A MILESTONE WAS reached on the Koeberg interchange in Cape Town at the end of May 2010 as ramp A was opened to the public, giving direct access from the N1 incoming to the M5. At the intersection of the N1 and the M5 highways, the Koeberg interchange experiences some of Cape Town’s heaviest traffic with 200,000 vehicles passing through the network every day. Ramp B, which takes traffic from the M5 onto the N1 highway will be completed by November 2011.

The original intersection was designed and built soon after World War 2. However, by the start of the 21st century the congestion caused by the burgeoning population was aggravated by freight vehicles travelling between the Cape Town and Bellville CBDs.

The interchange was identified by the Provincial Department of Transport as one of several areas needing infrastructural upgrades, and in May 2008 Group Five, in joint venture with Power Construction, started on the R690 million contract for the expansion of the interchange. At the time, the project was deemed by the Provincial Minister of Transport to be the most difficult project undertaken up to then in the Western Cape.

Working closely with consulting engineers HHO Africa, the joint venture is responsible for the construction of the ramps and new bridges that take the traffic over the interchange instead of
through it, widening the existing M5 Viaduct, adding new lanes, the erection of a 60 m temporary girder support for two bridges constructed over operating railway lines, and the 15 m sideway shift of the Salt River canal to make way for one of the ramps.

Moving existing services added to the complications of working around the very congested interchange. Although the services are all well recorded, during excavations an unrecorded pipe was unearthed, which dated back to World War II. It was discovered, incidentally, that the pipe had been a top secret conduit transporting bunker oil from Ysterplaat Air Force base to the harbour and, as such, it had never been mapped.

To enable the new lanes to go over the Koeberg interchange, 37 piers were constructed – 17 of these support ramp A (which is 640 m long and 10.7 m wide) and 20 support ramp B (which is 690 m long and also 10.7 m wide). With the exception of two cast in situ sections per ramp, the balance of decks are formed by 135 stressed precast U-beams weighing up to 84 tons each, cast in two precast yards adjacent to the site.

Whilst smaller precast concrete U-beams have been cast on other contracts, the ones used for the Koeberg interchange are the largest yet to be cast in South Africa. Group Five’s custom-built beam carrier is used to transport the beams to site. A Volvo 540 horse had to be purchased to tow the carrier as none of the company’s horses was powerful enough. A 715 ton and an 850 ton crane are used to erect the beams.

Crossing the fully operational and very busy Metrorail and Transnet railway lines from Bellville to the CBD are two 68 m single span bridges 10.7 m wide, and two three span ramp exit segments, each 140 m long abutting against earth fills that are supported by stabilised earth walling. Each of these four in situ cast structures is post-tensioned with approximately 64 km of stressing strand per structure. The project has 560 km of stressing cable in total – enough to stretch from Cape Town to Beaufort-West – and requires some 24 000 m³ of concrete.

Before construction could start, the project was faced with a number of challenges.
First, due to a delay in awarding the contract, the relocation of the Salt River canal, 15 m to the west of the M5 for a distance of about 600 m, was complicated by the winter rains and subsequent flooding.

A Telkom exchange and City of Cape Town electrical substation are located on the site, so, as well as relocating the usual underground services, the joint venture had to locate and move Telkom cables and electrical services before they could start excavations for the piers that support the ramp structures.

Most of the obstacles were in the ground, complicated by undocumented services. An abandoned oil pipeline, used to feed the Navy from the nearby tank farm, was discovered still filled with oil. This had to be decommissioned before some 200 m of the pipeline could be removed.

As with all road upgrade projects, ongoing traffic management is one of the major challenges, particularly in such a busy interchange, and especially when the heavy beams have to be transported across both inbound and outbound traffic. This, and the fact that there is a fine of R10 000 for every 15 minutes of unapproved lane closures during working hours, necessitated extensive night work.

The interchange spans major railway lines. Both Transnet and Metro Rail initially declined the proposed intermediate pier due to safety concerns but, after protracted negotiations, agreed to it under certain conditions. The result was that the two cast in situ box sections had to span the railway lines on a 68 m long temporary girder support during construction. These girders, which are 3.2 m deep, are supported by a central temporary support consisting of a base and wall founded on 80 Titan piles.

During the course of the project, contracts to the value of about R84 million are being carried out by BEE companies, with some R9 million earmarked for female sub-contractors. Local workers employed account for R43 million of the contract spend.

**MAIN ROLE PLAYERS**

**Construction**
- Main contractor: Paarden Eiland
- Joint Venture (Group Five and Power Construction)

**Design**
- Lead consultant: HHO Africa
- Directional ramps: HHO Africa
- MS viaduct widening, canal realignment: Asch/Bergstan
- Road works: HHO Africa
- Street lighting: Goba
- In-situ decks, signs and overhead gantries: Jeffares and Green

**Sub-contractors**
- Canal diversion: Darson Civils
- Piling: Frankipile
- Prestressing: Structural Systems