



Bridges



Reference Details:

Owner Hong Kong Highways Department
+++ Main Contractor JV of Kumagai-Maeda-Yokogawa Hitachi +++
Design Greiner International Ltd. in association with Leonhardt Andrae and Partners; Consultant: Mott Mac Donald

DSI Services Supply and installation of DYWIDAG stay cables with bond socket 61 to 108-0.62", a total of 176 stays.

Bond socket - here to stay!

Hong Kong: The Kap Shui Mun Bridge

Hong Kong sets the pace in Asia and so does DSI. Before the eve of Hong Kong's transition to mainland China, Hong Kong has undertaken the largest construction project in Asia. Assisting Hong Kong in its ambitious endeavour of relocating its airport, DSI has set the pace in bridge technology that reaches into the 21st century.

International Cooperation - Technical Know-how

The Kap Shui Mun Bridge combines international expertise from across the world: Main Contractor is Joint Venture of Kumagai-Maeda-Yokogawa Hitachi, the design by Greiner International Ltd. in association with Leonhardt Andrae and Partners, consultant Mott Mac Donald and for the stay cables DSI with more than 25 years experience in stay cable technology.

High Performance Stay Cables

Hong Kong Highways Department chose DSI for its experience in bridge technology and for the DYWIDAG stay cable system. The critical factors for the design and the performance of the bridge are:

- Heavy loading scheme due to multilane and multideck traffic consisting of airport cargo and passengers
- Higher design loading criteria due to the combination of highway and railway traffic
- Stringent deflection criteria due to railway operations
- Severe wind conditions due to 'open sea' conditions
- Possible typhoon winds, the bridge must withstand wind speeds up to 300 km/h
- Harsh marine environment such as salt water exposure

DYWIDAG Stay Cable Bond Socket System

The DSI philosophy in reliability and safety persevered beyond its competitors. The stay cable anchorage system consists of a threaded socket head and ring nut for adjustability. The strands are desheathed and degreased within the bond socket zone thus guaranteeing a bond transfer between the strands, the filling and the socket. The bond ensures a multi-redundant loadtransfer at the anchorage and reduces the dynamic stresses in the strands at the wedge gripping zone by 50 %. The corrosion protection of the strands consists of hot dipped galvanizing with 280g/m² corrosion inhibiting grease, and a 1 mm thick individual PE sheathing. The

DSI - Design and Engineering

DSI not only relies on well proven methodologies, but also steps ahead in development. Some of these innovative developments are:

- Halfshells for the outer HDPE sheathing
- High fatigue filling component for the socket, epoxy and quartzsand
- Development of injection method for the bond socket filling
- Monostrand tensioning for the holddowns and as an option

total strands will be encased in a HDPE pipe which is erected as halfshells and butt-welded after complete installation of the strand cable.

General

The Kap Shui Mun Bridge, 750 m in total length, is a double deck cable stayed bridge with a span configuration of 80 m - 430 m - 80 m - 80 m. The concrete box girders on the side spans have been constructed using the incremental launching technique. The main span is currently constructed with the cable segmental cantilever erection. The erection of the segments is performed simultaneously from both sides of the Kap Shui Mun Channel. The bridge carries dual lane carriageways on the upper deck and on the lower deck a twin track railway. The lower deck also consists of two single carriageways for emergency vehicles and limited vehicular access to the airport during typhoon conditions. The bridge deck is a 7.5 m deep trapezoidal box girder, with a width of 35.2 m at the top and 29.0 m at the bottom. DSI Hong Kong was awarded the contract for the supply and installation of the stay cables. Later the contract was amended to include the supply and installation of the hold down cables.

Records for DSI

DSI hit the records with Kap Shui Mun:

- With 430 m main span Kap Shui Mun is a record bridge for highway and railway traffic
- Supply and installation of the stay cables, total project value 10.2 million EUR.
- Largest stay cable 108x0.62" with 102 strands.

The stay cables are in a semifan arrangement and consist of 88 stays per pylon, totaling 176 stays with approx. 2,400 tonnes of strands. The sizes of the stay cables range from 61x0.62", 75x0.62", 91x0.62" to 108x0.62" with a maximum of 102 strands. The largest stay cable has an ultimate capacity of more than 26,000 kN which equals the weight of more than 1,700 mid-sized cars.

for the stay cables.

DSI - Installation - The site

Successful coordination of the works on the site is an accomplishment by itself. The population of the worksite included many nationalities such as Chinese, Thai, Canadian and European. Despite the language barriers the team functioned quite smoothly. Moreover, environmental conditions could be at times extreme, such as threats of typhoons, heavy rainfalls, extreme heat and humidity. However, none of these particular challenges, language or environment, hindered progress of this tightly planned project. With a work crew per pylon of 1 foreman and 30 workers the necessary tasks were accomplished within a set erection cycle of 14 days. The necessary tasks can be briefly summarized as:

- Cutting of the strands to individual length
- Preassembly of anchorage and installation at deck and tower
- The PE strands are desheathed and cleaned at the anchorage area
- One by one installation of the strands
- Seating and postblocking of the strands at pylon and deck anchorage
- Installation of collars as a centering for the outer HDPE sheathing
- After closure of midspan and final force adjustment, injection of the stay cable.

The installation methods proved the "learning by doing" theory. Numerous adjustments and improvements were made and thus contributed to the successful and timely performance of DSI. More tasks were come, such as the installation of the sheathing and the injection. With further communication, feedback and constant exchange of ideas between DSI site, DSI Far East and Munich, these challenges were also be met successfully and contributed to a fruitful construction process.

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