THE VERIFICATION ON THE EFFECT OF AUTOMATED LIFE CYCLE MANAGEMENT SYSTEM FOR CURTAIN WALL

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ABSTRACT :

The Automated Life Cycle Management System (ALMS) is a web based system that is devised to manage a curtain wall from design to installation and maintenance using Radio Frequency Identification (RFID) tags on the curtain wall units. ALMS is not yet completed, but the prototype was implemented to analyze the effects. It was tested for three months in a construction project to analyze the effect of the ALMS. During the pilot test period, the task time was measured related to the management of curtain wall works in the office and site, the accuracy and quickness of document and information delivery, and the efficiency of information share among the participants. This paper presents the results of the analysis on whether or not the use of the ALMS can increase the efficiency of the curtain wall management process.

Key Words : Curtain Wall, Automated Life Cycle Management System, Verification of system effect

1. INTRODUCTION

Although construction has the many complicated courses such as the management of enormous materials, planning, designing, construction work and maintenance, the management of construction is concentrated on the management of each phase and each material. So, several problems such as the reworking, errors and omission by exchanging of inaccurate information have occurred.

Especially, curtain wall work has a variety of such characteristics such as; each work site has centered production, lack of communication and cooperation among the participants because it is consists of many different subjects. However, it has yet to find the way to manage the business, delivery & distribution and the flow of information among all the participants more systematically and flexibly. The ALMS is the automated management system which is capable of managing from C/W the phase of design to the phase of maintenance after the finishing of the construction by using RFID tags.

The purpose of this study is to analyze the detailed result of comparing the existing As-Is process in Curtain Wall work and the improved To-Be process at the Automated Life Cycle Management System using RFID technology. Also, this research is aimed at demonstrating the valuation lists and how to measure the degree of the effectiveness improvement after analyzing the compared contents of the results.

2. THE RANGE AND METHOD OF THIS STUDY

This study analyzes the C/W process from production (finishing glazing · attaching RFID) to the installation of the C/W to verify the effectiveness and the improvement of Automated Life Cycle Management System which will be used to management the C/W during the theist entire Life Cycle.

This study has measured the task time related to the management of curtain wall works in the office and site, the accuracy and quickness of documents and information delivery, and the efficiency of information share among the participants in order to compare the effectiveness between the existing As-Is process Model and the improved To-Be process Model.

3. BACKGROUND

3.1 What is the ALMS?

The ALMS is a web based system that is devised to manage the curtain wall from the design process to installation and maintenance using RFID tags on the curtain wall units. It can identify the problems in the As-Is process Model such as reworking caused by exchanging inaccurate information, errors and omissions. It provides an improved To-Be Model which will aid the participants in decision making matters during the C/W Life Cycle.

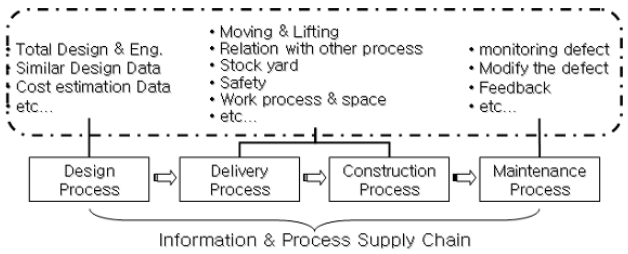

Figure 1. ALMS diagram

3.2 The function & organization of the ALMS

The ALMS manages schedules, deliveries & distribution, quality and materials. The part of schedule management shows the situation of glazing, delivery, warehousing, installation, conformation of installation and last inspection by the updated data on the web.

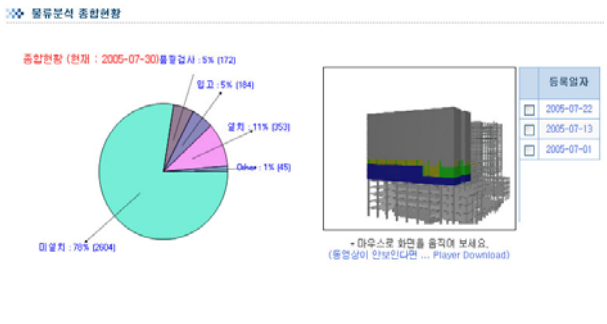

Figure 2. The Management Process

Along with quality management, the warehousing inspection is carried out along with the warehousing process and the Check-list can be followed by PDA. For delivery & distribution, a variety of information, from the date of that the material is ordered to the date of the installation can be shared by all of the participants in the supply chain.

Figure 3. Quality & Physical Distribution Management

4. THE METHOD OF MEASURING THE EFFECTIVENESS ON DELIVERY & DISTRIBUTION BY THE ALMS

4.1 The expected effect of delivery & distribution using the ALMS

According to the interview with the involved participants at the designated C/W work site, new delivery & distribution process was an effective improvement because it made it easy to confirm the amount of warehousing, installing and lading.

In addition, the procedure of last inspection report related to the quality inspection before & after the installation is expected to be reduced by the ALMS.and the effect of shorting a C/W work's duration is mainly dependent on the experience of the workers and the number of workers on the work site. So, the ALMS can be directly effective but can have an indirect effect on C/W management. .

This is the expected effect of the ALMS.

① a reduction in the amount of documents C/W related documents

② the quick of accurate delivery of C/W related documents & information

③ the sharing of information among all the supply chains

The most important point is that the introduction of the ALMS will help us find the direction of continuous future study to be more perfect.

4.2 The range of measuring the effectiveness

During this study, we selected the A site to compare the existing As-Is process Model and the improved To-Be process Model which is used the RFID Tags in each C/W unit. We analyze the effectiveness of the C/W delivery & distribution, focusing on the difference between the site “B” used the ALMS and the site “C” which didn’t use the ALMS.

5. THE EFFECTIVENESS OF THE DELIVERY & DISTRIBUTION SYSTEM

5.1 The point of the detailed process view

The best advantage of attaching the RFID tag was that the reduction of the work procedure and time for confirming the amount of warehousing, installation and loading.

To verify the contents, we need to divide each process related to the C/W in detail and compare the needed time and procedure for each C/W process between the site “B”that used the ALMS and site “C” thich didn’t use the ALMS

5.1.1 Analysis of the procedure of confirming the amount of warehousing

We have measured the total step and proceeding time concerning the As-Is process & the To-Be process of confirming the amount of warehousing to determine the effectiveness of ALMS.

The follow table 1-a represents the As-Is process of confirming the amount of supplies in the warehouse. It has 9 steps for completion and three kind of paper work related to the C/W. Also, an average of 37 minutes was needed to complete the task.

Table 1-a. As-Is process of carrying material into construction site check

No	Work	person in charge	total time	Related paper
1	hand over the transaction invoice	truck driver	2 Min	transaction invoice
2	confirm the warehousing material	engineer	5 Min	
9	complete the warehousing step		30 Sec	

On the other hands, table 1-b represents the To-Be process which has 6 steps for completion and doesn't require any paper work. An average of 7 minutes was required to complete the task.

Table 1-b. The To-Be process of carrying material into construction site check

No	Work	person in charge	total time	Related paper
1	Downloading the data at the PDA	engineer	30 Sec	
2	Move the warehouse site	engineer	3 Min	
6	Complete the warehousing step		30 Sec	

Table 1-c presents site "B" which used the ALMS can make the proceeding time shorter than that of site "C" and the task becomes a simpler procedure.

Table 1-c. The result of measuring site "B" and site "c"

Site "B"	total step	6	total time	7 Min	paper	0
Site "C"	total step	9	total time	37 Min	paper	3

5.1.2 Analysis of the warehousing inspection procedure

Table 2-a. The As-Is warehousing inspection procedure

No	Work	person in charge	total time	relation paper
1	print Check-list for quality confirm	engineer	2 Min	Check-list for quality confirm
2	submit the requesting form of check for quality confirming	engineer	7 Min	request form of quality confirm
10	complete checking		30 Sec	

Table 2-a represents As-Is warehousing inspection process. There are10 steps to be completed and two kinds of paper work. Also, an average of 27 minutes was needed to complete the inspection.

Table 2-b. The To-Be warehousing inspection process

No	Work	person in charge	total time	relation paper
1	Downloading the data at the PDA	engineer	30 Sec	Check-list for quality confirm
2	Reading the RFID tag by PDA	engineer	3 Min	request form of quality confirm
6	complete checking		30 Sec	

For the To-Be warehousing inspection process, there are 6 steps for completion and no paper work. An average of 7 minutes is needed to complete the inspection.

Table 2-c. The result of measuring site "B" and "C"

Site "B"	total step	6	total time	7 Min	paper	0
Site "C"	total step	10	total time	23 Min	paper	2

As a result, site "B" was able to reduce the total time by about 16 minutes and two kind of paper work. Thereby shortening the process.

5.1.3 Analysis of the procedure of verifying the amount of total installation unit

Table 3-a represents the As-Is process of verifying the total installation. The process has 7 steps and two kinds of paper work. An average of 49 minutes was needed to complete the task.

Table 3-a. The As-Is process of verifying the total installation unit

No	Work	person in charge	total time	relation paper
1	requested that establishment confirm	C/W engineer	2 Min	
2	work complete and after, report the worth of establishment	C/W engineer	3 Min	
7	complete the report of establishment		30 Sec	

Table 3-b represents the To-Be process of verifying the total installation. The process has 5 steps and no paperwork is required. An average of 13 minutes was needed to complete the task.
As a result, site "B" using the ALMS was able to reduce the total time by about 36 minutes and two kinds of paper work and thereby shortening the process.

Table 3-b. To-be process of verifying the total installation unit

No	Work	person in charge	total time	relation paper
1	Downloading the data at the PDA	engineer	30 Sec	
2	Reading the RFID tag by PDA	engineer	7 Min	
5	complete the report of establishment		30 Sec	

Table 3-c. The result of measuring site “B” and site “c

Site “B”	total step	5	total time	13 Min	paper	0
Site “C”	total step	7	total time	49 Min	paper	2

The simple procedure can reduce the proceeding time about many tasks related to C/W. and the engineers who in charge of the task make their time more efficiently use.

5.2 The point of the whole delivery & distribution management process view

To measure the effectiveness of the delivery & distribution process by the ALMS, we survey the frequency of phone calls the amount of document related C/W processes between site “B” which used the ALMS and site “C”which didn’t use the ALMS

5.2.1 The frequency of phone calls related to the C/W between participants at sites “B” and “C”

In case of site “B’, the frequency of phone call related to the C/W was higher than site “C” at the beginning. because, the engineers were unfamiliar with the system and the PDA, which caused an increase in the frequency of phone calls with questions about the ALMS.

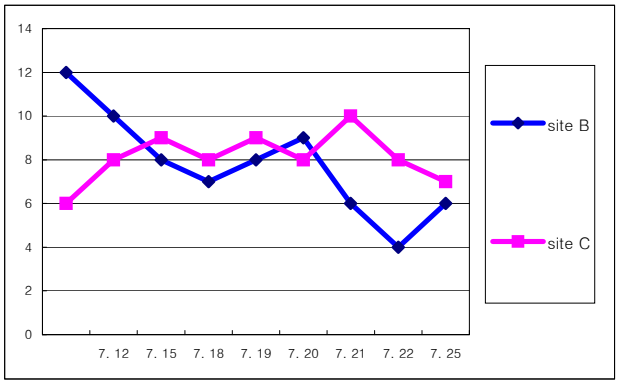

Figure 4. The frequency of C/W related phone calls

As time passed, however, the frequency of C/W related phone calls from site “B” decreased and the calls form site “C” stayed nearly the same.

5.2.2 The amount of document related to the C/W

The ALMS can reduce the amount of paper work related to the C/W. According to the results of the measurement, site “B” had a smaller amount of paper work than site “C”.

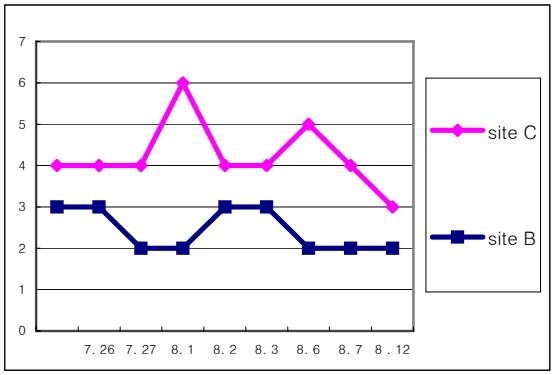

Figure 5. The amount of document related to the C/W

6.DISCUSSION AND CONCLISION

It can be concluded that the To-Be Model is more effective than the As-Is Model by analyzing the results of the test site. Especially, the To-Be process & the As-Is process have the some major differences in the areas of confirming the amount of warehousing, warehouse inspections and verifying the total installation. Also, the To-Be Model was much more efficient than the As-Is Model in the frequency of phone call and the amount of document related to the C/W.

During the pilot test period, the RFID tag was detached in the warehousing just one time. But, the RFID tag was detached from the Parrot 7 times.

This can cause additional work and a disturbance when workers are carrying out their tasks. So, it would be necessary educate the plant's packing staff about mapping the parrot ID and unit ID. Also, the internet speed and the number of warehousing units influenced the amount of time it took to upload & download the information related to the C/W, when using PDA.

In conclusion, using the ALMS to manage the C/W process on the site simplified the procedures and reduced the amount work related to the C/W by measuring the management about the effectiveness of material, information and schedule at the C/W.

6. ACKNOWLEDGEMENTS

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