



Improvements to Dr Chota Motala Interchange on the N3 National Road

OVERVIEW

The Dr Chota Motala Road Interchange is located at the junction between the National Route N3 and Provincial Route R33 (Dr Chota Motala Road). The N3 is a key national route linking Durban with the 'hinterland', whilst the R33 provides access to the interior of KwaZulu-Natal and links the Pietermaritzburg CBD and southern suburbs with the northern suburbs.

Peak hour traffic volumes along the Dr Chota Motala Road are extremely high – approximately 2 700 vehicles per hour in the peak commuter traffic direction. Various intersections along Dr Chota Motala Road were operating at a low level of service, particularly at the ramp terminals with conflicting right turns on the major movements.

The traffic operations were also affected by high pedestrian activity across the interchange (6 500 persons per day) because of its proximity to the CBD, local industry, schools and public transport facilities.

THE PROJECT

The improvements to the Dr Chota Motala Road Interchange on the N3 were aimed at relieving the traffic congestion on the

FINALIST – Technical Excellence Category

KEY PLAYERS

Client

South African National Roads Agency Limited (SANRAL)

Professional team

Iliso Consulting (Pty) Ltd / Aurecon Joint Venture with DNA Consulting as sub-consultant

Main Contractors

Group Five Joint Venture in consortium with Phambili

Sub-contractors

Fynns James / Structural Systems Joint Venture

N3 and Dr Chota Motala Road by eliminating problematic traffic movements and providing additional capacity up to the year 2026. Aesthetically pleasing bridge structures and enhancement to the riding quality of the N3 concrete pavement were also incorporated into the design.

Improvements which best solved the traffic problems on Dr Chota Motala Road, the interchange ramps, and the N3 included:

- An auxiliary (fourth) lane between the interchanges. This included a complete concrete overlay to the existing carriageways, and widening in the median or along the outer edge.

- Maintenance, widening and improvement of the northbound exit ramp A and southbound entrance ramp D.
- Redesigning the horizontal and vertical geometry of the southbound exit ramp C to accommodate the auxiliary lane and the widening to four lanes. The ramp still follows the existing alignment.
- A new directional ramp E being introduced for the heavy east-north traffic movement. This ramp is carried over the N3 and Dr Chota Motala Road on a 220 m curved incrementally launched structure.

The design was dependent on information from the Msundusi Municipality;

however, when construction commenced, major difficulties were identified which resulted in the need for additional works. These included:

- Pipe jacking in order to realign a large-diameter sewer trunk main that was in the way of the proposed piled foundations for the abutments to the new bridge over the N3 freeway.
- The construction of a new sewer pipe bridge across the Dorpspruit River. The existing large-diameter steel pipe was attached to the side of the Dorpspruit Bridge. During the design stage it was envisaged that this pipe would be attached to the soffit of the new widened bridge and protected with a concrete encasing. However, during construction this was rejected by the Msunduzi Municipality, as it would deny them access to the pipe.

DESIGN AND CONSTRUCTION

Bridge structures

The project included six structures of varying function and structural complexity.

The 220 m long curved viaduct for ramp E at the highest level was incrementally launched to avoid any impact on traffic.

The Dr Chota Motala Road Bridge over the N3 was constructed in half

widths, with the existing structure rapidly demolished during a 48-hour closing of the N3. The foundations for this structure were all spread footings. At a later stage, the layout was amended to allow for a future loop ramp. This required an additional lane and wider bridge deck.

The Dorpspruit River Bridge was widened and raised to eliminate future flooding potential.

At the same time the demolition of heavier and ungainly existing bridges created the opportunity to develop more slender structures with aesthetically attractive concrete shapes and finishes. The new bridge piers have curved mushroom shapes with up-and-down lighting to improve their appearance.

N3 improvements

The existing N3 concrete pavement was distorted and in poor condition, with varying cross falls and levels. Its design therefore included an asphalt inter-layer over the existing concrete, both to improve the distortion in the surface levels, and to separate the new continuously reinforced concrete pavement.

A fundamental requirement was to maintain traffic flow through the interchange during construction. However,

the method of construction of the concrete pavement resulted in the tie bars between adjacent lanes extending into the available space and therefore the available lane width being too narrow to accommodate traffic. The contractor therefore had to introduce contra-flow traffic so that two-lane traffic could be maintained in each direction.

The N3 was also widened to three lanes in each direction. The design allowed for the widening to be accommodated in the median, with carriageways separated by concrete barriers. An additional auxiliary lane was also required between the two interchanges to improve capacity and weaving movements.

Considerable effort was put into the design of horizontal, vertical and cross section geometry and levels. This yielded a smooth finish to the riding surface and a 7% super-elevation resulting in level differences of up to 1.8 m between the carriageways.

The median barrier was also constructed before the median widening. This resulted in an unstable retaining wall during the excavation of the layer works box on the lower side, which increased the height of the retaining wall by approximately 1 m with a maximum



height of almost 8 m in places. A cast-in-situ retaining wall with precast barriers fastened to the wall at the appropriate levels solved the problem.

Drainage

Due to the difficulty of working in an urban environment where there was little as-built information, the final design for the drainage structures included prefabricated pipes, culverts, kerbing and channelling and subsoil drains.

In addition, a large-diameter storm-water pipe across the N3, which was not shown on the as-built drawings, had to be extended under ramps B and E. This required a special culvert with induced trench design to counter the effect of the loading of the 18 m high fill.

Commuter safety

The major challenge during this project was the accommodation of 30 000 vehicles per day on the N3. The contractor went to considerable lengths to maintain free flow of traffic, utilising adequate safety barriers and contra-flow

measures. In the 30-month contract period there were no accidents directly related to the construction works.

CONCLUSION

Traffic congestion on the interchange has been eliminated by substantial improvements to the ramps and the

construction of a directional ramp on an impressive overhead structure. The professional team ensured continuous public safety, free flow of traffic and high-quality finishes, elegant structures and additional features to improve the aesthetic appeal of the concrete structures and the road. □



Proud to be part of the Joint Venture/Consortium at Chota Motala Road Interchange



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