Planning and Design of Long Span Bridges

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Summary

The Planning and Design of Bridges is part art and part compromise which is most significant of aspect of Structural Engineering . It demonstrates the creative capability , imagination, innovation and exploration of the Designer .Bridge design is a Complex Engineering problem.

For planning of Bridge at a particular site, it is essential to consider many factors, such as the need for a bridge, the present and future traffic, stream characteristics, subsoil condition, alternative sites, aesthetics and cost. It may not be possible always to have a wide choice of sites for a bridge. It may not be possible to have a wide choice of sites for a Bridge particularly in case of Bridges in Urban Areas & Flyovers .

In India, past two decades have seen unprecedented growth of knowledge in the field concrete bridges, development of new structural forms, new methods of computer-based analysis and design and development of high strength materials. A new code IRC:112-2011 based on Limit State Method has been issued which will be very useful for design of long span bridges.

Continuous Long Span Bridges spanning more than 60 m are provided over valleys , rivers .streams , marshaling yards & locations where the soil conditions , water currents , pier heights , traffic conditions etc may warrant. The design of long span Bridges is a Challenge to the ingenuity and perseverance of the Designer .Every long span Bridge poses new problems in design concepts & new construction details

Long span concrete bridges are usually post tensioned pre stressed concrete and are constructed either as a continuous beam types or free cantilever structures. Many methods have been developed for continuous deck construction. If the clearance between the ground and bottom of deck is small and the soil is firm, the superstructure can be built on staging. But this method is becoming obsolete. Currently free cantilever and movable scaffold system are being used to save time and to improve safety. Arch Bridges have been built since Ancient times . There are known examples of Babylonian Masonry Arch Bridges and Chinese /Roman stone Arches . Some of them are still in use. The arch form is best suited to deep gorges with steel rocky banks which furnish natural abutments to receive the heavy thrust from the arch .The arch form is aesthetically the most pleasing and have been used in steel bridges with span range of 100-250 m

Any body seeing a Bridge will have clear idea whether he or she likes it or not . The impression is independent of the Technical knowledge. It is directly inspired by the lines & proportions of the Bridge .Old Howrah bridge at Kolkata is a steel truss. Such a mighty river like Ganga could have been bridged by better looking structure. If compared with Golden Gate Bridge in Sanfransico, USA which has become a landmark of the environment. Many foreign tourist to USA with certainly go to just see and enjoy the beauty of the Bridge.

1. Case Study

Good for Construction Drawings (GFC) of a Major Bridge at Surajbari ,Gujarat ,India in East-West Corridor Project , Package IV , NHAI ,designed by Working Stress Method has been referred .

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For Comparison with Limit State Method as per IRC 112-2011 , same section for the PSC Girders , same system of 4 PSC Girders , same Cross section of the Bridge & same width of carriageway has been considered , but the Span arrangement has been taken as 1x30+37x40+1x30 m in place 1x22.82+37x32.9+1x22.82 ie 21% increase in Span Length for 37 Central Spans(PSC Girders) and 31% increase in span length of approach spans on either ends (RCC Girders) .

2. Conclusion

Based on this case study it may be concluded that by using Limit State Method , total length of the bridge (keeping same section/depth of superstructure)could be increased by 22% as compared to working stress/allowable stress(WL/AS) method. Alternately section /depths of the superstructure could be reduced by retaining the same spans arrangement as compared to working stress/allowable stress(WL/AS) method.