Hierarchical Classification System of TBM Construction Work Information based on DB structure

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Abstract. In this study, a work information classification system standard for TBM tunnel construction is presented, and based on this standard, a work information classification system is constructed hierarchically based on DB structure. The proposed system divides into facility classification level, functional component classification level, work classification level and resource classification level hierarchically. Using this approach, the cost estimation automation relational D/B structure and cost estimation automation data modeling are possible

Keywords: TBM tunnel construction, DB structure, TBM tunnel construction classification system, Hierarchical level

1 Introduction

A cost estimation system using a scientific approach to provide construction cost estimation has to be consistent. For the system to have maximum effect, a systematic work information classification system and computer system have to be set up as priorities. However, in existing cost estimation systems, the operators have to classify and input work information one by one, followed by the analysis process, so cost estimation system operators need to be sufficiently knowledgeable for the system to be useful.

Various tunneling methods are utilized in Korea today including NATM, SHIELD, and TBM depending on geological conditions, such as terrain and rock quality. But after 1990, the use of the TBM method, which is a large-diameter tunnel excavation method, increased due to various complaints, labor cost increases, reduction in construction time, and government establishment of construction standards. According to statistical data provided by the International Tunneling Association (ITA), around 30% of the tunnels constructed in the U.S., Austria, and Germany have used the TBM method [1]. The TBM method has also been actively utilized in consideration of the global push for industrial disaster prevention and environmental...
protection, because the method repeats the processes of excavation, mucking, and support.

Prior to undertaking this research, domestic and international previous studies were surveyed with regard to a preliminary cost estimation method. Park et al.[2] presented the basic data for golf course construction cost prediction in the initial planning stage based on a formula that estimates construction cost by considering the construction scale and time of actual construction data for other golf courses constructed in similar locations. Kim[3] developed a cost estimation model for power plant construction using construction models of similar construction types. In this manner, previous studies were also carried out that mainly concerned golf courses, plants, apartments, and roads.

As an alternative, in this study, a work information classification system for the TBM tunnel construction was proposed along with a conceptual model of an automated cost estimation system, with the goal of relieving the cumbersome operation of existing systems. The proposed system divides into facility classification level, functional component classification level, work classification level and resource classification level hierarchically. Using this approach, the cost estimation automation relational D/B structure and cost estimation automation data modeling are possible.

2 TBM Construction Work Information Classification System

Construction projects can be classified into functional components which represent the basic configuration for each facility or structure, and these functional component classifications are individually related to specific work components. In addition, the work components classification corresponds to resource components, including their specific functionality and equipment, depending on the material used. When put together in a hierarchy, these 4 classifications systematize the work information classification system, and produces a form that is similar to faceted classification.

![Diagram](image)

Fig. 1. TBM tunnel construction information classification system
As shown in Fig. 1, the TBM tunnel construction information classification system is composed in a hierarchical order of facility component-functional component-work component-resource component.

3 Standard for Information Classification System for TBM Tunnel Construction

Fig. 2 shows the TBM tunnel construction information classification system based on Fig. 1. The function division and work division of Fig. 1 can be explained in the following manner, based on Fig. 2.

The function division is categorized into two classifications. The first is a facility classification, based on the facility or structure type, which in this case is the TBM tunnel construction diameter (for example, ø2.6 TBM tunnel construction, ø3.0 TBM tunnel construction, ø3.5 TBM tunnel construction, ø5.0 TBM tunnel construction, ø8.0 TBM tunnel construction). The second is a functional component classification based on the structure type for each facility or structure (for example, TBM excavation, mucking process, support construction, lining and waterproof work, machinery and electrical work, subsidiary work).

This completes the sub-commodity classification that composes all tunnel construction. The work division is a lower classification system than the function division, and this division is composed of the resource classification (for example, the TBM ROCK BOLT for sound rock, regular rock, soft rock, weathered rock) for the manpower, resources, and equipment used, as well as the work component (for example, ROCK BOLT installation, PILOT ROCK BOLT, SHOTCRETE installation, PILOT SHOTCRETE, STEEL RIB installation, PILOT STEEL RIB, reinforcement method) of the tunnel construction carried out at the site, regardless of the function division. Combining the function division and work division provides the construction information classification system of the TBM tunnel construction.

![Fig. 2. Standard for Information Classification System for TBM Tunnel construction](image-url)
4 Conclusion

In this study, a work information classification system standard for TBM tunnel construction is presented, and based on this standard, a work information classification system is constructed hierarchically based on DB structure. The proposed system divides into facility classification level, functional component classification level, work classification level and resource classification level hierarchically.

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References