NILIM's Activities to Support Management of Water Supply and Sewerage Pipes

SANMIYA Takeshi, General Manager Water Supply and Sewerage Department

(keywords) anti-earthquake measures, measures against deterioration, inspection survey, preventive maintenance, database

1. Introduction

The administration for construction and management of water supply was transferred from the Ministry of Health, Labor and Welfare to the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in April 2024 and the Water Supply and Sewerage Department and Water Supply System Division were established at NILIM. In addition, on January 1, 2024, preceding the transfer, the M7.6 magnitude earthquake that struck the Noto region occurred (hereinafter referred to as Noto Peninsula Earthquake) and much of the water supply and sewerage facilities were damaged in the north area of the Noto Peninsula. With the objective of supporting the affected cities and towns, Noto Water Supply and Sewerage Reconstruction Support Division was established in Nanao city (the details of this achievement are described on page 119 of this document).

Now that the penetration rate of wastewater treatment facilities including sewerage exceeds 90%, it is not yet sufficient to ensure sufficient measures to continuously maintain both water supply and sewerage system in the future including anti-earthquake measures and measures against deterioration. In this report, I will explain survey and research results, that NILIM is currently making, contributing to these measures.

2. Survey and research that contribute to reducing disaster damage similar to the damage caused by earthquakes

The Noto Peninsula Earthquake damaged 136,000 houses, at the maximum, and caused a water outage. The water pipelines were restored on May 31, 2024, and the discharge function of sewerage pipelines was secured on April 25, 2024, so restoring the systems took around 5 months and 4 months, respectively. NILIM dispatched its staff to the affected areas just after the earthquake to ensure support to local governments affected by the disaster to help with temporary restoration and to conduct a survey on the disaster situation. (Figure-1)

In the Committee's report [1] that reviewed anti-earthquake measures for water supply and sewerage system (Chairman: Satoshi Takizawa, Professor of The Tokyo University Graduate School) created by MLIT, it was pointed out that the delay in ensuring anti-earthquake measures for facilities was a substantial factor contributing to the amount of damage. NILIM

Hearing on disaster situations (January 3rd: at the Ishikawa prefectural office)

Survey on disaster situations (January 13th: in Hakui city)

Survey on disaster situations (February 12th: in Wajima city)

Second survey on reviewing support status (February 13th: in Uchinada machi)

Figure-1 Approaches by NILIM's Sewerage Department (at that time) to Noto Peninsula Earthquake

plans to analyze disaster trends such as liquefaction in accordance with pipe specs such as pipe type, diameter, soil nature, micro-topography and earth covering as well as whether there exist anti-earthquake measures or not, using the database for earthquake damages to sewerage pipelines accumulated through research into earthquake disasters up until the current day. We assume that the local governments will ensure anti-earthquake measures to critical facilities such as shelters and hospitals used as disaster control centers, or the most critical facilities. High priority is given to the facilities that would cause a loss of function to the entire system if their ceased to function. Additionally, we would like them to review the vulnerability of their facilities to disasters using the above-mentioned analysis results. After the Noto Peninsula Earthquake, it was tantamount to restore the water supply and sewerage system comprehensively and promptly. We would like to ensure prompt execution of temporary restoration when disasters strike by streamlining applicable technologies, in addition to analyzing the survey method used to determine the reasons for disasters and for disaster prone situations, the time required for temporary restoration, the cost and other issues.

3. Survey and research contributing to measures to prevent the deterioration of pipelines

We have around 490,000km of sewerage pipeline

stock (as of the end of FY2022) and we estimate that their deterioration will rapidly accelerate in the near future. In such a situation, it is important to optimize the sustainable assurance of pipeline system functions and its cost through an appropriate management cycle such as inspection, survey, plan making, repair and renovation. NILIM publicly discloses [2] a database streamlining such information as pipe type, number of years elapsed and deterioration evaluation results including corrosion by collecting TV camera survey results, etc. for sewerage pipelines from local governments possessing such data that is freely available. Even if there is not sufficient inspection data available including TV camera survey results from local governments that have a plan for sewerage pipelines. Additionally, NILIM discloses a relative estimation of the soundness rate showing the proportion of "soundness level ranking the soundness of pipeline facilities by systematically classifying the status of sewerage pipeline facilities". It incorporates data regarding the total pipelines and the years elapsed (hereinafter referred to as "soundness rate prediction formula"). We present the soundness rate prediction formula and the urgency-importance matrix shown in the graph describing the formula seen in Figure-2. It is based on data covering around 310,000 spans for 60 local governments (as of May 2021). We continue to periodically update the data.

In addition, every year we review the total management length of sewerage pipelines and the occurrence of road collapse caused by sewerage pipelines. In this review, we summarize pipe type, earth covering, collapse factors, abnormal situations such as breakage and joint misalignment and present examples of preventive measures for road collapse caused by sewerage pipelines. [3]

Moreover, we created "sewerage pipeline simulation facilities" in FY2021, reproducing a life-size pipeline to verify the function of devices that can inspect and survey the inside of sewerage pipelines, and to enable local governments to select survey devices suitable for usage when conducting a sewerage pipeline survey. They also promote further technological development by private companies. We prepared a "catalog for sewerage pipeline survey devices" in July 2024 based on experiments using this facility. (its details are described on page 97 of this document).

Also, we made a questionnaire survey, for water supply utilities all over Japan to identify the execution status of deterioration evaluation for water pipelines, and to evaluate the deterioration level for each pipeline based on pipe type, burial period and burial environment, etc.

Through the above-mentioned surveys and research, we continue to support local governments to establish the method of efficient preventive and maintenance management for water supply and sewerage pipelines. Also to develop inspection and survey technologies.

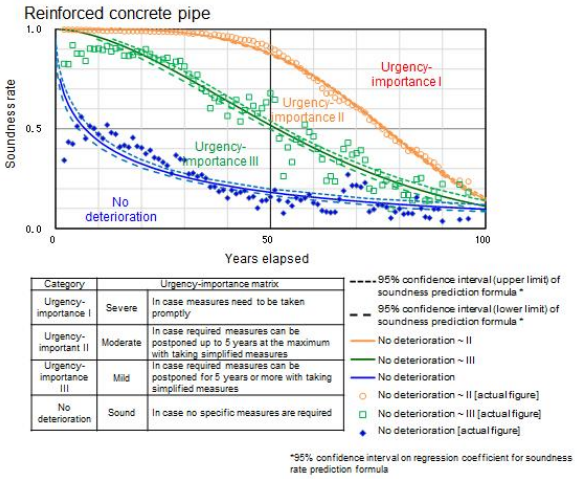

Figure-2 Soundness rate prediction formula (reinforced concrete pipe) and urgency-importance matrix

4. Conclusion

On January 28, 2025, there was a large-scale road collapse in Yashio city, Saitama Prefecture which resulted in a tragic accident where a driver with his truck fell into the collapsed hole. At the moment I was writing this article, the rescue of the truck driver as well as the sufficient analysis of the cause were not yet determined. The cause of the collapse was damage to the sewerage pipeline in the area, and we believe the root cause was the pipeline's corrosion. This accident reminded us that the water supply and sewerage system are an important infrastructure closely linked with our daily lives and substantially related to our living. NILIM would like to continue to develop its research activities and give support to system management bodies so that local governments can appropriately and efficiently manage their water supply and sewerage system.

☞Detailed information is as follows.

1) MLIT homepage: The Committee to review anti-earthquake measures for water supply and sewerage system, August 2024 https://www.mlit.go.jp/mizukokudo/sewerage/mizukokudo_sewerage_tk_000874.html

2) NILIM homepage: Database for deterioration of water supply and sewerage pipelines, soundness rate prediction formula, referred to on February 25, 2025 https://www.nilim.go.jp/lab/ebg/rekka-db.html

3) NILIM homepage: The total management length of sewerage pipelines and the occurrence of road collapse caused by sewerage pipelines, referred to on February 25, 2025 https://www.nilim.go.jp/lab/ebg/kanbotsu.html