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Cost Comparison For RCC Girder And PSC Girder Used In Construction

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Abstract: This work includes cost comparison between two Bridge forms RCC girder and PSC girder. A range in which these bridge forms are usually used. The bridge forms are designed in prepared Excel sheet and thereafter analyzed in Staadpro and this process is repeated for all the span length considered in the comparison. The detailed cost estimation of all these structures have been prepared and presented and thus suitability of the better bridge type have been scrutinized on the ground of economy.

***Index Terms* – RCC Girder, PSC Girder.**

I. INTRODUCTION

I. RCC girder Type Bridge:

In this type of structure the solid slab is replaced by Reinforced cement concrete girder. The RCC Girder type bridge consist of RCC precast I girders, bearings, abutments or piers, cast in situ deck slab and crash barrier. The girders are provided between the deck slab and abutments. Bearings are provided at the junction of slabs and the top of pier and abutment to transmit the load coming from super structure to the sub structure. The girder arrangement drawing of this type of bridge has been shown below which shows us the RCC girder superstructure resting on the pedestal-bearing and a solid slab on girders also the girders in detail are shown. For a better understanding elevation and plan of girder has been also shown in below figures.

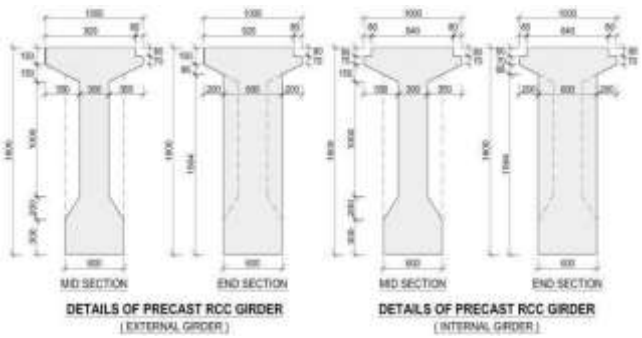

Fig. : Detailed view of RCC Girder

II. PSC girder Type Bridge*:*

In a PSC Girder type bridge the foundation and sub-structural features remains the same as RCC Girder, the superstructure i.e. The RCC Girder is replaced by PSC- Girder. Prestressed concrete girder that facilitates rapid construction of a bridge using girders that are fabricated off-site and then transported and erected into place at the job site. Once the deck is poured, the structural section becomes composite, minimizing deflections. PSC girders employ high performance concrete for strength, durability, and/or constructability To achieve this, PC girders employ prestressing strands that are stressed before the concrete hardens. In the figure below it would be quite clear as the PSC and RCC girder have almost similar cross-section but the pre-stressed girder consist of prestressing cables which are arranged horizontally in the end portion of girder and by reaching the mid portion the become concentrated as shown in cable profile figure below.

Different spans have been taken to analysis the two bridge forms for their suitability 30 meter, 35 meter, 40 meter. The Detailed designs for RCC Girder type Bridge type Bridge and PSC Girder type Bridge have been carried out.

III. Concept of Bridge Design

Design standards and loading to be considered are generally based on the requirements laid down in the latest editions of IRC and IS Codes of practices & standards specifications, and guidelines of Ministry of Road Transport & Highways. Additional technical references would be used wherever the provisions of IRC/IS codes are found inadequate. All the bridge forms have been designed and after which analyzed on Staadpro. Here for a simplified understanding of the design concept and a broader overview of all forms a stepwise approach has been described

A. Geometry and specification:

Firstly a suitable section is taken including slab thickness, Girder depth and other size and cross sections. The clear cover as For all the reinforcement the clear covers to be adopted as per clause. 14.3.2.1 of IRC: 112-2011. Back fill properties , Density and other such specification taken as perstandards

B. Material:

Material used basically includes the Reinforcement and Concrete grade. HYSD (TMT) bar of Grade Fe-500 is used in all RCC components as reinforcing steel. grade of concrete in different elements are listed below

- RCC Girder M30, M35
- PSC Girder M40, M45
- RCC Pedestal M35, M40
- RCC Approach Slab M30
- PCC Leveling Course M15
- PCC substructure & foundation M25
- RCC substructure & Open foundation M30, M35
- RCC Abutment cap/Pier cap M30, M35
- RCC Crash Barrier M40
- Retaining Wall M30

C. Loading:

There are various loads acting on the structure and they have to be taken into account while designing, all such loads and stresses which have a impact on the structure are stated as codal provision to us in IRC 6-2014. The loads and stresses which are to be considered for design of Bridges are as follows:

- Dead Load
- Live Load
- Impact factor due to vehicular live load
- Vehicle Collision Load
- Wind Load
- Longitudinal forces due to braking
- Earth Pressure (including live load surcharge)
- Temperature Effect
- Seismic Forces

D. Design check:

For stability and safety of structure the checks have to applied i.e.., Check for Moment capacity, Check for stresses, Check for crack width , Deflection check, Distribution reinforcement , Check for Reinforcement percentage. For a section failing in any of the stated check either extra reinforcement has been provided else the section i.e... the slabthickness have to be revised.

E. StaadPro analysis :

The structure designed is then been analyzed in the software(Staadpro) for its structural behavior and to check failed members if any. On the basis of these the design the drawingare pre-paired and further the cost estimation has been done.

IV. Cost Analysis

In the cost analysis part of the study we work out the detailedcost analysis of both bridge forms for span lengths taken into considerations to come to a conclusion as of which bridge forum would be most economically efficient for the span ranges. The following considerations have been taken into account for the estimation purpose:

- The Dimensions are taken in meter and millimeter for thestructures.
- The quantities of the Structures have been worked out.
- The rates have been taken in accordance with GOVERNMENT OF MADHYA PRADESH PUBLIC WORKS DEPARTMENT SOR for Road & Bridge work(2016).
- The product of quantities and rates gives us the cost estimation.
- All other specification and details like SBC, Seismic zone, wind considerations etc have been taken same for both the bridge forms which are compared so as tocompare the quantity and therefore the final cost for the both bridge forms.
- The Concrete grade and steel grade have been mentionedin the format for each bridge forum and have been takenas per specifications of codal provision and that used in the construction practices.

V. Result & Inferences

From the deduction made as per the cost analysis as shown inthe Graph-I it is very clear that the pre stressed concrete bridge curve is always on the lower side of the graph and hence it can be clearly inferred from the calculation that cost of pre stressed concrete bridge is much less than the cost of reinforced cement concrete bridge. Therefore PSC girder type bridges are the clear choice from the 2 bridge forms. This bridge form is not used in the smaller span structure as the same requires skill labour and pre stressing material which makes the cost high.

SPAN(in m)	30	35	40
Cost of RCC Type	196.2	238.75	280.95
Cost of PSC Type	188.58	202.25	231.51

VI. Conclusions

Hence it is evident that the PSC girder type bridge is economical as compared to RCC girder type bridge over a span length more than 25 meter for which the present study has been performed.

VII. References

[1]IRC 6-2010, “Standard Specifications and Code of Practice for Road Bridges”, Section II, loads and stresses,The Indian Roads Congress , New Delhi, India, 2010.

[2]Natraj Singh, N.P. Devgan, A.M. Kalra, Surinder Pal, “Effect on Economy on Successive Increase in the Spanof Bridges” Proceedings of the 2nd InternationalConference on Civil, Structural and Transportation Engineering (ICCSTE’16) Ottawa, Canada – May 5 – 6,2016

[3]N. Krishna Raju, 2013. “Prestressed Concrete”, Fifth Edition, McGraw- Hill Education (India) Pvt. Ltd., NewDelhi.

[4]Dr. B.C. Punamia, “R.C.C. Design (Reinforced Concrete Structure)”, Laxmi Publisher, 2006.

[5]Ramamurtham & R.P.Sharma., "RCC Box Bridge form Methodology and Designs including Computer method"Journal of the Indian Roads Congress, October- December 2009.

[6]Shaheenjaham, Akshata C Sureban, Megha Chappalagaon, Mudassar Sharif. Studied "Comparative Study on Design of RCC and PSC Beams" InternationalJournal of Advanced Research in Science, Engineering and Technology Vol. 3, Issue 6 , June 2016.

[7]Anupam Sharma, suresh singh kushwah "Comparative Analysis Of Reinforcement And Pre-stressed Concrete Beam" International Journal of Current Engineering andTechnology Volume 5, No 4, July 2015

[8]Natraj Singh, N.P. Devgan, A.M. Kalra, Surinder Pal, "Effect on Economy on Successive Increase in the Spanof Bridges" Proceedings of the 2nd InternationalConference on Civil, Structural and Transportation Engineering (ICCSTE'16) Ottawa, Canada – May 5 – 6,2016