MacWest Bridge facilitating coal delivery

THE MACWEST BRIDGE near Vereeniging lies about 100 km south of Johannesburg. The bridge links the new Maccauvlei West coal reserve to the existing New Vaal Colliery Maccauvlei East mining operation.

This project will facilitate the improved mining of the Maccauvlei West coal reserve, which supplies the nearby Lethabo Power Station. The bridge carries an internal access road over an electrified railway line and provincial road in the Anglo Coal facility.

DESIGN

The mining operations of the New Vaal Colliery use a multitude of abnormally sized vehicles. The MacWest Bridge needed to be designed with these vehicles and their heavy loads and abnormal widths in mind. The design and positioning of the bridge, and the fact that it had to accommodate the severe live loading of dumper trucks and occasional heavy shovels, posed a challenge.

1 The bridge will facilitate the delivery of coal to Lethabo Power Station
2 The MacWest Bridge near Vereeniging is certified to carry 715 t

THE MACWEST BRIDGE PROJECT

Submitted by Vaal Triangle Branch in the category Technical Excellence

KEY PLAYERS

Consulting engineers (design) Africon
Supervision Semane Consulting Engineers (supported by Africon)
Quantity surveyor Venn & Milford Incorporated Project Services
Contractor WBHO Construction

3 Special precast triangle units to form a balustrade
4 The abutments consist of reinforced earth walls with concrete panels to retain the approach fills
5 The piers are founded with augered concrete piles
6 The bridge has to carry fully loaded dump trucks
7 The bridge was officially opened for use on 2 April 2008

The road and railway lines over which the bridge was built also had to remain operational throughout the construction period, except during the erection of the precast concrete T-beams.

Anglo Coal required the bridge to carry, on a daily basis, fully loaded Euclid R170 rear dump trucks, each with a total static dead load of 352 t, and occasionally the single P&H 2300 rope shovel with a mass of 715 t.

The target payload for dump trucks is 211 t and they travel over the bridge at a speed of 35 km/h. The rope shovel has two crawler shoes each with a contact area of 6,6 m long and 1,8 m wide.

The bridge was designed within the principles of ultimate limit design methods, and only static load weights were supplied by the vehicle manufacturer as a guideline. An additional 1,5 dynamic factor for dumper trucks and 1,33 for the occasional shovel were applied. At the approach road, a bridge width of no less than 27,4 m was required to accommodate a carriage width of 21 m.

Another operational factor influencing the design was that coal falls from the dump trucks onto the road. This necessitates regular clearing of the

gravel approach roads using a grader. The same applies to the bridge surface, which required the deck surface to be designed to accommodate the operation of a grader blade.

CONSTRUCTION

The bridge length is 36 m with three deck spans of 14 m, 10,3 m and 11,6 m respectively. The deck spans are simply supported and consist of 1,5 m deep inverted precast concrete T-beams with a 240 mm thick in-situ cast structural concrete slab. A topping of 100 mm with a grid of cast-in rails was provided to protect the structural concrete and expansion joints against the action of grader blades.

The two piers each consist of four wall-type supports topped by a seating beam. Each pier is founded with 24 augered concrete piles with a length of 12 m to 14 m on top of soft rock (coal).

Precast beams were required for the construction above the railway line and the road. Pre-stressing of the beams was considered, but as a result of the extreme ratio of live load versus dead load, it was found to be more economical and practical to use reinforced concrete.

To prevent material from falling on the railway line or the provincial road, a 2,5 m high barrier and a 3 m high steel screen wall had to be erected on each side of the bridge. Hollow triangular concrete elements were erected on either side to safeguard the dumper trucks while crossing the bridge.

Bridge construction consumed over 3 000 m^3 of concrete and 500 t of reinforcing steel. The contractor, WBHO Construction, completed the bridge in 11 months. The construction cost for the bridge with reinforced earth walls amounted to some R36 million.

CONCLUSION

The MacWest Bridge is expected to be in use for the next 30 years and will boost New Vaal Colliery's supply to the Lethabo Power Station by an annual 2,7 million tonnes. This means that the mine's existing output will rise to 17,8 million tonnes per annum.

The bridge, which is jointly funded by Anglo Coal and Eskom, forms an important component of the Maccauvlei West project. As such, it will contribute towards solving South Africa's current energy crisis. □


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Source:
http://www.saice.org.za/downloads/monthly_publications/2008/CivilNovDec2008.pdf