Study on Inventory Database Construction for Asset Management in Water Supply System

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Abstract. To construct an inventory database for a water supply system, an inheritance tree is constituted from Level 1 to 5 for specification of a classification structure for the water supply system. Level 1 is specified based on systems while Level 2 to 5 are specified to classify water supply systems by considering a structure's role, function and type for each system. Also, the property information for asset management of each structure is systematcially investigated and written on a form to enable standardization of an inventory database. The property information is divided into asset classification information, asset location spatial information, asset specification information and asset management-related information, and the definitions, types, units and descriptions of the examined data are systematcially organized.

Keywords: Asset management, Inventory database, water supply system, inheritance tree, property information

1   Introduction

A water supply system, which is recognized as being a critical and necessary form of infrastructure and lifeline for our everyday lives, is a facility aiming to supply water to those who demand it in a safe, stable manner. Due to aging and deterioration, however, issues such as reduction in functionality, leakage and consumer complaints as well as reduction in stability and increase in socio-economic costs, one of which is maintenance cost, have recently been generated regarding such facilities, and, subsequently, a need for a corresponding asset management technique is being raised.

Thus, this research aims to introduce an asset management system in water supply network facilities for their operation and systematic, efficient maintenance. Through this research, the means to construct a water supply system inventory database are proposed as a base step to achieve establishment of an asset management structure and asset management system.

2   Constitution of Inventory Inheritance Tree of Water Supply System

2.1   Classification of Water Supply Network Facilities

As the first step for construction of an inventory database of a water supply system and development of software, the inventory inheritance tree of the supply system is established. For an overall analysis on the status of water supply systems, standard literature such as construction books and drawings, network drawings, other design documents and water supply system criteria (Ministry of Environment, 2010) related to water supply systems are utilized. Water supply system facilities including water conveyance facilities, transportation facilities, drainage facilities and water supply facilities are specified as Level 1, and structures corresponding to each type are categorized and summarized as in Table 1.

Table 1.   Facility classification of water supply system criteria

Level 1	Level 2	Level 3
Water conveyance facility	Drainage pipe, aqueduct, water balancing reservoir	Building, structure, machine equipment, control measurement facility
Transportation facility	Water pipe, pump station, balancing reservoir	
Drainage facility	Cess pipe, distributing reservoir, water tower and elevated tank	
Water supply facility	Water pipe, reservoir	

Level 2 summarizes notable structures for each type and Level 3 specifies a classification system that considers characteristics of each structure type including buildings, structures, machine equipment and control measurement facilities. Based on these, detailed structures that constitute a water supply system were investigated and, subsequently, a classification system was created.

2.2   Specification of asset classification levels for water supply systems

For a systematic and efficient management of detailed structures in a water supply system, there is a need to build facility classification system and classify the water supply network facilities in detail according to the classification criteria considering utility. To classify the objects that belong to each of the detailed water supply system structures proposed in Table 3, items such as construction type, facility purpose, function and type were selected to categorize and constitute systematic levels on these structures.

The number of levels for water supply system classification is 5 in total, and the descriptions for each of these levels are as follows.

Table 3. Definition and description of asset classification levels for water supply systems

Classification Level	Name of Classification Level	Description of Classification Level (Standard)
Level 1	System	A group of facilities that fall into the category of water supply systems, which can be divided into water conveyance facilities, transportation facilities, drainage facilities and water supply facilities according to facility systems
Level 2	Facility Classification	Facilities of a comprehensive concept that constitute each facility system, categorized in Level 1, are further classified based on their purpose and type.
Level 3	Construction Type	Facilities categorized in Level 2 are further classified based on their construction types (characteristics)
Level 4	Classification	Facility assets corresponding to different facility areas based on construction type classification in Level 3 are further classified in detail according to their purpose, function and type
Level 5	Sub-Classification	Breakdown of Level 4 classification

3 Writing a Form for Standardization of Inventory Database of Water Supply System

Through the results of an inventory tree construction for a water supply system, facility asset objects were classified in detail, and a form was prepared for standardization of a water supply system inventory database on such objects. The form, which was created on Microsoft Excel, organized property information related to facility assets and proposed definitions, description, property information data type, categorization and input type for each of the property information items in the list.

The property information related to water supply system assets can be largely divided into ① asset classification information ② asset location spatial information ③ asset specification information and ④ asset management-related information. A legend for the item list is shown below and, in the legend, the constituting items of the property item list as well as definitions of the terminology are provided in brief.

Definition and description of items constituting item list The constituting items entered in for each asset in an item list include data name, data type, unit, data classification and input type. Data name can be written in Korean or English

independently or in combination, and data types include text (character-type information, expressed in characters either in Korean or English), string (string information, listed one-dimensionally by combining characters and numbers), number (numeric information, expressed in numbers, associated with unit (or non-dimensional) information), date (date information, expressed in the form, YYYYMMDD). Units are only entered when applicable and, in this item list, MKS and CGS unit systems were proposed by default. The entire data is classified by acquired information (existing data acquired) and created information (data newly created through specifications, different from existing data), and data input types can be categorized into required (standard items) and selected (additional of user-defined) items.

4   Conclusion

For systematic asset management in a water supply system, a process for construction of an inventory database for each facility is required and, through this research, a form was prepared for constitution of a water supply system inheritance tree and standardization of an inventory database.

For inheritance trees, different levels, from 1 to 5, were formed to specify a classification system by considering characteristics and purposes of water supply systems. In addition, a form was prepared in such a way that the property information (historical information) for asset management of each facility was systematically investigated and entered in to enable standardization of an inventory database.

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