

12th UIC Sustainability Conference



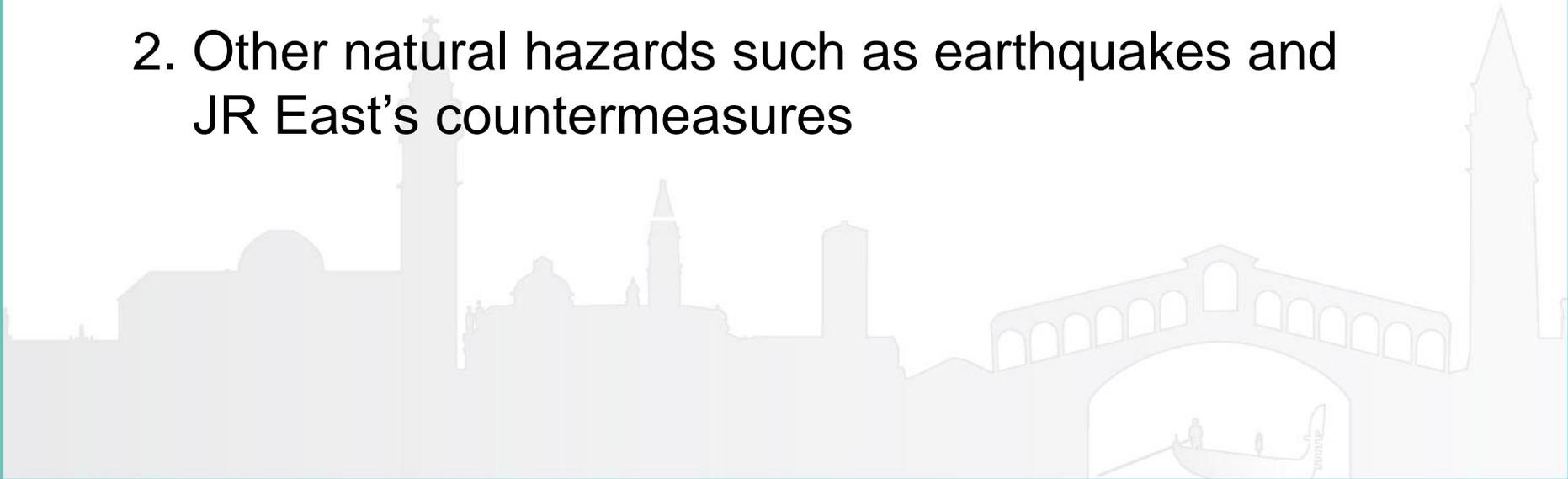
Snow problems and other natural hazards

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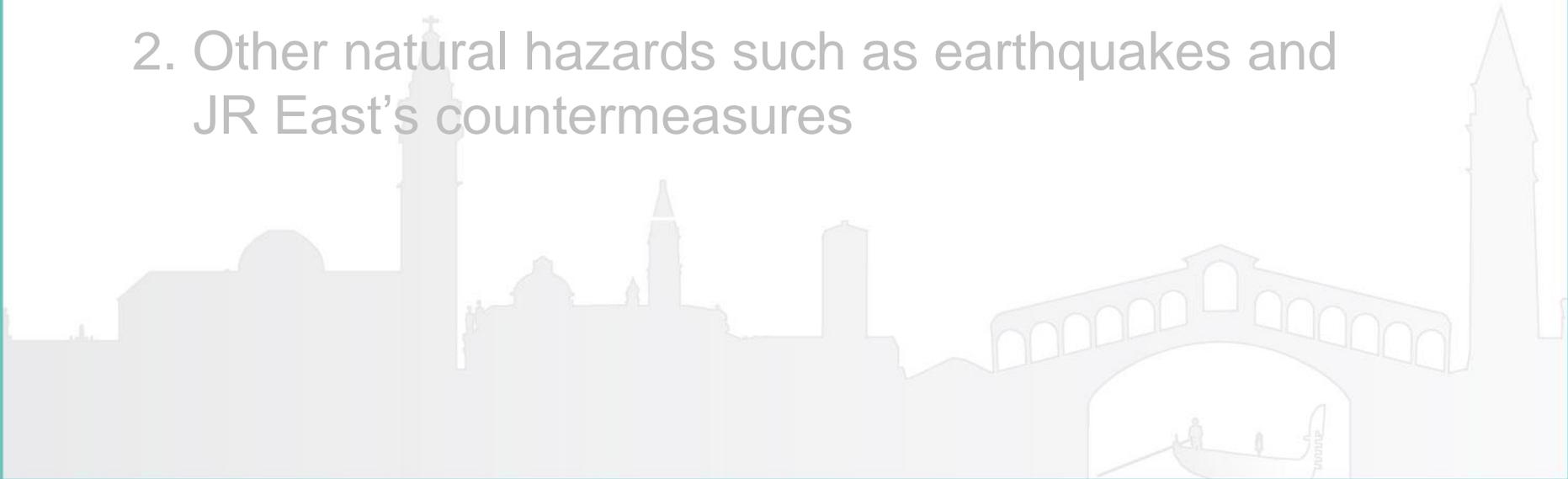
1. Snow problems and JR East's countermeasures
2. Other natural hazards such as earthquakes and JR East's countermeasures





1. Snow problems and JR East's countermeasures

2. Other natural hazards such as earthquakes and JR East's countermeasures

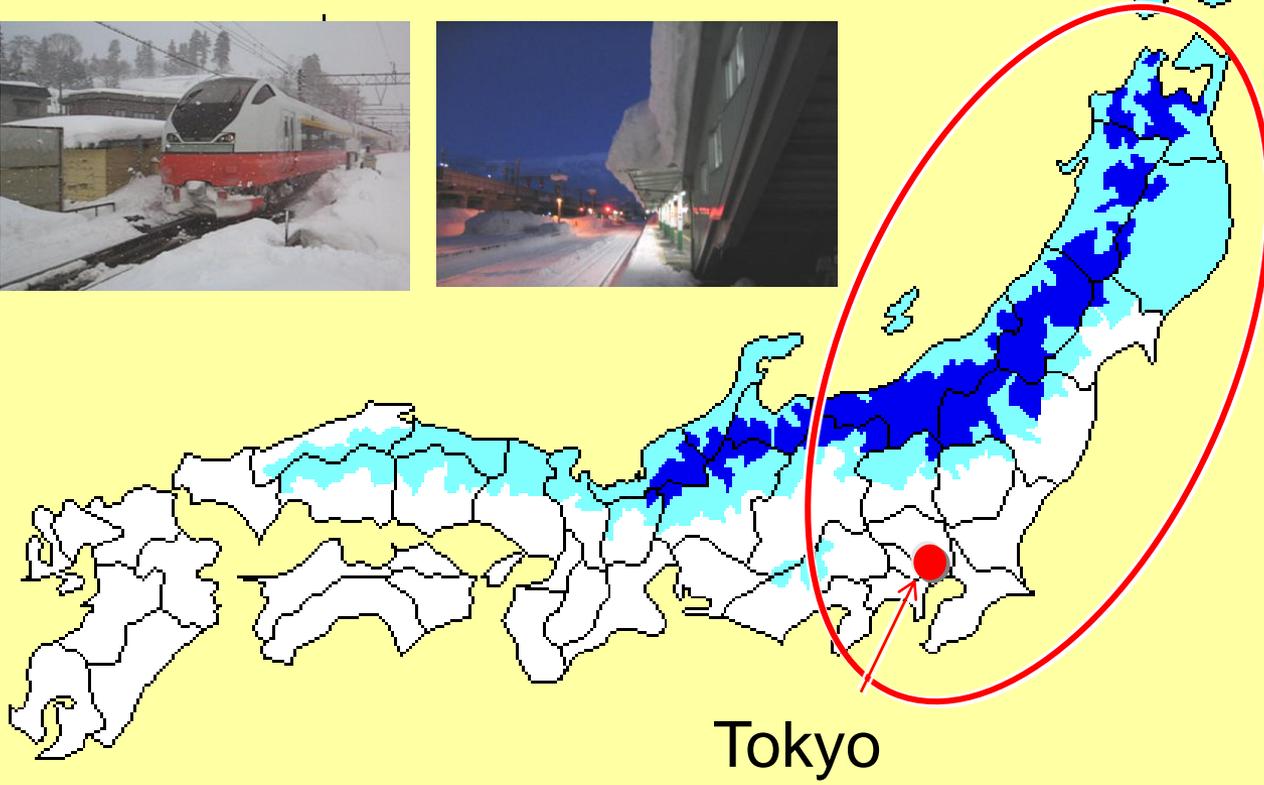
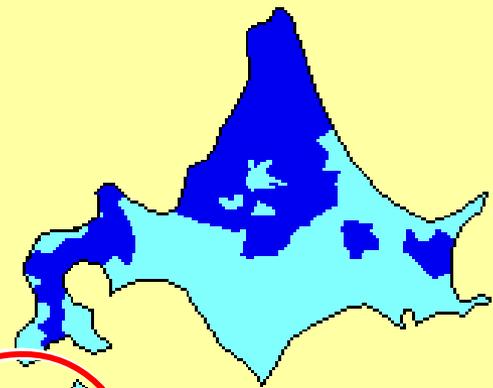


JR East's area and snow belt in Japan



Legend for snow belt areas:

-  Heavy snow belt
-  Snow belt

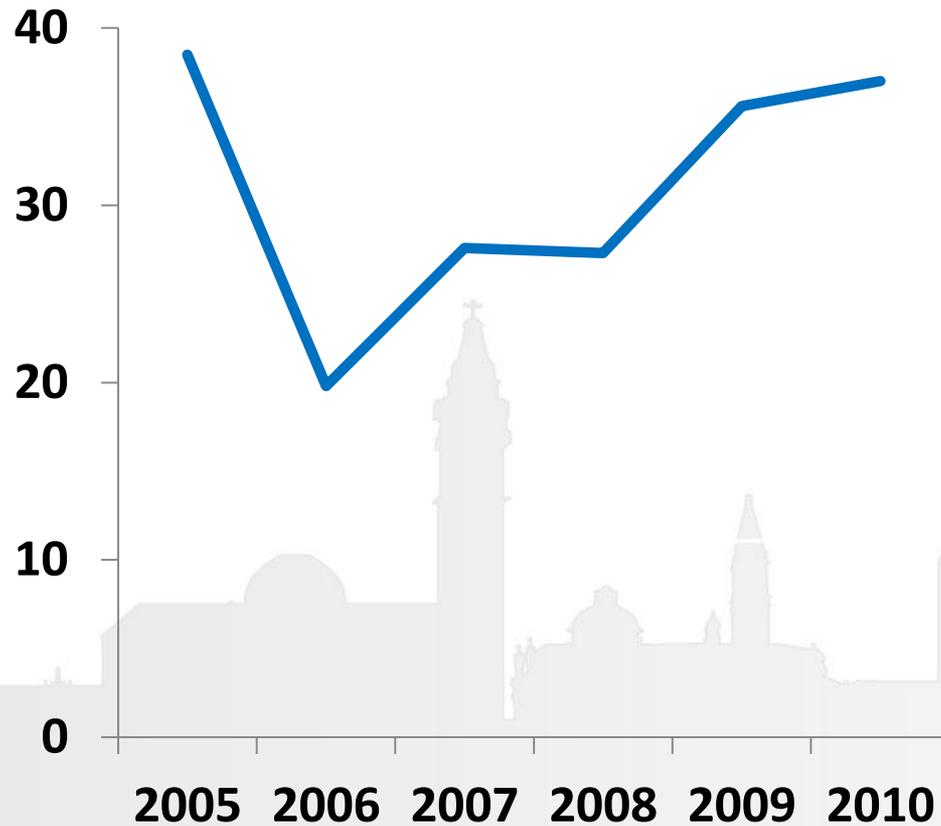


Tokyo

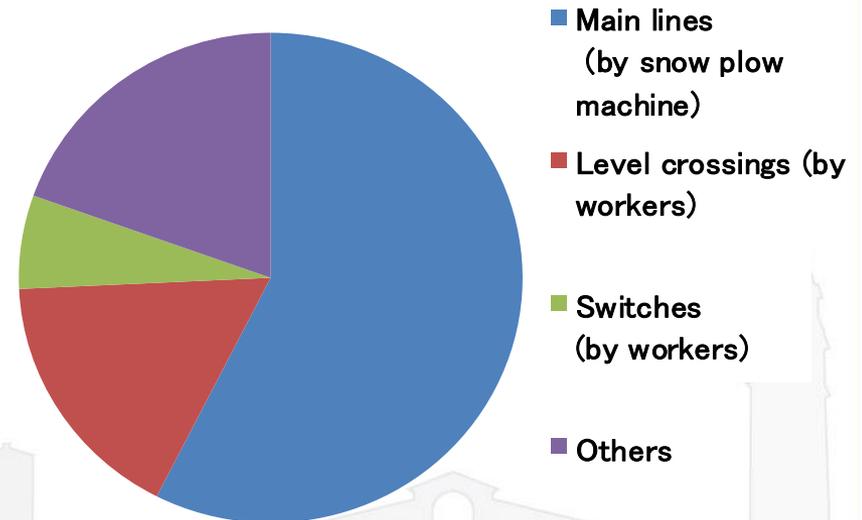
Snow removal costs



Million €



Breakdown



Recent transport disruptions by snow



■ Number of disruptions by snow

(at least 1 service cancellation or delays of 30 min. or more)

Year	Number
2006	5
2007	26
2008	58
2009	37
2010	58
2011	70

■ Main causes of transport disruptions

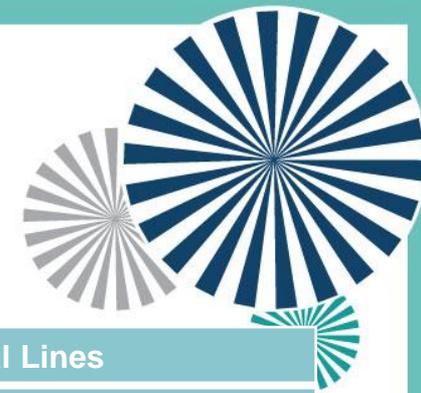
1. Snow removal work after heavy snowfall
2. Switch malfunction due to snow dropping
3. Fallen tree
4. Snow on pantograph causing loss of contact with catenary

▶ Impacts on infrastructure are more severe than rolling stock.

▶ We have taken different measures, based on;

- High-speed or conventional lines
- Snowfall or snow lump dropping

Major countermeasures against snow

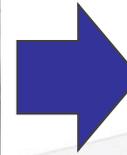


Snow removal equipment

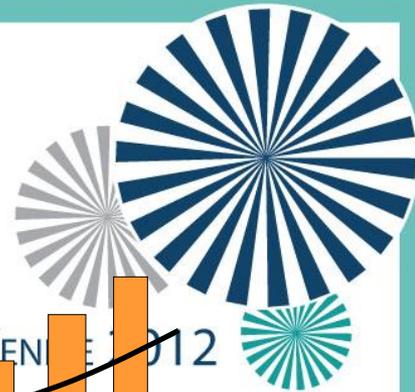
	High speed Lines		Conventional Lines	
	Snow fall	Snow Lump dropping	Snow fall	Snow Lump dropping
Tracks	Snow accumulation  Sprinkler	Ballast flying  Ballast screen	Snow accumulation  Snow removal machine	—
Turnouts	Freezing  Hot water mat melting device	Turnout malfunction  Hot water jet or Air injection	Freezing  Hot water mat melting device	Turnout malfunction  Hot water jet or Air injection
Rolling Stocks	Snow adhesion  Electric heater	Snow adhesion  Warm water injection	—	—



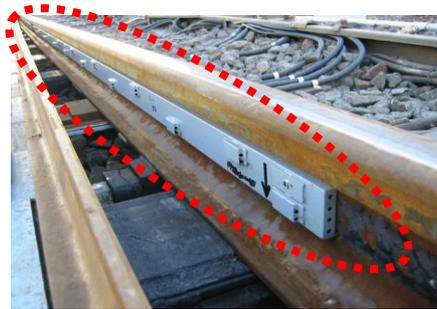
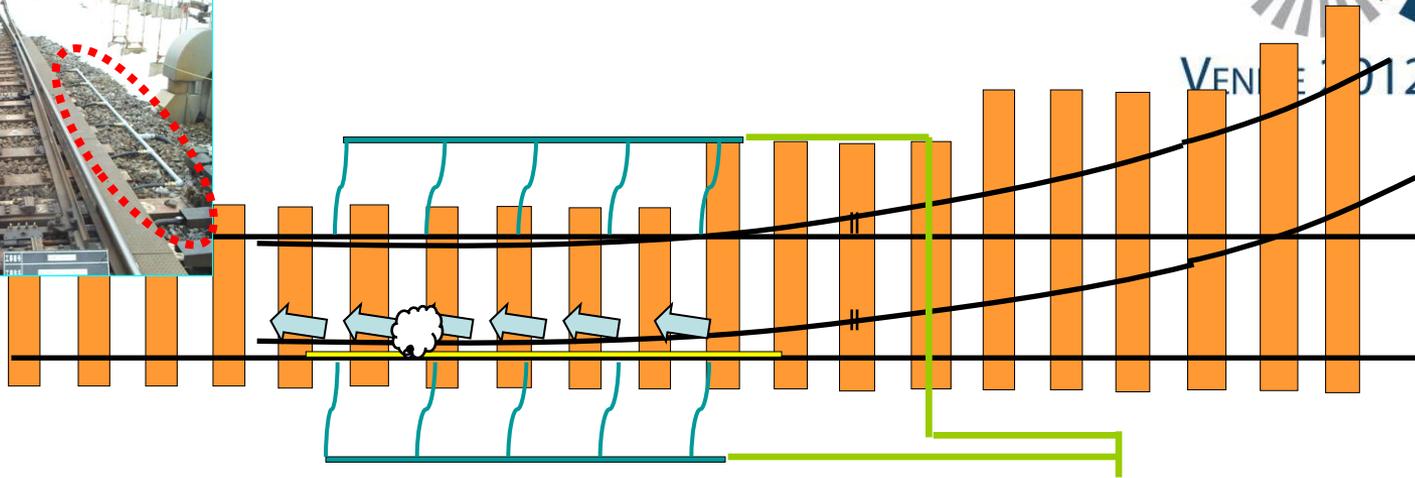
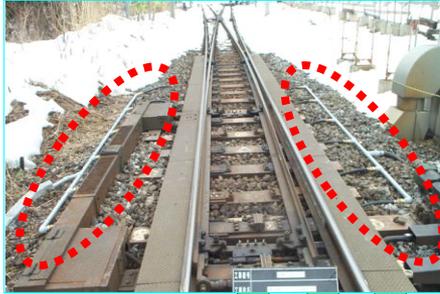
Sprinkler



Air injection snow removal device



Ice lumps at turnout can be removed by air pressure



Air nozzle



Air tank unit

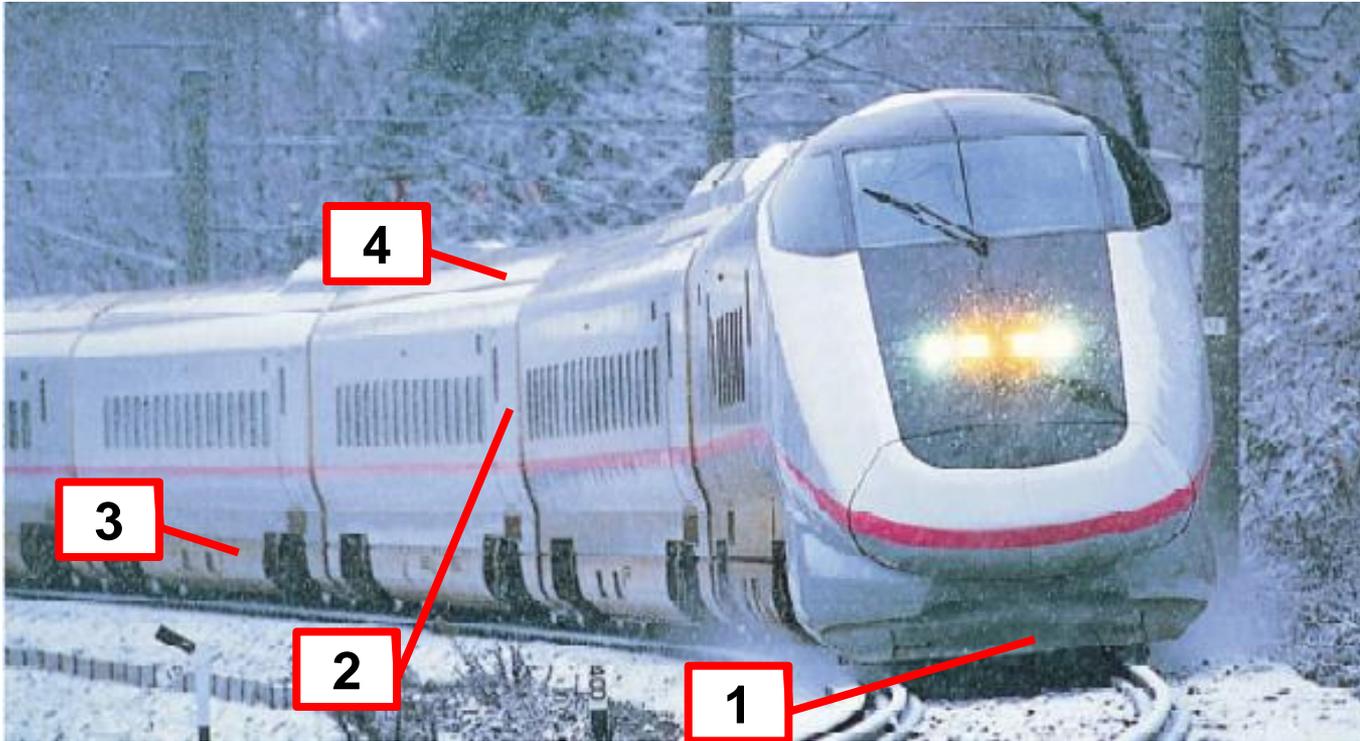
Development concept: melting snow



removing obstacles

Major cold and snow-resistant car body design

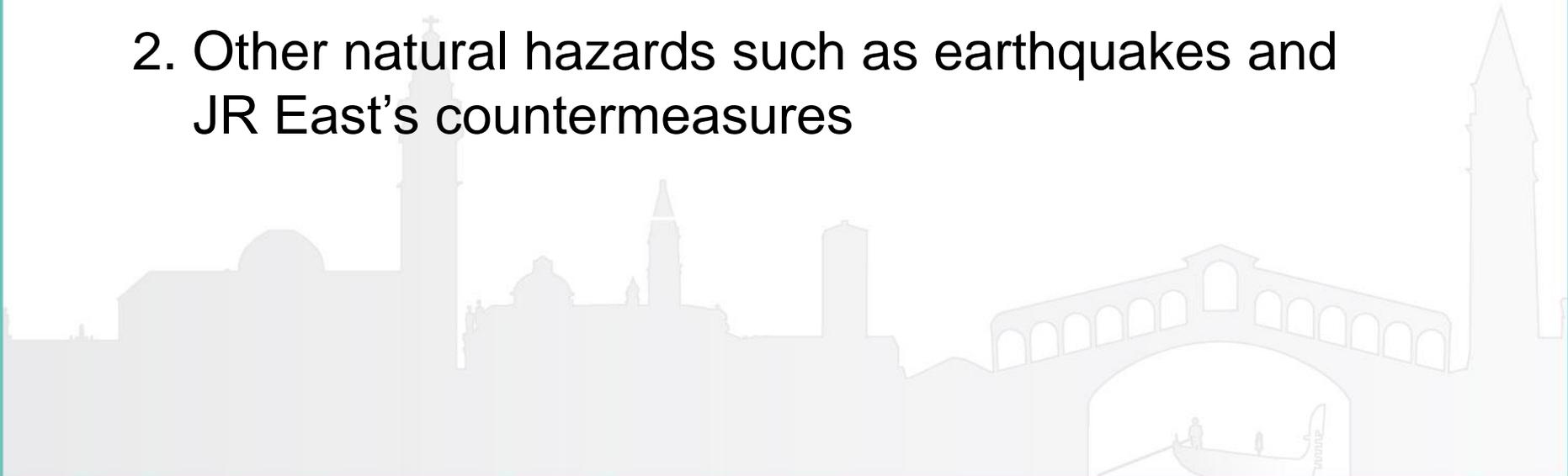
for both High-speed trains and Conventional line trains



- 1 Snow plow (at the front of lead car)
- 2 Heater to prevent doors from freezing
- 3 Fully covered under-floor equipment to prevent snow sticking
- 4 Smoothing car body (to prevent snow sticking to the car body)



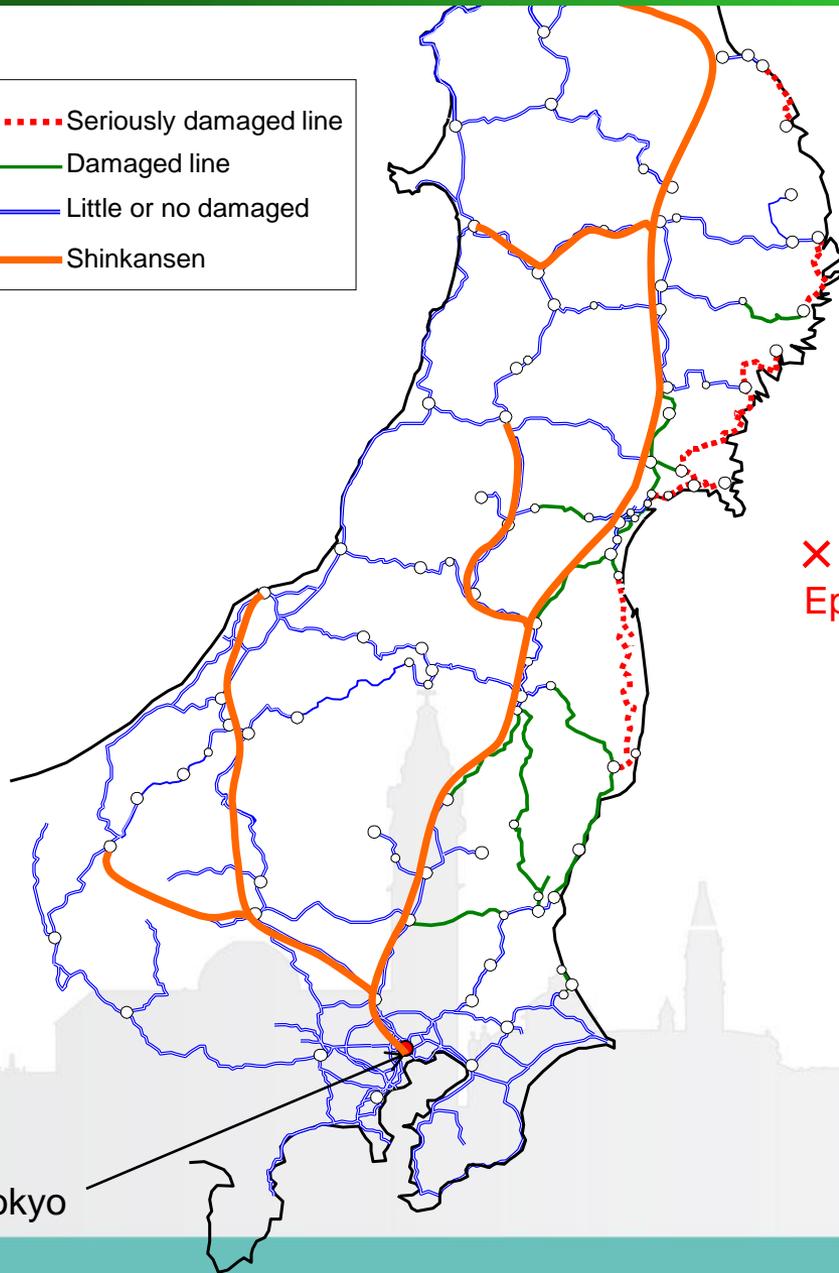
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Damage by the earthquake and tsunami



- Seriously damaged line
- Damaged line
- Little or no damaged
- Shinkansen



X
Epicenter



Tokyo

No fatalities or no injuries on trains
No derailment

Countermeasures against earthquakes

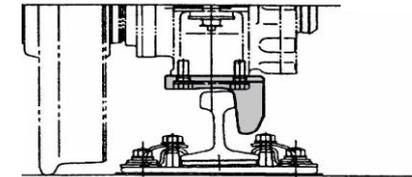
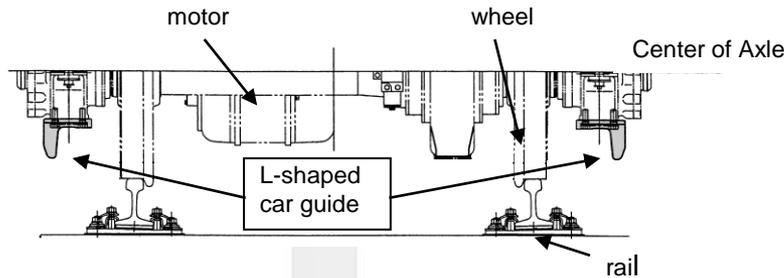


1 Prevent collapse of the viaduct



2 Detect the earthquake and stop the trains as quickly as possible

3 Prevent trains from a large scale deviation in case of a derailment



4 education and training for staff



Hazard map



Training

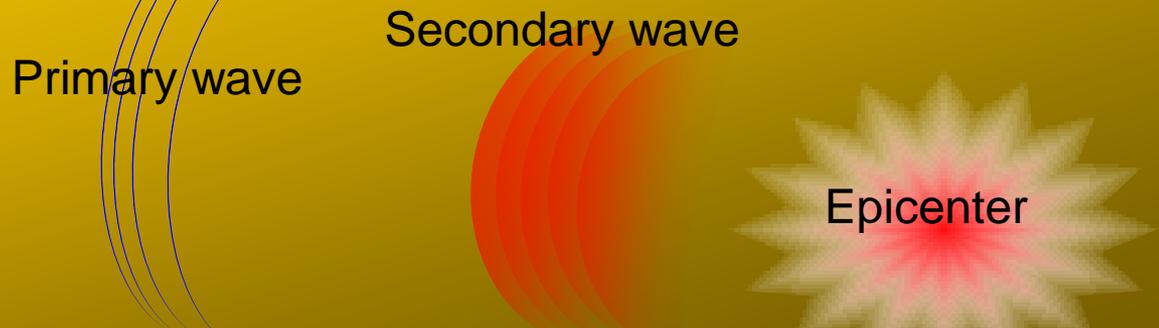
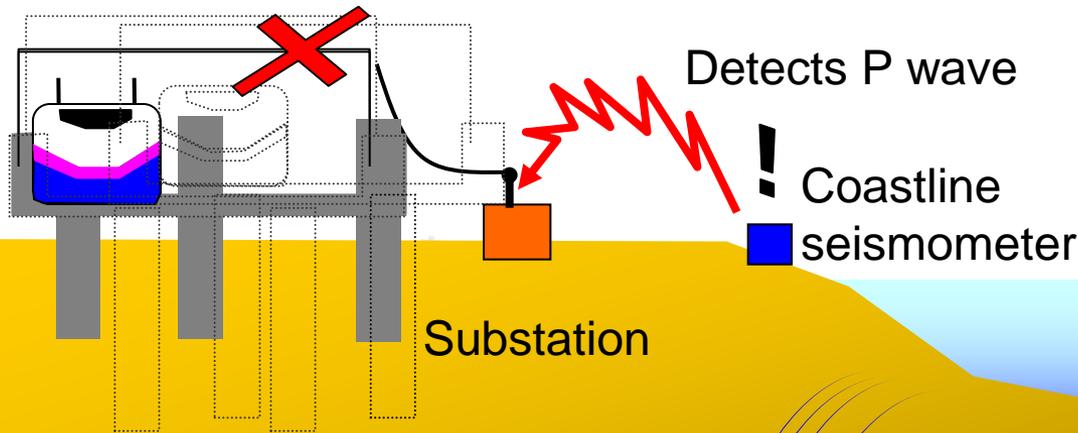
Early Earthquake Detection System



When the coastline seismometer detects a primary wave.....

Power shutdown

Emergency brakes

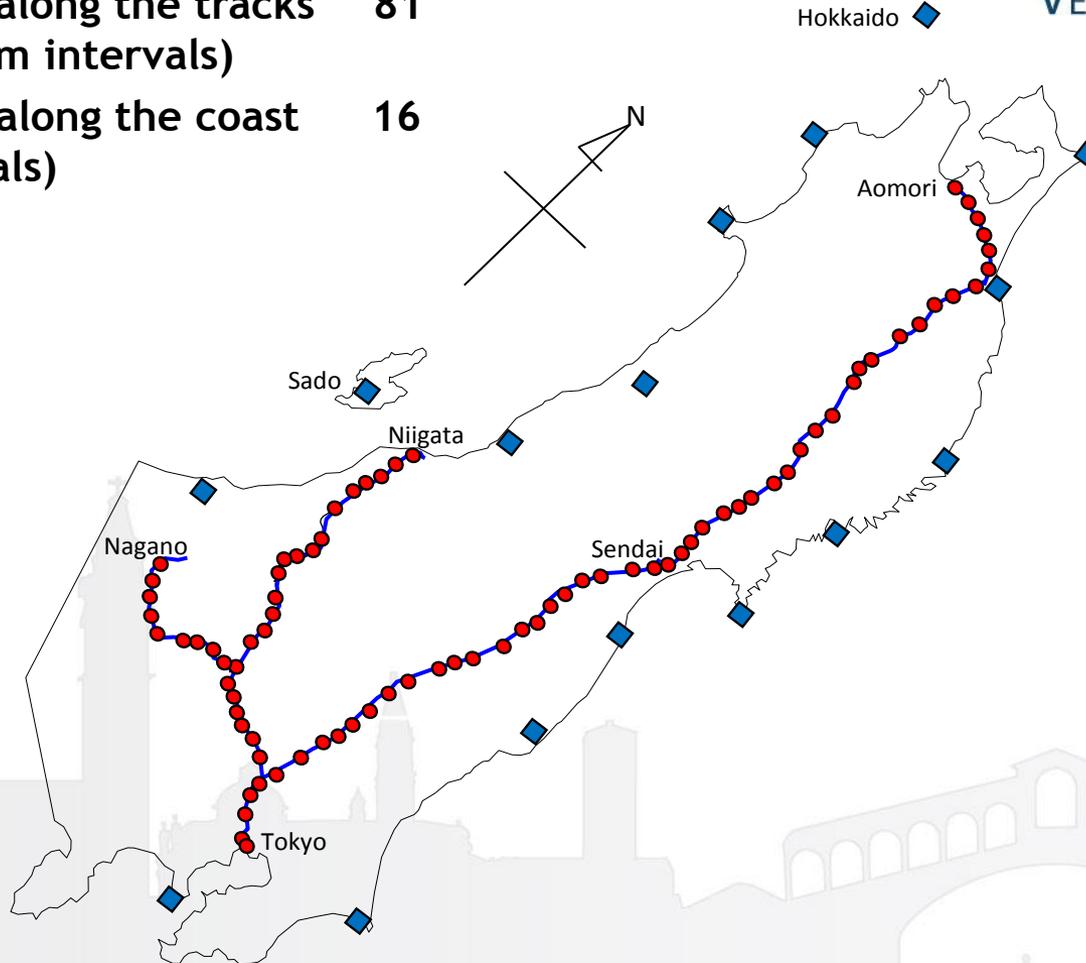


Early Earthquake Detection System



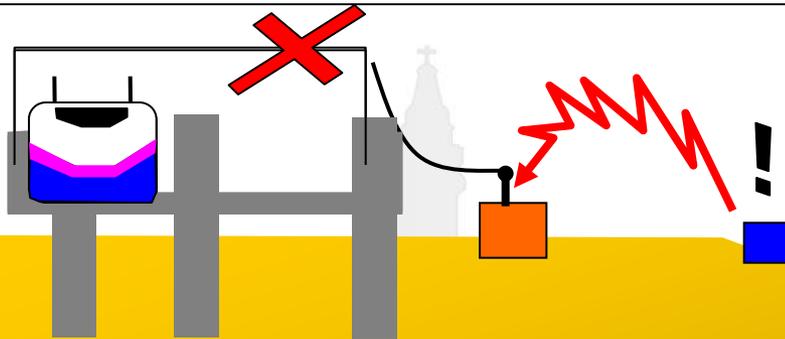
Number of Seismometers

- Seismometers along the tracks 81
(Less than 20km intervals)
- Seismometers along the coast 16
(100km intervals)



Early Earthquake Detection System

- **Two trains** running at **approx. 270 km/h** through the Sendai area were exposed to strong shaking from the earthquake.
- **The power supply** to these trains was **cut 9 to 12 seconds** before the first vibrations arrived, and their **emergency brakes were applied**.
- **The largest shock** came to these trains **approx. 70 seconds** after their **emergency brakes were applied**. By then, it is likely that the trains had slowed down to a speed of about **100km/h**.



Earthquake wave

Epicenter

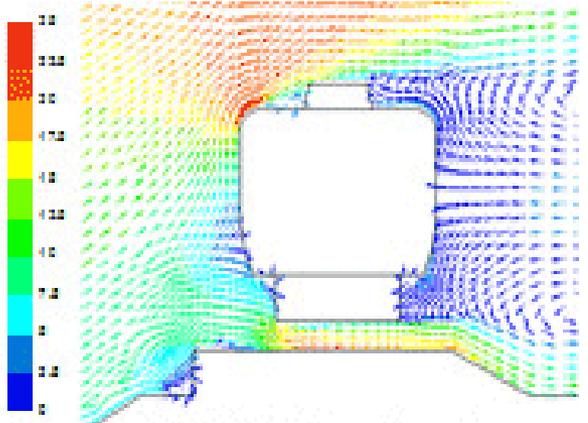


Research and development

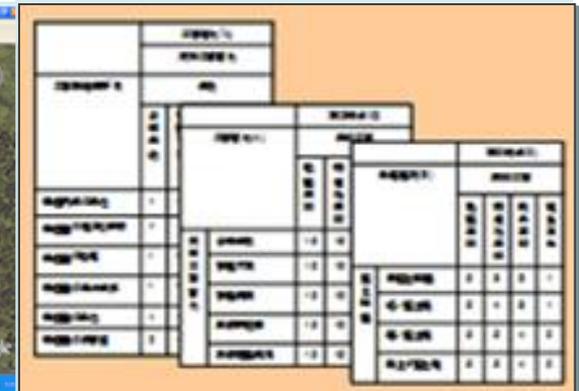
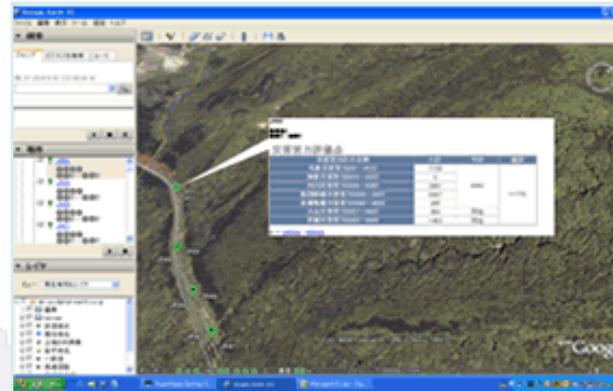


The Disaster Prevention Research Laboratory

- Study on mechanism of natural disasters and risk evaluation
- Development of observation and detection methods
- Development of countermeasures and technical standards



Simulation



Hazard map

Conclusion



- JR East's operation area has severe natural conditions. However, the average delay time per train is only 0.7 minute on high speed lines and 1.3 minutes on conventional lines.
- We have experienced many natural hazards, not only snow but also other ones. We have examined those results and derived lessons from them. And we have made the best use of those lessons for measures such as technological development.
- We will share our experiences with the world and contribute to the safety and reliability of railways.

