

4 Maintenance Records

4.1 General

For the proper maintenance of port facilities, it is necessary to appropriately preserve not only the records of design and construction, but also the records of various inspections, investigations, and diagnoses that have been carried out, as well as the records of countermeasures such as repairs and reinforcements. Since these maintenance records will serve not only for subsequent maintenance but also as reference materials when conducting large-scale repairs or improvements in design and construction, it is important to record and preserve them in a manner that is easy to reference and understand.

By preserving maintenance records, the validity of the applied maintenance technologies can be confirmed. Furthermore, through the analysis of these records, design and construction issues and points for improvement from the perspective of maintenance can be clarified, thereby contributing to technological advancement.

When conducting inspections and diagnoses, deterioration prediction, and countermeasures for port facilities, it is necessary to carefully consider and implement them based on an analysis of records, and to record and preserve the results after completion.

In addition, concerning maintenance records, since these records will be used over a long period of time, and it is expected that they will be utilized by various stakeholders and involve the management of large amounts of data, including 3D data, it is necessary to ensure a unified format, use of versatile software, and efficient data management with low data volume.

4.2 Items and Methods of Recordkeeping

Standard record items are shown in Table 4.2.1. The items to be recorded should be selected to efficiently and accurately capture the actions necessary for maintenance management.

Table 4.2.1 Standard record items

Category	Items to be recorded	
General	Person in charge	Maintenance manager, inspection/diagnosis personnel, recorder
	Structural characteristics of the facility, etc.	Structural type, natural conditions, material properties, etc.
Inspection and Diagnosis	Type and timing	type of inspection/diagnosis (regular or special), and date and time of implementation
	Location	target structure, part/member, and detailed position
	Items	inspection/diagnosis items conducted
	Method	Survey methods for each inspection/diagnosis item
	Results	Results by item, results of inspection, and survey
Deterioration Prediction	Method of deterioration prediction	Deterioration prediction model used
	Results	Predicted results of deterioration progression
Comprehensive Evaluation	Method of comprehensive evaluation and judgment	Criteria used for comprehensive evaluation and judgment, etc.
	Results	Results of comprehensive evaluation (judgment based on inspection results, results of reviewing the necessity of countermeasures)
Countermeasures	Method of selecting countermeasures	Criteria used for countermeasure selection, design calculations, etc.
	Personnel	Design supervisor, construction supervisor, construction management supervisor
	Countermeasure Method	Construction plan and detailed drawings for the countermeasure
	Construction record	Timing of implementation of countermeasures, as-built drawings of countermeasures, and construction history

In general, port facilities are used for several decades; therefore, even when maintenance personnel are replaced, it is necessary to ensure that the maintenance history of the facility can be easily understood by referring to past records. For this reason, records should, in principle, consist of data that are as accurate and objective as possible, and maintenance activities should be conducted in a consistent manner. It is also desirable to establish in advance a recording method suitable for each facility and to record information using an easy-to-understand data sheet format.

At present, the use of BIM/CIM is being promoted in all stages of facility development — from planning, design, and construction to maintenance management. While BIM/CIM primarily handles three-dimensional data, it is important that data are continuously inherited from the initial planning stage through to the maintenance stage, thereby enabling efficient maintenance management.

4.3 Storage and Utilization of Records

Records related to facility maintenance are used over long periods and by various stakeholders. In some cases, such as when utilizing three-dimensional data for certain facilities or when managing many facilities collectively, a very large amount of data must be handled. Therefore, to ensure that records are always easily accessible and usable, it is advisable to employ versatile software and database systems. Establishing a database for the maintenance management of facilities enables all stakeholders to quickly access the necessary data at any time, which is highly effective for achieving efficient maintenance management.

Figure 4.3.1 illustrates the concept of database utilization in maintenance management. In this example, numerous surveyors input the results of facility inspections or post-earthquake damage investigations directly on-site, and these results are instantly stored in a maintenance management database via a dedicated server. Once data are entered or updated, notifications are sent to all relevant parties, enabling them to share the information. Moreover, the accumulated maintenance data can be edited and utilized as needed for various purposes, allowing for more efficient maintenance management.

By conducting statistical analyses using the vast amount of data stored in the database, it becomes possible to understand the actual conditions of deterioration progression of facilities under Vietnamese environmental conditions and to develop effective countermeasures against deterioration. Furthermore, this approach may lead to the development of technologies unique to Vietnam for port facilities. For this reason, the continuous accumulation of highly reliable data is of utmost importance.

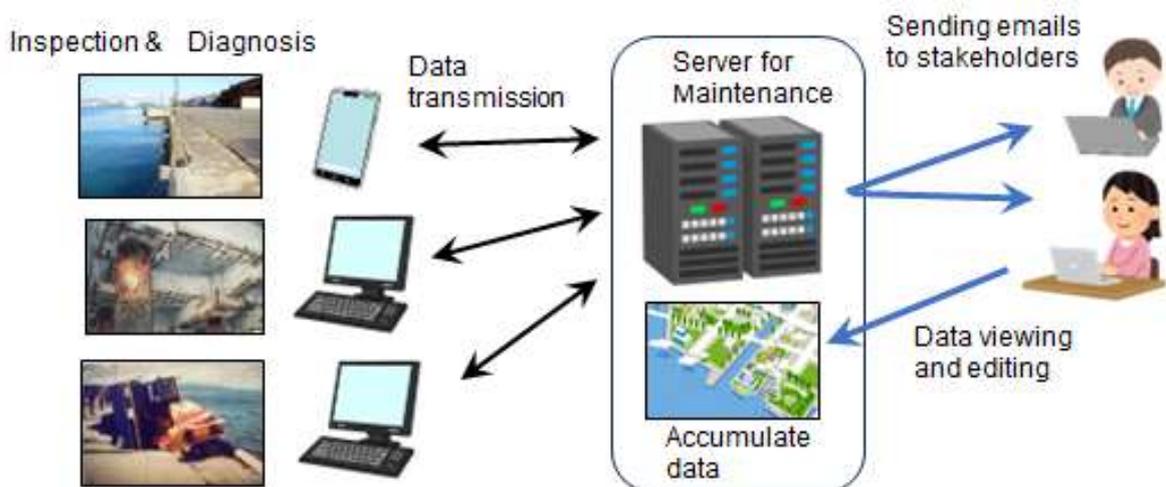


Figure 4.3.1 Example of a maintenance management system utilizing a database

As time passes and responsible engineers are replaced, there is a risk that the locations or usage methods of past recorded data may become unclear, making such data unusable. Therefore, it is important to ensure that the methods for preserving these valuable historical maintenance records are clearly handed down.

4.4 Retention Period

Since records serve as essential materials for efficient and rational maintenance management, they should be preserved for as long as the maintenance of the facility continues.

After a facility has been decommissioned or repurposed, the need to maintain the facility to meet its original performance requirements generally ceases. However, it is desirable to continue preserving the records so that they can be utilized for the maintenance management of other similar facilities.