International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 12 | Dec 2020 www.irjet.net p-ISSN: 2395-0072

Seismic Analysis and Design of Cable Stayed Bridge with Different Cable Arrangements

Abhishek Pandey[1], Nitesh Kushwah[2]

[1]Research Scholar, Department of Civil Engineering, MITS Bhopal
[2]Professor, Department of Civil Engineering, MITS Bhopal

Abstract: This work will deal with the design and analysis for different cables arrangement with the different shapes of pylon using STAAD Pro. There are many types of cable arrangements among these we chose fan type, radial type, star type and harp type arrangements. "Two laterals of stays, i.e. "A" shape, "Y" shape, "H" shape and one axial layer of stays, i.e. circular pylon shape, are indeed the pylons. Many of the considered pylon forms have a cross-sectional area", or are circular in nature. Following review of the structures, a most appropriate structure will be proposed. The relation becomes produced with the all the cases of shear stress, bending moment, displacements. The inference will be reached with respect to the implementation of a few of the agreements. This can be useful in the modifying the drawbacks of others. This work will give directions to make other arrangements more efficient. Finally, among all these the circular H shape with harp and the fan shape configuration is the best configuration.

Keywords: Cable stayed bridges, Radial arrangement, Star arrangement and harp arrangement, Tower

1. INTRODUCTION

Cable stayed bridges Good stability, optimal use of structural components, cosmetic properties, comparatively low cost of construction and upkeep, and useful structural functionality.

This style of bridge is thus becoming more common and, opposed to suspension bridges, are commonly favoured for long span crossings. One or two towers and cables connecting a bridge deck consisting of even a cable-stayed bridge.

Throughout this work, the cable-stayed bridge was studied while adjusting the configuration of both the cables but each time with a lot phylon shapes to obtain their bending moment, pressures, and deflection effects. That arrangement of three cables is really a fan, semi-fan but harp arrangement. Which pylons have two lateral stays, i.e. "A" shape, "Y" shape, "H" shape, or one axial stay plate, i.e. circular pylon shape? The all pylon forms considered get a cross sectional area, which are of modified ways.

In this job, contrast is taken out between arrangement forms, throughout terms of forces, bending moment, deflection. That bridge becomes evaluated by finite element-based commercial programme STAAD Pro

2. LITERATURE REVIEW

Pawan Patidar and Sunil Harne (2017) on different spans, its economic status of both the Plate Girder Bridge (Railway) was tested, retaining one parameter constant but varying certain parameters. In order to obtain most economical bridge and for six traffic lanes.

Guru prasad D (2016) performed a survey of the these two bridges. They concludes here that cable-stayed bridge configuration with three plane wires does seem to be affordable besides bridges with even more soon as reasonably to just the configuration with two plane cables.

Shivanshi and Pinaki (2016) Fan type, semi fan type including cable configurations of the harp category were regarded. This same bridge is planned and evaluated through STAAD Pro software for all these cable arrangements. Through study of both the three, its most appropriate arrangement is indicated. Shear power, bending moment, displacements for both the instances are contrasted. That findings found that the system of fans is more successful than two alternative systems

G. M. Savaliya (2015) The cable-stayed Hybrid Bridge suspension study was carried out. Modelling and verification of the cable-stayed suspension Hybrid Bridge in SAP2000 software. Throughout the SAP2000 programme, a nonlinear static analysis including modal period history study of a cable-stayed suspension hybrid bridge were worked out. In contrast that results of the research paper against Sap 2000 software, that time span of bridge for various geometrical form is provided.

Atul K. Desai (2013) A updated static system was built to improve the overall span between cable-stayed bridges. Through use of sets for inclination pylon legs which extend longitudinally from either the base of a foundation or even from the girder stage is the central idea of that kind of modern design. Spread-pylon cable-stayed bridge provides tangible advantages, such as cable sag elimination without cable oscillation

throughout earthquakes versus conventional cable-stayed bridges.

Deep Gupta et al (2016) Plan to construct a bridge next to COER also at intersection of NH-58 and Kaliyar lane. This would eliminate traffic jams or road delays but eliminate clashes between pedestrians including motor vehicles.

Mohammed Yakub Ali &Gugulothu Swarna (2016) Plan Bridge also for removal of disagreements amongst pedestrians & motor vehicles whereby traffic reaches or more 2500 vehicles.

T. Pramod Kumar and G. Phani Ram (2015) Concept of super road cum Railway Bridge system over Krishna River proposed on the downstream side of both the present bridge connecting Sithanagaram Mahanadu Road and Vijayawada P.N.Bus Station. That bridge consists of a stainless truss that previous two stages train tracks only at level lower but a three-lane roadway only at upper level.

3. DESCRIPTION OF BRIDGE

Cable-stayed bridge research is done. The bridge's overall span was 200 m. The overall width of both the bridge's deck is 10 m. That bridge diagram is like seen in Fig. A-3. 1-3. In building, edge beams were only erected and instead preceded through crossbeams on either the deck slab. A bridge's overall height reaches 65 m. A pylon with various shaSpe used together. Bridges of arrangement of fans, radial arrangement, organization of stars or arrangement of harps were just as seen in Figure 1, Figure 2 and Figure 3.

Table 1: Description of Structure

Description	Value
Total span of the bridge	200 m
total width of the deck of the bridge	10 m
Total height of bridge	65 m
Dia. of column	0.3 m
Beam size (1)	0.5 x 0.45 m
Beam size (2)	0.5 x 0.5 m
Deck thickness	0.3 m
Support type	Fixed support

Fig. 1: H shape tower with different cable arrangement

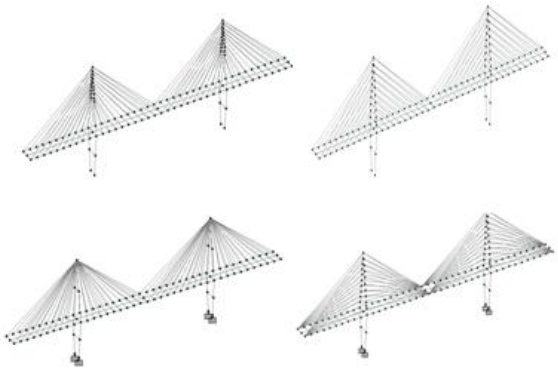


Fig. 2: A shape tower with different cable arrangement

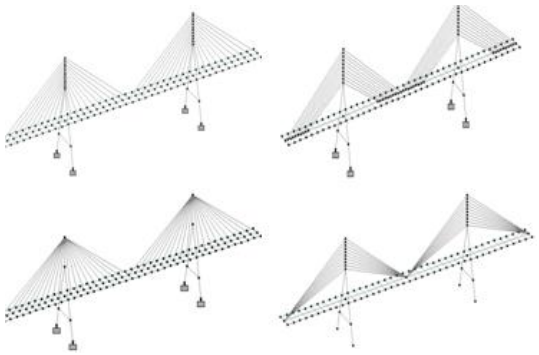


Fig. 3: Y shape tower with different cable arrangement

4. LOAD CONSIDERATION

Considered loadings for the proposed bridge are as follows

1. Dead Load

Gravity load

2. Live Load

Moving load

3. Seismic Load

Seismic parameter type: UBC 1997

Seismic zone: 4

Seismic zone factor: 0.4

Soil profile type: 4

4. Temperature effect

Temperature change for axial elongation - 16°F

Temperature difference from top to bottom - 10°F

Temperature difference from side to side – 10°F

5. Wind Effect

Exposure type: Type C

Base wind velocity: 100 mph

Category: I

Structure type: Lattice framework

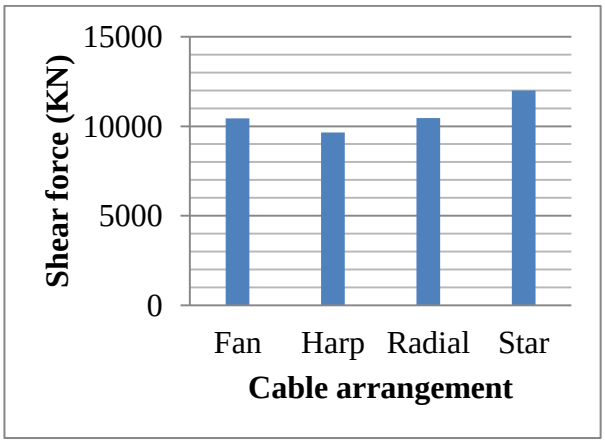
Common data: ASCE-7, 2002

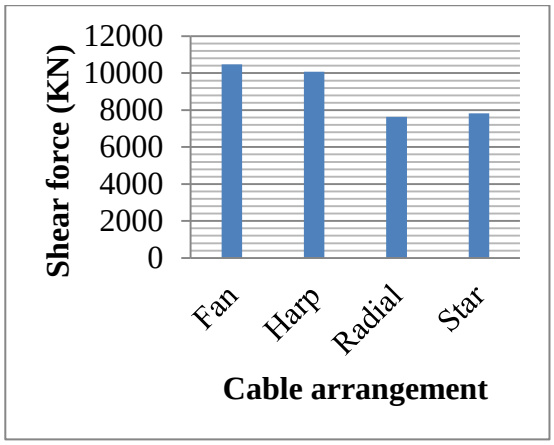
5. RESULTS AND DISCUSSIONS

The findings for both the optimum organization of both the four cable-stayed bride configurations like star, fan, radial or harp arrangements of specific tower shapes were discussed in this section.

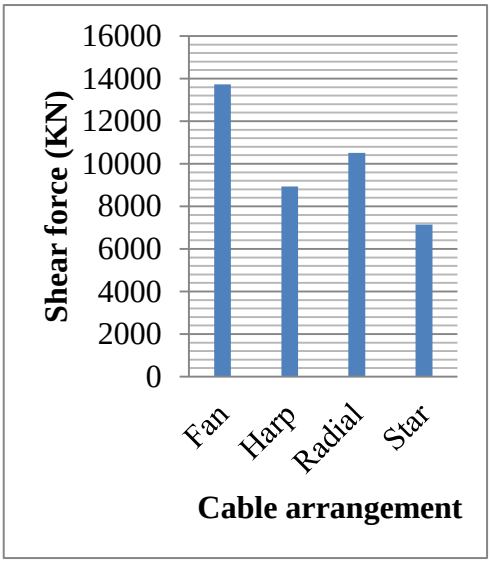
5.1 SHEAR FORCE AND BENDING MOMENT

Magnitude of maximum shear force and bending moment for various cable arrangements has been plotted in figure number 4-5, Maximum shear strength or max are reported throughout this comparative analysis. The bending moment would be in the arrangement of the star, while the organization of the harp form indicates minimal shear force or minimum maximum bending value, resulting in such a cantered segment.



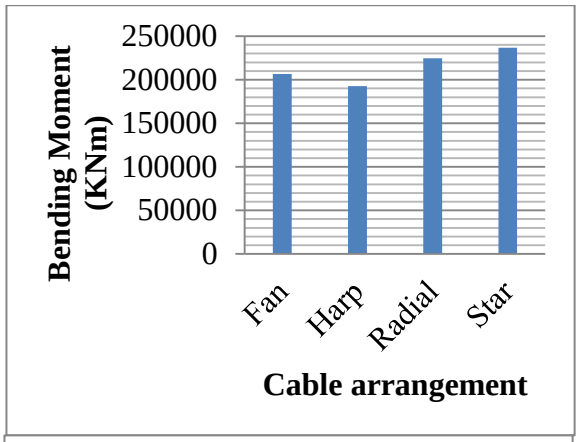


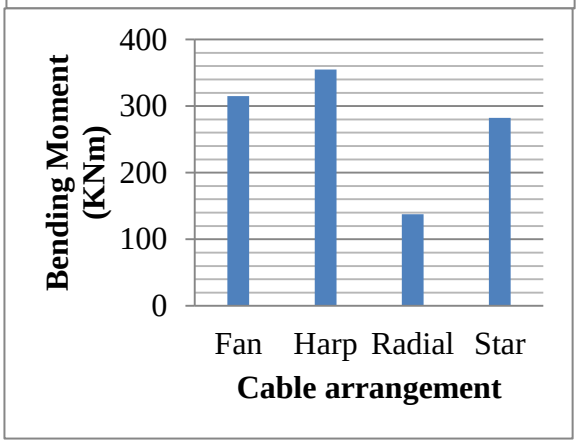
H shape towerA shape tower



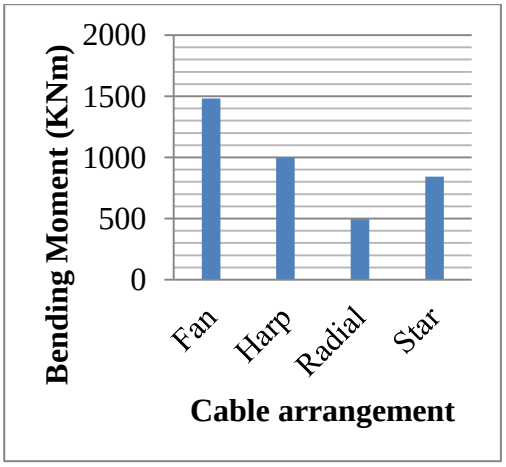
Y shape tower

Fig. 4: Variation of shear force in various arrangements





H shape towerA shape tower



Y shape tower

Fig. 5: Variation of bending moment in various arrangements

5.2 DEFLECTION

Magnitude of maximum in Figure 6-8, displacement of different types in truss was plotted, above it is calculated which deflection becomes maximum throughout the arrangement of star cable while minimal throughout the arrangement for harp cable indicates that far more help

is necessary for star cable arrangement relative to several other cases.

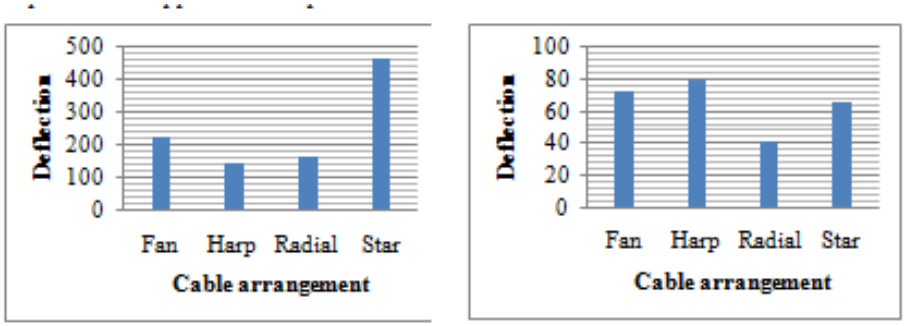


Fig.6: deflection for H and A shape tower

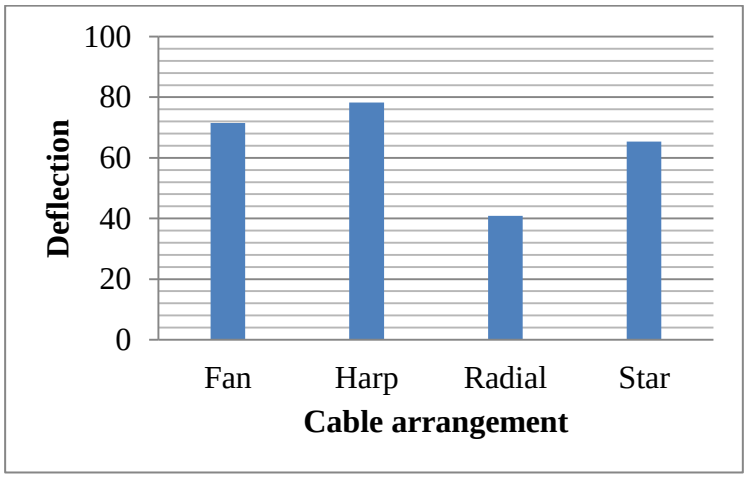


Fig. 8: deflection for Y shape tower

6. CONCLUSIONS

And for conscious minds arrangements with both the H, Both a Y shape tower, those who regarded multiple cases together with dead load & live load for analysis using Stand-Pro software. The findings and conclusions below is-

Based on cable configuration to the tower and the deck:

H shape tower

1. The shear force is more in star and least in harp arrangement

2. The bending moment is more in star and least in harp arrangement

3. Deflection is more in star and least in harp arrangement

4. The findings suggest that the configuration of the harp is much more successful than three other configurations.

A shape tower

1. The shear force is more in Fan and least in radial arrangement

2. The bending moment is more in harp and least in radial arrangement

3. Deflection is more in harp and least in radial arrangement

4. The results indicated that the radial arrangement is more efficient then three other arrangement.

Y shape tower

1. The shear force is more in Fan and least in star arrangement

2. The bending moment is more in Fan and least in radial arrangement

3. Deflection is more in harp and least in radial arrangement

4. The findings suggest that now the radial configuration was most successful than that of the other three configurations.

Based on shape of the tower:

The circular or the H shape pylon can have a small amount of sag and moment in the cables or the deck among all of the pylons (i.e. one axial layer of stay and two lateral of stays) also because greater number with joints was n't homogeneous such that the composition with pressure and anxiety carrying capacity of both the cables wasn't really efficient towards the other parts of both the cable which might lead with sec, In comparison with a circular with a homogeneous member.

Based on cable configuration to the tower and the deck:

This same specification of the harp as well as fan shape is far more appropriate than that of the star as well as radial configuration. Also because harp configuration that is distributed uniformly to both the tower as well as deck can decrease this same sag throughout the cables. While the configuration of both the fan shape does have sag especially in comparison to the harp shape, this same outer cables and in configuration of both the fan can achieve the most stress concentration unless some dampers were also provided to both the outer cables (i.e. far away from the tower) The much more appropriate configuration would be. So if compared to other methods, the star but also radial configuration may have had more sag.

Eventually, this same pylons (i.e. one axial layer with stay but also two lateral stays) are the circular or the H shape with harp as well as the fan shape configuration of many of these studies.

REFERENCES

1. Pawan Patidar, Sunil Harne (2017), "Parametric Study of Plate Girder Bridge", Journal of Mechanical and Civil Engineering, Volume 14, Issue 6, PP: 01-08.

2. Shivanshi, Pinaki (2016), "Analysis of the behaviour of Cable stayed bridge with different types of cables arrangement", International Journal of Innovative and Emerging Research in Engineering Volume 3, Issue 5, PP: 125-134.

3. Guruprasad D (2016), "Comparison of Two Planes and Three Planes Cable Configuration Of Cable Stayed Bridge", International Research Journal of Engineering and Technology, Volume: 03 Issue: 09, PP: 1029-1031.

4. Atul K. Desai (2013), "Seismic Time History Analysis for Cable-Stayed Bridge Considering Different Geometrical Configuration For Near Field Earthquakes", International Journal of Engineering and Technology, 5(2), 1-10.

5. G. M. Savaliya, A. K. Desai, S. A. Vasanwala (2016), "Static And Dynamic Analysis Of Cable-stayed Suspension Hybrid Bridge & Validation ", International Journal of Advanced Research in Engineering and Technology , Volume 6, Issue 11, PP: 91-98.

6. Mohammed Yakub Ali, Gugulothu Swarna (2016), "Design and Analysis of Pedestrian Bridge", International Journal of Advance Technology in Engineering and Science, Volume 4, Issue 10, PP: 323–331.

7. Aishwarya Kulkarni, Priyanka Kumbhar, Pooja Mandge, Sarita Khot (2016), "Materials for Footover Bridges", International Research Journal of Engineering and Technology, Volume: 03 Issue: 04, PP: 2701-2703.

8. T. Pramod Kumar and G. Phani Ram (2015), "Analysis and Design Of Super Structure of Road Cum Railway Bridge Across Krishna River", International Journal of Engineering & Science Research, Vol-5, Issue-7, PP: 830-838.