

# Collaborative Design Tools Accelerate Chinese Railway Electrification System

**Ambitious project promises to become the world's longest high speed railway, ahead of existing lines in Japan, France, and Germany**

DURING a trial run of high-speed rail service on the 115-kilometer route between Beijing and Tianjin, a China railway high-speed train hit a record speed of 394 kilometers per hour (kph). The 27-minute trip indoctrinated China into an elite cadre of countries that have adopted high-speed electric trains as an energy-efficient and environmentally friendly alternative for millions of commuters.

Fully operational in time for the Beijing Olympic Games in August, the Beijing-Tianjin line is the first segment to be completed in the 1,318-kilometer Beijing-Shanghai high-speed line — part of the China's long-term plan to construct 12,000 kilometers of track for passenger trains running at 200 kph or more by 2020.

## Project

The Beijing-Shanghai line is now the country's largest capital construction project, currently valued at \$31.6 billion. When it is complete in 2013, the high-speed rail line will cut travel time between Beijing and Shanghai from 14 hours to five hours, with trains operating at speeds of

up to 350 kph. During the early period of operation, the interval between trains is set at four minutes, and it will be shortened to three minutes at the peak time. Each train will be able to carry 1,000-2,000 passengers, and there will be 110-120 round trains running each day. An estimated 220,000 passengers per day will use the trains to shorten their commutes between the country's most prominent centers of business and industry.

Crossing four provinces to connect 24 stations in six major cities, the new high-speed line runs parallel to an existing railway that has become a transportation bottleneck. The 1,464-kilometer mainline is the busiest in China, accounting for 10 percent of passenger traffic and 7 percent of freight transportation. Regions along the route house 25 percent of China's population and produce 40 percent of its gross domestic product.

The Ministry of Railways began planning a dedicated passenger line to alleviate pressure on the mainline in 1994. Feasibility studies were

● See page 18



Image Courtesy: Bentley Systems, Inc

The 1,318km Beijing – Shanghai 4 Speed Line

●From page 17

finally approved in 2006, and in 2007 the Beijing-Shanghai High-Speed Railway Co. Ltd. was named as the project management company. This high-profile project is being designed entirely in China by Chinese engineers. The ministry reports that at least 70 percent of the technology developed will be proprietary. Contracts are awarded to the engineering firms that can deliver the best designs in the shortest time at the lowest cost.

### Collaborative Design

The alignment of the Beijing-Shanghai high-speed rail line presents numerous design challenges. Two-thirds of the route will be constructed on ground and much of the remainder will be built on bridges — including major crossings of the Yellow River and Yangtze River Delta.

“Traditional design methods cannot meet this kind of requirement,” said Kaiyu Chen, product manager at the Shanghai office of Bentley, which is providing technical support to the China Railway Electrification Survey Design & Research Institute Co. Ltd. (EDI). “Collaboration is the best way to improve efficiency, especially at EDI, which is a specialised design institute with a limited number of designers.”

EDI is completing the electrification design work for the Beijing-Shanghai line using MicroStation as the platform for collaboration both within the firm and with other local companies. The firm is designing the substation, power supply, electric automation, and catenary systems. Bentley is providing on-site training and support, and the Bentley Developer Network is helping to troubleshoot problems. Bentley’s sup-

port helped the designers to grasp the MicroStation collaboration method and rapid response to requests for software modifications such as Chinese font support won the engineers’ trust.

In the absence of off-the-shelf software, EDI’s first challenge was to develop proprietary applications for railway electrification design on the Bentley platform. The team finished the catenary system applications development work within just four months. This application improved the efficiency of the 50-member project team as it forged ahead with the electrification system design.

MicroStation’s ease of use and interoperability with other CAD systems enables EDI engineers to reduce design time while proving quality. Using the 3D functions, the team is creating 3D models for visualization and analysis of the designs to ensure they meet the exacting standards for safety and economy.

### Sources of Capital

Taikang Asset Management Corp., a state-owned insurance assets management corporation, created in May 2006, will facilitate the insurance companies to invest in the project with debt investment. The debt may be changed into shares from the railway’s operating company once the project is completed, Xinhua reported. According to the Beijing Review, the unprecedented capital investment is expected to be recovered within 14 years at most.

### Assets Creation

Investment into the Beijing-Shanghai high-speed railway will be creating fixed and mobile



The Rail Route

facilities and the electronic control system, which is shared at 40% for fixed and more than 50% for mobile and electronic control systems.

Fixed facilities include assets such as construction of bridges, railway beds, tunnels and railway stations, suppliers of related construction materials, equipment. Mobile facilities include rolling stock. Computer hardware, software including electronic control systems and signal and telecommunication equipment, cables and fiber optics form the remaining scope of the project supplies.

### Economic Impacts

The Beijing and Shanghai Hi-speed rail runs through the municipalities of Beijing, Tianjin and Shanghai and the four provinces of Hebei, Shandong, Anhui and Jiangsu. The network connects the largest economic areas of China: the Bohai rim economic sphere and the Yangtze River economic zone. As there would be dedicated freight and passenger lines moving at half of existing traveling time, these economic bases would readily connect and mutually contribute to the overall economic development, skill and labour exchange. ICA

## PROJECT CREDITS:

- Operator:** Chinese Ministry of Railways
- Signal Technology & Equipments:** Siemens
- Design Organisation:** EDI
- Software Solutions:** Bentley Systems Inc.

### References:

Xinhua; [http://www.bjreview.com.cn/quotes/txt/2007-09/30/content\\_78543\\_2.htm](http://www.bjreview.com.cn/quotes/txt/2007-09/30/content_78543_2.htm); <http://chinadigitaltimes.net>; <http://www.railway-technology.com/projects/beijing/>

