RESEARCH ARTICLE OPEN ACCESS

Finite Element Modeling on Bridge Superstructure

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ABSTRACT

With the spreading use of the electronic computer there has been a revolution in strategies of structural analysis, that is normally has been a boon to the engineer. However, it's LED to issue in choices for the engineer once one has got to choose the foremost applicable methodology for a selected downside. Bridge type very important links with the communication system and therefore the ought to build bridges across wide rivers with deposit and securable beds, deep gorges, open seas and grade separators on urban highways, imply the answer of a large number of engineering issues. Bridge analysis and style in any respect over the globe has undergone exceptional changes within the past 20 years. The exaggerated demand for complicated road alignments, advances in technology for bridge analysis and style, are a number of the factors for these developments. Normally the bridge are created straight for simplicity of construction and style, however generally the positioning condition for bridge is such it's uphill to own straight bridge. In such case it's necessary to construct the skew or curve bridge. it's comparatively simple to investigate the straight bridge however once the bridge is skew or curve, the analysis is somewhat troublesome. Analysis of skew or Curve Bridge is allotted mistreatment pc programs that incorporate varied analysis strategies like finite component analysis. SAP 2000 is one among such pc programs that has been employed in gift study for the analysis of bridge structure. In gift study for bridge analysis the finite component methodology is employed. Here, during this study 2 styles of bridge are thought of block bridge and beam kind bridge. within the block bridge 2 styles of configuration are taken specifically skew block bridge and arched block Bridge. For the beam kind bridge skew kind bridge is chosen. In the constant study of skew bridge the skew angle is varied from 0° to 20°. In curve bridge the plane figure angle is varied from zero° to 45° and ratio is taken as 0.5, 1.0, 1.5 and 2.0. In skew block bridge totally different parameters are studied like variation of shear force and torsional moment at acute and obtuse corner of bridge. Variation of most span moment and deflection of bridge ar studied for various skew angles.

I. Introduction

A bridge may be a very important link of communication in any country. A bridge exposes inaccessible areas & is instrumental in development of the world. an outsized variety of bridges are created each year. the range of web sites is more and more difficult the ingenuity of engineers to supply new structural forms and applicable materials. strategies of research have developed equally quickly, significantly with the employment of laptop strategies. as a result of the restriction the out there house and alignment of the traffic system skew, curvilinear bridge decks are being wide used. The accessibility of microcomputers is creating it more and more sophisticated skew, curvilinear and continuous spans, within the past a substantial quantity of theoretical and experimental analysis was needed to develop the look strategies.

Today, many style strategies are developed to such usable kind that, with Associate in Nursing understanding of physical behavior, designer will analyze advanced decks while not recourse to sophisticated mathematical theory. The word associate in Nursingalysis implies the abstract breaking apart of whole into the components in order that one will have an insight into the entire entity. within the context of structural engineering, the analysis sometimes refers to force analysis; a method during which one determines the distribution of force effects or responses, like deflections and bending moments, in numerous elements of the structure. Another less unremarkably used term in structural engineering is strength analysis.

II. *Finite Element Modeling of Bridge Superstructure using SAP-2000*

SAP2000 could be a powerful and fully integrated module for analysis and style of structures supported the static and dynamic finite component analysis. just in case of style, it will style each steel and concrete structures. Non-linear analysis may also be performed by the SAP2000. It options a robust graphical interface in terms of ease-ofuse and productivity. Creation and modification of the model, execution of the analysis, and checking and improvement of the look are often done through this single interface. Graphical displays of the results, as well as time period show of time-history displacements, square measure simply made. The analytical capabilities square measure even as powerful, representing the newest analysis in numerical techniques and answer algorithms. SAP2000 feature refined capabilities, like quick equation solvers, force and displacement loading, non-prismatic frame components, extremely correct shell components, Eigen and Ritz dynamic analysis, multiple coordinate systems for inclined pure mathematics, many various constraint choices, the power to merge severally outlined meshes, a fully-coupled 6-by-6 spring stiffness, and also the choice to mix or envelope multiple dynamic analyses within the same run. The program is structured to support a large kind of the newest national and international style codes for the automatic style and check of concrete and steel frame members. The presentation of the output is evident and laconic. the data is in an exceedingly kind that permits the engineer to require acceptable remedial measures within the event of member exaggerate. Backup style data made by the program is additionally provided for convenient verification of the results. English still as SI and MKS metric units are often wont to outline the model pure mathematics and to specify totally different parameters.

III. *Finite Element Modeling & Analysis of Skew Slab Bridge*

The majority of bridge decks engineered nowadays has supports that don't seem to be orthogonal to traffic directions because of the very fact that the crossings don't seem to be at orthogonal directions. attributable to the increasing restrictions on out there house for traffic schemes and conjointly because of the increasing speed of the traffic, the alignment of the transport system will rarely be adjusted for the aim of reducing the skew of the bridges. This chapter principally deals with the finite component analysis of skew block bridge structure. Normally an oblong block upper deck behaves in flexure orthogonally within the longitudinal and thwart wise directions. The principal moments also are within the traffic direction and within the direction traditional to the traffic. For skew slabs, the force flow through the strip of space connecting the obtuse angular corners and also the block primarily bends on the road change of integrity the obtuse angular corners. The breadth of primary bending strip is that the operate of skew angle and also the quantitative relation between the skew span and also the breadth of the deck (aspect ratio). The areas on either aspect of the strip don't transfer the load to the supports directly however transfer the load solely to the strip as cantilever. Hence, the skew block is subjected to twisting moments. This twisting moment isn't tiny and thus can't be neglected. attributable to this, the principal moment direction conjointly varies and it's the operate of skew angle. Skew has the right smart result on the deck's behaviour and demanding style stresses.

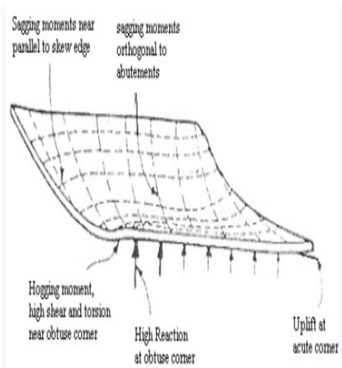

Fig.1 Characteristics of a Skew Slab Deck

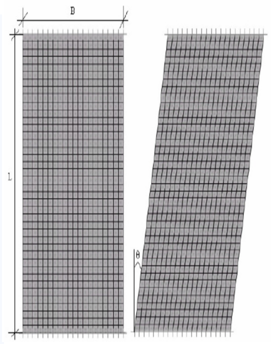

Fig.2 Finite element model of straight and Skew slab bridge

As skew angle increases the shear force distribution at four corners of skew slab bridge are varies. The Fig.3 and Fig.4 are shows the shear force variation of straight slab bridge at 5×10 meshing and at 40×80 meshing. The Fig.4.6 and Fig.4.7 Shows the shear force variation for 20° skew slab bridge at 5×10 meshing and at 40×80 meshing. The unit of shear force is taken as kN per unit length.

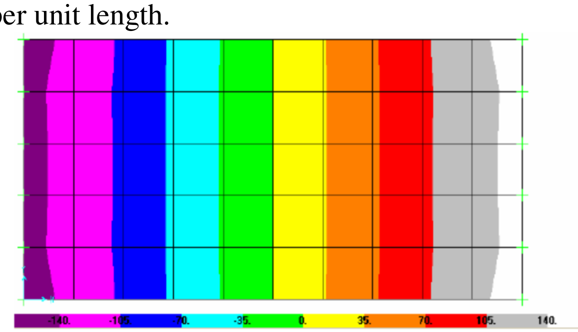

Fig.3 Shear force variation on straight bridge at 5 x 10 meshing

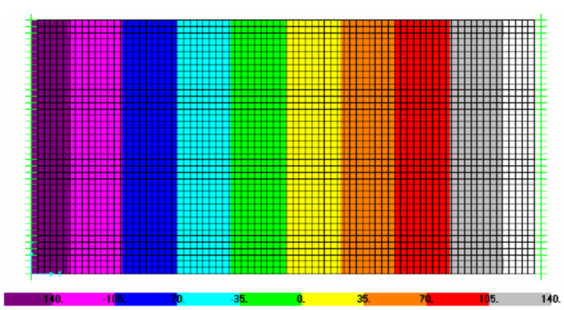

Fig.4 Shear force variation on straight bridge at 40 × 80 meshing

Fig.5 shows the shear force variation of 20 ° skew slab bridge at 5×10 meshing. The Fig.6 shows the shear force variation at obtuse angle of skew bridge.

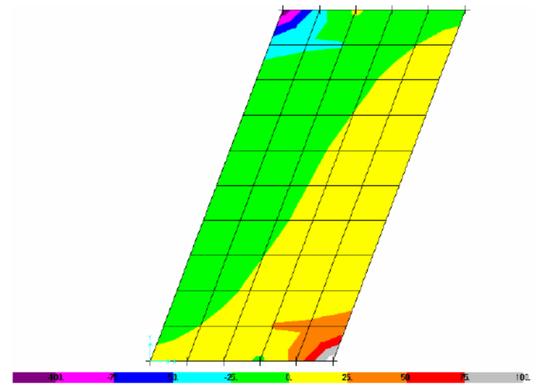

Fig.5 Shear force variation at 20° skew at 5 × 10 meshing

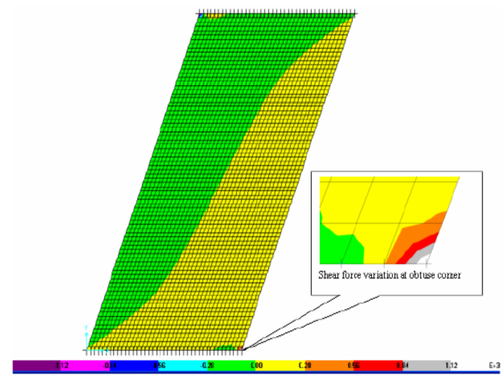

Fig. 6 Shear force variation at 20° skew bridge at 40 × 80 meshing

Torsional moment distribution on straight and skew bridge-

As skew angle increases the Torsional moment distribution at four corners of skew slab bridge are varies. The Fig. 7 and Fig.8 are shows the Torsional moment variation of straight slab bridge at 5×10 and at 40×80 meshing. The Fig.4.10 and Fig.4.11 shows Torsional moment variation for 20° skew slab bridge, at 5×10 and at 40×80 meshing. The unit of Torsional moment is taken as kN-m/m.

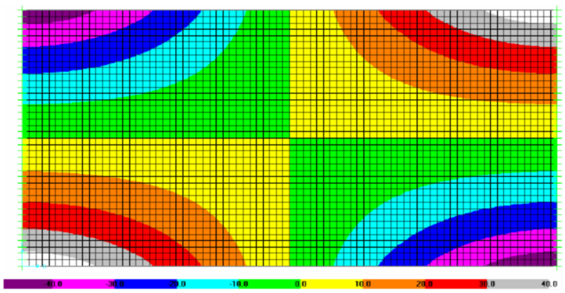

Fig.7 Torsional moment variation in straight bridge at 5 × 10 meshing

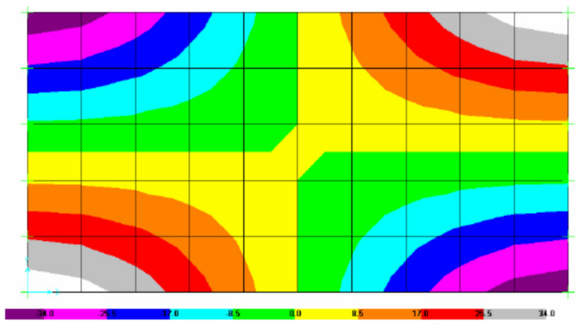

Fig.8 Torsional moment variation in straight bridge at 40 × 80 meshing

Fig. 9 shows the Torsional moment variation of 20° skew slab bridge at 5 × 10 meshing. Fig. 10 shows the Torsional moment variation of 20° skew slab bridge at 40 × 80 meshing and variation of torsinal moment at obtuse corner.

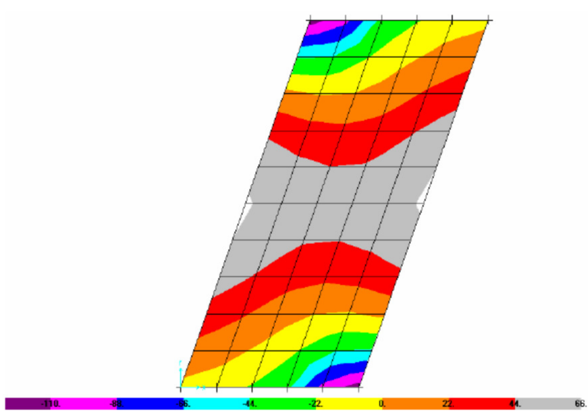

Fig.9 Torsional moment variation in skew bridge at 5 × 10 meshing

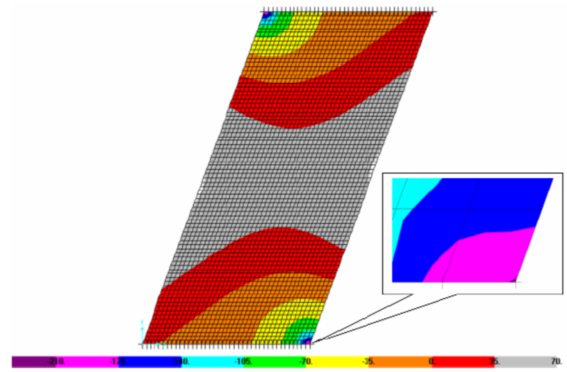

Fig.10 Torsional moment variation in skew bridge at 40 × 80 meshing

IV. Result & Conclusion

In the gift study the finite component analysis of bridge structure, having totally different configuration is dole out to watch the result of varied parameters on behaviour of bridge. to check constant, 2 sorts of bridges are thought of particularly, block bridge and beam sort bridge. In block bridge 2 sorts of configurations are chosen i.e. skew and incurved block bridge. within the beam sort bridge, skew configuration of bridge is chosen. For analysis the SAP2000 software package is employed. totally different issues studied, are as delineated below.

For the skew block bridge the span of bridge is 10m, breadth of bridge is 5m and thickness of block is taken 1m. The block bridge is shapely as each, the straight bridge and skew bridge. The skew angle is varied from 0° to 20° skew angle. There are 2 load cases thought of, (1) uniform load case and (2) vehicle load case. within the uniform load case the intensity of load is ten kN/m^2. For the vehicle load case the bridge is loaded with the class-AA half-track and class-AA container. just in case of class-AA self-propelled vehicle, 2 position of auto ar thought of, vehicle at mid-span and close to the support. For the bridge subjected to class-AA container the situation of auto is taken at middle span

From the work distributed following conclusion square measure drawn.

1. Just in case of skew block bridge high torsional moment and shear force occur at obtuse angulate corner because the skew

angle will increase. Low shear force square measure thrown towards the acute angulate corners as skew angle will increase.

2. Low torsional moment or risk of the uplift at the oblique angle corners as skew angle will increase.
3. In skew block bridge because the skew angle will increase deflection in middle span will increase.
4. Bridge with having the less ratio square measure at risk of offer additional deflection, span moment and torsional moment than the bridges having the upper facet ratios.

V. References

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