# Field surveys of damage to buildings and foundations from the 2014 northern Nagano earthquake

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## 1. Foreword

The department conducted two surveys of damage to buildings, mainly wooden houses, by the November 22, 2014 earthquake in Northern Nagano Prefecture, and a survey of the surrounding ground and foundations. For details, refer to literature 1.

## 2. Damage to buildings focused on wooden houses

In order to clarify the state of damage to wooden houses and other types of buildings from the earthquake that struck northern Nagano prefecture at 22:08 on November 22, 2014, in cooperation with the Building Research Institute, the department conducted surveys centered on the Kamishiro part of Hakuba Town. The primary survey confirmed many houses that collapsed or showed severe residual deformation in the Horinouchi district of that region. Judging from such conditions, it is thought that earthquake motion higher than upper 5 on the Japanese seismic intensity scale might have occurred in Hokujo in Hakuba Town, which is the location of the nearest earthquake observation station. And damage to mud-plastered wall houses, damage to houses in which the column and brace end joints were not connected adequately, displacement of houses in which the column ends or sills were not fixed to their foundations, and damage to houses with block foundations or non-reinforced foundations were found at many places. The secondary survey was a detailed survey of the state of damage including a visual inspection of the interiors of houses. The results of the surveys will be analyzed and summarized in technical documents to be used to study the causes of damage to buildings.

Photo 1: Collapsed houses

In the future, we intend on compiling technical documents for the evaluation of damage factors to the buildings.

## 3. Ground deformations at building sites

The survey of ground and foundations has revealed that a number of stone and retaining walls were heavily damaged or overturned in the Horinouchi district, which is a south-facing slope terrace. Many power poles were also shifted about 5-30 cm and inclined southward in the district. These indicate that strong ground motions could have been predominant in the north-south direction during the main shock.

Some documents reported that this district was placed near the shore of a large lake before, suggesting that the surface strata consist of soft soils and their geophysical conditions could vary with locations on the slope in the district. And by surveying soil investigation data, we will study the relationship between the structural damage and ground characteristics in the district.

Photo 2: Stone walls and power poles damaged southward

(Reference) Literature 1: Investigation report HP
http://www.nilim.go.jp/lab/bcg/kisya/journal/kisya20141127.pdf（Wooden building primary investigation report）
http://www.nilim.go.jp/lab/bbg/saigai/h26/141126nagano_kenchiku.pdf（Basic foundation investigation report）
http://www.nilim.go.jp/lab/bbg/saigai/h26/141129nagano_juutaku2.pdf（Wooden building secondary investigation report）