Impact Factor Value 4.046 e-ISSN: 2456-3463
International Journal of Innovations in Engineering and Science, Vol. 4, No.6, 2019
www.ijies.net

Self Weight Analysis of Cable Stayed Bridge

Praful S. Misal[1], Dr. N. R. Dhamge[2]

[1]M.Tech-student appearing (Structural Engineering),
[2]Professor, KDK College of Engineering, Nandanvan, Nagpur, India, 440009

Abstract – *This paper deals with the study of self weight analysis of cable stayed bridge for various cable patterns. It is to be shows in prominent aspect for this analysis of cable Stay Bridge. In cable stay bridge cable transmitted the reaction forces of deck to pylon. Pylon transmitted the load of cable to foundation. There used some criteria for pylon height. Various Types of Patterns of CSB i.e. semi fan, fan & harp arrangement were considered. With the help of using STAAD software modelling & analysis are done.*

Keywords- Cable patterns, Cable configuration, IRC-6-2016, STAAD Pro.

I- INTRODUCTION

It is a type of bridge which has one or more towers (or pylons), it has cable support to the bridge deck, cables hold the deck by connecting it towers, and these bridges is called as cable stayed bridge. These bridge are very economical for long spans. A distinctive feature are the cables or stays. Which run directly from the tower to the deck, it normally forming fan like pattern. It is similar to the suspended bridge. Where the cable supporting the deck are suspended vertically from the main cable, it anchored at the both ends of bridge running between the towers. The cable stayed bridge is optimal for span longer than cantilever bridges and shorter than the suspension bridge. As traffic pushes down on the road way is attached, transfer load to the towers, compression force which act on the towers, tension is acting on the cables which are stretched because they are attached to the RCC deck or roadway.

Cables are made of high strength steel and it covers in a plastic or steel. Steel covering that is filled with grout and fine grained form of concrete for protection against corrosion.

A cable may be composed one or more structural ropes, structural strands, locked coil strands or parallel strands.

A strand is an assembly of wire formed helically around center wire in one or more symmetrical layers. A strand can be used as an individual load carrying member, where the radius or curvature is not major requirement.it is component in the manufacture of the structural rope.

Cable-stayed bridges may appear to be similar to suspension bridges, but in fact, they are quite different in principle and in their construction .In suspension bridges, large main cables (normally two) hang between the towers and are anchored at each end to the ground.

II- METHODOLOGY

Various steps are as follows:

Step 1: Create a model in STAAD Pro
Step 2: Define the section property to the members
Step 3: Create a load case as load case 1, Dead load →Add Self Weight → Assign to view
Step 4: Analysis Print →select all → from menu bar Run analysis.

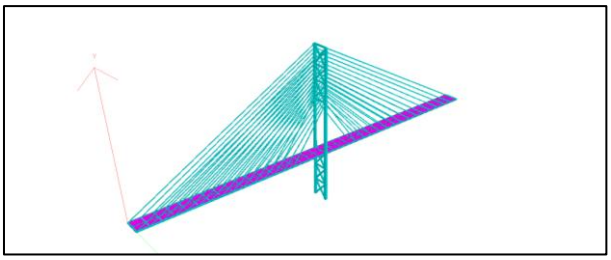


Fig 1: Model of CSB semi fan type

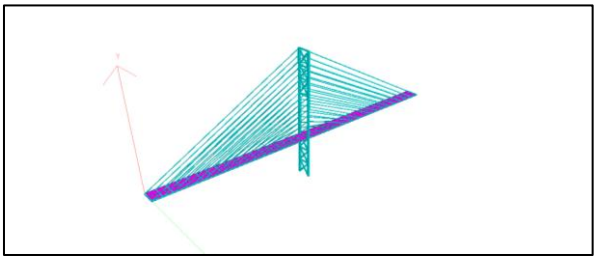


Fig 2: Model of CSB Harp Type

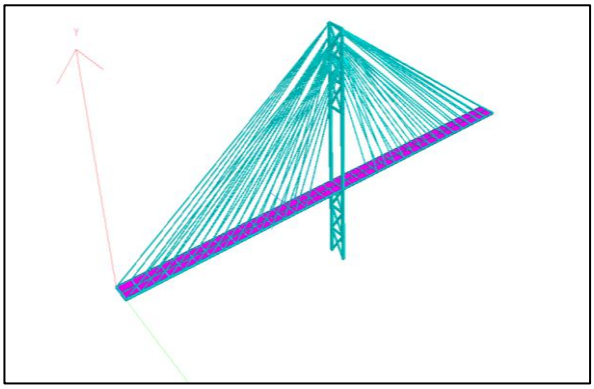


Fig3: Model of CSB Fan Type

Model Specification:

1. Total Span of Cable stayed bridge = 200m
2. Width of bridge = 8m
3. Height of Pylon above deck slab level = 60m
4. Height of Pylon Below deck slab level = 30m
5. c/c distance between cross girder = 5.70m
6. Dimension of Components
    1. Diameter of Pylon = 1.5m
    2. Cross Section of longitudinal Girder = 0.40x0.60m
    3. Cross Section of cross girder = 0.40x0.80m
    4. Thickness of deck slab = 0.3 m
    5. Diameter of cable = 0.3 m

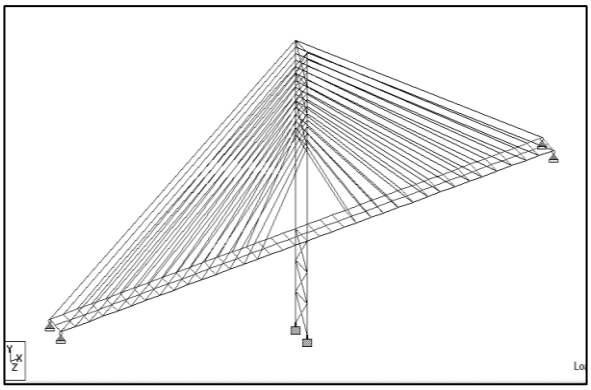
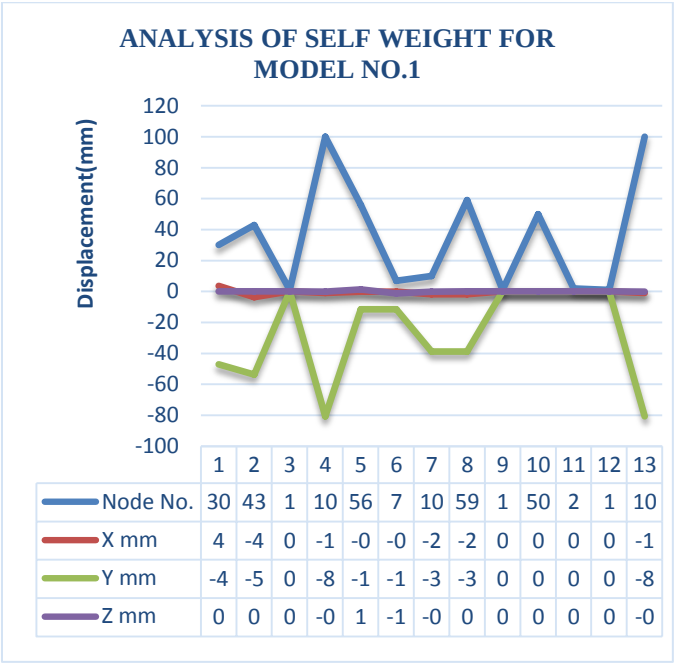
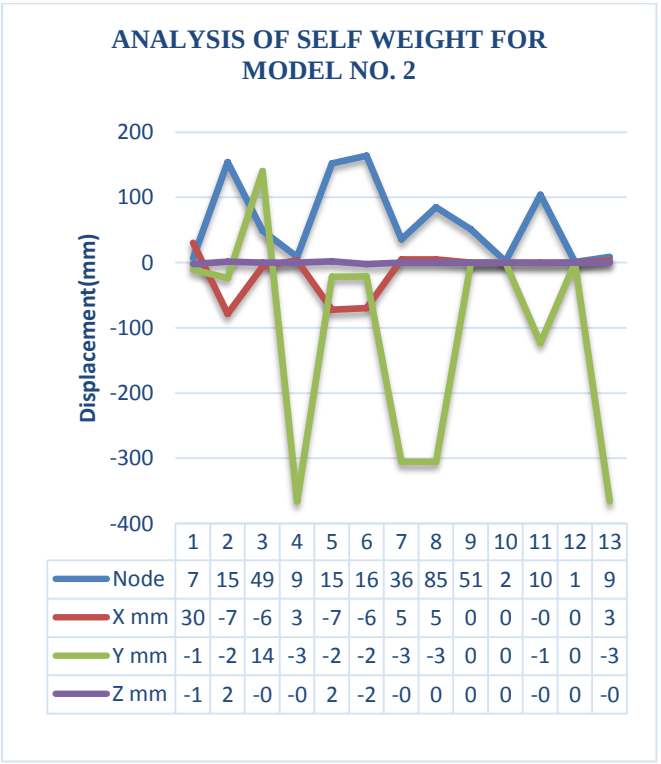


Fig 4: shows the Structural model of bridge in STAAD-Pro software



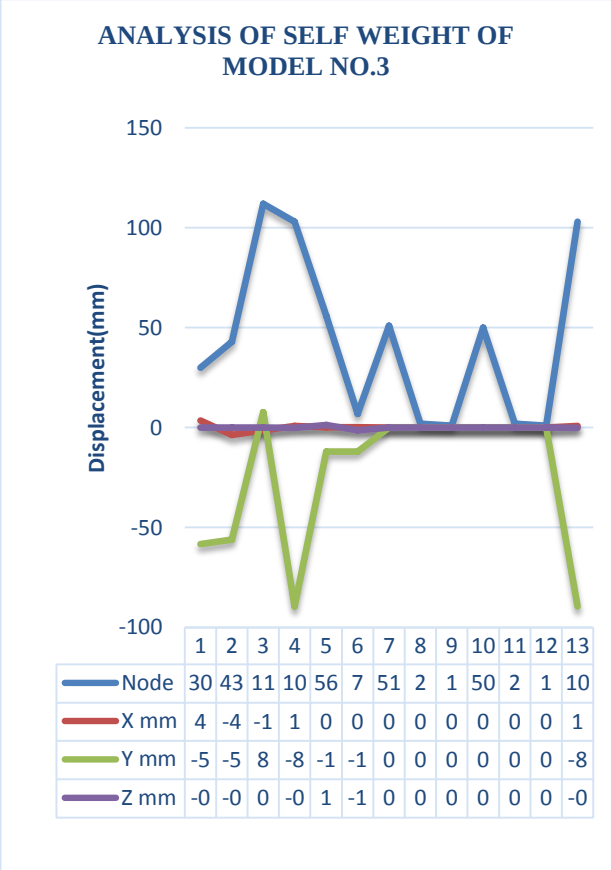
	1	2	3	4	5	6	7	8	9	10	11	12	13
Node No.	30	43	1	10	56	7	10	59	1	50	2	1	10
X mm	4	-4	0	-1	-0	-0	-2	-2	0	0	0	0	-1
Y mm	-4	-5	0	-8	-1	-1	-3	-3	0	0	0	0	-8
Z mm	0	0	0	-0	1	-1	-0	0	0	0	0	0	-0

Graph 1: shows maximum displacement in X, Y and Z direction.



	1	2	3	4	5	6	7	8	9	10	11	12	13
Node	7	15	49	9	15	16	36	85	51	2	10	1	9
X mm	30	-7	-6	3	-7	-6	5	5	0	0	-0	0	3
Y mm	-1	-2	14	-3	-2	-2	-3	-3	0	0	-1	0	-3
Z mm	-1	2	-0	-0	2	-2	-0	0	0	0	-0	0	-0

Graph 2: shows maximum displacement in X, Y and Z direction.



	1	2	3	4	5	6	7	8	9	10	11	12	13
Node	30	43	11	10	56	7	51	2	1	50	2	1	10
X mm	4	-4	-1	1	0	0	0	0	0	0	0	0	1
Y mm	-5	-5	8	-8	-1	-1	0	0	0	0	0	0	-8
Z mm	-0	-0	0	-0	1	-1	0	0	0	0	0	0	-0

Graph 3: shows maximum displacement in X, Y and Z direction.

CONCLUSION

As per IRC-6-2016 by using software STAAD - Pro has been studied. The cable stayed bridge is modeled as 3D space frame using STAAD-Pro software. The cable stayed bridge for different cable pattern such semi fan, fan & harp for self weights has been analyzed and get the maximum displacement values.

This analysis provides complete guidelines for STAAD-Pro software analysis of self weight. STAAD-Pro gives result very quickly as compared to manual calculation

REFERENCES

[1] *Hamidreza Naderian, Moe M. S. Cheung, Zhenyuan Shen and Elena Dragomirescu "Seismic Analysis of Long-Span Cable-Stayed Bridges by an Integrated Finite Strip Method", Journal of Bridge Engineering, © ASCE, ISSN, 2016.*

[2] *Eleftheria Efthymiou, Alfredo Camara "Effect of Spatial Variability of Earthquakes on Cable-Stayed Bridges", Elsevier Ltd, volume199, 2017.*

[3] *Kuihua Mei , Yajuan Li , Zhitao Lu, "Application study on the first cable-stayed bridge with CFRP cables in China", journal of transportation engineering, volume 248,2015.*

[4] *Vikas A C, Prashanth M H, Indrani Gogoi, Channappa T M, "Effect of Cable Degradation on Dynamic Behavior of Cable Stayed Bridges", Journal of Civil Engineering Research, volume 35,2013.*

[5] *IRC-6-2016 standard specifications and code of practice for road bridges.*

[6] *G. M. Savaliya , A. K. Desai, S. A. Vasanwala,"The Influence Of Cable Sag On The Dynamic Behaviour Of Cable-Stayed Suspension Bridge With Variable Suspension To Main Span Ratio", International Journal of Research in Engineering and Technology, volume2319, Nov2015.*

[7] *Cheng-Yu Yang, Moe M. S. Cheung, "Shake Table Test of Cable-Stayed Bridge Subjected to Non-Uniform Excitation", Elsevier Ltd.,Volume 931, 2011*

[8] *Salvador Ivorra, Dora Foti, Francesco Paparella, F. Javier Baeza, "Dynamic load tests on the North-South axis cable-stayed bridge with a non-symmetric central pylon", Elsevier Ltd.,volume 2967, 2017.*

[9] *G.Lakshmi Poornima, R.Bharath, "Optimization and Analysis of Cable Stayed Bridges", International Research Journal of Engineering and Technology, Volume04, Aug-2017.*

[10] *Wang Hui-Li, Tan Yan-Bin, Qin Si-Feng and Zhang Zhe, "Geometric Nonlinear Analysis of Self-Anchored Cable-Stayed Suspension Bridges", the Scientific World Journal, Volume 2013, September 2013.Ioan Doroftei; Victor Grosu and Veaceslav Spinu; "Omnidirectional mobile robot- Design and Implimentation" from "Gh.Asachi" Technical university of lasi, Romania.*