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# Extent of Damage to Buildings Caused by the Flooding of the Kinugawa River in the City of Joso, Ibaraki Prefecture, on September 10, 2015

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## 1. Foreword

The flooding of the Kinugawa River of September 10, 2015 caused extensive damage across the city of Joso, Ibaraki Prefecture. On that day, the Kinugawa River overflowed and burst its banks, submerging residential houses, buildings, other structures, farm fields, etc. across a wide area of the city, scouring the ground right beneath the collapsed levees, washing away residential houses, buildings, structures and vehicles, among other things, or making them tilt. Concerning damage to buildings and other structures caused by the flooding of the Kinugawa River, NILIM, in conjunction with the Building Research Institute, conducted on-site investigations on September 16 and October 7, 2015, to grasp the extent of damage to buildings and other structures caused primarily by the flow of floodwaters in areas right beneath the collapsed levees and other inundated areas.

## 2. Damage to Wooden Residential Houses and Prefabricated Residential Houses

Most of the buildings and other structures in areas supposedly hit directly by floodwaters bursting through the collapsed levees were washed away from foundations, but there were several wooden residential houses whose structural frames remained without being washed away. We saw the second floor section of a two-story wooden residential house whose structural frame had been heavily damaged and washed away (see Photo 1) and a heavily-tilted wooden residential house with the ground of its premises scoured (see Photo 2), among other wreckages. We saw a steel fabricated residential house, which was located approximately 150 meters away from the collapsed levee, with the ground all around it scoured, but we could not find no visual structural damage in the upper structure of the house. We saw some of foundation piles exposed in the scoured sections of the steel prefabricated residential house's premises, but it was later found, based on the manufacturer's information, that these foundation piles were those for ground improvement work.

## 3. Damage to Other Buildings and Structures

In addition to damage to residential houses, we saw

electric poles that had been heavily tilted in the direction of the flow of floodwaters, street lamps that had been completely uprooted together with their foundations, concrete slabs or asphalt slabs on subgrade that had been washed away downstream, vehicles that had been washed away or overturned, fallen trees that had been completely uprooted together with their roots, and heavy erosion of the ground, among other things.

Going forward, we plan to estimate the magnitude of external forces exerted, and study the mechanism of damage occurrence, on the damaged buildings, structures, etc., by analyzing conditions in which they had been washed away or had survived.



**Photo 1. Wooden residential house whose structural frame was heavily damaged and washed away**



**Photo 2. Wooden residential house with the ground of its premises scoured**

☞ For further information, please visit the following:

1) NILIM website on investigative report

<http://www.nilim.go.jp/lab/bbg/saigai/h27/20150910kinugawa.pdf>