Analysis Of A Bridge Considering Different Anchorages Using Analysis Tool: A Review

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Abstract- *The best option for longer spans are cable stayed bridges, and it's crucial to examine their behaviour under static and vehicular pressure. The analytical results are more satisfactory and the modelling of the cable-stayed bridge is more accurate. Although there are numerous ways to create a structural model, in the current work two distinct types of structural models—the Spine Model and the Area Object Model—are utilised to analyse a cable-stayed bridge.*

In this paper we have reviewed articles related to suspension bridge considering different anchorages using analysis tool.

Keywords- suspension bridge, , Staad.Pro, Axial Force, cable-stayed bridge, Shear Force, Bending Moment

I. INTRODUCTION

The main cables' stress is supported by anchorages, which are essential components of earth-anchored suspension bridges. Gravity and tunnel forms of anchorages can be used for earth-anchored suspension bridges.

The pull-out behaviour of a tunnel-type anchoring is proposed in this work while taking into account both geometric and rock joint properties. With reference to the design and construction of Indian tunnel-type anchorage instances, a three-dimensional finite element analysis is proposed. The expanded part, anchorage spacing, joint orientation, spacing, and the shear strength of the rock joints are the parameters impacting the anchorage reaction that need to be examined. The size of the enlarged component had an impact on the failure shape of the tunnel-type anchoring, per the numerical simulations.

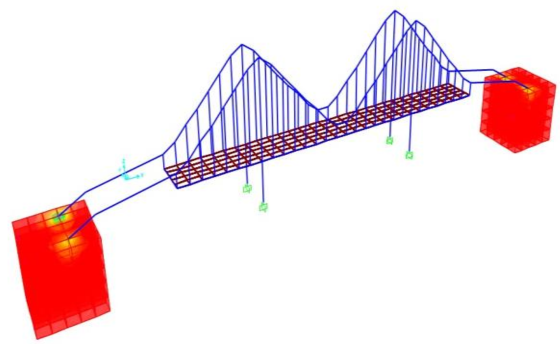

Figure 1: Model Structure

II. Suspension Bridge

A suspension bridge is referred to a type bridge supported by cables. This type of bridge has been with mankind since ancient times.

Components of Suspension Bridge

A suspension bridge is composed of the following members:

- Girder
- Main cable
- Pylon
- Suspender
- Anchorage
- Saddle

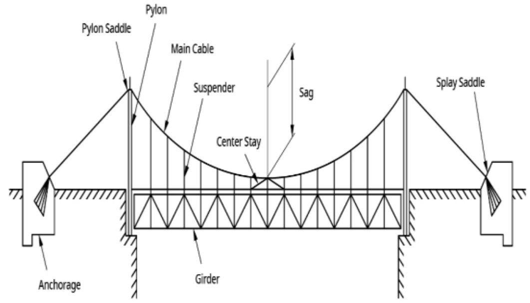

Figure 2: Components of Suspension Bridge

III. LITERATURE REVIEW

Farhan Farid Reshi et.al (2021) research paper presented analysis and design of cable stayed and suspension bridge subjected to wind loading. The modelling and analysis of the case was done using analytical application STAAD.Pro.

According to the findings, cable stayed bridges are a novel structure that are chosen over traditional steel suspension bridges for long spans. This is mainly because the stiffening girders' moments are reduced, resulting in smaller sections of the girders and lower overall costs. Numerous types of transportation, such as cars, trucks, bicycles, and pedestrians, can use this sort of bridge. A cable-stayed bridge can be used for light rail in particular circumstances. When a span needs to be greater than a cantilever bridge can maintain because to weight, but it also needs to be short enough that suspension Cable-stayed bridges can be built more quickly than other alternatives.

Neel Shah et.al (2021) In a study report, the dynamic impact on various cable-stayed bridge pylon layouts was examined. To evaluate the dynamic response of the bridge, pylons are inclined at 5o, 10o, 15o, 20o, 25o, and 30o with both vertical and horizontal axes, and they are compared with vertical pylons. The 3D bridge models were created using the CSI BRIDGE software, and the Imperial Valley 1947 Earthquake was used to seismically analyse the bridge. The axial force, moment, and torsion of the bridge reaction were measured for the pylon, girder, and cable.

Results concluded that that minimum axial force we got at 10o in Cable at main span near pylon in X - Direction and Y - Direction both. Minimum axial force we got in girder at 10o at main span and side span both in X – Direction. Minimum axial force we got in pylon at 10 o in X – Direction and at 15o for Y – Direction. Minimum moment in pylon we got at 10o and minimum torsion in pylon at 5o .

Hyunsung Lim et.al (2020) Numerical evaluations for a plausible gravity-type anchorage design were done in the research report. The evaluation of the passive earth pressure's impact on gravity-type anchorages subject to pullout loading was the main focus. FE evaluations in three dimensions were carried out for various bedrock kinds and embedded depths.

Due to the rise in passive resistance in front of the anchorage, it was discovered that the displacement of the gravity-type anchorage reduced with increasing embedded depth. Additionally, it is discovered that the resistance caused by passive ground pressure in front of the anchorage makes up roughly 10 to 30 percent of the entire resistance, which significantly improves predictions of the realistic resistance for gravity-type anchorages subjected to pull-out pressures.

Feifei Shao et.al (2020) The ANSYS finite element programme was used to create a three-dimensional finite element model of the Fenghuang Yellow River Bridge, which is currently under construction and boasts the largest span of its kind in the whole globe. Additionally, a number of bridges of the same type or with spans similar to those of the super long-span TSSB were evaluated and their structural dynamic properties were compared. The effect of significant design elements, such as the stiffening girder stiffness, tower stiffness, main cable and suspender stiffness, central buckle, and longitudinal restraint system, on the structure's dynamic properties was also investigated.

The longitudinal bending stiffness of the side tower, the central buckle, the vertical bending stiffness of the stiffening girder, and the torsional stiffness of the stiffening girder, respectively, are found to have the greatest influence on the frequencies of the longitudinal floating mode, first asymmetric vertical bending mode, first symmetric vertical bending mode, and first torsional mode. The research's findings and pertinent conclusions can offer fundamental information for long-span TSSBs under dynamic loads and serve as a design guide for comparable bridges all over the world.

Wen Lina et.al (2017) LSSVM and PSO analytical models, FLAC3D numerical techniques, and research paper's intelligent displacement inversion were applied. Through the inversion of the model's anchor parameters, the solid bridge anchor numerical model is established, and the excavation of the anchor tunnel, load and overload conditions for deformation, and internal force are then examined, followed by an examination of the stability of the anchor. Floor rock mass fundamental in flexible working state, anchoring roof and side wall stress relaxation zone in the plastic zone. Increase the main cable and 7P forces, the region of the anchor rock contact where shear failure occurs, and the nonlinear displacement of the anchorage.

The results stated that under the design load, the tunnel anchor maximum displacement was 5.7mm, anchorage roof and side wall stress relaxation zone was in the plastic zone, floor rock mass basicly in a flexible state. Increase the load to 7P, shear failure and anchor rock contact area, the displacement of anchorage was nonlinear. Under the overload condition, the anchor rock rupture increased significantly and produce compression, the plastic zone developed to top of deep surrounding rock, failure mode changed to compressive shear failure.

G. M. Savaliya et.al (2015) In a research paper, a dynamic analysis of a cable-stayed suspension hybrid bridge was undertaken, with cable sag of the main cables and the suspension component taken into consideration. A 1400m central span and 312m side span cable-stayed suspension hybrid bridge is taken into consideration for research in order to distinguish behaviour and examine the viability of this novel hybrid bridge type. The axial force in the main cable was inversely proportional to its sag. Investigation on the impacts of main cable sag used dimensionless factors such as sag to main span ratios of 1/9, 1/10, and 1/11. Using SAP2000 v14.0.0, nonlinear static analysis and modal analysis results were produced.

Results stated that lateral bending mode time period of cable-stayed suspension hybrid bridge is found to be minimum in case of sag to main span ratio is 1/10 (Cable sag=140m) and suspension to main span ratio was 0.6. The longitudinal bending mode time period of bridge decreases with decrease in cable sag. The reason for the enhancement of bridge stiffness with a decrease in cable sag is the length of flexible main cable.

IV. CONCLUSION

Suspension bridges are characteristically adopted for spans greater than 1000 m, the CSB can be a suitable option even for these spans because of its higher stiffness, cable replaceability and low cost.

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