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Analysis and Design of Pre Cast Box for Road under Bridge and Road Over Bridge by using Staad Pro

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ABSTRACT

A level crossing or a grade crossing is a place where railroad line and a street meet each other at a similar level. In the Urban regions for the most part the level intersections are checked by qualified railroad staffs that screen the train development and close the level intersection door to stop the meddling street traffic yet such shutting of entryways prompts gridlock in streets, makes loss of time the street clients and now and again likewise prompts a mishap. The best choices to kill the level going across are Road under Bridge (RUB) and Road over Bridge (ROB). There are 3 fundamental strategies for development of street under scaffold. Box pushing strategy, Cut and spread strategy, moving method utilizing RH brace. In this paper a plan of Road under Bridge or Subway by Box Pushing Method is introduced. During that time, traffic is continuing overhead typically, ignorant of the development beneath. The no problematic nature of the cycle along with its inalienable wellbeing, effortlessness and economy make box pushing a valuable apparatus for the rehearsing structural designer. This paper means to carry a more noteworthy experience with the crate pushing cycle to the peruser and afterward give a few contemplations and rules to help engineers in planning an undertaking that can be assembled utilizing the container pushing strategy. Box pushing is a settled methods for designing ducts or passages under rail banks or streams to oblige street or rail traffic.

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

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1. INTRODUCTION

It is notable that railroad tracks need to go across through the streets in and around very populated, well - set up urban areas and towns, so a level intersection is given in those focuses yet these level intersections might be monitored or automated, and further causes a gridlock when a train passes. As both populace and traffic are expanding step by step, delays and the danger of mishaps at the level intersections are likewise expanding. Around 30-40 % of train mishaps were at level intersections, regarding causalities it contributes 60-70 %. So Indian Railways needs to choose either go for street over scaffolds (ROB's) or street under extensions (RUB's) the place ever fundamental in populated regions. In planning of structure the two main considerations ought to be remembered for example economy and wellbeing. On the off chance that the heap is overestimated than the structure will be uneconomical while if the heap is thought little of the wellbeing of structure will be undermined. Subsequently the figuring of burden and their mix ought to be done accurately. The all out burdens following up on the container are resolved and the subsequent twisting minutes, shear powers and pivotal powers following up on the case are determined for every blend of burdens and afterward it is intended for the most unfavorable mix of burdens.

Box pushing procedure is most broadly utilized in view of its different focal points over the other regular techniques for example cut and spread strategy and moving procedure utilizing RH support, box pushing strategy is simple and helpful to build in a functioning intersection of rail and street over ordinary techniques. In Box pushing method, pre projected R.C.C. box sections are utilized and pushed through the weighty banks of Rail or Road by Jacking. The necessary push is created through push bed, just as the line and level of precast boxes is likewise constrained by the pushed bed. This underpass RCC Bridge is driven into bank by methods for water powered jacks which is definite clarified in this report, since the accessibility of land in the city is less, such kind of scaffold uses less space for its development. Thus developing Underpass Bridge by Box pushing strategy is a superior alternative where there is an imperative of room or Land.

Extension development these days has accomplished an overall degree of significance. With quick innovation development the ordinary scaffold has been supplanted by imaginative practical auxiliary framework. The productive dispersal of clogged traffic, financial contemplations, and tasteful attractive quality has expanded the fame of box type connects these days in present day thruway frameworks, including metropolitan trades. They are conspicuously utilized in interstate and scaffold frameworks because of its basic proficiency, functionality, better strength, satisfying feel and economy of development. They are effective type of development for spans since it limits weight, while expanding flexural solidness and limit. It has high torsional solidness and quality, contrasted and a comparable individual from open cross area. Albeit critical examination has been in progress on cutting edge investigation for a long time to all the more likely comprehend the conduct of a wide range of box connects, the aftereffects of these different exploration works are dispersed and unevaluated. Subsequently, a straightforward comprehension of later work on straight and bended box spans is exceptionally wanted which disclosed the consideration towards pointing a current report. The principle objective is to give an away from about the examination and plan of box type minor railroad spans. This examination would empower connect specialists to more readily comprehend the conduct of Box Bridge laying out an alternate methodology towards investigation and plan. Some of the brief summary of the research are presented here:

2. LITERATURE REVIEW

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.

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.

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.

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.

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.

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.

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.

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.

3. MODELING AND SOFTWAREVALIDATION

A. Analysis Software

STAAD represents Structural investigation and plan PC Program initially created by Research Engineers International in Yorba Linda, CA. Exploration Engineer International was purchased by Bentley Systems. The various adaptations of the product are utilized in present time. STAAD III is utilized by Iowa State University for instructive purposes for common and basic specialists. Presently we are utilizing STAAD expert v8i programming for basic investigation and plan. It can perform different type of examination in 2-measurement and 3-measurement exposed to various burden blends, uphold condition and so on relying upon specialist's necessity. The arrangements for steel configuration, solid plan, establishment plan and so forth are likewise given by their important codes. The issues of first request static investigation, second request p-delta examination, mathematical non-straight investigation, clasping examination, dynamic investigation, reaction range and so forth can be performed without any problem. In present work box section is dissected by utilizing 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

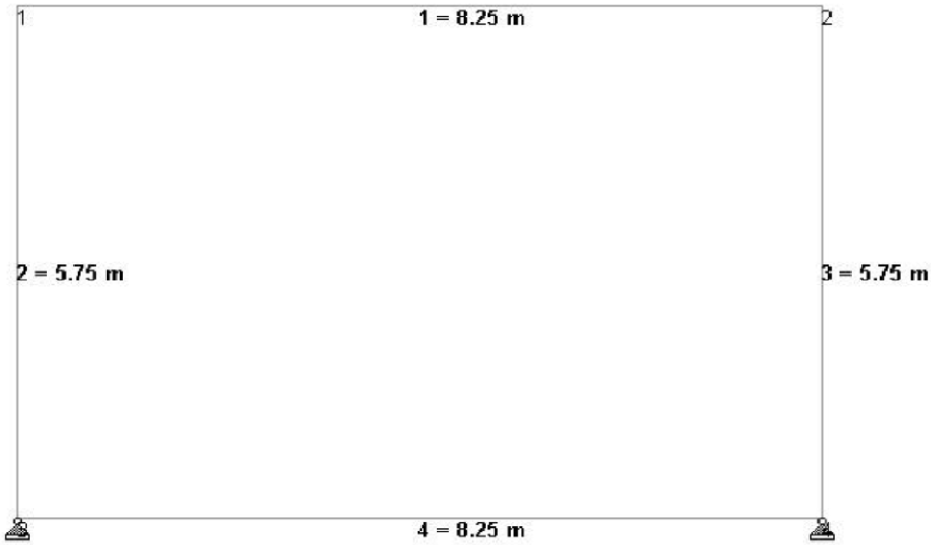

Figure 1 STAAD model of Box segment

C. Software Validation

AbovemodelfordeadloadistakentovalidatetheSTAADresults.Problemissolvedbymanually, 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.

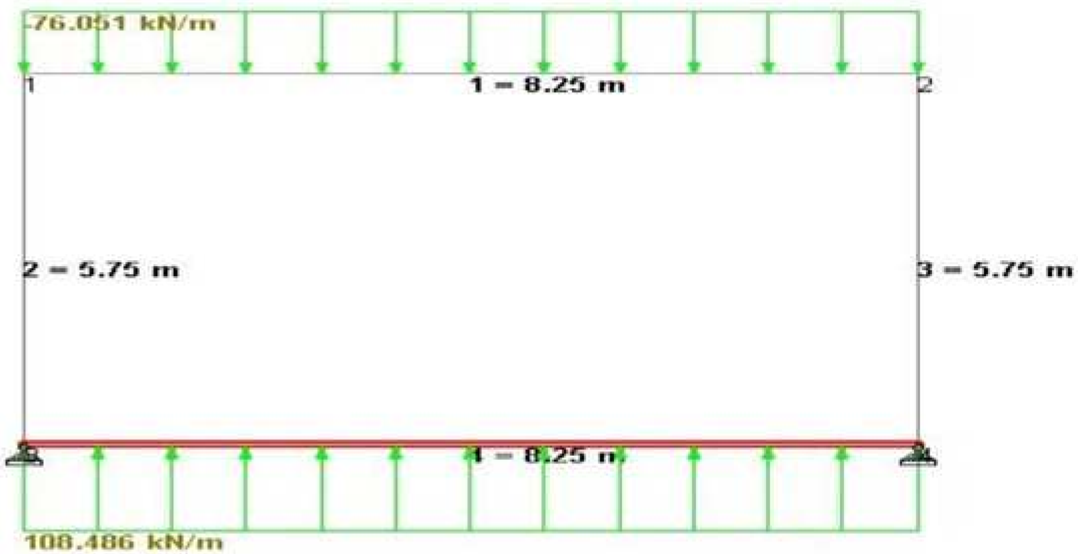

Figure 2 Loading diagram

D. Manual Analysis

ProblemStatement:Analyzetheplaneboxframeshowninfigure2usingthemomentdistribution method and making use of symmetry.

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

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

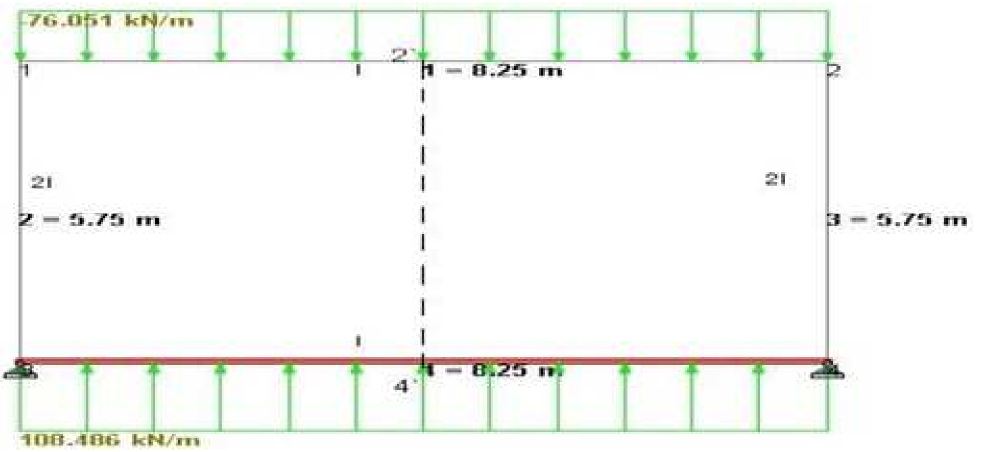

Figure 3 Loading diagram for MDM

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 ashalfofits original value and carryout the end moment distribution for half of the box only.

1. Fixed end moment

$Mf_{1\ 2}' = -\frac{wl^2}{12} = -\frac{7.755\times8.25^2}{12} = -43.98tm$

$Mf_{2}'_{1} = \frac{wl^2}{12} = \frac{7.775\times8.25^2}{12} = 43.98tm$

$Mf_{1\ 3} = 0$

$Mf_{3\ 1} = 0$

$Mf_{3\ 4}' = \frac{wl^2}{12} = \frac{11.0625\times8.25^2}{12} = 62.74tm$

$Mf_{4}'_{3} = -\frac{wl^2}{12} = -\frac{11.0625\times8.25^2}{12} = -62.74\ tm$

2. Distribution Factor

Table 2 Distribution factor

Joint	Member	Relative Stiffness	Total R S	DF
1	12'	$\frac{1}{2}(\frac{I}{8.25})$	$\frac{38.75I}{94.875}$	0.148
	13	$\frac{2I}{5.75}$		0.852
3	31	$\frac{2I}{5.75}$	$\frac{3875I}{94.875}$	0.852
	34'	$\frac{1}{2}(\frac{I}{8.25})$		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		3955	22.77	- 15.96	- 2.775	
COM	19775		- 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.

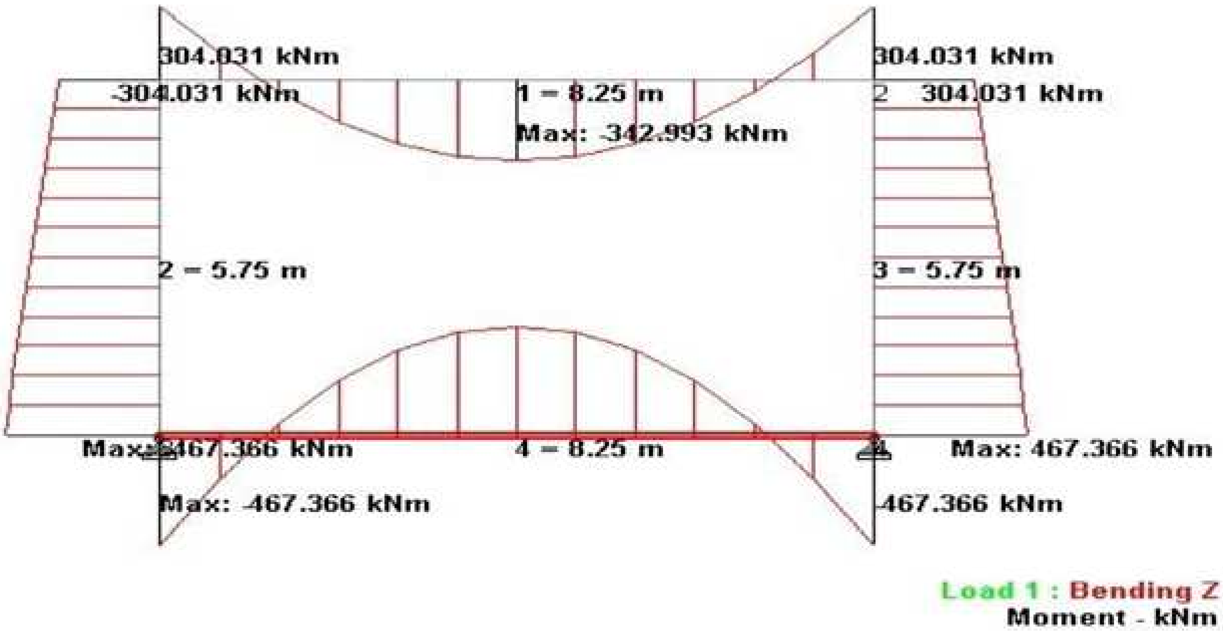

Figure 4 BMD for Dead load

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 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.

1. The basic areas considered are the focal point of range of top and base chunks and the hindquarters and at the middle and rump of the vertical dividers since the most extreme plan powers create at these segments because of different mixes of stacking designs.
2. The investigation shows that the most extreme plan powers produced for the stacking condition when the top section is exposed to the dead burden and live burden and sidewall is exposed to earth weight and overcharges, and when the course is unfilled.
3. The greatest negative second create at the waist of the top piece for the condition that the container is unfilled and the top chunk conveys the dead burden and live burden.
4. The most extreme positive second create at the rump segment of the top piece for the condition that the crate is unfilled and the top section conveys the dead burden and live burden.
5. The most extreme positive second create at the midriff of the base piece for the condition that the container is unfilled and the top chunk conveys the dead burden and live burden.
6. The most extreme negative second create at the backside part of the base section for the condition that the crate is vacant and the top piece conveys the dead burden and live burden.
7. The greatest positive second create at the hindquarters of vertical divider when the container is vacant and when sidelong weight (Earth pressure, Live Load Surcharge and Dead Load Surcharge) acts.
8. It was seen that Computational strategy (Staad Pro) was significantly more able than Moment Distribution Method (MDM) in term of productivity of result and time utilization.
9. Quantities will be less as compared to the conventional method of construction.

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