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Ben Schoeman Freeway

BACKGROUND

In 2008 SANRAL launched the Gauteng Freeway Improvement Project (GFIP) which is a far-reaching upgrading programme for the province's major freeway networks in and around the Metropolitan Municipalities of Johannesburg, Ekurhuleni (East Rand) and Tshwane (Pretoria region). The project aims to provide a safe and reliable strategic road network and to optimise, among others, traffic flow and the movement of freight and road-based public transport.

The GFIP is being implemented in phases. The first phase comprises the improvement of approximately 180 km of existing freeways and includes 16 contractual packages. The network improvement comprises the adding of lanes and upgrading of interchanges.

The upgrading of the Ben Schoeman Freeway (Work Package C of the GFIP) is described in this article.

AIMS AND OBJECTIVES

The upgraded and expanded freeways will significantly reduce traffic congestion and unblock access to economic opportunities and social development projects. The GFIP will provide an interconnected freeway system between the City of Johannesburg and the City of Tshwane, this system currently being one of the main arteries within the north-south corridor.

One of the most significant aims of this investment for ordinary citizens is the reduction of travel times since many productive hours are wasted as a result of long travel times.

Apart from widening of the freeway, the Ben Schoeman Freeway project will also ensure that bottlenecks at interchanges are alleviated; this includes the infamous Allandale Interchange which will be transformed into a full free-flow system interchange.

Another aim is improvement of the environmental impact of the freeway, due to decreased vehicle emissions resulting from the reduced traffic congestion. Road safety will be enhanced through the improvement of the median lighting and the introduction of an intelligent transport system (ITS) consisting of cameras, electronic noticeboards and other traffic management features along the route.

The GFIP, which includes the Ben Schoeman Freeway upgrading, was planned before South Africa's 2010 FIFA World Cup bid was accepted, but was substantially completed before the 2010 event. At least four lanes per direction were made available over the length of the project for the duration of the FIFA World Cup.

On completion of the first phase of the Ben Schoeman Freeway project by early 2011, the next phase, consisting of an open-road tolling system, will be introduced. It is envisaged that the project will be completed by April 2011.

PROJECT DESCRIPTION

The Ben Schoeman Freeway project is located in Gauteng on the 21 km section of the N1 Freeway between the Buccleuch Interchange linking the N3, N1 and M1 in the south, and the Brakfontein Interchange linking the N14 and N1 in the north.

This section of the N1 Freeway includes two system interchanges (Buccleuch and Brakfontein) and five access interchanges (Allandale, New Road, Olifantsfontein, Samrand and Old Johannesburg Road). The freeway has a number of underpasses and overpasses, which include the Woodmead Drive underpass, Maxwell Drive underpass, Le Roux Avenue overpass, Alexandra Avenue underpass and Nellmapius Road overpass. The interchanges, underpasses and overpasses and improvements to them are described in more detail below.

Before the upgrading, the Ben Schoeman Freeway was a six-lane dual carriageway facility (three lanes per direction). The initial roadway was paved with a continuously reinforced concrete pavement (CRCP) and the two carriageways are separated by a New Jersey concrete median barrier.

1. Widened to five lanes per carriageway
2. Bridge widening at the Jukskei River
3. Placing beams at Le Roux overpass
4. Brakfontein interchange – adding a third lane

The upgrading concept includes the following:

- The dual carriageway of the National Road is widened towards the outside to make provision for four to six lanes per carriageway, depending on traffic volumes. Furthermore, continuous auxiliary lanes are provided between the on-ramps and off-ramps of all consecutive access interchanges.
- The structures of all overpasses and underpasses are widened to accommodate the widening of the freeway.
- The majority of all interchanges and their cross-roads are upgraded to provide additional capacity on the freeway.
- Eight new bridges are constructed as part of the interchange and freeway upgrades.

5 Allandale Interchange
6 and 7 Bridge construction and accommodation of traffic

UPGRADING OF THE BEN SCHOEMAN FREEWAY

Only minor upgrades are being implemented at the Buccleuch Interchange. The freeway section between the Buccleuch Interchange and the Allandale Interchange is being upgraded from the existing three lanes per direction to six lanes per direction.

Major capacity upgrading is required at the Allandale Interchange. The initial diamond configuration of the Allandale Interchange is being upgraded to a full free-flow system interchange with an additional carriageway overpass and new directional ramps and access loops as shown in Figure 5. Allandale Interchange is a major part of the project and almost half of the earthworks and structures quantities are allocated to the upgrading of this interchange.

Allandale Interchange is being constructed in three phases due to severe challenges from a traffic accommodation point of view. The fully upgraded interchange will be opened in 2011 after the construction of five new bridges and the demolishing of the old Allandale bridge.

The freeway section between the Allandale Interchange and the Le Roux Road overpass is being upgraded from the existing three lanes per direction to six lanes per direction.

The Le Roux Road overpass bridge, located between the Allandale and New Road Interchanges, will be replaced with a bridge spanning six lanes per direction, but no capacity upgrading is required at the New Road and Samrand Interchanges.

The freeway section between the Le Roux Road overpass and the Brakfontein Interchange is being upgraded from the existing three lanes per direction to five lanes per direction, except for the sections between the off-ramps and on-ramps at the New Road Interchange, Olifantsfontein Interchange, Samrand Interchange and the Old Johannesburg Road Interchange which will be upgraded to four lanes per direction.

The capacity upgrading of Olifantsfontein Interchange entails mainly the addition of a second overpass bridge adjacent to the existing structure to provide four through lanes on Olifantsfontein Road (R562).

At the Rooihuiskraal Interchange the capacity upgrading entails the construction of a new free-flow directional off-ramp on the N1 for northbound traffic travelling to the west, and the construction of slip lanes to improve continuous free flow of traffic.

At the Brakfontein Interchange the capacity upgrading entails the widening of the main directional ramps from two to three lanes each.

Various pavement designs have been adopted for new and upgrading works. The layers vary from a bitumen rubber semi-open-graded hot-mix asphalt (BRASO) wearing course, various continuously graded hot-mix asphalt surfacings, a stress-absorbing membrane interlayer (SAMI), continuously reinforced concrete (CRC), a graded crushed stone base, a cement-stabilised subbase and natural gravel selected layers. Rehabilitation of the existing surfaced pavement is required in this project, such as milling of the existing surfacing and replacing it with appropriate inlays.

The structural works consist of four bridges that are to be widened, seven major culverts that are to be lengthened, the construction of eight new bridges, and the demolishing of three existing bridges that did not have sufficient horizontal clearance to accommodate the required number of lanes passing under them on the N1 Freeway. Barriers, retaining walls and overhead sign gantries are also being constructed.

The appurtenant works consist of the relocation of services, lighting, platforms and footings for technical shelters and toll gantries, and other auxiliary works. The services to be relocated or reinstated include major 88 kV and 11 kV lines with pylons, sewer pipelines 100–450 mm in diameter, water pipelines 200–600 mm in diameter, localised road crossings of Telkom and electrical cabling, six permanent comprehensive traffic observation (CTO) stations, an intelligent transport system (ITS) and its infrastructure along the length of the freeway, and the movement of electrical cabling next to the median barrier along the full length of the freeway so that it is closer to the barrier.

The existing lighting of Ben Schoeman Freeway is being upgraded and new high-mast lighting is required at the upgraded Allandale, Rooihuiskraal and Olifantsfontein Interchanges.

Four platforms and footings for technical shelters and toll gantries are also being constructed.

All construction works are being undertaken in accordance with an environmental management plan and the contractor is taking the necessary precautions to minimise the impact of his environmental footprint.

Minimising the disruption to traffic is an important aspect of the contract. The Ben Schoeman Freeway is the major corridor between Pretoria (Tshwane) and Johannesburg and serves some of the fastest-growing urban areas in South Africa. At present the estimated maximum annual average daily traffic (AADT) volume is 159 000 vehicles, with heavy vehicles comprising 4,3% of the total vehicles. The route is also subject to seasonal demand, particularly associated with school holidays and vacation traffic.

During construction traffic is being accommodated by means of long-term and short-term accommodation-of-traffic plans. Short-term accommodation of traffic is in operation at night between 21:00 and 05:00, and over weekends with two lanes always available to the travelling public. The number of temporary New Jersey barriers available for long-term closures allows a total closure length of approximately 20 km.

The project requirements have been tailored to implement the government's programme for Broad Based Black Economic Empowerment (BBBEE). Accordingly, it is a requirement of this project that the specifications relate to the transformation of the construction industry through adherence to the policies of the Reconstruction and Development Programme. Other similar government initiatives are also being considered, such as the employment and/or creation of Black Enterprises (BEs), the arrangement of generic skills, engineering skills and entrepreneurial skills training programmes – for which provision has been made in the project's pricing schedule – and, as far as possible, the employment of construction methods using labour maximisation principles.

Adherence to the requirements of the Occupational Health and Safety Act and Regulations is also a prerequisite of this project.

CHALLENGES ENCOUNTERED AND INNOVATIONS

Some of the major challenges on this project are the bridge construction methods, accommodation of traffic during construction, the demolishing of existing bridges and the relocation of services.

Careful planning and design are ensuring that the different bridge construction methods used have limited impact on the traffic flow; this includes conventional support and overhead girders, with the most elaborate method being incremental launching of a bridge deck.

It is one of the requirements of the contract that the status quo lane configuration at the time of tender has to be maintained during day time on normal weekdays. The contractor is therefore not allowed to close lanes for construction purposes from 05:00 to 21:00 during weekdays. The major part of the work that impacts on traffic is undertaken at night with short-term closures.

8 Night-time demolition of the old Allandale Bridge
9 Next morning – almost there!

A major challenge for the project is the demolishing of three existing bridges that do not have sufficient horizontal clearance to accommodate the required number of lanes on the N1. The 40-year-old Allandale Interchange bridge was the first to be demolished. With fast-track demolition techniques, the old Allandale Interchange bridge became just a memory in 16 short hours without the use of any explosives. The bridge was reduced to rubble with the use of appropriate mechanical equipment such as excavators equipped with hydraulic hammers and pulverisers. The accommodation of traffic during this demolition process was a challenge on its own.

The relocation of services also posed major challenges due to inaccurate as-built information and limited allowance in the contract programme for the necessary investigations during the design stage to determine the impact of the relocation of services. The relocation of the existing 88 kV overhead power lines crossing the N1 at Allandale Interchange is a good example of these challenges.

PROJECT STATUS

Construction works for the upgrading of the Ben Schoeman Freeway commenced on 26 May 2008, with an initial completion date of 25 November 2010, allowing a 30-month construction period. The tender amount is R1 701 425 336,99, subject to escalation. After 24 months of construction, the project is still on track and within the parameters of time and cost allowed within the conditions of the contract. □

PROJECT TEAM

The project team consists of the client, the South African National Roads Agency Limited (SANRAL), the consulting engineer, BKS (Pty) Ltd, and the contractor, the GLMB Joint Venture, which is a tri-party joint venture between Grinaker-LTA Roads & Earthworks, Moseme Road Construction cc and Boitshoko Road Surfacing and Civil Works cc.

Source:
http://www.saice.org.za/downloads/monthly_publications/2010/2010-Civil-Engineering-September/#/0