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Analysis of Box Culvert to ReduceStressValues

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***Abstract*—*At the time of construction of roads, highways a structure is placed (commonly used) to transfer the traffic, rain water, drainage from one side to another of the road is called a culvert placed beneath the road. Due to the structural use, multiple loads are placed on the box causing various types of stress which occurs on it. The paper tries to reduce the stress occurred in the box by flaring the box partially.*

Keywords*—*Box culvert, flaredportion,pressure cases, side walls, staad pro.

I. INTRODUCTION

Culvert is an underpass provided beneath the high way which under goes various types of loading .It helps to facilities the flow of water, provide cross drainage, roadways or railways, to take electrical or other cables from one side of road to another side of the road . due construction of these high load bearing components various stress and shear gets generated in very high values the paper objects to reduce the values of the stress which have been generated for various cases.

II. TYPES OF CULVERTS

1 On basis of shape:-

- 1.1 Pipe culvert
- 1.2 Pipe Arch culvert
- 1.3 Box Culvert (single/multiple)
- 1.4 Arch culvert
- 1.5 Bridge culvert

2 On basis of material used:-

- 2.1 Concrete
- 2.2 Steel
- 2.3 Plastic
- 2.4 Aluminum
- 2.5 High density polyethylene

III. CASES TO BE SOLVED

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

Case-1:Dead Load, Live Load and Earth Pressure Acting from Outside, no Water Pressure Acting from Inside.
Case-2:Dead Load, Live Load and Earth Pressure Acting from Outside, Water Pressure Acting from Inside.
Case-3:Dead Load and Earth Pressure Acting from Outside, no Water Pressure Acting from Inside.

IV. PARAMETERS USED

1 Plate thickness= 0.30m
2 Length =10.50m
3 Width =3.80m
4 Flared width= 1.05m
5 Support= Fixed Type
6 Live Load on top slab= 6420kg/m^2
7 Earth Pressure Load from bottom slab= 7860kg/m^2
8 Earth Pressure Load on side walls= 1900-4180kg/m^2(case 2)
9 Earth pressure Load on side walls= 400-2280kg/m^2(case 3)
10 Water pressure Load on inside side walls= 0-3800kg/m^2
11 Coefficient of Active Earth pressure = 1/3
12 E= 2.17185e+007
13 Poisson= 0.17
14 Density = 25
15 Damping=0.05
16 Strength FCU = 25000

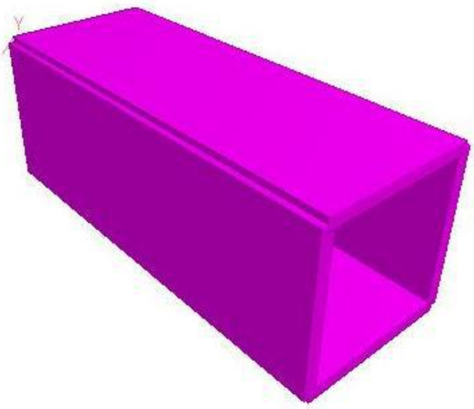

Fig.1: 3-D View of Flared Box Culvert

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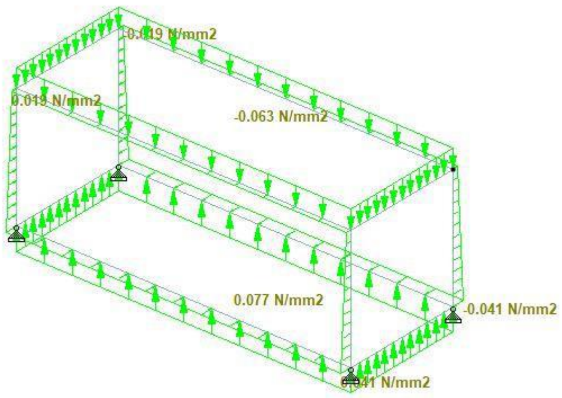


Fig.2: Case -1 of Box Culvert

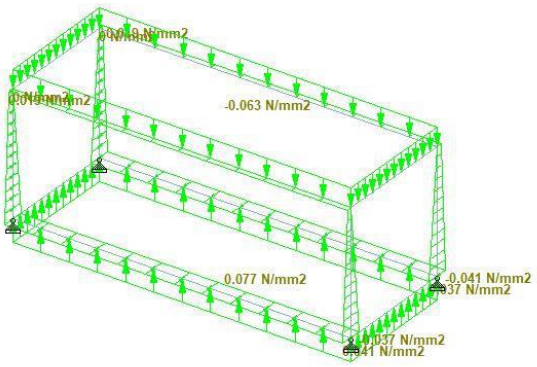


Fig.3: Case -2 of Box Culvert

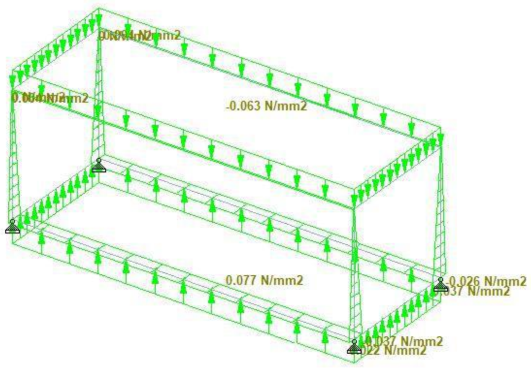


Fig.4: Case-3 of Box Culvert

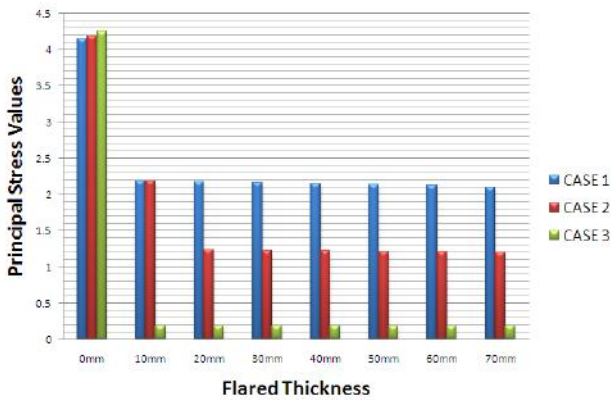
V. RESULT AND DISCUSSIONS

1. PRINCIPAL TOP values declined in case 1 by 49.36% when there is an increase of flared portion from 0mm to 70mm.
2. PRINCIPAL TOPvalues declined in case 2 by 71.36% when there is an increase of flared portion from 0mm to 70mm.
3. PRINCIPAL TOPvalues declined in case 3 by 95.80% when there is an increase of flared portion from 0mm to 70mm.
4. TRESCAvaluesdeclined in case 1 by25.75% when there is an increase of flared portion from 0mm to 70mm
5. TRESCA values declined in case 2 by 37.97% when there is an increase of flared portion from 0mm to 70mm
6. TRESCA values declined in case 3 by 52.55% when there is an increase of flared portion from 0mm to 70mm
7. VONMISS values declined in case 1 by 30.62% when there is an increase of flared portion from 0mm to 70mm
8. VONMISS values declined in case 2 by 40.81% when there is an increase of flared portion from 0mm to 70mm
9. VONMISS values declined in case 3 by 49.24% when there is an increase of flared portion from 0mm to 70mm.

Detailed values are described in tables shown below:-

Table.1: For Analysis of Principle Top in Box Culvert

FLARED PORTION	PRINCIPAL TOP(KN/MMSQ)		
	C1	C2	C3
0MM	4.147	4.19	4.243
10MM	2.185	2.185	0.179
20MM	2.171	1.228	0.179
30MM	2.157	1.221	0.178
40MM	2.142	1.215	0.178
50MM	2.128	1.208	0.178
60MM	2.114	1.201	0.178
70MM	2.1	1.2	0.178



Graph 1- Principle Stress Values v/s Flared Thickness

Table.2: For Analysis of Tresca in Box Culvert

FLARED PORTION	TRESCA IN (KN/MMSQ)		
	CASE1	CASE2	CASE3
0MM	6.519	6.125	5.67
10MM	4.983	4.983	2.738
20MM	4.959	3.866	2.728
30MM	4.936	3.849	2.719
40MM	4.913	3.832	2.71

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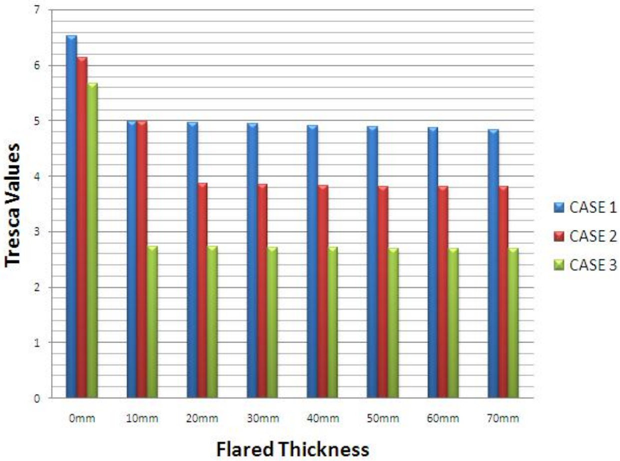
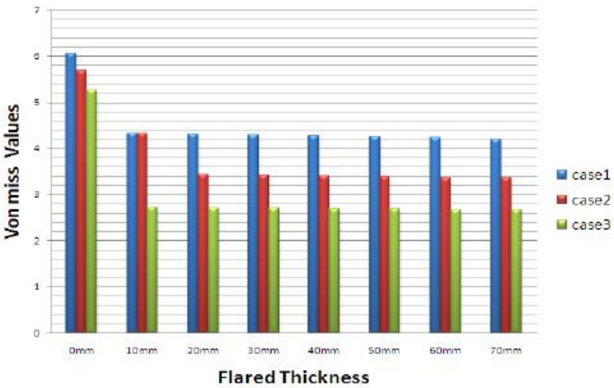
50MM	4.891	3.816	2.701
60MM	4.867	3.8	2.69
70MM	4.84	3.8	2.69



Graph.2: Tresca Values v/s Flared Thickness

Table.3: For Analysis of Von miss in Box Culvert

FLARED PORTION	VONMISS IN (KN/MMSQ)		
	CASE1	CASE2	CASE3
0MM	6.054	5.689	5.266
10MM	4.326	4.326	2.717
20MM	4.306	3.423	2.709
30MM	4.286	3.409	2.7
40MM	4.266	3.395	2.691
50MM	4.246	3.381	2.682
60MM	4.227	3.367	2.673
70MM	4.2	3.367	2.673



Graph.3: Von miss Values v/s Flared Thickness

VI. CONCLUSION

1. By usage of Staad pro software analysis of structure was thoroughly done.
2. Shear values decreased on increment of flared portion.
3. Vonmiss values decreased very fast and remained constant on further increment of thickness.
4. Principal stress declined and gave a positive response for structural change.
5. Tresca values also dropped.

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