

Response of JSEG (Japan Society of Engineering Geology) to the Noto Peninsula Earthquake in January 2024

Tomohiro Nishimura^{1*}

¹Disaster Geology WG of JSEG (Kokusai Kogyo Co., Ltd.), Tokyo, Japan

(*Corresponding E-mail: tomohiro_nishimura@kk-grp.jp)

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Abstract: For the Noto Peninsula earthquake of 2024, JSEG formed a survey team of 119 members and conducted a year-long survey and research. As a result, it was clarified that topographical and geological characteristics of the Noto Peninsula and the surrounding area were largely responsible for the disaster caused by the earthquake. The results of the study were compiled into 43 reports, and a public meeting was held.

Keywords: 2024 Noto Peninsula earthquake disaster, Slope disaster, Surface displacement, Coastal uplift, Research mission.

Introduction

At 4:10 p.m. JST on January 1, 2024, the magnitude 7.6 Noto Peninsula Earthquake occurred with its epicenter in the Noto region of Ishikawa Prefecture on the Sea of Japan coast. The earthquake caused strong seismic motion in Ishikawa, Toyama, Niigata, and neighboring prefectures, centered on the Noto Peninsula in northern Ishikawa Prefecture. The earthquake registered a maximum intensity of 7 (the highest intensity in Japan), triggered a tsunami along the coast of the Sea of Japan, and caused many landslides in various areas, burying many houses and cutting off many roads (Figure 1). Many houses collapsed and fires spread in the urban area of Wajima city. The earthquake caused 634 deaths (including 406 disaster-related deaths), 2 missing, 1,398 injured, 6,532 houses destroyed, and 23,680 houses partially destroyed (all as of August 5, 2025).



Figure 1, Landslide area on the northern coast of Noto Peninsula (January 2, 2024: Photo by Kokusai Kogyo).

JSEG's response to the 2024 Noto Peninsula earthquake disaster

JSEG established a Disaster Response Headquarters on January 2, the day after the earthquake, to deliberate on the disaster, and the Board of Directors meeting held on January 23 resolved to establish the "2024 Noto Peninsula Earthquake Disaster Mission Team" (led by Prof. Tomoyuki Otani, Gifu University). The Mission Team consists of 119 JSEG members who want to join in the survey and was divided into 8 working groups: Disaster Geology WG, Engineering Geomorphology WG, Environmental Geology WG, Civil Engineering Geology WG, Volcanic Geology WG, Chubu Regional Branch WG, Hokuriku Regional Branch WG, and Kansai Regional Branch WG.

The members of the Mission Team worked vigorously to prepare a report for the special session of the JSEG Annual Conference on October 9, 2024. During this period, representatives also made interim reports at the "Noto Peninsula Earthquake 3-Month Report" and "Noto Peninsula Earthquake 7-Month Report" organized by Japan Academic Network for Disaster Reduction. The reports were disseminated overseas through the International Committee of JSEG, and many of the Mission team's survey results were posted on the JSEG's website.

The results of the Mission team's activities were compiled and published as the "Survey Mission Report" in January 2025, exactly one year after the earthquake. This report includes 43 survey reports prepared by the members of each working group. In addition, a debriefing session for the public was held on January 11, 2025, in Kanazawa City, Ishikawa Prefecture, near the damaged area. This debriefing session received a great response, with 131 people attending at the venue and 124 people participating via the web, for a total of 255 people.

After successfully completing these activities, the Mission Team was disbanded in January 2025. However, survey activities are continuing at the individual and group levels, and future reports will be submitted to JSEG's journal. In addition, some groups plan to hold debriefing sessions in areas closer to the damaged

areas and in areas far away from the damaged areas to discuss lessons learned from this earthquake disaster.

Results of mission team's activities

In March 2024, an advance team was dispatched to the main candidate survey sites to collect information of assessing the site situation and planning a detailed survey. Each WG considered the theme and target of the survey, referring to the information obtained through the advance team's survey and various other site information at that time, and each WG conducted its own survey. This section introduces the summary of the reports published in the "Report of the Mission Team".

Slope failure and landslide

In the Noto Peninsula, numerous slope failures and landslides occurred because of the earthquake. Especially in the cities of Suzu and Wajima at the northern end of the peninsula, there were thousands of large and small slope failures and landslides. The earthquake caused roads to be cut off and many villages to be isolated. Some villages were buried by collapsed debris. These slope failures and landslides are considered to have been largely caused by the unique topography, and geology of the Noto Peninsula.

Surface displacement

In Wakayama-Cho, Suzu City, in the northern part of the Noto Peninsula, surface displacements of up to 2 m in height occurred along the lowlands of the Wakayama River (Figure 2). It is still under debate whether this displacement was caused by faulting, geological structure, or related to landslide activity.



Figure 2, Surface displacements along Wakayama River.

Coastal uplift and tsunami hazard

In the northern and western Noto Peninsula, the earthquake uplifted the ground up to 4 m and landed on the seafloor along the coast. The coastline moved up to 200 m offshore, and many fisher ports were rendered unusable. On the other hand, a tsunami hit the coast facing Toyama Bay on the east coast of the Noto Peninsula a few minutes after the earthquake, inundating or destroying many houses.

Liquefaction occurred in distant areas

Slope collapse, land surface displacement, and uplifts caused much damage in the northern part of the Noto

Peninsula, but there were also areas more than 100 km away from the epicenter that were severely damaged by liquefaction. In Kahoku City and Uchinada Town, Ishikawa Prefecture, and Niigata City, Niigata Prefecture, significant liquefaction occurred in areas behind dunes that developed along the Japan Sea and were heavily cut and flattened for sand mining and later urbanized. In these areas, liquefaction caused the ground to be displaced horizontally by up to 2 m, and many open cracks and compressive uplifts occurred on roads and the ground (Figure 3).



Figure 3, Cracks and Compressive Uplifts caused by lateral flow due to liquefaction (Uchinada-Town).

Thus, the 2024 Noto Peninsula earthquake caused a wide variety of disasters due to topographical and geological factors, and Mission Team members were investigating the mechanisms of these disasters and discussing future countermeasures.

Preparing for possible future disasters

In Japan, large-scale disasters have occurred every year in recent years (Table 1).

Table 1, Recent Major Disasters in Japan.

Year	Name and Causes of Disasters
2011	Great East Japan Earthquake
2011	Kii Peninsula Heavy Rain
2014	Hiroshima Heavy Rain
2015	Kanto and Tohoku Heavy Rain
2016	Kumamoto Earthquake
2017	Northern Kyushu Heavy Rain
2018	Hokkaido Eastern Iburi Earthquake
2020	July heavy Rain
2024	Noto Peninsula Earthquake

For most of these disasters, JSEG formed Disaster Survey Mission Teams to study their mechanisms and response measures. The results have been compiled into reports for society, and debrief meetings held for local government agencies and residents. To prepare for future disasters, JSEG members continually strive to improve their skills and contribute to a safe and secure society by sharing insights on disaster occurrence and response from the perspective of Engineering Geology.

References

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