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Design & Analysis of Pre Cast Box Segment using Limit State Method Manually and Staadpro

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ABSTRACT

A level crossing or a grade crossing is a place where a railway line and a road intersect each other at the same level. In the Urban areas generally the level crossings are monitored by qualified railway staffs that monitor the train movement and close the level crossing gate to stop the interfering road traffic but such closing of gates leads to traffic jam in roads, causes loss of time to the road users and in some cases also leads to an accident. The best alternatives to eliminate the level crossing are Road under Bridge (RUB) and Road over Bridge (ROB). There are 3 main methods of construction of road under bridge. Box pushing technique, Cut and cover method, rolling technique using RH girder. In this paper a design of Road under Bridge or Subway by Box Pushing Method is presented. The design is carried out as per Indian standards, particularly Indian railways standards, IRS (Bridge Rules), IRS- Code of Practice for design of substructures and foundations of Bridges.

KEYWORDS: *grade, railway, crossings, pushing, technique, Indian standards*

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I. INTRODUCTION

It is well known that railway tracks need to cross through the roads in and around extremely populated, well - established cities and towns, so a level crossing is provided in those points but these level crossings may be manned or unmanned, and further causes a traffic jam when a train passes. As both population and traffic are increasing day by day, delays and the risk of accidents at the level crossings are also increasing. About 30-40 % of train accidents were at level crossings, in terms of causalities it contributes 60-70 %. So Indian Railways has to decide either go for road over bridges (ROB's) or road under bridges (RUB's) where ever necessary in populated areas.

Road over Bridges (ROB's) - Road over bridge are constructed to continue the roadway in the presence of obstruction like railway tracks, valleys, rivers etc. to provide passage over the obstructions. They are preferred when there is no other option of a vehicular pathway over the obstructions.

Figure 1.1 Road over Bridge

II. Literature review

Dina Mahmoud Mansour et al. (2013) Value Engineering Analysis in the Construction of Box Girder Bridges: This paper describe, a model which is developed to determine the most appropriate box-girder bridge construction method, using the Value Engineering concepts, which is used for comparing the different construction methods for achieving the required basic function after considering the main significant factors.

C. Lyons et al. (2012) Cardinia Road Railway Station-Pedestrian Underpass Jacking: This paper consist the case study of Cordinia Road Station Pedestrian under pass. The analysis of structural design construction, construction and planning a beck analysis of the under pass jacking, analysis of tolerances are discussed in this paper.

Mohankar R. H. et al. (2012) Analysis of Underpass RCC Bridge: The design methodology of under pass bridge analysis is in this paper. The analysis is done on 2D model of box type structure. The comparison of 2D frame of RCC Box with soil stiffness and without soil stiffness is also compared by the author.

Michael Peter et al. (2011) Railway Foundation Design Principles: This study describes sub grade failure under the Railway track and methods to design safe thickness of safe track bed. This paper describes various procedures and compares the thickness of track bed layers proposed by each for a number of hypothetical situations.

Geoff Casburn et al. (2009) Underpasses for moving livestock under expressways: Case study of under pass construction under expressway is described in this paper. RCC Box culvert tunnel constructed for crossing of livestock under the expressways and motorways are used.

B.N. Sinha et al. (2009) had studied box culverts made of RCC without and with the Cushion. In that study, design of RCC box culvert was done manually and by computer method using STAAD Pro. The structural design involved consideration of load Cases like box empty, full, surcharge load etc. and factors like Live load, effective width, impact force, coefficient of Earth pressure. Relevant IRC codes were referred in their paper. The designs were done to withstand maximum bending moment and shear force. Effective width in Case of box culvert played an important role without Cushion as the Live load became the main load on the top slab. They also told amount of required Steel Reinforcement confirmed by the required depth of section.

Mouratidis (2008) The "Cut-and-Cover" and "Cover and-Cut" Techniques in Highway Engineering: The use of "Cut & Cover" and "Cover and Cut" methods are studied in this paper for construction of underground tunnels or subways. In this paper, the overview of both the methods is presented which includes describing main features, advantages and field applications.

Douglas Allenby et al. (2006) Creating underground space at shallow depth beneath our cities using jacked box tunneling. This paper describes the jack box tunnel method with example, its use and detailed about the sensitivity. Jack box tunnel is a method of construction that enables Engineers to create underground space at shallow depth in a manner that avoids disruption of valuable infrastructure and reduces impact on environment.

III. Software Validation

Software Validation

Above model for dead load is taken to validate the STAAD results. Problem is solved by manually, STAAD. pro software and results are compared.

A box having Dead load on top slab = 7.755 t/m² = 7.755 × 9.81 = 76.051 kN/m² and Dead load on bottom slab = 11.0625 t/m² = 11.0625 × 9.81 = 108.486 kN/m².

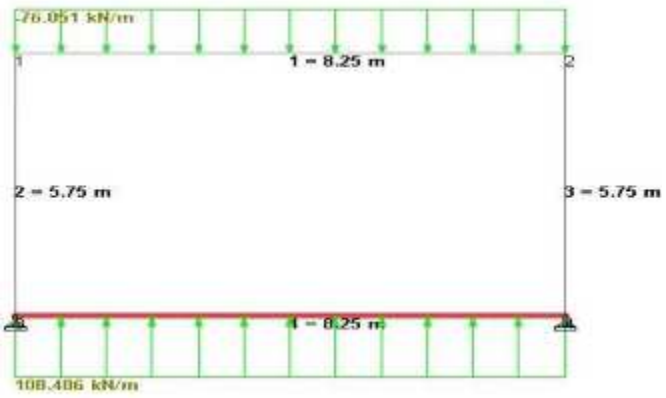

Figure 1 Loading diagram

STAAD Analysis

Problem Statement: Analyze the plane box frame shown in figure using STAAD Pro software.

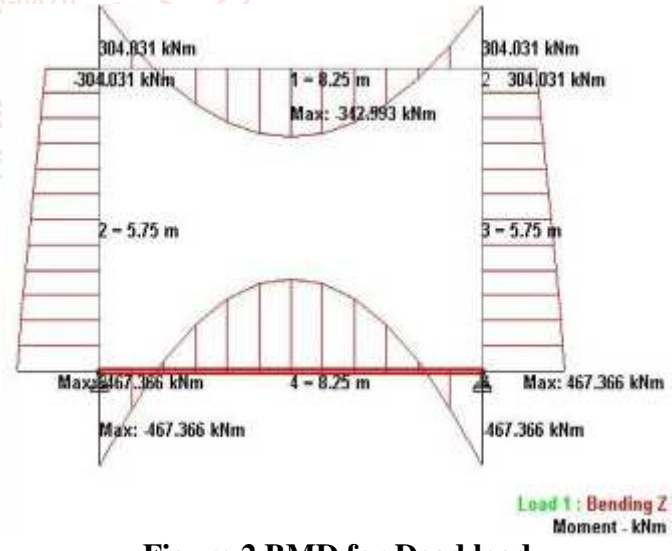

Figure 2 BMD for Dead load

IV. Conclusion

Based on the above study following conclusions can be made:

From the literature review, it is concluded that the comparison to the years ago technology in construction world was quite developed. So we construct the tunnels and over-bridges using the box culverts very rapid and the cost of construction is less

and there is less risk and pushing technology is widely used nowadays and gives very good results of work.

With the box pushing technique, there is no interruption to the traffic moving around.

Better quality control due to the provision of precast boxes.

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