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THE CIVIL ENGINEERING CONTRACTOR

Subscription-based electronic and print media serving the construction industry

May 2019

Vol 53 No 5

ANNUAL SUBSCRIPTION:
11 print editions + 24 email bulletins

South Africa
International

R1 955
USD170

ISSN 0009-7888

SA–Botswana Platjan Bridge border's precast upgrade

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The P105-million project was initially earmarked for commencement in 2014 (and had first been mooted as early as 2009) under the Botswana Department of Roads, but was taken over by SPEDU in April 2017 for facilitation. Platjan is located in the Bobirwa sub-district, where there are border posts on both sides of the Limpopo River that constitute points of entry between Botswana and South Africa.

The determining design criteria of the bridge was to design at sufficient level above the 15-year flood line. The bridge is therefore cambered and raised in relation to approach roads. The in situ bridge deck spans onto prestressed concrete bridge beams 800mm deep, spanning 15.5m continuously over 1m thick by 9m-high tapered concrete piers.

These are typically founded on 1.2m thick \times 9m \times 4.5m-wide concrete bases with 8No. \times 5m deep, 32mm diameter high-yield anchor dowels on the upstream side and 4No. \times 3m-deep base anchor dowels on the downstream side of the pier bases.

The final finish over the bridge will be a 60mm layer of asphalt with the approach roads having concrete paving. Two agricultural culverts, each 5m wide by 2.5m high, are provided at chainages +0.180 and +0.420, respectively.

Site project manager with Estate Construction, Julius Katzke, explains the commercial basis for the project: "The Platjan border post is currently not a commercial border. The nearest commercial border is heavily backed up with trucks waiting hours to cross, and the strategic intent of this development is therefore to turn Platjan into a fully fledged commercial border post to ease that logjam and simultaneously stimulate the local economy by providing improved access for small towns and big farming enterprises that are located within a 35km radius. Increased through-traffic will also create opportunities for local hospitality businesses in and around the border post."

There is 40km of gravel road leading to the border post on the South African side, and more on the Botswana side. These would have to be paved. The current bridge is regularly affected by seasonal flooding, making it impassable for both vehicles and pedestrians. The most affected are farmers in both countries, as they experience a great inconvenience in crossing to either side to sell their produce. The business and farming communities in the Tuli Block area have engaged in business partnerships with South African-based entrepreneurs on the other side of the border.

The Platjan Bridge upgrade is part of a bilateral covenant in which the South African government committed to construct a bridge across the Notwane River in Ramotswa. Both bridges are located at international

border posts and are meant to ease travel between the two countries.

Scope of work

The bridge is of concrete and a hybrid construction, its span being 155m with 10 equal spans. The overall bridge width is 12.7m. The single carriageway has two 3.7m traffic lanes — one in each direction — with a 2m-wide pedestrian walkway on either side of the traffic lanes. The new bridge dwarfs the existing bridge level alongside, being 7.5m higher. The current means of crossing the river is through a single lane causeway or low-level culvert with concrete pipes along the 100m length of river width.

Quantities of material include:

- About 13 000m³ of rock fill.
- About 3 500m³ of gravel material.
- A total of 220 rock dowels will be drilled into sound rock.
- A total of 54t of reinforcing steel will be used for in situ culverts construction.
- A total of 400m³ of 40N concrete will be used for in situ culvert works.
- A total of 3 200m³ of 40N concrete will be used for the main bridge works.
- A total of 210 prestressed T bridge beams, each 15.3m long, will be transported to site and erected.
- 120t of steel in the deck
- 2 200m³ of concrete crunched.

At end-January, the bridge was 72% complete, and was consequently somewhat more advanced at the time of the March site visit by *Civil Engineering Contractor*, with all the foundation concrete work done by that time, barring the deck slab and approach roads. The contractor commenced work in early January 2018 and the project is set for completion by end-June.

Katzke says the project, as a Botswana project, had to procure from local Botswana 'citizen companies'. One exception was the precast concrete beams, as these were not locally manufactured to the appropriate quality, he says. Jaco



Photos by Emann Ryan



Precast concrete slabs were manufactured by CoreSlab.



The old bridge alongside the new one being built.

de Bruin, MD of CoreSlab, explains that the company manufactured I-type beams for the project, with installation done by Corestruc once the bearings were installed. Corestruc is the installation arm of CoreSlab. “We supplied 210 precast-concrete beams for the bridge, and each span comprises 21 beams.”

Delivery of the 210 beams was a logistical challenge, considering space constraints on site. Katzke explains that they were, therefore, supplied on a just-in-time basis rather than being offloaded all at one go, as the bearings on which they rest were consecutively completed. “They were consequently stored at CoreSlab’s factory and installed as the bearings were completed.

“The beams consequently are conventionally transported straight from factory to site and lifted directly from the truck trailers using a mobile crane from CoreHire. There are five beams per load, each beam weighing 2.8t, enabling us to complete two spans a day. Once all the beams are laid, we will pour concrete on the central slab, which will facilitate access to the bridge at that level,

enabling us to easily construct the barrier wall side section, drainage pipes, and service ducts. The side section can be done with the precast acting as shuttering. This is more efficient and will ensure the accuracy required for this component of the work,” says Katzke. He notes that the project demands the same high standards as South Africa. SABS standards are applied throughout and the FIDIC Red Book form of contract is being used on this project. “We are close to South Africa in this regard.”

The bridge site has its own batching plant, with aggregate for the concrete sourced from a crusher in Selebi Phikwe, which recycles mine waste rock on site. This was more economic, as only tertiary crushing and screening was necessary, while also mitigating the need to open borrow pits. “Aggregate and sand were stockpiled here for batching on the Botswana side, as a contingency for flooding. The concrete batching plant has a capacity of between 200m³ and 300m³ a day for a 15MPa blinding material and 35MPa material for structural requirements. An independent laboratory was operated

by the client to test the concrete. On every pour, we do a slump test, something which was possible considering the smaller pours.” Truck-mounted booms assist with pouring at that level, enabling one section to be completed each day in continuous pour.

The relief culverts were to be done in situ, but the design opted for prefabricated units from Rocla on both sides.

Project challenges

Like any project, Platjan Bridge came with its challenges, says Katzke. The Limpopo’s watershed area extends as far as Johannesburg, which saw a huge amount of rain flooding into the Crocodile River and hence into the Limpopo. “We struggled at the start due to flooding during wet season — February 2018 saw a massive flood on the river. We had to use large pumps to remove water and isolate the pier bases at that time. Thereafter, we built a coffer dam that also served as a platform for the mobile crane, as the existing bridge was too small for the machine with its outriggers fully extended. Once the



pier footings were constructed, the piers themselves went much faster.

“Although the ground conditions were good on the South African side, with good rock bed material,” says Katzke, “generally, there were complex ground conditions. We had to blast 1.5m into the river bedrock, which was the most time-consuming aspect of the works programme. The nine 4m × 9m pier bases and two abutments were constructed with starter bars, with rockfill required around the abutments.”

The isolated bush location was a second significant challenge, with big

towns such as Gaborone, Francistown, and Polokwane all many hundreds of kilometres distant — requiring logistical planning. “The steel came from Gabarone and the precast beams from Polokwane, for instance. Whenever ordering tools and materials, we would have to ensure we had at least one spare — because it is not feasible to pop out to a local hardware store to get a replacement. We managed this challenge by efficient planning and doing transport ourselves to ensure timely deliveries. Even so, our foreman would constantly be on the road between Selebi Phikwe and Francistown.”

Accommodation also required the hiring of an entire lodge and the establishment of a camp for staff — also well away from the river, which contained hippos and crocodiles.

“Machines are serviced by dealers in Gaborone. They do major repairs and services, with the basics done on site. We do our own plant repairs and have our own workshop. We use brands already well established in the mining sector, which have a strong presence in Botswana: Komatsu excavators, Bell ADTs, and JCB loaders.”

Conclusion

There were 50 workers on site, including the foreman and supervisor, and the project peaked at the end of 2018. The most experienced local workers that Estate has used before also worked on this project. In addition, there were two steel



Site project manager with Estate Construction, Julius Katzke.

contractors on site with their own staff doing the steel fixing.

The area was cleared of vegetation prior to the commencement of the project — with one exception. Katzke explains the project gave a little nod to the heritage of the site by leaving in place a single tree. This tree had in earlier times marked the border post, and therefore takes pride of place in the centre of the new border as a symbol of cooperation between the two countries. ■■

List of professionals

Client: SPEDU (the Selibi Phikwe Economic Development Unit)

Supervising consultants:

ACE GIBB of Botswana

Bridge design:

Wellfield Engineering of Botswana

Major contractor:

Estate Construction — a ‘citizen contracting company’

Precast concrete supplier:

CoreSlab (South Africa)



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