Connecting outlying SEKHUKHUNE DISTRICT

The Roads Agency Limpopo is forging ahead with the construction of a new road that will connect three villages in the mainly rural Sekhukhune District Municipality to two provincial roads, including the D1547 that is administered by the South African National Roads Agency Limited.

When completed in September 2019, the new 13 km single carriageway will provide citizens of Mmotwaneng, Legonaneng and Luckau with quick access to major urban centres in Limpopo and Mpumalanga.

Notably, many small businesses in these villages, among them emerging farmers,will also benefit from the new infrastructure by being able to expand into new markets.

Meanwhile, numerous local small businesses have already benefited from on-the-job training provided by the main contractor, Lonerock Construction, during the construction phase of this project.

This still stands out as a major highlight for both Thabiso Phetla, site manager of Lonerock Construction, and Joseph Myoya, Ubona Engineers' resident engineer on site.

"As a typical Expanded Public Works Programme project, it has been designed to be extremely labour intensive. By November 2018, there were as many as 60 locals working alongside members of our team. This number will increase when we commence on the ancillary works, such as the installation of the guardrails and construction of the storm-water drains, in mid-2019," Phetla says.

Notably, four engineering student technicians were also selected by Lonerock Construction to gain practical experience while working alongside its team as part of the company's ongoing commitment to skills development in the construction industry.

Considering its many complexities that have often demanded 'out-of-the-box' thinking by the client and its professional team, this project has proved to be a very fertile training ground for these students.

Myoya says that one of the challenges was quickly adapting the original engineering design that was completed more than eight years ago to current conditions without delaying the works programme.

"While the engineering design was completed by another engineering consultancy in 2010, the construction of the road was delayed by RAL due to limited financing and other pressing responsibilities. The villages have since rapidly expanded with many properties located within the planned route. The road, therefore, had to be extensively realigned to avoid having to relocate more than 200 affected properties.

Our approach, which also included reducing the width of the two metre shoulder in areas, resulted in significant cost savings for the client, while also mitigating further delays to delivering this critical infrastructure to the communities," he says.

Moreover, the original design of the bridge over the Mankgatle River had to be adapted to align with the higher level of the new realigned road.

It is one of two major and technically-complex structures that were built by Lonerock Construction as part of this project.

At six metres in height, it is significantly taller than the original design and is, thus, well above 20 year floodplain.

Substantially more reinforcement steel was required for the taller concrete abutments and additional precast-concrete elements were needed to build the larger 20 m long and 11,5 m wide superstructure.

The eight I8 precast-concrete beams and 126 precast concrete deck planks were manufactured and installed by CoreCivils, the precast-concrete bridge beam and parapet arm of CoreSlab.

Representatives of Lonerock Construction and Ubona Engineers worked closely with CoreCivils to ensure that the bridge beams conformed to the clients' exacting standards.

Representatives of the company visited the factory in Polokwane on several occasions to observe the manufacturing processes deployed at the company's state-of-the-art factory in Polokwane.

Most importantly, they wanted to witness the tensioning processes to allay any concerns regarding potential cracking at the ends of the elements. The benchmark for quality was confirmed after the first element had reached a compressive strength of 45 MPa and CoreSlab was given instruction by the team to proceed with the manufacture of the remaining seven beams and deck planks.

"CoreSlab can be commended for its willingness to accommodate us every step of the way, starting with the design and generation of a method statement of the manufacturing process. The company was also appointed to undertake the installation of the precast-concrete beams once the bearings had been installed on the abutments. This is considering that it is also a specialised process that demands absolute precision to avoid deflections during the lifting of the beams and after they have been placed," Phetla says.

The design of the foundations of the bridge also had to be modified by Ubona Engineers considering that the terrain is overlain by rocks and large boulders.

A decision was taken to anchor the foundations of the bases of the abutments into the large boulders as opposed to removing them by drilling and blasting.

"Mass concrete was cast over the boulders and we then drilled through them to insert the dowels. This approach provided some cost savings for our client considering that up to 45 000 m³ of rock had to be removed by drilling and blasting during the earthworks stages of the construction of the road. It also mitigated any delays as we decided to first prioritise the completion of the two large structures before working on the road," Myoya says.

Some of this material was crushed and used in the layer works of sections of the roads and in the foundations of the large cast in-situ three-barrel culvert.

These challenging ground conditions were compounded by the perched water table in many areas along the route.

Affected areas were excavated and then filled with crushed rock that was covered with a Bidim geotextile, before

work commenced on the layer works. The road comprises a bedding layer compacted to 93% AASHTO density; selected layers compacted to 95% AASHTO density; and a C3 base course compacted to 98% AASHTO density.

This road will then be primed and sealed with 13,2 mm and 6,7 mm thick bitumen layers. Quality G6 material for the sub-base layers was sourced on site from the various cuttings and the remaining material from two borrowpits that were opened specifically for this project. In terms of the stabilisation of the sub-base layers, the pockets of cement supplied to site by PPC were unpacked and spread by hand to ensure accuracy and to provide further work opportunities for members of the community.

Phetla and Myoya note that meticulous attention also had to be paid to the implementation of the design of the water control and drainage systems considering the high rainfall experienced in this area.

More than 20 precast-concrete culverts were installed at the various crossings along the route as part of this aspect of the works programme. They are both looking forward to handing over this quality infrastructure to the community members, who have struggled for many years with gravel roads that required extensive maintenance especially after heavy rains.

They are also already benefiting from the boreholes that were installed by the contractor with the help of the municipality to support the construction operations.

Jaco de Bruin, managing director of CoreCivils, says that he is proud of the company's involvement in a project that has already had such a profound positive impact on lives of so many people in a very impoverished area of the country. ■

LESOTHO HIGHLANDS WATER PROJECT PHASE II UNDERWAY

The Lesotho Highlands Water Project (LHWP) is a multi-phased project intended to provide water to the Gauteng region of South Africa and to generate hydro-electricity for Lesotho. The project entails harnessing the waters of the Senqu/Orange River in the Lesotho highlands through the construction of a series of dams, for the mutual benefit of the two countries. Phase I of the project was completed in 2003 and inaugurated in 2004. Phase II is currently underway.

This phase comprises the construction of the Polihali Dam; an approximately 38 km transfer tunnel to convey water from Polihali to Katse Dam; and all associated advance infrastructure.

SMEC South Africa, as a member of the Metsi a Senqu-Khubelu Consultants Joint Venture (MSKC) appointed by the Lesotho Highlands Development Authority (LHDA), is providing professional services for the design and construction supervision of the Polihali Transfer Tunnel. Altogether, MSKC will carry out the design and construction supervision of approximately 8,3 km of drill-and-blast tunnels, including intake tunnels, access adits, connector tunnels and outlet tunnels; approximately 34 km of tunnel-boring-machine tunnels; approximately 230 m of shaft sinking; a lake-tap outlet into the Katse reservoir; and all associated concrete work, access roads, site offices, storage /laydown areas and other related surface works and infrastructure.

"Training LHDA staff to operate and maintain the tunnel is part of the skills and technology transfer element of this contract", states SMEC South Africa Project Director, Chris Viljoen. "The contract also makes provision for the training of young professionals".

Water from the LHWP is transferred in terms of the Treaty between Lesotho and South Africa, via the Katse reservoir, through a transfer tunnel and delivery tunnel, to the Ash River outfall between Clarens and Bethlehem in South Africa. Water flows from the Ash River into the Liebenbergsvlei, which joins the Wilge River near Frankfort before finally reaching the Vaal Dam in Gauteng, South Africa.

Phase II is expected to ensure another source of reliable water supply to South Africa that will meet the demands of the Gauteng region, increasing the current supply rate of 780 million m^3 per annum from the LHWP to the Vaal System by approximately 465 million m^3 to make a total of 1 255 million m^3 per annum. ■