

## Development of tsunami fragility curves on railway structures based on the 2011 off the Pacific coast of Tohoku earthquake

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The Great Tsunami associated with the 2011 off the Pacific coast of Tohoku earthquake caused severe damage to railway structures on the coast of the Tohoku region in Japan. It is effective to obtain fragility curve from damaged data in this disaster to predict the risks of railway structures to the tsunami in the future. It is generally represented by a lognormal distribution or a normal distribution. In this study, we obtained fragility curve by integrating spatial damage data for railway structures and spatial inundation data accompanying the 2011 off the Pacific coast of Tohoku earthquake on GIS. The method of obtaining tsunami fragility curves were referred to Koshimura et al. (2009).

In this study, we collected the data of damage and location for railway structures located in the Tohoku region to refer multiple documents. First, the data of inundation depth at intervals of 100 meters of the 2011 off the Pacific coast of Tohoku earthquake published by the Ministry of Land, Infrastructure and Transport was utilized to grasp the inundation depth where the railway structure is located. Second, we used the railway data of MLIT and Geospatial Information Authority to grasp the location of the railway structure. The kinds of structure in railway structures are different from station, bridge, tunnel, railway crossing, roadbed, retaining wall, cage, embankments, cuts and so on. The kinds of material in railway structures are also such as soil, C, RC. The tsunami fragility curves were obtained by using the all data and the case of using only RC to consider the influence of the structural kind.

As a result, it was shown that the gradient of tsunami fragility curve becomes smaller as compared with the tsunami fragility curve for buildings in the 2011 off the Pacific coast of Tohoku earthquake shown at Koshimura and Gokon (2012). The reason is to obtain the tsunami fragility curve from various railway structures. Furthermore, tsunami damage probability for railway structure on Ishinomaki in Miyagi Prefecture and Shimanokoshi in Iwate Prefecture were shown to confirm the reproducibility of the obtained tsunami fragility curve by using the spatial inundation depth calculated by using the Cabinet Office model.

Keywords: Tsunami fragility curve, The 2011 off the Pacific coast of Tohoku earthquake, Railway structures

