



Recent Disaster Responses & Lessons Learned in EASTS Member Countries & Regions

Outline of the Seminar

- The Asian region is one of the regions most affected by various natural disasters such as earthquakes, droughts, floods, & typhoons.
- In recent years, various urban facilities & transportation infrastructures have been severely damaged by natural disasters. In this context, building disaster resilience is a central challenge for achieving the SDGs. However, the impacts of such natural disasters on vulnerable groups such as low-income people, women, the elderly and children are extremely severe, making it difficult for them to rebuild their lives afterwards.
- This seminar aims to share information on natural disaster response efforts and lessons learned in Philippines, Taiwan, and Japan, and to hold a comprehensive discussion on how to rebuild the livelihoods of socially vulnerable groups, especially in the Asian context.

Program of the Seminar

1. Opening remarks:

Atsushi Fukuda (President of EASTS-Japan)

MC and Moderator of panel discussion:
Sunkyung Choi (Lecturer, Institute of Science
Tokyo)

2. Topic presentations:

- a) Overview of the seminar, and
“Disaster Response and Adaptation in Rural Areas: The Case of the 2024 Noto Peninsula Earthquake”
Daisuke Fukuda (Professor, The University of Tokyo)
- b) “Disaster Response and Adaptation - Lessons learned from Hualien Earthquake”
Yu-Chiun Chiou (Professor, National Yang Ming Chiao Tung University)
- c) “Disaster Response, Recovery, and Resilience: Flooding in the Philippines”
Ma. Sheilah G. Napalang (Professor, University of the Philippines)
- d) “Inclusive Disaster Recovery: Strengthening Support Mechanisms for Vulnerable Populations”:
Mikio Ishiwatari (Visiting Professor, The University of Tokyo & Senior Advisor, JICA)

3. Panel discussion

Disaster Response and Adaptation in Rural Areas: The Case of the 2024 Noto Peninsula Earthquake

Daisuke Fukuda
The University of Tokyo

Contents

1. Overview of Earthquake Damage
2. damage and restoration of the transportation system
3. combined damage in depopulated areas with declining population

Acknowledgments

Special thanks to the team member of the disaster investigation organized at the Japan Society for Civil Engineers (JSCE) who shared their study outputs for this presentation:

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Yoichi Kanayama, Takumi Asada,
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Masayoshi Tanishita*

Overview of the Noto Peninsula Earthquake and Damage

Time of Occurrence: Jan. 1, 2024 at 16:10

Magnitude of earthquake: **Magnitude 7.6**

Depth of epicenter: 16 km

Ishikawa Pref. Seismic Intensity 7: Shiga, Wajima

Intensity 6 Strong: Nanao, Suzu, Anamizu, Noto

Intensity 6 Weak: Nakanoto

Niigata Pref. Seismic Intensity 6: Nagaoka

Human casualties:

Deaths: 426 (including 199 disaster-related deaths)

Serious and minor injuries: 1,300

Noto Region (Itatani et al. 2024)

Damage to buildings: Totally destroyed: 8,695, Half destroyed: 18,986

Partially damaged: 86,309 buildings, Overall: 113,990 buildings

As of November 1, 2024

Damage to a High-Graded Arterial Road



Norisatoyama Kaido [High-Standard Arterial Highway].

Most of the section was constructed with embankments.

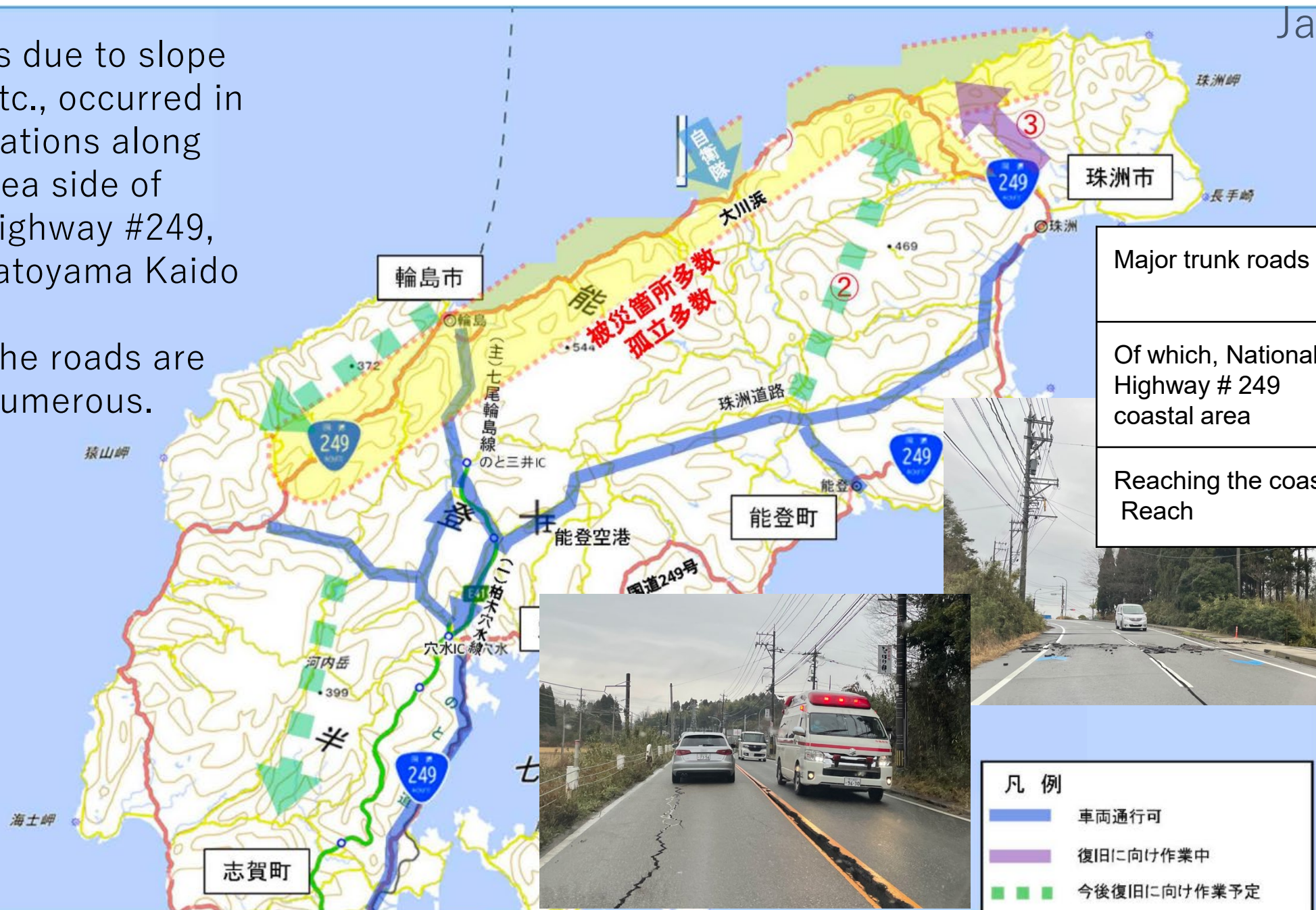
Damaged during the 2007 earthquake (intensity 6)

→ All of the 12 sites that were reinforced and restored at that time are safe this time (but adjacent sites were damaged).



Disruptions due to slope collapse, etc., occurred in various locations along the outer sea side of National Highway #249, and Notosatoyama Kaido

Cracks in the roads are also very numerous.



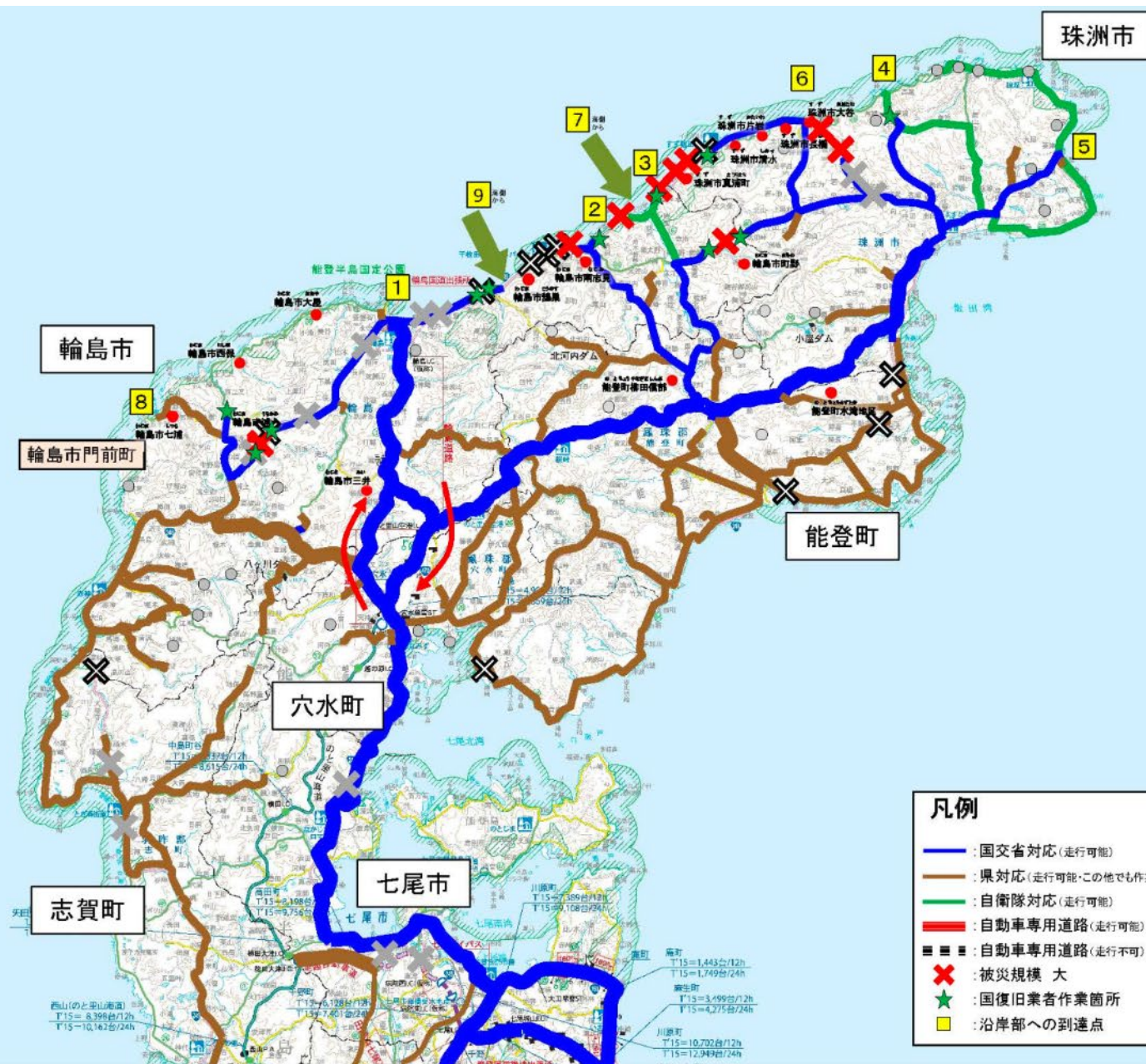
Major trunk roads	Approx. 60%
Of which, National Highway # 249 coastal area	Approx. 20%
Reaching the coast Reach	6 directions

凡 例

 車両通行可

復旧に向け作業中

■ ■ ■ 今後復旧に向け作業予定



Major trunk roads	Approx. 90%
Of which, National Highway # 249 coastal area	Approx. 70%
Reaching the coast Reach	9 directions

Roundabout-like traffic operation between Anamizu and the airport

February 1



Major trunk roads	Approx. 90%
Of which, National Highway # 249 coastal area	Approx. 80%
Reaching the coast Reach	10 directions

Emergency restoration of comb-shaped NW



Major trunk roads	Approx. 90%
Of which, National Highway # 249 coastal area	Approx. 80%
Reaching the coast Reach	13 directions

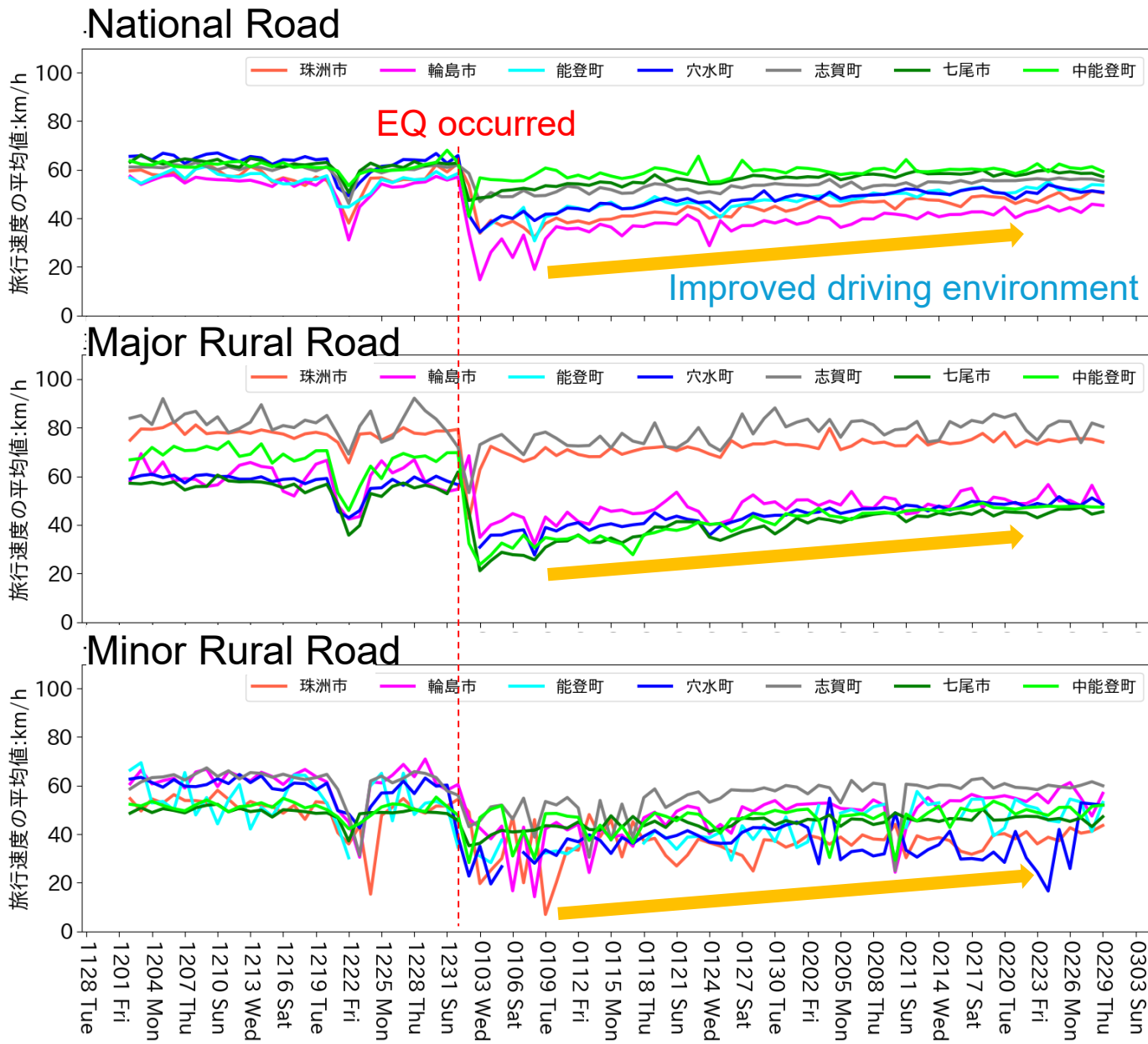
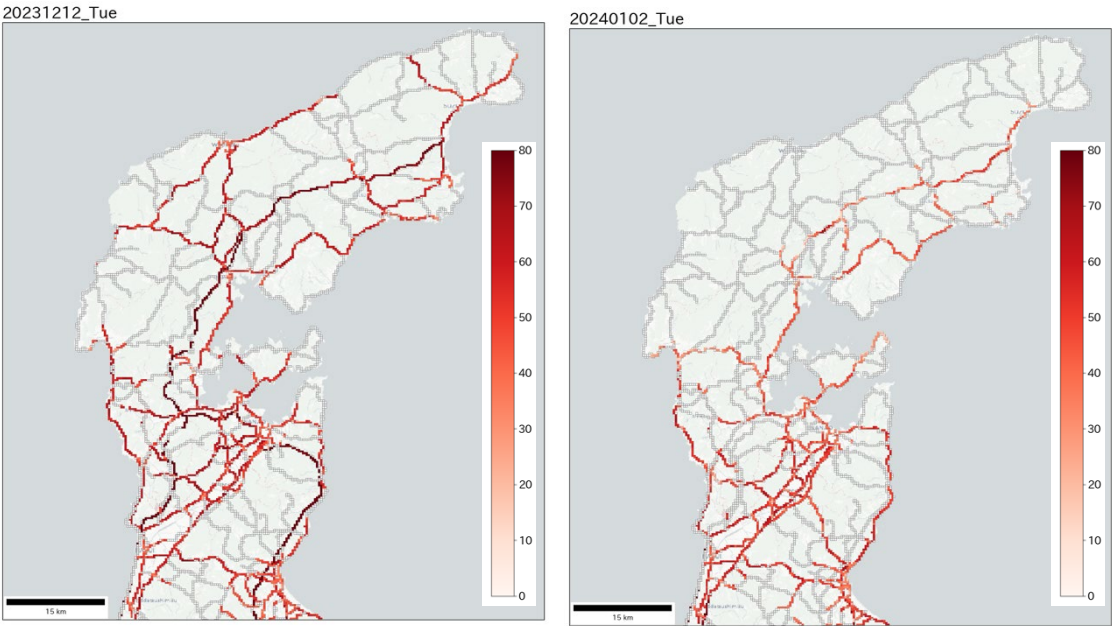


Major trunk roads	Approx. 90%
Of which, National Highway # 249 coastal area	Approx. 80%
Reaching the coast Reach	13 directions

Time-series Changes in Travel Speed (Toyota's Probe Data)

- Speed reduction in most sections on Jan 2.
- Major local roads except for the Suzu Road and Noto Satoyama Highway (Shiga Town) have significantly reduced speed
- Trend of increasing speed due to restoration.

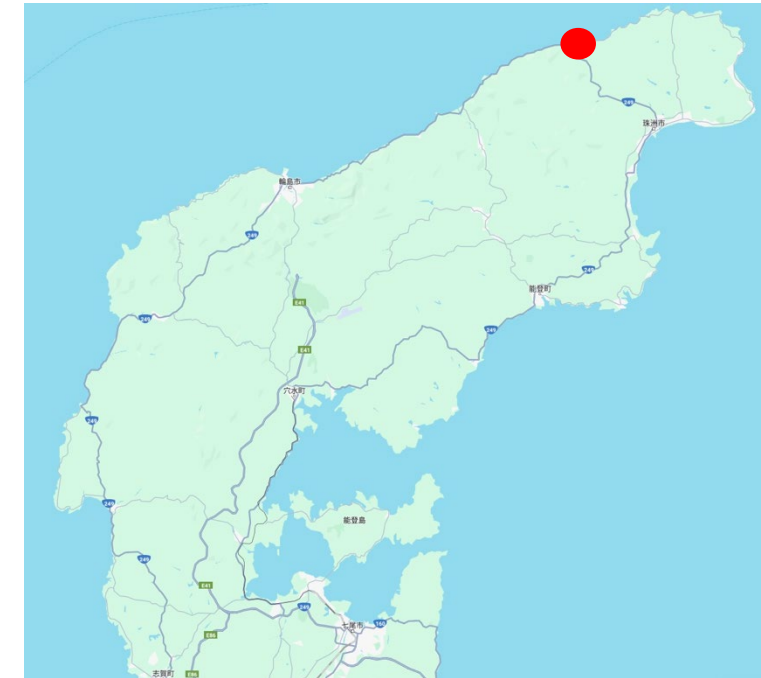
→The impact of bumps on the road surface that still remain?



Route 249, Oya Loop Bridge (Suzu City, photo taken May 15)

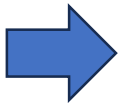


Large skidding of the pier bearing section



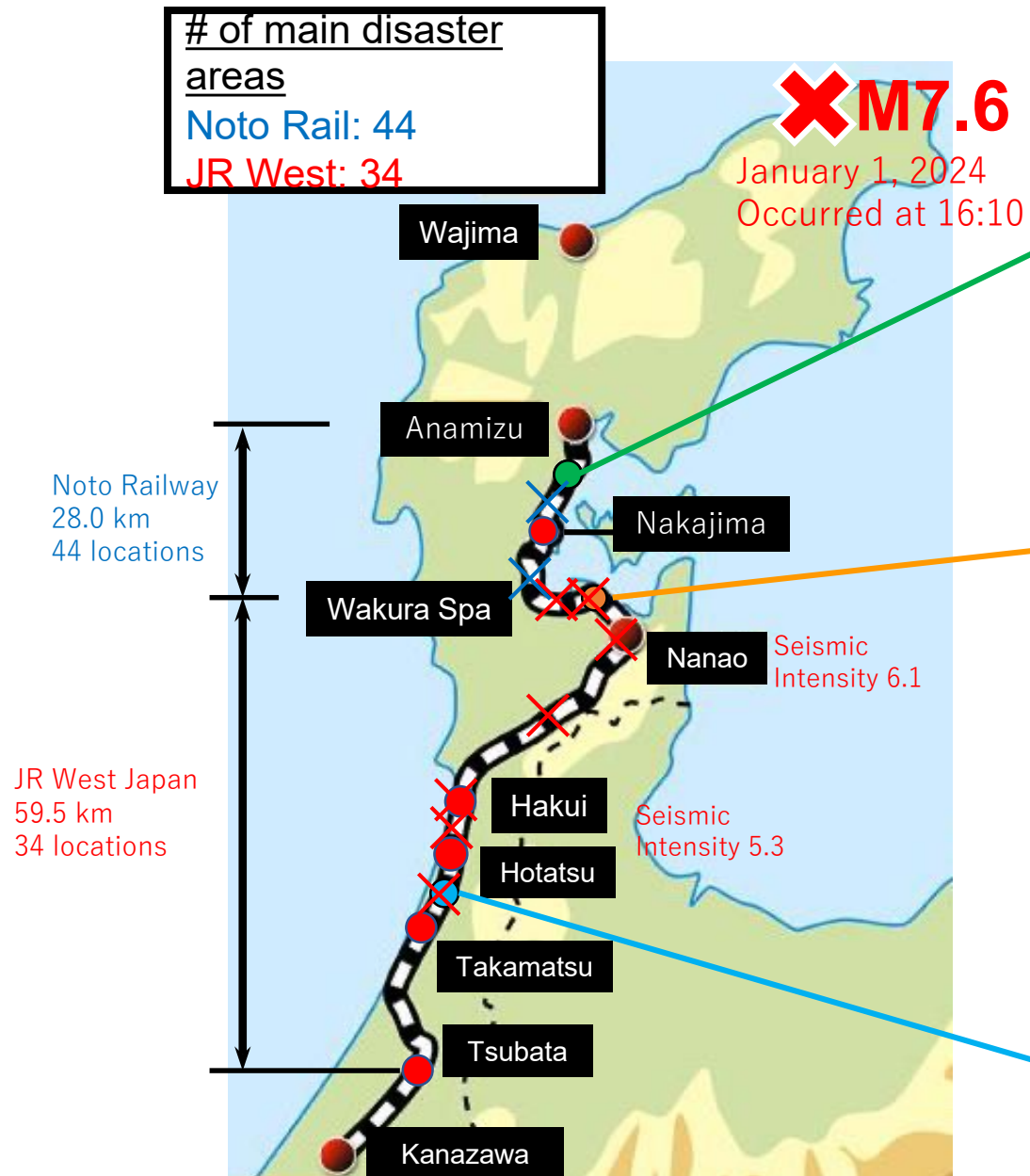
Large scale slope failure in the loop area

Route 249, near Senmaida Roadside Station (Suzu City, photo taken May 15)



Established an emergency road in the uplifted area.

Major Damages and Restoration on the Local Rail Line



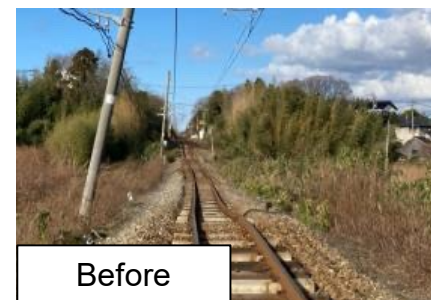
Noto Kashima - Anamizu (embankment subsidence)



Wakura Spa St. (platform sinking etc.)



Shikinami - Minami Hakui (pole tilt, track displacement,)

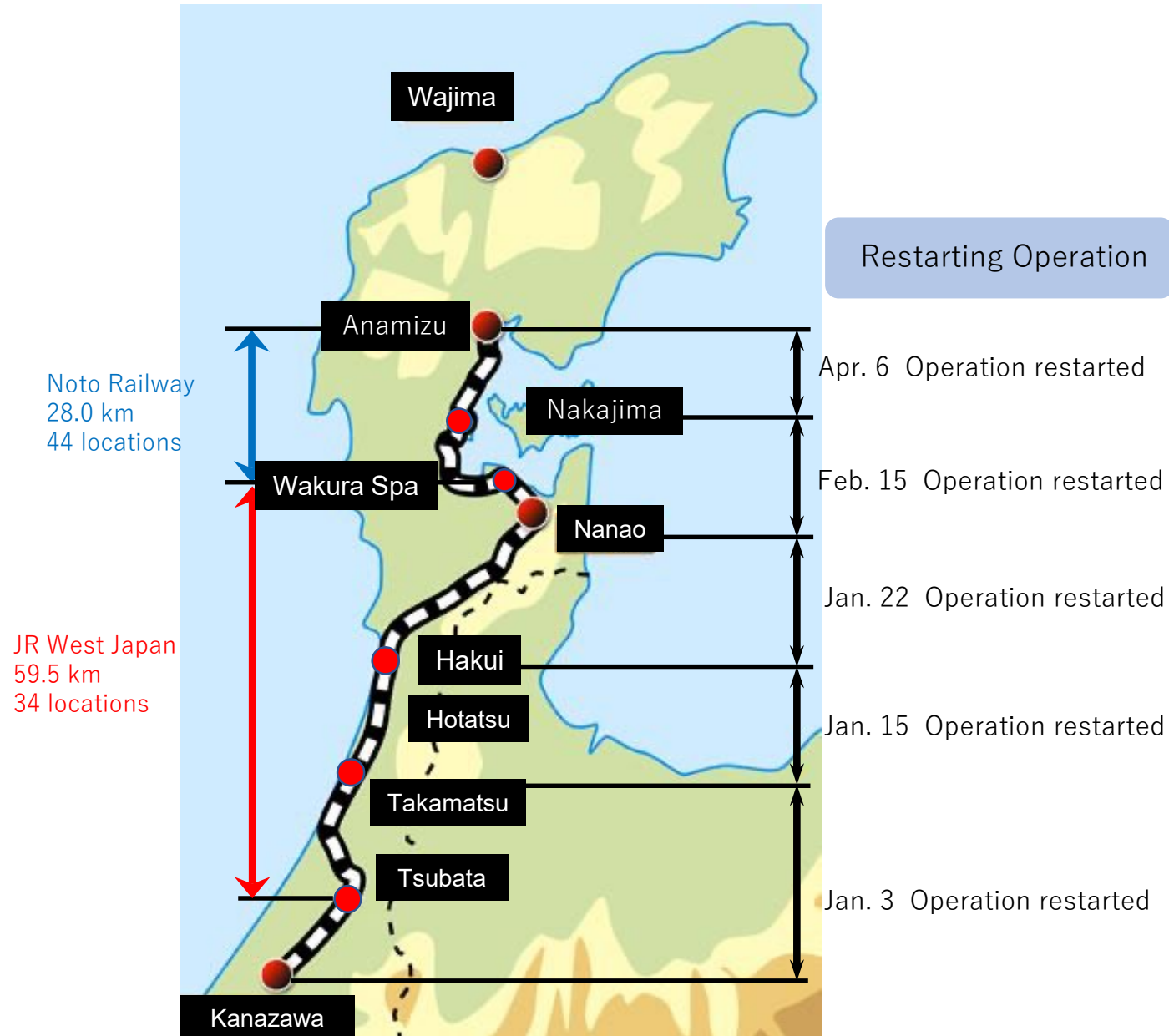


Before construction



After construction

Progress in the Recovery of Railway Operations



Apr. 6: Resumption of all train operations
(at Anamizu St.)



Apr. 13 at Noto Kashima St.



Major Damages and Restoration on the Local Rail Line

Damage
d



After
restoration



Photo on the left: By the Noto Railway
Photo on the right: By Yoichi Kanayama



Noto Satoyama Airport

- ✓ Opened in July 2003 (prefecture-managed airport)
- ✓ Runway with the length of 2000m.
- ✓ Administrative facilities (e.g., Branch of Ishikawa Pref. Office)
- ✓ Designated as a roadside station (designated as a disaster prevention roadside station):
- ✓ Japan Aviation Academy (high school & college) opens their campus
- ✓ 2 round-trip flights to Haneda (1 round-trip now after the earthquake)
- ✓ Chartered flights between Taipei
- ✓ 174,544 passengers in 2019 (1,615 international)



(Figure source) Norinosatoyama Airport HP

Damage at Noto Satoyama Airport

The red area indicates an
embankment.

Range of
subsidence due to

Range of
occurrence of steps

Emergency Transportation Roads and Disaster Base Hospitals in Ishikawa Prefecture

“Double Ladder Shine Bichi (Michi) Concept” (Ishikawa Prefecture, 2016)

Red Road

Primary Emergency Road

Blue Road

Secondary emergency road

Yellow Road

Tertiary Emergency Road



Toward a “Disaster Prevention Base Airport”

It is important to position airports as bases for wide-area relief and goods transport in the event of a disaster, and to enable airports to function as transport hubs in the event of a disaster.

- Earthquake resistance of basic facilities
- Fueling facilities
- Disaster prevention function
- Space required for support activities
- Emergency power generation



Complex disasters in areas with declining population

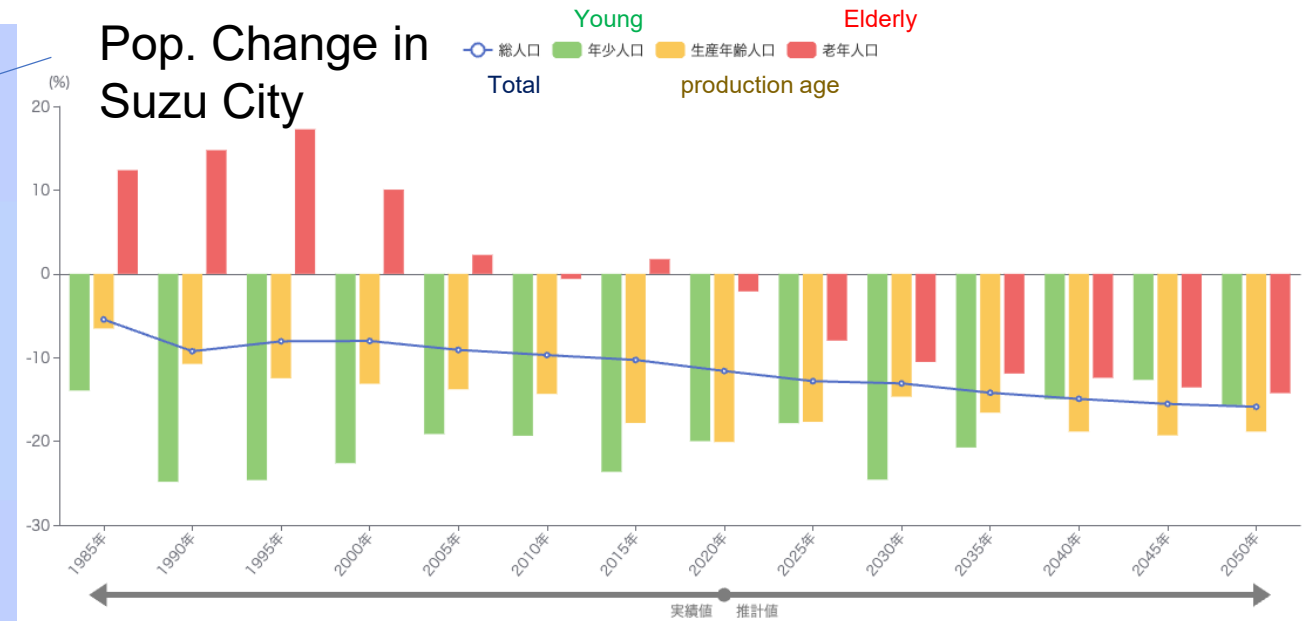
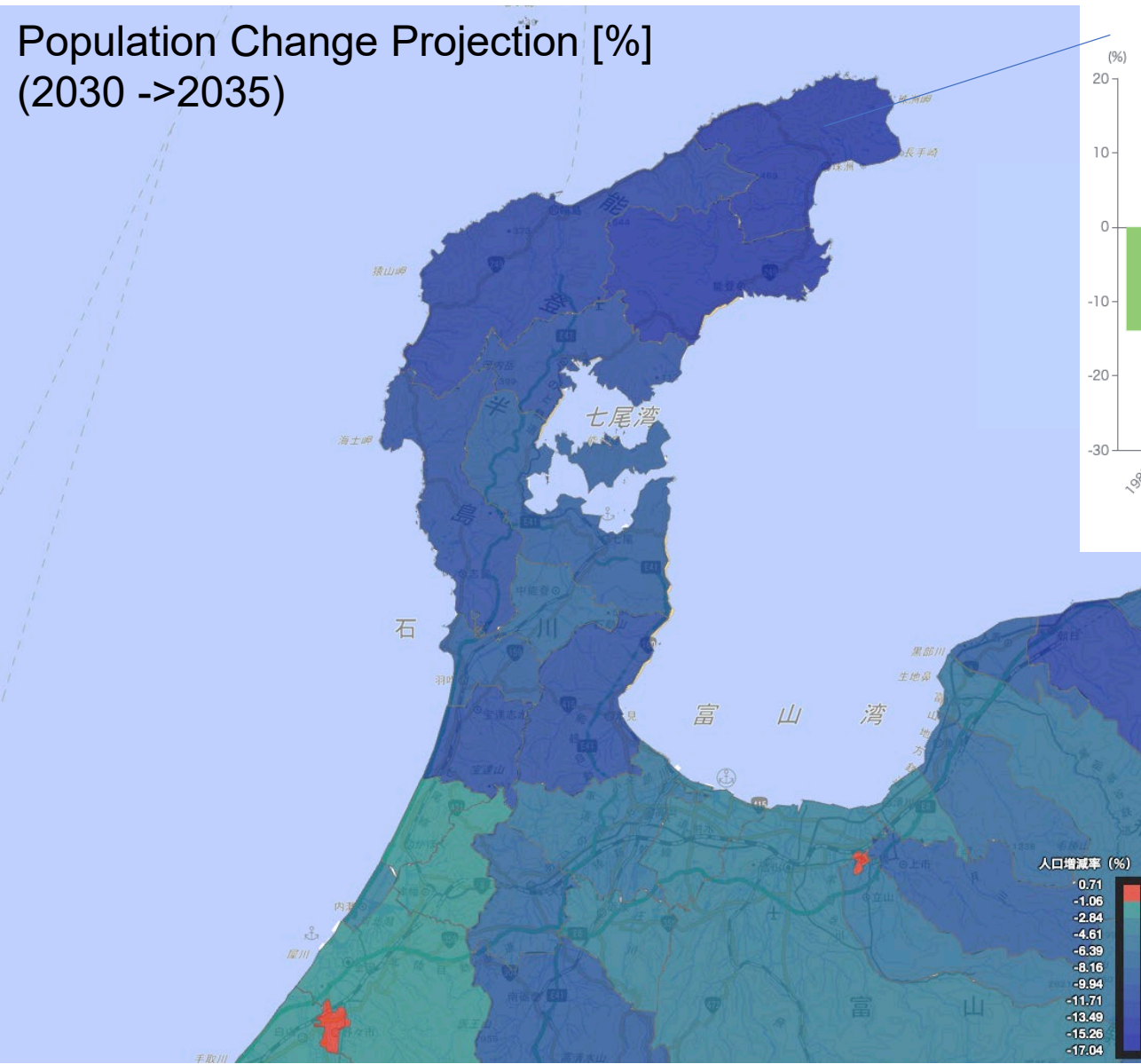
- Torrential rainfall in Noto Peninsula
- September 21-23, 2024
- Number of Deaths: 15
- Landslide locations:
Over 1900



Impacts of the Two Large Natural Disaster in Noto Peninsula in 2024

Types of damages	Earthquake in January	Heavy Rainfall in September
Dead and missing	342	15
Number of buildings totally or partially destroyed	7,463	16 Flooded above floor level 318 6 temporary housing complexes 209
Water supply: Number of water outage (thousands)	110	3.6
Electricity: Number of blackouts (thousand units)	40	6.5
Road: Blockage (Number of routes and locations)	26/85	17/28
Rivers: channel filling, bank subsidence, revetment damage, etc. (Number)	88	Inundation 23
Agricultural land (Number of locations)	1,810	346
Reservoirs (number of locations)	369	34
Number of isolated villages (persons) ⇒8 days after the disaster	49⇒33/3,345	115⇒46/367
Temporary housing units constructed	6,804	390

Complex disasters in areas with declining population



Large damage → Recovery will take time

↓
Designation of Disaster Hazard Area

↓
Population declines

Minimizing damage is extremely important, but not being affected by a disaster is not the only way to build a sustainable community.

Thank you for your attention

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Route 249, Otani Tunnel (Suzu City, photo taken May 15)



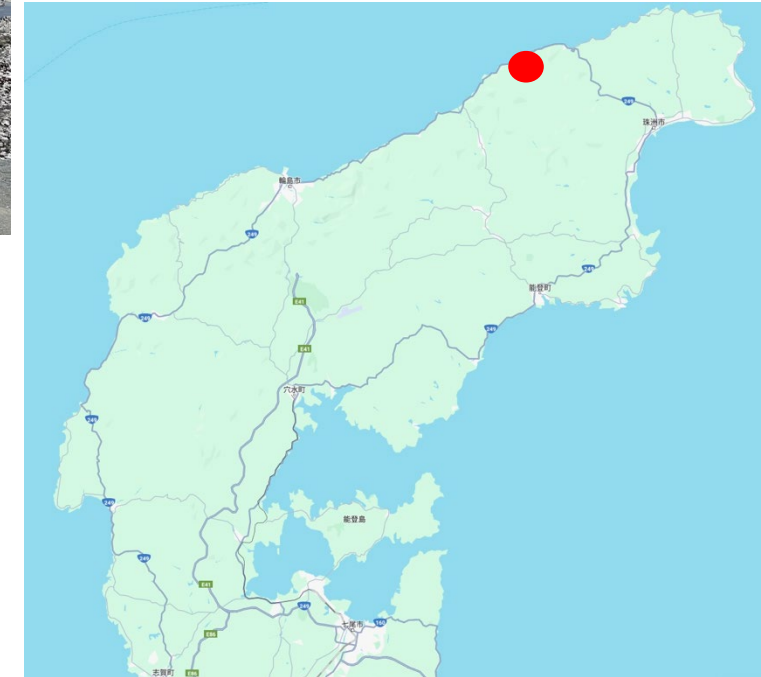
Due to a large landslide, over a distance of about 100 meters concrete lining collapsed



Survey members: Sasaki, Iryo, Fukuda, Hirata, Arata

Route 249, near Roadside Station Enden (Suzu City, photo taken March 20)

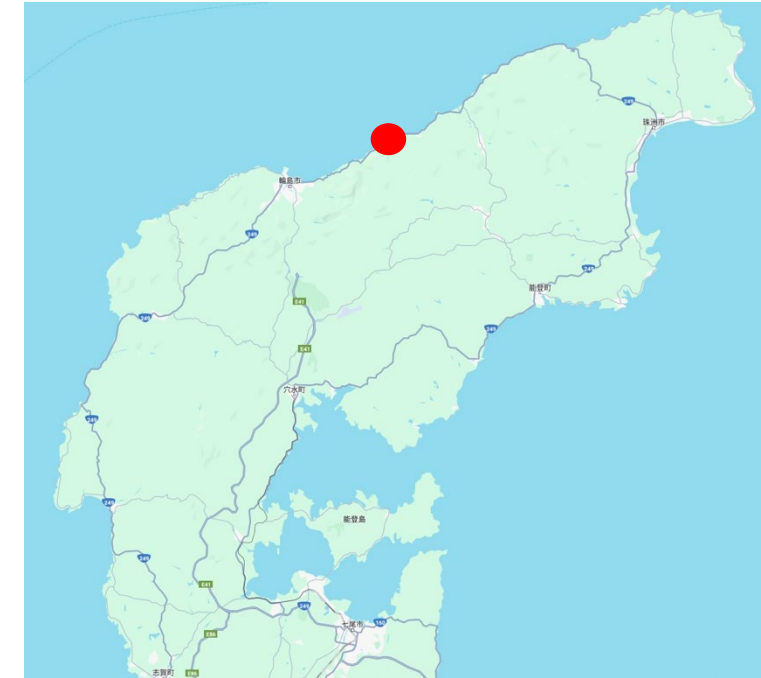
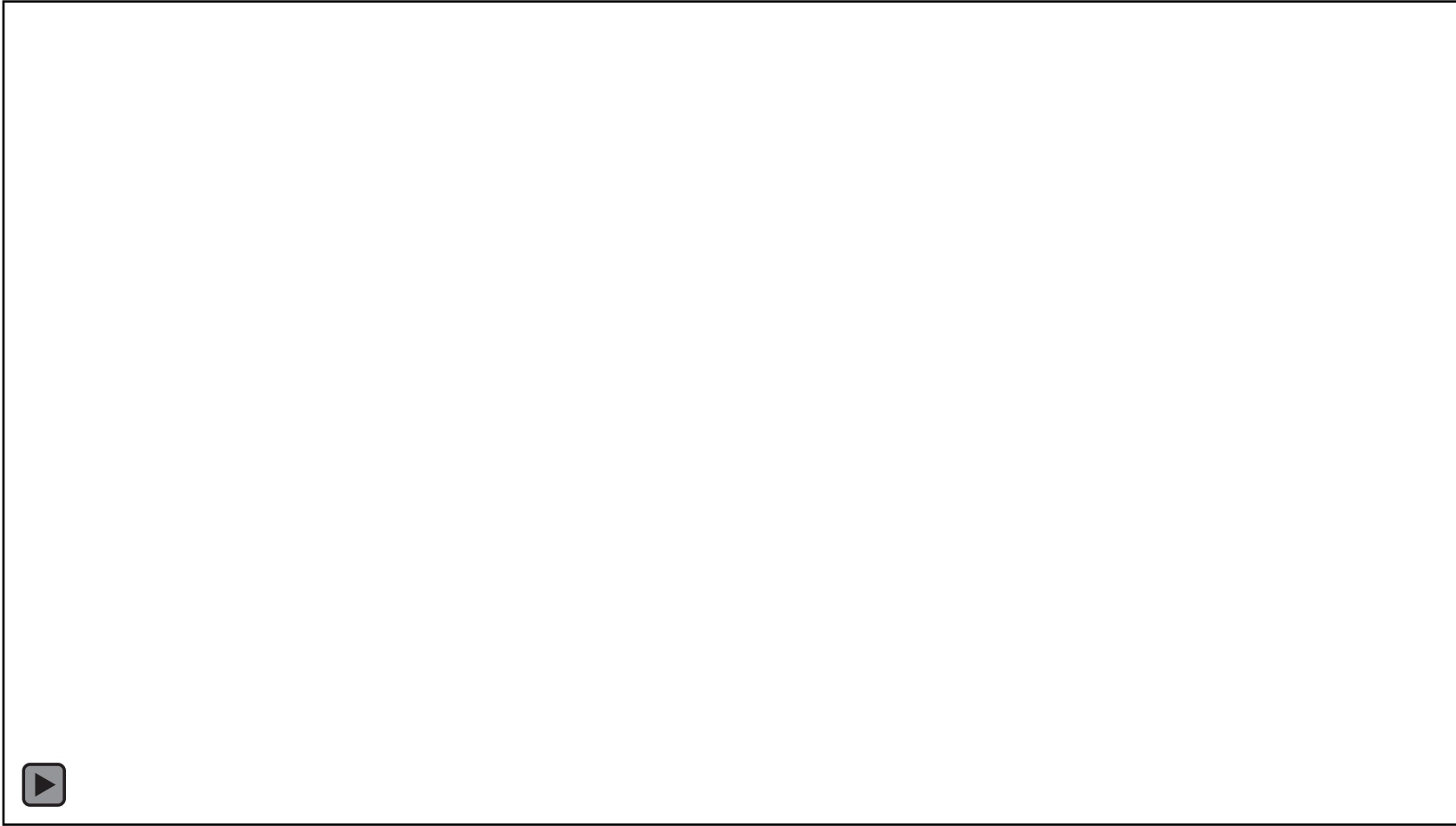
A total of 85 km of
seafloor was uplift



Road closed due to slope collapse
(The situation is still the same)

Survey members: Fukuda, Hasegawa, Ebashi, Nakamura,

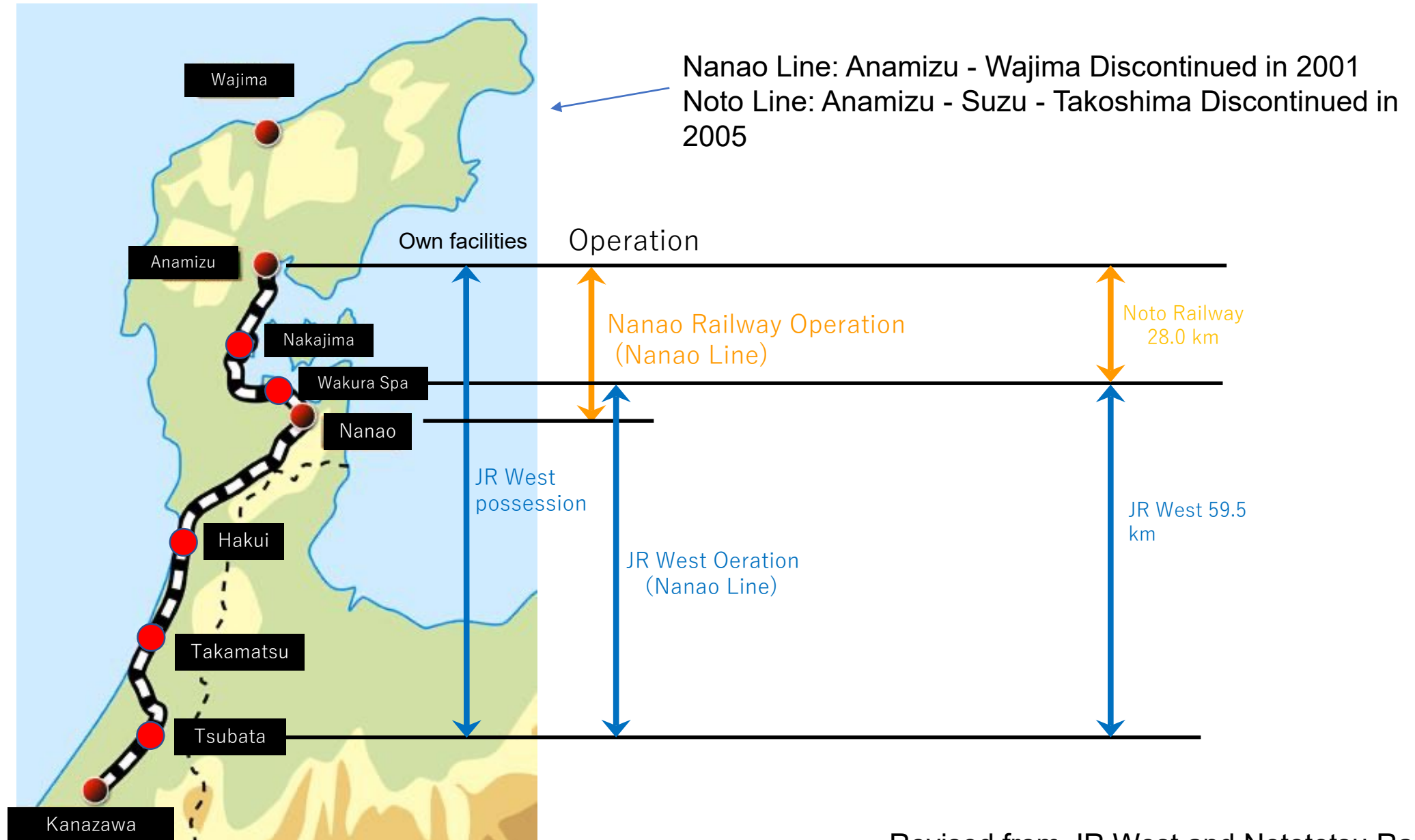
Route 249, near Senmaida Roadside Station (Suzu City, photo taken May 15)



Established an emergency road in the uplifted area.

Survey members: Sasaki, Iryo, Fukuda, Hirata, Aratani

Railroad Routes in Noto Peninsula



The mechanism of the runaway damage that occurred at Noto Airport

- Large cracks and steps occurred on the runway, which had been arranged as not requiring seismic countermeasures (e.g., liquefaction countermeasures).
- This is caused by either (1) slip displacement or (2) settlement due to shaking.
- Since no cracks, bulges, or collapses were observed on the slope of the embankment at Noto Airport, it is assumed that settlement due to shaking (2) had an impact.
- The mechanism of the settlement is that the shaking and vibration caused by the abnormalities in the pavement surface
Settlement due to shaking
The soil particles that make up the embankment are rearranged, causing subsidence to occur.

Embankment