A Study on Seismic Analysis of Straight Bridge and Skew Bridge Structure

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Abstract- *A bridge is a structure built to tackle physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. Non-linear analysis is required due to geometric irregularities of the bridge structure, including curves, long spans or significant total length, multiple expansion joints, massive substructure components, or unstable soil conditions (Krishnakanth, 2015). From above mentioned irregularities this thesis mainly focuses on geometric irregularities like curves and long spans. The study of Skew Bridge's behavior under the time history load is important for the areas which are prone to the earthquake.*

Keywords- Non-linear analysis, Skew bridge, Long span, Time history load, Geometric irregularities.

I. INTRODUCTION

The purpose of evaluating the bridge structure damage is not only to determine the effect of damage to its remaining service life and load-carrying capacity, but also to determine the causes of defects. Generally, the damages occur in concrete bridges under unacceptable loads can be classified into cracks beneath the beam and slab, additional settlement of bridge slab, extra vibration under passing loads, corrosion of steel reinforcement, and spalling of concrete (Sadeghi and Fathali 2007). In the present study, Longtan truss-Skew concrete bridge is inspected by the team of inspection in School of Transportation Science and Engineering/ Bridge and Tunnel Engineering/ Harbin Institute of Technology (HIT). The objectives of this study are to investigate and classify the damages of Longtan truss-Skew concrete bridge structure and to evaluate the structural performance of bridge structural members by adopting static load test.

II. STATE OF DEVELOPMENT

Ali Fadhil Naser, Wang Zonglin This paper deals with the Longtan truss-Skew concrete bridge is located near the mountain of Longtan in the east of Jilin City in the east north of China. This bridge crosses the Songhua River. The damages inspection of the bridge structure must be taken each member to evaluate the structural performance. The main objectives of their study was to inspect and classify the damages of Longtan truss-Skew concrete bridge structural members, to determine the compressive strength of concrete, corrosion of steel reinforcement, to check the leveling of deck, and to evaluate the structural performance of the bridge structure members. ANSYS version10 software was used by them to analyses the internal forces.[1]

Dai Yu-wena, Wang You-yuana This paper deals with an optimizing calculation method to optimize the cable initial force of cable-stayed Skew bridge while in Skew rib cantilever erecting. The Skew rib cantilever erection of cable-stayed Skew bridge has the construction process of cable removal. It is different in cable stayed bridge or Skew Bridge. Therefore, common influence matrix cannot be used directly. And the optimizing method in the paper was developed by modifying influence matrix.[2]

T.E. Ford et al This paper deals with the Numerical models of masonry Skew bridges required for accurate determination of ultimate failure loads. Finite element analysis (FEA) has been surprisingly underused in this area perhaps because the main features of masonry behaviour, namely strongly non-linear loss of stiffness through cracking and failure of an Skew by the formation of a mechanism, are hard to model using conventional continuum elements, familiar to industrial users. This paper describes models of masonry Skew bridges built within a basic FEA package, basing numerical results on field data from tests to destruction on Skew bridges.[3]

E.C. Kandemira et al. This paper deals with the retrofitting process of an existed upper-deck type steel Skew bridge located in the Ground Type I which include good diluvial ground and rock. Since the bridge was been designed by the old code of 1980, it was in need of retrofitting. As a first step of dynamic response analysis, the dynamic characteristics along both longitudinal and transverse directions were analyzed by eigenvalue analysis to figure out the natural behavior under the dead load. The nonlinear dynamic response analysis is conducted under Hyogo ken Nanbu earthquake occurred in 1995. After detecting the critical sections as abutments, the viscous dampers are

installed to increase the seismic performance of the bridge under severe earthquakes.[4]

José de Jesús et al. This paper deals with the seismic response of a concrete deck type Skew bridge with linear and nonlinear fluid viscous dampers (FVDs) subjected to the ground motions in terms of time-acceleration data including near field effects using 2D analytical models. FDVs were placed on both ends of the deck connecting the superstructure with foundation. The force velocity relation for FDVs Can be expressed as f equals to c into v n; parametric study was aimed to identify the optimum dampers was carried out.[5]

P. K. Chatterjee et al. This paper deals with the dynamic analysis of Skew bridges traversed by a single moving load using a mixed approach in which the advantages of continue and lumped mass methods I've been combined. The bridge deck is idealized by a flat plate supported by struts of equal stiffness. The applicability of the method eid studied by comparing the results with those obtained by the lumped mass method. The results in this study indicate that for a relatively stiff Skew supporting a flexible deck the proposed and the lump mass method shows good agreement.[6]

B. K. Lee et al. This paper deals with the Skew on equations governing free in plane vibrations of curvature Skews which are derived and solve numerically to obtain frequencies and mode shapes of sinusoidal parabolic and elliptic geometry. their analysis affords a method for computing Skew frequencies and mode shapes that is Efficient and robust. their method accommodates configuration of variable curvature and mixed and restraints such as hinged clamp. Medical results show that for a set of Skew parameters and matching end constraints the earth geometry parabolic sinusoidal or elliptic has little effect of the frequency parameter.[7]

Seung-Eockkim et al. This paper deals with the performance based design method of three dimensional Steel Skew bridge using practical in elastic nonlinear analysis in this design method separate member capacity checks after analysis are not required because the stability and strength of the structural system and its component member can be rigorously treated in analysis the geometric nonlinearity was considered by using stability function for beam column members and the geometric stiffness Matrix for Truss members the proposed analysis presented in this research Skew is adequate in assessing the strength when compared with the other approaches the analysis results showed that the proposed method was suitable for adoption in practice.[8]

S. N. Krishnakanth. This paper deals with the design and analysis of bridge design with the help of STAAD.Pro two categories of nonlinear behavior incorporated in the bridge model to properly represent the expected response under moderate to Intense level of seismic demand. The first category consists of inelastic behavior of elements and cross sections due to nonlinear materials stress strain relation, as well as the presence of gaps dampers nonlinear springs in the special Bridge company.[9]

Joan R. Casas et al This paper deals with the reliability analysis on Mega roller Bridge situated in Barcelona. Since the no documentation is available regarding fridge, in order to check the feasibility of bridge to carry the overloaded special trucks was present in the Spanish network the road directorate danish Ministry of Public Work decided to perform the structural evaluation and assessment of the existing structure in face of the actual traffic the expected overload permits as well.[10]

Elizabeth Scheimbmeir. This paper deals with the him determine the influence of different constitutive material laws and non-elastic parameters for masonry on the seismic performance level of an existing triple Skew masonry Bridge which was built world war 2 close to the village of San marcelo in Italy. Seismic evaluation was carried out with the help of DIANA FE software applying the method of static pushover analysis; additionally, a nonlinear dynamic analysis was conducted.[11]

Marine Franetovic et al. This paper deals with the author discussed a new seismic assessment procedure for Skew bridges the linear response spectrum analysis nonlinear static pushover methods combined in this procedure through various assessment levels and appropriate checks according to author criteria for seismic assessment such as the required participation of effective model masses adequate stiffness distribution of spandrel column and determination of reference point for forming capacity curve improved and adjusted for Skew bridges.[12]

Kazuhiko Kawashima et al. This paper deals with the analysis of seismic response characteristics seismic performance of an Skew bridge which was designed in accordance with the traditional static design approach based on allowable stress design method under a strong ground motion recorded in 1995 hyogoken nanbu japan earthquake. He has conducted nonlinear dynamic response analysis the uniform excitation and multiple excitations.[13]

LUO Chaozhuan, et al. This paper deals with the analysis of the dynamic characteristics and seismic response

of the integral abutment curved box bridge (IACBB) automatic iteration of the multimode modal response spectrum (MMRS) is realized by APDL language of the structure analysis ANSYS software according to the IACBB's structural characteristics. The results given by author states that the iterative MMRS is an efficient simplify method, and can be used as an estimating method of seismic analysis for the bridge. And the method provides a reference for future similar structures.[14]

F. Fanous et al. This paper deals with the due to the importance of historical timber covered bridges throughout history, their preservation is necessary. However, conducting an accurate structural evaluation of these types of bridges has always caused difficulties to bridge engineers. This paper summarizes an investigation that was sponsored by the Federal Highway Administration and the USDA Forest Products Laboratory to develop a simple but accurate analytical model to analyze Burr Skew Truss bridges. A three dimensional model that included the splice joints that were used in the construction of the bridge was utilized in the analysis.[15]

III. CONCLUSION

This paper focuses In this report non-linear analysis of bridge is carried out and report covers every important aspect of the analysis. This study includes the analysis of time-displacement, time-velocity &time acceleration results for the given models. The results obtained in this study are representing that the Skew Bridge is having more stability if used with proper geometry. The models used in this study give response for the given time history analysis proves that Skew bridge is having more rigidity under dynamic loading condition.

After studying the bridge models for the results of the displacement it can be found that for given loading the straight bridge of 168m span shows the displacement in x-direction as 21.8mm, and the same result for equivalent Skew bridge is found to be 13.8mm which shows that Skew bridge is having more stability under earthquake loading than that for straight bridge. For the various span of Skew bridge it can be stated that as the span of bridge increases the values of displacement, velocity and acceleration also increases with respect to span in percentage It can be noted, the smaller span size will have more stability regarding displacement, velocity and acceleration response of the structure. Another field of wide research Skew could be the analysis and design of curved bridge with base isolation system for time history analysis. The study of seismic behavior of structural system could be extended using one another software.

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