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CASE STUDY OF SIGNATURE BRIDGE

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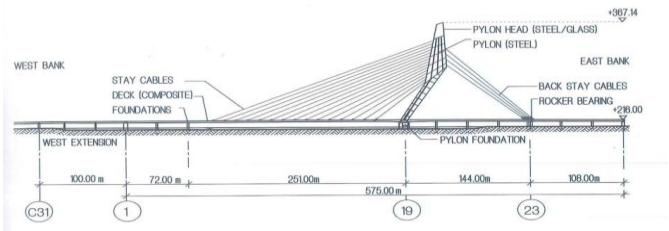
ABSTRACT: This project focuses on designing a unique, safe, elegant and economical bridge in India that helps to make in the field of structural art. The type of structure chosen for this project is cable stayed bridge. The structural cum artistic factor of the project that qualifies it as a structural art is that the bridge will be designed in a way that only one supporting tower will exist to carry the entire bridge, thus making it 'SINGLE PYLON CABLE STAYED BRIDGE' . wazirabad in delhi is chosen as the site location for this bridge and it will go over the Yamuna river. Delhi has taken lot of initiative to increase the tourism , many of which are civil related. The bridge is constructed over the Yamuna river with a span of 575 m span. It is constructed as a bridge for vehicle and is supported by single pylon. For the structural design , the guyon-massonet method was adopted as it satisfies the differential distribution of loads. With this design being successful fellow engineers throughout the country will gain awareness of this field and India can show the world it's engineering and artistic capabilities.

I. INTRODUCTION

A single pylon cable stayed suspension bridge comes under the category of "structural art". These types of bridges are designed for the sole purpose of marking how far civil engineering has come and how much can we accomplish. The beauty of this type of bridge is that the entire bridge is supported by one pylon alone.

The signature bridge is cantilever spar cable stayed bridge , a type of cable stayed bridge and in which cable were in a combination of radial and semi harp arrangement , in which cables are spaced apart on the pylon, like the harp design , but connected to one point or a number of closely spaced points on the deck. The dynamically shaped pylon consist of two inclined columns, which are rigidly connected to the driving lanes and bend mid-way. The upper portion of the pylon anchors the back stay cables as well as the main-span cables and the self-weight of the pylon balances out the self weight of the super structure through the eccentric location of it's centre of gravity with respect to the pivot point if the pylon footing , reducing the load on back stay cables which are fewer in numbers converged from the main span cables.



II. SIGNATURE BRIDGE PROJECT

Project Description Adapted from:

• Tribune News Service. (2010). Delhi Cabinet okays new Wazirabad bridge. The Tribune, Chandigarh, 24 February 2010.

• Indrani Basu (2012). Far between and few: Delhi's bridges. Times of India, Delhi, 5 December 2015.

• Amita Bhaviskar. (2007). Common Wealth Or White Elephant?. Outlook India, 11 July 2017.

• SBP (2018). Yamuna Bridge at Wazirabad.

• Times of India (2018). Signature Bridge gets a final push. Times of India, Delhi edition, 2 May 2018.

• DTTDC. (2015). Weekly Progress of Signature Bridge (As on 24.08.2015)

The eastern and western parts of New Delhi are connected by 6 bridges across the river Yamuna, which divides the city in two parts. Wazirabad is located in North Delhi along the banks of river Yamuna. It forms an important gateway connecting Ghaziabad in the state of Uttar Pradesh and New Delhi. The adjoining areas are densely populated and the Wazirabad Barrage cum Bridge constructed in 1959 serves as the only connection between the two areas. With the increase in vehicular traffic, the bridge has outlived its designed capacity and to address this issue Signature Bridge was planned.

The proposal to enhance the existing Wazirabad barrage cum bridge was initiated in 1989, however only after the fatal accident of a school bus in 1997, the proposal to construct a new bridge started to gain momentum particularly due to public opinion. . Government of National Capital Territory of Delhi (GoNCTD) assigned the project to Delhi Tourism and Transport Development Corporation (DTTDC) to construct the bridge as a deposit work. DTTDC had significant experience in the construction of flyovers and had constructed many significant flyovers across Delhi. In 2005, the project was proposed with an estimated cost of INR 464 crores, later approved by the Delhi cabinet in 2006 with a budget of INR 459 crores. Subsequently a proposal to change the bridge as a Landmark Bridge and the area adjoining the bridge as a recreational spot enhanced the complexity of the project. The plan was to create a state of the art bridge, on the lines of the London Bridge which will not only help in reducing the traffic woes in the areas but will also give a boost to the tourism related activities in the region. Project was divided into two phases with Phase I including Approaches to the Bridge and Main Bridge to be completed before Commonwealth Games and Phase II of developing surrounding area as recreational area requiring additional environmental clearances. Phase I was initially conceived as a single global tender, the project then split into two parts- the main cable stayed bridge and the approaches

to the bridge. The main cable stayed bridge and approaches were expected to be completed with a revised estimated cost of INR 1131 crores and was expected to be completed by Common Wealth Games 2010. This added the issue of time constraint. As per DTTDC report (24th Aug, 2015), subsequently in 2015 the revised estimate of INR 1594 crores was sent to Delhi government for approval out of which INR 1021.830 crores were released and INR 975 were utilised.

Adapted from:

• Yamuna Bridge at Wazirabad- Conceptual and Structural Design (2011). Steel Structures and Metal Buildings. 1 (4)
• Amita Bhaviskar. (2007). Common Wealth Or White Elephant?. Outlook India, 11 July 2017.
• Kurian, J and Rustagi, S.K. (2013). Bearing System of Signature Bridge, Delhi. The Bridge and Structural Engineer. 43 (4), p36- 48.

III. MATERIALS PROPERTIES

The physical and mechanical properties of all ingredients like sand, natural coarse aggregate, cement and demolished coarse aggregate as per IS:2386-1963 were determined

CEMENT

OPC (Ordinary Portland cement) of grade 33, 43, 53 was used which conformed to IS:8112-1989. Testing of cement was done as per IS:4031-1968.

COARSE AGGREGATE

Coarse aggregate for the works should be river gravel or crushed stone. It should be hard, strong, dense, durable, clean and free from clay or loamy admixtures or quarry refuse odr vegetable matter. The pieces of aggregate should be cubical , rounded shaped and should have granular or crystalline or smooth (but not glossy) non powdery surfaces.
The grading of coarse aggregates should be as per specification of IS:383.
After 24hrs emerging in water, a previously dried sample of the coarse aggregate should not gain in weight more than 5%.
Aggregate should be stored in such a way as to prevent segregation of sizes and avoid contamination with fines.

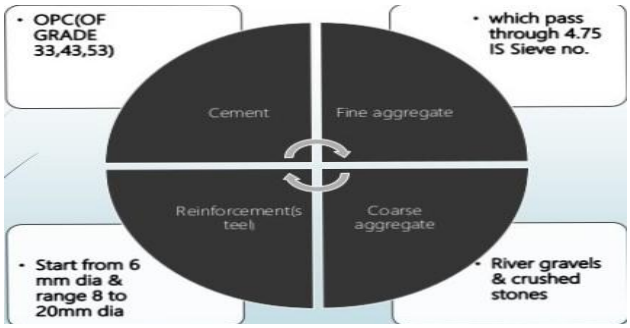
FINE AGGREGATES

Aggregate which is passed through 4.75 IS sieve is termed as fine aggregate. Fine aggregate is added to concrete to assist workability and to bring uniformity in mixture . usually the natural river sand is used as fine aggregate. Important thing to be considered is that fine aggregate should be free from coagulated lumps.
The grading of natural sand or crushed stone shall be such that not more than 5%
Shall exceed 5mm in size, not more than 10% shall IS sieve no.150 not less than 45% or more than 85%
Shall pass IS sieve no.1.18mm and not less than 25% or more than 60% shall pass IS sieve no.600 micron.
River sand, crushed sand, 20mm msa and 10mm msa aggregate was used for different purposes.

STEEL

steel reinforcement are used , generally, in the form of bars or circular cross section in concrete structure.
Mild steel bars conforming to IS:432(part 1) and cold worked steel high strength deformed bars conforming to IS:1786(grade Fe 415 and grade Fe 500, where 415 and 500 indicate yield stresses) are commonly used.
Start from 8mm diameter. For general house construction bars of diameter 6 to 20mm are used.
In this project, Fe500 of different diameters was used at all the places.

IV. MATERIALS USED IN CONSTRUTION.



V. CONCLUSION

- The "Signature bridge" as the new landmark of New delhi connects the city wazirabad across the river Yamuna.
- The automated monitoring system which is being provided for the new signature bridge in wazirabad will provide enormous amounts of information which will enable the condition to which the bridge is subjected , and the structure's conditions and performance
- It is a good example of the type of comprehensive service which can be provided by modern SHM systems
- It's just like a SIGNATURE mark toward the progress of nation.

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[2] IS: 383-1963, "Indian Standard Specifications for

Coarse and Fine Aggregate from Natural Sources for Concrete", Bureau of Indian Standard, New Delhi.
[3] IS: 516-1959, "Methods of Tests for Strength of Concrete", Bureau of Indian Standard, New Delhi.
[4] IS: 10262-1982, "Recommended Guidelines for Concrete Mix design", Bureau of Indian Standard, New Delhi.
[5] Jani juvani and olli lipponen, "DESIGN OF BRIDGES, CABLE STAYED BRIDGE".
[6] N.KRISHNA RAJU, "DESIGN OF BRIDGES" , fifth edition.
[7] N.krishna raju, "DESIGN OF REINFORCED CONCRETE ELEMENTS"
[8] Skandinavisk spaendbeton, "Post-tensioning freyssinet ETA-06/0226".

