Taizhou Yangtze River Highway Bridge

LOCATION:
Taizhou - Zhenjiang - Changzhou, China

SUBMITTING FIRM:
Jiangsu Province Communications Planning and Design Institute Limited
Company, CREC Bridge Survey and Design Institute Group Co., Ltd. & Tongji University Architectural Design Institute (Group) Co., Ltd.

FIDIC MEMBER:
China National Association of Engineering Consultants (CNAEC)
Taizhou Yangtze River Highway Bridge is located in the middle section of the Yangtze River in Jiangsu Province, linking Taizhou City in the north, Zhenjiang and Changzhou in the south. It consists of four parts, i.e. the north extension, the main bridge across the river, the branching channel bridge and the south extension, with a total length of 62.088 km. Therein, the main bridge across the river is the three-tower two-span suspension bridge with the span arrangement of (390 +1080 +1080 +390)m. Taizhou Yangtze River Highway Bridge, an important part of China’s Yangtze River Delta expressway network and Jiangsu Province’s expressway network, which is the world’s first one-thousand-meter-span three-tower continuous-span suspension bridge independently designed and built by China. The three cities along the Yangtze River, i.e. Taizhou, Zhenjiang and Changzhou, put forward the idea of building Taizhou river-crossing passage since 1998. Through nine years of preliminary research and demonstration, the bridge construction was started in December 2007 officially, and it was opened to traffic in November 2012.

In November 2013, Taizhou Yangtze River Highway Bridge won the highest award - Structural Engineering Excellence Award in 2013 Annual Meeting of The Institution of Structural Engineers, UK; in 2014, Taizhou Yangtze River Highway Bridge received the final nomination of American Society of Civil Engineers (ASCE) 2014 Outstanding Civil Engineering Achievement Award. Taizhou Yangtze River Highway Bridge appeared on the cover of the first quarter issue of BRIDGE DESIGN & ENGINEERING, a world-renowned bridge magazine in 2012, which also made the detailed description of the bridge and demonstrated the majestic
appearance of the main bridge after its closure in a prominent position on the home page of the magazine’s website. In addition, the relevant technical achievements of Taizhou Yangtze River Highway Bridge have also been applied to China Maanshan Yangtze River Bridge, China Wuhan Yingwuzhou Yangtze River Bridge and many other major projects. The success of Taizhou Yangtze bridge construction has put forth new bridge type solutions to the technical challenge of spanning broad waters and made great contribution to bridge construction in the world.

As the world's first one-thousand-meter-span three-tower continuous-span suspension bridge, Taizhou Yangtze River Highway Bridge conducted the study on the structural system and the stiffness suitability of the one-thousand-meter-span three-tower suspension bridge in the international arena for the first time, tackled the multiple factors coupling optimized analysis method based on the best objective of the structural system-stiffness; it carried out the experimental study on slip resistance between the multi-strand main cable and saddle, and put forward the evaluation system on the safety of slip resistance between the multi-tower continuous-span suspension bridge's middle tower saddle and the main cable in the international arena for the first time; it obtained the spatial distribution of the structural fatigue sensitivity of the main beam of three-tower suspension bridge, and proposed the dynamic response sensitivity energy index considering the local fatigue effect of beam in the for the first time internationally; it was also the first to propose the reasonable and equivalent method on wind resistance test of the three-tower continuous-span suspension bridge based on aerodynamic model. Through numerous design, testing and scientific research work, Taizhou Yangtze River Highway Bridge successfully resolved these key technical issues, surpassing the previously recognized double-tower model for long-span suspension bridge in the world, thus providing valuable experience and making a breakthrough for the construction of long-span three-tower suspension bridge.

The construction of Taizhou Yangtze River Highway Bridge has successfully overcame a lot of challenges brought about by the Yangtze River, known as a natural barrier, such as poor
weather conditions, complex hydrological conditions and high traffic density. The construction process created four world records, namely the largest span of 2 × 1080m three-tower two-span continuous steel box girder suspension bridge, the highest 200m vertical inverted Y-shaped steel tower, the longest 3,117m suspension bridge cables, and the deepest open caisson foundation with the burial depth of 55.5m, thus achieving the great leap of three-tower suspension bridge from the maximum span of 210m to a kilometer, creating a new valuable experience for the world bridge construction, and adding a splendid touch for the history of bridge in the world.

In the whole process of the project management, including consulting services, bidding and procurement, Taizhou Yangtze River Highway Bridge always adhered to FIDIC's terms of transparency and integrity, selected designers and constructors in scientific, impartial and fair manner, applied contract management model and quality management model, as well as multi-project, cross party collaborative project management system, efficiently coordinated the activities of dozens of consultants, research institutes, contractors and other agencies, ensured the quality, safety, progress, environmental protection and investment management objectives, and guaranteed the smooth implementation of the bridge construction.

The new bridge structure has brought difficult technical and management challenges, but the designers and constructors of Taizhou Yangtze River Highway Bridge always adhered to the overarching goal of quality, safety, efficiency, innovation, conservation and environmental protection. The bridge fully complied with "W"-shaped cross-section riverbed at the bridge site and applied three-tower continuous-span suspension bridge solution, which minimized the damage to the Yangtze River waterway; during the movable bed model test, this solution caused minimum impact to the flow and river regime of the Yangtze River. Meanwhile, compared with the traditional two-tower suspension bridge design solution, it can significantly reduce the stress of the main cable and anchorages, reduces the absolute size of components, achieve large-span bridge construction on a weak foundation, and save costs of 263.9 million yuan. The construction of the bridge has given full play to the technical characteristics of the
bridge type, achieved all-win in road traffic and shipping, ports, urban construction, epitomized the protection on coastline, waterways and other non-renewable natural resources and the innovative idea based on full-life design.

Taizhou Yangtze River Highway Bridge has established a comprehensive real-time online structural health monitoring system, which focused on the middle tower according to the structural characteristics of three-tower two-span suspension bridge, while giving consideration to the main beam and main cables; through various technical means, it monitored contents such as the bridge’s overall alignment, vibration, strain, cable force, wind speed, temperature, humidity, etc., displaying the conditions of the bridge structure. After a year of monitoring after operation, the bridge structure displacement and stress levels were within design range; the bridge is in flexible working condition; the structural performance is sound, meeting project requirements in all aspects.

Currently the average daily traffic flow of Taizhou Yangtze River Highway Bridge has reached 30,000. After Taizhou Yangtze River Bridge was completed and opened to traffic, the driving time between Taizhou and Changzhou has been reduced from two hours to one hour,. In addition to improving national and provincial trunk road network in Jiangsu Province and serving the regional transportation services, the bridge also serves to link the east-west transportation between Nanjing and Nantong, Taizhou and Shanghai, playing a significant role in giving full play to the radiation function of the south Jiangsu, accelerating the development of Taizhou and the rise of the central area of Jiangsu; meanwhile, it will play a great role in promoting the development of Jiangsu along the Yangtze River, its coastal development, and the balanced development of economy in the Tangtze River Delta region.