditated for various backing situations and infill circumstances. The behavior constraints are also establish for each building using the values found from pushover curve and is investigated.

Saudamini Y. Jambhulkar et. al. (2016) Reinforced concrete exceptional moment frames are used as fragment of seismic force-resisting structures in buildings that are intended to resist earthquakes. Beams, columns, and beam-column joints in moment frames are proportioned and detailed to resist flexural, axial, and shearing actions that result as a building sways through multiple displacement cycles during strong earthquake ground shaking. Special proportioning and detailing requirements result in a frame capable of resisting strong earthquake shaking without significant loss of stiffness or strength. These moment-resisting casings are called "Special Moment Resisting Frames(SMRF)" because of these added requirements, which enhances the seismic resistance in contrast with less severely detailed Intermediary and Ordinary moment resisting frames. The design standards for SMRF constructions are given in IS: 13920 (2002). In this study, the houses are designed both as Special moment resisting frames and Ordinary moment resisting frames, and their respective performance results are compared. the buildings are exhibited and pushover exploration is implemented in Structural Analysis Program 2000 (SAP 2000). The pushover curves are drafted from the analysis observations and the performance of buildings is premeditated for numerous support environments and infill surroundings. The behavior constraints are also established for each structure using the values acquired from pushover curve and is reconnoitered.

IV. NEED FOR THE PROPOSED WORK

today the earthquake engineering community believes that there are four virtues of an earthquake-resistant structure. These are:

Sufficient strength – capacity to resist earthquake forces

Adequate stiffness – capacity to not deform too much

Large ductility –capacity to stay stable even after a damaging earthquake

Good configuration – features of building size, shape and structural system that are not detrimental to favorable seismic behavior..

V. OBJECTIVE OF THE WORK

The key objective of the existing study are as follows:

To model structures for analyzing multistoried frames having Special moment resisting frame (SMRF), Ordinary moment resisting frame (OMRF) configurations.

To convey the analysis of the nominated structures in seismic zone II to zone V.

To analyze even and uneven construction and find out most promising one.

To make a relative study with the aid of outcomes like bending moment, shear force, nodal displacement etc.

To provide structural engineers with a guideline on the economy aspect that could be acquired using comparative analysis of both having Ordinary moment resisting frame (OMRF) and Special moment resisting frame (SMRF).

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