Revised PPC Measurement Method considering Interfering Float Weight of Task

Jung-Sook Yun[1], Hyung-il Kim[1], Jung-Ho Yu[2], Chang-Duk Kim[2]

[1] Unified Master's and Doctor's Course, Kwangwoon University, Seoul, Korea
[2] Professor, Kwangwoon University, Seoul, Korea
Correspond to pinkstar114@kw.ac.kr

ABSTRACT: It is commonly recognized to need performance management for successful construction project. PPC measurement of Last Planner System is one of construction project measurement method. PPC measurement is quantitatively assessment to go through construction, and that is not completely to be trusted when compare a project with another or an individual case work with another in same project. According to, purpose of this study is comparison indicator establishment that compare project with another or an individual case work with another it is not use PPC measurement for quantitatively assessment to go through construction. The procedure of this study is derive of the point at issue of existing PPC measurement for a aim PPC measurement in this study expenditure and select weight about that and it is applied to actually construction.

Keywords: PPC; Performance measurement; Float weight

1. INTRODUCTION

1.1 Background and objective of the Study

Successful project accomplishment requires management. Through finding and fixing troubles, management enables project execution as planned. As Peter Drucker once said "If you can't measure it, you can't manage it," measurement makes management possible. The bottom phase of construction project management is task management which also can be considered as the first one of that. Performance measurement through PPC measurement is used for performance management in unit of task. PPC management is in the ratio of the number of completed work to planned work in a week. This method has a flaw which can degrade reliability by other factors, focusing only completion of each task.

Since a construction project consists of a series of works, connection between tasks and impact from one task to another are to be considered. Thus, this study aims to identify factors affecting relation between preceding and following tasks process and to suggest an improved PPC measurement method considering the factors needed complimentary measures.

1.2 Methodology and scope of the study

Project consists of each work and that can be separated into several individual tasks. For successful project completion, each work should be accomplished as it planned before. Work completion up to time and plan depends on effective management of individual tasks, a subordinate unit of work. Therefore, scope of this study is limited to PPC measurement method which assesses task performance, the lowest project unit, among project management methods. This research discovers imperfection of current PPC measurement method through studying it and proposes enhanced measurement method adopting weight to make up for the errors and its utilization.

2. IMPROVEMANAGEMEBT OF THE EXISTING PPC MEASUREMENT METHOD

2.1 Necessity of PPC measurement

The most important factors in construction are work process, cost and quality, and they forms mutual interrelationship shown in the figure.

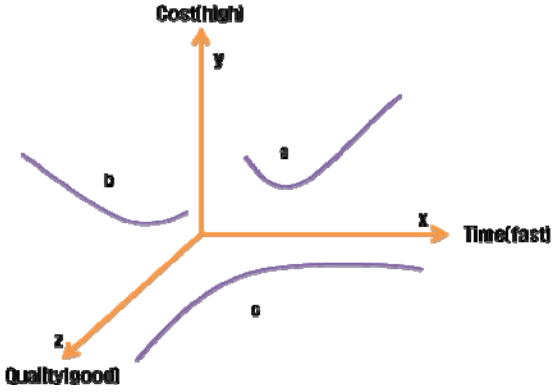

Figure 1. Tree factor mutual interrelationship

Schedule management, among the three, targets to elevate a rate of operation through providing activities

time basis by input of resources and cost, rationalizing work process in making concrete output, being punctual in work period or even shortening it and allocating appropriate work load.

Schedule management, among the three, targets to provide activities time basis by input of resources and cost, to rationalize work process in making concrete output, to be punctual in work period or even shorten it and to elevate a rate of operation through allocating appropriate work load.

Also, it aims to finish individual work on time to prevent any delay of following events, to improve construction method and to pursue effective performance through arranging logical work procedures. Moreover, it cuts cost by suitable schedule management. According to the research result done by Business Roundtable Study, it reduces total 7.44% of cost including 3.00% of daily time management, 1.44% of resources management and 3.00% of cost management respectively.

Table 1. research result by Business Roundtable Study

Division	Effect
Time	3.00%
Resource	1.44%
Cost	3.00%
Total	7.44%

Schedule management forms a circle of Plan, Do, Check and Act (PDCA cycle). Check phase is necessary input not only to Act but also for a project. In this study, Check phase is the focal point. Since construction project consists of a series of events, it is difficult to make sure every task to be finished on time as planned earlier. Consequently, readjustment is inevitable passing through Check phase. At this moment, precise measurement and consideration are essential to avoid adverse influences on the Project.

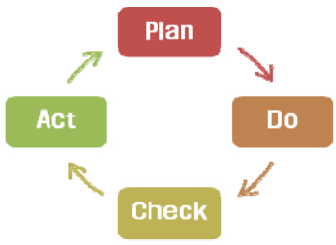

Figure 2. PDCA Cycel

Successful construction project requires management of task, the minimum work unit. PPC measurement method, assessing whether each task is achieved or not, is one of the task performance measurement and management methods.

2.2 PPC measurement method

The Last Planner production control system is a philosophy, rules and procedures, and a set of tools that facilitate the implementation of those procedures.

PPC is utilized at the bottom phase, weekly work plan, as shown in the Figure. PPC is a standard of measurement, percentage of completed task to total task planned earlier every week. To enhance PPC, identifying interfering factors after PPC measurement every week and analyzing the causes by tracking adversely to prevent the same mistakes are necessary.

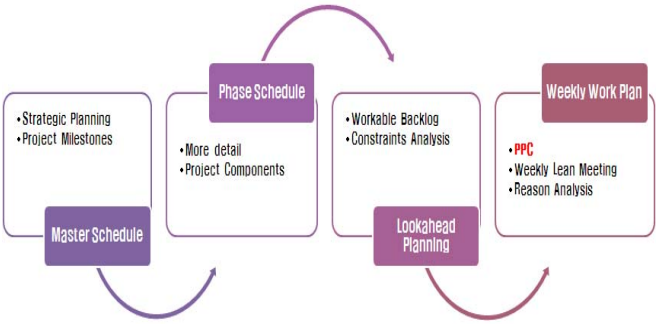

Figure 3. Las Planner System

PPC prevents excessive work plan and input of personnel and material and minimizes waiting time of workers in the field by setting up right amount of work load in a single day. In other words, it has a advantage of reduction of buffering time and material and of effectiveness enhancement through building up plan reliability and work process planning capability.

According to Ballard and Howell (1997), in the study of a relation between PPC and productivity, one group with over 50% of PPC saved 15% of budget compared to other group with PPC of less than 50% spent 15% more. Accordingly, PPC measurement enables management of various aspects, such as schedule, budget and quality control.

2.3 Flaws of the existing PPC measurement method

Successful completion of project goes with quality control within budget and schedule. However, the existing PPC measurement has not been considering interrelation between preceding and following tasks and its impacts but focusing only completion of each task in timely manner. Due to this, the PPC measurement is not a perfect method to control process of construction project. Process control of the construction project is defined as management by comparison planned schedule with actual

schedule. It maintains steady execution and prevents extra cost expenditure derived from delay and quality degradation by speedy construction work. The existing PPC measurement method is applied to stop repetition of the same mistake by recognizing interrupting factor. It is unable to avert influence to following tasks together with quality degradation and over-expenditure caused by delay.

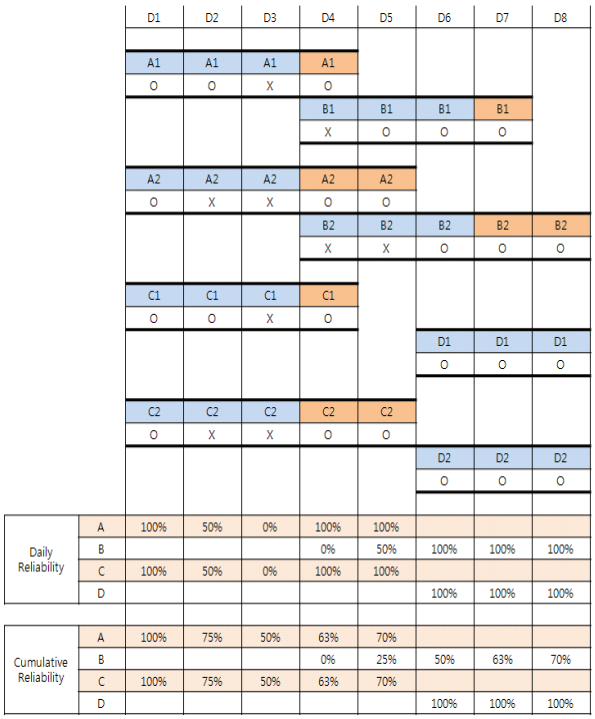

Figure 4. Example of PPC measurement error

In the example of measurement error in the Figure shows that task A, B, C and D each has three working days. The task A and C are the preceding tasks to the task B and D respectively, forming Finish to Start relationship both. The reason of delay in following tasks is derived from the delay of preceding tasks.

While PPC measurement result of task A and task B are the same, impact on following tasks are different. Task B1 is delayed by 1 day due to the delay of task A1 and so is task B2 by 2 days affected by task A2. Task C shows the same PPC measurement reliability as task A because task C1 is delayed 1 day and task C2 is completed 2 days late. However, since task C has executed with float, it has not affected following task D. In this case, task A can be regarded Critical Path and task C is deemed as task with float. Thus, it is not appropriate to conclude that the two tasks have the same reliability in every aspect only because both have an identical PPC measurement result.

It is necessary that reliability measurement of each task considering not only completion but also float

3. IMPROVED PPC MEASUREMENT METHOD

3.1 Measuring concept

Reliability measurement requires impact of preceding task to the following task. Complimentary PPC measurement method is shown as below in simple concept.

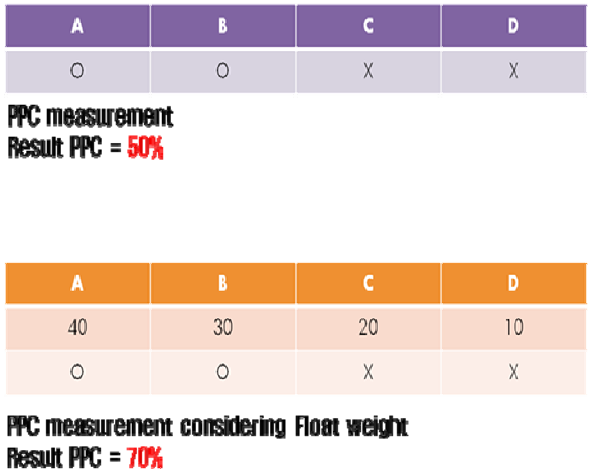

Figure 5. Improved PPC measurement concept

In the existing PPC measurement method, completion of 2 out of 4 projects is measured as 50%. However, float weight setting method brings out 70% if completed task A and B have float weight of 40 and 30 respectively. The total weight of the task is 100.

There are 4 type of float generally used in Critical Path Method for project management.

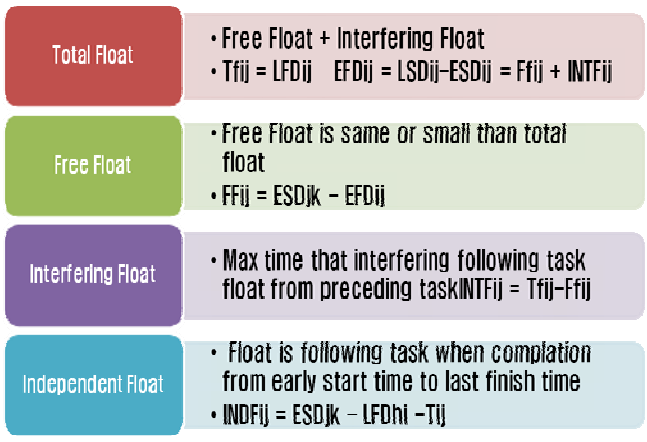

Figure 6. Float of CPM

In this study, interfering float is focused. Interfering float is subtraction free float from total float and the maximum float which affecting the beginning time of the following task without lagging it behind the schedule. In

short, it is the maximum float allows preceding task to interfere float of the following task.

The PPC measurement result after application of float is called rPPC. The result calculated by improved PPR measurement method is defined as reliability able to affect following task applying float.

■ Revised PPC

rPPC ---------- (3-1)

3.2 rPPC usage

It is better to compare rPPC with PPC result rather than to apply it alone.

■ rPPC usage

$$\frac{rPPC}{PPC} \leq 1 \quad \text{(3-2)}$$

$$\frac{rPPC}{PPC} \geq 1 \quad \text{(3-3)}$$

As shown in formula 3-2, when the relative reliability of rPPC is less than 1 compared to that of PPC, preceding task is less likely to affect following tasks. In formula 3-3, relative reliability of rPPC more than 1 means preceding task is more likely to get involved with retarded following task completion.

The databased results make preparation of potential delay possible by using it as a future reference to influence from preceding task to following ones.

3.2 Weight distribution depending on interfering float

If Figure 4 example were limited to 1 week load, it would be as follows.

		D1	D2	D3	D4	D5	D6	D7
		A1	A1	A1	A1			
		O	O	X	O			
					B1	B1	B1	B1
					X	O	O	O
		A2	A2	A2	A2	A2		
		O	X	X	O	O		
					B2	B2	B2	B2
					X	X	O	O
		C1	C1	C1	C1			
		O	O	X	O			
							D1	D1
							O	O
		C2	C2	C2	C2	C2		
		O	X	X	O	O		
							D2	D2
							O	O
Daily Reliability	A	100%	50%	0%	100%			
	B				0%	50%	100%	100%
	C	100%	50%	0%	100%			
	D						100%	100%
Cumulative Reliability	A	100%	75%	50%	63%			
	B				0%	25%	50%	63%
	C	100%	75%	50%	63%			
	D						100%	100%

Task Name	A	B	C	D
Interfering Float	0	1	2	0

Figure 7. Example of PPC measurement a week and interfering float

■ rPPC weight calculation

1) Add 1 to calculated interfering float. In case of CP, 0 comes out and it makes an error of substitution.

Task Name	A	B	C	D
Interfering Float for calculation convenience	1	2	3	1

2) Convert the interfering float in percentage to make calculation easier.

Task Name	A	B	C	D	Total
Percent of interfering float	14	29	43	14	100

3) Subtract the percent from 100 each.

Task Name	A	B	C	D	Total
100-percent of interfering float	86	71	57	86	300

4) Convert the result in percentage total of 100.

Task Name	A	B	C	D	Total
Interfering float weight	28.57	23.80	19.05	28.57	100

5) Multiply accumulative reliability by the final percent of each task.

Task Name	A	B	C	D
rPPC	80%	77%	74%	129%

■ PPC measurement calculation to compare

In the existing PPC measurement, weight of each task has not concerned. Suppose every task has the identical weight to compare and calculate through multiplying cumulative reliability by the same weight. In the example, weight of each task is 25% since there are 4 tasks in a week.

Task Name	A	B	C	D
PPC	78%	78%	78%	125%

■ Application of the result

Task Name	A	B	C	D
rPPC/PPC	1.029	0.990	0.952	1.029

By analyzing the result, it is found out that task C is the least likely to influence following task. As shown in the example Figure, it has float in between the beginning of following task. The result derived from the existing PPC measurement method is equally 78%, while the results of each task A, B and C have different reliability after comparison of rPPC result.

4. OBJECTIVE OF THE IMPROVEMENT OF MEASUREMENT METHOD

It cannot be said that individual completion of task is the key to successful management of project because it is a series of continuing tasks. Thus, complimentary PPC measurement is thought to be necessary to apply interrelation between preceding and following tasks.

However, the improved PPC measurement method cannot be flawless since construction project has various complicated factors and circumstances. Thus, it is recommended to apply the improved method when it is necessary while the existing PPC measurement method is trusted.

5. CONCLUSION AND FURTHER STUDIES SUBJECT

In this study, rPPC considering float and its application are suggested. The proposed method is expected to be utilized for determining reliability as a preceding task of interrelation and it will support relative measurement of reliability as a preceding task by comparison with the result from the previous PPC measurement, rather than using it alone.

The preset condition of rPPC application is calculation of float of the project by CPM head. Thus, when practical utilization is processed, a study regarding development level of CPM and float measurement in actual project process management is highly needed. In addition, more researches about other factors, except for float, are required to classify them and to adopt this method in right direction.

ACKNOWLEDGMENT

The authors would like to thank Korea's Ministry of Construction and Transportation for supporting this research (Research Project 05 CIT D05-01).

REFERENCES

[1] Alberto Peixoto San Martin and Carlos Torres Formoso, "Evaluating building systems based on production process management and lean construction concepts", Proceedings IGLC, 1998.
[2] Chul-woo Lim, Jung-ho Yu, and Chang-duk Kim, "Implementing PPC in korea's construction industry",
[3] Chul-woo Lim, Jung-ho Yu, Chang-duk Kim, "Construction Progress Management System for PPC Implementation", Korean Journal of Construction Engineering and Management, Vol. 8(2), pp.57, 2007
[4] Eric Johansen and Geoff Porter, "An experience of introduction Last Planner into a UK construction project"
[5] Greg Howell and Glenn Ballard, " Lean production theory : Moving beyond 'can do'", Presented on the 2nd workshop on lean construction, Santiago, 1994.
[6] Greg Howell and Glenn Ballard, "Implement lean construction : Reducing inflow variation", Presented on the 2nd workshop on lean construction, Santiago, 1994.
[7] Greg Howell and Glenn Ballard, "Implement lean construction : Stabilizing work flow", Presented on the 2nd workshop on lean construction, Santiago, 1994.

[8] Hong-Tea Pack, “Construction schedule management operation business practice”, goomibook, 2007.
[9] Kati Ranskanen, Tutu Wegelius & Hannu Nyman, “New tools for lean construction”, Presented on the 1st workshop on lean construction, Espoo, 1993.
[10] Luis F., “Modeling waste and performance in construction”, Presented on the 1st workshop on lean construction, Espoo, 1993.
[11] Luis Fernando Alarcon, Patricio Venegas & Mario Campero, “Identification of critical factors in the owner-contractor relation in construction projects”, Presented on the 2nd workshop on lean construction, Santiago, 1994.
[12] Ralph D., “Identifying and monitoring key indicators of project success”, Presented on the 1st workshop on lean construction, Espoo, 1993.
[13] Dong-soo Won, “A method of establishing optimal performance measurement baseline and calculation schedule variance for implementing EVMS”, Master Course in Graduate School Seoul National University, 2002.