ANALYSIS OF ARCH BRIDGES CONSIDERING LOADING USING ANALYSIS TOOL: A REVIEW

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Abstract- *Bridges are the structural components that are required for the efficient movement of Trains and locomotives and under earth embankment for crossing of water course like streams across the embankment as road embankment cannot be allowed to obstruct the natural water way. Bridges can be of different shapes such as arch, slab and box. These can be constructed with different materials such as masonry (brick, stone etc.) or reinforced cement concrete. Since bridges cross through the earthen embankment, these are subjected to resist traffic loads as the road carries and therefore, required to be designed for such loads. The cushion depends on the rail profile at the bridge location. For analysis relevant IRCs are required to be referred. The structural elements are required to be designed to withstand maximum bending moment and shear force.*

In this paper we have reviewed articles related to Arch Bridges, analysis tools and non destructive testing.

Keywords- Staad.Pro, Axial Force, Storey Displacement, Shear Force, Bending Moment

I. INTRODUCTION

Bridges are an important component of all types of modem transport systems. In the half of the past decade technical knowledge of earthquake engineering increased considerably. Performances of bridges have vital importance before and after an earthquake event. Hence it must remain functional even after dissipation of seismic events to endure relief as well as security purposes. Substructure of the bridge is more susceptible to damage and its performance must be good during ground motion because the substructure bridge superstructure to the foundation. Hence failure of substructure leads to collapse of the entire bridge which may turn to disaster. There are many design codes and guidelines available worldwide for the seismic design of bridges. These guidelines are helpful for improving the seismic capacity of the bridges. Despite many advances made in the design of the earthquake Resistance Bridge some gaps still remain in many areas due to the unpredictable nature of ground motion. For the analysis of bridges under seismic excitation simplified method (response spectrum method) or time history analysis and pushover analysis are used

II. TYPES OF ARCH BRIDGES

Corbel arch bridge – Even though Corbel arch does not function in the same way as true arch bridges (they are not conveying forces across the arch), they can be created to look very similar like them. They are made by laying successive layers of masonry or stone with each having successfully larger cantilevers.

Aqueducts and canal viaducts – To bridge large distances, ancient romans built series of supports which were connected with stone arches. These series of arched structures were butt not only in one layer like ordinary bridge, but with several layers that could reach very impressive heights.

Deck arch bridge – Common arch bridge in which deck is situated on top of the arch.

Through arch bridge – Arch Bridge in which deck is not situated completely above the arch, but it travels in one part below it and is suspended to it via cables or tie bards. Famous Sydney Harbour Bridge is the best example of this design.

Tied arch bridge – Also known as bowstring arch bridge, it incorporates a tie between two opposite ends of the arch.

II. LITERATURE REVIEW

Yutao Pang and Li Wu (2018) the exploration paper examined the impact of delayed repercussions on seismic reactions of multi-range supported cement (RC) spans utilizing the delicacy based mathematical methodology. For that reason, a constant brace RC bridge class containing 8 extensions was chosen dependent on the factual investigation of the current RC spans in China. 75 recorded mainshock-delayed repercussion seismic arrangements from 10 notable tremors were chosen for the examination. To represent the vulnerability of demonstrating boundaries, a uniform plan strategy was applied as the testing technique for creating examples for delicacy investigation. Delicacy bends were then evolved utilizing nonlinear time-history examination as far as the pinnacle curve of the dock section and removal of orientation. At long last, the framework delicacy bends were determined by carrying out Monte Carlo reproduction on the multi-ordinary appropriation of two parts.

Results expressed that for the RC constant extensions, the impact of delayed repercussions can be unsafe to both scaffold parts and framework, which increments both the part delicacy of the removal of orientation and seismic curve of dock areas and framework delicacy. Also, it is smarter to assess the weakness of the bridge framework, instead of just surveying the impact of delayed repercussions dependent on a solitary part.

Luca Pelà et.al (2009)the research paper presented practical methodology in order to evaluate the seismic safety level of existing masonry arch bridges. Two particular cases were considered namely a stone masonry bridge with brick-made vaults and a stone masonry bridge with concrete-made vaults. The structural analysis was carried out by making use of a simplified inelastic procedure: the structural capacity, obtained by a nonlinear static (pushover) analysis, was directly compared with the demand of the earthquake ground motion described by an inelastic response spectrum, in order to estimate the seismic performance of the bridges.

The methodology defined in the present work seems to be suitable for a careful seismic assessment of existing bridges without resorting to specialised packages. In particular, the seismic safety of the S. Marcello Pistoiese Bridge and the Cutigliano Bridge was demonstrated by ascertaining that their displacement capacities are higher than the seismic demands of the sites in which they are located, for the whole range of the masonry material properties that bound the actual ones.

Rahul Gangwar et.al (2020) This paper gives a similar investigation of R.C.C.(Reinforced Cement Concrete) Girder and P.S.C.(Prestressed Concrete) Girder, which incorporates the plan and gauges of R.C.C. furthermore, P.S.C. Support of different ranges. The point of this work is to examine R.C.C .brace just as P.S.C. support and afterwards analyze the outcomes. The thought is to prevail in a prevalent end in regards to the predominance of the 2 procedures over one another. R.C.C individuals are normally utilized for private just as business structures and limited ability to focus. In R.C.C. profundity of support increments with the expansion in length because of avoidance limit. To deduce, R.C.C support will be reasonable for little to medium range anyway the pervasiveness of prestressed substantial brace is unquestionable for broadened ranges.

The conclusion from the outcomes expressed that Reinforced cement footers are by and large weighty. They generally need shear fortifications other than the longitudinal support for flexure. Prestressed cement footers are lighter. By giving the bent ligaments and the pre-pressure, an impressive piece of the shear is stood up to. In built-up cement footers, high strength concrete isn't required. However, in prestressed cement footers, high strength concrete and high strength steel are essential. Supported cement footers being gigantic and substantial are more reasonable in circumstances where the weight is more wanted than strength. Prestressed cement footers are truly reasonable for weighty burdens and longer ranges. They are thin and creative medicines can be effortlessly given. Breaks don't happen under working burdens. Regardless of whether a brief break happens when over-burden, such a break gets shut when the over-burden is eliminated. The avoidances of the prestressed cement footers are little. Prestressed substantial areas are more slender and lighter than RCC segments since high strength cement and steel are utilized prestressed concrete.

MelikaNaderi and Mehdi Zekavati (2018) the aim of research was to investigate the seismic behavior of the bridge. Nonlinear dynamic analysis was used for simulation of seismic behavior of the bridge. Regarding the complexity in mechanical features and geometry of the bridge, precise evaluation of seismic behavior is a difficult task. Therefore, experimental analysis was used to increase the modeling precision.

Bridge numerical modeling was used by combination of FEM and DEM. This combinational method is a powerful tool for crack and failure simulation. Friction was also used to increase the precision of analysis for accurate simulation of Osmanli Bridge seismic behavior, combination of FEM and DEM was used. After 5.7 s from the earthquake the creation of cracks started in both lateral walls. At the end of the earthquake cracks were created in the arch which is about 1 cm. due to the applied acceleration. The blocks would be thrown away. Discrete simulation was used for simulation of Senyuva Bridge. A part of right lateral wall was destroyed during the earthquake. The left lateral wall also damaged but was not destroyed. The blocks of the right wall were thrown along z direction. The growth of arch cracks increased during the earthquake and the maximum crack had the side of 4.5 cm.

Wei-Xin Ren et.al (2010) the exploration paper introduced a pillar curve fragment gathering system for the dynamic displaying and examination of curve spans. It is exhibited that the proposed shaft curve fragment gathering methodology is productive with the upsides of fewer component numbers and enough exactness. It is normal that this strategy can be a successful methodology for the further unique reaction investigation of curve spans under a wide range of dynamic loads like tremors, winds and vehicles.

HayderAla'a Hasan et.al (2012) the primary objective of the research was to investigate the damage in the typical reinforced concrete bridge pier under seismic loads of intensity same as that happened in the area around Iraq and see whether it will support such an earthquake or not. The whole bridge substructure and the surrounding soil were modeled using ANSYS. The case under study was modeled using the SOLID65 concrete element, which is used for modeling three dimensional solid models with or without rebars. The soil model is 18m long, 9m width and 17m depth. The distances between center to center of piles are equal to 4.5m. Since the diameter of piles is 1.5m, therefore distances between the centers of piles and the edges of soil volume is 4.5m which is equal to three times the diameter of piles.

IV. CONCLUSION

Past researches suggested the use of a finite element modeling of the Bridges with various material. Implementation of FEM is found beneficial in order to develop a relation between software and practical condition.

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