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# Pre-Cast RCC Underpass Box Structure for Railway Track Crossings

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**ABSTRACT:** Underpass are required to be provided under earth embankment for crossing of roads and railway tracks as overpass cannot be constructed where there are various either height restrictions or already there are some heightened structure over the railway tracks or some natural obstructions which cannot be destroyed this study deals with the advantages of using pre-cast RCC box underpass instead of signals or overpass structures that are constructed on site, we have also shown the various types of loading like dead load, live load and the combination of these loads for different cases using IS codes and with the help of these loads we did the analysis of this structure using SAP2000 software and are going to prepare a thickness to moment comparison for optimal design.

**KEYWORDS:** Box underpass, SAP2000, STAAD.PRO, pre-cast structure

## I. INTRODUCTION

With the increase of railways and roadways, there are bound to be few places where they intersect each other and as these intersects appear we have to provide few crossing between them, traditionally we provide either an overpass or signal crossing in them, the major drawbacks of these techniques are that they require a large amount of time to be constructed and during this time the railway track are to be shut down, and as the increasingly busy schedule of the railways its becoming more and more difficult to keep the tracks closed and on the other hand the problem with traffic signals is that they come with a risk factor, signal crossing are prone to accidents, many of human lives are lost due to accidents occurred at a train signal crossings. As an accident happens this causes the loss of human live as well as a delay in the train schedule also the trains cannot run on a tight schedule and many trains on a same track numerous time a day. Even if one train is getting behind schedule by few minutes then all rest of the trains also lag behind so once incident causes all the upcoming trains to fall behind which causes huge loss of time as well as monetary loss as many business are very time depended and cannot afford late delivery. The traffic signals also causes traffic jams which further increases inconveniences to the average user, suppose there is a medical emergency and the ambulance has struck in a traffic signal at a train crossing which may cause loss of human life.

So as to avoid these type of problems and loss of time we need modern methods of crossing which should be easy to construct, place, cost effective and should request very less shut down time of the railway track .So we have decided to use a RCC underpass box which are to be placed inside an embankment then all the traffic will pass through below the railway tracks and then there would be no need for the train and the motor vehicles to stop and smooth traffic can occur.

## II. LITERATURE REVIEW

Dr. Mohankar.R.H, Dr. Ronghe.G. N provided a discussion on “Analysis and Design of underpass RCC bridge” and said that the underpass RCC Bridge is very rarely adopted in bridge construction but recently the underpass RCC Bridge is being used for traffic movement. In this paper, the analysis of the underpass RCC bridge is carried out. The analysis of this underpass RCC bridge is done by considering fixed end condition. Finite element method (FEM) analysis is performed and results are presented. Comparison of different forces between 2D and 3D models for fixed end condition is provided.



Y.Vinod Kumar and Dr. Chava Srinivas (2015)<sup>3</sup> have presented a complete study of box culvert by using computational methods such as grillage analysis and Finite element method. Grillage analysis is versatile in nature and can be applied to variety of bridge decks having both simple and complex configurations with ease and confidence. Grillage analysis has done by most commonly using software STAAD Pro. Their main objective was to know the behaviour of box culvert and variation of stresses in terms of shear force and bending moment values.

Mulesh k. Pathak (2014)<sup>9</sup> has carried out study on performance of RCC box type superstructure in curved bridges. The study provides multiplication factors for all the parameters for varying degree of curvature (i.e. 10° to 90°) W.r.t. a straight bridge (0°) and for varying spans (between 15m to 30m). These can be useful to simplify the analysis by considering straight bridge instead of curved bridge, in which multiplication factor is used multiply to the corresponding action of the straight bridge. This can be very much useful in the preliminary design of the section.

Dr. Abdul-Hassan (2014) has made study on optimal design of reinforced concrete box culvert by using genetic algorithms method. This paper shows the optimal design of reinforced concrete box culvert based on minimum cost (economical design). It is found that the genetic algorithms GAs optimization method is a suitable method that can be used to obtain the minimum cost (i.e. optimum design) of reinforced concrete box culvert. It is important for any optimization problem using genetic optimization method to carry out the convergence studies to investigate the capability of establishing the optimum design with or without initial population and governing population size.

D.Vamshee Krishna (2015)<sup>7</sup> studied the modelling and analysis of RCC bridge using parametric study of soil structure interactions. In this paper, the analysis of the underpass RCC bridge is carried out. The analysis of this underpass RCC bridge is done by considering fixed end condition and the soil structure interactions at different sections are presented. comparison of different forces with results at different sections of the model for fixed end condition is provided. In this study a 2D model can be effectively used for analysis purpose for the loading condition mentioned in IRC: 6, "standard specifications and code of practice road bridges" The indianroads congress and directorate of bridges & structures (2004), "Code of practice for the design of substructures and foundations of bridges" Indian Railway Standard.

### III. OBJECTIVE

- To use precast structure instead of cast in situ
- To analysis of structure shall be done in SAP2000-
- To estimates of design underpass box structure
- To compare with cast in situ construction
- A. Check its durability in environmental conditions
- B. Check time taken in construction
- C. Check its quality
- D. Curing conditions

### IV. PROPOSED METHODOLOGY

#### 1. Excavation and casting of thrust bed

Open excavation is carried out for construction of thrust bed. The thrustbed and thrust beam and keys are designed in R.C.C. to resist the required thrust extorted by Jacking force and transfer it to soil at bottom and sides. In cohesive soils even shallow piles are required to transfer the load. provision for jacking supports is made by providing suitable pockets in the bed to accommodate pin supports. On completion of jacking the thrust bed is utilised as floor bed, and so it is left in place.

#### 2. Fabrication of Front Shield

It is fabricated for cutting action and to provide support to prevent caving in of soil.

#### 3. Fabrication of Rear Shield

It is provided by anchoring steel plates on the face of bottom slab of RCC box to suitably distribute the jacking load.

#### 4. Box Casting And Pushing

The RCC Box is cast in segments of convenient lengths of Total pushing length. The box section is designed as per IRS / IRC codes of practice for loading. Concrete grade normally kept as M-35.

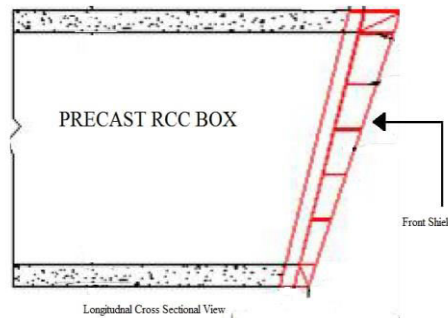


Fig 1

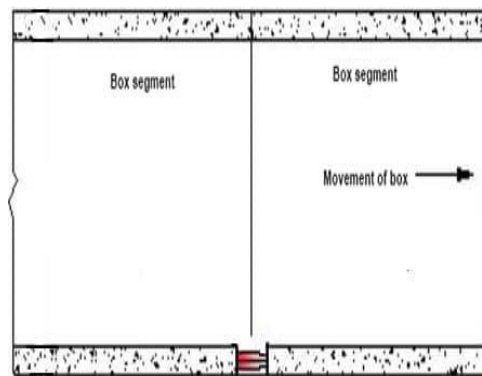


Fig 2

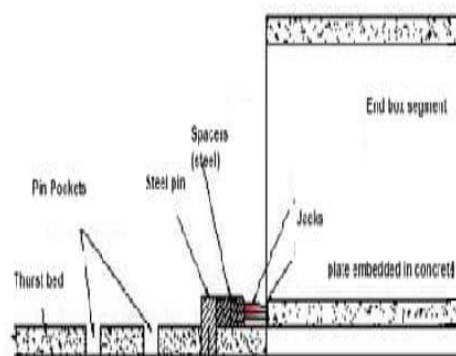


Fig 3

#### 5. Pushing Operation of the Box

The purpose of pushing of box is to form a horizontal opening below ground or through embankments, can say a tunnel, by providing precast box units underground or an embankment, without disturbing the overhead amenities, like traffic & structures. To reduce the frictional resistance, a thin film of grease and thick gauge plastic sheet is provided between the top of the thrustbed & bottom of the box. This is done before casting of the bottom slab of the



box. A glossy epoxy layer is also provided to reduce friction on the top and prevent the disturbance of the mass over box to least during progress of pushing. Where mass of embankment is less or the soil is of poor quality, drag sheet system is also considered for least resistance of friction and disturbance of mass above box.

#### 6. Miscellaneous works by hydraulic equipment's

The entire box pushing system is matter of proper selection of hydraulic equipment, as tremendous driving force is required for pushing of medium to large size of boxes. So for this, number of jack units are provided in series for distribution of pushing load evenly on the face of the concrete, and all Jacks are operated simultaneously with a common power pack, which supplies uniform flow of pressure through network of hydraulic pipes of required pressure capacity, commencing from front unit to rear unit. Jacking force is applied in sequence. This way pushing cycles are repeated till total pushing is completed.

#### 7. Precautions

Cutting edge of front shield is fabricated with adequate thickness of steel plate and the front edges of the steel plate are sharpened to facilitate penetration into the soil. To prevent caving of earth during excavation quantity of earth shall be removed to barest minimum duly following the slop of cutting edge. Guide channels to be provided in the thrust bed to guide the segments to ensure straight alignment. The level of the boxes should be continuously checked. The speed limit should be set to 20 km/h at the site of construction. The work should be stopped when a train is passing over the work.

### V. CONCLUSION

- Box pushing work means at least partly working in blind, so problems usually come up during execution of work.
- Box pushing work requires close supervision and monitoring and quite often the unsafe conditions develop at these sites.
- Track must be watched regularly to see signs of heaving, settlement, misalignment etc.
- Work must be done under block protection / caution order only.

### REFERENCES

1. Dr. Mohankar.R.H, Dr. Ronghe.G. N provided a discussion on “Analysis and Design of underpass RCC bridge”
2. Mulesh k. Pathak (2014)9 has carried out study on performance of RCC box type superstructure in curved bridges.
3. Dr. Abdul-Hassan (2014)8 has made study on optimal design of reinforced concrete box culvert by using genetic algorithms method.
4. D.Vamshee Krishna (2015)7 studied the modelling and analysis of RCC bridge using parametric study of soil structure interactions.
5. Y. Vinod Kumar and Dr. Chava Srinivas



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