Padma Multipurpose Bridge: A dream is becoming true

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ABSTRACT: The Padma Multipurpose Bridge is the longest and most difficult bridge in South-Asia crossing the mighty river Padma, which carries the combined flow of the rivers Ganges and Brahmaputra.The river Padma is the second largest river in the world in respect of discharge. The Padma Multipurpose Bridge Connecting the southwestern part to central parts of the country and the two major ports by rail and roadwill provide a vital link in the transport network. In the regional context, the bridge over the river Padma is strategically located on the Asian Highway Route A-1 and Trans-Asian Railway Route. It will result in significant economic and social uplift of the country, especially in the southwestern part and will function as catalyst for poverty reduction. The additional GDP growth for the construction of Padma Multipurpose Bridge is estimated at 1.2 percent. The Padma bridge, the dream of the people of Bangladesh has a long story of hope and disappointment but finally it is near completion.

The Padma Multipurpose Bridge is a 6.15 km long main bridge across the river designed to carry 4 lanes of highway traffic, a single rail track, a 760mm high pressure gas line and a 150mm diameter Fibre optical and telephone duct. The 2-level main bridge is a warren type steel truss composite bridge with a concrete upper deck level to accommodate two 10m wide roads and a lower deck level to carry a single railway track. The bridge has 41 spans, 150m each having expansion joints at 900m apart. The bridge is connected with approach roads and railways by a complex arrangement of viaducts. The total length of the bridge including viaducts is 9.83km.

The river Padma is located in the lower reach of the rivers Ganges and Brahmaputra.The bed material is fine grained soil, which can go into suspension by relatively weak velocities and turbulence to cause scour. The scour depths are further increased by local scour around foundation. The stratified cohesive and loose to dense sandy bed materials having an estimated extreme scour depth 62mfor the design discharge of 151,000 m^3/sec and a design velocity of 5 m/sec required a very deep foundation consisting of clusters of inclined piles driven to a depth of ±120m. This is the deepest pile ever driven in the world to support an inland river bridge. Driving of 3m diameter steel piles to such a depth required huge energy. The world's largest hammer of 2400kJ capacity and later another hammer of 3500 KJ capacity specially designed and manufactured in Germany for this project were in use for driving of pile to the required depths. Unfortunately presence of cohesive layers of soil at the end of piles of some piers and lower than expected skin friction on test piles created bigger problem in the construction phase of the bridge. However, the problems were overcome by enhancing skin friction of steel piles by innovative skin grouting technology first time used in the world. Similar technology was used to increase skin friction of some RC bored piles.

The Padma river is known for its fury and ferocity in the monsoon and often termed as *Kirtinasa* (destroyer of landmark).The river is unpredictable in nature showing both braiding and meandering characteristics. The main flow of the river moves from one bank to other at an interval of around12 years causing enormous bank and bed erosion. After considering geomorphology at bridge section and several alternatives, 2km river training works (RTW) at Mawa end and 13km RTW at Janjira end were designed to protect the bridge and ancillary facilities. The RTWs were located along relatively stable bank lines allowing the river to continue its usual movement. The major RTW works involve establishment of designed river side slope by precision dredging to a depth of -25m PWD, placing of layers of sand filled geobags on the side slopes and then placing of 90cm stone riprap on geobags and finally establishment of falling apron at -25mPWD. Again the river RTW work came out to be the largest single contract in the world.

The construction of Padma Multipurpose bridge has significant environmental and social impacts. Comprehensive environmental management and resettlement action plans prepared to compensate and mitigate all environmental and social impacts are under implementation. There are many challenges in the construction of the bridge that include fabrication of 3m diameter piles from 60mm thick steel plates, driving of large diameter piles at an inclination of 1 in 6 to required depths, skin and base grouting to increase pile capacity, load testing of large capacity piles, fabrication of steel trusses with high precision, transport and erection of 3000 ton assembled

trusses on world’s largest double curvature friction pendulum bearings. The complex project has unique applications of structural, geotechnical, river, environmental, social and construction engineering.