Quick Report on Damage to Infrastructures and Buildings by the 2007 Noto Hanto Earthquake

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Overview of Presentation

- Earthquake and ground motions
- Damage to infrastructures
 - Slope failures and rock falls
 - Sewage system
 - Highway bridges
 - Road embankments
 - Port
- Damage to buildings
- Summary

Epicenter and Affected Region



Overview of Earthquake and Damage

- Origin time: 9:42 am, March 25, 2007 (JST)
- Epicenter: West off Noto Peninsula
- Magnitude: 6.9
- Focal depth: 11km
- Maximum seismic intensity: 6 upper
- Casualty: 1, Injured: 336
- Destroyed houses: 593, Partially destroyed houses: 1,206, Partially damaged houses: 10,889

Fire Defense Agency

Past Earthquakes and Probability of Occurring Seismic Intensity of 6 upper or Greater in 30 Years from 2006





Distribution of Seismic Intensity



Ground Motions and Acceleration Response Spectra



Rock Shed, Sosogi, National Highway Route 249

 Rock failure: 10m long x 30m wide





Rock Fall, Shibuta, National Highway Route 249



Uplift of Manhole, Monzen, Wajima City



Settlement of Road Surface and Backfill of Sewage Pipe, Monzen, Wajima City



Highway Bridges

- No serious damage to threaten structural safety
- General types of damage found during past earthquakes
 - Crack and spalling-off of cover concrete of RC column
 - Failure of bearing part
 - Crack at girder end by collision
 - Settlement of backfill soil at abutment

Highway Bridge Damage -Notojima Bridge

- 3-span continuous PC frame
- 18-span PCT simplysupported girders
- Bridge length: 1,050m





 Damage at the bottom of Pier No.7

Highway Bridge Damage -Other Damage

- Settlement of backfill soil (Noto Bridge, Right)
- Damage to expansion joint



Failure of Road Embankment, Toyota (H=30m), Noto Toll Road



Aerial view



Close view

Failure of Road Embankment, Beshodake SA (H=35m), Noto Toll Road



Aerial view

Close view

Schematic Mechanism of Earthquake-induced Flow Failure



•Existence of seepage water in embankments

Nanao Port -10m Sheet Pile Quaywall



Nanao Port -10m Sheet Pile Quaywall, No.1



Nanao Port -10m Sheet Pile Quaywall, No.2



Damage to Wooden Buildings, Monzen, Wajima City



Fall of tomb stones in E-W direction



Retrofitted Monzen District Office Building, Wajima City





JMA 6+ 1304 cm/s²

Retrofitted by steel braces

Damage in office room



Damage to Ceiling of Gymnasium



Elementary school Noto Town S Roof girder + RC column

Elementary school Shika Town S Roof girder + RC column

Summary

- The earthquake occurred in a seismically inactive region.
- Generated strong ground motions at several locations.
- Induced numerous slope failures and rock falls.
- Among the infrastructures, road embankments constructed by filling valleys were heavily damaged.
- Liquefaction-related damage was rather limited to sewage system and a port.
- In addition to wooden buildings, ceilings of large structures were damaged.