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Comparative Study of Performance based Pushover Analysis of Tall Structure

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I. INTRODUCTION

Pushover analysis is a relative analysis method which gives the result close enough to predict the behaviour of the tall structure under earthquake loadings in which the structure is subjected to uniformly increasing lateral forces with a stable and constant height-wise distribution until a target displacement is hit. This method of analysis comprises of a set of sequent elastic analysis, overlap to relate a force-displacement curve of the comprehensive structure. The method start witj creatiob of two or three dimensional model which comprises of bilinear load deformation diagrams or tri-linear load-deformation diagrams of all lateral force resistive elements and weight loads are applied originally. A predetermined lateral load pattern is distributed across the building height is applied[[The lateral forces are increased up till few members yield. The structural model is altered to account for the decreased stiffness of yielded members and lateral forces are again raised up till more members yield. The method is continued up till a controlled displacement at the top of building attain a cerain level of deformation or structure becomes unsteady. The roof displacement is obtained and then plotted with base shear to obtain the global capacity curve.

The pushover analysis can be carry out as force-controlled or displacement-controlled. In the pushover method (force-controlled) in which All load combinations is applied are already known, i.e, force-controlled procedure is used when we known loads (such as weight loads). Also, in pushover procedure (force controlled) few numerical difficulties that influence the accuracy of results take place because target displacement can possibly related with a very small positive or a negative lateral stiffness since mechanism is developed and P-delta effects.

As we all known the hinge properties in SAP2000 are of three types.These are default 1) hinge properties 2) user-defined hinge properties and 3) generated hinge properties. for this method we can assign only default hinge properties and user-defined hinge properties to frame elements. after assigning these hinge properties to a frame element, the program automatically generate a separate hinge property for each and every hinge.

II. LITERATURE REVIEW

Vojko Kilar and Peter Fajfar (1998) They performed the pushover analysis of building structures in a very simplified way. They also presented a method which is very simplified method for non linear static analysis of building structures exerted by uniformally increasing horizontal loading (Push over analysis) is presented. Step by step analysis and computation is done to find a relative relationship between the global base shear and top displacement. The development of plastic hinges all over the building in between the steps of the procedure is monitored. For a seven storey reinforced concrete frame wall building this process is used.the structure is used as symmetrical and in asymmetrical form for the analysis results. They found that the proposed procedure is very much raltive to practical solution and can be used for practical analysis and earthquake resistance building can be designed using these techniques and existing structures can also be evaluated

V.S. Tsiggelis et al. (2008) they performed a comparative study between the spectral pushover analysis and static & modal pushover analysis. They additionaly evaluated a more simplified procedure for guessing seismic demand for structures also known as spectral pushover analysis. A parametric study for planer and spatial is done to evolve seismic deamands using spatial pushover analysis considering: (a) The nonlinear static procedure for analysis of structure(b) the model pushover analysis for the structure (c) the SPA for the frame and (d) the nonlinear response history analysis for the structure. They have done analysis for a non symmetrical nine storey building structure of planer frame as well as a set of monosymmetric building structure of single storey with dissimilar inertial characteristics of structures and eccentricity of structures were used in the analysis for 20 recorded ground motions by applying all the above mentioned method. From the comparative study ithas been shown that, as much as planer frame is concerned, it has been found that for all the approximate method the magnitude of errors are equal.For single storey building the results produced by the NLRHA and SPA are exact same.

A.S. Elnasha (2001)For earthquake applications he applied inelastic pushover analysis.for earthquake design and assessment the potential of static inelastic analysis is acknowledged, especially inherent shortcomings is observed in contrast under scaled forces with elastic analysis. On study of inelastic application of static (pushover) analysis he found crtical issues and the obtained results with their effect was estimated. Areas were explored in which

the method are more applicable to the estimation of dynamic response of possible developments. For a fully adaptive pushover method inelasticity , geometric nonlinearityof structure , full multi-modal, spectral amplification and period elongation, within a framework of fibre modelling of materials were analysed and preliminary results provided were developed. The developments are made to lead the static analysis results which are closer to inelastic time-history analysis. He made conclusion that improvements of this simple and powerful technique has great scope to increase confidence in its impliment as the primary tool for practice of seismic analysis .

H. Moghaddam and I. Hajirasouliha (2006) they made investigations for predicting the seismic deformation of braced steel frames and pushover analysis to make it more accurate. The accuracy of the pushover analysis was made to represent design spectrum by performing the analysis on 5,10,15 story frames that was verified by conducting nonlinear dynamic analysis which were subjected to 15 synthetic earthquake records. The observations are made that pushover analysis having predetermined lateral load pattern gives doubtful estimations of inter-story drift. To overcome this inadequacy, the idea was proposed for seismic response estimation of concentrically braced frames as the use of simplified analytical model. For this approach, a pushover analysis is performed and a multi strorey frame is reduced to an equivalent shear model. they introduced few supplementary springs to account for flexural displacements in addition to shear displacements to modify a conventional shear-building model. they made the conclusion that compare to nonlinear static procedures the modified shear-building models have a better estimation for the nonlinear dynamic response of real framed structures

R. Hasan et al. (2002) he performed Push-over analysis for performance-based seismic design of structure. For a performance-based design of building frame subject to earthquake loading he studied a simple computer-based techniques for push-over analysis . The technique used in the analysis is based on the conventional displacement method of elastic analysis. the standard elastic and geometric stiffness matrices for frame elements (beams, columns, etc.) are progressively modified by successful usage of a plasticity-factor which measures the degree of plastification, so that under constant gravity loads calculations for nonlinear elastic–plastic behavior and incrementally increasing lateral loads can be done .

For material inelasticity due to both single and combined stress states the calculations are made for model behvaiour and this provides the understanding and ability to monitor the progress in plastification of frame elements and structural systems under developing intensity of earthquake ground motion. The proposed analysis technique was used and distinguished for two building framework examples. Two working examples are presented which provide the push-over analysis providing very important information for the performance-based seismic rehabilitation of existing steel moment-frame building structures. In all the other results, the overall ductility demands are used as a basis for checking confirmity with global ductility limits, the ductility demands for interstory serve to recognize the existence of soft stories,

The proposed push-over analysis procedure can be used for performance-based seismic design of new steel moment-frame buildings as a effective design tool.

III. PROBLEM FORMULATION

Nowadays in earthquake prone zones consideration of frequency and intensity of earthquakes are taken for designing building structure because the failure can lead to loss of life also as property which can impact the economy of the country. Structures ought to be analyzed and checked time to time for his or her structural integrity and resistance to earthquakes.for earthquake resistance structures the analysis will be through with the assistance of properly defined strategies and softwares regarding the topic.

In this study we will perform pushover analysis on different multi-storey buildings without shear walls and with shear walls if the failure case occurs , the model of building of 5,10,15 and 20 storey are used .then the results

Obtained will be compared and displacement are calculated .and pushover curves are obtained

The main aim of this study is to understand the behavior of Reinforced Concrete framed structures of different height under earthquake loading by using nonlinear static procedure (NSP) or pushover analysis in finite element software “SAP2000”.and the Comparative study made for different models in terms of base shear, displacement, performance point.

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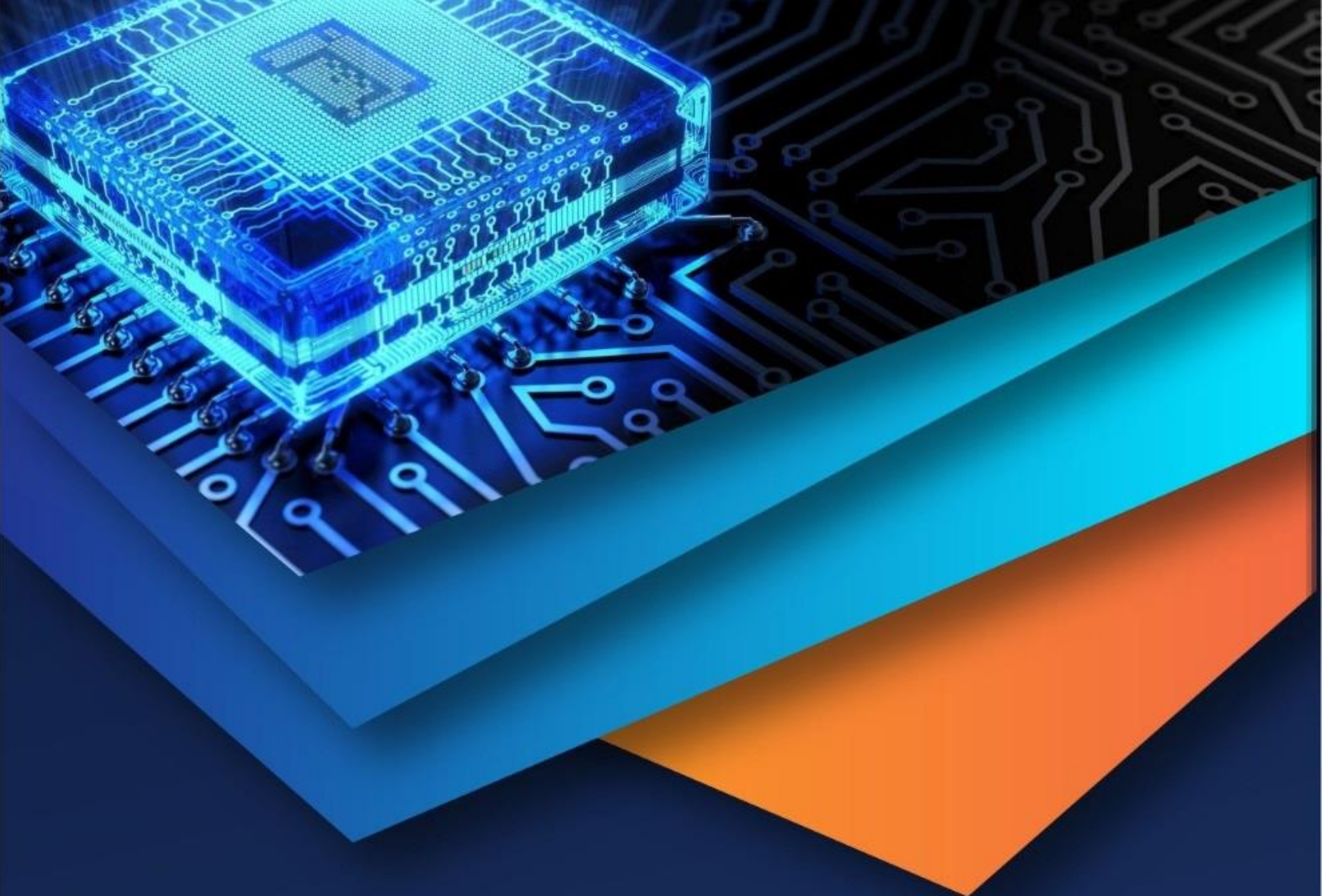

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