



## G7 Transport Academic Workshop

# Reconstruction experience of rail infrastructure from Great East Japan Earthquake 2011

**Soichiro Minami**

Policy Research Institute for Land, Infrastructure, Transport and Tourism

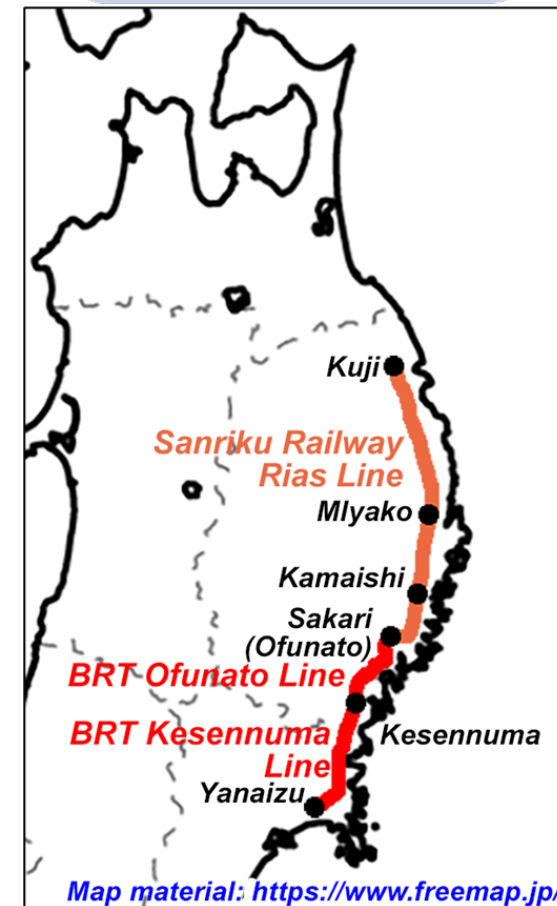
Wednesday, 10<sup>th</sup> April 2024 - Aula Magna "Carassa e Dadda"  
Politecnico di Milano, Bovisa Campus, Milan (Italy)

## Table of Contents

This slide shows the case of the Sanriku region, where the railroad infrastructure was severely damaged by the tsunami.

- 1. Damage of Rail infrastructure from Great East Japan Earthquake**
- 2. Case of Converted to BRT system from Rail Infrastructure**
- 3. Case of Reconstruction by Regional Rail Company**
- 4. Fiscal System and Resilience of Public Transport – as a Conclusion**

Rail map of Sanriku

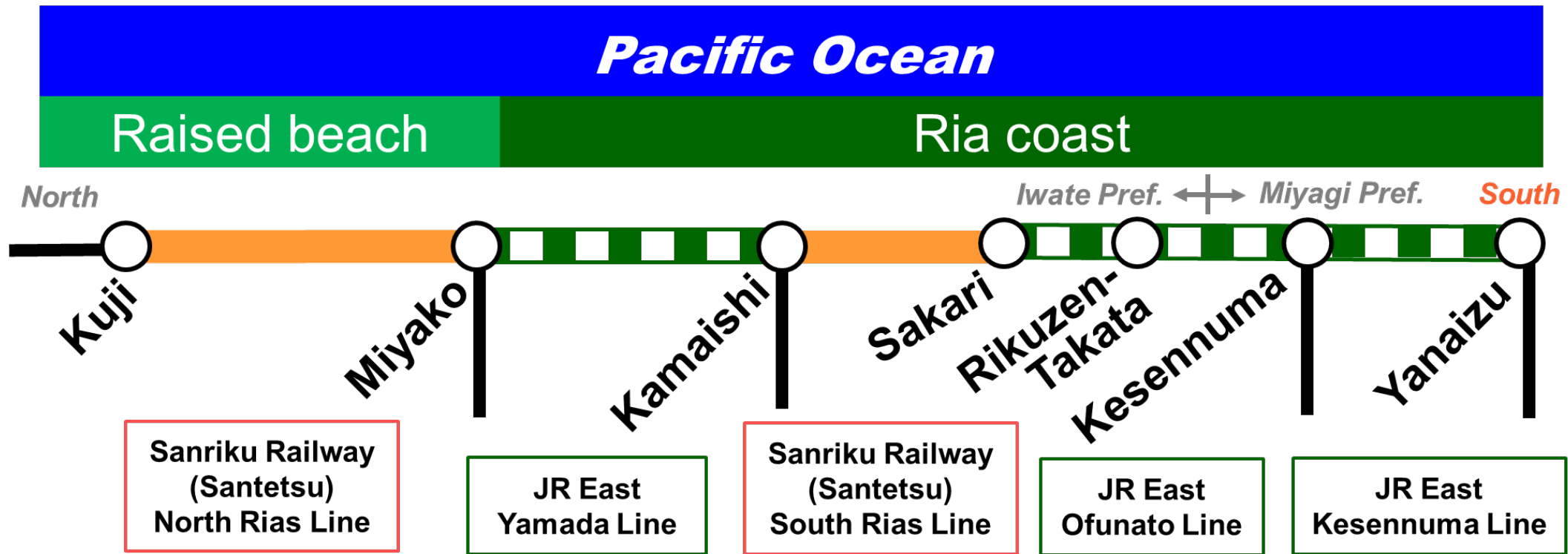


# 1, Damage of Rail infrastructure from Great East Japan Earthquake



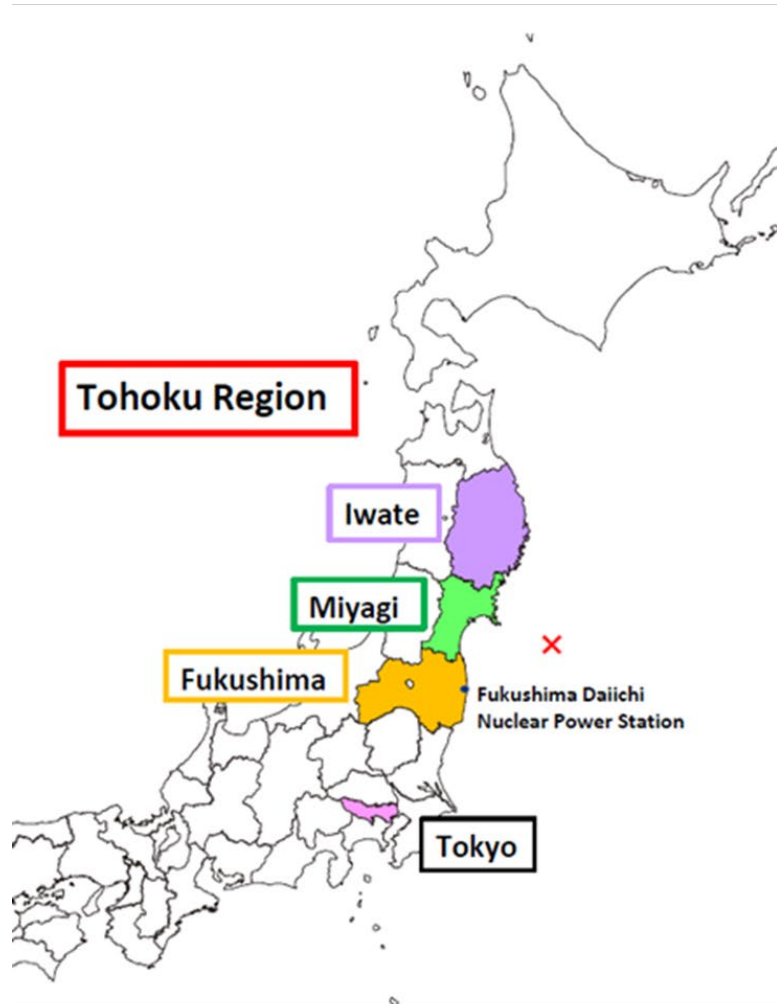
Copyright© Tohoku District Transport Bureau

# Rail Lines in Sanriku before Earthquake



- There are two rail operators in the Sanriku region: JR East, which took over from Japan National Railways (JNR), and Sanriku Railway, a regional rail company.
- Sanriku Railway (Santetsu) is a company that operates branch lines separated from JNR in the 1980s, and its shareholders are local governments.

# Great East Japan Earthquake



## The Great East Japan Earthquake

- Name: The 2011 Great East Japan Earthquake
- Date and Time: 11 March 2011, 14:46 JST (05:46 UTC)
- Hypocenter: 38° 6.2'N, 142° 51.6'E (130km ESE off Oshika Peninsula),
- Depth 24km
- Magnitude: 9.0 (the largest earthquake recorded in Japan)
- JMA Seismic Intensity: 7 (max: Kurihara City, Miyagi Prefecture)

## Casualties and Damages

### Human Casualties

- Deceased: 19,729
- Missing: 2,559
- Injured: 6,233

### Damaged Buildings

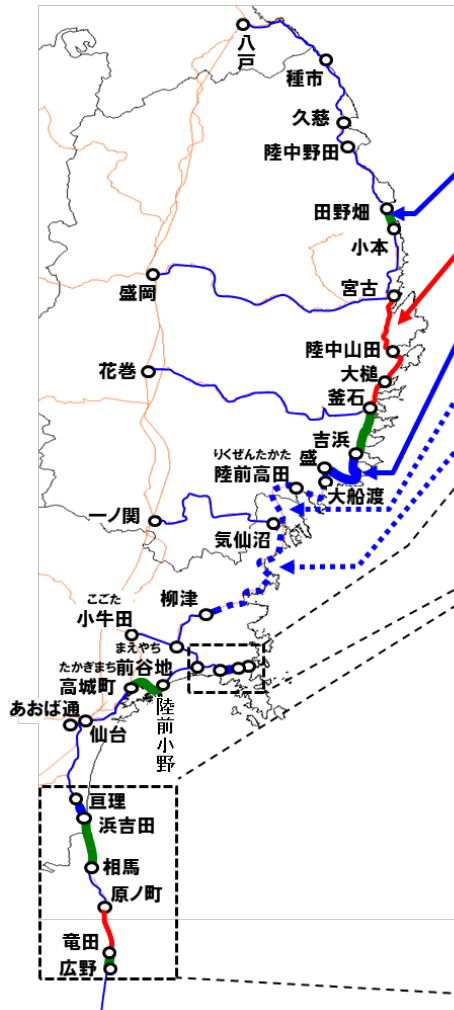
- Completely destroyed: 121,996
- Half destroyed: 282,941
- Partially Destroyed: 748,461

Source: Reconstruction Agency

# Damage of Rail Infrastructure and situation of 1<sup>st</sup> June 2014

Total length of damaged areas in Iwate, Miyagi and Fukushima prefectures: 2350.9 km

- Resumed operation: 2113.7km  
Of which, 67.1 km resumed operation after December 2012
- Suspended sections 237.2km  
Of which, 99.0 km is the section of BRT temporarily reopened after December 2012



**Sanriku Railway North Rias Line**

- Tanohata~Omoto(10.5km): April 6 2013 resume operation

**JR Yamada Line**

- Miyako~Kamaishi(55.4km): JR Yamada Line Reconstruction Coordination Meeting is currently discussing how to respond.

**Sanriku Railway South Rias Line**

- Yoshihama~Sakari(21.6km): April 3 2013 resume operation

**JR Ofunato Line**

- Sakari~Kesennuma(43.7km)  
: Temporary restoration by BRT is put into service.(March 2

**JR Kesennuma Line**

- Kesennuma~Yanaidu(55.3km)  
: Temporary restoration by BRT is put into service.(Dec 22 2012)

**JR Ishinomaki Line**

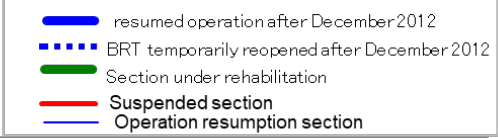
- Watanoha~Urajuku(6.5km): March 16 2013 resume operation

**JR Joban Line**

- Watari~Hamayoshida(5.0km)  
: March 16 2013 resume operation

**JR Joban Line(evacuation area)**

- Haranomachi~Tatsuta (46.0km)  
: JR Joban Line Restoration policy is under consideration by the "Study Team for Restoration
- Tatsuta~Hirono (8.5km)  
: June 1 2014 resume operation



※BRT: A rapid transit system that runs buses on bus-only roads, etc.

Source: Reconstruction Agency

# 2, Case of Converted to BRT system from Rail Infrastructure



---

## Deficit rail lines affected.

- Three Rail lines section of JR East company was severely damaged. As all of them were deficit line, JR East wouldn't like to continue running these rail lines as its own line.
- JR East propose municipalities to temporarily rehabilitate these three section with the BRT (Bus Rapid Transit) system. This is a way to pave the tsunami-devastated railroad track site and turn it into a dedicated bus lane.
- JR East think that BRT system is cheaper than rail system both in operating costs and infrastructure management costs. In addition, BRTs can travel on public roads in sections where there are no dedicated lanes.
- At Ofunato line and Kesennuma line, municipalilites accept temporarily rehabilitation as a BRT.
- BRT has been in operation since 2012.



---

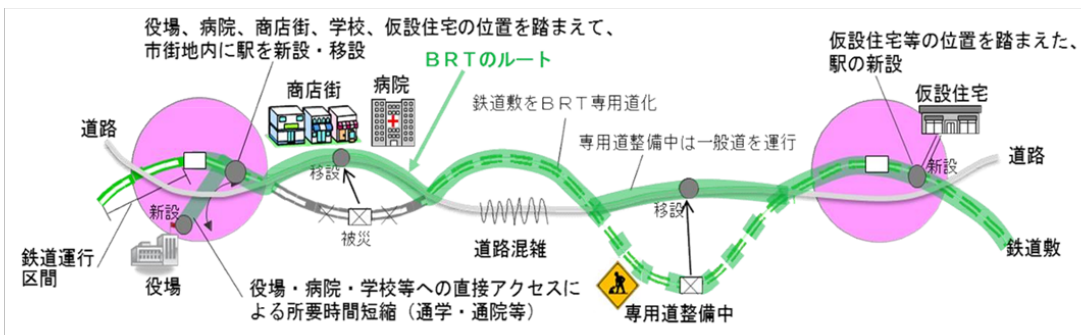
## Abandoned, but continued

- JR East proposed to the municipalities that the BRT would be used for permanent reconstruction. In other words, these two lines would be discontinued as rail lines.
- JR promised to continue public transportation service by BRT, as a JR's business. In other words, municipalities do not have to pay for infrastructure costs or subsidize operating costs for BRT.
  - *If municipalities want to restore it as a rail system, these lines will be separated from JR East rail network (municipalities must pay subsidize operating costs).*
- In 2015 and 2016, municipalities agree this propose. In 2020, these two rail lines were legally discontinued.
- People can travel by BRT service as a rail service of JR East.

# Advantages of BRT



- i. Customers will be able to evacuate more easily by running under their own power to the extent possible in the event of earthquakes and tsunamis.
- ii. Flexibility in setting routes and adding stations in accordance with each stage of community development.
- iii. Fast and on-time delivery can be ensured by using the railroad bed.
- iv. Increased frequency and convenience
- v. Early start of service is possible by utilizing general.



Source: JR East

- The two BRT Lines have increased frequencies since the rail era.
- BRT stations are being relocated or built outside of the rail line to accommodate the relocation of town halls and housing to higher ground.
- Some BRTs will be routed via expressways between cities.

# 3, Case of Reconstruction by Regional Rail Company - Sanriku railway(Santetsu )



# Santetsu (Sanriku Railway Company)



- This was the last section built by JNR to connect the missing link of rail in the Sanriku region. But, 1980 law concerning the reconstruction of JNR decided to freeze construction of the new section and abolish the existing sections.
- Iwate Prefecture and the municipalities decided to keep the railroad alive and open the entire line by new semi-public regional rail company –Santetsu (Sanriku Railway). In April 1984, 107,6 km of the North Rias and South Rias lines, including the newly opened sections and the sections taken over from JNR, were opened.
- Santetsu was profitable for the first 10 years after its opening. However, due to increased sprawl and the relocation of a large public hospital to the suburbs, the number of passengers declined, and the rail business has been non-profitable since 1994.
- In 2009, the prefectural and municipalities formulated a regional public transportation plan to revitalize the Santetsu.
- Based on the plan, financial support was provided by making some infrastructure such as bridges and tunnels owned by municipalities.

## Earthquake Damage and Reconstruction

- The Great East Japan Earthquake and tsunami damaged Santetsu infrastructure, suspending service on all lines.
- Mr. Mochizuki, the president of Santetsu at the time, together with his employees, surveyed the damage to all lines in March 2011 and established a policy to restore the entire line within three years and to prioritize the restoration of sections that could be partially restored as soon as possible.
- In April, he negotiated with the mayors of the eight municipalities along the line and obtained their informal consent for the following: 1) restoration of the entire line within three years, 2) restoration work to be divided into three stages depending on the damage and difficulty of the work, and 3) the route to be unchanged.
- The cost of restoring the Santetsu is approximately 10 billion yen, all of which is effectively borne by the Government.
- Five days after the earthquake, a section of the line was restored. Restoration work proceeded in stages, and the entire line was restored in April 2014.

**As the Santetsu is the last section of this region, it was built with the latest technology for resilience. It was designed to mitigate tsunami damage (laying tracks at higher elevations) and did not need to be rerouted after the earthquake.**

---

## Reconstruction of JR Yamada Line

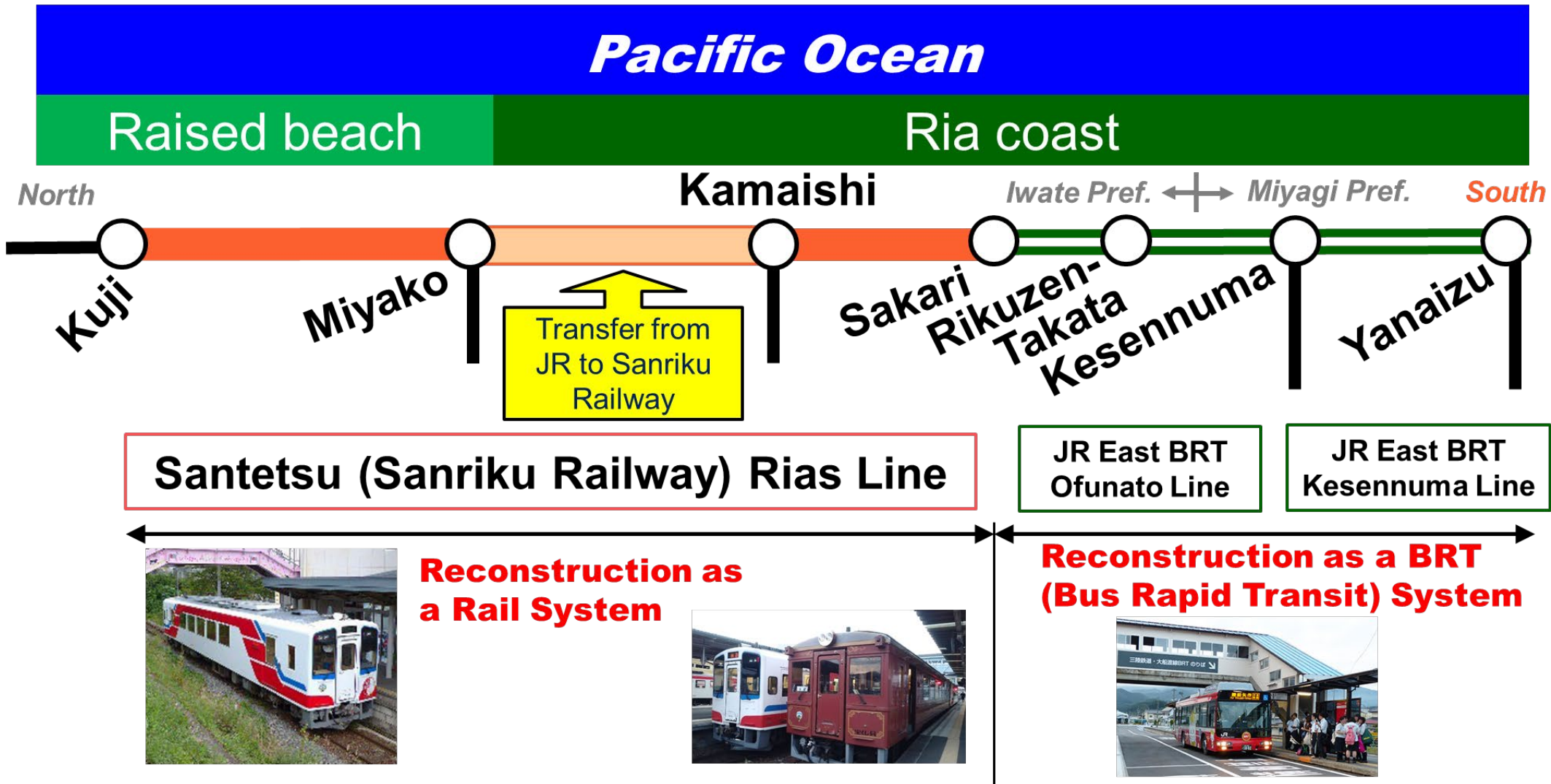
- JR Yamada line (Section between Miyako and Kamaishi, 55.4km) like the other two lines, was severely damaged. JR East propose municipalities to temporarily rehabilitate this section with the BRT system, like other two section. But the municipalities rejected that approach, because they insisted that they should be restored as railways.
- JR East wouldn't like to continue running this rail line as its own line. So, JR East proposed municipalities that would carry out the restoration work on this railway line, which will be transferred to Santetsu on completion in January 2014. In end of 2014, municipalities agreed to this approach.
- JR paid all restoration costs and transferred the railway infrastructure to the municipality free of charge, while still paying the municipality 3 billion yen in aid.
- This Section reopened in March 2019 as line of Santetsu. This section and other 2 sections were marged, it's called Rias Line (163km).
- The municipalities were able to adopt this approach because they had already established a scheme to financially support the Santetsu.

# 4, Fiscal System and Resilience of Public Transport – *as a conclusion*

## ITF, Policy insight from “The Future of Public Transport Funding”

- Fund public transport as a crucial part of a sustainable, decarbonised and accessible transport system.
- Formulate integrated funding strategies for future public transport services.
- Ensure effective co-ordination between levels of government when funding public transport investments.
- Improve the efficiency of public transport infrastructure investments and service provision.
- Adopt explicit fare policies and implement them via formal processes.
- Use structured fare policies for more equitable accessibility.

# After railroad infrastructure reconstruction





# Different restoration methods on JR East railway lines.

1

Restored as JR East's own line at its own expense

*Example: Joban Line, Senseki Line*

Profitable lines or important trunk lines

2

Converted to BRT system at the expense of JR East

*Example: Kesenmuna and Ofunato Line*

3

Separated from JR East and restored as a rail line at the expense of the local government.

*Example: Yamada Line*

Non profitable Regional lines

What is the reason for the choice?



**Fiscal Reason**

# Characteristics of Japanese Funding Public Transport

Europe and North America



● Japan



No Profitable



Profitable



There are many independent large private transport operators in Japan, not only JR groups but also many private company.

# Funding Regional rail lines in JR company

Trains in Rural Area, in Tohoku and Koshinetsu Region



Trains in Tokyo Metropolitan Area



- It was possible to cover the operating costs of rail lines in the Rural Area from the profits of Shinkansen trains and commuter rail services and in the Tokyo metropolitan area.
- Municipalities did not have to bear the costs of maintaining the railway lines.

---

## Crisis of Regional Rail service by Great East Japan Earthquake

- Problems arose when the earthquake destroyed the railway infrastructure: as a private company, JR East found it difficult to bear the costs of restoring railway infrastructure on non profitable lines (it was difficult to persuade shareholders). Moreover, JR East's railway business itself is profitable, so it could not receive subsidies for infrastructure restoration from the Government.
- If JR East were to continue its services, the cheapest option would be to abandon restoration as a rail line and convert to BRT system.
- If municipalities wish to continue the rail service, they would transfer the line to Santetsu, a regional railway company, on condition that the local authorities bear the costs of future infrastructure and operating costs.

---

## Conclusion (1/2)

- In Japan, the enactment of Act on Revitalization and Rehabilitation of Local Public Transportation Systems in 2007 was an opportunity to start exploring ways of funding regional public transport. In the process, the rail lines in Sanriku was severely damaged by the Great East Japan Earthquake in 2011.
- Municipalities along the Santetsu line had originally established a public spending scheme for the revitalization and regeneration of the regional railway company, and the JR Yamada Line was able to be restored under this scheme.
- The municipalities along the BRT lines did not have support schemes like a Santetsu. It was difficult for the municipalities to establish a new scheme after the earthquake.
- Municipalities and JR East consider BRT system as a “build back better” solution, adapted to the decline in ridership of public transport in the region.

---

## Conclusion (2/2)

- In other words, in the case of Sanriku, the availability of public transport funding from the local government affected the resilience of the railway infrastructure.
  - Regarding the maintenance and restoration of regional public transport, decision making on the choice of mode (rail or BRT) requires thorough discussion among residents and stakeholders, under guaranteed access to information on funding and ridership.
- 
- 

***Thank you !***

***Grazie !***

