



MARKET CONTRIBUTION: INFORMATION TECHNOLOGY

Fast-tracked projects how 2010 has set the delivery benchmark

MEETING SERVICE DELIVERY deadlines according to tight specifications is the aim of every engineering project.

This was especially true for the restricted time frames and fast-tracked processes leading up to the 2010 FIFA World Cup, with infrastructure investment in the air, rail and road transport networks boosting much-needed development.

Projects such as the Gautrain were fast-tracked – in this case into a period of 40 months in its first phase, compared to the five to ten year time frame that is usual for construction of this size and nature.

INFRASTRUCTURE AND DEVELOPMENT

Whilst the momentum of construction leading up to 2010 is over, government spending on infrastructure is set to continue, with R846 billion earmarked for development programmes over the next ten to twenty years.

This is good news for professionals in the engineering and construction industries and welcome news for service delivery throughout South Africa.

Looking back to the much-praised acceleration and delivery of projects that led to new stadiums, bridges, rail networks, airports, transport interchanges and public spaces, it is useful to ask what constraints were faced by some of South Africa's engineers over and above the usual restrictions dictated by environmental impact assessments, existing infrastructure and congested urban traffic areas.

And how did technology facilitate in the capturing, analysis and integration of data into the legacy of 2010 projects?

GAUTRAIN

As one of the largest design-and-build projects of its kind in South Africa, the Gautrain Rapid Rail Link (GRRL) was a pilot scheme in many respects. Its fast-tracked development was allocated to two phases, with final completion earmarked for March 2011.

HHO Africa in joint venture with Ingerop were appointed to do the preliminary and detailed design and construction monitoring phases for the

Marlboro to OR Tambo International Airport, and Euefees to Pretoria and Hatfield links.

Their 40-month contract included work on the most technically complex sections in terms of space constraints, as the majority of the route had to be designed and built within a 12 metre wide and 8 metre deep cutting, bordered on the one side by residential and commercial properties, and on the other by an operating South African Rail Commuters Corporation line (SARCC, now PRASA).

What made the design of the linear works so challenging, was that they had to be fitted in next to the SARCC line, all



1 Gautrain flyovers and viaducts in Pretoria

within the existing rail reserve. In order to thread the GRRRL through the existing urban infrastructure, 6,4 km of earth retaining walls, three viaducts, three rail-over-rail flyovers and eighteen bridge structures were required.

Donovan Hugo, Director and Project Manager at HHO Africa Consulting Engineers, says, "We used Civil Designer software for the rail and road alignments and to calculate the earthworks profiles. We also determined the details of the various types of earth retaining walls, as well as rail clearances. At most

2 Earthworks in progress at Soccer City in NASREC

3 Aerial view of the Koeberg Interchange



sections, there was only 200 mm clearance. The surveyor on site also used Civil Designer. This made the interchange of alignment and designer files so much easier."

The unique aspect of the project was just-in-time construction, which required that HHO had access to software that maximised the benefits of time, cost and user interface advantages.

Because of the shorter learning curve necessitated by the project, true integration capabilities were important for the designer to switch between different elements of the design within a common framework and user interface, and share data between different design modules without interruption.

But the added value of Civil Designer came down to the support provided and the peace of mind for the designer in knowing that there was someone to call with queries on specific project constraints when faced with delivery deadlines.

Knowledge Base, developers and suppliers of Civil Designer and AllyCAD software, have built their reputation on providing onsite support that enables clients to directly interface with developers and even customise the programme to meet their objectives.

Donovan Hugo, Director and Project Manager at HHO Africa Consulting Engineers, has first hand experience of this, having worked extensively on Civil Designer over the course of his career. Says Hugo, "Having this kind of support is absolutely amazing, it is unheard of in the industry."

Working closely with Knowledge Base to customise the alignment functions on Civil Designer, specifically for the Gautrain project, enabled Hugo to meet the challenges in working on the first rapid transit system in the country.

NASREC DEVELOPMENT

Key to any well-designed software program is its ability to allow the user to generate multiple 'what if' scenarios. This allows the engineer and client to evaluate different options and make well-informed recommendations and decisions. Adjustments become relatively simple without having to worry about the millions of calculations that are needed to adjust the basic design concept accurately for each scenario.

The more complex the project, the more important this functionality is. A case in point was the NASREC 2010 Infrastructure Development, a five-phased project commissioned by the Johannesburg Development Agency (JDA) and funded by the National Department of Transport and the City of Johannesburg.

Significant upgrades, estimated at R180 million, saw the provision of a public transport hub and the extension of the Golden Highway by 2 km. In addition, a pedestrian bridge between the transport hub and the main entrance to Soccer City facilitated the movement of visitors to the stadium during the World Cup matches.

Leon Mbongwa, technologist at Goba Consulting Engineers, says, "We used Civil Designer for the earthworks

modelling; the program also handled all the calculations and became a real time-saving asset when we had to update any changes.”

As the NASREC infrastructure was taking shape, PDNA (PD Naidoo & Associates) were working hard at creating the structure of the Soccer City Stadium from its calabash design concept.

SOCCER CITY

Hans Koorn, Director at PDNA (principal consulting structural engineers on the project) talks of the design challenges: “Take the 120 sloping façade columns as an example. Each column is 17 metres high and the top of the column is offset by 6,5 metres from its base. Because gravity always works downwards, and engineers always like things to go in the same direction as gravity, we had to make sure that those forces come down to the base.”

According to Hans, every single pile position was set out with coordinates, using AllyCAD software, a draughting package developed and supplied by Knowledge Base. PDNA also used Knowledge Base's Civil Designer software package for their civil engineering infrastructure work.

Mandy Koorn, who brought her skills and expertise to the draughting process for the Soccer City Stadium, says she must have produced 3 000 drawings and issued approximately 5 000 coordinates in AllyCAD. These included the exact position of every pile, as well as the setting out data of the geometry of the stadium.

The multi-disciplinary project deadlines and shortage of manpower in South Africa have necessitated the kind of integrated software that provides a multi-disciplinary software suite, enabling engineers to access a variety of compatible applications that operate on a single design platform.

KOEBERG INTERCHANGE

Cape Town's Koeberg Interchange is another good example of where infrastructure design software facilitated in speeding up the project. The scope of the project, divided into a two-part process, entailed the provision of additional traffic lanes along both N1 carriageways between Marine Drive and Sable Road Interchange, and the construction of two new third-level ramps – Ramp A, which carries traffic directly from the N1 to the M5, and Ramp B, taking traffic from the

M5 to the N1. It also included the widening of the M5 Viaduct with two single-span sections over the railway tracks and the realignment of the Salt River Canal, as well as provision for future BRT infrastructure development on the N1.

Earmarked by the Western Cape Provincial government, and designed by HHO Africa Infrastructure Engineers, the Koeberg Interchange forms part of the national transport planning grid which links provinces and municipalities together in key projects throughout the country.

Graeme Warrin, Director at HHO, says, “I used Civil Designer to come up with the vertical alignment and to produce a design that was geometrically sound. To do this I had to make sure that all the geometric parameters were satisfied. For an 80 km design speed I had to get all the constraints using maximum grades and the K values.”

Accuracy in terms of analysis and calculation, seamless integration between different design modules and all-round dependability are vital for the makings of a successful project.

QUALITY PUBLIC SPACES

According to Brendon Abrahams – founding member of BACE Consulting Engineers, whose company was responsible for the upgrade of quality public spaces in the build up to the World Cup – having the right software was the most vital aspect in project delivery.

The rationale behind the provincial and national strategy to create dignified public spaces, was to upgrade and construct promenades, walkways, squares, boulevards and viewing points across the country's cities – particularly at transport interchanges – in line with a focus on urban renewal to compensate for the historical legacy of apartheid planning and development.

For Brendon it was important to use software that would fulfil a number of criteria, such as ease of use, robustness, accuracy and flexibility.

“We used Civil Designer from Knowledge Base to design all final surface levels and to perform bulk earthworks calculations. With this software it was easy to generate contours and design new surface levels, making the calculations of quantities for tender purposes much faster than the conventional way. It was also used extensively in the construction period to confirm quantities.

CAPE TOWN STATION FORECOURT

The R418-million project, known as the Cape Town Station 2010 Project, is one component of a longer-term upgrade and expansion project to transform the station into a retail and entertainment centre.

Within the broader framework of the renewal of the Cape Town Central Business District, and the move towards establishing urban public spaces, the Cape Town Station precinct plays an important role in the economic life of the city.

First constructed in the early 1960s in parallel with other foreshore and CBD developments, the Cape Town Station had largely remained undeveloped. Its transformation was a key element in the creation of the Fan Park and Transport Hub for the World Cup.

Consulting engineers, Nelcor Civils, were responsible for the upgrade of the Station Forecourt, an area that comprises three open sections: 1) ‘Creative’ Cape Town space, 2) Station Square, and 3) Station Corner. Its upgrade was fast-tracked for 2010 to enable visitors to pass through on their way to the stadiums.

Using Civil Designer for this project, Administrative Manager at Nelcor Civils, Dale Meyer, says: “We were able to carry out calculations and basic design work for Arcus Gibb, who also utilise the software, thereby allowing for seamless interchange of information. The benefit of using Civil Designer is that it is very intuitive and flexible, allowing you to control any function you want.”

SERVICE DELIVERY IN 2011 AND BEYOND

The fast-tracking and delivery of 2010 World Cup projects showcased the skills and talents of South African engineers, architects and designers, as well as the host of other professionals responsible for making sure the infrastructure was in place to host a successful event, and beyond that to leave a vital legacy for future expansion and development.

Undoubtedly, the success of the projects rests on the skills of the people making sure that delivery happens.

However, technology, too, has become a vital tool in the way in which challenges are transformed into manageable solutions. With the advances of software, such as Civil Designer and AllyCAD, which increase productivity and simplify complex tasks, the country's infrastructure has been built and shaped in tangible and practical ways. □