

## Study of methods of for predicting damage to sewerage facilities in large scale earthquakes and applications for the results

Whole term

2005.6 ~ 2006.3

### (Purpose)

The October 2004 Niigata Prefecture Chuetsu Earthquake, which occurred after the Hanshin-Awaji Earthquake, caused large scale damage to sewerage facilities and affected the lives of residents.

Therefore, in November of that year the “Committee to Investigate Seismic Technical Measures for Sewerage Facilities” (Chairman: Professor Kazuhiro Tanaka, Nihon University) was established. The Committee proposed ways that seismic countermeasures should be applied to sewerage facilities in the “Report of the Committee to Investigate Seismic Technical Measures for Sewerage Facilities”.

The report states: “First it is necessary to carry out seismic diagnosis and predict the damage state of sewerage facilities due to earthquakes. The results can be used to prioritize seismic countermeasures, and to prepare plans for seismic countermeasures for sewerage facilities. In addition, the results can be publicized as hazard maps that allow the status of seismic resistance and the effects of a disaster to be easily understood and can be used to facilitate the understanding of residents and local government of the necessity for seismic measures for sewerage facilities”.

Therefore the present research was carried out with the objective of demonstrating methods of predicting damage to sewerage facilities based on damage experienced in past large scale earthquakes and methods of utilizing the results of these predictions.

This research was carried out jointly with 12 local governments\*, based upon the status of deliberations of the “Committee to Investigate Seismic Technical Measures for Sewerage Facilities (Chairman: Professor Kazuhiro Tanaka, Nihon University, under the auspices of the Ministry of Infrastructure, Land and Transport)”.

\*: Saitama Prefecture, Chiba Prefecture, Tokyo-to, Kanagawa Prefecture, Shizuoka Prefecture, Aichi Prefecture, Saitama City, Chiba City, Kawasaki City, Yokohama City, Shizuoka City, Nagoya City

### (Results)

#### 1 . Method of postulating damage

##### 1 ) Pipeline facilities

The flow was determined for the method of calculating pipeline damage ratio and damage amount based upon grid cells. Also, two reference examples were provided for the method of setting the damage ratio.

- a. Relationship between damage form and ground conditions (relationship between microtopography and damage ratio)
- b. Relationship between construction conditions and damage state (relationship between earthquake intensity, liquefaction hazard, and type of pipeline and damage ratio)

##### 2 ) Processing and pump stations

The flow was determined for the method of calculating damage ratio and damage amount by dividing the damage form and extent into types from the earthquake motions, ground conditions, and status of seismic resistance. The damage ratios were set based upon the damage states in the Hyogo Prefecture Nambu Earthquake and the Niigata Prefecture Chuetsu Earthquake.

#### 2 . Methods of utilizing the prediction results

In order to use the prediction results, maps were made of the damage conditions, and an image of the creation of such maps was demonstrated. Also, by superimposing other information on the map (information on disaster prevention bases, facility design conditions, degree of aging, information on seismic countermeasures), the procedure for utilizing the map as a fundamental document for establishing seismic countermeasure plans was demonstrated.

**(Future Plans)**

Future investigations will include prioritizing seismic countermeasures establishing countermeasure plans (investigation of damage form and countermeasure methods, etc.) in conjunction with associated organizations.

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key words

Seismic countermeasures, Hazard maps, Damage postulation