Award

Architect: Yee Associates
Structural Engineer: Mott MacDonald
Steelwork Contractor: Kvaerner Cleveland Bridge Ltd
Main Contractor: Anglo Japanese Construction JV
Owner: The Hong Kong Special Administrative Region, Highways Department

Tsing Ma Bridge, Hong Kong

Hong Kong's Tsing Ma suspension bridge, which carries a new six-lane highway and twin-track high-speed railway across the mile-wide Ma Wan Channel between Tsing Yi and Ma Wan Islands, is the first long-span bridge to provide a truly all-weather crossing - even in typhoons!

Its 1,377m main span, linking Hong Kong and the new Lantau Island airport, is the longest in the world carrying both road and rail, and features the first deck to combine streamlining (to minimise drag) and venting (to enhance stability).

Disruption to sea traffic and the extreme depths across the Ma Wan Channel, which links Hong Kong Harbour to the Pearl River and southern China, precluded a tunnel and meant a long-span suspension bridge was the best solution for the new transport link. The Ma Wan side span of 377m is suspended from the cable. From there, the road and railway pass over a viaduct on Ma Wan towards Lantau Island.

At Tsing Yi, because the highway diverges and to achieve adequate stiffness for the railway, the side span is carried on piers at 70m centres into the hillside. The upper deck carries dual three-lane carriageways and the lower deck has 6m wide emergency roadways either side of the central rail envelope with its twin tracks.

Stringent operational and performance requirements demanded highly innovative design solutions - in particular the streamlined vented two-level deck able to remain serviceable in typhoon winds and the lightweight steel grillage track form on resilient bearings to minimise vibration from the 135km per hour railway.

Additionally, careful aesthetic treatment - integral to the scheme's design - contributed to an elegance accentuated by the steel deck aerofoil and softened by the towers' sensitive proportions and shape.

The deck structure, at 29 tonnes per metre, is three times the weight of the Humber Bridge. Each saddle on top of the 206m high towers weighs 550 tonnes and each 1100mm diameter cable comprises 33,000 wires of 5.3mm diameter.

The 3000 tonnes saddles, with indivisible components of up to 175 tonnes, had to be transported to site by special vessels and then raised up to 200m from the ground into place. To minimise suspended deck erection time, it was assembled at a site in China into 36m long, 1000 tonne units, shipped to the site by barge and lifted into place by pairs of travelling gantries of 600 tonne capacity.

Overall, the structure utilised British steel in many ways:

- 28,000 tonnes of high-strength wire in the cables
- 6,000 tonnes of steel castings, heavy plate work, alloy steel components and rope in the saddles, cable bands, anchor steelwork and hangers
- 50,000 tonnes of complex plate fabrication in the deck (50% UK, 50% Japan)
- over 500,000 square metres of stainless steel formed cladding in deck fairings and saddle covers

The whole project was completed on budget within the 50 month contract period and, with British engineers responsible for all the design, construction supervision and construction engineering, reinforces Britain's status in the international bridge building and engineering industry.