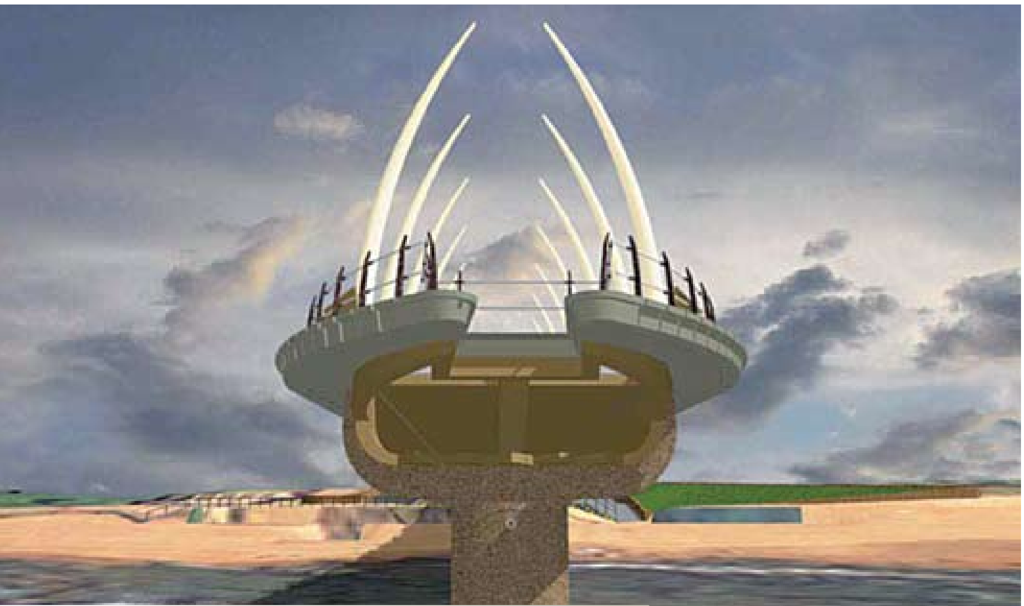
Umhlanga stormwater

The new Umhlanga stormwater outfall pier is a continuation of a box culvert which is also under construction at present. The pier will extend approximately 85 m across the beach to a deep-water channel to ensure maximum dispersal of stormwater into the sea. It will be unlike any constructed in the region previously with long-span sections on columns to permit continuous access along the beach. The architectural styling has been a very important element of the design and is in keeping with the proposed improvements to the promenade



UMHLANGA STORMWATER PIER

Durban Branch Award for Technical Excellence

KEY PLAYERS

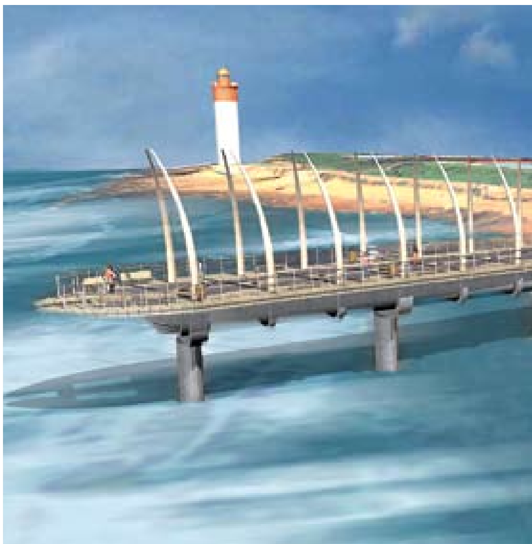
Client eThekwini Municipality
Concept, project management and stormwater design Coastal, Stormwater and Catchment Management Department
Structural design Structures Branch, Roads Provision Department
Architect André Duvenage
Electrical/lighting design Rob Anderson
Contractor ICON/ESOR JV

THE MAIN STORMWATER system that collects runoff from the greater part of Umhlanga Rocks was found to have inadequate future capacity and a series of contracts to increase the size of the lower reaches of the system was commissioned. The final stage of these consisted of two contracts; one for the construction of a large underground box culvert from the intersection of Tanager Road and Lagoon Drive to the promenade at the lower end of McCausland Crescent and a second for the construction of an outfall pier to carry the stormwater discharge across the beach as far into the surf zone as possible.

The underground box culvert terminates at the Umhlanga Promenade where it daylights just above the beach. The culvert then continues over the beach as the backbone of the pier. The pier extends approximately 85 m to a deepwater channel to ensure maximum dispersal of stormwater into the sea.

The nearby existing main stormwater outlet that presently discharges onto Umhlanga beach at Granny's Pool will be rerouted to the new system. While the Granny's Pool outlet can never be completely eliminated because of low level connections from existing buildings, the quality of the beach in this area should be greatly improved. This will contribute to maintaining Umhlanga's blue flag status by reducing one of the unsightly pools of stagnant water that sometimes form on an otherwise pristine beach.

The pier is unlike any previously constructed in the region with 12 m long spans to permit continuous public access along the beach beneath the structure. The deck spans are supported on large single elliptical section columns



outfall pier

founded in turn on rectangular bases excavated and anchored into competent rock. At the point of transition from underground culvert to pier, the cross-section changes from conventional box to a shallower boat hull shape to disguise the true function of the pier and provide a visually more streamlined, less obtrusive appearance at the edge of the structure.

FALSEWORK

Esor has constructed two piers off the Durban beachfront in the past. These have both been founded in beach sand, and so the challenges of constructing a pier founded on rock were new to us. The previous piers have consisted largely of pre-cast elements held together with relatively small amounts of in-situ concrete. The Umhlanga Pier does not have a single pre-cast element.

The architecturally pleasing design of the concrete spans is a nightmare for formwork designers and manufacturers. Because of the intricacies of the formwork, it was designed in house and manufactured by structural steel company Avellini Brothers.

A further challenge was to support the concrete structure during erection of the formwork and pouring of the concrete. Viewing the site on a calm day and at low tide, the temptation was to support the spans off the beach and underlying rock, using conventional staging. However, it was elected to eliminate the risk of tidal action by adopting a box girder system supported off cantilever brackets tied to the columns. This again proved to be the correct alternative during the extraordinarily high seas of the first weekend of April, when the support work was battered by giant waves.

The box girders are relatively easy to slide forward for subsequent pours, and the outer side shutters are gangformed as much as possible for speed of stripping and re-erecting. The internal deck shutter is also constructed on a traveller for speed of moving forward.

The column shutter was manufactured of heavy steel sections to eliminate through-ties and hence enhance the aesthetic appeal of the design.

DECK AND SUPERSTRUCTURE

The superstructure is a reinforced concrete 'double-box' section with six spans of 12 m and a 7,5 m cantilevered viewing platform at the end. In cross-section the deck slab tapers out from 7,9 m wide at the abutment to 9,6 m at the seaward end.

The functional portion of the superstructure comprises twin 2,8 m x 1,6 m voids that carry the stormwater from the culvert to the outlet into the sea just beyond the last column and it is this 'double-box' section that forms the main structural component. The design and staged construction of the superstructure is based very much on the design methodology of a bridge deck with the obvious exclusion being internal cross-beams at the supports. These were simulated by a thickened rib cradling the structure over the supports.

During times of low flow, the water is channelled into one box and drained down the centre of the last column rather than left to trickle out of the end of the outlet.

DESIGN CONCEPT

The functional double-box superstructure was the starting point and inspiration for the development of the pier's three-dimensional design theme with strong maritime overtones.

Elliptical lighting masts make subtle reference to the skeleton of a large sea mammal. These are being fabricated from durable glass reinforced polyester with a weathered copper finish.

The functional stormwater void (the belly of the pier) has a shark-like mouth where the water discharges into the sea. The deck cantilevers some 6 m beyond the mouth. Visitors will be able to see and hear the water whilst standing on a large grating made from a 'pultruded' (extruded glass reinforced polyester) material.

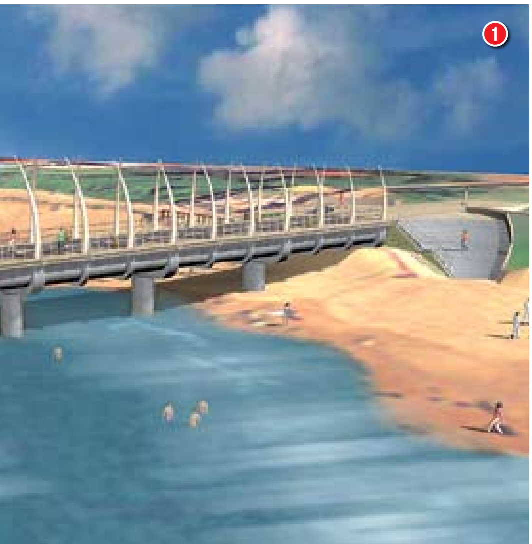
LIGHTING

An LED-based lighting solution was selected. Although LED (light emitting diode) lighting solutions have been available for many years, it is only during the last three years that this technology has achieved outputs high enough to be used for pedestrian, decorative and even more recently, automotive lighting.

IN CLOSING

The project has been a particularly pleasurable one for all concerned – not just because of technical interest, but also because of the excellent team spirit that has prevailed at every stage of the job. □

1 Artist's impression of the finished pier
2 View of the pier under construction showing the falsework, concrete reinforcement and box girder system



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