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SELF LEVELLING CONCRETE SOLVES ACCESS

ISSUE ON PEDESTRIAN BRIDGE

AfriSam's self levelling concrete solved a pressing concern which arose during construction of a pedestrian bridge as part of the Gauteng Freeway Improvement Project (GFIP) contract on the N1 between the Beyers Naude and 14th Avenue interchanges.

The vertical clearance of 5.4 metre on the existing (or old) bridge was insufficient due to widening of the road and possible future road layer overlays which could reduce the vertical clearance even further. The old bridge had already had repair work to it as a consequence of damage caused by a vehicle overloaded in height, striking the bridge in 1994. The new South African National Roads Agency Limited (SANRAL) present vertical clearance requirement for new pedestrian bridges is 5.9 metres.

SANRAL decided to replace the bridge as part of the GFIP contract and the new bridge raises the clearance to 5.95 metres. The bridge span is a 54 metres long cable-stayed structural steel space frame which is suspended from a 29 metre high eccentric support pylon on the west side of the freeway. The bridge rests on the cross beam of a slender A-shaped pier on the east side.

The GFI JV employed WBHO Civils division, under site agent Clinton Barnes, to construct the bridge and undertook the associated earth and roadwork. Work commenced in July 2009. An additional team, sourced from the GFI JV, comprising men from WBHO (Roads & Earthworks), under site agent Nicol van Rensburg from Sanyati Construction came on board in November 2009 to resource the peak production demand. The bridge was successfully completed at the end of May 2010.

Van Rensburg says that a major issue was public access as the old bridge was used by hundreds of people daily. "Fairlands Laerskool is situated on the opposite side of the freeway and the bridge is a primary access to the school. This meant that access to the old bridge had to be maintained, a challenge on its own with the close proximity of the construction of the new bridge" he says.

"The foundation of the new bridge encroached into the founding area of the old bridge access stairs, which necessitated their demolition, and with safety being a priority at all times we erected temporary stairways to maintain safe access for pedestrians. In fact, there was not one incident, not with the public nor on site during construction." he says.

Another challenge lay in the geology of the area which comprises large boulder and solid bank syenitic granite. "The design called for founding the base of the pylon four metres below the surface within the rock horizon. It was decided that the existing bridge might not tolerate any sideways acceleration due to blasting, and

such socketing as was needed was done by hydraulic hammer," van Rensburg explains.

Grouted Y32 anchors were adopted by the client as ground anchors and these were installed through ducts in the completed base. They were subsequently post tensioned thereby applying a downward force to the top of the base which increases the pylon stability.

The tusk-like shape of the pylon curves in all three axes, leaning backwards away from the highway and position of the bridge and as a result of this the formwork needed to be a unique shape. Formscaff was employed to design and fabricate shutters specifically for the construction of this, and Barnes says that the company made a great effort to make sure that this was accurate.

"The stressing ducts were installed according to profiles that also curved in all three dimensions and it was a novel experience to have to stress vertically," Barnes says. "The density of the reinforcing was such that it was extremely difficult to fit everything into the geometry of the pylon. Most notably it is difficult to weave Y32s."

The six stay cable pairs on the bridge, comprising four 20 mm thick cables in each rope, are anchored in place with lugs at the top of the pylon and into the appropriate place on the space frame. An international team from Freyssinet was responsible for installing, tensioning and fixing the cable stays.

The pylon which supports the bridge had to be a very robust structure. However the client's intention of producing a tusk-like structure required the pylon to also be relatively slender. This meant that the combination of internal stressing ducts, reinforcing and attachments for the cables resulted in an intensely congested space inside the shutters and there were concerns regarding compaction of the concrete as well as the level of finish desired for this iconic structure feature.

Barnes says that special attention needed to be taken when placing the concrete, and AfriSam's 50 MPa self levelling concrete suggested itself as a solution for all these problems. "The mix proposed and subsequently developed by AfriSam was accepted for the works and trials were done on site with narrow samples to verify that the concrete would indeed meet the specification."

Furio di Nado, project technical team leader at AfriSam, says that the self levelling concrete is ideal for applications where accessibility is an issue. "The concrete has good inherent strength, while at the same time containing plasticisers which make it more malleable. This flexibility means that the product flows readily into confined spaces."

Self levelling concrete, with a consistency like pancake batter, has a low viscosity and the high, even flow ensures that it fills all spaces in the formwork under its own weight, leaving no voids. It has the ability to flow through and around confined spaces between reinforcing bars and other intrusions without segregation or blocking.

"The product can be placed in one lift with minimal labour and there is no need for vibration or tamping. In total AfriSam pumped 87 m^3 of its self levelling concrete into lifts 4 to 6 and on the last lift they used their longest concrete pump (34 metre boom) to reach the top of the space frame,"

On completion of construction, the old bridge was demolished. This was done using a crane to remove the loosened deck and the three supporting piers. These were demolished alongside the freeway.

AfriSam products have played a major role in a number of GFIP contracts and have allowed these road building contractors to build with confidence over the past two years.

CAPTION PIC 01 : The combination of internal stressing ducts, reinforcing and attachments for cables resulted in an intensely congested space.

CAPTION PIC 02 : The pylon which supported the bridge had to be a very robust structure.

CAPTION PIC 03 : The final stges of the pylon construction.

CAPTION PIC 04 : The tusk like shape of the pylon curves in all three axes.

CAPTION PIC 04A: The tusk like shape of the pylon curves in all three axes.

CAPTION PIC 05 : The old bridge being removed.

CAPTION PIC 05A: The old bridge being removed.

CAPTION PIC 05B: The old bridge being removed.

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