COMPARATIVE STUDY OF SUPERSTRUCTURES USED FOR RAIL OVER BRIDGE

[1]Shruti Shah, [2]Dipesh Pindoriya, [3]Vaibhav Joshi

[1]ME Student, [2]Assistant Professor at HJD Institute, [3]Freelancer as Bridge Engineer
[1]Structural Engineering,
[1]HJD Institute of Technical Education and Research-Kera,India

Abstract : The bridge construction is old as human civilization. Bridges are much important for infrastructure development of country. In design of any kind of structure, economy is the essential criteria. For the rail over bridges there are many types in superstructure. As per the criteria of RDSO they have given some standard design for some typical span of rail over bridge. But if the span differ from the given design span than we have to design bridge by considering RDSO design criteria. So it is important to decide the economic type amongst them. There are many types of bridge superstructures so there is two types considered among them. Which are bowstring Girder Bridge and steel concrete composite bridge. The decisions based on the obvious element of engineering that are safety, serviceability, and economy. Following this aspect, a design for different type of superstructures has been performed. After calculation the most economical has been selected.

Key words - STAAD Pro.,Rail over bridge, type of superstructure.

I. INTRODUCTION

1.1 Rail Over Bridge:

The rail over bridge is designed to let the road traffic to pass over the railway line. The designing and construction of rail over bridge is the major structures in road ways and railways. The main purpose of construction of rail over bridge is to decrease the travel time of road traffic and trains also, and increasing the speed of traffic, and avoiding the stopping of road traffic during passing of trains.

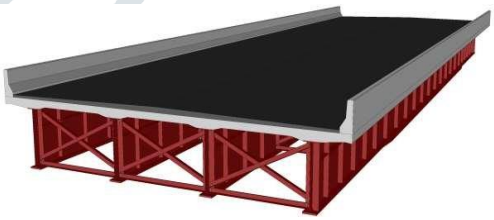
1.2 Bowstring Girder Bridge:

Bow-String Girder Bridge is well known for their aesthetic value and has undergone a gradual change in the material used for its construction to reach its present concrete and steel configuration. In India Bow-String Girder Bridge have been used mainly in the regions where small spans are to be bridged and are mainly for light vehicular traffic. However in the developed world these have been used for multilane of heavy traffic. Though the economical sense of it is not much clear, it is preferred to make an impression on the viewers with its beauty.

1.3 Steel-Concrete Composite Bridge:

Steel-concrete composite bridges provide an efficient and cost-effective form of bridge construction. By utilizing the tensile strength of steel in the main girder and the compressive strength of concrete in the slab, the bending resistance of the combined materials is greatly increased and larger spans are made possible.

(Fig 1: bowstring girder bridge)



(Fig 2: steel concrete composite bridge)

II. OBJECTIVE AND METHODOLOGY

2.1 Objective:

In this study there is a comparison of two types of bridge superstructures (Bowstring girder bridge, steel concrete composite bridge) used for rail over bridge of span 30m, 36m, 40m and 45m.

So main objectives are,

- To get economic bridge superstructure.
- To get impact of superstructure on overall cost of bridge.

2.2 Methodology:

Design for two different spans (30m, 36m, and 40m) and analyze it in STAAD pro. By using IRC codes for the loading. By using designs given by RDSO for rail over bridges, compare bowstring bridge for 30m and 36m span. For 40m span RDSO has not given any proper design for Rail over bridges so, design and analyze for all three types and compare. Conclude the best suitable type for the given spans.

III. DESIGN AND ANALYSIS

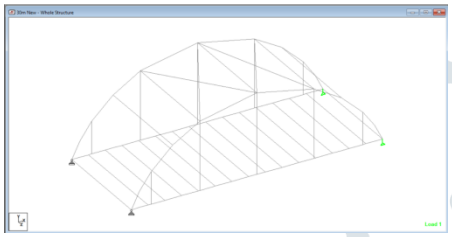
3.1 Design Of Bowstring Bridge

Loading:- IRC 6 ,Class 70R loading and Class A Loading
Steel design:-Code : IS:800 LSD
Commands:Check code,Take off and Member take off

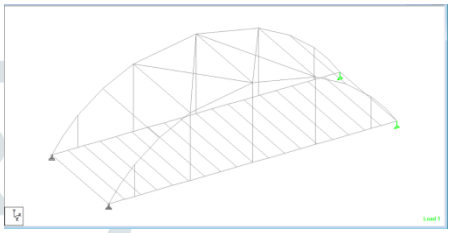
1).30m span: L= 30m ,Width= 12.3m ,Height = 10m and Spacing of cross members=2m
2).36m span: L= 36m ,Width= 12.3m ,Height = 10m and Spacing of cross members=2m
3).40m span: L= 40m ,Width= 12.3m ,Height = 10m and Spacing of cross members=2m
4).45m span: L= 45m ,Width= 12.3m ,Height = 10m and Spacing of cross members=1.8m

Member	30m span(mm)	36m span(mm)	40m span(mm)	45m span(mm)
Top	750*650*20	850*750*20	950*850*20	1050*950*20
Bottom	750*650*20	850*750*20	950*850*20	1050*950*20
Vertical	650*450*20	750*550*20	850*650*20	950*750*20
Cross	650*550*20	750*650*20	850*750*20	950*850*20

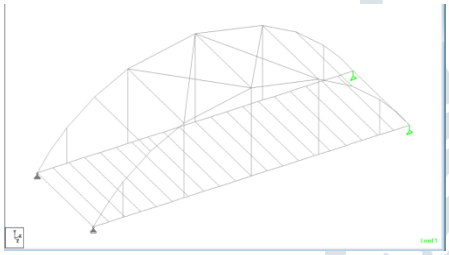
(Table 1: section definition)



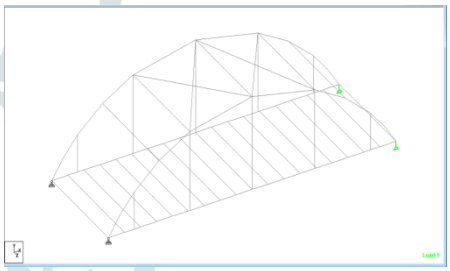
(Fig 3: Design model of 30m span bowstring girder bridge)



(Fig 4: Design model of 36m span bowstring girder bridge)



(Fig 5: Design model of 40m span bowstring girder bridge)



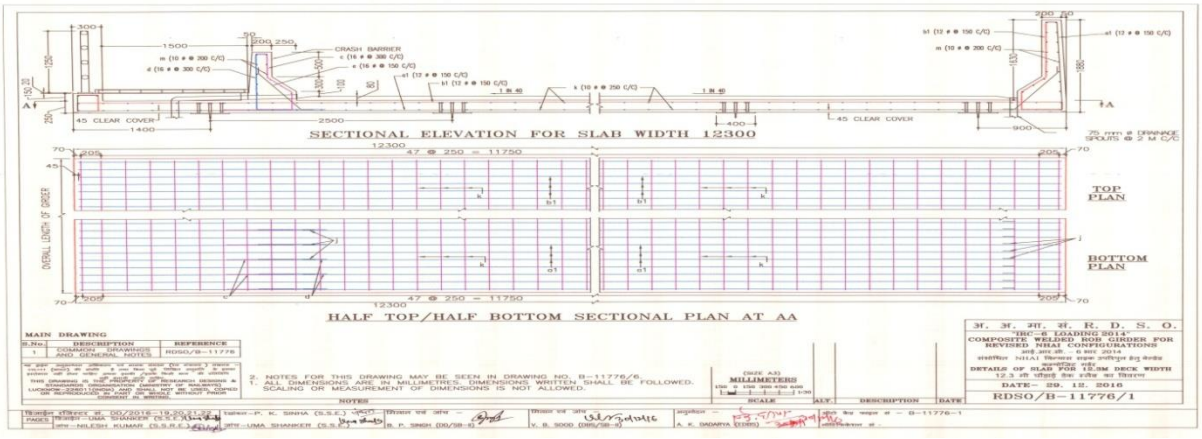
(Fig 6: Design model of 45m span bowstring girder bridge)

3.2 Analysis Of Bowstring Bridge

Failed members for the all four designs are zero. So, the design is ok.

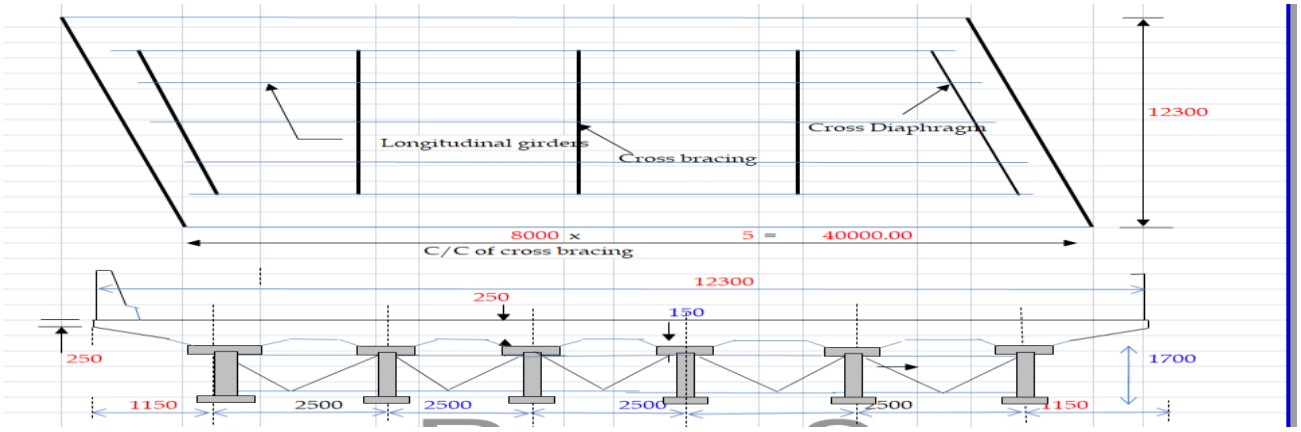
3.3 Design Of Composite Bridge

1) 30m and 36m span



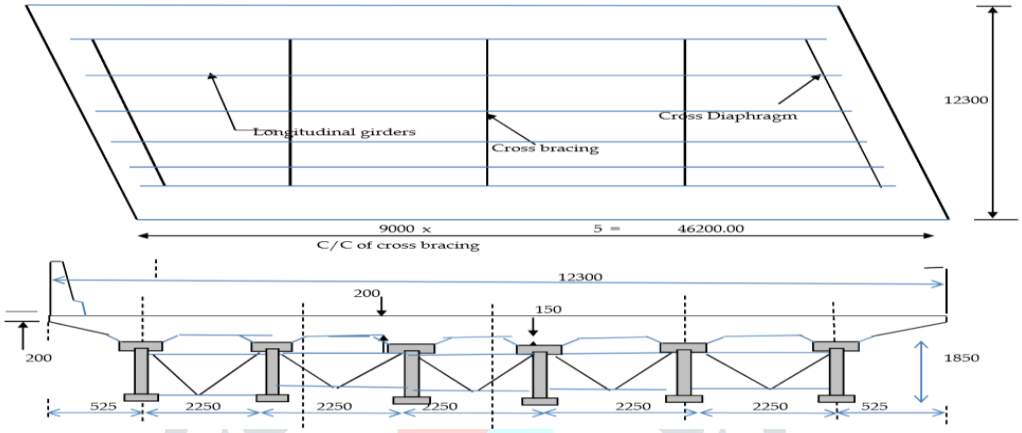
(Fig 7: Design of composite bridge for 30m and 36m span)

2) 40m and span



(Fig 8: Details of 40m Composite bridge)

3) 45m and span



(Fig 9: Details of 45m Composite bridge)

3.2 Analysis Of Composite Bridge

All checks are performed hence design is ok.

IV. ESTIMATION AND COSTING

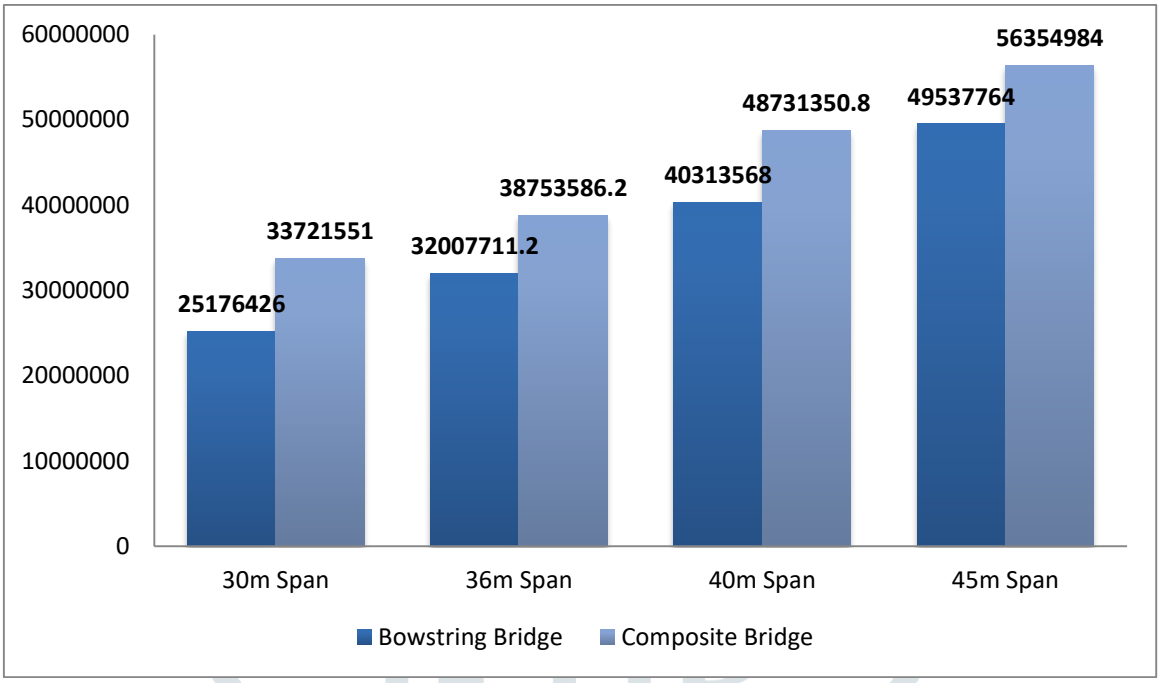
Bowstring Girder Bridge							
	Steel Quantity			Concrete Quantity			Total Cost
Span	Quantity	Unit	Rate	Quantity	Unit	Rate	(In Rs.)
30m	196.11	T	125000	73.8	cum	8979.35	25176426.0
36m	249.70	T	125000	88.56	cum	8979.35	32007711.2
40m	315.44	T	125000	98.4	cum	8979.35	40313568.0
45m	388.35	T	125000	110.7	cum	8979.35	49537764.0

(Table 2: estimate of bowstring bridge)

Composite Girder Bridge							
	Steel Quantity			Concrete Quantity			Total Cost
Span	Quantity	Unit	Rate	Quantity	Unit	Rate	(In Rs.)
30m	264.47	T	125000	73.8	cum	8979.35	33721551.0
36m	303.67	T	125000	88.56	cum	8979.35	38753586.2
40m	382.78	T	125000	98.4	cum	8979.35	48731350.8
45m	442.89	T	125000	110.7	cum	8979.35	56354984.0

(Table 3: estimate of composite bridge)

V. RESULT



(Chart 1: Cost Comparison of Both Bridge for All Span)

VI. CONCLUSION

- The material used in Bowstring bridge is less than that used for Composite Bridge.
- The depth of girder is more in Composite bridge than Bowstring bridge. So, the cost for the approach will be less for Bowstring Bridge.
- In composite bridge depth of girder gets increased with increase in span so because of the increase in depth the cost of approach also gets increased so it affects overall cost of the bridge.
- Approx 17.28% cost saving in Bowstring Bridge than Composite Bridge.
- So, we can say that the Bowstring Bridge is more economic than composite bridge for the large spans.

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