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A Review on To Evaluate Behavior of Bridge for Varying Pier Height and Span Using Dynamic and Analytic Techniques.

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Abstract— *One of the most crucial components of an integrated transportation system is a bridge, and having one in the case of an earthquake is crucial to everyone's safety. The management group started investigating various techniques for constructing bridges under seismic stresses in order to prevent bridge collapse. They are vital to a city or region's economy because they make it possible for first responders to get to them in the event of a seismic catastrophe. Because of its affordability, ease of use, and durability, reinforced concrete (RC) bridges are the most often utilised kind of bridges globally. In fact, a lot of research focuses on how they behave while under seismic stress. This study looks at how various structural characteristics, such as height and kind of continuous rock, affect the seismic reaction. As a result, several models of continuous girder multi-span bridges with various geometric characteristics are considered.*

Keyword*: Bridges, SAP2000, Time History, Response Spectrum, Unequal Pier.*

1. INTRODUCTION

Consideration for seismic stresses is sometimes lacking in the design and construction of bridges. Furthermore, as long as the models function within the elastic limit, linear elastic models employed for bridge measurements are still valid. The elastic system is insufficient to assess the model if it responds in excess of the elastic limit. This causes an overestimation of how much seismic force the building can absorb. As of right now, engineers are not able to assess the current bridges or their strengthening using any kind of generic guidelines.

1.1. Bridge Pier

The purpose of the bridge's piers is to sustain the loads on the superstructure and move them to the foundation. Wind loads, water pressure, and impacts from vehicles are just a few examples of the vertical and horizontal loads they can sustain. The kind of support, relative stiffness, and stability and expansion of the support arrangement of each pier will all depend on the superstructure loads applied to it.

Uneven footed bridges are those that are supported by piers that vary in height. Such bridges supported by uneven piers require complicated and challenging earthquake design. There are two types of special piers: long piers and short piers, like bridges. A column is considered short when its length to minimum length ratio is less than 12, while a line is considered long when its length to minimum length ratio is greater than 12. This example demonstrates that small struts typically lead to brittle shear failure, hence reducing their ductility, whereas long struts typically break in the ductile bending mode.

2. STATE OF DEVELOPMENT

Camilo Perdomo, et. al. (2017) The study investigated four iterations of the algorithm and changed the original GPA used in buildings for the bridge model. By comparing the irregular outcomes with the "winning" result, two straight lines with various horizontal and vertical irregularities are utilized as research data to validate the procedure and assess the GPA algorithm's correctness. Approximation from NTHA. The target spectrum's reflection time, which varies according to seismic danger, will be considered when assessing the method's accuracy for both low and high seismic demand. Furthermore, the GPA outcomes were contrasted with the commonly utilized NSP (volumetric spectroscopy). The case study's findings demonstrate that the bridge GPA algorithm is a more accurate predictor of NSP alternatives and is appropriate as the NSP technique for seismic evaluation of bridge structures. It also shows high agreement with NTHA results.

Themelina S. Paraskeva and Andreas J. Kappos, et.al. (2009) The fundamental concept is to substitute a suitable deformation model that provides an elastic response during

the earthquake phase for the elastic model. It is next examined for two actual connections using the suggested MPA approach. The first model is the 638-meter-long, multi-story Krystallopigi Bridge, which has piers that vary in height, a broad curving design, and many methods to link the piers to the bridge deck. The second type, a three-span, 100-meter-long Bridge, is one of the contemporary highway building projects in Europe. Usually, variations in voltage are the cause. Response spectra, "standard" repulsion (SPA), MPA, and, for a small number of spectrally matched people, nonlinear response history analysis (NL-RHA) were used to evaluate connectivity. For the majority of applicable earthquakes, the maximum inelastic deck displacement is well-estimated by MPA. Nevertheless, when the first mode's contribution to the bridge reaction is minimal, SPA is unable to accurately forecast the inelastic deck displacement of the bridge.

T. S. Paraskeva, A. J. Kappos and A. G. Sextos, et.al. (2006) details on lengthy connections that are now in place and built in compliance with earthquake rules; We used three nonlinear analytic techniques, including THA, to analyse it. Comparative measurements of bridge response show the bridge modal pushover method's viability and potential, as well as comparing its accuracy to results from other inelastic approaches. Over the past ten years, nonlinear static (pushover) analysis has gained popularity as a method for building seismic evaluation. Its primary cost-saving benefit over not using time history analysis (THA) is, however, outweighed by its inability to sample the meaningful response. Although there has been some interest in expanding the push approach to account for more modal effects, very little research has been done on bridges and most studies have been conducted on buildings.

Yongliang Zhang, Xingchong Chen, et.al. (2020) This paper proposes and verifies an enhanced group foundation pushover analysis model to quantify the group effect using quasi-static testing. The development model simulates soil lateral resistance, lateral friction, and load using basic concepts. To simulate the impact of alterations in the group's axial force on its elastic-plastic characteristics, the PM (axial load bending moment) plastic hinge model is presented. In the stress-relationship, the group impact is considered by lowering the soil's lateral resistance. Discussed were pertinent aspects of the foundation pile's negative attributes, such as the distribution of plastic hinges, pier height, stirrup ratio, pile longitudinal reinforcement ratio, and soil mechanical parameters. Further information provided to assess the seismic performance of the soil group includes the ductility coefficient of change, resistance increase coefficient, and stability values. For instance, a 32-meter-spanning beam-only railway bridge's foundation pile underwent numerical study. The findings demonstrate that training alone does not define a group's final strength. Because of this, the mass impact is significant for assessing the railway's seismic performance in relation to the foundation mass.

Reza Akbari, et.al. (2012) For continuous concrete, a number of fragility curves with varying levels of stability are built. There are eighteen bridge configurations known, ranging from pseudo-irregular patterns to regular patterns. One might suppose that the geometric imperfections of these bridges change as pier height does. Each of the eighteen bridge models' constituent piers had analytical fragility curves created for it utilising a nonlinear analytical model and the relevant 60 ground motion package. There is discussion of the connection between earthquake usage, bridge regularity, and the ductility requirements for bridge pier displacement. The bridges most vulnerable to damage are typical bridges, whose short piers should make them more prone to collapse, according to a comparison of the fragility curves. The study discovered that regular and irregular connections may be categorised using the fragility curve.

T. Isakovic, M. Fischinger and P. Kante, et.al. (2003) Bridge earthquake analyses have often employed the single degree of freedom (SDOF) model, particularly in more recent times. more typical. and more, more, more loud. The correctness of this formula, however, is still up for debate (for example, 8 equals 2 in Eurocode). Particularly in "uniform models," the use of variance, force, and the degree of freedom model can result in less-than-ideal outcomes. As a result, the authors suggested a model that suited the SDOF model well and provided a precise description for the constant. Certain viaducts throughout Europe have had their seismic reaction examined. Numerous variations on the fundamental model have been employed, utilising both elastic and inelastic seismic analysis techniques. Multiple degrees of freedom (MDOF) and single degree of freedom (SDOF) models were used to analyse the response's variation. The response is deemed incorrect and the SDOF model is inappropriate if this disparity is substantial. One way to assess the validity and regularity of the SDOF model is to use the "regularity test." The comparison of several photographs derived from the same kind of static analysis forms the basis of the index. With the use of this measure, the primary determinants of the viaduct's transient reaction were located and examined.

Kocaeli Üniversites (2016) Due to its location in the planet, our country is vulnerable to earthquakes. Because of this, the structure's seismic performance has an impact on the economy of the nation. Both accurate analysis and predictive analysis are available for analysing seismic patterns. Many people believe that "historical time analysis" is the best approach. The two most used approximation techniques

among the others are the "modal superposition approach" and the "equivalent static seismic load." Using either linear or nonlinear form, modal superposition and time history analysis are dynamically based techniques. This study examines the performance of high-rise reinforced concrete structures using the modal superposition method and the time history approach. This study employed the finite element approach to assess the performance of five, ten, and twenty storey reinforced concrete buildings. The historical analysis employed five distinct earthquake records. Using the study findings, it is possible to assess how well the prediction approach predicts behavioural traits as the number of retailers rises.

Onur Merter, et. al. (2013) Structure analysis techniques employ either nonlinear or linear elastic static and dynamic analytical methodologies. Geometric nonlinearity and material behaviour above the speed limit are considered in the nonlinear analysis approach. A nonlinear dynamic analysis, sometimes referred to as a nonlinear time history analysis, makes use of recorded or synthetic ground movements. This study used seven ground sound recordings from various Turkish soils to perform linear and non-linear dynamic analyses of six- and ten-story reinforced concrete frame structures that were primarily developed in accordance with Turkish seismic design rules. However, a static examination, sometimes known as a push analysis, of the frame is required. To compare the aforementioned approaches, determine the base shear force and inter-storey displacement ratio as the analysis findings.

Markanday Giri, et. al. (2019) Currently, every structure must have large spans; thus, installing slabs is the only method to address this issue from a structural standpoint. On many parts of the structure, removing beams can have a big effect. After doing data inquiry for this study, it was found that the plates' work was also lost. The response spectrum approach helps determine the lateral force applied on the structure. analysis in the midst of a seismic event. This page discusses curtain walls as well. The essay concludes with a discussion of examples that were produced throughout the literature review.

Nikos D. Lagaros, et. al. (2015) The seismic resistance of structural structures should be suitable estimated for design or assessment purposes utilising different times of different alternatives in the ground for different seismic threats. measured in order to establish its level. The choice of soil has a significant impact on the efficiency and precision of the survey or design process. For the sake of design and assessment, we give an overview of time-history seismic analysis here.

Waseem Khan, et. al. (2014) This study presents the findings of an extensive investigation of the seismic behaviour of dampers at various seismic acceleration frequencies installed in the EQ Altadena, EQ Lucerne, EQ Pomona, EQ Smonica, and EQ Yormo buildings. & Without Any Dumper. In order to assess the performance of various models with dampers up to the ninth floor area, dampers up to the fifth floor, and no models at all, the suggested way is to install dampers on the ninth and fifth floors of a nine-story frame building. absorbers of shock. Within the nine-story skyscraper lies SAP2000 V15. Installing dampers on the building frame from the foundation support to the fifth floor and from the foundation support to the ninth floor can reduce the maximum displacement, maximum foundation shear force, and maximum acceleration, according to the negative history of the IS1893 2002 frame model. Similar to a typical frame.

Andrei M. Rein horn, et. al. (1997) Time history analysis, monotonic static nonlinear analysis, and static equilibrium analysis with simulated inelastic effects are the analytical techniques that are now available to designers. This study demonstrates that some basic analytical procedures have been produced by equating the huge inelastic nature described by the force-deformation characteristics with the seismic demand represented by the response spectrum. These techniques are in addition to time history analysis. Accurate measurement of the complex response of velocity and maximum displacement is possible for single-degree-of-freedom (s.d.o.f.) systems and roughly multiple-degree-of-freedom (m.d.o.f.) systems. This method, which will be published in the future, is comparable to the response evaluation procedure suggested by NEHRP in 1996.

N. Gopala Rao, et. al. (1988) Two locations give direct boundary formulas for the elastic and inelastic analysis of two-dimensional reinforced concrete structures. The first section discusses the expansion of the boundary approach for elastic analysis of issues involving reinforced concrete on both sides. It was discovered that the steel rods extended over some locations, thus an initial voltage was utilised using the iterative technique to accommodate for inconsistencies. The purpose of this technique is to address stress issues in the anchoring region of mono-reinforced beams and pressurised concrete components. It has also been demonstrated that the same method may be applied to issues when the region experiences thickness variations. The outcomes are contrasted with the FEM findings. This article's second section presents an expansion of the boundary approach that uses the rising iterative method to analyse fractures in reinforced concrete use the starting stress model. Utilised are the energy-based scattering approach and the diffuse scattering idea. Included is the energy output from metal. This approach works well with cases from the

literature that have finite and experimental aspects. The outcomes of the current analysis and the current measurements are nearly in accord.

J. T. Boyle, et. al. (1980) As noted in the crucial area, one of the most difficult issues facing engineering analysts is the analysis of pipelines operating in settings with large local inelastic deformations. It is beyond the capabilities of present computer technology to analyse in full the spatial complexity of even the most complicated systems using finite element methods. Thus, keeping things simple is crucial. This article's goal is to present a thorough examination of inelastic pipe engineering analysis while attempting to pinpoint the locations where pertinent and trustworthy data may be found.

Jie Li et. al. (2023) Wave height enhances the maximal dynamic reactivity of wave crests and troughs. Waves' increasing impact on SP and BP is proportional to the well's depth. The positive response of SP and BP rises with increasing wave height and water depth because of the integration of waves and currents. When running at varying speeds, the maximum value of the wave crest's dynamic response rises as the speed increases, whereas the maximum value of the wave trough's dynamic reaction falls as the speed grows. The dynamic reaction that occurs when waves and currents come together is not the same as the dynamic response that occurs when waves and currents separate. The dynamic response reaches its largest value at the crests and troughs of the waves, suggesting that the waves continue to play a significant role in the wave field even in the presence of current. Specifically, the following are the ways in which water influences BP's favourable response: Pier top displacement is greater than pier bottom shear force and bending moment; Water has the following effects on the dynamic field SP: Pier top displacement > pier bottom displacement + pier bottom bending moment. Inadequate cutting.

S.S. Law et. al. (2004) We looked at the concrete's damaging behaviour in the truck. Bridges were modelled as continuous Euler-Bernoulli beams that just sustain lift at either end, and vehicles were modelled as moving or as four-degree-of-freedom systems with linear suspension and basic tyres. In order to depict the position of the cracks in the fire line, the damage that represents the open crack pattern or breathing pattern may or may not vary as the load increases. Increased power. Truck loads was applied to T-section reinforced beams in order to assess the fractured structure's performance. The simulation research also examines the effects of other factors including road roughness and vehicle speed. It also uses dynamic deviation, relative frequency shift (RFC), uncertainty frequency shift (AFC), and lines to indicate the degree of learnt responses to comprehend these factors. Connections to the damage pattern, like breathing or open cracks.

Myungjae Lee et. al. (2020) In this study, a full-scale model was made and the flooring close to the pier in the field was simulated in order to conduct non-destructive testing and develop a safety measure. We investigated the impact of load on stability by subjecting all scaffolding models to a load group of 0–250 kN. Impact was employed in the direction of the bridge axis, the bridge length, and the outer section of the piers to analyse the behaviour of the bridge piers according to the impact direction. The top of the pier is the same as the impact height. Simulated scour was one metre deep on the ground side adjacent to the pier foundation. To gauge acceleration during impact, one uses an accelerometer. We use the Fast Fourier Transform (FFT) to determine natural frequencies as overhead and pulse direction. Additionally, the impacts of the natural frequency of the resultant scour were investigated, and the first, second, and third modes—vibration and torsion, respectively—were analysed at various levels in accordance with their behaviour. Additional loads and scour often impact the first kind. Utilise the second kind to assess the piers' stability and the third type to ascertain the scour's direction.

Y .P . Pawar et. al. (2016) Over the years, numerous bridges have employed steel beams to support concrete piers as bridge piers to create the superstructure. Since 1945, the quantity of connected bridges has greatly expanded. After World War II, Germany's steel scarcity pushed engineers to use the greatest industrial design when building numerous bridges and damaged structures. Numerous studies have shown that bridges are the strongest structures when compared to other types of structures, and different steels and beams have been constructed and examined using a variety of techniques. Software for designing engine-girder bridges. The main goal of this project is to do beam analysis utilising SAP2000 software. For this reason, it is advised to use three different kinds of light beams to link the wires in this project.

G. D. Lakade, Y. P. Pawar, et. al. (2015) This article's information can serve as a roadmap for seismic design in the future, taking into account various operational goals and pertinent seismic consequences. The primary benefit of design based on performance is the ability to forecast seismic performance with less risk. Finally, the capacity to calculate the response through the use of effective, quantitative models (e.g., voltage, filter, transfer field, acceleration) will determine how reliable this strategy is. As performance-based design in earthquake engineering advances, a worldwide design will be possible, allowing for the performance-based design of different performance and risks while accounting for the compatibility of structures, non-

structural materials and procedures, and ground treatment techniques. contents.

Y. P. Pawar et. al. (2016) the strongest bond when weighed against other bridges. Datalink determines which steel and concrete beam is superior by calculating the bending moment of T-beams using a variety of software programmes for design and analysis. efforts to validate and analyse hyperlinks using SAP 2000 software. Software and manual techniques are used to determine the T-beam's static analysis. The software's analysis of the patterns compares its output with that of manual computation.

Ganesh Lakade et. al. (2019) In most workplaces, vibration is not as much of an issue since workers accept it as a necessary component of production. business setting. The performance of mechanical devices, particularly predictive ones, depends on the rigorous control of vibration in mechanical equipment, such as rotating machines, in compliance with professional and academic standards and industrial norms. triumph over Early identification of these activities and sensitive work environments helps minimize vibration issues and preventable expenses. At this point, it's a good idea to think about other ways to prevent vibration issues. Design and particular techniques for regulating building speed, such dividing floors from the rest of the structure or utilizing mitigating tools like tuned-size dampers, might be some of these answers.

3. CONCLUSION

For the sake of the literature review, this article exclusively considers earlier research. For the current long, curving bridge. A comparison of the bridge's numerical reaction demonstrates the effectiveness and potential of the modal thrust approach. Building seismic evaluation now uses nonlinear static analysis as a technique, although its applicability is restricted to models with finite starting response. Regular bridges sustain the most damage, while short piers are more vulnerable to damage. Each pier's superstructure load will dictate the kind, arrangement, and relative strength of the foot bridge's permanent and fixed bearings. The legs of these bridges must be shorter in order to prevent damage since the connector legs are continuous. In order to ensure that the design or research process is accurate and efficient, soil selection is crucial. Several studies have shown that bridges are stronger than other types of structures, and several steel products and beams have undergone various design and analysis techniques. Software for designing engine-girder bridges. Beam analysis with SAP2000 software will be the main emphasis of this research. Therefore, several bridge spans that can be used to link bridges were determined for this project.

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