FIDIC Centenary Awards
Nomination Form

Please enter all information requested below for each entry (signatures by the submitting firm(s) and the client(s)/owner(s) are required). Names and information should be typed or printed.
Applications should be accompanied by up to 5 photographs (JPG format) of the project being nominated.

Please return this form by email as PDF for the attention of Italo Goyzueta, FIDIC Deputy Director at igoyzueta@fidic.org or by Fax at +41 22 799 4900

Note: Only FIDIC Members can submit nominations.

THE PROJECT

Project Name: The Tokaido Shinkansen

(as it is to appear in the award)

Project Location

Country: Japan

City: Major cities along Tokaido Line: Tokyo, Nagoya, Osaka

Purpose: Construction of high speed train (Tokaido Shinkansen)

Year of completion: 1964

FIDIC Member submitting the nomination

FIDIC Member, Association of Japanese Consulting Engineers (AJCE)

(name of the association or firm submitting the nomination)

hereby authorises submission of this project into the FIDIC Centenary Awards call for nominations.

Name of President or Managing Director: Noriaki Hirose

Title: President

Date and signature: Sept. 6, 2012, [signature]

Address (no P.O. Box): 3-16-4, Ueno Taito-ku

City: Tokyo

Postal code: 110-0005

Country: Japan

Phone (with country code): +81 3 3839 8471

Fax: +81 3 3839 8472

E-mail: info@ajce.or.jp

Please tick beside the applicable options to confirm that this project is:

- ☑ Internationally recognised
- ☑ Demonstrate technical excellence
- ☑ Demonstrate innovation
- ☑ Is enduring and sustainable

Why do you think this project should receive an award? How does it meet the criteria of being internationally recognised, demonstrating technical excellence and innovation and being enduring and sustainable? Please use additional paper sheets if needed.

Please refer to the attached sheet for details

THE FIRM(S) SUBMITTING THE PROJECT

Firm(s): Central Japan Railway Company

Firm CEO: Tsutomu Morimura

Firm Representative: Shun-ichi Kosuge

Firm (s) Contact details

Address (no P.O. Box): 2-1-85 Konan, Minato-ku

City: Tokyo Postal code 108-8204

Country: Japan

Phone (with country code): +81 3 6711 9570

Mobile:

Fax: +81 3 6711 9707

E-mail: kosuge@jr-central. co.jp

Reason Why Owner and Firm are Same Entity

Tokaido Shinkansen was planned, designed and constructed by wisdom and efforts of the Japan National Railway (JNR)'s in-house engineers. It was developed and operated by responding the demands of the times by speeding up and increasing carrying capacity since its operation in 1964. It has greatly contributed to the development of economy in Japan.

Despite of these efforts, financial condition of JNR declined every year.
In April 1987, following privatization of JNR, it was separated into 7 private entities; 6 regional groups and one freight company, to improve its financial condition.

As the results of privatization, operation and management of Tokaido Shinkansen has handed over to new company, JR Central. In-house engineers of JR Central (previously JNR engineers) have been continuously exerting their efforts on research and development for the improved service of Shinkansen.

It can be seen from the history of Tokaido Shinkansen, shifting its operation and management from JNR (national entity) to JR Central (private entity), owner and firm are same body and can't be separated.

FIDIC 1913-2013 CENTENARY AWARDS

THE CLIENT/OWNER(S) OF THE PROJECT

Client/Owner(s): Central Japan Railway Company

hereby grant permission to enter the above mentioned project in the FIDIC Centenary Awards competition and authorise promotion and publication of its outstanding aspects according to the aims and conditions of the Awards.

Name of President or Managing Director: Tsutomu Morimura

Title: Executive Vice President

Date and signature: Sept, 6, 2012 Tsutomu Morimura

Client/Owner (s) Contact details

Address (no P.O. Box): 2-1-85, Konan, Minato-ku

City: Tokyo Postal code: 108-8204

Country: Japan

Phone (with country code): +81 3 6711 9570

Fax: +81 3 6711 9707

E-mail: kosuge@jr-central.co.jp

The Tokaido Shinkansen

Brief Summary

The Tokaido Shinkansen (hereinafter called as "Shinkansen") connects Japan's two largest cities, Tokyo and Osaka via Nagoya and it serves as Japan's main transportation artery. It was designed as the world's most advanced railways with the concept of total system engineering, i.e., civil, electrical, and mechanical engineering to operate massive transportation and high speed at 210km/h, a world record when it began service in 1964. The name "Shinkansen" has two meanings, "Shin" is new, "kansen" is trunk line. Now this name is well-known in the world.

Since its inauguration of 48 years ago, it has carried over 5,200 million passengers without any fatalities or injuries due to train accidents such as derailment or collision in commercial operations. It currently provides 323 trains daily at the maximum speed of 270 km/h with punctuality; the annual average deviation from schedule, including delays caused by uncontrollable reasons such as heavy rain, typhoon, and heavy snowfall is 0.6 minutes per train. Continuous research and development for durable and sustainable operation of Shinkansen are the basis in these achievements. Shinkansen has been contributing greatly not only for economical, and technical achievement in Japan but also has played a leading role in the development of high-speed trains in the world.

Train Series 0 (at opening)

Train Series N700 (at present)

1. Birth of Shinkansen

Despite of the area covered by Shinkansen is about 20 % of entire land of Japan, three major industrial cities, Tokyo, Nagoya and Osaka, are connected on one line and concentrated in this highly populated area. Demand for construction of rapid railway was high in 1950s when economic growth was steadily increasing due to reconstruction after World War II. Due to increasing transportation demand, Tokaido railway exceeded its capacity limit.

To cope with this challenge, high speed Shinkansen was designed that operates on wider-gauge and able to transport passengers between Tokyo and Osaka in 3 hours at maximum speed of 200 km/h. In 1958, construction of Shinkansen was approved by the Japanese government.

2. Spillover effect of Shinkansen

After recognition of successful operation of Shinkansen, developed countries in Europe have started research and development for high speed trains that run faster than 200 km/h. France has constructed TGV-PSE between Paris and Lyon at the maximum speed of 260 km/h in 1981. Starting from France, waves of high speed trains have spread over Europe and have expanded to cross border high speed train network in Europe. Besides the development in Europe, high speed trains have stated operation in Asian countries such as Korea, Taiwan and China　Based on these development in the world, Shinkansen has been appraised a pioneer of high speed trains.

3. Financial Aspect of Construction

Following the Japanese government's Approval, Japan National Railway (predecessor of JR Central)

started construction of Shinkansen in 1959 by introducing up-to-date technologies.

Since the start of construction, long-span tunnels and bridges were considered as the first priority as they affect completion period. However, land acquisition was the bottle neck of the construction as it took about 5 years and increased construction cost by 2 times. Financial resources of the construction were Japan National Railway's own budget, transportation bonds endorsed by government and a loan from the World Bank. National government did not allocate construction budget.

Finance by the World Bank

At time of Shinkansen construction, the World Bank (hereinafter "WB") was reluctant to finance train project. Despite of WB's policy, Japanese government and Japan National Railway explained to WB that Shinkansen project can cope with increased freight transport capacity and high-speed trains for effectively transporting passengers in Tokaido railway, thus cost effective. In May 1960, WB delegated study team to Japan to examine economical and technical feasibility of the project as well as to review competence in railway technology. Based on the study results, WB financed US 80 million dollars to Shinkansen project in May 1961. Later, WB reported that Shinkansen project used loan most effectively among many loan agreements.

4. World Recognition

The Central Japan Railway Company (hereinafter called as "JR Central") has received the two internationally honorable awards regarding Shinkansen,

1) "Electrical Engineering Milestones"

The award was established by the Institute of Electrical and Electronics Engineers (IEEE) in 1983 to honor important historic achievement in the field of electrical and electronic engineering. The award was given to Shinkansen on July 13th, 2000.

2) The Landmarks in Mechanical Engineering

The award was established by the American Society of Mechanical Engineers (ASME) in 1971 to honor important and historic achievements in the field of mechanical engineering. The award was given to the Shinkansen for the first time to Japan on July 13th, 2000.

There have been only four times that these two awards were given to same achievement since the award was established in 1971. This double award signifies the international recognition bestowed on the advanced technology applied to the Shinkansen.

In addition to the above awards, Shinkansen was given the Brunel Award in 1989 for excellent coloring design on maintenance & inspection vehicles, and the Special Award from the US High Speed Association in 1988 for its 25 years achievement since its inauguration.

5. Technical Excellence and Innovation

JR Central has been continuously exerting efforts to achieve advanced electrical and mechanical engineerings for Shinkansen to provide safe, reliable and comfortable service to passengers. Major technical excellence and innovation are briefly introduced in the followings:

(1) Embankment and Roadbed

As most of railway runs on relatively flat land, cutting off sections are not many except for hilly zone. There are no level crossings (all are grade-separated crossings), level of embankment sections is approximately 6-7 m in height. Length of embankment sections is about 227 km, 44% of entire route, whereas that of cutting-off sections is about 48 km, 9% of entire route.

Roadbed affects greatly to construction cost, maintenance of railways and smooth operation of Shinkansen. In design and construction of railway bed, following requirements were imposed:

- i) Surface layer of the roadbed does not collapse due to mud-pumping and dent
- ii) land subsidence coefficient is above the threshold
- iii) rate of continuous land subsidence is less than threshold

Based on these requirements, liquid limit, plasticity index, bearing capacity factor of railway bed were specified. If necessary, sub-ballasts are added for evenly distributing pressure on railway bed. In addition, 3% of inclination was made on the roadbed surface to enhance discharge of water as well as to reduce dent on roadbed.

In soft ground, replacement of soft soil by firm soil and sand-drain treatment were applied.

In addition, as there are many grade-separated crossings, interface between bridge- structures and embankments are evenly constructed by avoiding discontinuous uneven settlement.

(2) Curve Radius and Gradient

To secure safe operation of Shinkansen, straight line and large curve radius were selected for railways route. Areas where slow operations are required such as Tokyo metropolitan area, curve radius of greater than 2,500 m are imposed. There are 247 curved sections in the entire route whose total length is about 215 km, 42 % of entire route.

Typical gradient of roadbed is designed up to 15‰ to prevent electric motors from high operational temperature. Higher gradient of 20‰ was allowed for a distance within 1 km.

(3) Bridges and Tunnels

A total length of long-span bridges is about 21 km, 4% of entire route in which 9 bridges exceed 500 m in length whereas the longest one is 1,374m. In designing the bridges, standard design was employed to minimize construction period and cost. Common structural components were such as RC concrete girder (2-30m）, PC girder(8-35 m）, Plate girder(10-35 m), Composite girder (10-35 m), Steel girder (3 x 60m, 1 x 60m), etc.

As Shinkansen runs in highly populated areas, elevated railway track were constructed to reduce land acquisition cost. Space under the elevated track is used for public and commercial use. A total length of elevated tracks is about 151 km, 29% of entire route.

There are 67 tunnels with a total length of 68 km, 13% of entire route, in which 12 tunnels exceed 2 km in length, whereas the longest one is 7,959 m.

The longest bridge(Fuji River)

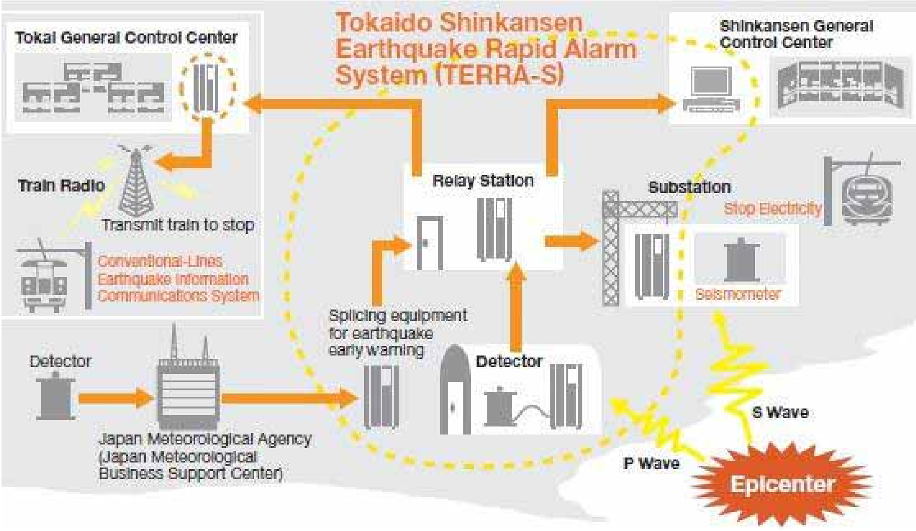
The longest tunnel (Tanna)

(4) Safety

No passenger fatalities or injuries due to train accidents such as derailment or collision in commercial train operations in 48 years of service.

1) TERRA-S (Tokaido Shinkansen Earthquake Rapid Alarm System)

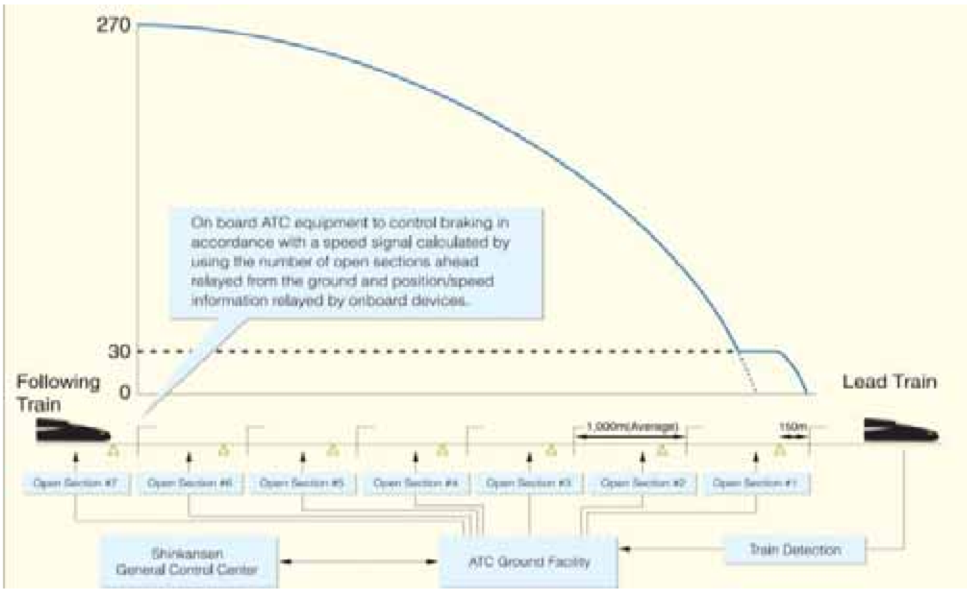
TERRA-S detects P-wave (Primary, longitudinal waves) which travel faster than S-waves (Secondary, transverse waves), and makes real time computation to identify scale of earthquake and distance to the epicenter. This system estimates the extent of damage, before issuing a warning. Detection of a large-scale earthquake will lead to immediate termination of power transmission to safely bring all train operations to a halt. A total of 21 detection points have been set up to ensure full coverage of the Shinkansen route, and to also provide information to train services for conventional lines.



Train Control System in the Case of Earthquakes(TERRA-S)

2) Automatic Train Control (ATC)

This system ensures smoother "one-step" braking from full speed to full stop. This smoother break control improves ride quality and also shortens stopping distance. ATC allows greater flexibility and efficiency in train diagram as well.



ATC (Automatic Train Control)

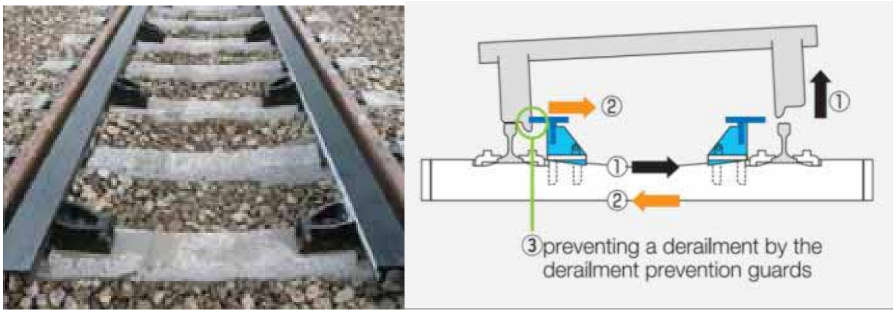
3) No level Crossings

No level crossings throughout the railway. This prevents from collisions as well as to assure smooth operation.

4) Countermeasures against Derailment

Shinkansen employs derailment measures as new earthquake prevention countermeasures since Oct. 2009. "Derailment prevention guards" are installed parallel to and inside of rails for minimizing

deviation of wheels from rails during earthquake to prevent vehicles from derailment.



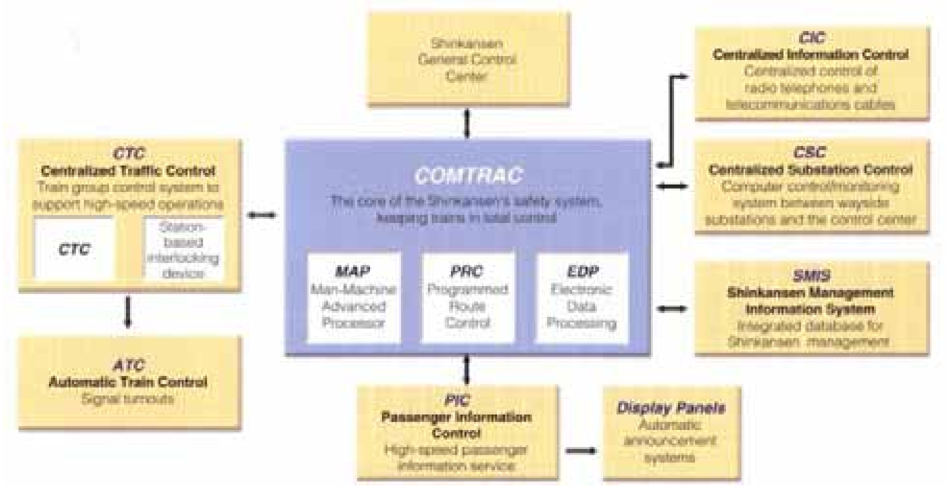
Derailment Prevention Guards

(5) Reliability

As described in brief summary, annual average deviation from schedule is 0.6 minutes per train.

1) Computer Aided Traffic Control (COMTRAC)

COMTRAC integrates various control systems such as Centralized Traffic Control (CTC), Automatic Train Control (ATC), Centralized Information Control (CIC), Central Substation Control (CSC) and Shinkansen Management Information System (SMIS). This system guarantees safe, reliable and smooth operation of Shinkansen.



COMTRAC(Computer Aided Traffic Control)

(6) High Speed

Shinkansen achieved the world’s first high-speed operations up to 210km/h in 1964. Latest models have been keeping high performance (max. operating speed:270km/h) in comparison with other foreign high-speed railways subsequently developed in Europe such as TGV (France)and ICE (Germany).

(7) High Performance in carrying Passengers

Shinkansen operates 323 trains/day and 143 million passengers/year.

(8) Efficient Maintenance System

In September 2001, JR Central introduced a new High-Speed Multiple Inspection Train, called as "Doctor Yellow". This employs state-of-the-art technology that is capable of taking necessary measurements on the track and catenaries while travelling at a speed of 270km/h and will underpin the safety and reliability of the Shinkansen corridor.

Dr.Yellow(Multiple Inspection Train)

(9) Cutting Edge Rolling Stocks

Since its first operation in1964, Shinkansen has been introducing state-of-the-art technology in rolling stocks (vehicles).So-called Series "0" (period: 1964-1999) operated at the max. speed of 210 km/h amazingly fast record at that time. The second generation, Series "100" (period: 1985-2003) improved interior accommodation. The third generation, Series "300" (period 1992-1999) achieved 270 km/h by developing light and durable body and efficient motor. The fourth generation, Series "700" (period: 1999-present) further improved performance. The fifth generation, Series "N700" (period: 2007 to present) at maximum speed of 270 km/h has achieved 32% reduction in electricity consumption as compared with that of Series "0" operated at maximum speed of 210 km/h. This advancement is made possible by following technological innovation:

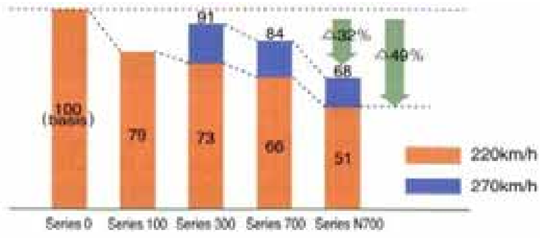
i) forefront nose- attain optimum aerodynamic performance at high speed,

ii) low-noise pantograph covered by streamlined body,

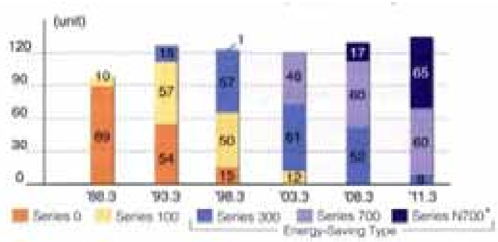
iii) anti-vibration control device,

iv) body inclination device that allows vehicles to operate without reducing speed at curved sections,

v) brake regeneration system that uses the motor as a generator to convert kinetic energy into electric power when braking and then returns it to the overhead contact wires for other train to use.



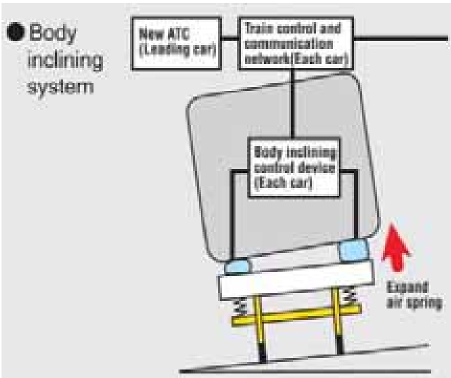
Energy Consumption Level of Shinkansen Trains



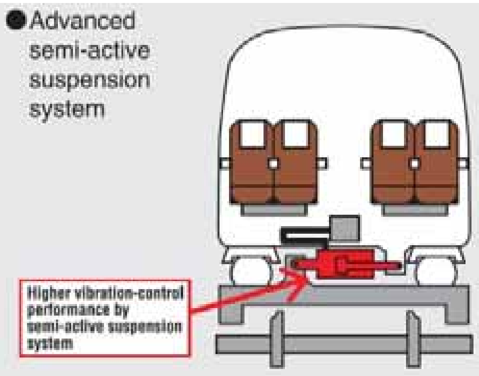
Introduction of New Energy-Saving Type Rolling Stock

Nose shape(Aero Double-Wing)

Low Noise Pantograph



Body inclining system



Advanced semi-active suspension system

6. Durability and Sustainability

(1) Continuous operation

It should be noted again that Shinkansen has carried over 5,200 million passengers without any fatalities or injuries since its operation in1964.

(2) Environmental Considerations

1) Emission of Carbon dioxide

Emission of Carbon dioxide of the Series N700 trains (4.2 kg CO_2/seat) is about one twelfth of airplanes (49 kg CO_2/seat). This illustrates overwhelming advantage over airplanes.

2) Energy Efficiency

Shinkansen has increased its energy efficiency by introducing light and durable body, regenerative brake system, aerodynamically sound fore-front nose, high efficient power converter systems, controlled inclination system, efficient pantograph, etc.

7. Construction of New Major Sub-Terminal, Shinagawa Station

Transport capacity of Shinkansen has continuously increased since its operation in 1964. In 1991, it grew to 35% as compared with that of 1987 when JR Central has established. To keep high quality service and to cope with this increased demand for transport capacity, number of trains were increased. However, it did not solve increased demand for transport capacity. The major terminal, Tokyo station, could no longer respond to this demand but to construct new major sub-terminal, New Shinagawa Station, locating close to Tokyo station.

The sub-terminal is not only able to cope with increased transport capacity but also contribute for flexible operation of trains. This will prevent trains from delay in schedule. In October 2003, construction of New Shinagawa Station has increased convenience of passengers and has contributed greatly in the development of East Shinagawa district by accelerating existing ongoing construction.

Shinagawa Station

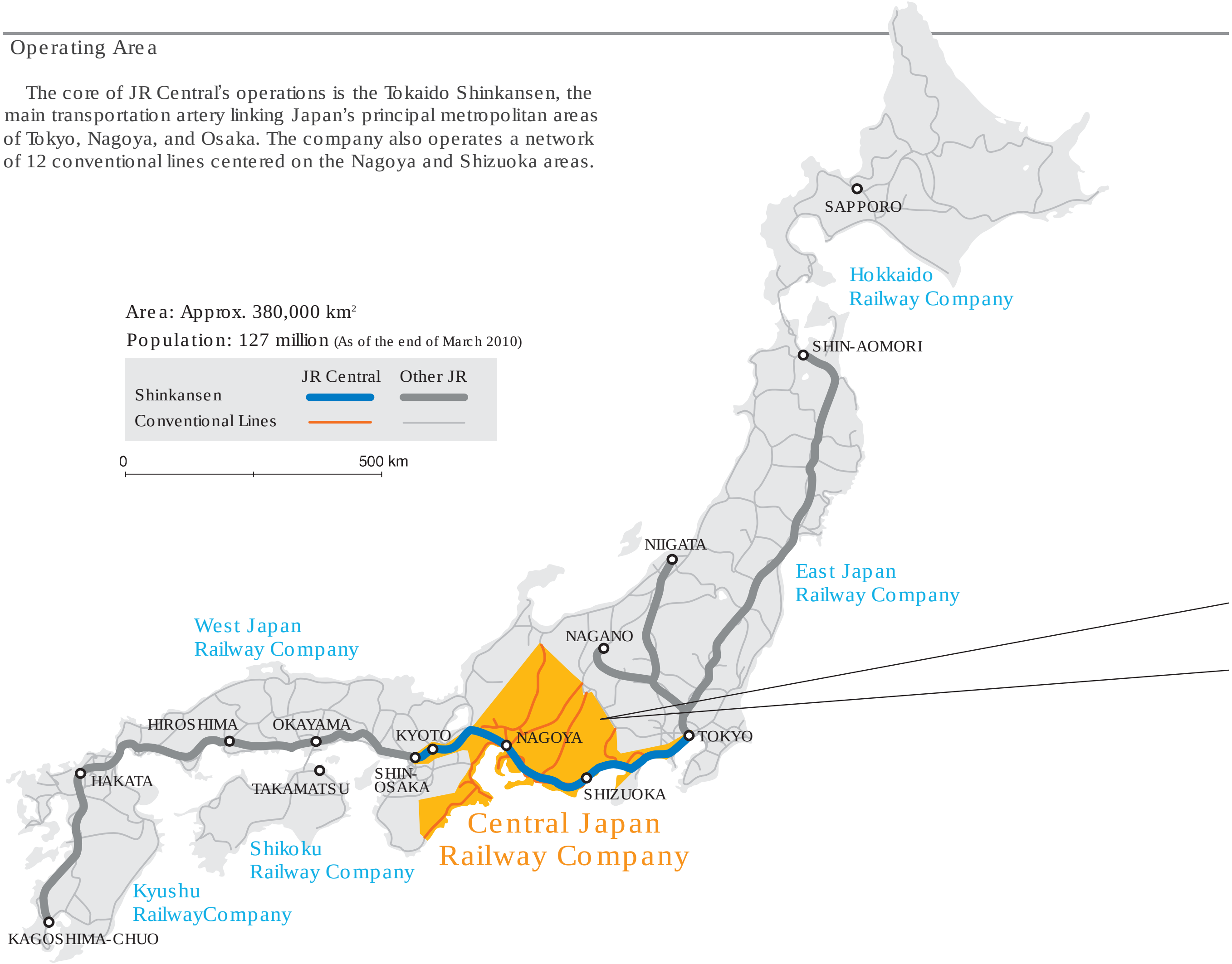
Based on the above facts and achievements, we recommend Shinkansen for FIDIC Centenary Award.

Appendix
Shinkansen Network in Japan
(Blue line : Tokaido Shinkansen)

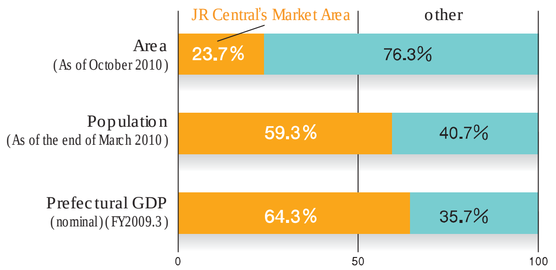
Corporate Data

Operating Area

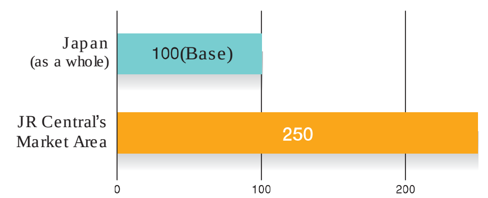
The core of JR Central's operations is the Tokaido Shinkansen, the main transportation artery linking Japan's principal metropolitan areas of Tokyo, Nagoya, and Osaka. The company also operates a network of 12 conventional lines centered on the Nagoya and Shizuoka areas.



● Percentages of Japan as a whole

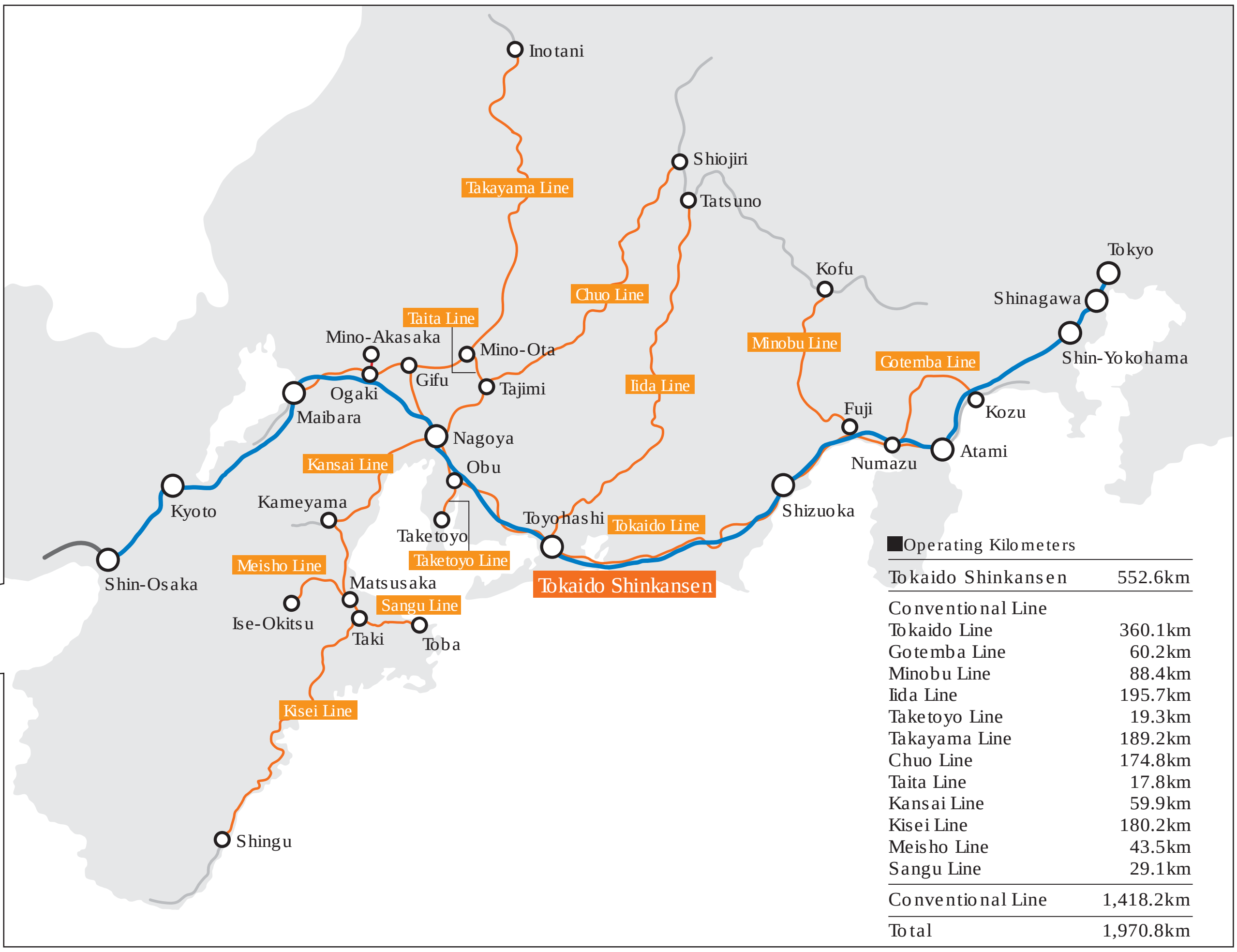


● Population Density (As of the end of March 2010)



Note : JR Central's market area includes the following prefectures:
Tokyo, Kanagawa, Chiba, Saitama, Ibaraki, Shizuoka, Yamanashi, Nagano, Aichi, Mie, Gifu, Shiga, Osaka, Kyoto, Hyogo, Nara
: Area data to calculate Population Density is as of October 2010
Sources : Area – Statistical Reports on the Land Area by Prefectures and Municipalities in Japan, Geospatial Information Authority of Japan
Population – Basic Resident Registration, Ministry of Internal Affairs and Communications
Prefectural GDP – Annual Report on Prefectural Accounts, Cabinet Office, Government of Japan

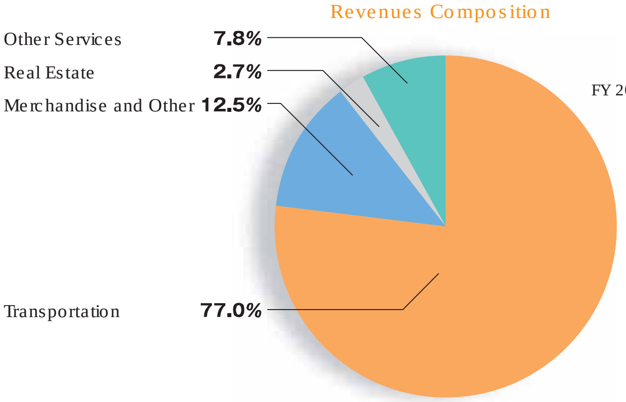
Appendix
Shinkansen Network in Japan
(Blue line : Tokaido Shinkansen)



■Operating Kilometers

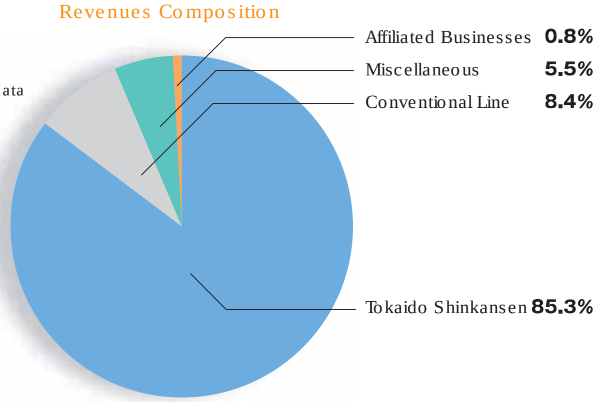
Tokaido Shinkansen	552.6km
Conventional Line	
Tokaido Line	360.1km
Gotemba Line	60.2km
Minobu Line	88.4km
Iida Line	195.7km
Taketoyo Line	19.3km
Takayama Line	189.2km
Chuo Line	174.8km
Taita Line	17.8km
Kansai Line	59.9km
Kisei Line	180.2km
Meisho Line	43.5km
Sangu Line	29.1km
Conventional Line	1,418.2km
Total	1,970.8km

Consolidated Operating Revenues Composition



FY 2011.3 data

Non-Consolidated Operating Revenues Composition



Note: Consolidated composition is based on the revenues from outside of JR Central's group