

## Behavior of the 2011 Tohoku Tsunami inundated in Taro area (Miyako City) inferred from the distribution of flow traces

TACHIBANA, Toru<sup>1\*</sup>

<sup>1</sup>Soil Engineering Corporation

An outsized tsunami generated by the 2011 off the Pacific coast of Tohoku Earthquake swept the wide area along the Pacific coast of the Japan Islands. Taro area in Miyako city (Iwate prefecture) is one of severely damaged cities. This area is located near the rupture zone of this earthquake and situated in the inner part of a narrow bay along the Sanriku Coast. The area has been repeatedly destroyed by tsunamis such as the 1986 Meiji Sanriku Tsunami and the 1933 Showa Sanriku Tsunami. Hence, various mitigation measures against tsunamis were taken in the area. For example, roads in Taro area were planned to be easy to escape from tsunamis; the large embankments of 10 m high and 2.4 km long were built, surrounding the central part of the area. Nevertheless, the 2011 tsunami completely destroyed the area again.

Based on huge damages of the 2011 tsunami, disaster prevention plan against tsunamis are reconsidered in Miyako city. The field survey along the Sanriku Coast, which was immediately conducted after the tsunami, shows basic information on the 2011 tsunami in Taro area: run-up height and inundated area. However, behavior of the tsunamis inundated into the area, however, is still unclear. Therefore, we report the tsunami behavior based on tsunami traces collected by a field survey in Taro area.

We take notice tsunami traces left on artificial objects. In urbanized area, tsunami traces such as tsunami deposits are rare, whereas those left on artificial objects such as concrete structures or asphalt-paved roads are abundant. Some of these traces record directions or orientations of tsunami flows and become clues to clarify behavior of the tsunami.

Our field survey was conducted in November, 2011 (about 8 months after the 2011 tsunami). In this survey, about 300 points of tsunami traces were observed and flow directions or orientations left in them were measured mainly on the embankments and the roads. These traces are categorized into two types of flow traces. One type of traces is linear scrape on flat surfaces of concrete structures or asphalt-paved roads. This type is left by some objects dragged by the tsunami such as ships, building materials, or gravels. Directions of the scrapes indicate those of tsunami flows. Another type is bending of poles such as street lights or utility poles. This type is formed by some objects that are moved by tsunami flows, and hit and bend poles. Bending directions of the poles reflect those of tsunami flows.

Distribution of flow traces of the 2011 tsunami in Taro area are interpreted assuming that these traces were left by the strongest run-up and backwash currents in the tsunami. Representation of behavior of the tsunami is summarized as multi-directional run-up currents shifted by landform and the embankments and backwash currents showing nearly direct routes to the sea.

Keywords: tsunami, 2011 Tohoku Earthquake, flow trace, Taro, Miyako