Joint Study on Sewer Damage and Its Impact Caused by Large Earthquake in Aomori City

Year of Research | 2007～2010

(Purpose)
In recent years, large earthquakes have occurred frequently and damage to sewer facilities has become a serious issue. There are multiple faults in Aomori City and the large-scale sewer damage that is expected should an earthquake occur in the Nyunai fault zone is a particular concern.

This study is being conducted to develop an earthquake countermeasure plan aimed at planning emergency, medium-term, and long-term earthquake resistance projects for the entire Aomori City area. The matters being investigated are as follows.

1. The estimated amount of damage that would be suffered as a result of a large earthquake in Aomori City.
2. The approximate cost of projects to implement disaster prevention measures in Aomori City and the prioritization for project implementation.
3. Disaster mitigation goals for Aomori City and the measures required to meet them once they have been set.

There are pipelines with a total length of 1,065 km in Aomori City. Of this length, 114 km in the combined sewer areas (Shijimikai and Sakuragawa drainage districts) is to be targeted in FY2007.

(Results)
1. Damage estimation
   1) Damage estimation for pipeline facilities
      An estimation of damage to the pipeline facilities was made according to the “Manual for Large-Scale Earthquake Induced Damage Estimation Techniques and Utilization of Estimates.” The damage estimation technique employed was to set a damage rate according to the earthquake intensity, liquefaction risk level, and pipe type (clay pipe, polyvinyl chloride pipe, or concrete pipe) and calculate the length of damage, monetary cost of the damage, and rate of damage for each mesh.

      For each pipeline facility, the earthquake damage was classified by pipe type, construction method (depth of excavation), occurrence or non-occurrence of liquefaction, pipe diameter, and other conditions. Based on the results, a hazard map was created.

   2) Calculation of the population affected
      The sewer data for Aomori City was organized according to earthquake resistance. This revealed that 99% of collecting sewers were clay pipe in the combined sewer areas in Aomori City. More reports of breakage and other damage have been received for clay pipes in past large earthquakes than for any other type of pipe. Breakage of a collecting sewer means the functional failure of the drainage facility (toilets and the like) as a direct result.

      Thus, the population affected was calculated from the number of installed collecting sewers and the number of persons per household.

Fig. 1. Joint study flow
Approximate cost of projects to implement disaster prevention measures and prioritization for project implementation

In estimating the damage, earthquake damage to pipeline facilities was classified. Based on the results, we selected disaster prevention works. For the selected disaster prevention works, we calculated the approximate cost of the earthquake resistance projects required and the volume of work to be implemented as emergency, medium-term, and long-term projects. Once these had been ascertained, project implementation was prioritized.

Establishing disaster mitigation goals and disaster mitigation measures based on these goals

Based on the calculated population affected and other such data, we investigated how to narrow down areas to be inspected in the event of a disaster, how to conduct emergency and makeshift surveys efficiently, and how to use the survey results for restoration. The necessary number of temporary toilets per evacuation site was calculated.

(Plans for the future)

Going forward, we plan to perform damage estimations, earthquake countermeasures planning, and disaster mitigation planning for the remaining combined sewer areas and separate sewer areas in Aomori City. In this way, we will compile an earthquake countermeasures plan for the entire Aomori City area by FY2010.

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Key words
Damage estimation, population effected, earthquake countermeasures plan