STATIC AND DYNAMIC ANALYSIS OF SEISMIC PRESSURE ON THE RC BRIDGE

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***Abstract*: After the Bhuj earthquake in 2001 & the occurrence of the earthquake in Kashmir in 8 Oct 2005 derives the much attention on the seismic assessment of existing building. Many literatures are available based on the seismic evaluation procedures for the RC buildings using the non-linear analysis. But the seismic evaluation of the bridges is not taken out effectively while the bridges play an important role as a structure. The Aravali series of rock formation having the quartzite rock formations in the Delhi NCR region. In this region mainly alluvium soil is found near the Yamuna and the area near to the Delhi. Hindon River is the branch of the Yamuna. The site of the Hindon River having the sandy alluvium soil which is perfectly suitable for the bridge foundation. Bridges extends horizontally with its two ends restrained & that makes the dynamic characteristics of bridges different from buildings. For doing the seismic evaluation of the bridge at the time of earthquake open sees software is used. The open sees model is used to describe the various performances of the bridge. By comparing the various results obtained through the non-linear analysis (static and dynamic). The concrete developed by Chang and Mander is used for assessment. This new material is used in assessment enhance the existing bridge capacity against the bridge element damage during the seismic activity. From the various evaluation results it is worked out that the bridge structure under the designed seismic vibrations is safe and the results obtained from this pushover analysis is verified through the results obtained from the dynamic analysis.**

***Keywords*: Hindon River, Alluvium Soil, Earthquake, Bridge Structure**

Introduction

The Bridge is considered the most important structure of engineering in modern times. The bridge that connects these two countries is separated by a body of water or a plot of land separated by any obstacles on the land. Hence, in severe circumstances, its structural integrity is also found in the Ghaziabad area where the Indus River Bridge is situated in the fourth earthquake zone and is strong enough for mild and high-intensity earthquakes. There have also been many earthquakes in the region's last ten years (5-6, 6-7) with different densities, and sometimes 7-8 earthquakes, which were not built according to various aspects of the design posing a threat.

The architecture of the superstructure in bridges depends on a number of charging requirements. During the chassis performance period, various types of loads may occur. This frequent presence of differing degrees of earthquakes contributed to the system being developed to enhance the 2002 seismic architecture framework (i.e. 1893, part 1). In fact, structural engineers do not have ideal guidance to define structural requirements for building bridges during earthquakes, however. Several research papers on building overrun analysis have been published but little work on reinforced concrete bridges has been done. The aim of this research is to use non-linear static analysis to conduct seismic assessments on established river bridges and to equate them with nonlinear dynamic analysis tests. The work was done with the assistance of Open Sees. The Hendon River Bridge is a continuous triangular bridge with a pre-tensioned square form beam and tightened steel cables. Its gross length is 114.9 m, and the height of bending is 8.05 m and 8.66 m respectively. The bridge model is required for non-linear bridge research. The columns during the earthquake are the most impactful component of reinforced concrete bridges

Activities on Planet. Column performance is therefore described in detail, and enough models are prepared during seismic activity. Research and model various aspects of different elements of the bridge (such as curved columns). (Including Map of the site). The results obtained were used for seismic analysis, static analysis, and dynamic analysis of construction.

Finite Elements Model for Nonlinear Materials

The software is split into various process modes according to the difficulty to reduce the sophistication of product strategy. This is:

(1) General prototype
(2) form of discrete finite elements.
(3) Method of finite element microscopy.

Such classifications of models aid research the numerous sections of the system in depth. The following two approaches are used for analysis:

(1) A movement-based formula.
(2) A Versatility model.
Both methods are used to analyze the framework, and both provide objective responses at various (i.e. global and basic) levels.

Among the two approaches, the force-based approach is a stronger system relative to the displacement-based approach, since both representatives are subject to equilibrium in the force-based method, which can be implemented without displacement. The purpose of cloning the shake design is to integrate the nonlinearity into the group of penises. Their debut reigns in the 1960s. Many of the elements of the system have longitudinal elasticity in these examples, and the plasticity sensitivity is centered on the revolving spring or fluid axis. The greatest curiosity has been stimulated by presenting all systems as a simple and consistent form, and a system for displaying only restricted nonlinearities. Cuts the model's computing power and versatility. Then again, based on some uncertainties, the focus is on the benign model, expanding the risk of errors or deficiencies in the results of the examination.

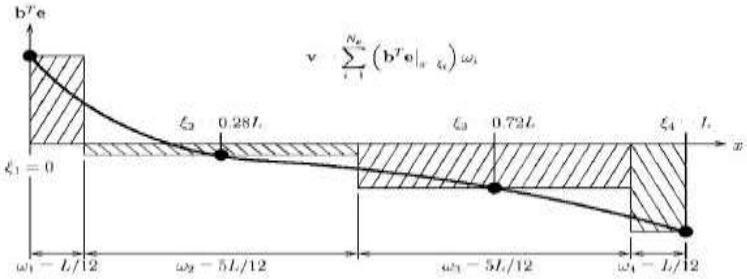

Fig Application of gauss – lobatto analysis quadrature

Excellent knowledge is also required to solve the key issues that come with it: there is little question that since the early days there has been no dispute that the longitudinal loss of movement in the system circulates in the framework, which is in reality a crucial region of plastic. Assessment of the duration of this plastic axis; many installations are proposed in literature, one of which calls for concern as to whether the plastic axis can be installed in a particular area. Determine the correct relationship between stress and anxiety because of the nonlinear zone. In components dependent on power, when the part is closed and discharged the torsional duration is highest. Use of the orthogonal Gauss-Lobato in this way is appropriate. In fact, since the components are closed, this system focuses on integration. A graphical representation of the Gauss-Lobato four-point orthogonal criterion, in which the product is evaluated by excitation and remains consistent throughout its length. The highest multi-order boundary neatly combined by the Gauss-Lobatto orthogonal law is that those two commands are less than the Gauss-Legendre orthogonal. For the horizontal bending portion of a horizontal curvature without a segment stack, due to the direct curvature distribution in vector e and the direct input capability of the curvature minutes in network b, several squared boundary limits arise in the integration. As a result, Gauss-Lobato should be mentioned at least three major incorporation points along the component's straight curve. The nonlinear physical response to energy-based beam assembly is the focus of Gauss-Lobato's four to six groups, to be precise. The distribution of the transverse forces inside the entity is in equilibrium, which falls within a small, nonlinear set of constituents. In the primary framework, the fundamental force is transformed by interpolation into a transverse power.

Case Study of the Bridge

The Bridge is situated in Ghaziabad, India, the United States. Here, it plays a significant role in connecting the Indian capital, Delhi, to the UN region. And other areas. The location of this bridge is 28,6700 north, and 77,4200 east, according to the geographical coordinates. In the ncr area of delhi the aravali sequence of rock formations includes quartz rock formations. Alluvial soil is found mostly in the area near Yamuna and close to Delhi. Yamuna is a tributary of the Hendon River. Except for the Hendon River high water level in Delhi, its water state is the same as that of Yamuna in Delhi. It is always at the lowest point. The site on the Hendon River contains sandy soil, which is very suitable for bridge building.

The bridge has 3 extensions and uses a post-tensioning mechanism to make prestressed concrete. The bridge's overall length is 114.9 m, divided into 3 extensions: 36.5 m, 47.2 m and 31.3 m. There are two columns on the left with 6.96 m of height, and two columns on the right with 8 m of height.

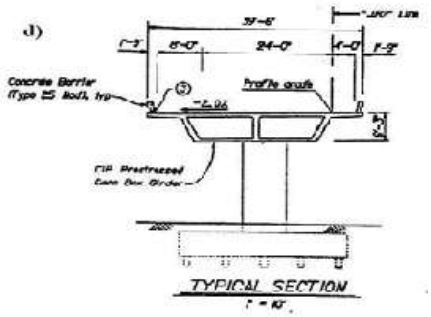

Fig. Typical section

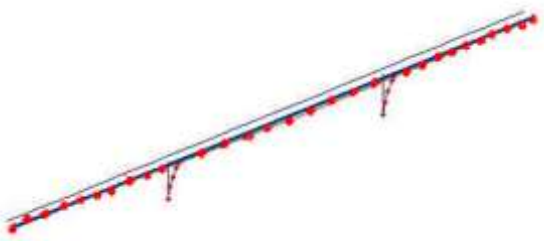

Fig Bridge model with nodes

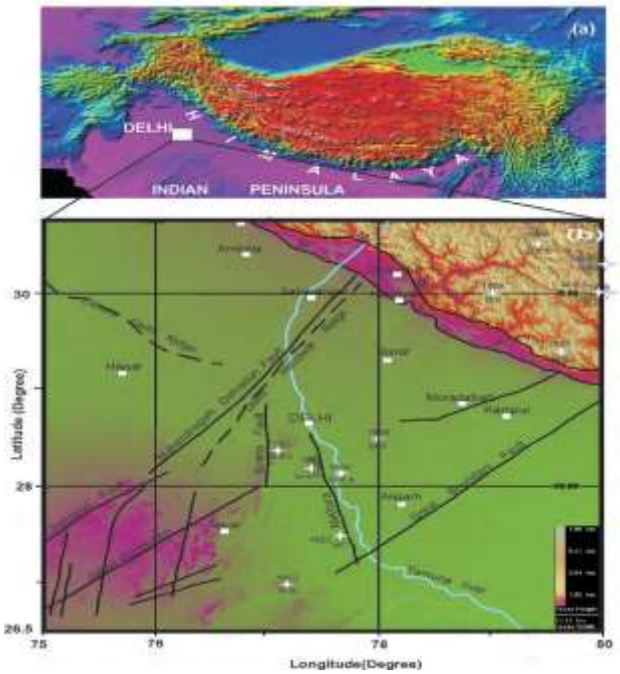

Fig. Location of the faults present in the NCR region.(GSI)

Open Sees Software

With the help of open software developed by the Pacific Earthquake Engineering Research Centre, non-linear analysis is carried out. The mobile platform drop shape is an interactive framework used for seismic engineering simulations. The pretreatment and graphical analysis of seismic evaluation is quite basic, and the research of finite element of building models can be conveniently carried out thanks to the usage of this software.

Is object-oriented programming, operating on TCL is a language focused on software, and it is essentially a language similar to commands. TCISH and Wish are the stages of TCL translators working on finite element analysis, including:

Modeling-Creating contracts.
Research-Want to carry out the study.
Output Specifications-Specifies what is displayed during analysis on screen.
The software is mainly used in science, and is conveniently accessible from the website of Berkeley University.

Results & Discussion

The thrust curve between the general basic shear force and the bridge displacement was obtained in the final stage of the analysis. Displacement at the middle of the bridge is recorded. Node 16 is in the middle of the deck of the Bridge. The load on each platform is first measured during pass analysis in node 11 in the left column, and node 21 in the right column. After that, the whole bridge comes under the burden of the earthquake, and all elements are affected by the vibration, which is the pier and the roof. Different analyzes are performed using sealed concrete which gives accurate results and the most ideal result is concrete sealed result 02. To support the beam, Opensees uses articulated elements, so that this function can be used for analysis. Two non-linear fixed linear analyzes were conducted simultaneously, the small pier was a high pressure pier, and due to the load, the displacement curve of the two piers was obtained. Concrete material was obtained by using different results to analyze the drift. Since the observations obtained in the figure are difficult to properly analyze, an analysis of the drift is required. Let's consider a 1-foot difference = 3.5

per cent of the height of the beam as a consequence, the concrete parameters are as follows in terms of the curves of the two piers collected.

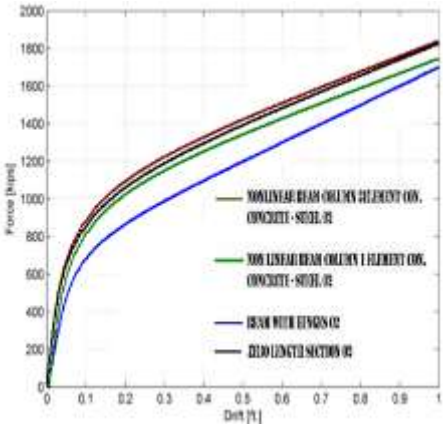

Fig. Left Column Pushover

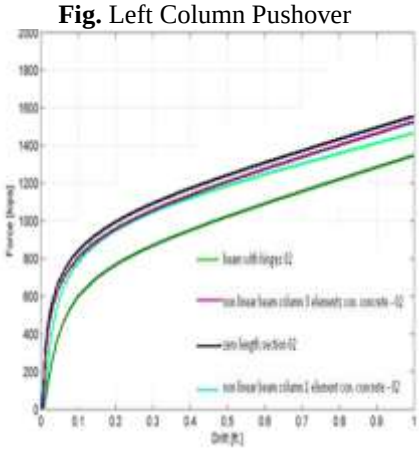

Fig. Right Column Pushover

After the nappe curves were obtained from the two platforms a nappe analysis was performed of the entire structure. The seismic loaded inversion analysis curve for MTS. Hardness is typically accomplished dependent on the structure's technical defects, which are used with the plastic components being delivered. However, this is restricted to flexible behavior and does not contribute to the final displacement, that is, it has nothing to do with plastic behavior.

Conclusion & Future Scope

This work includes an analysis of pressure on the bridge to the RC. The bridge is located in Ghaziabad, India, on a Hindu River. This bridge plays an significant part in connecting Delhi with Uttar Pradesh. This is an ordinary triple span bridge, built from prestressed concrete on site, which is a platform-supported crossbar. The Bridge's overall length is 114.9 m, the right pier is 8 m, while the left pier is 6.96 m. The first mandatory research is to establish the seismic characteristics of the bridge construction and the average seismic vibration likelihood is around 5%. The spectrum is designed with 5 per cent damping flexibility according to Caltrans seismic design criteria. Accelerometer readings come from the library of NGA (Next Generation Attenuation), which roughly parallels the elastic range blocked by 5 per cent. The latest research focuses primarily on the usage of pillar components for force-based beams. Their formulas quickly address condensed elements of plastics and dispersed elements of plastics. There is also talk about integrated iterations of non-linear materials. Use an open program to create the finite element model when using this program, because the main extension is given to the input unit when using this program, because the program is designed according to the customary American system which differs from the unit used in India. The facts have demonstrated that the different elements of the open display library are very useful in modeling bridge piers. In this essay, the propulsion modeling is used to model the overall bridge layout, as well as to model elements such as pavement and surface analysis. Different thrust curves were obtained after analyzes under seismic vibrations. These curves reflect the ratio of the simple shear force to the central displacement curve. This curve reflects numerous pattern structures. The bridge performance points can be obtained after obtaining the pressure curve, converting it according to the ATC 40 amplitude spectrum. The tests from this conversion demonstrate that the bridge system won't do this. From the point of execution It's far from apparent failure points but due to the tensioned steel strip element, the concrete cracks can do some harm to the bridge 's components. The system was exposed to seismic displacement in historical background research, collected with a hinge feature model from the beam acceleration diagram, and the overall read offset and relative shear intensity was measured and performed once. The results of the static and dynamic analysis of the readings obtained are all

plotted on the same graph. Consequently, the results obtained from the dynamic analysis verify downwards the pressure curve results.

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