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ANALYSIS AND DESIGN OF BOX TYPE MULTIBAREEL SKEW CULVERT

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Abstract-*As the numbers of bridges comes up it has become healthy to provide box type multi-barrel skew culvert where traffic moves on the top of continuous slab and water flows through barrels underneath it. Present situation of traffic requirements demand straight alignment of road in view of the fast traffic and this in turn necessities the use of skew crossings. By providing this type of alternatives, bridge span is in direction of road, we can directly provide skew culvert. So there is no need for provide approaches on both side in form of curve which will solve land acquisition problem and project becomes faster and economical.*

Keyword: *Culvert, multi-barrel box culvert, Skew culvert, STADD PRO*

I. INTRODUCTION

A. GENRAL

A bridge is a structure which maintains communication such as the road and railway traffic and other moving loads over an obstacle, namely channel, river or a valley. The structure is termed as a bridge when it carries a road and railway traffic or pipe line over a channel or a valley and an Overbridged when it carries the traffic or pipeline over a communication system like roadways or railways.

B. CLASSIFICATION OF BRIDGE

For the purpose of investigation and cross drainage structures can be grouped into three categories as follows,

1. Culvert and Minor bridge (linear water way up to 30m).
2. Major bridge (lineal waterway over 30 m but on stable rivers and canals).
3. Important bridge (lineal waterway over 30 m but on major rivers or tributaries which are shifting in nature).

C. CULVERT

A culvert is a bridge like structure designed to allow vehicle or pedestrian traffic to cross over the waterway while allowing adequate passage for the water. Culverts are commonly used for ditch relief and also to pass water under a road at natural drainage and stream crossings. Culverts come in many sizes and shapes including round, elliptical, flat-bottomed, and box-like constructions.

According to construction a culverts are classified as follows,

- Slab culvert
- Pipe culvert
- Box culvert

Figure I-2Box culvert

Figure I-1Pipe culvert

D. NEED OF SKEW CULVERT

Skew bridges are necessary when a stream crosses the road at an angle different from 90 degree. Present situation of traffic requirements demand straight alignment of road in view of the fast traffic and this in turn necessities the use of

skew crossings. Bridges in plane form is a parallelogram; the angle obtained subtracting the acute angle of parallelogram from 90 degree is termed as skew angle.

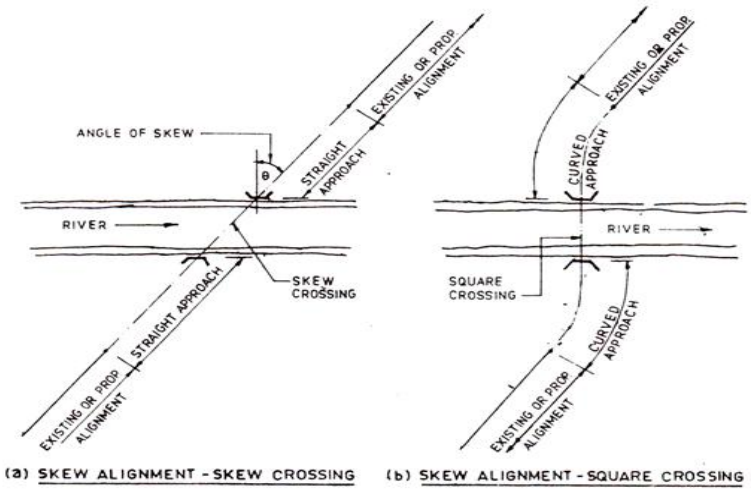

Figure I-3Skew and Square crossing

II. LITERATURE REVIEW

A. EFFECT OF SKEW ANGLE ON STATIC BEHAVIOUR OF REINFORCED CONCRETE SLAB BRIDGE DECKS

- B V Sindhu and S.V Dinesh

• Investigations are carried out on RC slab bridge decks with and without edge beams for a various aspect ratio, skew angle and different type of load using finite element method.

• The results of a finite element analysis conclude that, Dead load, Live load, bending moments and deflections decreases with increase in skew angle, whereas maximum support reactions increases with increase in skew angle and the maximum torsional moment increases with skew angle up to 45 degrees and there after decreases.

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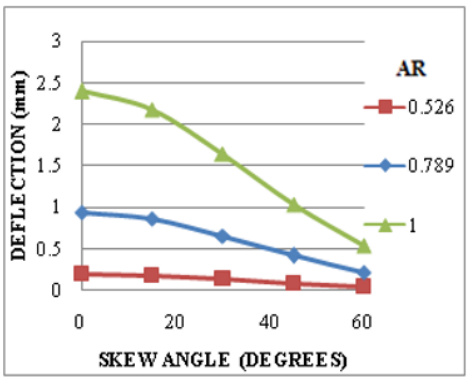

Figure II-2 Dead load with Edge beam

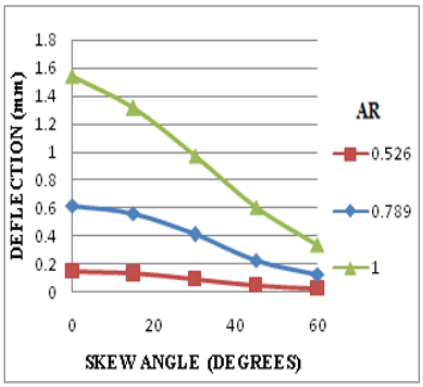

Figure II-1 Dead load without Edge beam

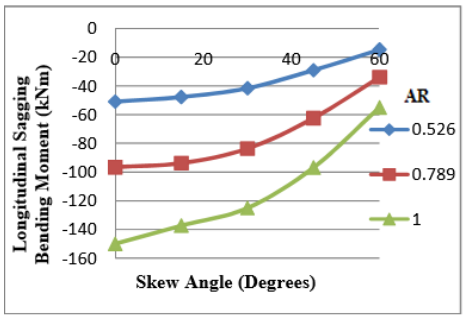

Figure II-3 Dead load with Edge beam

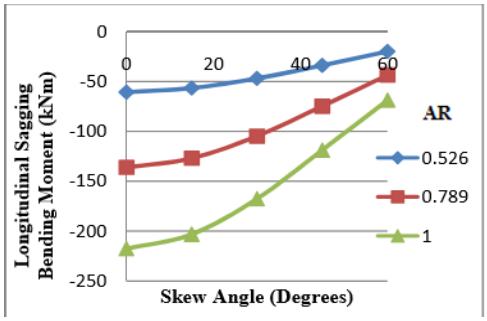

Figure II-4 Dead load without Edge beam

B. ANALYTICAL AND EXPERIMENTAL STUDY OF SKEW BRIDGE MODEL

- Jun Meng and Hamid

This paper describes an experimental study of a skew bridge model conducted at the Federal Highway Administration Turner-Fairbank Highway Research Centre. The objectives of an experiment are :1)To perform a pilot study on the design, construction, testing and data processing of a skew bridge model, 2)To provide experimental data to validate 3D finite element modal developed for a skew bridge, and 3)To conform the applicability of a simplified bridge modal developed for a dynamic analysis of skew bridge. Result for static displacement, natural frequencies mode shapes and damping of the model bridge will be presented. A comparison of the result obtained from these test with those obtained numerically from a finite element analysis and analytically from the dual stick bridge model showed that good correlation is obtained.

C. SEISMIC RESPONSE OF SKEWED RC BOX-GIRDER BRIDGES

- Gokhan Pekcan and Ahmed Mohti

This paper examines the seismic performance of a three-span continuous concrete box girder bridge with skew angles from 0 to 60 degrees, analytically. The bridge was modeled using finite element (FE) and simplified beam-stick (BS) using SAP2000. Different types of analysis were considered on both models such as: nonlinear static pushover and linear and nonlinear time history analyses. A comparison was conducted between FE and BS, different skew angles, abutment support conditions, and time history and pushover analysis. It is shown that BS model has the capability to capture the coupling due to skew and the significant modes for moderate skew angles. FE models should be considered when dealing with very large skew angles (> 30 degrees) in order to capture the higher mode effects.

D. DYNAMIC RESPONSE OF SKEWED MULTI-SPAN STEEL COMPOSITE BRIDGE

- M Hasan and Sakthieswaran

This paper examines the seismic performance of a three-span steel girder bridge with skew angles from 0 to 60 degrees, analytically. The bridge was modelled using finite element (FE) method using SAP2000. Different types of analysis were considered on models such as: modal response spectrum and nonlinear static pushover analyses. Some of the seismic responses of the bridge discussed are: modal stiffness, time period, base shear, deck displacement and bearing and bent column reactions of the bridge. A standard numerical method is employed in the dynamic analysis of the bridge. From the numerical results of the bridge it is observed that the seismic responses of the bridge are significantly affected by skew angles of the bridge. For example, large skewness is likely to increase base shear, deck acceleration and bearing reactions of the bridge, which may cause an increase in axial forces, shears, moments and torques in the supporting bridge piers

III. CONCLUSION

1. Box culvert is easy to add a length in the case of widening of the road.
2. Box culvert is structurally very strong, rigid and safe.
3. Box does not need any elaborate foundation and can easily place.
4. Box of required size can be placed within the embankment at any elevation by varying cushion.
5. Abutment stiffness increases with increase in the skew which significantly contributes to stiffness of the bridge.
6. The deflection of a deck slab is decrease with increasing a skew angle.
7. Longitudinal moment also decrease in skew approach compared to straight approach.

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