

Survey Study on Maintenance and Operations Control Policies based on Sewer Manhole Cover Soundness Evaluations (F City)

Year of Research

2012 • 2013

Appropriate stock management

(Objective)

This study was held with the objective of establishing the efficient maintenance and operations methods required for the systematic maintenance and operations of existing manhole covers. As performance standards for manhole covers have changed with the times, many of the older manhole covers in F City now in service may not meet the current standards. Other problems include being weakened by corrosion, level gaps between the manhole cover and the frame, etc. In this study, we carried out performance evaluations on existing manholes and field surveys in order to determine the performance level of the city's unique existing manhole covers. Further, we created an order of priority for the purposes of efficient maintenance and operations, and considered evaluation standards, etc., which also included quantitative evaluations.

(Result)

1) Changes of existing manhole covers

The specifications of the city's manhole covers have been revised countless times in order to meet the demands of increases in traffic and vehicle size over the years. As can be seen in **Figure 1**, the structure and features of manhole covers are changing.

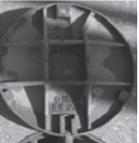
Product Type	A	B	C	D
Photo (Underside)				
Years in Service	Over 40	Over 30	Over 20	Over 15
structure	Lateral bracing	Lateral bracing	Steep incline structure	Steep incline structure

Fig 1. Changes of old-type manhole covers

2) Performance evaluations and consideration of the order of priority

Through weight-loading tests, Type A was found not to meet the standards for deflection, residual deflection, or load bearing. Further, a high percentage of lateral bracing structured covers, which include Types A and B, were found to be rattling. Considering the results of these performance evaluations, we considered the priority of inspection and replacement for the purposes of risk management involving existing manhole covers (**Chart 1**). While countermeasures will generally be made in the order of longest years in service, with older covers being higher priority, lateral bracing structured covers that have been in service for over 30 years pose an especially high risk, requiring top-priority handling.

Chart 1. Inspection/Modification Priority by Product Type

Inspection / Modification Priority	Product Type	Estimated Years of Service
High	A	Over 40
	B	Over 30
Low	C	Over 20
	D	Over 15

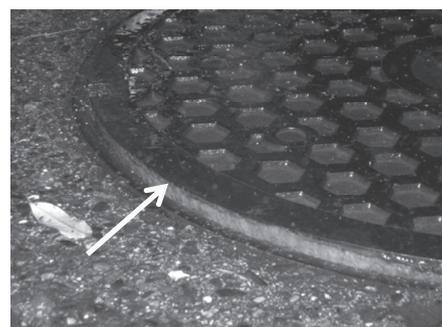


Fig 2. Level gap formed (cover in corrosive environment)

3) Effects of corrosion

The remarkable deterioration of the bottom of covers in corrosive environments was found to have lead to the loss of parts and the erosion of the ribs of the covers. Further,

Chart 2. Inspection Items for Evaluating Corrosion Levels

Inspection Items	Phenomenon observed in corrosive environments
1. Check cast bottom of cover markings	Separation or loss of cast markings (letters)
2. Check functionality of parts	Missing or non-functional locks or hinges
3. Measure surface level gap (Cover/Ring)	Deformation or corrosive buildup on sloped contact faces, protrusion of cover
4. Check for Looseness	Deformation or corrosive buildup on sloped contact faces, looseness of cover
5. Rib Width Measurement	Separation of outer face, reduction of rib width

there was considerable corrosion of the contact faces of the cover and frame of steep incline structured covers. Therefore, corrosion built up on the incline face of the frame, causing evenness in the contact face, leading to the formation of a level gap (**Fig. 2**). Further, it was found that the size of the gap grows with the number of years in service in a corrosive environment. Compared with the cover and frame in general environments, it was found that there was a remarkable difference in the amount of the erosion of the ribs of covers in corrosive environments. Analyzing the results of this survey, the problems witnessed in corrosive environments were added to the items of surface inspection and detailed inspections (**Chart 2**). In order to allow for quantitative evaluations of the degree of corrosion, measurement of the level gap between the cover and frame and of the width of the ribs were added to the inspection items on top of the previous visual performance evaluations.

(Summary)

In this study, we performed performance evaluations on old-type manhole covers and considered the order of priority for the purpose of future maintenance and operations. Further, by investigating and analyzing the deterioration level of incline bracing structured covers in corrosive environments, which has become an issue in recent issues, we considered quantitative inspection items for the purposes of determining the degree of corrosion. By applying the results of this study, we expect improvements in the efficiency of maintenance and operations to occur.

※ F City, Japan Institute of Wastewater Engineering and Technology
Inquiries ; 2nd Research Department., Hiroshi Kouchiwa, Yuji Itoh, Shintaro Sugi [03-5228-6598]

Key words	manhole cover, performance evaluation, corrosion
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