

Practical Standard Methods of Measurement Cost Estimating in the Design Stage

Jae-Ho, Cho

Doctor's course, Dept. of Architectural Eng. School of Architecture, Dankook University
(email: cjhace@naver.com)

Woo- Chul, Cha

Master's course, Dept. of Architectural Eng. School of Architecture, Dankook University
(email: gaioum@hanmail.net)

Hyung-Wook, Seo

Master's course, Dept. of Architectural Eng. School of Architecture, Dankook University
(email: cms9980@naver.com)

Seung-Won, Tak

Master's course, Dept. of Architectural Eng. School of Architecture, Dankook University
(email: tagisw@naver.com)

Jea-Sauk, Lee

Doctor, Research Professor, Dept. of Architectural Eng. School of Architecture, Dankook
(email: jslee3w@hanmail.net)

Jae-Youl, Chun

Doctor, Professor, Dept. of Architectural Eng. School of Architecture, Dankook University
(email: jaeyoul@dankook.ac.kr)

Abstract

For accurate cost estimating in the initial design stage of a project, various factors related to the characteristics of the project should be reflected in the cost planning. It is impossible, however, to reflect all the side factors on the construction cost. Therefore, at least the cost factors from similar conditions in similar projects must be reflected. For the effective method used at this time, the unit price for the measurement of the quantity could be the most suitable cost model. This research aims to study the utilization goal and the current utilization status of the standard methods of measurement of some countries, and to propose new directions for the domestic standard methods of measurement. Not only are the standard methods of measurement utilized in the detailed design stage, but a method of interconnecting the information to be utilized in the initial design stage is also required.

Keywords: SMM(Standard Methods of Measurement), Cost Estimating, Design Stage

1. Background and Goal

Cost planning model can be applied to cost factors based on quality methods of measurement with respect to the characteristics of the construction project. Many studies have been

performed in domestic until now, but they have various problems regarding their utilization in practice.

Therefore, this study proposes the cost model, through it is compared and analyzed with the standard methods of measurement (SMM) of developed countries and that can reflect the construction cost factors based on quantities unit by design stage.

This cost model is to support decision-making by the owner and the architecture considering cost and design simultaneously

This study first examined the primary theoretical base for performing the conceptual cost calculation model, and then studied the prototype of the calculation system as an advanced study. This study is meant to be a practical study that will make possible systemization and computerization through consistent review of and complementation by succeeding research.

1.1 Research Process

This study examined the methods of utilization of standard methods of cost measurement and calculation by stage based on related literature and standard methods of cost measurement in other developed countries.

(1) Study of the Cost Calculation Method by Design Stage

(2) Study of the Current Status of Advanced Foreign Countries' Standard Methods of Measurement

(3) Analysis of the Cost Estimating Utilization Model in the Planning Stage with the Standard Methods of Measurement in the Construction Documents Stage.

The abovementioned research process aimed to study the utilization of standard methods of measurement and the method of connecting cost calculation methods in the construction documents stage and the initial design stage based on the quantities of unit or elements.

2. Cost Estimating Method by Design Stage

The cost estimation method is generally classified into three types. The first type is the Conceptual Estimation Method, which is used for incomplete designs.

For example, the conceptual estimation method is used in the planning stage or the schematic design stage. The second type is a combination of the conceptual estimation method and the semi-detailed cost estimation method. The semi-detailed cost estimation method is generally used in the design development stage. The design development stage is the stage in which the entire plan design is completed even as other designs in other construction-type projects are still partly uncompleted. Lastly, the construction documents stage is calculating the Quantities Take

Off from the complete plan and specifications. The following sections examine the cost estimation method by design stage.

2.1 Planning Stage

There are three types of conceptual estimation methods in the planning and schematic design stages. The first method is the ROM (rough –order –of magnitude) method, or the calculation method by pyeong or m². This calculation method estimates the construction cost based on the total gross area. The second method is the assemblies cost estimation method, which estimates the cost based on the database of the costs of the individual components of a building such as the base, roof, upper structure, lower structure, exterior wall, interior wall, interior, machine and electricity, etc. The third method is the calculation method by cost index. This method estimates the cost using region, time series, or construction economy indices of similar types of projects.

2.2 Design Development Stage

The semi-detailed cost estimation method was developed for use in decision-making on the design within the budget of the owner. The major decisions related to the construction, including the outline of the project, the use of each room, and the land arrangement. However, Some parts of design or engineering construction are generally yet determined. Cost estimation is possible only when the design has been complete. Therefore it is used with conceptual estimation, when the design is incomplete or has yet been completed. This means that for incomplete designs, cost estimation can be performed using the actual results database; (reference historical data). And in complete designs, detailed cost estimation is performed through the market price or labor cost calculation method, take off quantities. In other words, the semi-detailed cost estimation method is applicable depending on the completeness level of the development design. Both methods are practically performed in a mixed manner in each type of design stage.

2.3 Construction Documents Stage

Detailed cost estimation is performed when the design specifications have been completed. The estimator performing quantities take off all types of construction materials used in the project and adds indirect costs to calculate the total construction cost.

In Korea, public and private organizations differ to the Standard Methods of Measurement. In the USA, both types of calculation standards are used. The types are more widely known as Uniformat(GSA) and Masterformat(CSI) in Korea. The selection of the format depends on the personal preference or the strategy of the detailed estimation.

3. Current Status of the SMM in Developed Countries

3.1 Status of SMM in Developed Countries

The details of the standard methods of measurement of other developed countries are based on the study of AIQS (The Australian Institute of Quantity Surveyors) and RICS (Royal Institution of Chartered Surveyors). The purpose of this study is to examine the current status of utilization by developed countries of standard methods of measurement (SMM) and the roles of these SMMs. Through this, it aimed to propose new domestic standard methods of cost measurement and utilization SMM methods through a review of the current SMM. In the case of Australia, it has about 10 years of history in SMM, and it went through four times the revision process. In the case of the UK, three main concepts on SMM were introduced in the 1970s, and a calculation concept related to the calculation method, time and quantities was proposed. In the case of the UK, where the level of utilization of SMM is high, it aimed to enhance the utilization level with respect to the integrated information concept of the project. The details were introduced in SMM 7, which was announced through CPI (Coordinate Project Information) in 2000. CPI aims to integrate all the factors related to quantities measurement details to reduce repetitive and wasteful factors, specifications and plans and to use them as a cooperative information system.

3.2 Comparative Analysis of the SMM

The results of the current status of the SMM of each country are shown in Table 1. The results explain the concrete details of the standard methods of measurement. In the case of Singapore, the analytical details are shown in Table 1 (Singapore ; Purpose of SMM is to provide a uniform basis of measurement, and Enabling the exchange of date between SMM, National Productivity and Quality Specifications CAD drawings)

Table 1- General Rules and Recommendations – Identified similarities and differences

classification country	Comparison analysis
Australia	Purpose of SMM is to provide a uniform basis of measurement
Canada	Work measured as net in position
Ireland	Allows for the provision of Location Drawing and Bill Diagrams to aid the descriptions of time
United Kingdom	Location to be provided in descriptions unless evident from drawings or other information required to be provided by these rules
Singapore	Purpose of SMM is to provide a uniform basis of measurement Enabling the exchange of date between SMM, National Productivity and Quality Specifications CAD drawings

3.3 The Prototype of Cost Estimating by Utilized SMM in Initial Design Stage and Construction Documents Stage.

The details of estimation, it is necessary to operate the Masterformat in the construction documents stage. The Unifomat is able to utilization of the standard methods of measurement in the schematic design and design development stages. The figure 1 is concept of utilization SMM for cost estimating which is connecting in the construction documents stage and the initial design stage through with the quantities take off (figure 1.) It is connecting labor cost and equipment cost with the Quantities Take Off the works in each design stages.

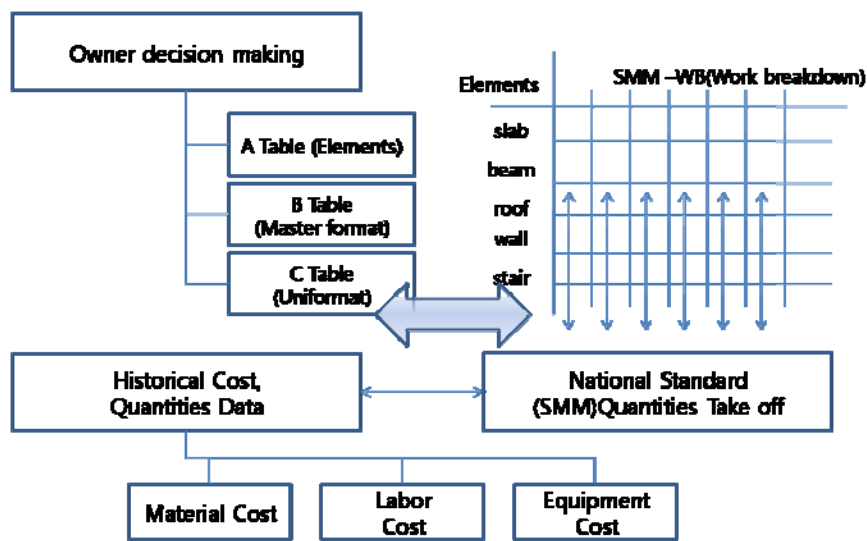


Figure 1- The concept of cost estimating by connected SMM in design stage.

Table 2 - Sample historical cost and quantities data – Connected Materformat and Unit format

010103 reinforced concrete											
		unit	quantities	material		labor		expense		sum	
ready mix [structure]	25-270-15	M3	15903.97	0	0	0	0	0	0	0	0
ready mix [structure]	25-240-15	M3	6244.6	0	0	0	0	0	0	0	0
pump car (25/20)	100M3 slump ~12cm	M3	2670.06	775	2,069,296	8,138	21,728,948	3,622	9,670,957	12,535	33,469,201
reinforcing rod	HD10	ton	174.06	0	0	0	0	0	0	0	0
reinforcing rod	HD13	ton	566.38	0	0	0	0	0	0	0	0
reinforcing rod	HD16	ton	112.46	0	0	0	0	0	0	0	0
reinforcing rod	HD19	ton	72.93	0	0	0	0	0	0	0	0
cutting and assemble	general	ton	2633.72	10,400	27,390,688	336,600	886,510,152	0	0	347,000	913,900,840
Circle form	1th	M2	1716	8,600	14,757,600	36,600	62,805,600	0	0	45,200	77,563,200
Board form	3th	M2	24747	3,900	96,443,100	17,200	425,338,800	0	0	21,100	521,781,900
Uro-form	wall	M2	34237	2,500	85,592,500	15,300	523,826,100	0	0	17,800	609,418,600
vibrator		M3	21929	241	5,284,889	0	0	30	657,870	271	5,942,759

Table 3 - Sample cost on market and quantities take off data – Masterformat

Unit/Works (Quantities)	Board Form (3th)	Circle Form	Uro-Form	Concrete (M3)
FT	216		360	7,754
FT	216	0	360	7,754
B2	10,117		8,498	3,590
B1	10,941		8,061	4,464
Substructure	21,058	0	16,559	8,054
1	500	273	2,958	935
2	356	198	1,717	689
3	356	198	1,776	744
4	360	198	1,712	739
5	363	198	1,687	762
6	447	178	2,347	767
7	460	200	1,433	564
8	132	137	1,795	428
9	194	117	1,110	289
PH1	305		881	267
Superstructure	3,473	1,695	17,417	6,183
Total	24,747	1,695	34,335	21,991
Total compound cost	524,672,600	77,563,200	609,418,600	351,360,749

4. Conclusions

The Unifomat is a standard method of measurement that can be used as a semi-detailed cost estimation method by forecasted the quantities take off in the initial design stage. It is to used subject to building components of the base, superstructure, substructure, the exterior walls and finishing, etc. In spite of even in dazzling construction development in korea, effective cost estimating methods such as Unifomat standard methods of measurement haven't practically been established yet. To enhance the accuracy of cost estimating in the planning design and the development design stage, the quantities measurement methods of transforming from the Masterformat to the Unitformat should first be performed. This study aims to encourage future studies on a method of connecting the Masterformat and the Unitformat through case studies with the historical data.

5. Acknowledgments

This paper was supported by the Ministry of Construction & Transportation in Korea (Subject Number : 06기반구축A03)

The work presented in this paper was supported by the ministry of Education & Human Resources Development through the Second Stage of BK21

References

- [1] Kenneth K. Humphreys, Ph.D. Applied Cost Engineering(Third Edition), MARCEL DEKKER, 1997.
- [2] Len Holm, John E. Schaufelberger, Dennis Griffin, Construction Cost Estimating Process and Practices, University Washington, 2005.
- [3] Dr Anthony Mills, Peter Lawther and David Jones, Standard Methods of Measurement-A Comparative study of National and Regional Publications, Padghams, RMIT University, October, 2006