

A REVIEW ON THE STUDY OF CABLE STAYED BRIDGES

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Abstract: A bridge is a structure which is built to provide a passage over lake, valley, road or any other obstruction. The wooden cantilevered bridges in the Himalayan regions have its roots in India. They were made with planks of woods anchored at the two banks using heavy stones. The development of bridge engineering from timber structure and stone arches during the ancient period to the modern cable stayed bridges of the 20th century. It is the notable change in the historical evolution of bridges with the development of civilization. During the past twenty years cable stayed bridged has occurred as the most structurally dominant system for the long spans. Innovative efforts has been taken to reduce the depth of girders of large span bridges resulting in the development of cable stayed bridge decks in which the deck system is suspended by steel cables. The objective of this is to study in detail the cable stayed bridge which his continuously evolving as an efficient structure.

Keywords: Bridge, development, structure, steel cables

1. INTRODUCTION

Among all the types of bridges the cable stayed bridge are basically opted for long spans and aesthetics. The seismic design of cable stayed bridge has merged as the strongest output in nearly two decades from both conceptual and construction point of view. Cable stayed bridges are considered as the indeterminate structure. Determinacy and indeterminacy depends upon the end support condition of the beam. The advancements were made in the structure system of bridges to increase the stress in the cables to prevent sagging.

Cable stayed bridges are also constructed in high seismic areas and further attempts are adopted for the challenging structure with the natural evolution of economic growth of the continents. For such reasons the cable stayed bridges are recognized as the most economical with easier construction techniques for the span up to 1000m. the first bridge structure was a combination of suspension and cable system. They were first constructed at the end of 18th century.

Cable stayed bridges are constructed along the structural system which contains a deck and girders in the form of cables attach to the tower located at the main pier.

1.1 COMPONENTS OF CABLE STAYED BRIDGES

The various structural components of a cable stayed bridge are:

- A) Towers
- B) Types of cables
- C) Cable arrangement

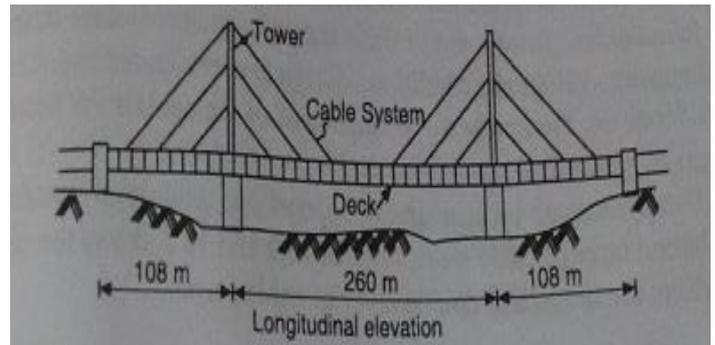


Figure 1. Longitudinal elevation

The above figure shows the typical elevation of cable stayed of North Bridge. The bridge consist of continuous suspended box girders. The tower for Centre cable is fixed but lower cables are supported on rocker type bearings.

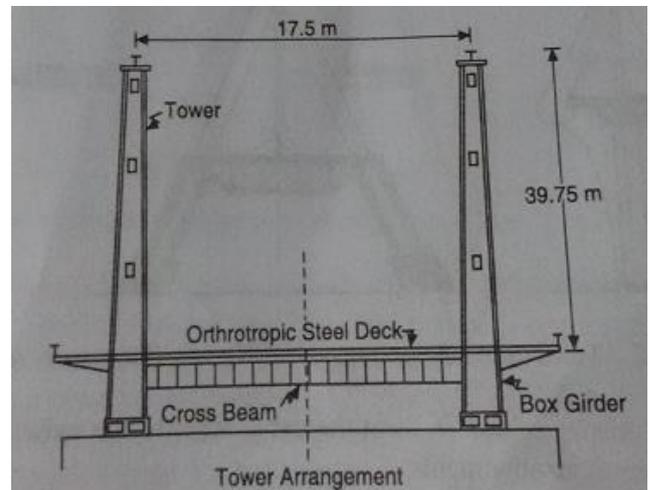


Figure 2. Tower arrangement

IN CABLE STAYED BRIDGES THE CABLES ARE THE MOST IMPORTANT ELEMENT AS IT TRANSFERS THE LOAD FROM THE SUPER STRUCTURE TO THE TOWER AND TO THE ANCHORAGES. DIFFERENT TYPES OF CABLES ARE

- (a) helically wound galvanized strands
- (b) parallel wire strands
- (c) locked coil strands

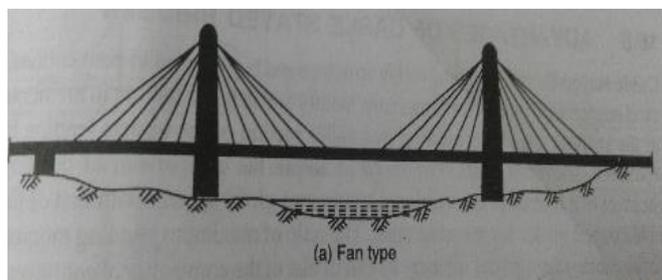
1.2
1.3

In the construction of cable stayed bridges, the cables are chose on the basis of high and constant value of modulus of elasticity, therefore, the parallel wire strands is the most commonly used cable type.

The arrangement of cables depends upon factors like clear span, tower height and level of roads. There are four types of cables used and they are classified as :

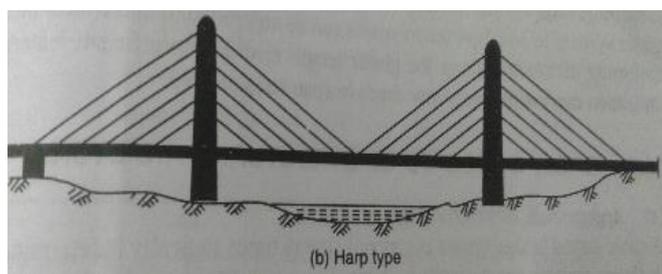
(a) Fan type

In this system, the cables are connected at the same distance from the top of the tower it is the most economical arrangement of cables. The fan typed cable system increases the buckling problems.



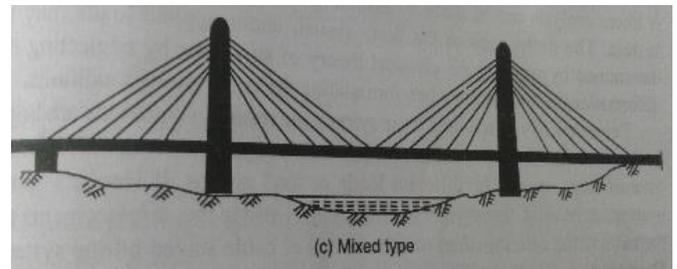
(b) Harp type

In this type of cable system, the cables are connected to the tower at different heights and are parallel to each other. The compression is higher in this kind of pattern. The harp typed cable system increases the bending problems.



(c) Mixed type

It is basically used when it becomes different to accommodate all cables at the top of the tower



1.3 WORLD,S LONGEST CABLE STAYED BRIDGES

S.No	NAME OF THE BRIDGE	SPAN (m)
1	Saint-Nazaire(France)	404
2	Zarace(Argentina)	330
3	Rafeal Urdanela(Venezuela)	235
4	Akkar(India)	152
5	Vidyasagar sethu(India)	452
6	Messina Straits(Italy)	1800

1.3 BASIC CONCEPTS OF STRUCTURAL ANALYSIS

A Cable Stayed Bridge is statically indeterminate structure. The first process of the design of cable stayed bridges to set the sectional properties in different stages before applying statistical method of analysis.it also includes the computation of the (a)degree of redundancy (b)height of the tower (c)self-weight of cables (d)cable forces

2. LITERATURE REVIEW

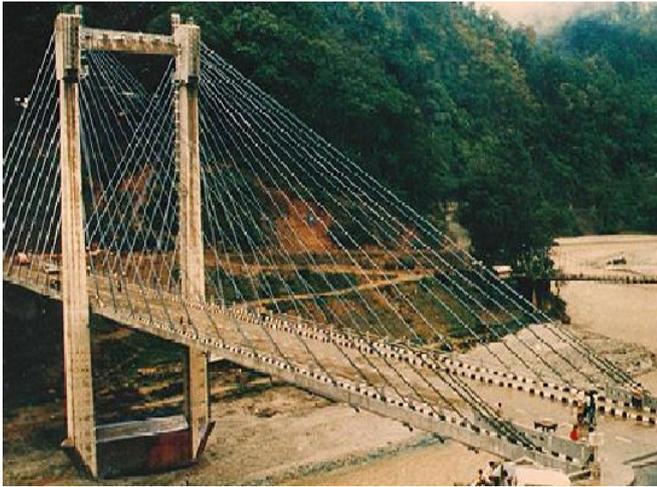
(1) Akkar Bridge Sikkim India

The Akkar Bridge is the first cable stayed bridge of Asia in which deck and pylon were designed entirely in reinforced concrete.it consists of parallel wires and to prevent to prevent the wires from corrosion the cables are filled with polyurethane. The following are the some of the characteristics of Akkar Bridge :

SPAN – 77 m

DECK WIDTH – 11.10 m

TOWER HEIGHT – 54.60 m



(2) Vidyasagar Sethu Bridge Kolkata India

It is one of the longest cable stayed bridge in India was made in 1943. In this 121 cables are in a fan arrangement built. The deck is made up of composite steel reinforced concrete

TOTAL LENGTH of 823 meters

DECK WIDTH of 35 meters.

Pylon 127 meter high.



(3) Octavia Frias Brazil

It is one of the longest cable stayed bridge in Brazil with a

TOTAL LENGTH of 290 meters having SPAN of about 140

meters with a DECK WIDTH of 16 meters. The pylon height

of Octavio Bridge is of 138 meters and the cables used are

144 in number



(4) Golden Gate Bridge

Golden Gate Bridge is one of the oldest and world's longest suspension bridge made in 1937, having a total length 2737 meter deck width of about 27 m with pylon height of 227 meter. The bridge connects San Francisco, California to Marin country with a span of 1280 meter.



FUTURE SCOPE

Cable Stayed Bridges have much greater stiffness since the cables can handle more pressure. They are also much more resistant to environmental changes such as the frequent occurrences of earthquakes. Such types of bridges take less time to construct and are economical too since they require fewer materials and less building hours. Cable Stayed Bridges are preferred over conventional steel suspension mainly because of the reduction in moments in the stiffening girders.

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