Design and Construction Features of Nivedita Bridge

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The tradition is one of iconic crossings across the river Hooghly in the stretch of the river falling within the enlarged Kolkata metro area – Vivekananda Bridge (Bally Bridge), Rabindar Setu, (Howrah Bridge) and Vidyasagar Setu (Second Hooghly Bridge). While the mighty river forms the backdrop of the development of the region over centuries, it had also posed a challenge as regards connecton to the rest of the country. It is this challenge that the continuing tradition addresses, and addresses a new with a state-of-the-art, recently opened and the newly christened Nivedita Bridge.

In the northern reaches of the river within the metropolitan area the Vivekananda Bridge had served well the requirements of cross-river traffic till about the past decade or two. But, it has proved to be singularly incapable of accommodating the current demands, not to speak of the future what with the region, indeed the state anchoring itself as the hub of the “Look East” policy of the government. The existing 76 year old Vivekananda Bridge offers only a weak connectivity between National Highways 2 and 6 on the west and the National Highways 34 and 35 on the east of the river Hooghly.
Hence, the planning for a second crossing in the vicinity of the existing facility, started in 1993. This effort has fructified into the Nivedita Bridge, a necessary infrastructure item, a technological marvel and a successful paradigmatic resource mobilization, of the given magnitude through Public Private Participation (PPP), initiative in the bridge sector.

The concessionaire company is Second Vivekananda Bridge Tollway Company – SVBTC – which attests to the origin and also the incubation of the idea. SVBTC comprises a group of developers, consultants and builders of international repute, from India and abroad. SVBTC is led by the Pacific Alliance-Stradec Group Infrastructure Company LLC (PASGIC LLC) from Mauritius, a joint venture association since 1995 between the “Pacific Alliance Group” from USA, “Stradec Group” from the Philippines and Trans-Asia Infrastructure Holding LLC from USA that includes Parsons Brinckerhoff Infrastructure Development Company Inc. (PBDIC) from USA, Consulting Engineering Services (India) Pvt. Ltd (CES) from India and Carter-Burgess Phils. Inc. from the Philippines. SVBTC also includes Larsen & Toubro Limited (L&T) as the local co-sponsor from the field of construction. And, IJM Corporation of Malaysia is a Strategic Partner.

The uniqueness of the bridge arises in many aspects: the size of the project, the pioneering mode of finance of a bridge project, the state-of-the-art design and construction technologies – balanced cantilever, segmental construction, box-pushing etc.

During the techno-economic feasibility study stage, carried out by CES in 1993, three alignments were studied and the one 50 m downstream of the Vivekananda Bridge was recommended, from various considerations including connectivity, approaches etc. The hydraulic model study recommended piers aligned with existing piers with 110 m span and with low height pylons to avoid imposition on the spires of the Dakshineswar temple. This resulted in proposing PSC belt suspension system. However, as no temporary support from the river bed was acceptable, temporary stays were adopted and the system quickly metamorphosed into an extradosed bridge with permanent cable stays. And, it also became a pioneering PPP initiative.

CES was deeply involved in a multitude of aspects including resource mobilization, developing the Concession Agreement between NHAI and SVBTC, and the tripartite State Support Agreement, besides being the anchor on the technical front.

The bridge comprises the cable-stayed extradose configuration, a global first, over multiple spans, seven of 110 m and two of 55 m totaling 880 m. One of the arresting structural features of the bridge is the width of the deck, 29 m, with three lanes in each direction with a 2 m shoulder on each side, but supported by a single plane of stay cables along the median.

The crossing is 6.1 km long, some stretches on stilts and some on embankments, with an intricate set of entry and exit facilities that enable smooth traffic aggregation and dispersion on both the banks. The Howrah approach is 3.67 km long and Kolkata approach, is 1.56 km. The toll plaza is near the start of the project on Howrah side.
The Nivedita Bridge dramatically changes the traffic circulation scenario while it improves travel conditions in the region. The bridge immeasurably enhances the connectivity between the Kolkata and the Howrah sides, creating a more integrated metropolis for optimal leveraging of the advantages on both the banks. For example, the development of Dankuni sub-city and rejuvenation of Bally, Uttarpara and West Howrah would have been improbable in this stretch of the river. Industrial areas of Kamarhati, Panihati, Titagarh, Barrackpur, and Barasat would have better access to the regional and national road network and ailing industries along the corridor will be revived through improved movement of freight and passenger.

Stronger connectivity from Burdwan-Dankuni area to the proposed Rajarhat township and Salt Lake City, emerging as the electronic IT hubs of Kolkata, is a certainty. The city core areas are more accessible from across the river through other linkages that are planned. The connectivity to the international airport stands enhanced.

Direct connectivity across the river to the north–eastern region and to the rest of the country on the west, for goods and passenger traffic is established, through NH- 34 and NH-35. For smooth dispersal of traffic from NH-34 and NH-35 and from Barrackpur Trunk Road, the Government of West Bengal has taken many initiatives including a number of grade-separated interchanges – one at Dunlop-BT Road Junction, one near the airport and the other at Nager Bazar at the intersection of Jessore Road and Dum Dum Road.

Nivedita Bridge has immeasurably enhance the connectivity between the Kolkata and the Howrah sides, creating a more integrated metropolis – the putative twin-city configuration.
may even become a super megalopolis, leading to optimal leveraging of the advantages on both banks. The bridge, along with Belgharia Expressway and the proposed Eastern Link Highway could form an outer ring road around Kolkata. This outer ring road together with the western connectivity to Kolkata Port via Kona Expressway and Vidya Sagar Setu, and NH-6 /NH- 2 will form the peripheral express link.

The bridge is expected to carry traffic of 42,500 passenger car units at its opening and twenty years later, this number may rise to about 145,000.

The Second Vivekananda Bridge Tollway Company (SVBTC) as the Concessionaire has taken up the tasks of funding, developing, planning, designing, execution, and operation and maintenance of the project in a public-private partnership (PPP) format. NHAI the Government agency representing the Ministry of Shipping and Road Transport & Highways is the owner of the project and they have, besides offering a grant, provided the necessary infrastructure and support to the Concessionaire. West Bengal State government has extended all necessary support like power, traffic control, etc. for the successful implementation, within cost, of about Rs. 6,500 million, and on schedule, of this land mark project.

Over the years, the Second Vivekananda Bridge Tollway Group (SVBTG), (SVBTC being the successor corporate entity) took extensive efforts in project planning and designing, which eventually brought about the signing of the Concession Agreement between SVBTC and NHAI, and also with the Government of West Bengal in a tripartite State Support Agreement. This is the largest project in PPP format in NHAI’s Golden Quadrilateral project.

SVBTC, aiming at excellence at all levels of construction and management, brought in the best of global talent with proven track record and resources with formidable commitment. Prof. S S Chakraborty is the Chairman and Dr. Jay Ved, the Co-Chairman of the Board of Directors of SVBTC that represents the shareholders. The Executive Management Committee and QA/QC Audit committee ensures strict adherence to the norms of the highest quality and also corporate governance.

SVBTC has entered into three contracts – Engineering, Procurement & Construction (EPC), Operation & Maintenance (O&M), and Programme Management. Turnkey EPC contract is with L&T supported by a joint venture between CES & PB in association with International Bridge Technologies (IBT). While an alliance of CES-PB is carrying out planning, development,
design and quality assurance, PASGIC LLC in association with IJM has taken charge of O&M contract. The reputed engineering consultants from Germany, Schlaich Bergermann and Partners have been appointed Independent Consultants.

It is to the credit of the Concessionaire and all the technical and managerial professionals associated with the effort that the bridge has been executed on schedule and within budget. Kolkata region needs this bridge. In fact, the nation needs this, if only to assert its technological expertise and the wherewithal to carry out developmental projects.

**Technical Features of the Project**

The main bridge, Kolkata side approach, Howrah side approach with a 16-lane toll plaza (may be expanded to 20 lanes in future), with automatic toll collection facility and a toll-free service lane are the main components of the project.

**Main bridge:** The following have been used for the first time:

- Single plane cable supported extradosed bridge with short pylon.
- Precast single cell segment for a width of 29 m (6 lane traffic).
- Monolithically connected superstructure with substructure having bearings at mid-span of every alternate span i.e. away from substructure. Bearing allows movement in only longer direction and restraints other movements and rotation in all three directions.
- Transverse and web prestressing besides longitudinal prestressing
- Single column for 26 m height in the river bed.
- Segments weighing 150 ton in the balanced cantilever segmental construction.

**Viaducts:** First time use of:

- Dry jointed match cast precast segments for the full length of viaduct.
- Complete external prestressing in the longitudinal direction.

**Road Under Bridge (RUB):**

- Box pushing through embankment without stopping train movement
- This landmark project connects the missing critical link of the Golden Quadrilateral component of National Highway Development Projects between NH2/NH6 and NH34/NH35.

Source: