



INTERNATIONAL UNION
OF RAILWAYS

unity, solidarity, universality

High Speed system in Japan

Workshop on future TEN-T corridors
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Japanese high speed system: Shinkansen

- **Shinkansen**
- **Shinkansen Network and Operation**
- **Rolling stock**
- **Infrastructure**
- **Traffic volume**
- **Correlation of Tokaido Shinkansen**
- **Revenue**
- **Energy consumption**
- **Future**
- **Operating of High Speed and Freight**

Shinkansen

- Shinkansen = 'New trunk line'
- **First high speed rail system in the world (50 years history)**
Tokaido Shinkansen opened in 1st October on 1964
(maximum line speed was 210km/h)
to increase the capacity of the most congested Tokaido line
- **System** of high speed with concepts:
 - Dedicated high speed track** with 1435mm standard track gauge
 - closed system independent from the conventional line, no level crossing
 - Distributed power rolling stock (EMU)**
 - ATC** signaling system
 - Centralized traffic control system**
 - etc
 - > *high speed operation with high safety*
- **Maximum line speed: 240km/h – 320km/h**
- **Exceptional: Mini-Shinkansen**
upgraded lines from narrow gauge to standard gauge
operable through high speed line to conventional lines

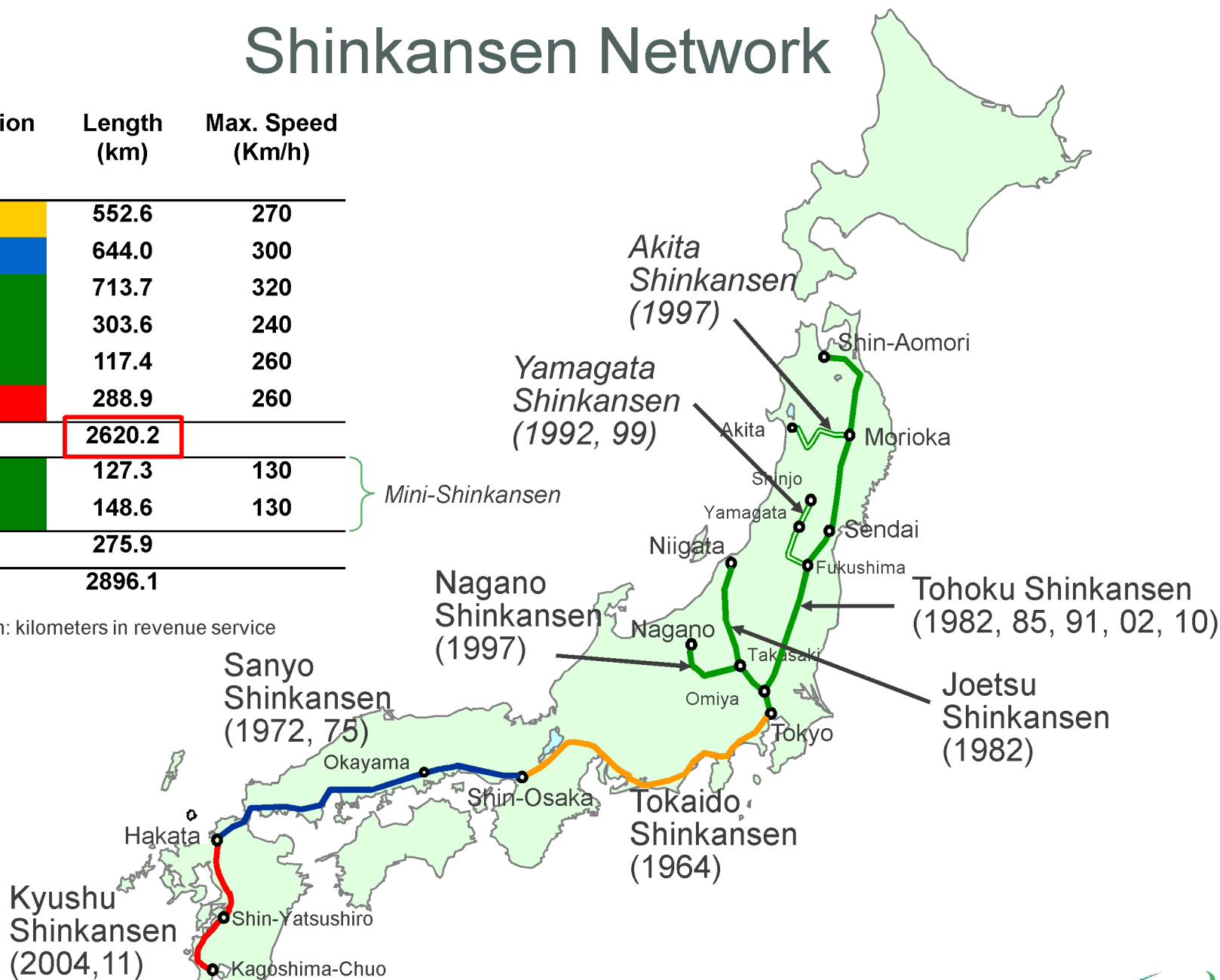


Series 0 (1964-2008)

Shinkansen Network

| Line Section | Length (km) | Max. Speed (Km/h) |
|------------------|---------------|-------------------|
| Tokaido | 552.6 | 270 |
| Sanyo | 644.0 | 300 |
| Tohoku | 713.7 | 320 |
| Joetsu | 303.6 | 240 |
| Nagano | 117.4 | 260 |
| Kyushu | 288.9 | 260 |
| Sub Total | 2620.2 | |
| Akita | 127.3 | 130 |
| Yamagata | 148.6 | 130 |
| Sub Total | 275.9 | |
| Total | 2896.1 | |

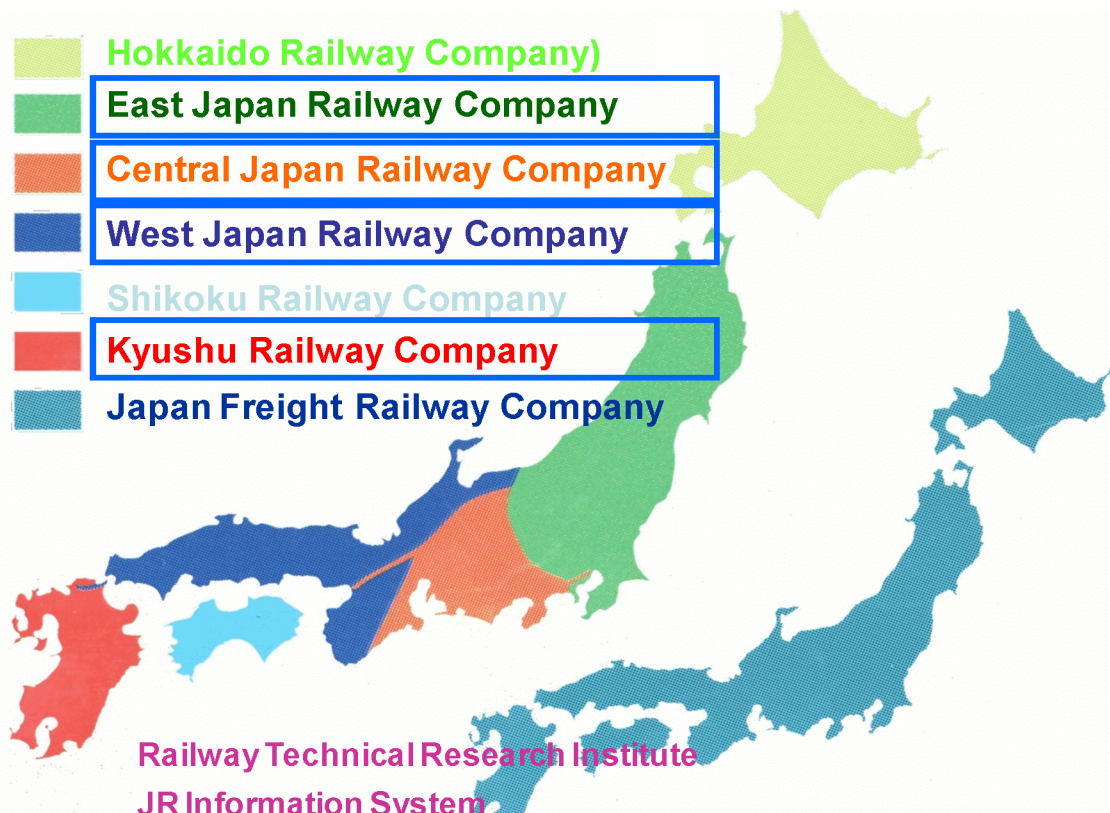
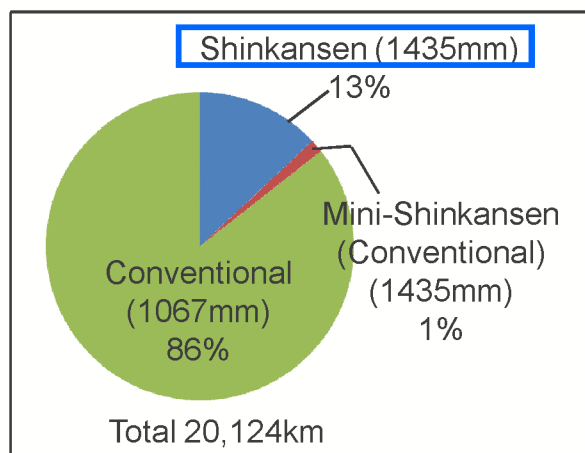
*Length: kilometers in revenue service



Shinkansen operation: JR companies

> **Privatized and geographically divided** from Japanese National Railways in 1987

6 passenger railway companies
+
1 freight railway company
+
Other companies

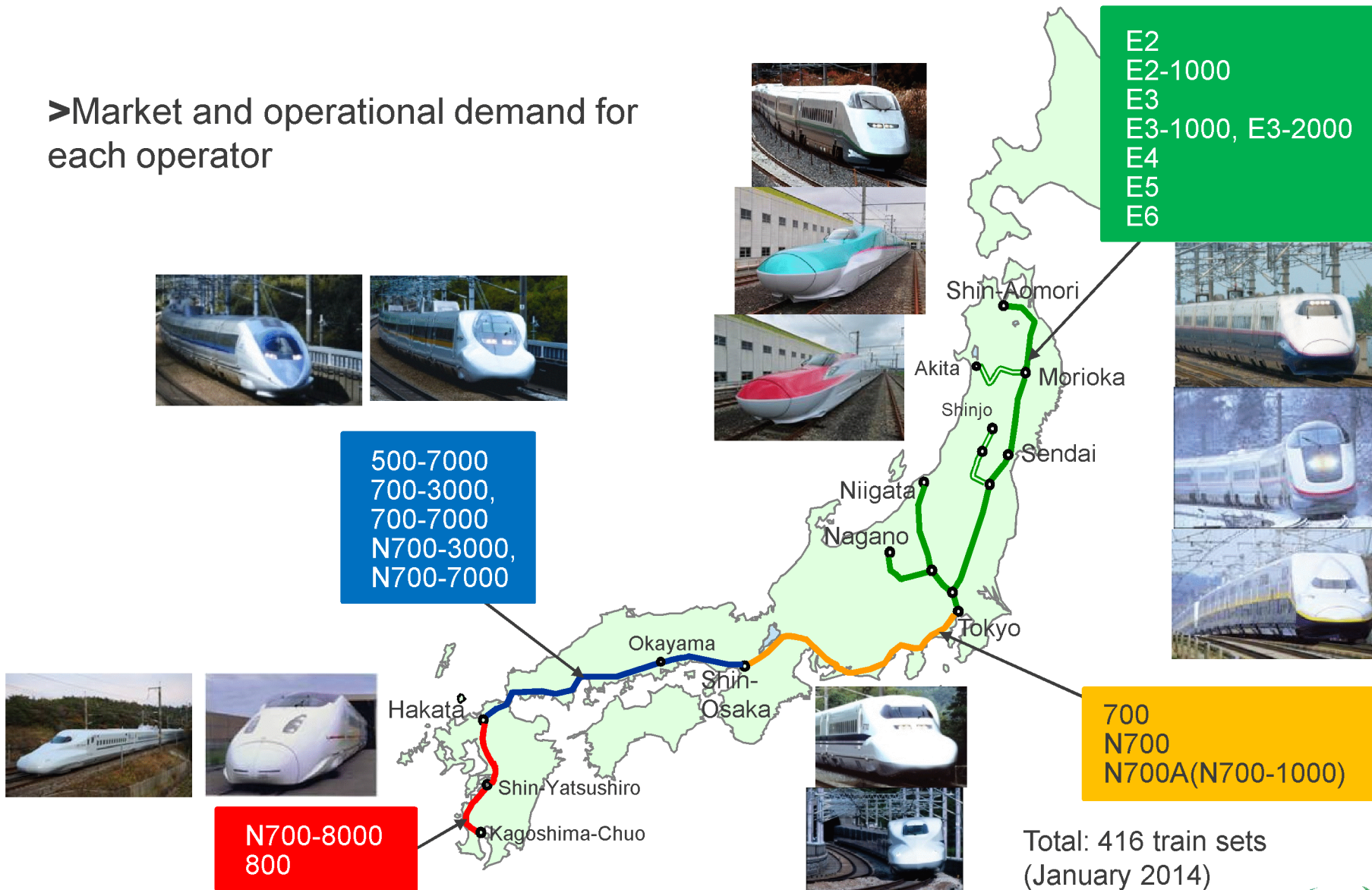


Railway Technical Research Institute
JR Information System
Japan Telecom (now, SoftBank Telecom)

> **Passenger companies own infrastructure**

Variety of Shinkansen rolling stock

➤Market and operational demand for each operator



Infrastructure



Tunnel
(Hokuriku Shinkansen)



Bridge
(Tohoku Shinkansen)



Viaduct
(Tohoku Shinkansen)



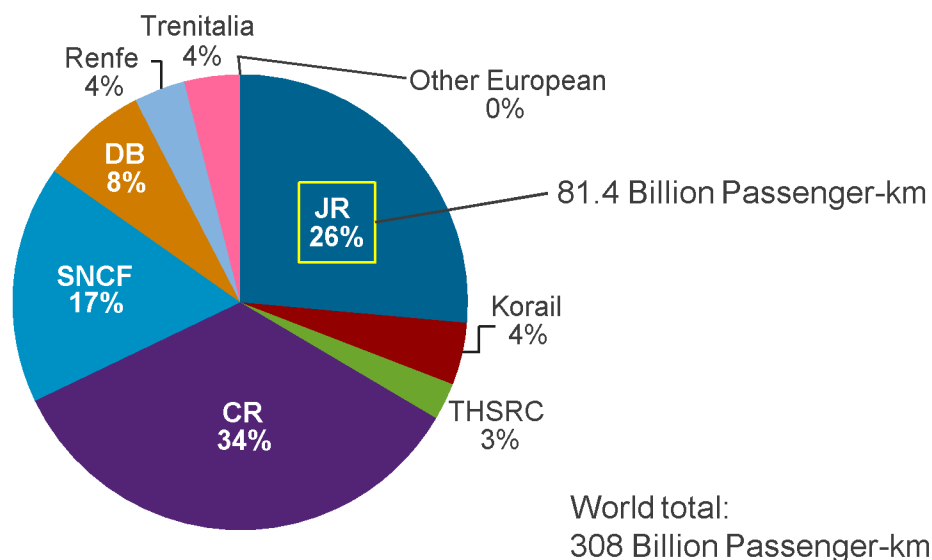
Earth Structure
(Kyushu Shinkansen)

Infrastructure

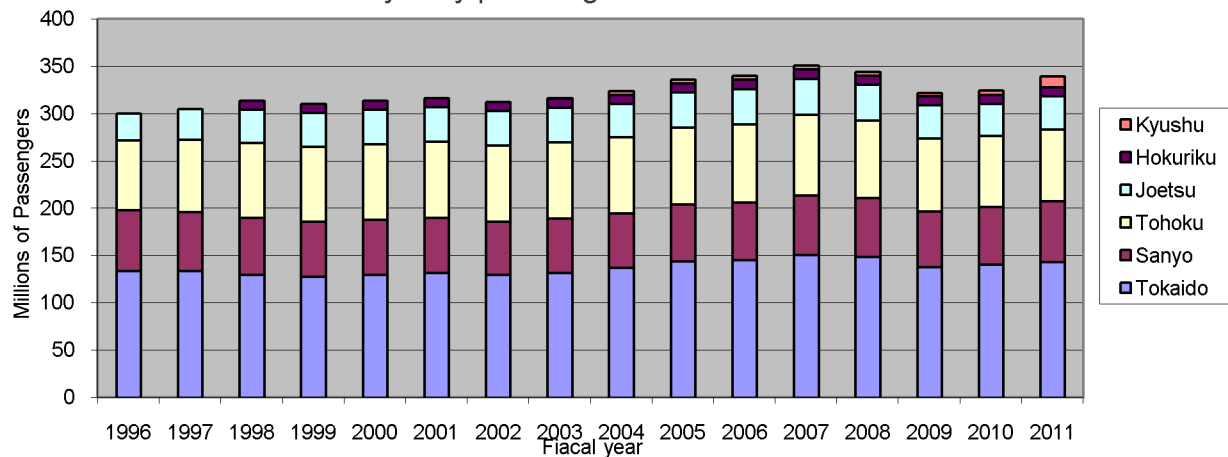
| Line name | Tokaido | Sanyo | Tohoku | Hokuriku |
|--|--------------------|------------------|-----------------|-------------------|
| Section of line | Tokyo - Shin-Osaka | Okayama - Hakata | Omiya - Morioka | Takasaki - Nagano |
| Year opened | 1964 | 1975 | 1982 | 1997 |
| Maximum speed (km/h) initial/present | 210/270 | 210/300 | 210/320 | 260/260 |
| Track gauge (mm) | 1435 | 1435 | 1435 | 1435 |
| Permissible axle weight (t) | 16 | 16 | 17 | 16 |
| Dominant Track type | Ballast | Slab | Slab | Slab |
| Distance between centers of main tracks (m) | 4.2 | 4.3 | 4.3 | 4.3 |
| Minimum curve radius (m) | 2500 | 4000 | 4000 | 4000 |
| Maximum designed cant (mm) | 200 | 200 | 180 | 200 |
| Cross section area of tunnel (m ²) | 60.5 | 63.4 | 63.4 | 63.4 |
| Maximum gradient (if needed) | 1.5% (2%) | 1.5% (2%) | 1.2% (1.5%) | 1.5% (3.5%) |
| Electrical power supply | AC25KV 60Hz | AC25KV 60Hz | AC25KV 50Hz | AC25KV 50/60Hz |
| Signal type | ATC (Digital) | ATC | ATC (Digital) | ATC |

Traffic Volume of Shinkansen

Passenger volume of high speed in the world (2011)

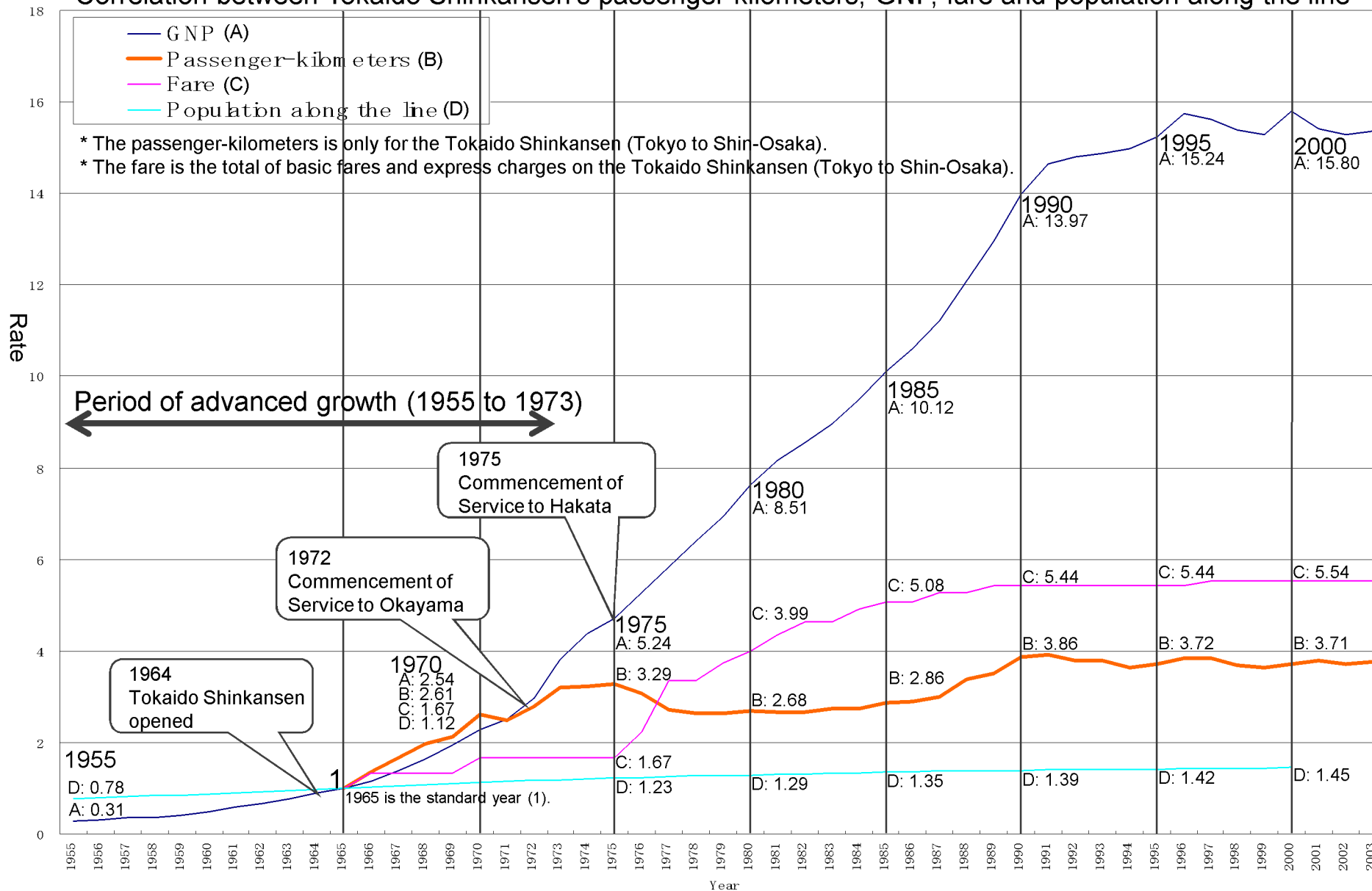


No. of yearly passengers for Shinkansen

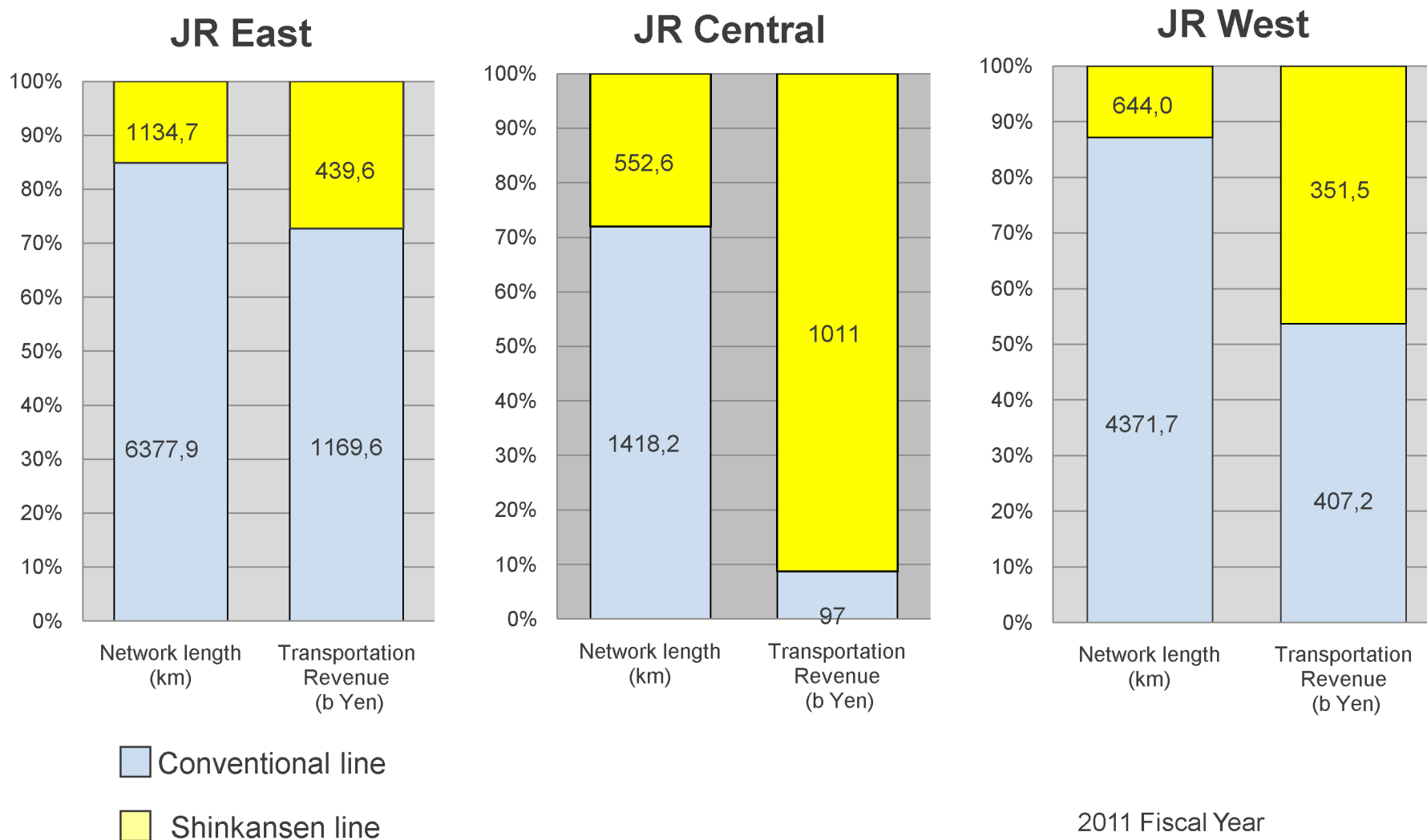


930 thousands passengers per day on average (2011 fiscal year)

Correlation between Tokaido Shinkansen's passenger-kilometers, GNP, fare and population along the line



Revenue of Shinkansen



Made from the data on JR East, JR Central, and JR West homepage.

Development (Energy consumption)

Series 200
(1982-2013)
12M



Energy consumption index

100

Maximum speed

240km/h

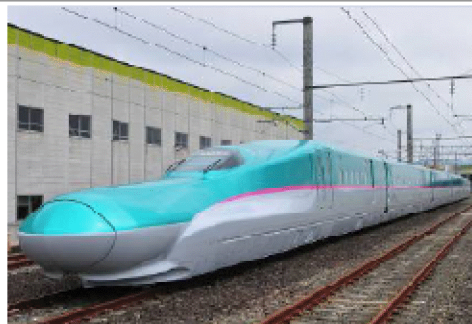
Series E2(1997-)
8M2T



69

275km/h

Series E5(2011-)
8M2T



67

320km/h

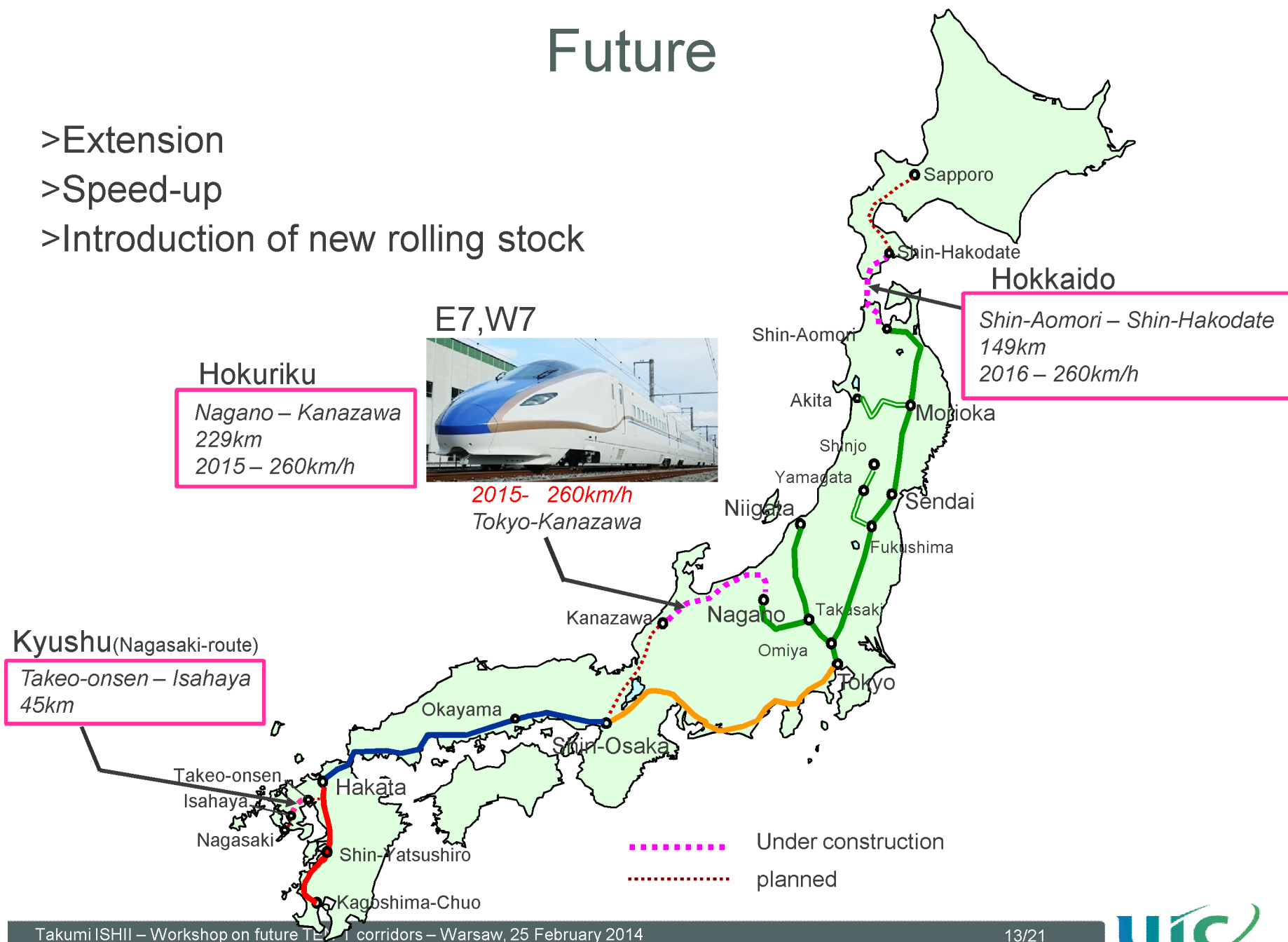
M: motor coach

T: trailer coach

Maximum speed: +80km/h Energy consumption:-33%

Future

- > Extension
- > Speed-up
- > Introduction of new rolling stock



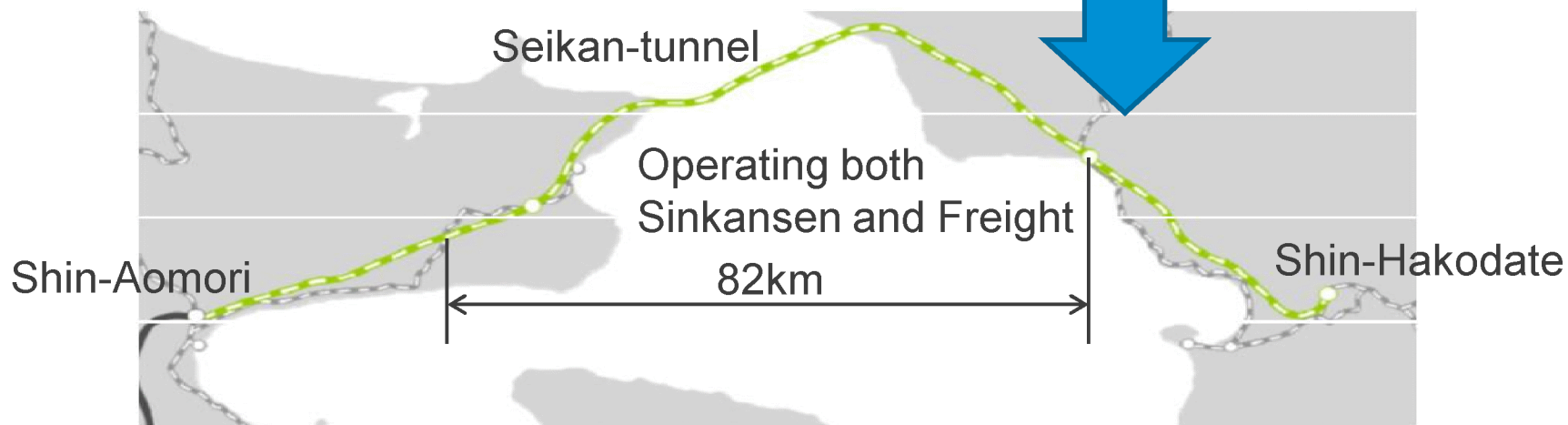
Operating of High Speed and Freight

▶ In Japan



Hokkaido

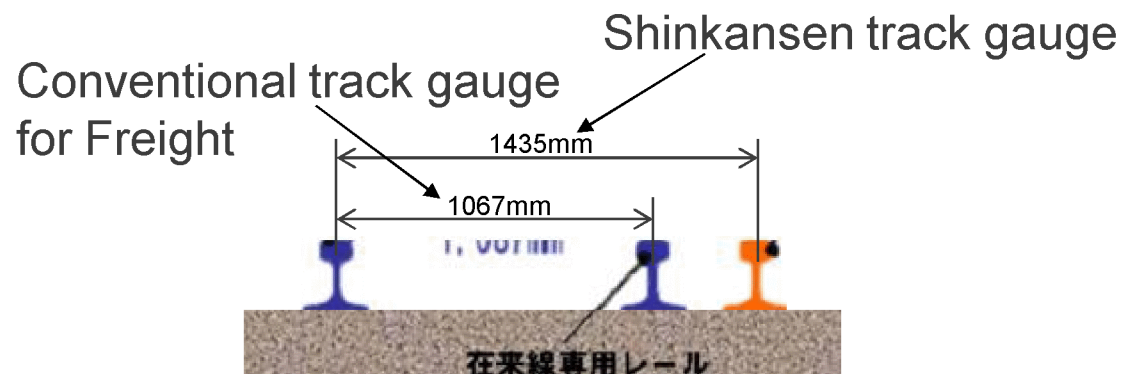
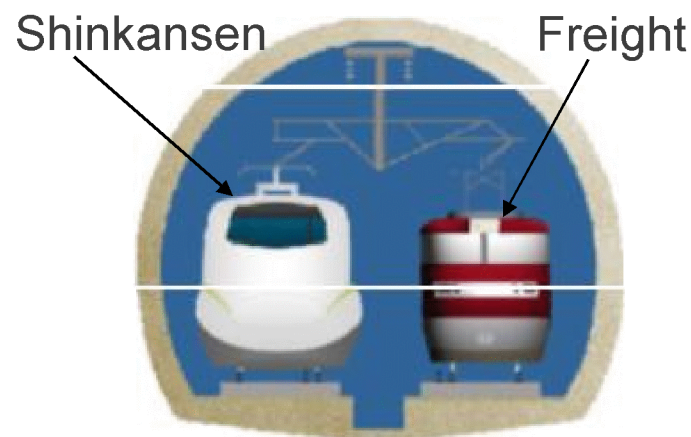
Shin-Aomori – Shin-Hakodate
149km
2016 – 260km/h



Operating of High Speed and Freight

▶ In Japan (Plan)

| | Japan |
|---|---|
| High Speed train | 260km/h※1 |
| Freight train | 140km/h |
| Passing each other between High Speed train and Freight train | Yes ※1 |
| Remark | <ul style="list-style-type: none"> •The operation between HS and Freight train will separate. <p>※1 260km/h operating of HS train will be only 2 hours in daly time. During the 2 hours, Freight train will not be operated. When the operation between HS and Freight train, Speed of HS will be 140km/h.</p> |



■ ■ ■ Thank you very much for your kind attention

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