

## BACKGROUND

The project comprised the maintenance, improvement and upgrading of roads, bridges and culverts for the Northern Emirates section on E11 road.

This road serves as the main South–North Inter Emirate Link and as such carries considerable volume of traffic comprising a mix of cars, pickups and heavy vehicles. Upgrading of the existing road included carriageway widening and construction of new bridges above frequently flooded areas.

Completed in 2000, the reinforced concrete arch bridge was considerably cheaper than a comparable RC girder bridge structure would have been. Additional benefit of excluding bridge bearings and expansion joints necessary for traditional bridge construction and consequent reduction of a bridge life cycle cost brought this value engineering proposal into prime position choice.

Aside of the cost and time execution benefits, the proven long life reputation of arch structures throughout the history of civil engineering had been one more significant factor in choosing the TechSpan® system.

## CHALLENGE

The project area is subjected to tidal changes in sea water level, which in certain periods of year becomes a dry land. As a temperature level is decisive for the rate of transporting aggressive substance into and within concrete, high temperatures characteristic for the area in combination with harsh marine environment were the main challenge for construction of Ras Al Khaimah arch bridges.

## SOLUTION

In order to mitigate potential hazards for structure long life, problem had been assessed from several aspects:

- a) Concrete mix design used for precast of TechSpan® arch segment has been designed specifically for marine application. Mixture has provided better impermeability of concrete and consequently resulted in reduction of chemicals ingress, that adversely affect steel reinforcement.
- b) Clear concrete cover had been increased to 75mm, from typically used 50mm, in order to potentially prolong time period required for chemicals to get in contact with steel reinforcement.
- c) Arch shape was optimized in such a way that in completed structure, tensile stresses are minimized or eliminated, leading to non-cracked and durable concrete section.
- d) Production quality control had been intensified, in order to ensure the correct concrete quality and thickness of concrete cover.

## Maintenance, Improvement and Upgrading of Roads, Bridges and Culverts Phase 1 - Group 5

Ras Al Khaimah, UAE

TechSpan® Arches

**Client:** Ministry of Public Works and Housing – U.A.E.

**Consultant:** Hyder Consulting Middle East Ltd.

**Contractor:** Al Owaidah General Contracting Co.

**Construction:** 2000



## Project Specifications

<b>System</b>	TechSpan®
<b>Arch type</b>	Funicular Shape 3 pin arch
<b>Span</b>	13m
<b>Height</b>	5.5m
<b>Thickness</b>	350mm
<b>Length</b>	330m (2x11x15m)
<b>System</b>	Freyssisil
<b>Structure</b>	Head/Wing wall
<b>Area</b>	2478 m <sup>2</sup>
<b>Design life</b>	120 years