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Analysis and Design of Box Type Major Bridge

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Abstract: The bridge is a structure that provides passage through the obstacle without closing the path at the bottom. The required passage may be for roads, railways, pedestrians, canal or pipeline. A river, road, railway or valley can become an obstacle for crossing. In other words, the bridge is a structure for road traffic or other moving loads on depression or obstruction, such as a canal, road or railroad. A bridge is an arrangement made to cross the obstacles in the form of low soil or flow or river without closing the path underneath. The focus is on a design methodology that naturally covers the type of load according to the respective IRC codes and their combination to get the worst effect for safe structure. There are: 1893-1984 m² (p. 6.1.3) Ensure that a box of cuverts should not be designated for an earthquake of force, hence the earthquake forces do not take into account. The present work is to analyze and design a box type bridge RCC structure using CSI-BRIDGE software.
Keywords: Bridge, IRC loading,

I. INTRODUCTION

Building Bridges today has reached a world level of importance. With the rapid growth of technology, the traditional bridge was replaced by an innovative profitable structural system. Effectively overclocking congested traffic, economic considerations, and aesthetic desirability increased popularity of a box-type bridges these days in modern highway systems, including Urban solutions. They occupy prominent place in highway and bridge systems due to their structural efficiency, operational efficiency, best stability, pleasant aesthetics and construction economy. They are an effective form of building for bridges, because it minimizes weight, while maximizing stiffness and efficiency. It has a high torgostiffness and strength, compared with the equivalent member of the Open cross-section. Although significant research is underway for advanced analysis over the years to better understand the behaviors of all types of bridges. The bridge is a structure that provides passage through the obstacle without closing the path at the bottom. The required passage may be for roads, railways, pedestrians, canal or pipeline. A river, road, railway or valley can become an obstacle for crossing. In other words, the bridge is a structure for road traffic or other moving loads on depression or obstruction, such as a canal, road or railroad. A bridge is an arrangement made to cross the obstacles in the form of low soil or flow or river without closing the path underneath. Bridges are an integral connection of the railway system.

II. REVIEW OF LITERATURE

Bridges are structural components that are necessary for the efficient movement of trains and locomotives and underground embankment for crossing the water course, as streams through the embankment as the road promenade may not be allowed to prevent the natural way of water. Bridges can be of different shapes, such as the arch, plate and box. They can be built with a different material, such as brick masonry (brick, stone, etc.). The structural elements must be designed to withstand the maximum bending point and shear effort. This article provides discussions on the position in codes, reasoning and justification of all the above aspects on the design (Mr. Afsal Hanif Sharif 2016). There are various studies that have been undertaken to perform (RC) box bridges in the previous with a variety of load combinations. Analysis and Development (RC) bridges box is a different assignment. The box bridge consists of the upper plate, the bottom (the raft) of the plate, two exterior walls. Easy to construct do not need any complex foundation. Research contract using frame design – Work RC BOX BRIDGE, like 2D and 3D analysis in various load combinations, SPAN/height proportions. Interaction of soil in which B M * S F expands without soil interaction in comparison with the method of soil interaction, method of effective width, moment of distribution of method and genetic method of algorithm is used. It is parallel and comparable to a pillow and without pillows on the box bridge with a pillow of over B * S F occurred compared to without pillows (MD. Salman Apacabani et al. 2019). Design of vertical loads on boxes under embankuses, usually calcu with the use of soil interaction factors (Fe), recommended by the American Highway Society and Transport Officials (AASHTO). The nonlinear finite part of the assay was used to update the Fe given by AASHTO, given the effects of posterior elevation padding, culvert rigidity, overfilled material rigidity, sealing of the back fill, and tightening of the layer upon which the remnants on culvert. Simplified reliability analysis was performed to determine the adequacy of the level of security in AASHTO-load resistance code-TOR (LNRFO) Specifications (Sami Oğuzhan Akbaş ET Al 2015).

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III. MODELING

The Box type bridge is modeled using CSI Bridge software and it consists of the parameters of Bridge as follows so that the analysis is to be carried out.

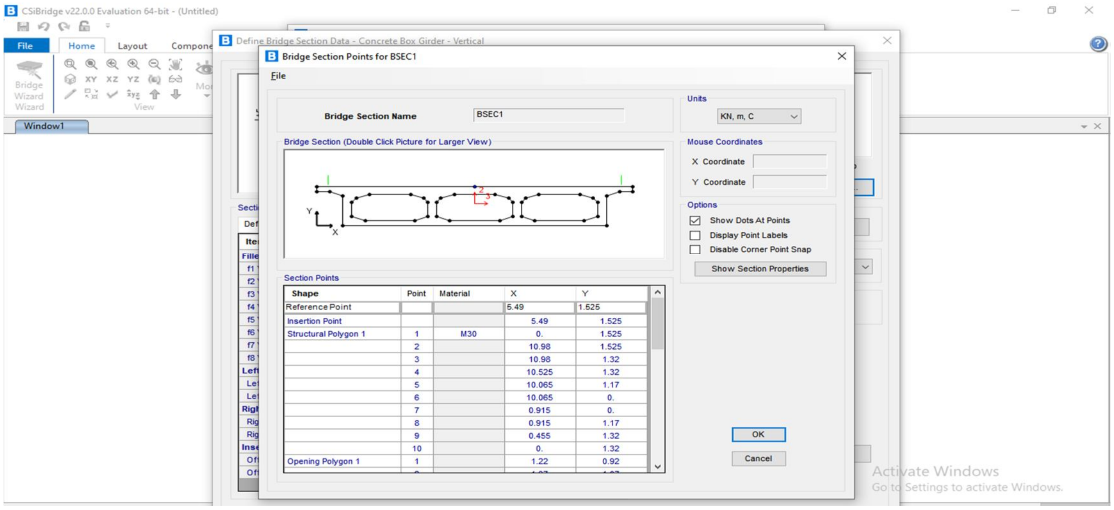

Fig.1: Bridge section Properties

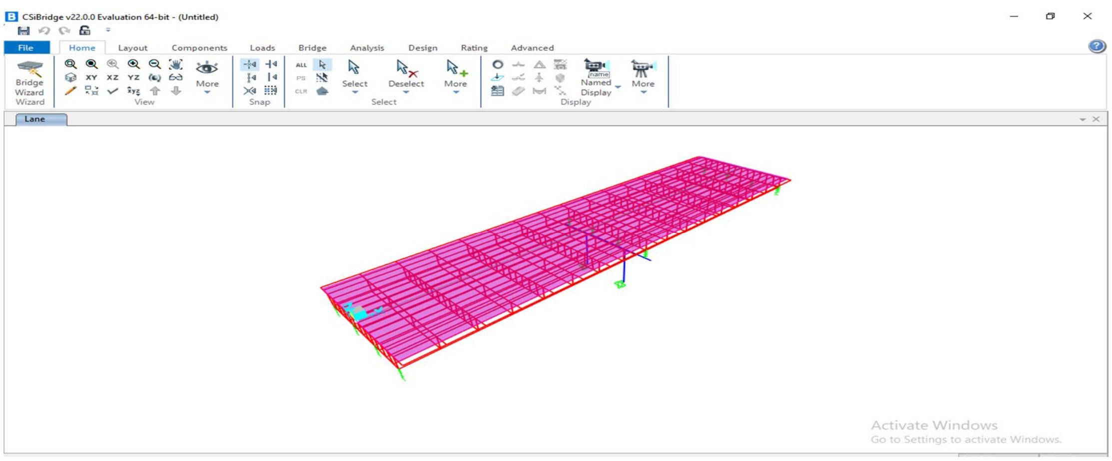

Fig.2: Bridge Model

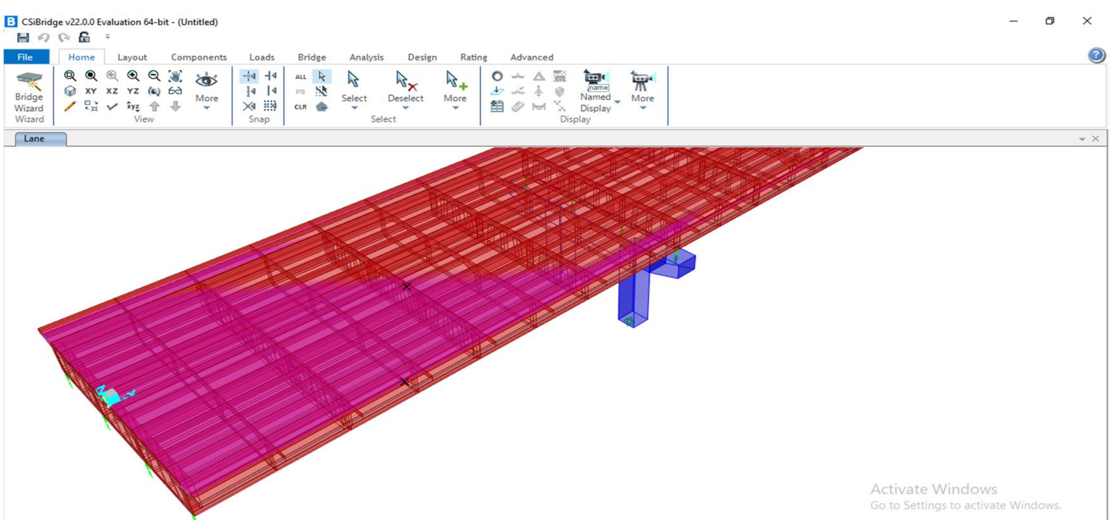

Fig.3: 3D- View of Bridge Model

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IV. RESULTS

The modeling of the bridge is completed and then the analysis is carried out, the results of the models are in terms of stresses and forces as follows.

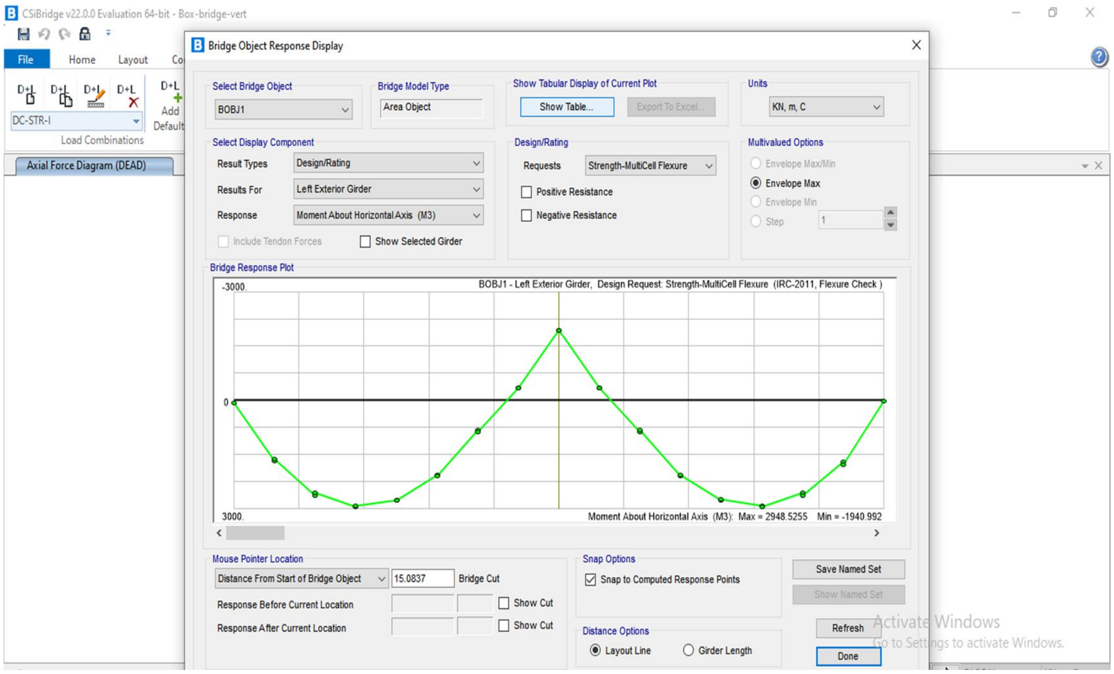
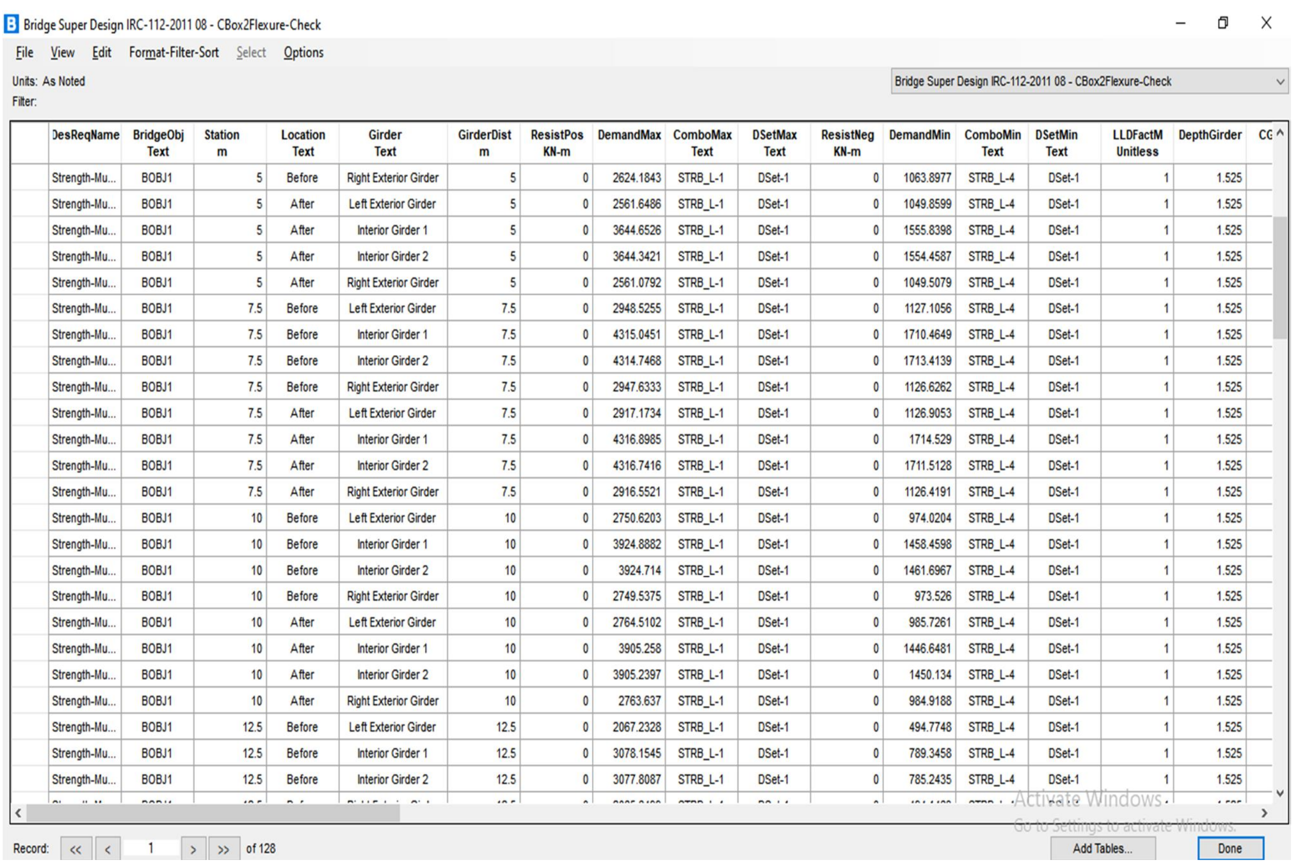


Fig.4: Moment about Horizontal axis



Bridge Super Design IRC-112-2011 08 - CBox2Flexure-Check

Units: As Noted

DesReqName	BridgeObj Text	Station m	Location Text	Girder Text	GirderDist m	ResistPos KN-m	DemandMax	ComboMax Text	DSetMax Text	ResistNeg KN-m	DemandMin	ComboMin Text	DSetMin Text	LLDFactM Unitless	DepthGirder
Strength-Mu...	BOBJ1	5	Before	Right Exterior Girder	5	0	2624.1843	STRB_L-1	DSet-1	0	1063.8977	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	5	After	Left Exterior Girder	5	0	2561.6486	STRB_L-1	DSet-1	0	1049.8599	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	5	After	Interior Girder 1	5	0	3644.6526	STRB_L-1	DSet-1	0	1555.8398	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	5	After	Interior Girder 2	5	0	3644.3421	STRB_L-1	DSet-1	0	1554.4587	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	5	After	Right Exterior Girder	5	0	2561.0792	STRB_L-1	DSet-1	0	1049.5079	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	Before	Left Exterior Girder	7.5	0	2948.5255	STRB_L-1	DSet-1	0	1127.1056	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	Before	Interior Girder 1	7.5	0	4315.0451	STRB_L-1	DSet-1	0	1710.4649	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	Before	Interior Girder 2	7.5	0	4314.7468	STRB_L-1	DSet-1	0	1713.4139	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	Before	Right Exterior Girder	7.5	0	2947.6333	STRB_L-1	DSet-1	0	1126.6262	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	After	Left Exterior Girder	7.5	0	2917.1734	STRB_L-1	DSet-1	0	1126.9053	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	After	Interior Girder 1	7.5	0	4316.8985	STRB_L-1	DSet-1	0	1714.529	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	After	Interior Girder 2	7.5	0	4316.7416	STRB_L-1	DSet-1	0	1711.5128	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	7.5	After	Right Exterior Girder	7.5	0	2916.5521	STRB_L-1	DSet-1	0	1126.4191	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	Before	Left Exterior Girder	10	0	2750.6203	STRB_L-1	DSet-1	0	974.0204	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	Before	Interior Girder 1	10	0	3924.8882	STRB_L-1	DSet-1	0	1458.4598	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	Before	Interior Girder 2	10	0	3924.714	STRB_L-1	DSet-1	0	1461.6967	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	Before	Right Exterior Girder	10	0	2749.5375	STRB_L-1	DSet-1	0	973.526	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	After	Left Exterior Girder	10	0	2764.5102	STRB_L-1	DSet-1	0	985.7261	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	After	Interior Girder 1	10	0	3905.258	STRB_L-1	DSet-1	0	1446.6481	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	After	Interior Girder 2	10	0	3905.2397	STRB_L-1	DSet-1	0	1450.134	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	10	After	Right Exterior Girder	10	0	2763.637	STRB_L-1	DSet-1	0	984.9188	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	12.5	Before	Left Exterior Girder	12.5	0	2067.2328	STRB_L-1	DSet-1	0	494.7748	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	12.5	Before	Interior Girder 1	12.5	0	3078.1545	STRB_L-1	DSet-1	0	789.3458	STRB_L-4	DSet-1	1	1.525
Strength-Mu...	BOBJ1	12.5	Before	Interior Girder 2	12.5	0	3077.8087	STRB_L-1	DSet-1	0	785.2435	STRB_L-4	DSet-1	1	1.525

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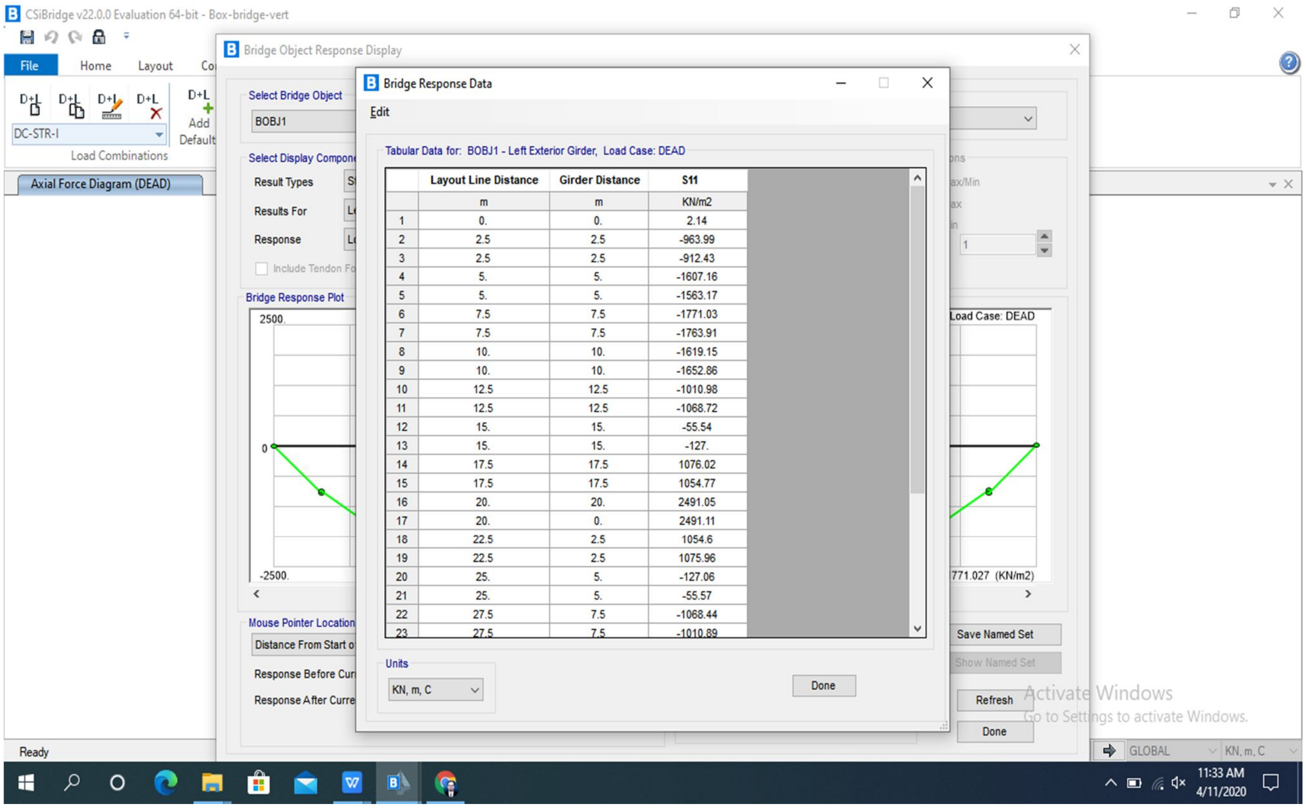
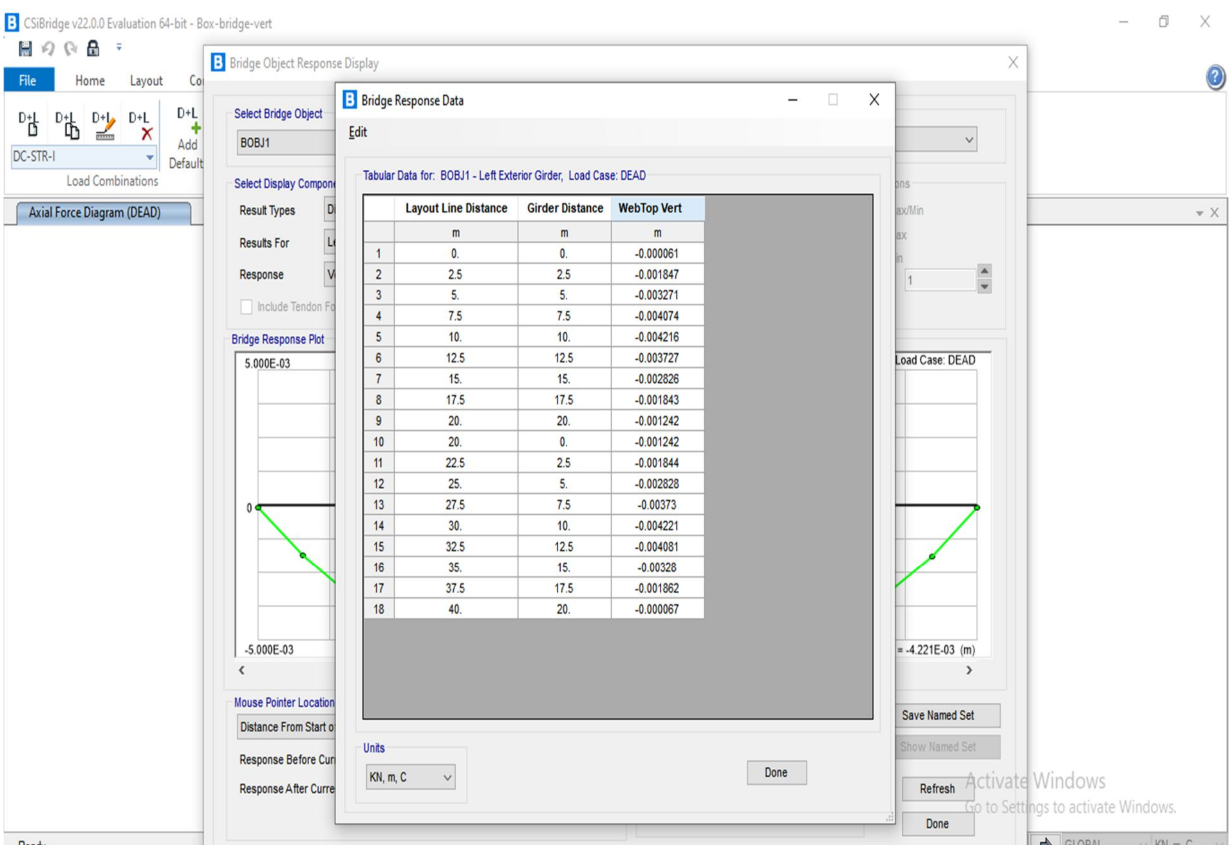
Fig.5: Stresses in the different parts of the Bridge



	Layout Line Distance	Girder Distance	S11
	m	m	KN/m2
1	0.	0.	2.14
2	2.5	2.5	-963.99
3	2.5	2.5	-912.43
4	5.	5.	-1607.16
5	5.	5.	-1563.17
6	7.5	7.5	-1771.03
7	7.5	7.5	-1763.91
8	10.	10.	-1619.15
9	10.	10.	-1652.86
10	12.5	12.5	-1010.98
11	12.5	12.5	-1068.72
12	15.	15.	-55.54
13	15.	15.	-127.
14	17.5	17.5	1076.02
15	17.5	17.5	1054.77
16	20.	20.	2491.05
17	20.	0.	2491.11
18	22.5	2.5	1054.6
19	22.5	2.5	1075.96
20	25.	5.	-127.06
21	25.	5.	-55.57
22	27.5	7.5	-1068.44
23	27.5	7.5	-1010.89

Fig.6: Stresses in the Left Exterior Bridge



	Layout Line Distance	Girder Distance	WebTop Vert
	m	m	m
1	0.	0.	-0.000061
2	2.5	2.5	-0.001847
3	5.	5.	-0.003271
4	7.5	7.5	-0.004074
5	10.	10.	-0.004216
6	12.5	12.5	-0.003727
7	15.	15.	-0.002826
8	17.5	17.5	-0.001843
9	20.	20.	-0.001242
10	20.	0.	-0.001242
11	22.5	2.5	-0.001844
12	25.	5.	-0.002828
13	27.5	7.5	-0.00373
14	30.	10.	-0.004221
15	32.5	12.5	-0.004081
16	35.	15.	-0.00328
17	37.5	17.5	-0.001862
18	40.	20.	-0.000067

Fig.7: Displacement in the Left Exterior Bridge

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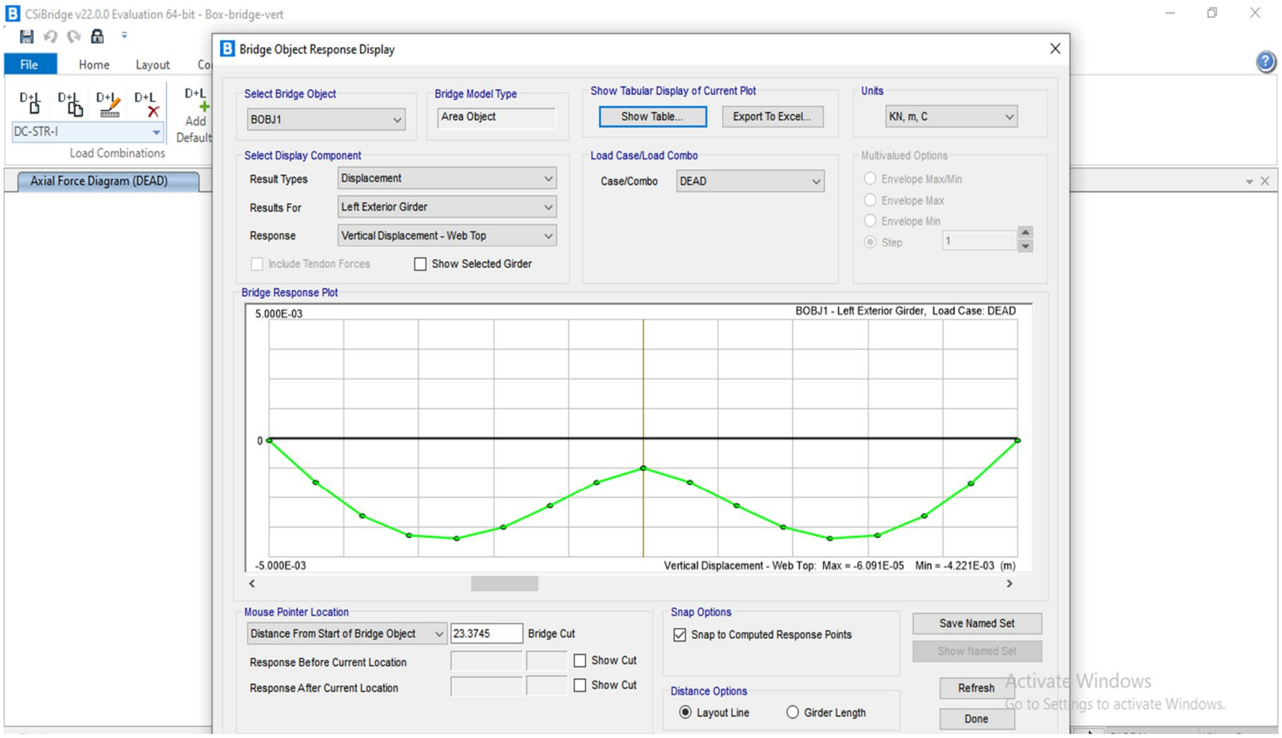
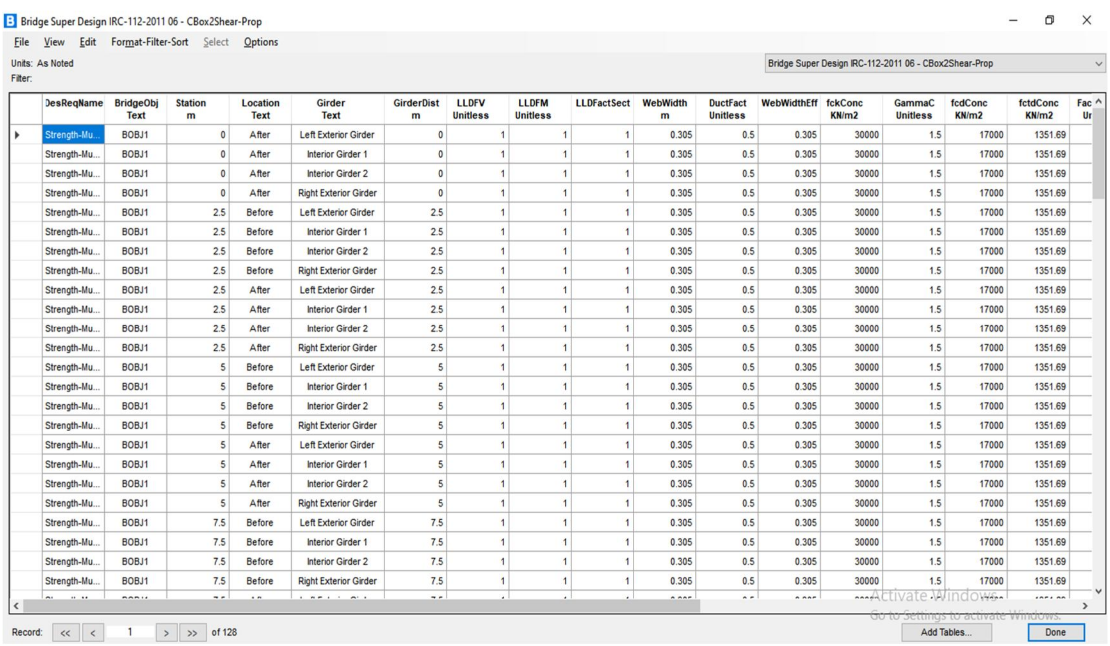


Fig.8: Displacement Diagram in the Left Exterior Bridge


Bridge Super Design IRC-112-2011 06 - CBox2Shear-Prop

Units: As Noted

DesReqName	BridgeObj Text	Station m	Location Text	Girder Text	GirderDist m	LLDFV Unitless	LLDFM Unitless	LLDFactSect	WebWidth m	DuctFact Unitless	WebWidthEff	fckConc KN/m2	GammaC Unitless	fcdConc KN/m2	fctdConc KN/m2	Fac Ur
Strength-Mu...	BOBJ1	0	After	Left Exterior Girder	0	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	0	After	Interior Girder 1	0	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	0	After	Interior Girder 2	0	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	0	After	Right Exterior Girder	0	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	Before	Left Exterior Girder	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	Before	Interior Girder 1	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	Before	Interior Girder 2	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	Before	Right Exterior Girder	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	After	Left Exterior Girder	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	After	Interior Girder 1	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	After	Interior Girder 2	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	2.5	After	Right Exterior Girder	2.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	Before	Left Exterior Girder	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	Before	Interior Girder 1	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	Before	Interior Girder 2	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	Before	Right Exterior Girder	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	After	Left Exterior Girder	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	After	Interior Girder 1	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	After	Interior Girder 2	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	5	After	Right Exterior Girder	5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	7.5	Before	Left Exterior Girder	7.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	7.5	Before	Interior Girder 1	7.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	7.5	Before	Interior Girder 2	7.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	
Strength-Mu...	BOBJ1	7.5	Before	Right Exterior Girder	7.5	1	1	1	0.305	0.5	0.305	30000	1.5	17000	1351.69	

Record: 1 of 128

Fig.9: Design parameters of Bridge

V. CONCLUSIONS

From the above study following conclusions can be drawn:

A. Box bridge is possible in CSI Bridge software as it is user friendly software
B. The stresses at the different parts of Bridge is observed
C. The moments in the different part are also presented
D. The displacement across the Bridge is also observed

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