



# ANALYSIS AND DESIGN OF ROAD UNDER BRIDGE (RUB) WITH DIFFERENT METHODS OF CONSTRUCTION

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*ABSTRACT: THE OBJECTIVES TO CONDUCT A LITERATURE REVIEW TO PROVIDE THE ROAD UNDER BRIDGE TO ELIMINATE THE GRID LOCK DUE TO CONGESTION OF ROAD AND RAIL TRAFFIC AT THE LEVEL CROSSING AND ALSO TO PREVENT THE LOSS OF TIME AND FUEL. FURTHER IN THIS WE AS DISCUSSED THE DIFFERENT METHODS FOR THE CONSTRUCTION OF RUB AND WHICH CONSTRUCTION METHODS TO BE WIDELY ADOPTED ACCORDING TO THE PRACTICAL PROBLEMS FACED DURING CONSTRUCTION AND SUITABLE TECHNIQUE TO BE ADOPTED AS PER SITE CONDITION.*

*Index Terms - TECHNIQUE, METHODOLOGY, MATERIAL, CUT AND COVER METHOD, PUSHING METHOD, UN-MANNED LEVEL CROSSING.*

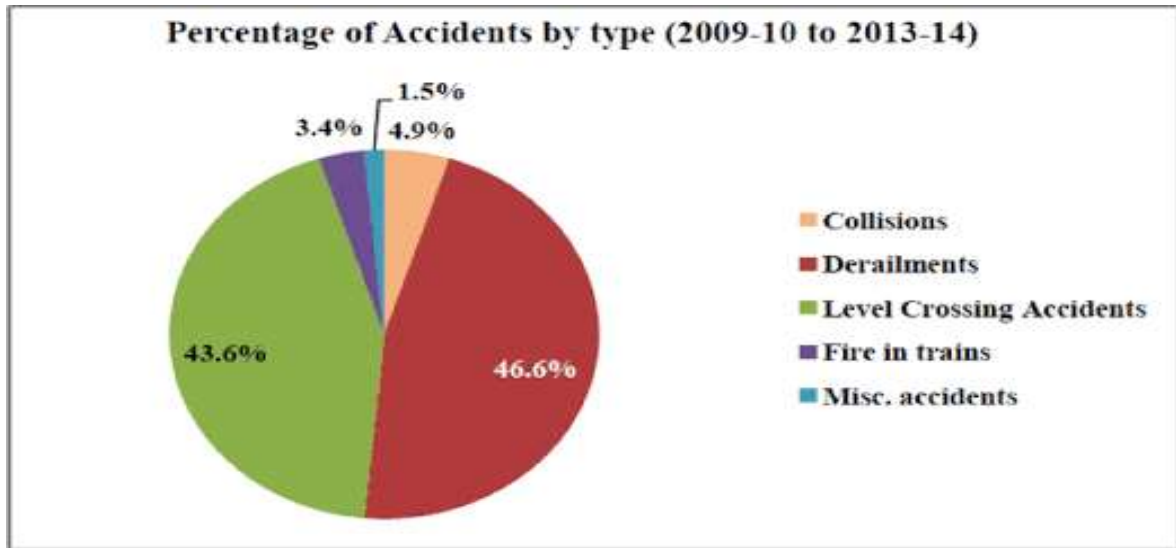
## I. INTRODUCTION

It is notable that the Road Rail tracks need to go across through in around very populated, well set up urban areas and town, so a Grade Separator is given in those focuses or alternative option and also help to reduce the grid lock when train passes. As both populace and traffic are expanding step by step in modern/growing India, there is need of delay and danger of Mishaps at the level intersection are like wise expanding. Indian railway are trying to eliminate all level crossing of railways to unmanned level crossing by constructing such Grade Separator such as Road under Bridge (RUB) and Road Over Bridge (ROB) to reduce the mishaps and even maintenance and repair cost of crossing. Around 30-40 % of train Mishaps were at level crossing, regarding casualties it contributed 60 to 70 %. To reduce this one of the following RUB/ROB are used.

Indian railways is one of the largest railway network in and around the world. The railway system is fully governed by the Indian government. Approximately there are 31854 level crossings in Indian railways. In this 18321 are manned level crossings and 13533 are unmanned level crossings.

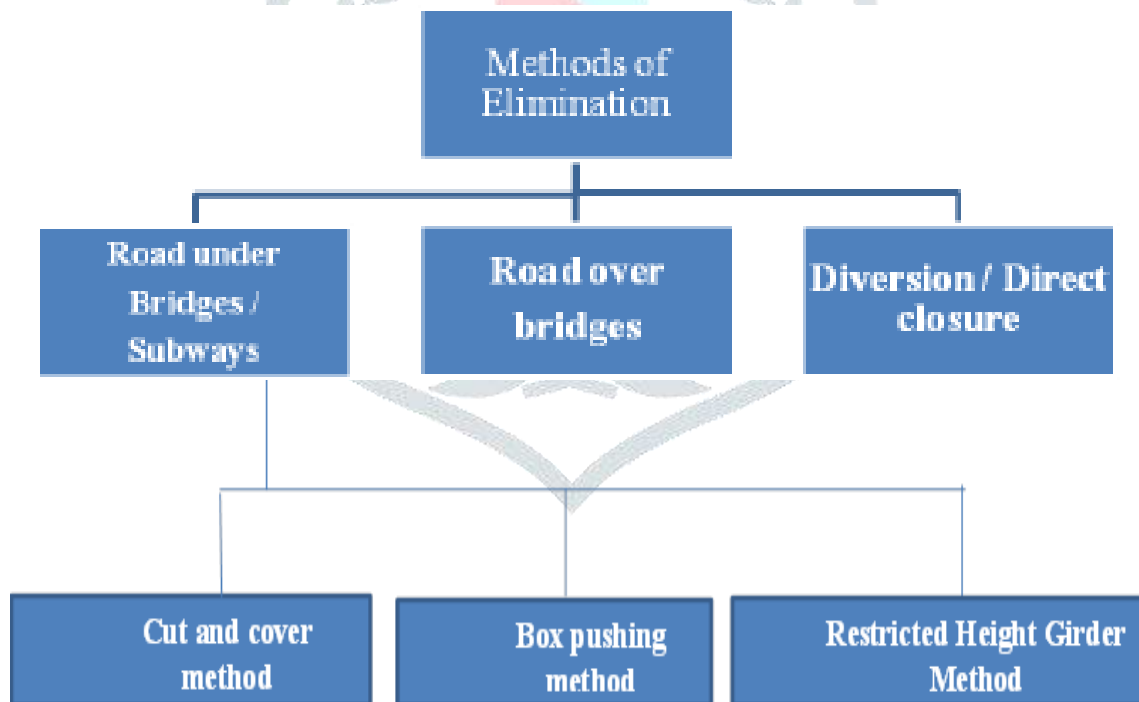
Looking into safety aspects Indian government tried eliminating unmanned crossings so that many accidents can be avoided and even the maintenance and repair cost can be reduced.

**Fig-1:** Percentage of Accidents by type



Level crossings continue to be the weakest point, most unsafe, and source of accidents. Due to increase in train speed and non-observance of rules by road users, these are more critical. Although, the total number of accidents occurring on the Indian railways is showing a progressive decline, level crossing accidents are still hovering at around the same level.

*Methods Of Elimination Of Level Crossings*



**Fig-2:** Methods of elimination of level crossings

To reduce this one of the following three methods are used:

1. Cut and Cover Method
2. Box Pushing Method
3. Restricted Height Girder Method

In this we will discuss about Box Pushing Technology. Now a days box pushing technology is mostly used when compared to other methods. This method is used as it is safe for construction in major traffic areas and busy junctions.

In this technique, RCC boxes separated in segments are cast outside and pushed through heavy embankments of rail or road by jacking system. The thrust bed is prepared along with line and level of precast boxes. Later by applying hydraulic force these RCC box segments are pushed into the embankment and as the land available is less in cities these box segments are used as it acquires less space for construction. Therefore, establishing of this method is a good option where there is less land or space for constructing underpass. Road Under Bridges by Cut and Covered Method :-



Fig-1: Road under bridge by Cut and covered method

**I. Road Under Bridges by Box Pushing Method :-**



Fig-2 Construction of Thrust Bed



FIG-3: PUSHING BOX SEGMENTS USING HYDRAULIC JACK

#### METHODOLOGY

1. Literature review and coding provision.
2. GAD of Road Under Bridge (RUB).
3. Loading as per Bridge Rule–Rules specifying the loads for design of super-structure and sub-structure of Bridges and for Assessment of the strength of existing Bridges.
4. Bridge Rules , Rules specifying the loads for design of super-structures and sub- structures of Bridges and for assessment of the strength of existing bridges, Second reprinting 2008, RDSO, Lucknow
5. Indian Railway Standard, Code of practice for the design of Sub-structure and Foundation of Bridges, RDSO, Lucknow
6. IRC:6 -2014, “Standard Specification and code practice for road Bridges”, Section II
7. Indian Railway Standard, Code of practice for Plain, Reinforced & Prestressed Concrete For General Bridge Construction, Concrete Bridge Code, RDSO, Lucknow
8. Analysis of RUB.
9. Design
10. Cost Analysis.
11. Conclusion.
12. References.

#### Literature Review

1. Ranjeet et al. (2019) talk about the Procedure and Construction of Road under Bridge by Box Pushing Method. This paper portrays different kinds of Road under Bridge development. In this paper, the itemized about execution of RUB soil grating, limit of jacks and its uses and slant Angles.
2. Mahto D et al. (2018) A Review on Bridge Construction Technology: This paper depicts the insights regarding the extension development innovation. This paper likewise audit the current different sorts of scaffolds with the historical backdrop of overall extensions and their grouping dependent on materials utilized in the exhibition.
3. K. Asudullah Khan (2017) the investigation of issues required during execution of Railway under scaffold utilizing box pushing method and its cures: This paper gives consideration towards issues that emerges during execution of RUB utilizing box pushing procedure and its cures. It likewise clarifies about the approach including in application in metro development.

4. Manisha D. Bhise et al. (2015) Analysis of resistance Bridge: The plan steps of RCC Box clarified in this paper. Configuration has been inspected by 2D outline with different burden blends and soil firmness. Significance of RCC box type underpass additionally portrayed.
5. Mohankar R. H. et al. (2015) Parametric Study of Underpass Bridge: 3D model of box connect structure has been investigated in this paper. The correlation of different conditions for the sheer power, twisting second, solidness and different components of configuration have been looked at in this paper.
6. G. Sampath Kumar (2015) Box pushing method on Railway under extension for cross traffic works: This is a contextual investigation of Railway under scaffold (RUB) development by box pushing innovation. The plan of pre-projected box arranged by utilizing STAAD ace programming.
7. Jha et al, (2015) had done Comparative Study of RCC Slab Bridge by Working Stress (IRC: 212000) and Limit State (IRC: 112-2011) and found that the thickness of chunk was 500mm for WSM which was diminished to 400mm for the two carriageways still there was about 20% sparing in measure of concrete and 5-10% sparing in measure of support for LSM for example LSM was significantly practical plan contrasted with WSM.
8. Lingampally Maithri Varun et al. (2015) Analysis, plan and innovation that is pushing box (Bridge): The pushing of RCC Box procedure has been clarified in detail. Apparatuses and supporting instruments/structures needed for box pushing innovation, for example, pushed bed, front shield, back shield, pin box, jacks, and so forth are likewise portrayed.

#### METHODOLOGY

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7. Indian Railway Standard, Code of practice for Plain, Reinforced & Prestressed Concrete For General Bridge Construction, Concrete Bridge Code, RDSO, Lucknow.

#### GEOMETRIC DETAILS OF BOX:-

The box is modeled as per the parameters given in Table 1 and the element considered as beam element.

The geometric of the box will be kept same and analysis by STAAD pro software will be done for Cut and Cover method and Pushing Method.

S. No.	Particulars	Details
1	Size of the box	5.5 m × 4.5 m
2	Thickness of top slab	0.55 m
3	Thickness of bottom slab	0.55 m
4	Thickness of end vertical walls	0.55 m
5	Effective height	5.6 m
6	Effective span	6.6 m
7	Support condition	Simply Supported

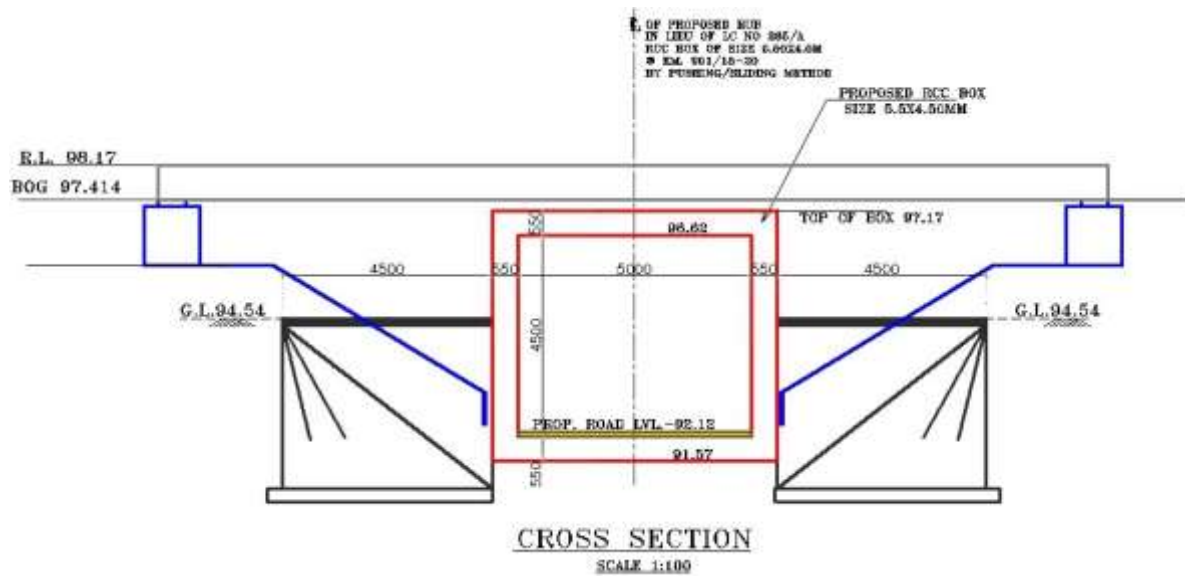
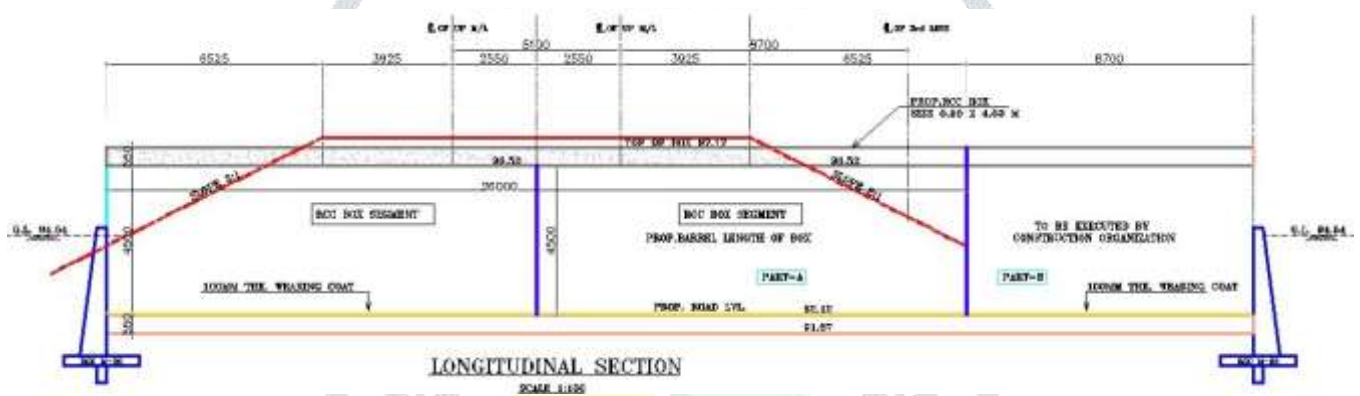


Figure-1 Transverse Section

**Conclusion:-**

Find out which construction procedure is more effective.

**CONCLUSION****A. In Cut and Cover Method:-**

1. Large area is required for the casting of Box Segments.
2. There is required Mega Block (OHE and Traffic) is required during Cut and Cover.
3. Heavy Cranes is required for the Launching of Box segments.
4. Total Train traffic is stopped during the excavation and launching of Box segments.
5. The construction joints are more in this method.
6. Work should be carried out only under supervision of higher authority and Traffic & OHE Blocked is required.
7. Track cutting before Launching of Box Segments and re fixing after launching is to be done with level and alignment.

**B. In Box Pushing Method:-**

1. There is no disruption to the rail traffic except in the reduction of speed of locomotive to 20 kmph at the site of construction of subway.
2. It's advantageous to use this technique to construct subway at embankment which consists multiple rail lines.
3. Time required for completing the project is less.
4. Night working is possible in this technique which further reduces the construction period.
5. Need trained staff and skilled supervision.
6. This method requires close observation and monitoring due to unsafe conditions on the site.
7. The construction of box pushing method is easy and faster.
8. The construction joints are less in this method when compared to other conventional method.

9. Work should be carried out only under supervision of higher authority and cautions only.
10. Misalignment and settlement should be closely watched regularly.
11. This method is totally dependent on hydraulic jack force for alignment of the segment.
12. There is no Mega Block (OHE and Traffic) is required during Box Pushing.

In view of the above construction procedure comparison, the RUB in Box Pushing Method is more easily and widely used than the Cut and Cover Method.

#### COST COMPARISON OF ROAD UNDER BRIDGE:-

##### **A. In Cut and Cover Method:-**

1. Cost for Casting of RCC Boxes and additional reinforcement to be added for lifting arrangement.
2. Cost for Excavation of soil required for the placement of Box segment as layout and level.
3. Cost for casting of Per cast Base Slab (250 mm thick) and launching of Base Slab below RCC box to be place as per Layout and Level.
4. Cost for Launching of Box segment as per layout and level.
5. Cost for Joint filling between Box segments.

##### **B. In Box Pushing Method.**

6. Cost for Excavation for Thrust Bed and Auxiliary Bed as per Layout and Level.
7. Cost for Casting of Thrust Bed and Auxiliary Bed along with pin pockets as per Layout and Level.
8. Cost for Casting of RCC Boxes.
9. Cost for Cutting Edge, Rear shield Plate and Jack pocket Plate.
10. Cost for Pushing of Box Segments.
11. Cost for insertion and removal of Rail Cluster/RH girder to be provided for the movement of Rail traffic during pushing.
12. Cost for Joint filling between Box segments.

In view of the above cost comparison, the RUB in Cut and Cover Method is more economical than the Box Pushing Method.

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