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PROJECT AWARDS: WINNERS AND FINALISTS CIVIL ENGINEERING ACCOLADE 2011

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Gautrain Rapid Rail Link

A monument to remind us that in South Africa it is possible

"Do not follow where the path may lead.
Go instead where there is no path and leave a trail."

George Bernard Shaw

(Irish Playwright, Nobel Laureate 1856-1950)

THROUGH ITS *Civil Engineering Accolade*, the South African Institution of Civil Engineering honours projects that masterfully capture the essence of civil engineering and that, at the same time, engage broader socio-economic enhancement imperatives through infrastructure development.

In 2011 the *Accolade* recognition goes to the mammoth, engineering-intensive Gautrain Project which provides a rapid rail link between Johannesburg, Tshwane (Pretoria) and the OR Tambo International Airport. The completion of the airport link in time for the 2010 FIFA World Cup contributed hugely to South Africa's image as a world-class destination.

The sight of the Gautrain in action,

and of its magnificent infrastructure traversing the landscape of Tshwane, Midrand and Johannesburg every day, is a powerful and emotive one for all those who cherish the rising of a new South Africa. It is a true testament of a land of possibility, and of the power of vision, forged forward by political will and superior engineering.

The Gautrain Project has indeed raised the profile of engineering, particularly civil engineering and its various sub-disciplines. The total route length of 80 km comprises some 15 km of tunnels in Johannesburg, and 10.5 km of viaducts along various sections of the route, while the balance of the line is on surface or in shallow open

cut. The engineering successes include addressing geotechnical problems (such as considerable dolomitic challenges), groundwater issues, and traffic and transport feeders, bridges, and so forth.

With ten stations along the route, a rapid rail artery of this magnitude also gives rise to profound new land use development and economic opportunities, all of which hold great promise for our country as a whole.

There are many challenges that remain, and indeed new ones that will emanate from this landmark project, specifically on operation and maintenance – but such is the nature of creating tracks where none existed before. Where new challenges appear, South African engineering skills will again rise to the occasion.

1 and 2 The Gautrain Sandton Station
3 Gautrain passengers at the OR Tambo International Airport Station



Although Gautrain was never a World Cup project, the first phase of the Gautrain, i.e. the link from OR Tambo International Airport to Sandton via Rhodesfield and Sandton, was opened on 8 June 2010, in time for the tournament. Local and international visitors were welcomed by a world-class train service. Much more important, though, is the legacy of the project that commenced at that time – almost three million passengers have been transported in absolute safety, comfort and reliability in the year since the opening of the first phase and the completion of the second, much more significant, phase linking Park Station in Johannesburg to Pretoria and Hatfield Stations in Tshwane via the metropolitan nodes of Rosebank, Sandton, Marlboro, Midrand and Centurion. The full system is expected to carry around 100 000 passenger

trips per day between its ten stations and on its hundreds of kilometres of supplementary bus routes. It serves as an environmentally friendly, cost-effective and reliable alternative to private car use and sets a standard to be emulated by other South African public transport projects.

The construction of the Gautrain rapid rail line encompasses the full spectrum of engineering disciplines. From a civil engineering perspective, two aspects of the project stand out particularly for their innovation in design and construction. These are the six-span balanced cantilever viaducts over the N1 and N14 crossings at John Vorster Drive and Jean Avenue respectively, the segmental viaducts and the U-beams used on the embankments over the dolomitic areas around Centurion.

The balanced cantilever construction technique and the segmental viaduct

solution allowed for minimal interruption of traffic while launching, connecting and post-tensioning of the sections took place, not just on the two busy freeways, but at all other major road underpasses and through the heart of Centurion. The spans of the balanced cantilever bridges range up to 122 m and the segmental viaduct/launching girder solution up to 55 m.

The U-beams were designed in response to the challenge of creating a stable rail line over the dolomite formations where the soils are very deep and prone to sinkhole development. The U-beams are designed to span sinkholes of up to 15 m in diameter, wherever they may occur beneath the rail embankment, by a combination of span lengths and novel articulation. As a result, operations may continue safely and without interruption.