The Twin River Bridges
Chongqing, China

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The City of Chongqing
Area = 82,000 sq. km.
Population = 32 millions

It has a lot of major bridges. People call it the
“BRIDGE CAPITAL” of China
Niujiaotuo (1966) — Steel Truss Bridge

Fendu (1997) — Suspension Bridge

Lijiatuo (1997) — Cable Stay Bridge

Huanghuayuan (1999) — Concrete Rigid Frame Bridge
Egongyan Bridge (2000)
total length of 1,022 m with 600 m main span

Wushan Yangtze River Bridge (2005)

Wanxian, the world’s longest concrete arch span

The entire Caiyuanba Bridge project
Wujiang Bridge, Fulin, 2007. Span = 340m = 1,115 ft.
The City of Chongqing

Chongqing is a very beautiful city with poetic landscape and rich history.

Twin River Bridges - Dongshuimen and Qianximen

Bridge Location
Certainly, bridges at this location deserve special aesthetic considerations!

This is Chongqing
The bridges are very close to many landmarks. The aesthetics of the new bridges must respect and be compatible with these landmarks.

This is Chongqing.

Most important, the bridges shall not spoil the beautiful view of the City.

Therefore, the bridges must be light and transparent!

The City is very serious about the aesthetics of these two bridges, therefore.

There was an international design competition.
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Our design, by a joint venture of
Chongqing Communication Design and Research Institute and
T.Y. Lin International
was selected.

We proposed two alternatives:
A pair of suspension bridges
&
A pair of partially cable-stayed girder bridges

Suspension Bridge Scheme
Main span of both bridges = 496m
Dongshuimen Bridge over the Yangtze River

Qianximen Bridge over the Jialing River

The rock in the peninsula is rather fractured – not suitable for cable anchorage in tension.

But compression is acceptable
There will be two tunnels in the Yuezhong Peninsula:
- A street tunnel and a transit tunnel

To eliminate any tension anchorage, the main cable of the two bridges are connected by a pair of center cables.

The tension force in the connection cables are always larger than the cable force in either bridge.

There will never be any tension force pulling the rocks.
The connection cables run underneath the transit tunnel.
Scheme 2: Partially cable-stayed girder bridges

索辅梁桥 - 部份斜拉梁桥
It is important to consider the significant difference in water level.
Peculiarities of these two bridges:

1. Partially cable-stayed Girder bridge
2. Single plane of cables
3. Very stringent requirement of the light rail
**Partially cable-stayed Girder bridges**

Shorter towers
Less number of cables

Bridges more transparent.
Less disturbance of the view from either side of bridge.

**Partially cable-stayed Girder Bridge - The concept**

Concept:
The girder is the main carrying member. The cables will supplement the shortfall.

Calculate bending moment diagram from loadings

Capacity of girder

Demand to be satisfied by the cables
Partially cable-stayed Girder Bridge

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The girder is the main carrying member.
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Demand to be satisfied by the cables

Arrange cables as desired.

Bending moment produced by the cables
Partially cable-stayed Girder Bridge

Concept: The girder is the main carrying member. The cables will supplement the shortfall.

\[ M(\text{load}) - M(\text{cable}) \]

Another way of looking at the concept.

\[ M(\text{capacity}) = M(\text{allowable}) = M(\text{load}) - M(\text{cable}) \]

Advantage: Fully utilizes the capacity of both the girder and the cables.

Bending moment produced by the cables:

Another advantage is, freedom in assignment of cable forces.

Number of cables and force in each cable.

Peculiarities of these two bridges:

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2. Single plane of cables
3. Very stringent requirement of the light rail
Cable Anchorage

Deck Plate

Main Truss

Transfer of horizontal force

Main Truss

Transverse girder

Transverse girder
Transfer of Cable Anchorage

Main Truss

Transverse girder

Transverse girder

Deck Plate

Deck

Cable Anchorage

Transfer of vertical force

Peculiarities of these two bridges:

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Single plane of cables

Girder under eccentric load

Box section is torsionally stiff

Single plane of cables

Girder under eccentric load
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Deflections, rotations, slopes, dynamic interactions, …………………
ALL FULLY SATISFIED!
The 13m high girder helps.
Thank You!