

PERBANDINGAN DAN PENILAIAN PEMELIHARAAN FASAD CW DAN ACP BANGUNAN GEDUNG TERHADAP PERMEN PU NO.24/PRT/M/2008

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Abstract : Façade maintenance is often neglected and seems imprecise due to many factors, one of which is the location of the facade which is quite difficult to reach. Whereas maintenance on the facade is very important because the facade is the earliest part that is seen from a building and becomes a characteristic of the building, the maintenance applied should not be modest, but must be optimal and heed the relevant regulations. This study reviews by comparing and assessing the maintenance of the facade of the curtain wall material and aluminium composite panel with the Minister of Public Works Regulation No. 24/PRT/M/2008. Data collection methods used are interviews and questionnaires and to analyse using qualitative descriptive methods and percentages. From this method, it is possible to investigate the comparison of procedures in the field with procedures based on Permen PU No.24/PRT/M/2008 and the level of conformity of the procedures under review. Based on the results of the comparative analysis, the two procedures have similarities and differences, the procedures in the field as a whole are not in accordance with the procedures for the Minister of Public Works No. 24/PRT/M/2008, but the procedures in the field also have their own advantages. Based on the assessment, the level of conformity of the procedures in the field with the Minister of Public Works No. 24/PRT/M/2008 overall reached 86.64%. Meanwhile, based on the grouping of respondents, the score was 66.17% for group I, 78.95% for group II and 91.14% for group III. The overall results stated that the maintenance carried out was not fully in accordance with the regulations, but the results obtained showed good results, where the percentage obtained was more than 50%, this indicates that more than half of the maintenance was carried out by heeding the regulations.

Keywords : Maintenance, Facade, Curtain Wall, Aluminum Composite Panel.

1. INTRODUCTION

The facade system is the outer layer of the building consisting of the outer walls, roof, doors and windows and serves to protect the building from the outside weather (Francis D.K., 1943; Frederick S & James, 1989). The most frequently used facades in high-rise buildings are curtain wall (CW) and aluminum composite panel (ACP) construction. These two materials are in great demand because they are believed to give an aesthetic impression and are easy to work with (Amin & Kornawan, 2016; Mohaney & Soni, 2018). The development of the facade system needs to be balanced with its maintenance, because the maintenance of the facade is an important thing that needs to be done, because the facade is the main factor in the appearance of the building (Willmott & Harris, 2001). The position of the facade which is a building envelope makes the facade more susceptible to damage because the potential for direct contact with the outside environment is very high. The facade is the first part that will face damage by external factors which causes the facade to experience a much greater decrease in performance than other elements (DeSouza, et al., 2016).

In the process of implementing maintenance in Indonesia itself, the Permen PU No.24/PRT/M/2008 concerning Guidelines for the Maintenance and Maintenance of Buildings is used. This regulation is also used as a reference or guideline for facade

maintenance because the regulation regulates all components of the building including the facade system. Regulations or regulations are made as a reference tool, but in fact in the process of implementing maintenance there are many discrepancies or irregularities. Based on research conducted by Mawardi, et al. (2020), the mismatch of the maintenance mechanism based on the Permen PU No. 24/PRT/M/2008 is 73%. Meanwhile, the percentage of non-conformance of maintenance to the Minister of Public Works Regulation No. 24/PRT/M/2008 for architectural items is more than 50% (Jalil, et al., 2016; Hidayat, et al., 2020).

Based on the relationship between the importance of maintenance carried out on the facade with the fact that the maintenance carried out is not in accordance with the Permen PU No. 24/PRT/M/2008, it is necessary to conduct an analysis to determine the suitability of the maintenance carried out on the facade of the building with curtain wall materials and aluminum composite panel in the Graha Rectorate UM building to the Permen PU No. 24/PRT/M/2008. The results of this study are the differences, advantages and disadvantages of maintenance in the field as well as the level of conformity of maintenance that has been carried out based on the Permen PU No. 24/PRT/M/2008. This research is expected to be one of the reference materials for research on facade maintenance.

2. METHODS

In this study, the method used is the analytical method applied to analyze research data in general using Miles and Hubberman qualitative analysis (**Figure 1**). The qualitative analysis method is based on data analysis through the steps of data collection, data reduction, data presentation and drawing conclusions (Sugiyono, 2016). This study also uses the descriptive percentage method, this method is used to facilitate qualitative research by converting the results of research data into quantitative data. In addition, in collecting research data using interview methods and questionnaires. Interviews were used to determine the maintenance procedures carried out in the field. The interview method used in this study is a special interview (elite interviewing). A special interview is an interview activity carried out on special groups or individuals, such as leaders or superiors of certain agencies. it aims to obtain information relating to the regulations of certain agencies (Jonathan, 2006). While the questionnaire is used to measure the level of suitability of curtain wall and aluminum composite panel maintenance.

This percentage descriptive analysis method is used to process the data from the questionnaire results. Data processing is done by the formula below:

$$\text{Instrument percentage} = \frac{\text{Number of "Yes"}}{\text{Respondent number}} \times 100\% \dots\dots\dots (1)$$

$$\text{Final score percentage} = \frac{\text{Percentage of each questionnaire}}{\text{Instrument number}} \dots\dots\dots (2)$$

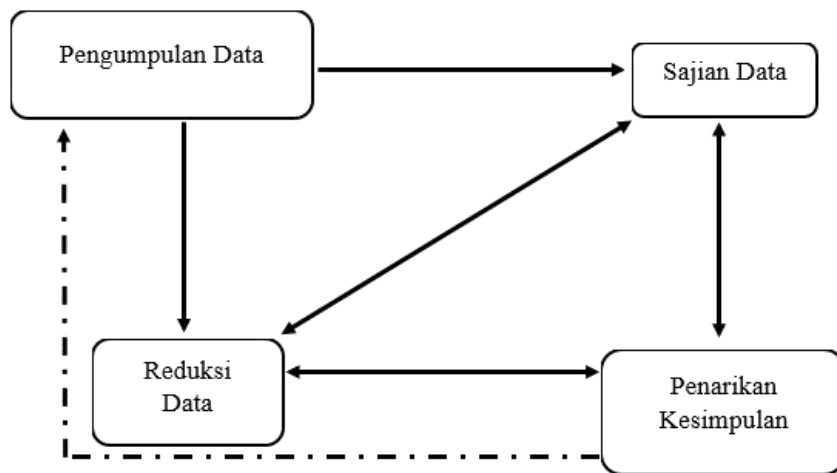


Figure 1. Flowchart of Interview Data Analysis Techniques According to Miles dan Hubberman

3. RESULTS

3.1 Comparison of Field Maintenance procedure with Permen PU No.24/PRT/M/2008

Result comparison of field maintenance procedure with procedure based on Permen PU No.24/PRT/M/2008 (Table 1).

Tabel 1. Comparison Similar and Different of procedure *Curtain Wall* and *Aluminium Composite panel* on field with Permen PU No.24/PRT/M/2008

Code	Procedure of Permen PU No.24/PRT/M/2008	Code	Procedure in the Field
Pekerjaan Persiapan			
-	There isn't any	LA1	Ensure the condition of the <i>curtain wall</i> and <i>aluminium composite panel</i> according to the drawings
-	There isn't any	LA2	Checking of activity approval
PA2	Preparation of help working tools and personal protective equipment	LA3	Preparation of help working tools and personal protective equipment
PA3	Checking help working tools and personal protective equipment	LA4	Checking help working tools and personal protective equipment
PA1	Preparation of tools and materials for cleaning <i>curtain wall</i> and <i>aluminium composite panel</i> .	LA5	Preparation of tools and materials for cleaning <i>curtain wall</i> and <i>aluminium composite panel</i> .
PA4	Ensure the using of	LA6	Ensure the using of

-	personal protective equipment and the installation of working tools There isn't any	LA7	personal protective equipment and the installation of working tools Checking of <i>curtain wall dan aluminium composite panel</i> surface
<hr/>			
Pekerjaan Pemeliharaan <i>Curtain Wall</i>			
PB1	Cleaning of <i>curtain wall</i> surface	LB1	Cleaning of <i>curtain wall</i> surface
PB2	Cleaning of <i>curtain wall</i> frame		Unstoppable
PB3	Cleaning of glass surface from stains of paint, glue, polish and putty		Unstoppable
PB4	Cleaning of <i>curtain wall</i> surface (second step)	LB2	Cleaning of <i>curtain wall</i> surface (second step)
PB5	Step of drying <i>curtain wall</i> surface	LB3	Step of drying <i>curtain wall</i> surface
-	There isn't any	LB4	Checking of <i>curtain wall</i> surface
PB6	Checking and replace <i>sealant</i>	LB5	Checking and replace sealant
<hr/>			
Pekerjaan Pemeliharaan <i>Aluminium Composite Panel</i>			
PC1	Maintenance and repair of sealant and joint backup		Unstoppable
PC2	Cleaning of <i>aluminium composite panel</i> surface	LC1	Cleaning of <i>aluminium composite panel</i> surface
PC3	Flushing of <i>aluminium composite panel</i> surface	LC2	Flushing of <i>aluminium composite panel</i> surface
-	There isn't any	LC3	Cleaning of <i>aluminium composite panel</i> surface (second step)
PC4	Drying of <i>aluminium composite panel</i> surface		Unstoppable
-	There isn't any	LC4	Flushing of <i>aluminium composite panel</i> surface (second step)
-	There isn't any	LC5	Checking of <i>aluminium composite panel</i> surface after cleaning.

The explanation of the code used to analyze the two procedures can be seen in **Table 2** Explanation of the Code on Procedures in the Field and Based on the Permen PU No. 24/PRT/M/2008.

Tabel 2. Explanation of the Code on Procedures in the Field and Based on the Minister of Permen PU No. 24/PRT/M/2008

No	Code	Description
1	L	Field procedure
2	P	Procedure of Permen PU No.24/PRT/M/2008
3	A	Maintenance preparation work
4	B	<i>Curtain Wall</i> maintenance work
5	C	<i>Aluminium Composite Panel</i> maintenance work
6	Angka	Sequence of step in the procedure

3.2 Level of Compatibility of Field Maintenance with Permen PU No.24/PRT/M/2008

The following is a recapitulation of the results of the conformity assessment of facade maintenance procedures with curtain wall and aluminum composite panel construction in the field with Permen PU No. 24/PRT/M/2008 based on the grouping of respondents (Table 4).

Tabel 4. Result of Conformity Assessment of CW and ACP Facade Maintenance field with Permen PU No. 24/PRT/M/2008 Based on Respondents Grouping

No	category	Total Respondent	Respondent (%)	score (%)
1	Respondent group I	14	13.73	66.17
2	Respondent group II	9	8.82	78.95
3	Respondent group 3 III	79	77.45	91.14

In addition to assessing the suitability of maintenance of curtain walls and aluminum composite panels in the field, using a questionnaire, it is also carried out based on an assessment through comparison of the suitability of procedures in the field with the procedures contained in the Permen PU No. 24/PRT/M/2008 (Table 5).

Tabel 5. Result of Conformity Assessment of CW and ACP Facade Maintenance Based on Comparison of Suitability of Procedures in the Field Against Procedures in Permen PU No.24/PRT/M/2008

No	Prosedur Permen PU No.24/PRT/M/2008	Prosedur di Lapangan	Ket
1	Before starting work, prepare complete work equipment, like: bucket, stick mop, wash applicator, glass wiper or unger kit, cloth rags, tapas, bottle sprayer, and glass cleaner.	Prepare the tools and materials used for the curtain wall and aluminium composite panel cleaning process. Such as preparing a bucket or container, cloth and other tools, as well as mixing the liquid used at a rate of 1:20 and 1:30.	1
2	In tall buildings prepare the gondola safely according to established procedures, a stairs, safety belt, masks and plastic helmets.	Prepare the supporting equipment needed during the curtain wall and aluminium composite panel cleaning process, in the form of gondolas,	1

		access ropes and safety belts or body hardnes.	
3	Check tools working, especially seat belts, ladders, whether they are fit for use and safe.	Ensure supporting equipment used is in good condition, by checking on these tools.	1
4	Waering a safety belt and helmet, before starting the cleaning of the outer glass wall, because it is very important for safety working.	Before carrying out work, make sure that you have used personal protective equipment and the adjustment of supporting equipment and ensure that it is in accordance with its position.	1
5	Clean the sunscreen dust using a half-wet cloth or clean the dirt that stick with a nylon brush, tapas and liquid glass cleaner or detergent mixture 1:30, rinse with a damp cloth.	First, spray the cleaning liquid (1:20 or 1:30) on the curtain wall surface evenly, then wait for a while. Furthermore, the distribution and cleaning of the surface of the curtain wall is carried out using a glass wiper while pressing slowly.	1
6	Clean aluminium glass frame, using multipurpose cleaner liquid (1:20).	Procedure not performed	0
7	Clean the stained glass with paint, glue, polish and putty, using trim scrapper and glass blade.	Procedure not performed	0
8	Dip the wash applicator or unger kit in the glass cleaner liquid with ratio 1:20. After that wet/spray thinly, use a bottle sprayer, rub using a rubber brush on the glass wall surface to be cleaned, pill it with a glass wiper vertically, until the glass is completely.	Spray using cleaning liquid (1:20 or 1:30) on the surface of the curtain wall evenly, then wait for a while. Furthermore, the distribution and cleaning of the surface of the curtain wall is carried out using a glass wiper while pressing slowly.	1
9	Clean the remnants of the dripping liquid with water using a stick mop and cloth immediately.	Wipe the surface of the curtain wall using a clean, soft fibrous cloth.	1
10	Check all the relevant rubber or sealant of glass. If there is damage to the sealant of glass, repair it with a new sealant the appropriate type.	Maintenance carried out on the curtain wall is also in the form or replacing peeled sealant (rubber connector). Sealant replacement is done by replacing the same sealant as before	1
11	Check the sealant and backup on the component joints, if there are parts that are flaking, repair them with the same sealant.	Procedure not performed	0
12	Clean the component surface with soap and detergent.	Spray with cleaning liquid (1:20 or 1:30) on the surface of the aluminium composite panel, then let it sit for while. Perform the smoothing of the cleaning fluid on the surface of the aluminium composite panel and proceed with cleaning the surface of the cleaning liquid.	1
13	Rinse using clean water with a manual sprayer.	After that, rinse by spraying water on the surface of the aluminium	1

14	Drying of the surface using a dry rubber surface with a flat edge. 14 point	composite panel. Procedure not performed 10 point	0
Nilai Akhir (%)			71,43

Bila ada persamaan, diharapkan menggunakan *Equation Editor* sehingga dapat mengurangi kesalahan apabila dilakukan pemformatan ulang atas naskah. Persamaan ditulis dengan font Times New Roman, rata kiri, besar huruf 11pt.

Contoh :

$$Q^1 = 2 \frac{rD}{c} + (1-R)Q^0 \dots\dots\dots \text{pers.1}$$

4. DISCUSSION

4.1 Comparison of Field Maintenance Procedures with Permen PU No.24/PRT/M/2008

From the results of the comparison of maintenance procedures in the field against the procedures of Permen PU No. 24/PRT/M/2008, it is found that there are differences in the number of stages in the two different procedures, overall, the stages of the procedures in the field are more than the stages of the procedures of Permen PU No. 24/PRT/M/2008. In addition to the procedures in the field, there are several stages that do not meet all the stages contained in the Permen PU No. 24/PRT/M/2008, namely the maintenance stage for curtain walls and aluminum composite panels. Meanwhile, in the preparatory work stage, all stages of the procedures based on the Permen PU No. 24/PRT/M/2008 have been completely fulfilled, although all stages have been met, but in the field procedures there are still three stages that are not included in the procedures of the Permen PU No. 24/PRT/M/2008.

In the curtain wall maintenance procedure that is not fulfilled, namely the stage of cleaning the curtain wall frame and the stages with the aim of cleaning the glass from stains of paint, glue, varnish and putty. In addition, at the stage of checking and replacing sealants in curtain wall maintenance, in reality in the field there are no routine checks, the procedures applied in the field only carry out the replacement of sealant components. For the stage of cleaning the surface of the curtain wall which is stained with paint, glue, putty and varnish using a trim scrapper and blade (glass knife), it is not included in the procedure in the field. Although the stains referred to in this stage are rarely found in the field, it is possible that they can also be found in the maintenance process, this stage should also be included in the procedures used in the field. The steps in question describe the methods that can be used when the cleaning process takes place, if there are stains on the glass surface.

Furthermore, for the stages of maintenance procedures for aluminum composite panels that are not fulfilled in the procedures applied in the field, these stages are in the form of maintenance and repair stages of sealants and backups at joints and stages of drying the surface of aluminum composite panels. In connection with the stages that regulate the maintenance and repair of sealants and backups on joints as stated in the Permen PU No. 24/PRT/M/2008. According to the results of the

interview regarding the maintenance that was not carried out during the maintenance process in the field, it was said that maintenance on these components would be carried out simultaneously with the sealant replacement process when it entered its expiration date, which is once every 5 years, which should be checked for backup connections and sealants every 6 years. once a month.

If it is related to the damage that can occur to the curtain wall and aluminum composite panel with the maintenance that has been carried out in the field. It can be said that the maintenance carried out is very minimal, as described above there are stages of maintenance stipulated in the Permen PU No. 24/PRT/M/2008 which are not fulfilled, meaning that these stages are not implemented in the field. These stages are a core maintenance process that can prevent damage to curtain walls and aluminum composite panels. The maintenance applied in the field only focuses on maintaining the surface of the curtain wall and aluminum composite panel. Whereas maintenance of the curtain wall and aluminum composite panel is not only visual maintenance, but maintenance must also be carried out to maintain the feasibility of the structure of the facade of the curtain wall and aluminum composite panel, where the maintenance applied must also include the components of the curtain wall and aluminum structure. composite panels. Although the overall procedure in the field has a higher number of stages, it does not mean that the maintenance carried out is good. Basically, the maintenance process carried out does not meet the minimum standards for the maintenance of curtain walls and aluminum composite panels. The number of stages of procedures in the field can be more because there are repetition of stages and stages that are made specifically for the benefit of the company. If you look at the objectives of these stages, they have a good goal for the maintenance process of curtain walls and aluminum composite panels. These stages are like, in the field procedure, two washing processes are carried out on the aluminum composite panel. There is also a stage of re-checking the cleaning results on the surface of the curtain wall and aluminum composite panel. these steps cannot be used as a benchmark to make the maintenance procedures applied in the field said to be good, because these additional procedures do not have much effect on the curtain wall and aluminum composite panel maintenance process and become a redundant procedure. Basically for the maintenance of the surface of the curtain wall, it is enough to wash it in one step as stipulated in the Permen PU No. 24/PRT/M/2008. On the other hand, the main steps of the curtain wall and aluminum composite panel maintenance procedure as a minimum limit for the maintenance of the curtain wall and aluminum composite panel components are not implemented.

4.2 Level of Compatibility of Field Maintenance with Permen PU No.24/PRT/M/2008

From the results of the maintenance suitability assessment based on the questionnaire, if you pay attention to the results of the three groups, the percentages with an increasing pattern in each group. It can also be noted that the respondents in group one produced the lowest percentage of scores. If we look at the respondents in group one, they are respondents with a good level of understanding of curtain walls and aluminum composite panels. The level of understanding in group one respondents can be said to understand both in terms and technically. Meanwhile, the third group of respondents produced the highest percentage of scores, where

respondents in this group had a cloudy understanding of curtain wall and aluminum composite panel maintenance. From the results of grouping respondents, it is illustrated that the higher the level of understanding the respondents have, the lower the percentage value generated for the assessment of the suitability of the maintenance of curtain walls and aluminum composite panels in the field. From the results obtained, it is assumed that the higher the respondent's understanding, the more observant the assessment will be and has a higher level of accuracy, this can happen because the respondent knows very well about the maintenance carried out in the field with what should be done based on the Permen PU No.24/PRT/M/2008, so that the resulting conformity assessment is getting lower as well. In group III the results obtained cannot describe the actual conditions in the field, because these results when validated or with the results of the conformity assessment through maintenance procedures applied in the field, have a gap that is very far or too far from the results obtained, where the results of the conformity assessment are based on procedures in the field get a result of 71.43%. The results of the conformity assessment based on the assessments of the respondents in groups I and II as well as the results based on the conformity of the procedures both stated that the maintenance applied in the field was not in accordance with the Permen No. 24/PRT/M/2008, where the comparison or difference of the results of the assessment not much different.

In this study, a discrepancy was found between the answers obtained through questionnaire analysis and the actual conditions in the field. The findings in question are in the form of maintenance activities for aluminium composite panels which are carried out every six months based on the Minister of Permen PU No. 24/PRT/M/2008. From the results of the questionnaire obtained, it is known that as many as 88 respondents stated that the maintenance of aluminium composite panels in the Graha Rectorate UM building is carried out every six months, in fact in the field maintenance for aluminium composite panels is only scheduled once a year. This is based on, the arguments given from CV. Cahaya Mulya as the maintenance contractor stated that the maintenance implementation time for aluminium composite panels is carried out once a year. In addition, the answers from the questionnaires are less precise with actual conditions in the field related to sealant maintenance and backups on aluminium composite panel connections. The results of the answers obtained those 92 respondents stated that the maintenance was indeed carried out in the field, but the maintenance carried out in the field was not in accordance with the provisions of the Permen PU No. 24/PRT/M/2008. The provision in Permen PU No.24/PRT/M/2008 states that maintenance of sealants and backups on aluminium composite panel joints is carried out at least twice a year, while in actual conditions the maintenance is carried out once every five years. The lack of conformity between the answers obtained through distributing questionnaires and the actual conditions in the field, is also in line with the results of the preparation of maintenance procedures applied in the field. When viewed from the procedures applied in the field itself, there are no stages of sealant maintenance and backup at the joints for aluminium composite panels.

5. CONCLUSION

From the results of the comparison of maintenance procedures in the field against the procedures of the Permen PU No. 24/PRT/M/2008, it is found that there

are differences in the number of stages in the two different procedures, overall the stages of the procedures in the field are more than the stages of the procedures of Permen PU No. 24/PRT/M/2008. These steps cannot be used as a benchmark to make the maintenance procedures applied in the field said to be good, because these additional procedures do not have much effect on the curtain wall and aluminum composite panel maintenance process and become a redundant procedure. In addition to the procedures in the field, there are several stages that do not meet all the stages contained in the Permen PU No. 24/PRT/M/2008, namely the maintenance stage for curtain walls and aluminum composite panels. Whereas maintenance of the curtain wall and aluminum composite panel is not only visual maintenance, but maintenance must also be carried out to maintain the feasibility of the structure of the facade of the curtain wall and aluminum composite panel, where the maintenance applied must also include the components of the curtain wall and aluminum structure. composite panels.

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