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Structural Analysis of I-Girder Bridge and Comparison for Various Loading

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Abstract- **I-beams and plate design in terms of the simple capital value of the superstructure, the advantages of the shape of the boxing beam, such as better appearance and reduced maintenance, may well deserve the evaluation of the boxing beam as an alternative for any bridge in the span range from 45 m to 100 m. For bridges with a significant curvature of the plan, box beams should always be considered. In particular, if more websites are introduced (than would be used with straps), thinner web panels will need more rigidity. Nevertheless, they may still have a lower shear stress limit and be less effective in bending. Wide compression flanges can also be less than fully effective due to bending considerations (plate beam flanges are usually fully effective). In this paper, various bridges of I-brothers are analyzed using BRIDGELINK software.**

Keywords- **I-girder, bridge, traffic, structure and analysis.**

I. INTRODUCTION

Typically, an alternative to a boxing beam requires about the same weight of steel as an I-beam bridge, perhaps a little less if the design is optimized to make the best use of the benefits of box beams. The thickness of the deck will usually be similar for both forms of construction. With box straps, using torsionally rigid beams can often reduce the number of bearings or support positions, and this can lead to a slimmer substructure.

Curvature is easier to achieve with box beams, although the curvature of the beams in the plan is not common in the UK. (This road curvature, as required, can usually be placed in the construction of a beam, making continuous beams from a number of straight sections.) If a true plan curvature is required, either for appearance or because the radius is unusually dense, boxing beams can be much easier to influence curvature and easier to place torsional effects. I-rays need significant transverse tightening in these situations.

II. REVIEW OF LITERATURE

With increasing span length, the pre-stressed concrete beam is more economical than the steel tank, but on span up to 15 meters, the steel beam is cheaper [2-1]. It was studied that the pre-stressed concrete beam from the trapezoidal section becomes popular due to better strength and appearance compared to any other section [4].

The design of the bridge structure consists of two stages. The first stage is a conceptual design, which solves the general form of the structure, and the second - a more detailed structural analysis [5-6]. Careful review and study of the literature indicate various studies aimed at solving problems related to the selection of the superstructure, using the method of work stress. The method of working stress takes into account only service loads, and the strength of the material is not fully used [7-8].

III. MODELING

The modeling is carried out in the BridgeLink software, mentioned as follows.

- Model-I: three span girder – Notional Rating load
- Model-II: One span girder – HS-25 load
- Model-III: Two span girder – HS-25 load
- Model-IV: three span girder – HS-25 load
- Model-V: three span girder – Fatigue load

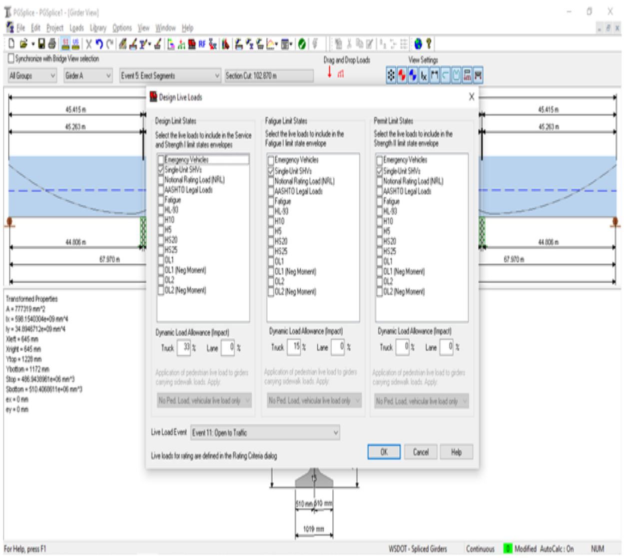

Fig 1. Design live load details of model-III.

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Above figure demonstrates Design live load details of bridge for the case of model-III.

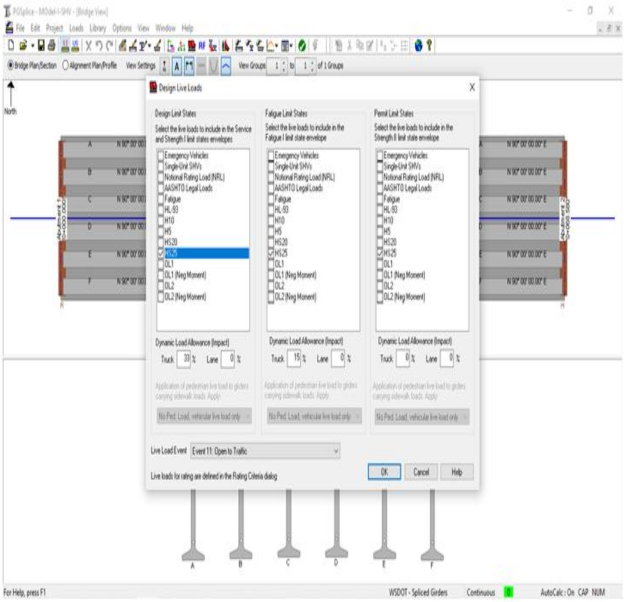

Fig 2. Design live load details of model-IV.

Above figure demonstrates Design live load details of bridge for the case of model-IV.

IV. RESULTS

The analysis is carried out in BridgeLink software and the results in terms of shear force, bending moment and other parameter is obtained as follows.

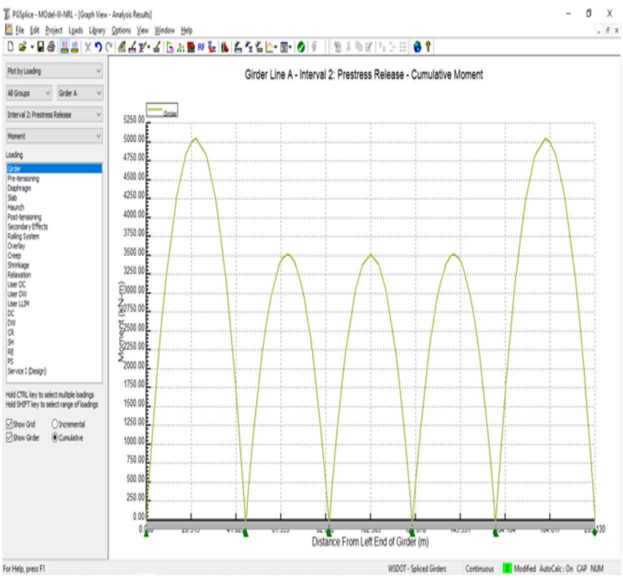

Fig 3. Cumulative moment for the model-I.

From the above figure it is observed that the cumulative moment of the model-I has the maximum value of 5000 kNm.

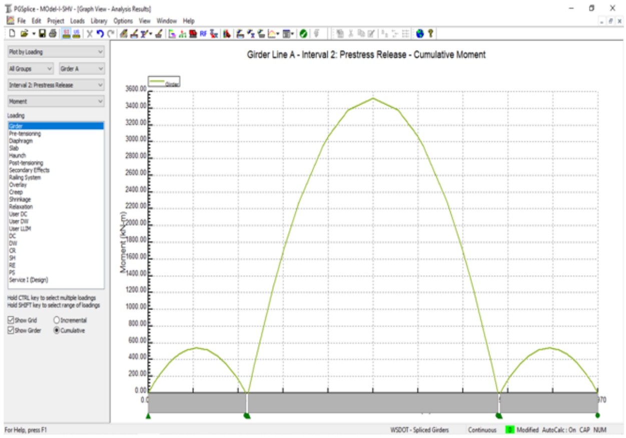

Fig 4. Cumulative moment for model-II.

From the above figure it is observed that the cumulative moment of the model-II has the maximum value of 3500 kNm.

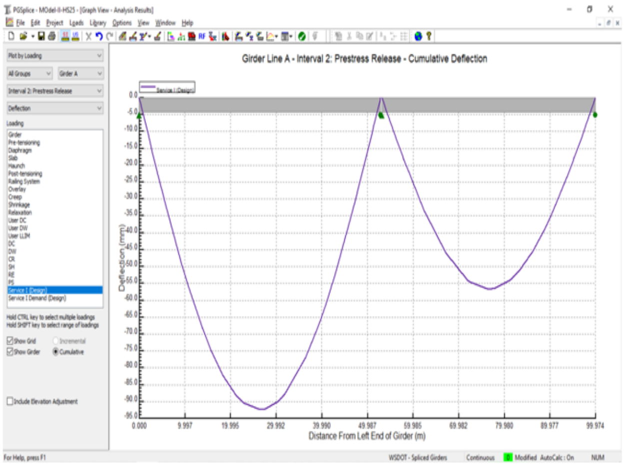

Fig 5. Cumulative deflection for the model-III.

From the above figure it is observed that the cumulative deflection of the model-III has the maximum value of 92.5 mm.

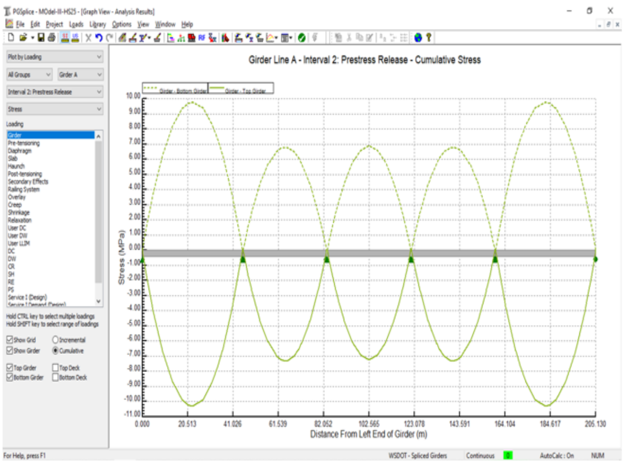

Fig 6. Cumulative stress for the model-IV.

From the above figure it is observed that the Cumulative stress for the model-IV has the maximum value of 10.5 MPA.

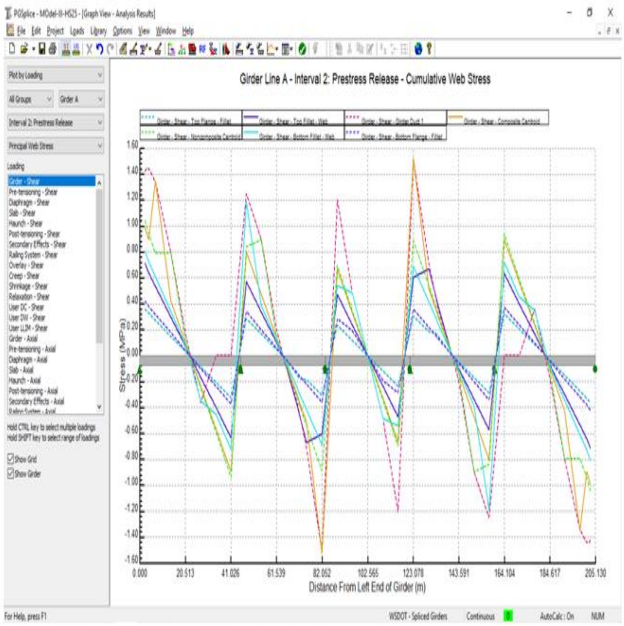

Fig 7. Cumulative web stress for girder-shear loading of the model-IV.

From the above figure it is observed that the Cumulative web stress for girder-shear loading for the model-IV has the maximum value of 1.55 MPA.

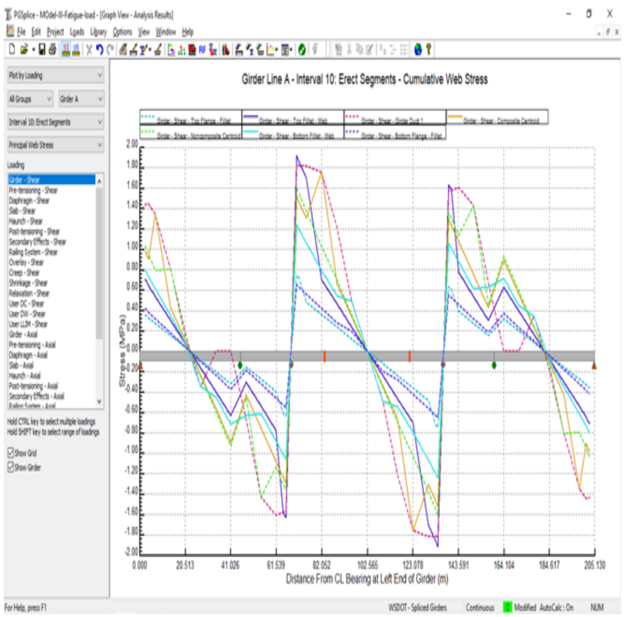

Fig 8. Cumulative web-stress (erect segment interval-girder shear loading) for the model-V.

From the above figure it is observed that the Cumulative web-stress (erect segment interval-girder shear loading) for the model-V has the maximum value of 1.85 MPA.

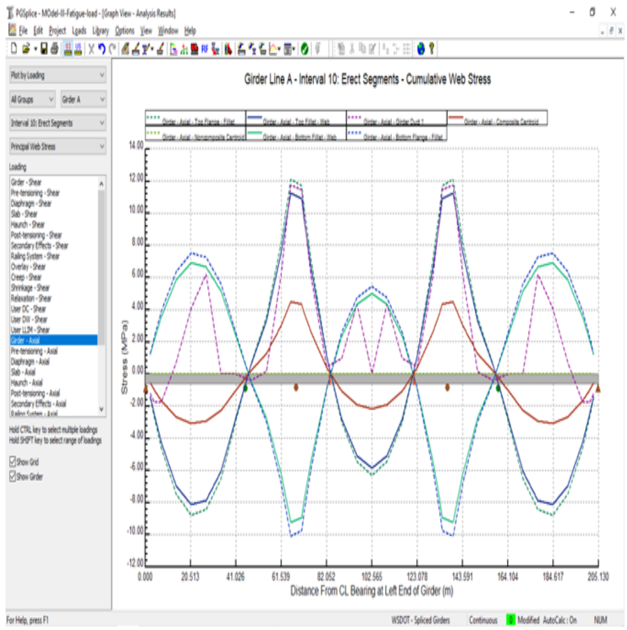

Fig 9. Cumulative web-stress (erect segment interval-girder axial loading) for the model-V.

From the above figure it is observed that the Cumulative web-stress (erect segment interval-girder axial loading) for the model-V has the maximum value of 12 MPA.

V. CONCLUSION

The conclusions from the above study are as follows:
From the above results it is observed that the Cumulative web stress for girder-axial loading pattern of the model-I has the maximum value of 9.0 MPA. Also it is observed that the cumulative moment of the model-II has the maximum value of 3500 kNm.

From the above results it is observed that the cumulative deflection of the model-II has the maximum value of 24 mm. Also it is observed that the cumulative web stress of the model-II has the maximum value of 1.2 MPA.

From the above results it is observed that the cumulative shear of the model-II has the maximum value of 1100 kN. Also it is observed that the Cumulative deflection for stressed tendons conditions of the model-II has the maximum value of 200 mm.From the above results it is observed that the Cumulative rotation for stressed tendons conditions of the model-II has the maximum value of 0.0105 rad. Also it is observed that the Cumulative stress for stressed tendons conditions of the model-II has the maximum value of 30 MPA.

From the above results it is observed that the cumulative moment of the model-III has the maximum value of 6750 kNm. Also it is observed that the cumulative deflection of the model-III has the maximum value of 92.5 mm.

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