

## Investigation of measures for protecting sewerage facilities from earthquakes

Whole term

2004.11–2005.9

### (Purpose)

Sewerage facilities are an important lifeline, and damage to these facilities has a major impact on the lives of residents and hinders other lifelines and emergency relief activities.

Seismic countermeasures have been promoted for sewerage facilities since The South Hyogo prefecture Earthquake in 1995, but the state of progress of applying seismic countermeasures to existing facilities in most localities is insufficient. Under these circumstances The Mid Niigata prefecture Earthquake in 2004 occurred in October 2004 causing large damage to sewerage facilities. This research was carried out based upon the damage to sewerage facilities caused by The Mid Niigata prefecture Earthquake in 2004. In last year's "Annual Report '04, Volume 2 (Japan Institute of Wastewater Engineering Technology)", seismic countermeasures for new facilities were reported, based upon a general overview of the damage condition and the knowledge gained from it. This year, seismic countermeasures based upon the state of application of seismic countermeasures were reported for existing sewerage facilities, which is a task for urgent response.

### (Results)

#### ( 1 ) Fundamental thinking regarding the progress of seismic countermeasures

The basis of seismic countermeasures is "disaster prevention" in which structural aspects of seismic resistance for each individual facility are improved so that the lives and property of residents are protected and emergency response measures are not seriously impeded after an earthquake. In addition, there is an urgent need to undertake "disaster reduction" as a provisional response to enable the effect of the disaster to be minimized and speedy recovery to be carried out in the event that an earthquake causes damage to sewerage facilities.

#### ( 2 ) The function that sewerage facilities should have in an earthquake

Seen from the viewpoint of residents, the function that sewerage facilities should be regarded as having following an earthquake is "supporting lives". The function of sewerage facilities during a disaster can be considered to be 1. Maintenance of public sanitation, 2. Elimination of flooding damage, 3. Securing the use of toilets, and 4. Enabling emergency response activities.

#### ( 3 ) Disaster prevention index, disaster reduction index

Disaster prevention indices for the improvement of seismic resistance have been set in stages for the long term, medium term, and urgent, corresponding to the necessity and urgency of the function that sewerage facilities should possess. The long term, medium term, and urgent indices for each facility are shown in Table 1. Also, while taking disaster prevention indices into consideration, disaster reduction indices have been set bearing in mind the functions that must be maintained in an emergency situation, so that provisional response to a disaster can be immediately undertaken.

Table 1 Long term, medium term, and emergency indices

Facility	Emergency indices	Medium term indices	Long term indices
Pipeline facilities	Maintain the flow in pipelines connecting processing facilities to important disaster prevention centers Prevent major hindrance to traffic caused by damage to pipelines buried underneath tracks and emergency transport routes. Improvement in the seismic resistance of the flow down function by networked utilization of existing facilities, etc.	Maintain the flow in important main lines apart from those on the left Improve the sewerage system overall flexibility by systematic response	Important main lines and other pipelines maintain their design capability in Level 1 earthquake motions Important main lines maintain their design capability during disasters against Level 2 earthquake motions
Treatment plants	Maintain water pumping function, settling function, and purification function Seismic strengthening of facilities for which failure can have a major impact	Maintain high performance processing function	Pumping function, high level processing function, and sewage processing function maintained in Level 1 earthquake motions A certain extent of structural damage is allowable in Level 2 earthquake motions, but rapid restoration is possible
Pump stations	Maintain the pumping function of pumping stations connected to the above pipeline facilities Maintain the pumping function of rainwater pumping stations Seismic strengthening of facilities for which failure can have a major impact	Maintain the flow down function of important main lines apart from those on the left	Pumping function maintained in Level 1 earthquake motions A certain extent of structural damage is allowable in Level 2 earthquake motions, but rapid restoration is possible
Toilets	Maintain the use of toilets at disaster prevention centers		

**(Summary)**

The results of this year's research have demonstrated the basic considerations for promoting seismic countermeasures in existing facilities. It is expected that the results of this research will help promote the application of seismic countermeasures to existing facilities.

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key words

Existing facilities, Seismic countermeasures, Preserving public sanitation, Disaster prevention, Disaster reduction