Project Reference Catalogue
Bridge Services

Suspension, Cables Stayed and Extradosed Bridges
Client
Mega Yapi Construction and Trading Company, Turkey.

Project
The Manavgat Antalya Cable Stayed Road Bridge, Turkey.

Services
- Preliminary design
- Detailed design

Services period
2007 - ongoing

Background
Services are being provided for the preliminary design and detail design for the Ministry of Public Works and Settlement, General Directorate of Highways, Manavgat Antalya Cable Stayed Bridge.

The steel cable stayed bridge will be 202 m long and 13.7 m in width, with equal spans of 101 m; and designed for two lanes of road traffic.

The bridge is supported by 7 sets of cable stays either side of the inverted Y shaped steel pylon; which is 40 m in height above the steel deck.

The central steel pylon is supported on a concrete pier, a pile cap which measures 25 m x 16 m x 3 m deep and on 24 driven piles.

The detailed design services includes the structural analysis of the bridge; dynamic analysis in accordance with the seismic requirements and detailed design of the piled foundation, pier, pylon, superstructure and abutments.
Taipei Ring Road Project No. 3, Taiwan

Cable Stayed Bridge

Client
The Ministry of Interior, Construction and Planning Agency, Taiwan; and Chun - Yuan Construction.

Project
Taipei Ring Road Project No. 3, Cable Stayed Bridge, Taiwan.

Services
- Construction stage calculations
- Contractors consultant
- Camber control calculations
- Project planning
- Supervision
- Cable vibration testing

Services period
2006 - ongoing

Background
The cable stayed bridge project is a part of the new Taipei Ring Road that is to span a canal feeding into the Tamsui River.

The new cable stayed bridge with its diamond shaped pylon and four cable stay configuration will become a new landmark for the Taipei City area.

The symmetric cable stayed bridge has a total length of 400 m; each span being 200 m. The 135 m high concrete diamond shaped pylon will support the 43 m wide fully welded orthotropic steel box girder deck.

The construction engineering support services will include:
- develop the construction method
- check stresses for each stage
- prepare pylon camber at each lift
- determine bearings presets
- geometry control procedures
- fabrication and erection planning

Shoring Platform fabrication designs and drawings will be provided.

Services for the temporary supports to the pylon and pier table segments include the designs for the:
- fabrication shop drawings
- pylon temporary struts
- tower crane & pylon connections

Services for the engineering of cable forces provide the:
- stressing procedure & instructions
- stressing forces & extensions
- cable lengths & sag calculations
- camber control instructions

The responsibilities also include for cable vibration testing to assess the stability of the bridge.
Keshu Suspension Bridge, 
Miaoli, Taiwan

The Keshu Bridge is Taiwan’s first suspension bridge for road traffic and crosses the Houlong River main channel.

The project has an overall length of 808 m. Commencing with two prestressed concrete spans of 58 and 78 m in the south; then two suspension bridge spans of 96 m and 215 m; with pylon spans of 20, 20 and 85 m; and five prestressed concrete spans of 69, 57, 50, 30 and 30 m in the north. A tubular section was designed for the main suspension span to save weight.

Problems during the design were to:
- arrive at a technical solution for this unconventional suspension bridge design
- ensure the bridge can withstand large earthquake forces
- ensure the bridge is stable during typhoon conditions

These problems were overcome by undertaking an extensive nonlinear dynamic calculation program as well as conducting the scale model wind tunnel tests.

The suspension bridge was opened to road traffic in July 2006.

Client
Miaoli City Government & Yong Lian Construction Engineering Company, Taiwan.

Project
Keshu Suspension Bridge, Miaoli County, Taiwan.

The bridge concept was developed for a turnkey bid and was selected as the winning design.

Services
- Concept design
- Feasibility study
- Preliminary & detailed design
- Contractors consultant
- Camber control calculations
- Project planning
- Supervision during construction

Services period
2003 - 2006

Background

This project is Taiwan’s first suspension bridge for road traffic and crosses the Houlong River main channel.

The project has an overall length of 808 m. Commencing with two prestressed concrete spans of 58 and 78 m in the south; then two suspension bridge spans of 96 m and 215 m; with pylon spans of 20, 20 and 85 m; and five prestressed concrete spans of 69, 57, 50, 30 and 30 m in the north. A tubular section was designed for the main suspension span to save weight.

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The suspension bridge was opened to road traffic in July 2006.
Nissibi Cable Stayed Road Bridge,
Turkish Republic

Client
MBS Construction Company, Ankara, Turkish Republic.

Project
Nissibi Cable Stayed Road Bridge Project, Turkish Republic.

Services
- Tender design services
- Consulting services

Services period
2006

Background
The Nissibi cable stayed road bridge project is to cross the upper reaches of the 817 km² reservoir created by the Ataturk Dam across the Euphrates River in south eastern Anatolia.

Nissibi cable stayed road bridge will connect Adiyaman City across the Euphrates River to the historic city of Diyarbakir on the banks of the Tigris River. The bridge will considerably shorten the present road journey.

Services are being provided for the tender design stage of the Nissibi cable stayed bridge; which includes the preliminary design.

The 620 m long cable stayed road bridge comprises of a 420 m long, 17.81 m wide, steel box orthotropic deck central span. With a 1.5 m walkway, and a 1.5 m emergency lane and 3.5 m traffic lane in both directions. Two 100 m back span areas are cast in place concrete roadway pavement.

The steel bridge is supported by the double splay cables from 2 inverted Y shaped concrete pylons between 4.5 and 5 m wide; 5 m thick and with heights of 113.6 m above the cable stay bridge deck.

Two sets of 9 double splay cables supporting the bridge and the back stays are anchored in 32 m x 25 m, 8 m deep concrete blocks tied down with prestressed ground anchors at both ends of the bridge.
Cuu Long Cable Stayed Road Bridge

Can Tho, Vietnam

**Client**
Taisei Corporation.

**Project**
The 1,010 m long Cuu Long cable stayed road bridge and a prestressed concrete approach bridge near Can Tho City. The project is currently the largest bridge project in Vietnam.

**Services**
- Construction engineering
- Specialist consultant for Cuu Long steel cable stayed road bridge and the separate prestressed concrete balanced cantilever bridge

**Services period**
2005 - 2008

**Background**
After its 4,800 km journey from the Tibetan Plateau the Mekong River splays across southern Vietnam in a web of waterways that discharge into the South China Sea through nine branches known as the “Cuu Long - Nine Dragons”.

Can Tho is the major city located in the Mekong Delta some 170 km south west of Ho Chin Minh City; and is the regional transportation center sited among a network of rivers and canals.

The Cuu Long cable stayed bridge and the approach bridge is the last section of the new road system in the Mekong River Delta connecting with Ho Chi Minh City.

The bridge deck has a total length of 1,010 m which comprises of two 230 m long prestressed concrete 4 cell side spans; with a 550 m main span of which the 210 m center part consists of an orthotropic steelwork section in order to reduce the overall weight of the bridge structure.

The bridge is supported by two cable stay planes arranged in a classical fan arrangement and supported by the two reinforced concrete pylons each towering 135 m above the deck. The pylon cross section is 7 m wide and varies from 5 to 6 m in thickness.

The prestressed concrete cantilever box girder approach road bridge is a separate structure spanning a nearby canal and is to be constructed by the balanced cantilever method with five spans of 50 m + 3 x 80 m + 50 m.
No.6 National Highway, Contract C 608, Taiwan

Extradosed Bridge

Client
MOTC, Ministry of Transportation and Communications and Riato Construction Company.

Project
No.6 National Highway, Contract C 608 Extradosed Bridge.

Services
- Construction stage calculations
- Contractors consultant
- Camber control calculations
- Prestress shop drawings
- Supervision during construction

Services period
2005 - 2007

Background
Contract C 608 bridge is a part of the east - west development programme between Nantou County and the west coast of Taiwan; designed to cross the Nankang River.

Extradosed bridges incorporate the characteristics of cable stayed and a segmental box structure.

In a cable stayed bridge the vertical loads are carried exclusively by the stay cables; but in a true extradosed bridge, the vertical loads are shared between the cables and the bridge deck. The cables are arranged at the center of the deck in dual cable stay planes and the deck itself consists of a multi cell prestress segmental box.

The 300 m long bridge is a part of No. 6 National Highway with a 26 m wide multi cell concrete deck, a main span of 140 m, and two 80 m back spans.

Near the pylons the concrete deck is 5.1 m in depth as the deck is required to carry a substantial portion of the loads and at mid span is reduced to 3 m as the cables carry some of the loads in this section.

The low profile pylons are needle type reinforced concrete structures with a height of 20 m above the deck. The double plane cable stays slope gently from both sides of the pylons which is a feature of an extradosed bridge.
Bei Kang Extradosed Bridge,
Yunlin County, Taiwan

Extradosed bridges incorporate the characteristics of cable stay and a externally prestressed concrete box segmental structure as illustrated in this design.

In a cable stayed bridge the vertical loads are carried exclusively by the stay cables; but in a true extradosed bridge, the vertical loads are shared between the cables and the deck of the bridge.

Cables are arranged at the center of the deck as double plane stays; and the deck itself is a multi cell prestress concrete box.

The bridge is 250 m long and 27 m in width, with equal spans of 125 m; having a multi cell concrete deck with varying depths between 2.5 to 6.0 m. The pylon is a single needle type concrete structure 35 m high.

In a longitudinal direction the double plane cable stays, the main multi cell concrete deck, pylons and pier forms a vertical structural plane.
Industrial Ring Road Cable Stayed Bridges,
Contracts 1 & 2, Bangkok, Thailand

Client
Ministry of Interior, Public Works Department, Thailand; and the Contractor, Taisai Corporation.

Project
Industrial Ring Road Contracts 1 & 2; Cable Stayed Bridges.

Services
- Construction engineering
- Specialist consultant for both cable stayed bridges at each construction stage
- Designs of temporary works structures

Services period
2002 - 2006

Background
The cable stayed bridges project is a part of the new industrial ring road that spans the Chao Praya River.

Both of the bridges are 37.4 m in width. The southern cable stayed bridge is 702 m in length, with a composite span of 398 m; and two prestressed concrete side spans 152 m long; deck area 25,201 m².

The northern cable stayed bridge is 576 m in length, with a composite span of 326 m; and two prestressed concrete side spans of 125 m long and deck area of 20,678 m².

Each cable stayed bridge has two concrete diamond shaped pylons, with two cable planes. The north bridge pylons are 176 m high and 163 m high on the south bridge.

Both bridges have a clear height above the river of 51 m for ships to enter and exit Bangkok Port.

The ring road project was open to road traffic in mid 2006 and now connects the Bangkok Port to an industrial development area south of the river.
Taichung No. 4 Cable Stayed Bridge,
Taiwan

Client
- Taichung City Government
- Chun Yuan Construction

Project
Taichung No. 4 Cable Stayed Bridge.

Services
- Construction stage calculations
- Contractors consultant
- Camber control calculations
- Project planning
- Site supervision
- Temperature and wind monitoring systems planning and installation

Services period: 2002 - 2005

Background
The Taichung No. 4 cable stayed road bridge crosses the Han River south of Taichung City. The bridge has a steel deck and an arch shaped steel pylon with a twin cable plan configuration. Services included the:

- detail construction stage analysis according to the tender design and final stage calculations
- detailed analysis of the cable stay stressing operation
- construction sequence planning
- cable stay stressing schedule and instructions
- check on the final stresses under service loading conditions
- bearing preset calculations
- stress check of deck and pylon for all stages of construction
- camber control calculations and values to monitor the pylon and deck for all construction stages
- design for additional stiffeners required during construction

The 28.9 m wide and 179 m long steel deck had 89.5 m side spans. The deck area was 5,173 m²; and the steel arch was 60 m high.
Tempisque River Cable Stayed Bridge, Costa Rica

Bridge Design & Construction

**Client**
Taiwan and Costa Rica Government.

**Project**
Tempisque Cable Stayed Bridge.

**Services**
- Construction engineering
- Design of superstructure elements
- Specialist consultant for the cable stayed bridge construction stage design checks and for the as built design calculations

**Services period**
1998 - 2003

**Background**
The cable stayed bridge crossing now eliminates a two hour journey to cross the Tempisque River and is bringing tourism development to the Nicoya Peninsula. The bridge has two lanes for vehicles and two for pedestrians.

The 780 m long, 13.3 m wide bridge included a 260 m cable stay of two spans of 90 and 170 m on the west side; with a 520 m long composite box girder bridge 2.5 to 3.0 m deep on the east side.

Tempisque cable stayed bridge has a concrete H shaped pylon 65 m in height above the deck; with 4 pairs of asymmetrical cables. The bridge having a height clearance of 15 m over the shipping channel.
Tah Chi Cable Stayed Bridge,
Taipei, Taiwan

Client
Taipei City Government, Taiwan.

Project
Tah Chi Cable Stayed Bridge.

Services
- Feasibility study
- Preliminary & final design
- Equipment and temporary works designs
- Construction stage calculations
- Contractors consultant
- Camber control calculations and stressing instructions
- Project planning
- Supervision during construction

Services period
1998 – 2003

Background
The deck elevation of the old Tah Chi bridge could not meet the demand for future road traffic. Hence the new Tah Chi bridge was built to meet these requirements.

The Tah Chi cable stay bridge has a 172 m long main span and two side spans of 50 m and 23 m. The bridge having a deck area of 6,838 m².

The superstructure is a fully welded orthotropic steel deck with a depth of 3.2 m and suspended by 6 twin stay cables and 10 back stay cables from a steel bow shaped pylon structure.

The height of the support structure was limited to 70 m above ground due to the proximity of the Domestic Airport flight path. Special erection procedures were developed to lift the support pylon into position.

The scope of work consisted of the aesthetic evaluation and preliminary design at the proposal stage. The detail design included static, seismic, buckling & cable sagging analysis.

The new bridge is a landmark in the newly created river side park; and was opened in 2002.
Kao Ping Hsi Cable Stayed Bridge, Taiwan
Second Freeway, Contract C 381
Cable Stayed Bridge Design

Client
Taiwan Area National Expressway Engineering Bureau; TANEEB.

Project
Kao Ping Hsi Cable Stayed Bridge.

Services
- Feasibility study
- Preliminary & detailed design
- Wind tunnel testing

Services periods

Background
The Kao Ping His Bridge is located on the border between Kaohsiung and Pintung Counties. The Bridge is a part of the Second North South Freeway and was opened to traffic in January 2004.

The asymmetric cable stayed bridge crosses the Kao Ping River and is a landmark for freeway traffic entering Pingtung. The 510 m asymmetric cable stayed bridge is the longest in Taiwan and the second longest of its type in the world.

The reinforced concrete inverted Y pylon is 183.5 m high, with a 34.5 m wide hybrid deck, 180 m prestressed concrete side span and a 330 m fully welded orthotropic main span. The bridge deck is 17,787 m² in area.

Various dynamic design methods were used during the services work phases of the:
- feasibility study
- preliminary & detailed design
- wind tunnel testing

Between 1998 & 2000 services were provided to TANEEB as a specialist consultant during the construction.
Kao Ping Hsi Cable Stayed Bridge, Taiwan
Second Freeway, Contract C 381

Construction Engineering

Client
The Taisei, Kawada, Raito, Pan Asia Joint Venture Contractors.

Project
Kao Ping Hsi Cable Stayed Bridge, Second Freeway, Contract C 381.

Services
- Construction engineering
- Temporary works design
- JV specialist consultant
- Camber control
- Pylon stability analysis
- Project planning
- Construction equipment
- Site supervision
- Wind tunnel testing

Services period
1996 - 2000

Background
The Cable Stayed Bridge is at the border of Kaohsiung and Pintung Counties, crossing the Kao Ping River. This freeway section was opened to traffic in January 2004.

The 510 m asymmetric cable stayed bridge is the longest in Taiwan and the second longest of its type in the world.

The reinforced concrete inverted Y Pylon is 183.5 m high, with a 34.5 m wide hybrid deck, 180 m prestressed concrete side span and a 330 m fully welded orthotropic main span. The bridge deck is 17,787 m² in area.

Service responsibilities included:
- all technical issues
- construction design calculations
- camber control
- construction equipment design
- design of temporary works
- wind tunnel testing during each
Shin Dong Cable Stayed Bridge,
Miaoli, Taiwan

Client
Miaoli City Government, Taiwan.

Project
Shin Dong Cable Stayed Bridge.

Services
- Preliminary & detailed design
- Construction stage calculations
- Contractors consultant
- Camber calculations and bearing presets
- Supervision during construction
- Wind tunnel testing

Services period
1995 – 1997

Background
Services included the preliminary and the detail design for the Shin Dong Cable Stayed Bridge.

The cable stay bridge has a multi cell fully welded orthotropic steel deck 2.5 m deep, suspended by a single plane of stay cables.

The Shin Dong bridge was:
- 325 m in length
- 21 m in width
- 175 m main span
- 6,838 m² deck area

The single needle pylon steel type structure was 44.6 m high.

The bridge was fitted with special hydraulic shock absorbers, which allow the earthquake forces to be distributed over several supports.
Tai 8 Cable Stayed Bridge,
Taroko Gorge, Taiwan

Client
Provincial Highway Bureau, Taiwan.

Project
Tai 8 Cable Stayed Bridge is located in the Taroko Gorge on the east side of Taiwan.

Services
- Preliminary design
- Detail design
- Construction consulting services
- Project planning

Services period
1991 – 1993

Background
Taroko Gorge is one of Taiwan’s famous scenic areas where the marble deposits have been eroded over time by the Liwa River creating lofty mountains, impressive canyons, sheer precipices and waterfalls and rapids.

The Tai 8 cable stayed bridge was designed to cross the Liwa River as a replacement for an existing bridge, which was heavily damaged during an earlier typhoon.

The bridge had a single central H shaped steel pylon and the deck designed as a composite structure in order to allow for rapid erection.

The bridge being 15 m wide, with a 136 m deck; and the deck area was 2,040 m².

The bridge is located in an area of very strong seismic activity and the design needed to consider the impact of seismic loads on the structure.