International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

Analytic Study of Box Culvert to Reduce Bending Moment and Displacement Values

Vasu Shekhar Tanwar, M. P. Verma and Sagar Jamle*

Department of Civil Engineering, Oriental University, Indore (M.P), India

Received 14 April 2018, Accepted 15 June 2018, Available online 22 June 2018, **Vol.8, No.3 (May/June 2018)**

Abstract

A passage provided under the roads to pass flood, rain, water and animals through it safely without disturbing traffic on road and providing safe passage to user, generally box culverts are used. Box under goes various loads by water, traffic, cushions and soil.In this paper we have tried to reduce the Bending Moment values and displacement values in order to make structure more safe and reliable to construct and use.

Keywords:*Box culvert, flared portion, pressure cases, Staad pro, side walls.*

1. Introduction

Monolithically constructed box shaped structure designed for heavy load transferring to grounds (soil). Box culverts are used a box size is limited to 6m x 3m respectively the width and height if the necessity increases the box culvert is then called as a box bridge and then a big varying sizes of box can be designed. Box culvert is designed firstly for a meter and then multiplied. If necessity of culverts increases as per discharge volume then multiple culverts adjoining sides could be used.

2. Cases to be solved

For the purpose of design, culverts are subjected to following cases:-

Case-1: Dead load, live load, earth pressure acting from outside, no water pressure acting from inside.

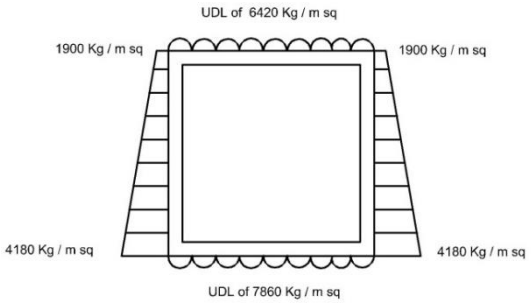


Fig.1 Case 1

Case-2: Dead load, live load, earth pressure acting from outside, water pressure acting from inside.

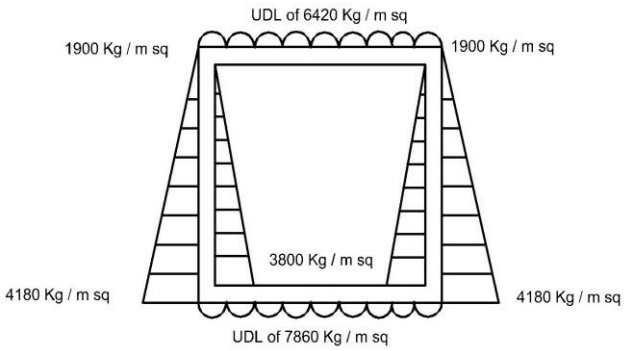


Fig. 2 Case 2

Case-3: Dead load, earth pressure acting from outside, no water pressure acting from inside without live load.

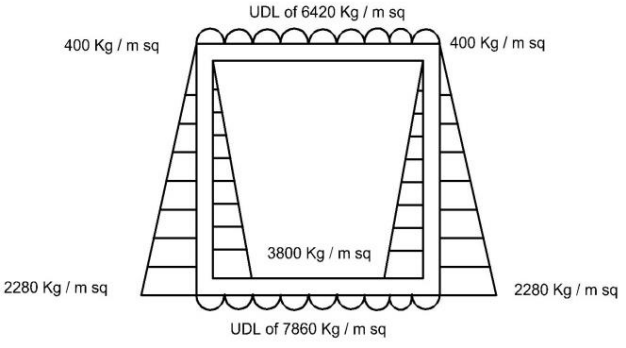


Fig. 3 Case 3

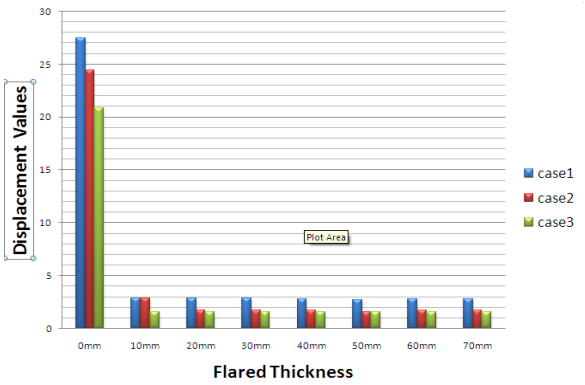
*Corresponding author's ORCID ID: 0000-0002-6890-6971
DOI: https://doi.org/10.14741/ijcet/v.8.3.33

Table 1 Providing Values for Box Culvert to determine reduction in Displacement

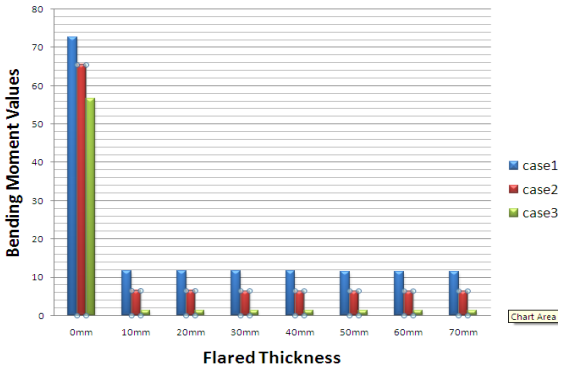
Flared portion	Displacement values (mm)		
	Case1	Case2	Case3
0MM	27.496	24.458	20.84
10MM	2.842	2.842	1.586
20MM	2.828	1.701	1.58
30MM	2.815	1.693	1.574
40MM	2.801	1.683	1.567
50MM	2.678	1.561	1.561
60MM	2.775	1.671	1.55
70MM	2.762	1.671	1.55

Table 2 Providing Values for Box Culvert to determine reduction in Bending Moment

Flared portion	Bending moment values (knm)		
	CASE1	CASE2	CASE3
0MM	72.677	65.465	56.545
10MM	11.665	6.485	1.246
20MM	11.63	6.467	1.242
30MM	11.596	6.450	1.238
40MM	11.561	6.430	1.234
50MM	11.526	6.415	1.230
60MM	11.492	6.397	1.226
70MM	11.457	6.397	1.226



Graph 1 Graphical Values of Displacement



Graph 2 Graphical Values ofBending Moments

Conclusions

1) Displacement values and Bending moment values declined and gave a positive response for structural change.
2) Displacement declined in case 1 by 93.89% as the minimum value of displacement is taken.
3) Displacement declined in case 2 by 93.61% as the minimum value of displacement
4) Displacement declined in case 3 by 92.56% as the minimum value of displacement
5) Bending Moment declined in case 1 by 84.23% as the minimum value of Bending Moment.
6) Bending Moment declined in case 2 by 90.22% as the minimum value of Bending Moment.
7) Bending Moment declined in case 3 by 97.84% as the minimum value of Bending Moment.

References

Mohankar R. H., Ronghe G. N. , (2010), Analysis and Design of Underpass RCC Bridge, International Journal of Civil and Structural Engineering, Volume 1, No 3, 2010, ISSN 0976 – 4399.

Mahesh Tandon, (2005), Economical Design of Earthquake-Resistant Bridges, ISET Journal of Earthquake Technology, Paper No. 453, Vol. 42, pp. 13-20, ISSN: 2455-2631,July 2016 IJSDR,Volume 1, Issue 7 IJSDR1607034 International Journal of Scientific Development and Research (IJSDR)

Y. Vinod Kumar and Dr. Chava Srinivas, (2015), International Journal of Engineering & Science Research, Vol. 5, ISSN 2277-2685.

Lande Abhijeet Chandrakant and Patil Vidya Malgonda, (2014), Finite element analysis of box culvert, International Journal of Advanced Technology in Engineering and Science, Volume No.02, Issue No. 06, June 2014, ISSN (online):2348 – 7550.

Neha Kolate, Molly Mathew and Snehal Mali, (2014), Analysis and Design of RCC Box Culvert, International Journalof Scientific & Engineering Research, Volume 5, Issue 12, December-2014 ISSN 2229-5518.

Sujata Shreedhar and R. Shreedhar, (2015), Design coefficients for single and two cell box culvert, International Journal of Civil and Structural Engineering , Volume 3, No 3, 2013, ISSN 0976 – 4399.

D. Vamshee Krishna and B. Jagadish Chakravarthy, (2014), RCC under pass design modeling and analysis using parametric study of soil structure interaction ,International Journal of Advanced Research, Volume No.03, Issue No.08, August 2015 ISSN 2320 – 9100.

Abdul-Hassan K. Al. Shukur, Dr. Mohammed Abbas Al. Jumaili and Hawraa Ali Hussein, (2014), Optimal Design of Reinforced Concrete Box Culvert by using Genetic Algorithms Method , International Journal of Scientific & Engineering Research, Volume 5, Issue 1, January-2014, ISSN 2229-5518.

Mulesh K. Pathak, (2014),Performance of RCC Box Type Superstructure in Curved Bridges International Journal of Scientific & Engineering Research, Volume 5, Issue 1, ISSN-2229-5518.

David Z. Yankelevsky, (1989), Loads on Rigid Box Buried InNonlinearMedium, Journal of Transportation Engineering, Vol. 115, Issue 5, September, ISSN 0733-947X/89/0005-0461. Paper No. 23870.

Kyungsik Kim & Chai H. Yoo, (2005), Design Loading on deeply buried Box Culverts, Journal of Geotechnical andGeo-environmental Engineering, Vol. 131, Issue1, ISSN 1090-0241, pp.20-27.

Richard M. Bennett, M. ASCE, Scott M. Wood, Eric C.Drum and N. Randy Rainwater, (2005), Vertical Loads onConcrete Box Culverts under High Embankments Journal of Bridge Engineering, Vol. 10, Issue 6, 2005, ISSN 1084-0702, pp. 643-649.

Ali Abolmaali and Anil K. Garg, (2008), Effect of Wheel live load on Shear Behavior of Precast Reinforced Concrete Box Culverts, Journal of Bridge Engineering, Vol. 1, Issue 1, ISSN 1084-0702, pp.93-99.

Ramamurtham & R. P. Sharma, (2014), RCC Box CulvertMethodology and Designs including Computer method, International Journal of Scientific & Engineering Research, Volume 5, Issue 12, ISSN 2229-5518.

Anil K. Garg, Ali Abolmaali, (2009), Finite Element Modeling and Analysis of ReinforcedConcrete Box Culverts Journal of TransportationEngineering, Vol. 135, Issue 3.

S. Shreedharand R. Shreedhar, (2013), Design coefficients for single and two cell box culvert, International Journal of Civil and Structural Engineering, Volume 3,Issue 3, pp. 475-494.

M.G. Kalyanshetti and S.A. Gosavi, (2014), Analysis of box culvert – cost Optimization for different aspect ratios of cell, International Journal of Research in Engineering and Technology, Vol. 03, Issue 04, pp. 508-514.

Komal S. Kattimani and R. Shreedhar, (2013), Parametric Studies of box culverts, International Journal of Research in Engineering and Science, Vol. 1, Issue 1, pp. 58-65.

L. M. Giletal, (2001), Simplified method for the analysis of square cross section buried structures, Soil Dynamics and Earthquake Engineering, Vol. 21, pp. 735-740.

Kalyanshetti M.G and Malkhare S. V., (2012), Analysis of box culvert by considering soil structure interaction, Indian journal of research, Vol. 1, Issue 4, pp.71-74.