Efforts to Minimize Damage to Sewerage Infrastructure in the Event of a Major Earthquake

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1. Introduction

In the Cabinet Office Central Disaster Prevention Council, there is concern about a massive earthquake that may occur in the Nankai Trough or directly under Metropolitan Tokyo. Should such an earthquake occur, sewer pipelines, one of the critical lifelines, are expected to suffer serious damage. It is, therefore, urgently required to establish pre- and post-earthquake measures to minimize damage, ensure toilet functions after earthquake and preserve water quality in public waters. Since damage simulations of higher accuracy are required to implement effective measures, it is effective to analyze and utilize damage trends based on data on pipeline damage caused by past earthquakes including the Great East Japan Earthquake.

NILIM is organizing data on pipeline damage caused by past earthquakes in a unitifed format in order to utilize the data for simulating damage to sewer pipeline infrastructure in the event of a massive earthquake such as a Nankai Trough Massive Earthquake. Using this data, NILIM is performing simulations of damage to sewer pipeline infrastructure in the event of a massive Nankai Trough Earthquake, studying disaster support systems and effective earthquake-proofing for infrastructure, and evaluating priorities in disaster mitigation measures.

2. Establishment of a database of damage information on sewer pipeline infrastructure

Since earthquake-proofing of existing infrastructure requires a lot of money and time, it is necessary to promote earthquake-proofing efficiently and effectively by estimating areas prone to damage in advance, determining priorities amongst earthquake proofing measures, and focusing investment in areas of high priority.

In prioritizing earthquake-proof measures, it is necessary to consider the probability of damage to any sewer system and the social impact if the sewerage system is damaged. To consider the probability of damage, it is effective to analyze damage trends, but information on past damage is not well organized. NILIM is collecting information on damage to sewerage systems available since the 2000 Western Tottori Earthquake, to create a database in a unified format.

In fiscal 2013, data from about 130 local governments damaged by the Great East Japan Earthquake was collected to organize the data on the specifications of sewer pipeline infrastructure (pipe type, pipe diameter, year of installation, etc.) and level of damage thereto, damage information including the number of cases of manhole liquefaction, ground information including the nature of soil, N-value, etc., and turbulence information including measured seismic intensity, etc.

3. Simulation of damage to sewer pipeline infrastructure in the event of a massive Nankai Trough Earthquake and study on support systems

A massive Nankai Trough earthquake, which is expected to occur, is estimated to cause wide-spread damage across prefectures and Regional Development Bureaus. Support from national and local governments is essential to minimize damage to sewer pipeline infrastructure and restore functions promptly. It is, therefore, important to study in advance necessary support systems, rules of support, etc. based on damage simulations.

Based on the seismic intensity and flooding from tsunamis assumed by the Central Disaster Prevention Council for a massive Nankai Trough Earthquake, NILIM is simulating damage to sewer pipeline infrastructure and studying necessary support systems. In the future, after analyzing the factors that greatly affect damage quantity, such as earthquake-proofing of infrastructure and ground conditions, we are going to improve the accuracy of damage simulations and study technologies for immediate damage estimation.

4. Conclusions

Since the Great East Japan Earthquake, local governments throughout the country are reviewing their disaster prevention plans and earthquake-proofing infrastructure. There are various constraints on such efforts, but since it is essential in the future to simulate damage at low cost and to a high degree of accuracy, and carry out measures efficiently and effectively, NILIM will also advance research relating to the issues.

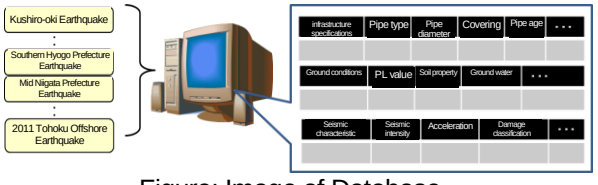

Figure: Image of Database