General view of the Fourth Nanjing Bridge.

The 4th Nanjing Bridge

– great suspension bridge in China

Nanjing, capital of the Jiangsu province, is situated in China along the Yangtze River some 300 km upstream of Shanghai. In Nanjing, there are many internationally remarkable bridges. Currently the 4th Nanjing Bridge is under construction [Ref.1], a suspension bridge with a span of 1418 m, one of the longest in the world [2].

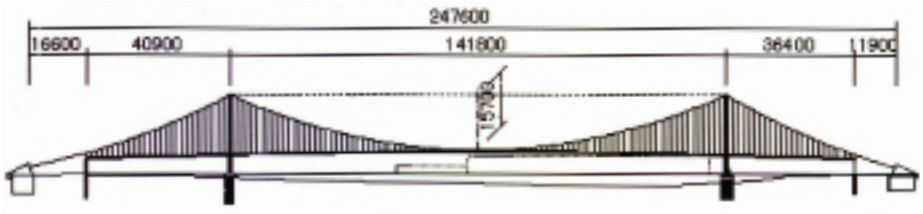
In the preliminary design, 7 alternatives were studied. Six of these were suspension bridges, the longest one with a span of 1800 m. The 7th one was a cable-stayed bridge with a span of 980 m.

The selected alternative is an ordinary 3-span suspension bridge with a main span of 1418 m. The north side span is 409 m and it is shown on the left side in the attached longitudinal profile, while the opposite south side span is 364 m. The anchorage distance of the bridge is 2476 m, and the two main cables are anchored in concrete anchorages at both ends of the suspension bridge.

The material of the both towers is mainly concrete, but at the top of each tower there is a steel cross-beam between the tower legs. The both towers are 229 m tall, and there are no other cross-beams between the tower legs in the portion from the deck level up to the steel cross-beam at the tower top.

The bridge has 2 main cables, spacing 34,0 m. The main cables consist of PPWS ropes (Prefabricated Parallel Wire Strands), the number of which is 135 at the main span, 141 at the longer side span, and 143 at the shorter side span. Each rope has 127 parallel wires, Ø 5,35 mm, tensile strength 1770 MPa, and the ropes are assembled to their position between anchorages over the tower tops. The main cables are compacted to circular shape and covered by wrapping wire, Ø 4,0 mm, tensile strength 1670 MPa. The diameter of the cables is then Ø 783 mm at the main span, Ø 800 mm at the longer side span, and Ø 806 mm at the shorter side span.

The deck of the bridge consists of a streamlined steel box girder, overall width 38,2 m, structural height 3,5 m. The deck has 3 + 3 traffic lanes à 3,75 m, and outside these there is a maintenance lane à 3,0 m at outer side of each roadway. Outside the main cables and vertical suspenders, there is also a further narrow maintenance lane at both outmost sides of the deck. The design speed along the bridge is 100 km/h. The vertical clearance at the main span is 50 m, and



Longitudinal profile of the selected alternative (units: cm).

the total length of the bridge including the viaducts is 5437 m.

The preliminary design of the bridge was commenced in 2003. The construction was commenced in December 2008, and the bridge is due for completion in 2013. The estimated cost is about 17,7 milliard yuans (CNY) or 2,6 milliard dollars (USD). The Client is 4th Nanjing Bridge Construction Headquarters (4NBCH), the Consultant being Zhongjiao Highway Planning & Design Institute.

There are in Nanjing some other internationally great bridges, too. The First Nanjing Bridge was completed in 1968, and it is a 2-level railway and highway bridge, total length 6,7 km [3]. The Second Nanjing Bridge (span 628 m) was completed in 2001 [4] and the Third Nanjing Bridge (span 648 m) in 2005 [5], both of which ranked at completion among the leading 10 long-span cable-stayed bridges worldwide.

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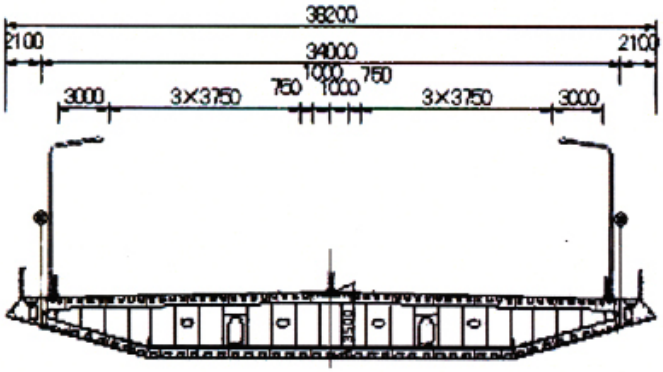
Illustration: Nanjing Institute of Technology (NIT)



Cross-section of the deck (units: mm).

Finnish summary:

Jiangsun läänin pääkaupunki Nanjing sijaitsee Kiinassa Jangtse-joen varrella, noin 300 km ylävirtaan Shanghaista. Nanjingissa on rakennettu useita suuria siltoja. Parhaillaan siellä on rakenteilla Fourth Nanjing Bridge -niminen silta [Ref.1], jänneväliltään 1418 m yksi maailman pisimpiä riippusiltoja [2].

The leading 10 long-span suspension bridges,[2]

No.	*Bridge*	*Span*	*Location*	*Year*
1	Akashi-Kaikyo	1991 m	Kobe-Naruto, Japan	1998
2	Xihoumen	1650 m	Zhoushan, China	2009
3	Great Belt East	1624 m	Korsor, Denmark	1998
4	Gwangyang	1545 m	Myodo-Gwangyang, South Korea	2012
5	Runyang South	1490 m	Zhenjiang, China	2005
6	Nanjing-4	1418 m	Nanjing, China	2013
7	Humber	1410 m	Kingston-upon-Hull, Britain	1981
8	Jiangyin	1385 m	Jiangsu, China	1999
9	Tsing Ma	1377 m	Hong Kong, China	1997
10	Hardanger	1310 m	Vallavik-Bu, Norway	2013

References:

[1] Information and illustrations kindly given by the Nanjing Institute of Technology (NIT).
[2] Bridge Tables of the Helsinki University of Technology (TKK), www.tkk.fi/ Units/Bridge/longspan.html
[3] Juhani VIROLA: "Great highway and railway bridge across the Yangtse River at Nanking, China". Journal of the East African Institution of Engineers 1970:4, p. 114 & 117-121.
[4] LIU Liping & ZENG Xianwu: "Second Nanjing cable-stayed bridge". Structural Engineering International SEI 2004:1, p. 34-36.
[5] LOU Xuequan, Juhani VIROLA & DING Dajun: "The Third Nanjing Bridge – great cable-stayed bridge in China". Rakennusinsinööri ja -arkkitehti RIA 2008:4, p. 56-58.