

Concrete piping for massive infrastructure project



Trenching and stormwater pipe laying at Waterfall City, one of Gauteng's largest infrastructure projects to date

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WATERFALL CITY

Just under 5 000 m of precast concrete stormwater piping is what it will take to drain Waterfall City, currently under construction and earmarked to become Midrand's new central business district. The concrete pipes were specified by the Johannesburg Roads Agency (JRA) for what is seen as one of Gauteng's largest infrastructure projects to date. Driven by Atterbury Property Developers, the initial Waterfall City development will comprise 800 000 m² of space available for letting when completed in 2018.

Spanning 125 hectares, the site forms part of a 565 hectare estate (formerly owned by the Mia family) bordered by Allandale Road to the north, the N1 highway between Johannesburg and Pretoria to the east, Woodmead to the south, and a mushroom farm.

EXTENSIVE WORKS

Infrastructural planning and project management are being undertaken by C-Plan Consulting Engineers. Earthworks, road infrastructure and the installation of stormwater, fresh water, and sewerage piping fall to Labucon Resources, while the concrete stormwater pipes are being supplied by two Concrete Manufacturers Association (CMA) members, Rocla and Southern Pipeline Contractors.

Infrastructural work began in 2009 when aerial surveys established land gradients. Labucon Resources moved

on site in 2011 where they will remain until the completion of all infrastructure work in August 2013. This includes the

construction of some six kilometres of roads and the laying of 4 985 m of concrete stormwater piping.



A bird's eye view of the Waterfall City site taken during an aerial survey, with the N1 visible at left, Allandale Road in the foreground, and the Jukskei River at the top of the photograph (south side)



Sections of 650 mm concrete pipe being aligned with laser beams prior to joining and sealing. Note the recently completed hospital in the background



Two 1 650 mm stormwater concrete pipes prior to being connected by an *in situ* constructed drop box



Two 1 950 mm pipe sections prior to being connected by an *in situ* built manhole

The stormwater piping project, which commenced in November 2011, will be completed in November 2012. The pipes, in diameters from 450 mm to 1 950 mm, will drain the site and discharge into three water channels, which will ultimately feed into the Jukskei River to the south.

Trench depths vary between 1.5 m and 5.5 m, and with natural gradients of 1 in 20 in some places, 17 drop boxes are being built at T-junctions and at bends to reduce water velocities. In addition, manholes are being constructed in all other areas where there is a change of direction.

According to KC Ooijkaas of C-Plan Consulting Engineers, all the roads are being built to JRA standards for which concrete stormwater piping is mandatory. "Precast concrete is the best material for stormwater drainage, which is why it forms part of the JRA road-building specifications," says Ooijkaas.

Besides fairly steep gradients, other engineering challenges include outcrops of rock and a high water table. Stone bedding comprising 19 mm imported ag-

gregate is providing additional founding stability for the pipes. Blasting is used to break up the rock which is then crushed and used as dump material for a road building project on an adjacent site.

Sias Swart, Labucon contracts manager, says the stone bedding prevents any soil movement from exerting excessive stress on the pipe joints. "We are also using a laser-beam system to ensure that the pipes are properly aligned."

The pipes are connected with ogee joints. These are rendered waterproof through the application of a water-based damp seal, also on 20 mm of piping surface on either side of the joints. They are then covered with A4 bitem sheeting and a second coating of damp seal.

Bitem sheeting is also being installed on the land embankments which rise above the pipes so that excess ground water is prevented from penetrating beneath the road surface material, in this instance bitumen. Instead, water will be trapped by the bitem and channelled into perforated 160 mm PVC pipes which run parallel to the stormwater pipes before



discharging into the manholes. To prevent them from being clogged with soil, the PVC pipes are covered with 19 mm stone and wrapped in bidem.

WING WALLS

Wing walls are being installed where the pipes discharge into the water channels to prevent soil erosion. However, the Waterfall City project is setting a precedent in that two of its wing wall outlets are not being constructed on site. Rather,

they have been factory-built in precast concrete by Rocla.

Recently introduced to the local market by Rocla, and approved by the JRA, precast wing walls offer several advantages, such as far quicker installation, a lower material requirement, no formwork and no waste. They are installed by crane, and depending on ground conditions, take between 15 minutes and an hour to install. By contrast *in situ* wing walls take a minimum of two days to con-

struct and seven days to cure and can also be adversely affected by rain during and shortly after construction.

Craig Waterson, sales and marketing director of Rocla, says that in stormwater applications, wing walls direct the water into a flow path that will result in the least amount of turbulence, thereby optimising the hydraulic capacity of the conduit.

“Precast wing walls come with a separate precast concrete toe which keys the entire unit to the ground and prevents any movement. The toe also reduces the risk of scouring of the soil below or to the side of the toe,” says Waterson.

CONCLUSION

CMA president, Taco Voogt, comments that, besides its durability and long life span, concrete piping is far less dependent on embedment material than a flexible pipe. Because concrete piping is rigid, contractors do not incur the same sort of difficulties with it as they do with the proper installation of flexible pipe products. These difficulties become even more pronounced when working in trenches.

“There is a great deal of knowledge available on concrete and its related performance, which guarantees workability and durability, and hence ensures value for money,” concludes Voogt. □



A section of 650 mm concrete piping is covered with soil after laying and joining. A layer of bidem sheeting which is installed to prevent excess water from penetrating beneath the road surface can be clearly seen



A five-ton precast concrete wing wall and concrete toe prior to installation at Waterfall City

Source:

http://www.saice.org.za/downloads/monthly_publications/2012/2012-Civil-Engineering-July/#/