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Analysis and Design of Pre Cast Box for Road under Bridge (RUB) and Road Over Bridge (ROB) by using STAAD Pro. and Box Pushing Technique

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ABSTRACT

A level intersection or a level intersection is where a railroad line and a road meet each other at a comparative level. In the Urban locales generally the level crossing points are checked by qualified railroad staffs that screen the train advancement and close the level convergence entryway to stop the intruding road traffic yet such closing of portals prompts gridlock in roads, makes loss of time the road customers and from time to time similarly prompts a disaster. The most ideal decisions to murder the level going across are Road under Bridge (RUB) and Road over Bridge (ROB). There are 3 essential systems for advancement of road under framework. Box pushing system, Cut and spread procedure, moving strategy using RH support. In this paper an arrangement of Road under Bridge or Subway by Box Pushing Method is presented. During that time, traffic is proceeding with overhead ordinarily, uninformed of the improvement underneath. The no risky nature of the cycle alongside its unavoidable prosperity, ease and economy make box pushing an important mechanical assembly for the practicing auxiliary fashioner. This paper intends to convey a more essential involvement in the carton pushing cycle to the peruser and subsequently give a couple of considerations and rules to help engineers in arranging an endeavor that can be collected using the holder pushing methodology. Box pushing is a settled strategies for planning conduits or entries under rail banks or streams to oblige road or rail traffic.

Keywords: *Box pushing technique, RUB, IRS, Subway, Road under bridge, Level crossing*

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1. INTRODUCTION

It is remarkable that railroad tracks need to go across through the roads in and around populated, well - set up metropolitan territories and towns, so a level convergence is given in those concentrations yet these level crossing points may be checked or mechanized, and further causes a gridlock when a train passes. As both people and traffic are extending bit by bit, delays and the threat of incidents at the level convergences are similarly growing. Around 30-40 % of train accidents were at level crossing points, with respect to causalities it contributes 60-70 %. So Indian Railways needs to pick either go for road over platforms (ROB's) or road under expansions (RUB's) the spot ever basic in populated locales. In arranging of structure the two principle contemplations should be associated with model economy and prosperity. If the load is overestimated than the structure will be uneconomical while if the stack is barely cared about the prosperity of structure will be sabotaged. In this way the figuring of weight and their blend should be done precisely. The hard and fast weights following up on the compartment are settled and the resulting bending minutes, shear powers and significant forces following up looking into the issue are resolved for each mix of weights and thereafter it is proposed for the most horrible blend of weights.

Box pushing methodology is most extensively used taking into account its distinctive central focuses over the other normal strategies for instance cut and spread system and moving method using RH uphold, box pushing procedure is basic and accommodating to work in a working crossing point of rail and road over standard strategies. In Box pushing technique, pre extended R.C.C. box segments are used and pushed through the profound banks of Rail or Road by Jacking. The vital push is made through push bed, similarly as the line and level of precast boxes is in like manner compelled by the pushed bed. This underpass RCC Bridge is crashed into bank by techniques for water fueled jacks which is clear explained in this report, since the openness of land in the city is less, such sort of framework utilizes less space for its turn of events. In this manner creating Underpass Bridge by Box pushing procedure is a predominant elective where there is a basic of room or Land.

Augmentation advancement these days has achieved a general level of essentialness. With fast advancement improvement the customary platform has been displaced by inventive viable assistant system. The profitable dispersal of obstructed traffic, budgetary considerations, and classy appealing quality has extended the popularity of box type interfaces these days in present day expressway systems, including metropolitan exchanges. They are obviously used in interstate and platform systems as a result of its essential capability, usefulness, better quality, fulfilling feel and economy of advancement. They are viable sort of improvement for ranges since it limits weight, while growing flexural robustness and cutoff. It has high torsional robustness and quality, differentiated and a similar individual from open cross territory. But basic assessment has been in progress on bleeding edge examination for quite a while to all the almost certain fathom the direct of a wide scope of box interfaces, the eventual outcomes of these diverse investigation works are scattered and unevaluated. Consequently, a direct appreciation of later work on straight and twisted box ranges is especially needed which uncovered the thought towards pointing a current report. The rule objective is to give an away from about the assessment and plan of box type minor railroad ranges. This assessment would engage interface experts to all the more promptly appreciate the direct of Box Bridge spreading out a substitute strategy towards examination and plan. A portion of the short outline of the exploration are introduced here:

2. LITERATURE REVIEW

Ranjeet et al. (2019) talk about the Procedure and Construction of Road under Bridge by Box Pushing Method. This paper depicts various types of Road under Bridge improvement. In this paper, the organized about execution of RUB soil grinding, breaking point of jacks and its uses and inclination Angles.

Mahto D et al. (2018) A Review on Bridge Construction Technology: This paper portrays the bits of knowledge with respect to the expansion improvement development. This paper moreover review the current various kinds of frameworks with the chronicled scenery of generally expansions and their gathering subject to materials used in the show.

K. Asudullah Khan (2017) the examination of issues needed during execution of Railway under platform using box pushing technique and its fixes: This paper gives thought towards issues that arises during execution of RUB using box pushing methodology and its fixes. It moreover explains about the methodology remembering for application in metro advancement.

Manisha D. Bhise et al. (2015) Analysis of obstruction Bridge: The arrangement steps of RCC Box explained in this paper. Setup has been reviewed by 2D diagram with various weight mixes and soil solidness. Importance of RCC box type underpass furthermore depicted.

Mohankar R. H. et al. (2015) Parametric Study of Underpass Bridge: 3D model of box associate structure has been examined in this paper. The relationship of various conditions for the sheer force, contorting second, robustness and various segments of arrangement have been taken a gander at in this paper.

G. Sampath Kumar (2015) Box pushing strategy on Railway under expansion for cross traffic works: This is a relevant examination of Railway under framework (RUB) improvement by box pushing advancement. The arrangement of pre-extended box organized by using STAAD expert programming.

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 lump was 500mm for WSM which was decreased to 400mm for the two carriageways still there was about 20% saving in proportion of concrete and 5-10% saving in proportion of help for LSM for instance LSM was essentially down to earth plan stood out from WSM.

Lingampally Maithri Varun et al. (2015) Analysis, plan and development that is pushing box (Bridge): The pushing of RCC Box methodology has been explained in detail. Contraptions and supporting instruments/structures required for box pushing advancement, for instance, pushed bed, front shield, back shield, pin box, jacks, etc are moreover depicted.

3. MODELING AND SOFTWAREVALIDATION

A. Analysis Software

STAAD speaks to Structural examination and plan PC Program at first made by Research Engineers International in Yorba Linda, CA. Investigation Engineer International was bought by Bentley Systems. The different variations of the item are used in present time. STAAD III is used by Iowa State University for informational purposes for normal and fundamental authorities. As of now we are using STAAD master v8i programming for fundamental examination and plan. It can perform diverse kind of assessment in 2-estimation and 3-estimation presented to different weight mixes, maintain condition, etc depending upon expert's need. The courses of action for steel setup, strong arrangement, foundation plan, etc are in like manner given by their significant codes. The issues of first solicitation static examination, second solicitation p-delta assessment, numerical non-straight examination, fastening assessment, dynamic examination, response range, etc can be performed with no issue. In present work box segment is dismembered by using STAAD.pro programming.

B. Model Description

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

Table.1 Details of structure

S. No.	Particulars	Details
1	Size of the box	7.5 m × 5.15 m
2	Thickness of top slab	0.6 m
3	Thickness of bottom slab	0.6 m
4	Thickness of end vertical walls	0.75 m
5	Effective height	5.75 m
6	Effective span	8.25 m
7	Support condition	Simply Supported

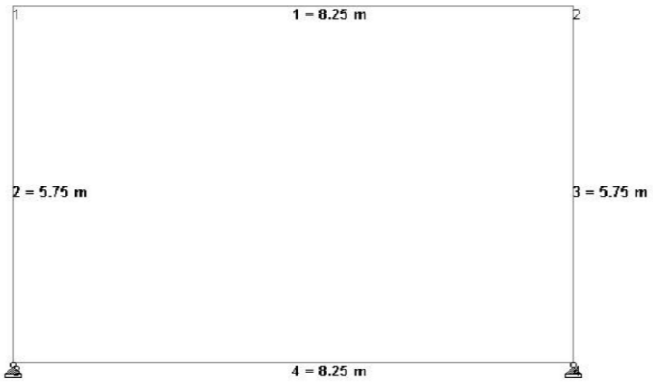

Figure 1 STAAD model of Box segment

C. 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.

AboxhavingDeadloadontopslab=7.755t/m^2=7.755×9.81=76.051kN/m^{2}andDeadloadon bottom slab = 11.0625 t/m^2 = 11.0625 × 9.81 = 108.486kN/m^2.

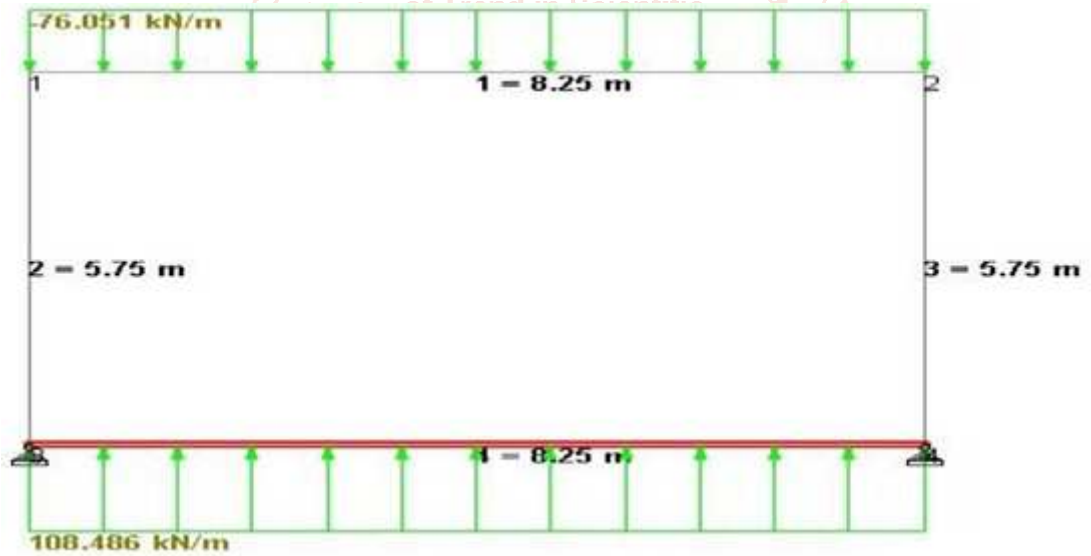

Figure 2 Loading Diagram

D. Manual Analysis

Problem Statement: Analyze the plane box frame shown in figure 2 using the moment distribution method and making use of symmetry.

$$I_1 = \frac{1 \times (.6)^3}{12} = I$$

$$I_2 = \frac{1 \times (.75)^3}{12} = 1.95I \cong 2I$$

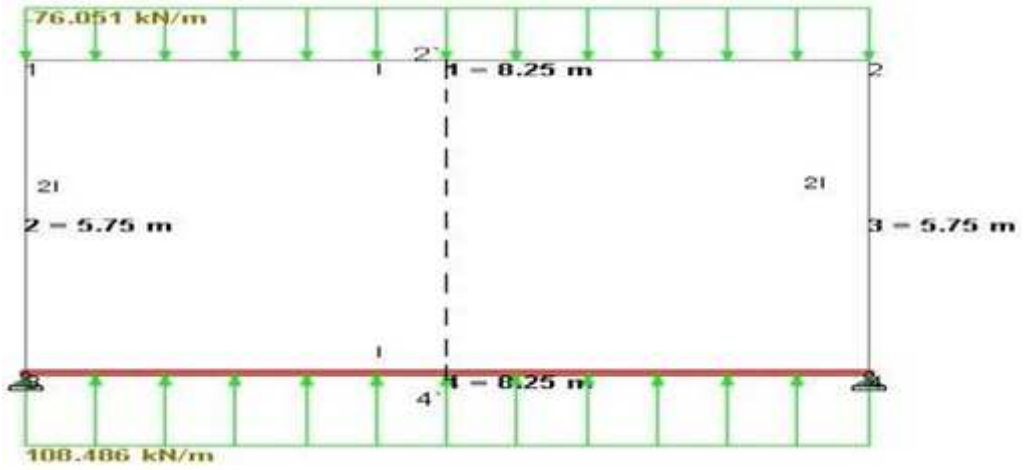

Figure 3 Loading diagram for MDM

The box frame is symmetrical and the centre line is passing through the mid span, then takes the stiffness of beam 1 and beam 4 ash alfofits original value and carry out the end moment distribution for half of the box only.

1. Fixed end moment

$Mf_{12}' = \frac{wl^2}{12} = \frac{7.775 \times 8.25^2}{12} = 43.98tm$

$Mf_2'_1 = \frac{wl^2}{12} = \frac{7.775 \times 8.25^2}{12} = 43.98tm$

$Mf_{1\ 3} = 0$

$Mf_{3\ 1} = 0$

$Mf_{3\ 4}' = \frac{wl^2}{12} = \frac{11.0625 \times 8.25^2}{12} = 62.74tm$

$Mf_4\ '_3 = -\frac{wl^2}{12} = -\frac{11.0625 \times 8.25^2}{12} = -62.74\ tm$

2. Distribution Factor

Table 2 Distribution factor

Joint	Member	Relative Stiffness	Total R S	DF
1	12'	$\frac{1}{2}\left(\frac{I}{8.25}\right)$	$\frac{38.75I}{94.875}$	0.148
	13	$\frac{2I}{5.75}$		0.852
3	31	$\frac{2I}{5.75}$	$\frac{3875I}{94.875}$	0.852
	34'	$\frac{1}{2}\left(\frac{I}{8.25}\right)$		0.148

3. Moment Distribution

Table 3 Moment distribution method

Joint	2'	1		3		4'
DF	1	0.148	0.852	0.852	0.148	1
FEM	43.98	- 43.98	0	0	62.74	- 62.74
Balanced		6.51	37.47	- 53.45	- 9.29	
COM	3.255		-26.725	18.735		- 4.645
Balanced		3.955	22.77	- 15.96	- 2.775	
COM	1.9775		- 7.98	11.385		- 1.3875
Balanced		1.18	6.8	- 9.7	- 1.685	
COM	0.59		- 4.85	3.4		- 0.8425
Balanced		0.72	4.13	-2.9	- 0.5	
COM	0.36		-1.45	2.065		- 0.25
Balanced		0.2146	1.2354	-1.76	- 0.305	
COM	0.11		-0.88	0.6177		- 0.1525
Final End Moments	50.27	-31.4	30.52	-47.56	48.185	-70.02

E. STAAD Analysis

Problem Statement: Analyze the plane box frame shown in figure 4 using STAAD Pro software.

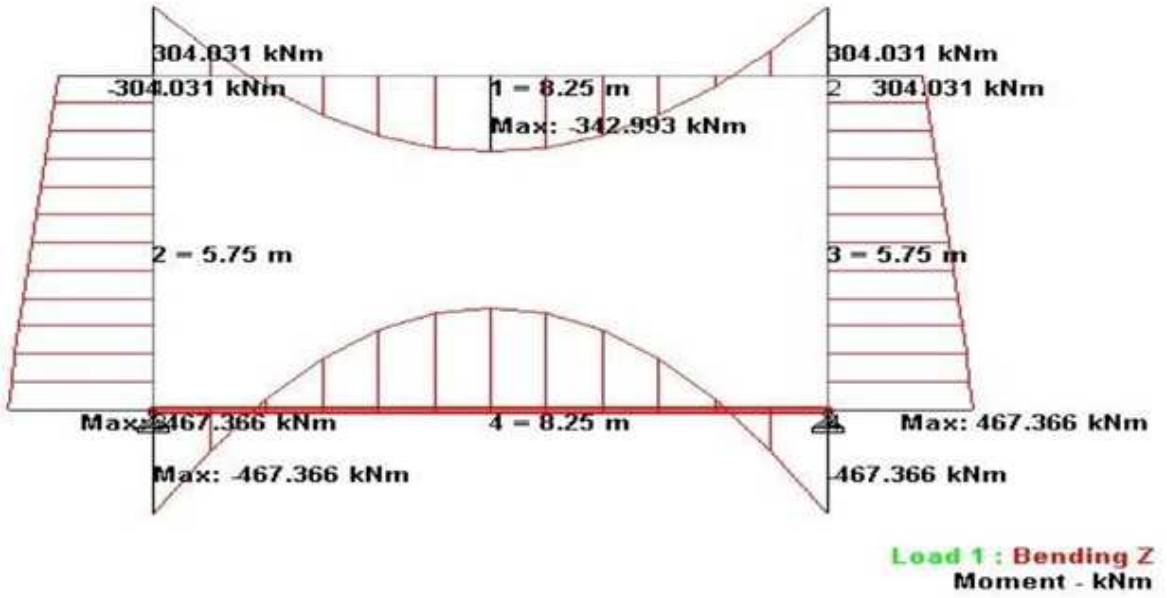

Figure 4 BMD for Dead load

Table 4 Comparison of BM between STAAD Pro and Moment Distribution Method

Joint	Manual	STAAD Pro	% Error
1	(31.4 + 30.52)/2 = 30.96 tm	304.031/9.81 = 30.99 tm	- 0.096
3	(47.56 + 48.185)/2 = 47.87 tm	467.366/9.81 = 47.64 tm	0.048

The Bending moment calculated by STAAD Pro is found to be approximately similar as calculated by Moment Distribution Method.

4. CONCLUSION

From the writing survey, it is reasoned that the correlation with the years prior innovation in development world was very evolved. So we develop the passages and over-spans utilizing the case courses fast and the expense of development is less and there is less danger and pushing innovation is broadly utilized these days and gives awesome aftereffects of work.

A. The essential regions considered are the point of convergence of scope of top and base lumps and the rump and at the center and back end of the vertical dividers since the most extraordinary arrangement powers make at these fragments due to various blends of stacking plans.

B. The examination shows that the most extraordinary arrangement powers delivered for the stacking condition when the top area is presented to the dead weight and live weight and sidewall is presented to earth weight and cheats, and when the course is unfilled.

C. The most prominent negative second make at the midriff of the top piece for the condition that the compartment is unfilled and the top lump passes on the dead weight and live weight.

D. The most extraordinary positive second make at the rear end portion of the top piece for the condition that the box is unfilled and the top area passes on the dead weight and live weight.

E. The most extraordinary positive second make at the midsection of the base piece for the condition that the holder is unfilled and the top lump passes on the dead weight and live weight.

F. The most outrageous negative second make at the posterior piece of the base segment for the condition that the box is empty and the top piece passes on the dead weight and live weight.

G. The most prominent positive second make at the rump of vertical divider when the compartment is empty and when sidelong weight (Earth pressure, Live Load Surcharge and Dead Load Surcharge) acts.

H. It was seen that Computational technique (Staad Pro) was essentially more capable than Moment Distribution Method (MDM) in term of profitability of result and time usage.

I. Quantities will be less when contrasted with the regular strategy for development.

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