he firm submitting the application

Why do you think this project should receive an award? How does it demonstrate?

- Innovation, quality, and professional excellence
- Transparency and integrity in the management and project implementation
- Sustainability and respect for the environment

I. Largest scale and significant model effect

This is the largest bridge lifting project in both span and weight in the world till now.

Table 1 Comparison of size and achievements of the project against similar domestic/international projects

Item	The project	Similar domestic projects	Similar international projects
Systematisms	A complete technology integration system	Individual technology and type	No integrated system is found
Lifting span and weight	Maximum sing span reaches 125m; total weight reaches up to 24,000 tonnage	Maximum single span is only 60m, total weight is 13,000 tonnage(lifting project for Changhushen section of Nanlin Bridge in Huzhou, Zhejiang, 2009)	Total weight is approximately 5,049 ton(Lifting project of N14 highway in South Africa, 2009)
Synchronism and precision control technology	24 synchronous control points, error of single lifting trip is only 1~5mm; accumulative error is less than 2cm.	There is no synchronous lifting control system for such big span	
Permanent spacer for lifting of large span bridge	1850x1850x200mm steel box concrete spacer characterized by large size, high strength, high level of smoothness and light weight	Concrete, steel spacer	
Follow-up lifting system	Large tonnage follow-up lifting system with high level of overall stress bearing capability and synchronism	No completed system is found.	
Technology of Synchronous simulation during lifting construction	Highly refined synchronous simulation technology specific to large span bridge is used to guide and coordinate construction and lifting control	Issues of stress transfer during partial modification and lifting transfers are not touched upon	
Patents of construction methods	5 thesis are published; one nation level and one city level construction method; 27 patents; preparation of national standards	No construction methods or patent specific to large span bridge lifting	
Application	The project achievements are applied to other projects in Shanghai, Chengdu and Zhuhai	The project sizes are limited, and are not representative.	

Hengliaojing Bridge refers to the bridge of Tong-San national highway (A30) over Hengliaojing-branch at upstream of Huangpu River. This renovation project aims to meet the renovation planning requirement of upstream channel of Huangpu River, Shanghai, and viz. under the premise of no change of original road section, renovate the bridge to meet the travelling requirements of renovated Class III channel. Per

ovation scheme with overall lifting of the bridge at 1.58m was reached.

The renovation project is nearly 800m long and involves 25 spans. Single hole reaches a maximum span of 125m. The total weight of single-bridge is about 24,216 tons, with about 10,408 tons for main bridge and 6,904 tons for approach span. Greatest span and weight of synchronous lifting not only pioneers in lifting of large bridges all over the world, but also brings in great challenges for implementation of this project.

With spirit of innovation and use of advanced technology, the project team finally overcome difficulties and completed overall lifting of this bridge with extra-long span, which filled up the blank of this industry. Moreover, multifaceted scientific demonstration system was established, and equipment and approaches at international advanced level were developed. A sustainable development model with low energy consumption and influence, and “zero waste” discharge was successfully established.

This project provides all-round reliable reference for more and more renovation projects of existing large river-crossing bridges, and produces significant model effect and application value.

II. Substantial innovative achievements in process and equipment and international leading technology

There are substantial innovative achievements in construction process and equipment in this project. We have applied and obtained 27 national patents and published 5 papers (including one EI). The achievements have been identified by authorities and advanced international level has been reached generally. While effectively guaranteeing successful implementation of engineering, these achievements comprehensively improve innovation ability, technology & equipment integration level and competitiveness of domestic enterprises.

The most prominent technological achievements of this project include:

(1) Theoretical analysis for lifting of extra span concrete bridge:

We analyze tolerances of various vertical and horizontal points in lifting of extra-large span concrete bridge and propose requirements on precision of synchronous control in formal lifting as theoretical basis of similar projects. Simulation analysis is made for transferring of stress from support to pier of lifting system in bridge lifting, providing theoretical basis for lifting limit, transferring method of cutting force system and reinforcement method of continuous box.

(2) Long-distance high precision synchronous lifting control technology:

A synchronous control system for overall lifting and falling of extra-large span

ina, taking effective measures to ensure reliability of signal of long-distance control system. Data of various construction points are delivered simultaneously and timely to realize long-distance real-time control of 112 simultaneous control points with lifting error of single travel of 1~5mm and accumulative error within 2cm. In construction, error of lifting height and vertical and horizontal position is within 5mm.

(3) Large tonnage mechanical follow-up support device:

A mechanical follow-up support device is provided to effectively support superstructure and avoid sudden falling of bridge in case of sudden failure of hydraulic jack. Synchronism and controllability are studied and related parameters are controlled.

(4) Large-scale lifting support block technology:

Temporary support load-bearing block (1850x1850x200mm) is produced for large span and large tonnage bridge, which has large area, high intensity, high flatness and small weight, satisfying concentrated arrangement of lifting devices and ensuing precision of lifting.

III. Widely accepted innovation and technology domestic and overseas

Overall lifting for bridge renovation rather than traditional demolition and reconstruction not only reduced project duration, cost and influences, but also greatly improved construction process for renovation via lifting and technology level of relevant equipment development, and produced rich original achievements, which were widely accepted by authoritative organizations and personnel at home and abroad.

This project obtained nearly 10 awards and honors, including first prize of Shanghai Science and Technology Development (2014), first prize of Huaxia Construction Science and Technology(2014), State Municipal Demonstration Engineering Golden Cup Prize (2013), Scientific and Technological demonstration project honor awarded by Ministry of Housing and Urban-rural Development of the People's Republic of China (2013), and second prize of national excellent engineering design (2013); it was presented as Growing Bridge in CCTV program-Approaching Science; World Record Association also notarized that this project created two world records, namely maximum span and weight in overall lifting of bridge all over the world.

Academician FAN Lichu, the world famous bridge expert, pioneer and leader in anti-seismic bridge field in China affirmed the bold and innovative idea of engineers on this project, kept a watchful eye and provided guidance on lifting work during construction. Professor GE Yaojun, currently vice-chairman of International Association for Bridge and Structural Engineering, and bridge department head of

ject as that it successfully solved relevant technical difficulties on synchronous lifting precision control of bridge with large span, effectively reduced risk via reliably technical approaches, and provided a model for similar renovation projects.

IV. Win-win for Economic and Environmental Benefits and Sustainable Development Model

With overall lifting process, R&D and implementation of its core technology, this project presents great achievements in cost efficiency and sustainability, which are shown in details below:

(1) As construction duration was almost 2/3 shorter than that for demolition and reconstruction, and there was hardly any noise and vibration caused by lifting, it greatly reduced influences on urban traffic, and surrounding residential and commercial environment;

(2) With adoption of construction scheme for lifting half width of the bridge at each time, half width of the bridge was available to traffic, and it produced limited influence on road traffic and no influence on shipping.

(3) More importantly, repeated use of existing structure greatly reduced the waste for raw construction materials, construction tools, fuels and other resources, and realized “zero waste” discharge.

(4) In terms of cost, this project saved about 153,450,000 Yuan for demolition and reconstruction. With application of this technology all over China, it saves about 468,000,000 Yuan for construction cost, avoids waste of resources, and realizes win-win of both economic and environmental benefits.

(5) Advanced and reliable technology and process also decreased the risk cost for jacking of bridge.

All those achievements establish a sustainable development model for renovation of similar bridges in future.

V. Due diligence, transparency and integrity in management

Transparency and integrity were strictly observed in this project.

(1) This project is carried out in a manner of internationally advanced EPC mode (Engineering Procurement Construction). We win this project by public bidding and provide professional, objective and impartial services and suggestions to client based on reliable quality.

(2) We extensively solicit opinions from Client, Water Service, Shipping, Expressway Management Department, maintenance organization and surrounding residents prior to construction, reasonably schedule construction and traffic organization, and

ures to satisfy all parties concerned.

(3) Engineering team followed open, transparent and efficient management principle, were supervised strictly by relevant governmental departments and social public during the whole process, and disclosed project progress and budget implementation information in a timely manner.

(4) Engineers consistently adhered to professional ethics of independency, objectivity, and impartiality to provide objective and fair suggestions as well as mostly optimized and feasible solutions with client's benefits first.

(5) With establishment of perfect integrity management system, involvement level of ordinary staffs, management and decision-making levels, as well their consciousness of responsibility were greatly improved. Legal engineering contract and agreement were signed with project quality as focus and system as safeguard to timely relieve potential benefit conflicts, and win trust of Client under premise of full respect of client's benefits.

What services did the member firm provide to the project? Please describe briefly.

Due to cooperation between design and construction firms, we carried out following researches and relevant creative work based on this project in combination with lots of investigation, analysis, and test study even if no relevant codes for reference:

(1) After thorough and reliable technological and economic analysis, we initiated innovative lifting renovation scheme to replace original scheme of demolition and reconstruction, which ensured successful "World First" lifting project; (Firm 01)

(2) We formulated general technical scheme of the project and took charge of the realization, provided all-process management of design studies, and made summary on patent, paper, specification and other intellectual property; (Firm 01&02)

(3) We carried out systematic study on synchronous control and precision, which were key to lifting of large span bridge and provided specific conclusions that guided implementation of the project effectively; (Firm 01)

(4) We provided whole construction process demonstration for lifting of large span bridge for the first time, and carried out simultaneous analogue simulation and analysis in strict conformance to construction procedures, which ensured real-time control of the structure in the whole progress; (Firm 01&02)

(5) We took charge of the research and realization of the large tonnage follow-up mechanical jack, the long distance high precision synchronous lifting control system and the large-scale lifting support block. (Firm 03)

In addition, our three firms provided coordination in effective transfer and application of relevant deliverables in this demonstration project.