"PRACTICAL CASE STUDY"

Name of Work: - Re-Construction of Major High level Bridge across River **PAINGANGA** on Wadki - Wani – Antargaon – Gadchandur - Dewada State Highway No. 236 in Chandrapur District.

Name of Contractor: - CHAPHEKAR & COMPANY (J/V), NAGPUR

The said work has been executed with Public Works Division No.1, Chandrapur under Public Works Region, Nagpur. The said Bridge was commissioned to Traffic on 1st May'2010.

The Bridge is of utmost important being a main link for 3 Cement Factories existing very close to Bridge site on the right bank i.e. in Chandrapur District. Hence completion time was of also an essence of the project.

Brief History: -

The old High level Bridge which was completed in March'2006 on this River at same location was washed away during the floods of July'2006 due to overtopping of the Bridge Super structure because of unprecedented rains in the catchment of the river. As such the Design HFL for which the Bridge was designed crossed its limits. Out of the 9 spans of 31 meter each, 7 central spans washed away to a distance of about 100 meters whereas the remaining 2 spans on either ends remained in slightly shifted position over the Pier Caps. A part of substructure at fixed level along with Pier Caps also washed away along with the super structure.

Pre-tender hurdles:

The major hurdle to be thought of at the time of tender submission of new Bridge was that the new structure was to be reconstructed at same location, with increased length and height, along the same alignment with partial remains in place of the old bridge Structure. At the time of tender submission we had to submit a Technical proposal with General Arrangement drawing showing the details of span length, Pier locations and type of sub structure with open foundations, etc. It was a challenge to

reduce the number of foundations by placing the Piers in such a way so as to avoid overlapping with the old foundation structures and their ancillary parts such as sacrificial wells, as it is not economical or feasible to dismantle remains of the old structure 2-3 meters below water. In the departmental drawing provided with the tender documents, Pier locations were shown exactly in between the positions of old structure.

As the tender was called on lump sum basis i.e. on contractor's own deign, we had to think of an out of the box alternative arrangement so as to be different from other agencies and to quote an economical and competitive offer. As such we proposed a combination of two different spans placed symmetrically along the length of bridge. While framing the proposal we were particular in taking into consideration the sizes of concrete cofferdams/ sacrificial wells of old bridge and having a clear margin of at least 0.5 m with them to cover up the shifting of cofferdams during execution of old work.

Post-Tender hurdles:

As per the Tender conditions of the new work, the old sub structure and super structure has to be removed prior to taking up the work of new structure to avoid any additional obstruction in the clear linear waterway, up to existing bed level.

In old structure, there were 6 nos. hollow circular piers with 12-15 meter of their height in tact with concrete sacrificial wells, below riverbed level, cast during the foundation work. There were 2 nos. RCC Box Girder type spans of 31 meter length at a height of 20 meters.

The first hurdle was to dismantle the RCC Box Girder by conventional equipments and avoiding use of expensive equipments such as concrete diamond cutters, etc. on a height of nearly 20 meters and to be within the stipulated time and cost. First the Deck slab was removed using heavy steel hammers and concrete breakers. The reinforcement was cut using gas cutters and all the girders were made free from compression flange. Similarly, the soffit slab was removed. Then by using a required charge of gelatins at the point of maximum bending moment, blast was carried out, as a result of which the girder completely collapsed below on the river bed at the very location without damaging the adjoining old structure. It was then removed from the riverbed in pieces using concrete breakers.

The second hurdle was in the form of hollow circular Piers, which were also to be dismantled up to bed level. These were also dismantled using a combination of hammers, concrete breaker and blasting. As the piers were hollow circular in nature, scaffolding has to be erected from all the sides to enable the workers to stand on the platforms for operating the breakers and other equipments. While making holes for blasting, care was taken to have at least one hole in the wall thickness and other hole a bit staggered at a distance of 0.3 m along the periphery.

The third hurdle, which we have already put worth in the starting paragraphs, was to avoid the overlapping of old bridge foundations and their ancillary structures such as concrete cofferdams/sacrificial wells. As structures were below bed level and further below lowest water level throughout the working season, it is very difficult or can be termed as "near impossible" task to break these structures, in case they had overlapped, by using conventional dismantling equipments within stipulated time and lump sum cost. Generally, the sacrificial wells are circular in shape due to ability of such section to sustain more compressive pressures from outside. For this work, we had to go for double D shaped concrete cofferdams, instead of regular circular, for excavation in sand for foundation activities. Because of this we could avoid the

overlapping with the old cofferdams at some locations. In such type of cofferdams the only draw back is that the walls are to be supported by temporary structural arrangement from inside to avoid their failures due to lateral buckling in presence of saturated sand from all sides.

Construction of Cast in situ Super structure:

As the super structure was Post Tensioned Box Girder type and was proposed to be cast in situ over the POT-PTFE bearings placed over the Pedestals, staging arrangement was done from the bed level to the soffit level of the span. As per our centering arrangement, the column supports were at every 8 meter distance and as such dead load and construction live load reactions were sufficiently high. For this specially designed trestles/ steel columns were erected over concrete foundations, which in turn are supported over rubble masonry. As an additional precaution, timebr/balli piles were also provided below this concrete foundation to avoid any settlement due to flowing of river sand below the bed level. These balli piles of 100 mm to 125 mm diameter were driven till refusal i.e. at least 6-7 meter below the bed level and its top tips were inserted in the doubly reinforced column foundation concrete. On an average 5 numbers of piles are provided below each column.

Staging arrangement for Cast in situ Super structure in flowing water:

Similar arrangement as mentioned above was also made for the span where the water flows throughout the season. The only difference was protection of rubble from flowing water and to avoid scour. Instead of the masonry directly on the sandy bed, cage islands were provided. The cages are made from steel bars welded together in the form of vertical bars and rings. The rings are further tied with closely spaced vertical bamboos and covered with bamboo mats, to retain the rubble filled in between them. The voids in the rubble filling after placing in these rings are further filled with dry mortar. To achieve the strength remaining voids are filled by cement grout injected by compressor.

With our past Technical experience and hard work of our organization we could turn the above challenges into successful completion of the project.

Further, it is because of the valuable contributions from our Design consultants and the departmental officers, directly or indirectly involved in the project, the Bridge was commissioned for traffic.