

Characteristics of Sewer Pipeline Damage by the Kumamoto Earthquake and Publication of Seismic Damage Database (Study period: Fiscal 2016 and 2017)

IWASAKI Hirokazu, Head FUKATANI Wataru, Senior Researcher

HIRAIDE Ryosuke, Researcher

Wastewater System Division, Water Quality Control Department

Keywords: sewerage, pipeline, earthquake, database

1. Introduction

Since the occurrence of the Great East Japan Earthquake and the Kumamoto Earthquake, local governments are promoting earthquake countermeasures including formulation of sewerage BCP and earthquake-proofing of facilities. It is, however, important to raise the efficiency of projects for earthquake countermeasures, etc. through selection and concentration based on disaster estimation since the stock of sewerage facilities is enormous and the time and budget that can be spent are limited.

As one of activities to support such local governments etc., Wastewater System Division created and published "Sewer pipeline seismic damage database (the "Database"), organizing information on past earthquake disasters that is available for determination of priorities etc., in implementing earthquake countermeasures in an integrated manner using unified items. We also analyzed the characteristics of disasters and countermeasures based on the data obtained from the field survey conducted after the Kumamoto Earthquake and from the materials collected so that results of the analysis, which are reported herein, may be referred to for more effective earthquake countermeasures and BCP formulation.

2. Outline of the sewer pipeline seismic damage database

The Database organizes the disaster information on sewer pipeline facilities for the earthquakes with seismic intensity of 6 or more that occurred during a period from 1993 to 2016 (13 earthquakes in total). Information registered in the Database consists of earthquake information (seismic intensity, magnitude, SI), ground information (type of soil, type of microtopography), sewerage information (earth covering, pipe type, pipe diameter, manhole type, etc.), and damage information (damage information, extent) and is organized according to each span of sewer pipeline. Total number of data in the Database reached 7,000 as a result of organization and addition of about 2,000 pieces of data (spans) obtained from the recent Kumamoto Earthquake. The Database is available, e.g. for estimation of hazardous sites in BCP formulation and renewal by local governments etc., preparation of practical drill plans, and determination of priorities in development of earthquake-proofing measures of facilities.

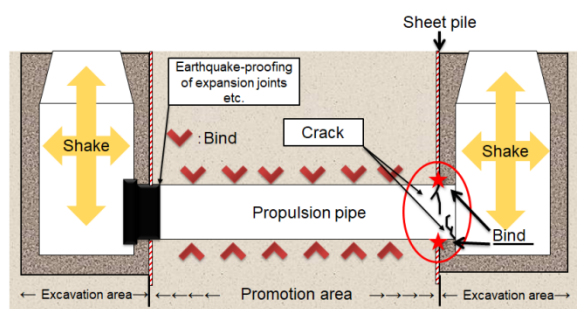


Figure 1: Mechanism of disaster in the jacking method section

3 Trend analysis of sewer pipeline damage in Kumamoto Earthquake

In order to clarify the characteristics of the pipeline damage (about 86 km) in the Kumamoto Earthquake, we analyzed the trend of disaster according to pipe types, pipe diameters, years of laying, earth covering, and damage forms by collecting the MLIT's published material, disaster assessment material, materials showing the sewer attributes of damaged pipelines (sewerage ledgers, drawings, etc.), reports on the telecamera survey of the inside the pipelines conducted after the Earthquake, landform division maps, completion documents, etc. It was mainly found from this analysis that backfill of crushed stones greatly contributed to the control of liquefaction and that earthquake-proofing of joints such as expansion joints is significant because most cracks occurred around the openings of the pipes laid with the jacking method (Figure 1).

Organization and analysis of disaster information as stated and accumulation of findings are considered important since results are available for disaster estimation in case of an earthquake, selection of more effective earthquake resistant measures, and prompt recovery activities after the earthquake.

See the following for details.

- 1) Wastewater System Division's website: Characteristics of damage to sewer pipeline facilities in the 2016 Kumamoto Earthquake and countermeasures
<http://www.nilim.go.jp/lab/ebg/jishin.html>
- 2) Wastewater System Division's website: Sewer pipeline seismic damage database
http://www.nilim.go.jp/lab/ebg/zishin_db.html