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Structural Analysis & Design of Balance Cantilever Bridge

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Abstract: Executing a structure under an earthquake of ground movements resulting in damage of a similarly general failure, history of apparent damage due to the breaking turmoil of Earth's dangerous movement, the structure of an earthquake in the prone area should be given the proper value for analysis and design, we know that in the modern infrastructure civilization is an important rule, so taking Long-range bridges are usually built by a balanced console method with segmental construction. For concrete and steel time dependent factors such as creep, shrinkage and relaxation, etc. There are factors that cause high variations in stress throughout the life of long bridges and in such a situation, seismic assessment has become critical and imperative. In the present work the balance cantilever bridge is analyzed and designed in CSI Bridge software.
Keywords: cantilever bridge, longitudinal stresses, span, vertical shear & axial force

I. INTRODUCTION

The bridge is a building that covers the gap between the two piers. This is an agreement made for cross-obstacles in the form of a river, a valley or another road or other railways, etc. The structure of the bridge is mainly composed of three parts: add-ons, load-bearing substructures. Superstructures confront its own weight, moving load transfer it to the bearing. The bearing will receive the exact load uniformly distributed in substructure. Then the substructure conveys this load on the strata through the foundation. Bridges in general are classified based on various criteria such as: flexibility add-ons like fixed bridges SPAN or movable bridges, the position of the bridge floor in relation to the level of education and the highest emission of the flood, like deck bridges, through bridges or semi-through bridges, interspan relationships like simple, continuous or cantilever bridges, based on benchmarks.

A. Types Of Bridge

Based on super structure

1) *Arch Bridge:* The arched bridge is a profiled bridge curve in which the horizontal thrust is developed and constrained by the buttresses at each end of the bridge. There are many varieties of arches there are bridges. In some cases, the arch may be under the deck, too.
2) *Girder Bridge:* In the case of the beam bridge, the columnar plate is maintained by means of bolts. The beam can be rolled steel balls or plate beams or box beams. The load coming from the logs are taken girder and handed them to the piers and buttresses.
3) *Truss Bridge:* Rafter is a member consisting of attached elements to the shape of a triangular part. In the case of the Rafter Bridge Super construction is provided by the farm. Typically, farms are made of steel. There are several types of farms available.
4) *Suspension Bridge:* In the case of suspension bridge, a chipped plate is suspended with cables and tightening. They will give a beautiful look. For long bridges, this type of suspension fits.

II. REVIEW OF LITERATURE:

The performed analysis was carried out between the steel bolts and reinforced concrete bridge. Based on the project calculations, the effect of each beam in relation to the displacement, the bending of the moment, the dead load, the live load, deviation and the most important value of each combination. It was adopted a variety of arrangements with a deck of plates with beams, bars at the edges, taken as one of the ways of the slab and beam between taking the deck of two ways. In two ways the deck of plates shear have positive and negative values. In the normal loading of the IRC-bridge with a beam distance of 2.850 m with a span of 50 m. Working load in bending moment in 400-450 order 1600-1800 Kn. Where the terms of staff Pro 1390 * 440 appears reasonable. Comparison of APC and steel beam Bridge I profiled became more economical (SP Vijaykumar, et al 2017). The object of work is to transform just the supported bridges into continuous bridges, and then compare the behaviour of continuous bridges with just supported bridges. To study the comparison with simply supported bridges, the bending of the moments developed in continuous bridges is much smaller, and thus smaller sections can be taken as a result of savings in steel and concrete. The ultimate capacitance of continuous deck bridge is more than just supported decks because of the phenomenon of redistributing moments in continuous structures. This work provides four continuous spans can be taken in place of one interval, when the bridge length is more than 14 m

(Akash Nalawade et al 2018).The main aim of building rail over bridge is to reduce road travel time and, as well as trains, and increase speed of traffic, and avoiding traffic stops while passing trains. With the help of staad.pro and manual for the design and analysis of the bridge values are almost identical. Staad.pro will be used to design and analyse the bridge more comfortable due accuracy and time consuming (Dande Gangasekhar et al 2018).

III. MODELING

The modeling of balanced cantilever bridge is carried out in CSI BRIDGE software and the following procedure is adopted.

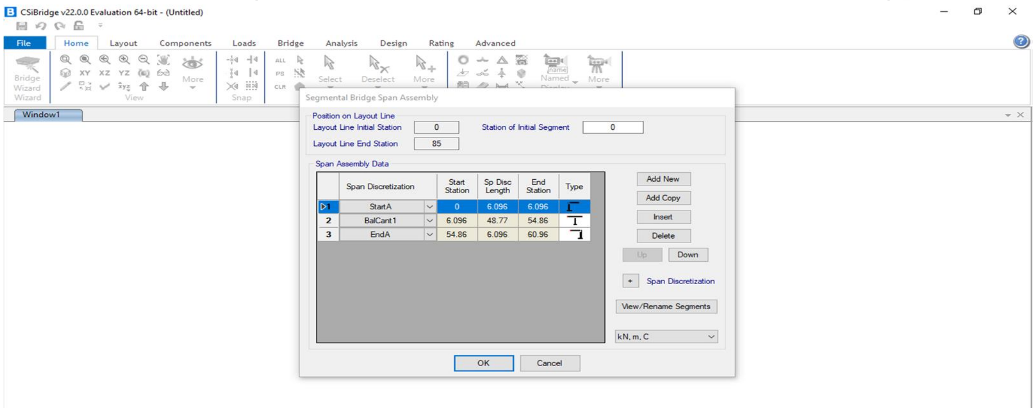


Fig.1: Parameters of Cantilever Bridge

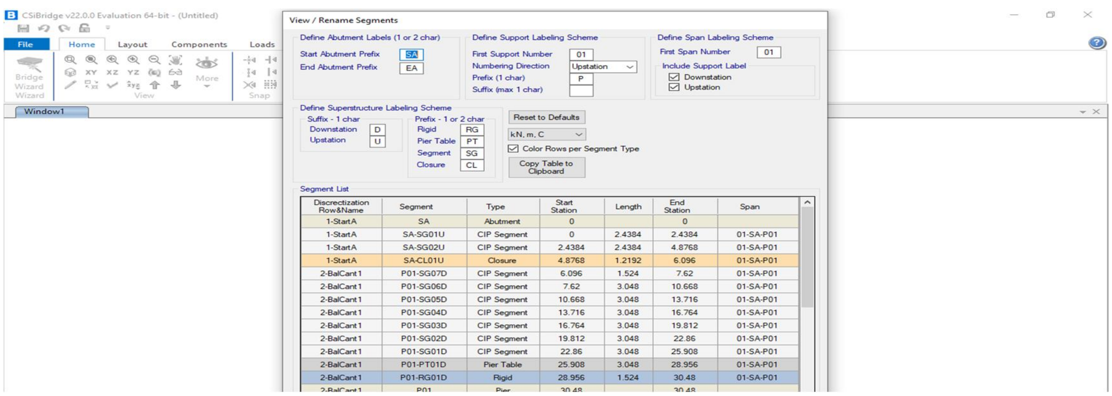


Fig.2: Details of Span

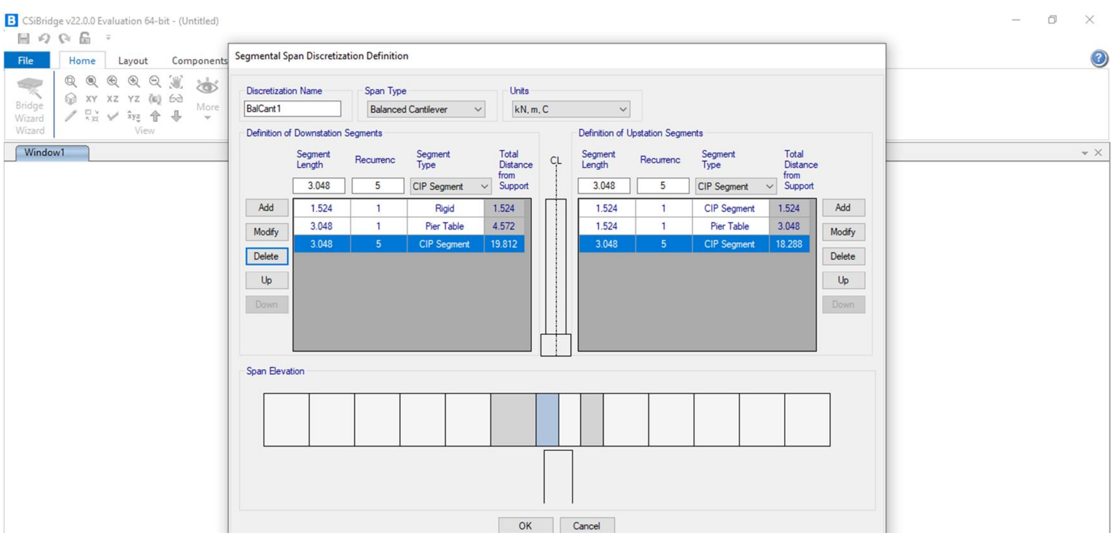


Fig.3: Segmental Span parameters

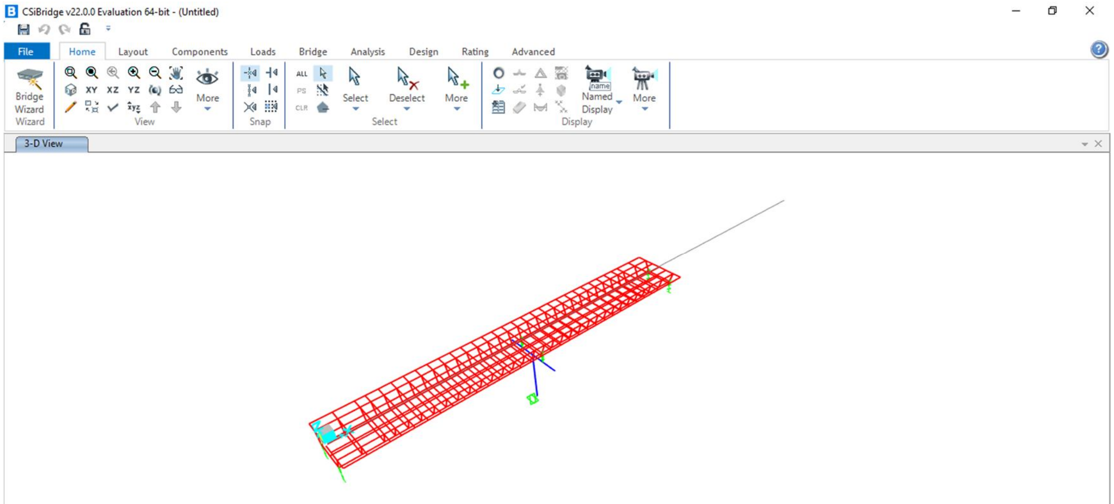


Fig.4: 3D model of Cantilever Bridge

The modeling once completed then the analysis is carried out in CSI Bridge software.

IV. RESULTS

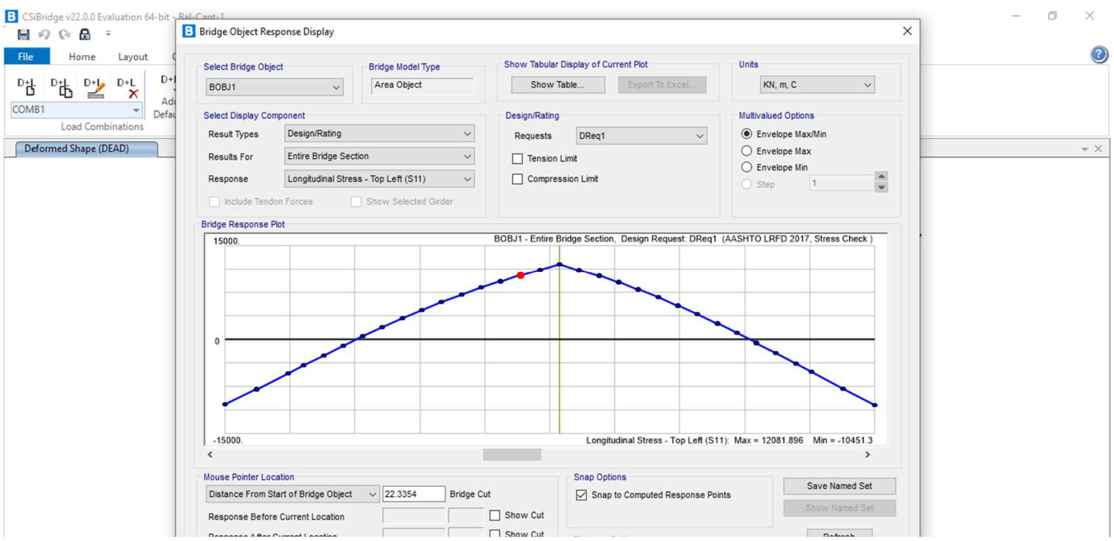
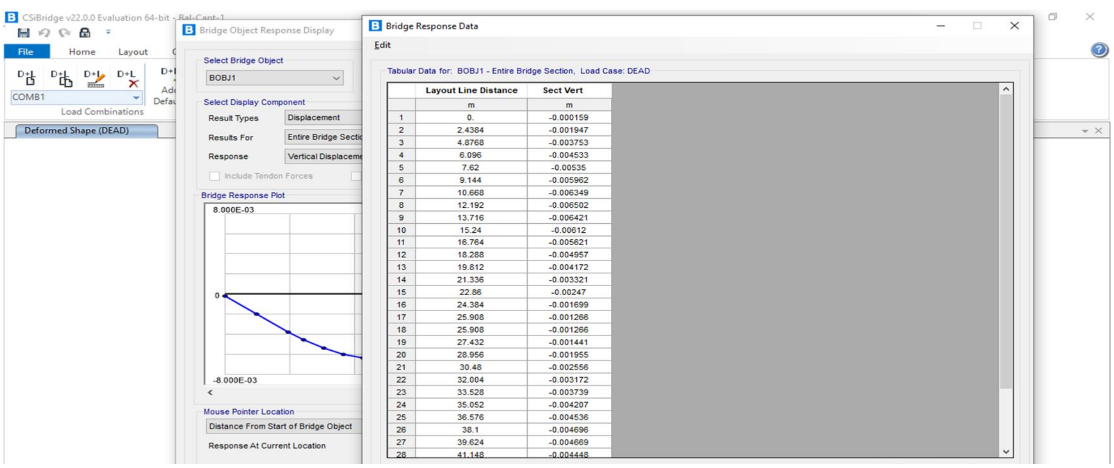


Fig.5: Longitudinal stress envelope for Bridge



	Layout Line Distance	Sect Vert
	m	m
1	0.	-0.000159
2	2.4384	-0.001947
3	4.8768	-0.003753
4	6.096	-0.004533
5	7.62	-0.00535
6	9.144	-0.005962
7	10.668	-0.006349
8	12.192	-0.006502
9	13.716	-0.006421
10	15.24	-0.00612
11	16.764	-0.005621
12	18.288	-0.004957
13	19.812	-0.004172
14	21.336	-0.003321
15	22.86	-0.00247
16	24.384	-0.001699
17	25.908	-0.001266
18	25.908	-0.001266
19	27.432	-0.001441
20	28.956	-0.001955
21	30.48	-0.002556
22	32.004	-0.003172
23	33.528	-0.003739
24	35.052	-0.004207
25	36.576	-0.004536
26	38.1	-0.004696
27	39.624	-0.004669
28	41.148	-0.004448

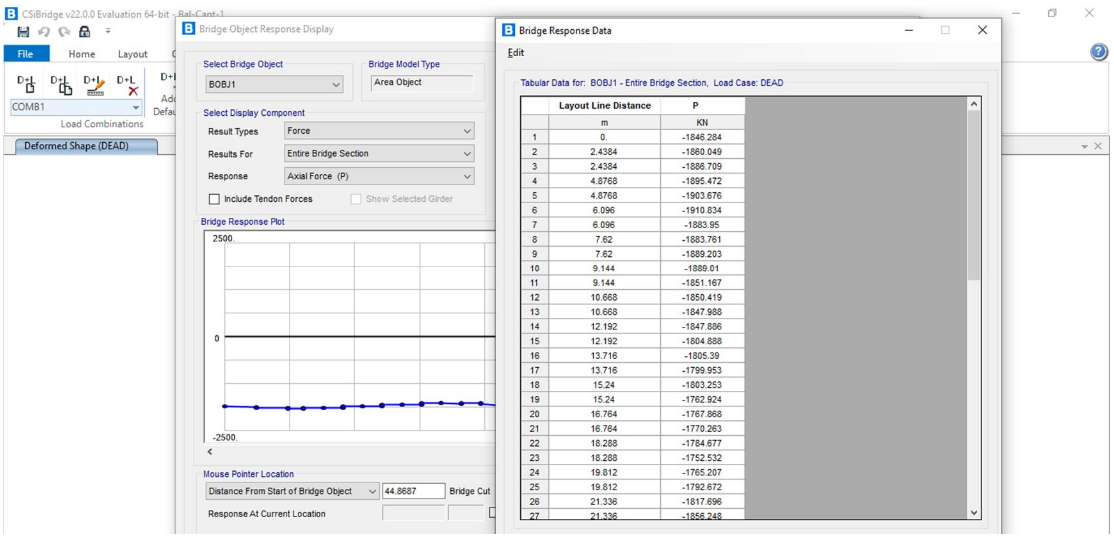
Fig.6: Vertical Displacement

Bridge Super Design AASHTOLRFD17 01 - CBoxStress

Units: As Noted

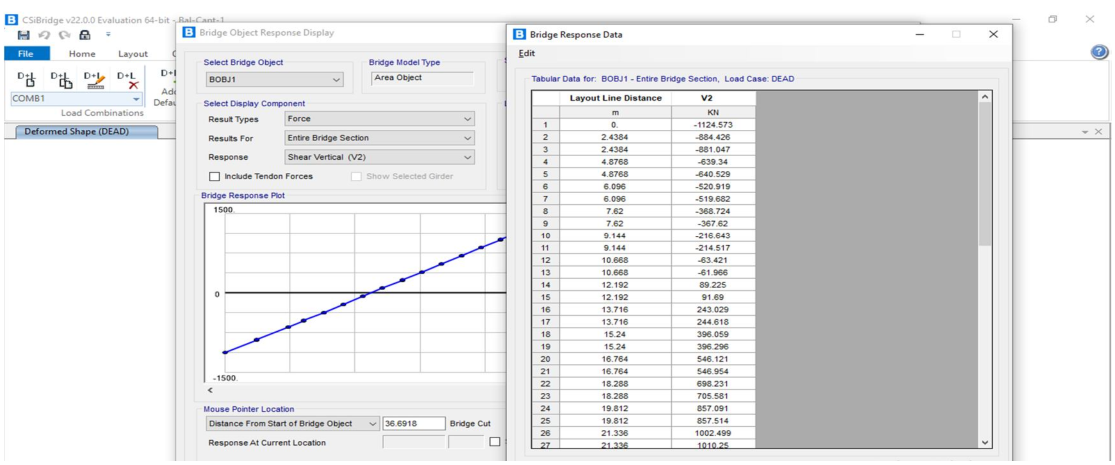
ame	BridgeObj Text	Station m	Location Text	Point Text	StressMax KN/m2	ComboMax Text	DSetMax Text	MaxTop Yes/No	MaxBot Yes/No	StressMin KN/m2	ComboMin Text	DSetMin Text	MinTop Yes/No	MinBot Yes/No	TensLimit KN/m2	CompLimit KN/m2
	BOBJ1	0	After	Top Left	-10358.74	COMB1	DSet1	No	No	-10358.74	COMB1	DSet1	Yes	No	2738.61	-13500
	BOBJ1	0	After	Top Center	274.82	COMB1	DSet1	No	No	274.82	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	0	After	Top Right	10908.37	COMB1	DSet1	Yes	No	10908.37	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	0	After	Bottom Left	-7491.39	COMB1	DSet1	No	No	-7491.39	COMB1	DSet1	No	Yes	2738.61	-13500
	BOBJ1	0	After	Bottom Center	-1794.84	COMB1	DSet1	No	No	-1794.84	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	0	After	Bottom Right	3901.71	COMB1	DSet1	No	Yes	3901.71	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	Before	Top Left	-7825.58	COMB1	DSet1	No	No	-7825.58	COMB1	DSet1	Yes	No	2738.61	-13500
	BOBJ1	2.4384	Before	Top Center	-623.82	COMB1	DSet1	No	No	-623.82	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	Before	Top Right	6577.94	COMB1	DSet1	Yes	No	6577.94	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	Before	Bottom Left	-4088.99	COMB1	DSet1	No	No	-4088.99	COMB1	DSet1	No	Yes	2738.61	-13500
	BOBJ1	2.4384	Before	Bottom Center	-230.9	COMB1	DSet1	No	No	-230.9	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	Before	Bottom Right	3627.18	COMB1	DSet1	No	Yes	3627.18	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	After	Top Left	-7927.91	COMB1	DSet1	No	No	-7927.91	COMB1	DSet1	Yes	No	2738.61	-13500
	BOBJ1	2.4384	After	Top Center	-623.41	COMB1	DSet1	No	No	-623.41	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	After	Top Right	6681.09	COMB1	DSet1	Yes	No	6681.09	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	After	Bottom Left	-4163.71	COMB1	DSet1	No	No	-4163.71	COMB1	DSet1	No	Yes	2738.61	-13500
	BOBJ1	2.4384	After	Bottom Center	-250.58	COMB1	DSet1	No	No	-250.58	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	2.4384	After	Bottom Right	3662.54	COMB1	DSet1	No	Yes	3662.54	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	4.8768	Before	Top Left	-5387.97	COMB1	DSet1	No	No	-5387.97	COMB1	DSet1	Yes	No	2738.61	-13500
	BOBJ1	4.8768	Before	Top Center	-1303.34	COMB1	DSet1	No	No	-1303.34	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	4.8768	Before	Top Right	2781.3	COMB1	DSet1	Yes	No	2781.3	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	4.8768	Before	Bottom Left	-1254.3	COMB1	DSet1	No	No	-1254.3	COMB1	DSet1	No	Yes	2738.61	-13500
	BOBJ1	4.8768	Before	Bottom Center	933.9	COMB1	DSet1	No	No	933.9	COMB1	DSet1	No	No	2738.61	-13500
	BOBJ1	4.8768	Before	Bottom Right	3122.09	COMB1	DSet1	No	Yes	3122.09	COMB1	DSet1	No	No	2738.61	-13500

Fig.7: Stresses at Top and Bottom of the Span



	Layout Line Distance	P
	m	KN
1	0.	-1846.284
2	2.4384	-1860.049
3	2.4384	-1886.709
4	4.8768	-1895.472
5	4.8768	-1903.676
6	6.096	-1910.834
7	6.096	-1883.95
8	7.62	-1883.761
9	7.62	-1889.203
10	9.144	-1889.01
11	9.144	-1851.167
12	10.668	-1850.419
13	10.668	-1847.988
14	12.192	-1847.886
15	12.192	-1804.888
16	13.716	-1805.39
17	13.716	-1799.953
18	15.24	-1803.253
19	15.24	-1762.924
20	16.764	-1767.868
21	16.764	-1770.263
22	18.288	-1784.677
23	18.288	-1752.532
24	19.812	-1765.207
25	19.812	-1792.672
26	21.336	-1817.696
27	21.336	-1856.248

Fig.8: Axial Force for the Span



	Layout Line Distance	V2
	m	KN
1	0.	-1124.573
2	2.4384	-884.426
3	2.4384	-881.047
4	4.8768	-639.34
5	4.8768	-640.529
6	6.096	-520.919
7	6.096	-519.682
8	7.62	-368.724
9	7.62	-367.62
10	9.144	-216.643
11	9.144	-214.517
12	10.668	-63.421
13	10.668	-61.966
14	12.192	89.225
15	12.192	91.69
16	13.716	243.029
17	13.716	244.618
18	15.24	396.059
19	15.24	396.296
20	16.764	546.121
21	16.764	546.954
22	18.288	698.231
23	18.288	705.581
24	19.812	857.091
25	19.812	857.514
26	21.336	1002.499
27	21.336	1010.25

Fig.9: Vertical Shear for the Span

The results obtained for the Bridge includes displacement, forces and stresses as presented in the above diagrammatically.

V. CONCLUSION

The conclusions from the above study includes:

A. Prestressing is essential for the balanced cantilever Bridge.
B. The stresses observed at the top, bottom, left, right, centre and the corner of the span.
C. Forces are also observed at the different location of the span
D. Displacement at the different locations are presented

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