The Port of Ngqura –
new administration building

BACKGROUND
The Transnet National Ports Authority (TNPA) required a new administration building at the Port of Ngqura to house existing staff and to allow for growth and expansion over the next 50 years. Staff currently occupy the temporary offices which were used by the project team during the construction of the Port of Ngqura, but space is extremely limited. The Eastern Cape Infrastructure Joint Venture (ECIJV) and WBHO were commissioned respectively as consultants and contractors to plan and construct the new building.

OBJECTIVES
The aim was to provide the TNPA with an iconic building, which would have clear, uninterrupted panoramic views over the existing port and over proposed future port expansions. The building structure had to be representative of the TNPA's corporate identity, as well as of the business conducted at the port. The building concept was inspired by the natural landscape and the flowing site contours, which echoed the idea of a ship sailing through the waves. This idea is strongly represented in the curvilinear shape and glazed façades of the proposed building.

The building concept was inspired by the natural landscape and the flowing site contours, which echoed the idea of a ship sailing through the waves.
The building also had to conform to the Green Building Guidelines, the aim being a 4 Star rating on the basis of the site, location, environmental characteristics, orientation and the relatively isolated nature of the project.

Procurement had to be in line with Transnet’s Supplier Development policy, which is aimed at addressing:

- Job creation and retention
- Skills development and transfer
- Rural development and regional integration
- Localisation and industrialisation
- Local procurement and small business development
- Transformation and empowerment
- 40% Local suppliers and contractors.

PROJECT DESCRIPTION

The new building, which is currently under construction, will be a five-storey building, including a basement which will be partially underground and will have parking bays and some storage and plant rooms. The building is divided into an east and west wing, separated by a foyer/atrium which extends the full height of the building and is serviced by two circular scenic lifts. An impressive porte cochère at the entrance welcomes staff and visitors. The east and west wings comprise offices for the 14 departments, and other facilities such as a gymnasium, canteen, boardrooms, training rooms, a port operations centre and staff rest areas.

Outside, on the port side of the atrium, there is a heritage site incorporating a lime kiln which dates back some 65 years. The contract allows for the lime kiln to be protected against damage during construction.

The total office area of the building is just under 10 000 m², with a high standard of internal finishes and fixtures. The building will also be characterised by large window areas to take advantage of the panoramic views and to allow ample natural light, thereby reducing the need for electrical lighting.

The bulk services comprise bulk earthworks, potable water supply (including fire), wastewater (sewer), data and communications ducting, stormwater management and access roads.

Bulk earthworks

Bulk earthworks was required to form the basement building platform and parking areas. The total volume of bulk earthworks excavated for the building amounted to 16 121 m³, which was carried out in a separate package together with the piling works.

Potable water supply and wastewater

A 90 mm diameter domestic supply for the new building will be connected to the existing 110 mm main supply. A separate 250 mm diameter main will be provided for the fire supply from an existing 315 mm diameter water main. A 75 mm water supply to two fire hydrants located in the parking area has also been allowed for. Calculations indicate that the capacities and pressures available in the existing mains are sufficient for both domestic water and water for firefighting purposes. The sewer drainage from the new building will be connected to the existing 200 mm diameter gravity main via an existing manhole.
**Stormwater**

Stormwater from the building will be connected to the existing stormwater piped network within the port close to the building site. Approximately one half of the basement stormwater will be managed separately from the main system. The outfall will be discharged via a new headwall positioned directly east of the building. A series of existing inlet structures and manholes are situated south of the building, i.e. facing the port, along the existing road. In order to tie into these structures, new connecting manholes will be constructed into which the runoff from the new building will discharge.

The rainwater harvesting and greywater collection systems that were considered, evolved during the course of the project. The greywater system was eventually omitted due to the complexity of its long-term management, the maintenance costs involved, and the fact that plumbing materials would have had to be doubled. An on-site rainwater harvesting system was originally envisaged, but the port has a central rainwater repository, and the project is taking advantage of this off-site facility. This provides the project with substantial additional storage facilities, as well as a greater scale of efficiency.

**Roads**

Access to the building is from the N2 interchange, via Neptune Road, through the port entrance and via the entrance slipway onto Klub Road. A traffic circle will be provided at the intersection with Klub Road to allow safe traffic integration during peak hours.

Access is also provided for delivery vehicles up to the size of a 22 m SU+T (single unit plus trailer). Delivery vehicles will use the existing access road through the same entrance as passenger vehicles, and will follow a route along the northwest of the building and parking area. Traffic will be one way through the basement, hence no turning, and will then exit from the basement at the west end of the building towards the parking areas, prior to re-joining the access road.

**Solid waste disposal**

Solid waste, generated during the normal operation of the building, will be disposed of in suitable containers, located in the basement and removed to a registered landfill site. Materials suited to recycling will be placed in specially marked containers and removed to suitable recycling facilities. Waste disposal will be outsourced.

**STRUCTURAL ENGINEERING**

The proposed building has a curvilinear layout approximately 125 m long and 20 m wide. The long axis of the building is orientated in a northeast to southwest direction. All slabs are constructed as flat slabs with edge beams. The edge beams reduce the deflection on the slab edges. The slabs will step back to form open roof gardens on the first, second, third and fourth floors.

The column grids were chosen to fit the parking layout in the basement, as well as the office layout above. The columns are set back from the edge of the building, to create a cantilever slab.
about 1.275 m all around. More cantilever edges are created where the slab steps back for the open roof gardens. The length of the cantilever edge is limited to 3.0 m in order to safely make use of a 300 mm thick reinforced concrete slab. The columns added in off-grid positions, in order to carry these cantilever slabs, are transferred out as soon as possible, to allow for a better office space layout below. The entire building is clad in glass. On the southeastern face of the foyer area, a glass wall continues up from the basement mezzanine level to the atrium roof level. This façade is approximately 27.5 m high. The support of the glass wall will be in the form of steel trusses, running horizontally at every floor level and vertically at equal spacing.

**Geotechnical considerations**

Due to the calcrete or coquinite layers, shallow foundations were not possible as these would lead to large differential settlement, or bearing capacity failure in certain areas. The building had to be founded on a series of piles with all the foundation loads being transferred to the bedrock, underlying the Alexandria Formation. The piles needed to be able to penetrate the calcrete and coquinite layers, and this was achieved by means of large-diameter auger piles.

With the building perched on the edge of a 40 m high ledge, investigations were done with possible slip circles in mind.

**Concrete**

Due to the building being located within 15 km of the ocean and constantly being exposed to salt-laden air, its external environment was classified as ‘severe’ in accordance with SABS 0100:2 (1994). The area also experiences high wind speeds. This constant exposure to chlorides from the seawater would result in chloride-induced corrosion on the reinforcement through the pore structure of the concrete, causing expansion of the rebar and cracking of the concrete over time, leading to structural deterioration or even failure. To mitigate this phenomenon SABS 0100:2 (1994) Table 8 prescribes certain minimum requirements for structures constructed in such conditions.

The minimum concrete strength for all concrete exposed to the environ-

**Lateral stability**

The structural system is that of a concrete frame. Shear walls were introduced to carry the lateral forces induced by wind and notional loads over the expected lifespan of the building. The columns also contribute to the stiffness of the building, although this contribution was not taken into account during the design of the shear walls. The shear walls are spread over the length of the building to ensure stiffness throughout the building, minimising substantial differential movements in the building. This is especially important for the glass façades, which could otherwise crack.
Only cast-in openings will be permitted in the shear walls, which are accounted for in the design. No coring will be permitted in the shear walls.

**Structural steel**

Structural steel will be utilised for the construction of the atrium roof, as well as the support structure for the curtain wall on the southeastern side of the foyer. The structural steel for the atrium roof will be galvanised and painted to protect it against corrosion. The curtain wall support structure will be constructed from stainless steel.

**ELECTRICAL DESIGN**

The electrical installation has been designed in accordance with the latest Green Building standards (Technical Manual Green Star SA – Office v1) (http://www.gbcsa.org.za/greenstar/ratingtools.php) in order to achieve an energy-efficient building. The anticipated relative electrical loading for the entire building, including outdoor power and lighting, will be approximately 55 VA/m² and 45 W/m², which are on par with Green Star best practice.

The lighting installation has been based on the latest energy-efficient equipment, which will achieve a relative loading in W/m² which is below that of an “Industry Leader” category. Most of the lighting, with the exception of a few service rooms, will be controlled automatically by means of occupancy and light sensors, in conjunction with the energy management system. This will ensure minimum energy usage, by switching off lights in unoccupied areas, and the harvesting of natural daylight.

**ELECTRONIC ENGINEERING DESIGN REPORT**

Electronic systems comprising security, surveillance, access control, IT and audio-visual, fire detection and the building management system are to be implemented at the new building.

Transnet currently has contracts with Neotel and G4S for the supply of the above services, and these service providers will be used on the building project as direct contractors of the TNPA. The utilisation of Neotel and G4S on this contract will require careful planning, monitoring and interface management to ensure that the project is successfully executed within the main contractor’s timelines.

**MECHANICAL ENGINEERING**

The basis of the design for the HVAC system is informed by Solid Green Consulting’s Energy Modelling Report. A variable refrigerant volume (VRC) air conditioning system was selected on the basis of its energy efficiency and flexibility in terms of localised independent control, whilst allowing selection of efficient refrigerant compression units.

Passive architectural shading elements are incorporated in the building design to optimise the building’s energy efficiency. This is further complemented by the glass selection for the façade that optimises daylight harvesting whilst limiting heat transmission into the building.

Two scenic lifts have been selected for the foyer of the building, and these offer
majestic views of the port container terminal and surrounding landscape.

FAÇADE ENGINEERING
The entire building between the external edge beams is clad in glass. On the southeastern face of the foyer area, a glass wall continues up from the basement mezzanine level to the atrium roof soffit. This façade is approximately 27.5 m high. The support of this glass is in the shape of tension rods running horizontally at every floor level and vertically at 1.2 m spacing.

The conceptual design of façade elements will be sufficiently detailed to assist prospective sub-contractors to tender for the works. The sub-contractor will be responsible for the complete detail design, general performance requirements, testing, supply, safe installation and warranties. The cleaning of the exterior vertical glazing will be done using the rail and hook system.

GREEN BUILDING
As mentioned earlier, the project is targeting a 4 Star Design rating on the basis of the site, location, environmental characteristics, orientation and the relatively isolated nature of the project. In addition, special consideration is being given to the industrial zone in which the development operates, as this provides a somewhat different set of circumstances to the typical Green Star building within an urban boundary.

The project furthermore required detailed ecological input to motivate the validity of the project to the Green Building Council of South Africa prior to registration. The project is still on track to achieve a 4 Star Design rating, despite some changes to the credits that are being targeted, due to building changes. The original Green Star intent and objectives, however, still remain intact. Each credit within the Green Star office tool categories was considered, and a targeted strategy was developed that aims to provide the most beneficial green outcomes, taking budget constraints, constructability, durability and long-term sustainability into account.

This flagship building is the first truly Green Star building for the TNPA with an anticipated 4 Star rating, and as such sets the benchmark for future developments.

HERITAGE STRUCTURES
Lime kiln
A historical lime kiln, which was declared a heritage site by the South African Heritage Resource Agency, and which dates back some 65 years, is being protected during construction, and will be restored to its original state and incorporated as a focal point in the landscaping of the building. (The geology of the Coega Industrial Development Zone is characterised by coastal limestone, overlaid by calcareous sands blown onshore.)

Wreckage of the County of Pembroke
Another important heritage structure which was recovered at the port is the remains of the County of Pembroke, a British cargo ship which was shipwrecked in Algoa Bay in 1903. She was towed to the mouth of the Coega River and sunk in 1904. The wreckage was finally found and fully identified in 2004 when divers, who had been exploring the Port of Ngqura, brought a part of her bow, with a faint outline of her name, to the surface. The wreckage was completely recovered according to instructions from the South African Heritage Resource Agency.

CHALLENGES
The biggest problem encountered on this project has been staying within budget.

The contract stipulates that the main contractor would obtain competitive market prices for the allowance packages, but the market responses have been much higher than the budgeted estimates, resulting in some strain on the project budget. The project team has therefore embarked on a rigorous value engineering and cost-cutting exercise for each of the packages to bring them back to within the budgeted amounts.

Another challenge is ensuring that the Neotel and G4S (Transnet-appointed service providers) costs remain within the allocated budget. The Transnet project team would also have to work closely with these service providers to ensure that they keep to project timelines, as delays could have dire consequences for the project completion, and could also result in claims from the main contractor.

PROJECT STATUS
The project is currently about 40% complete.

The concrete floor slabs from basement to fifth floor have been completed.

The casting of surface beds in the basement is in progress.

Construction of the concrete stair cases is in progress.

CONCLUSION
The construction of the TNPA’s flagship new administration building at the Port of Ngqura is progressing steadily, and is expected to be completed by December 2016.

It is anticipated that 725 tons of reinforcing and 7 073 m³ of concrete will go into the construction of the structure, together with approximately 560 000 bricks and 3 200 m² of glass façade.

Due to the stringent supplier and development measures applied to the contract, the region is expected to benefit greatly in terms of jobs created, skills transferred, and the upliftment of emerging contractors, as well as the support of local suppliers.

With the Port of Ngqura being well positioned as a transshipment hub, it is fitting that the shape of the building is that of a shipping vessel. Given the potential of Ngqura as a deep-water port, the new administration building will be able to support its long-term development for many years to come.

Historical lime kiln on the site of the new administration building

KEY PLAYERS

Main Contractor: WBHO Construction (Pty) Ltd
Consultants: ECIJV (Mott McDonald/PD Naidoo, LDM Quantity Surveyors, SFC Engineers (Pty) Ltd) Dominic Bonnesse Architects SV Architects (Interior Design) Project Management: Transnet Capital Projects (TCP) Project Sponsor: Transnet National Ports Authority – Port of Ngqura