Comparative study on the level of interest in the maintenance of apartment and office building in Jakarta

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Abstract. Jakarta has ranks 14th place as the number of city with many high rise buildings in the world. As time goes by, destruction of property could not avoided again. Hence, rearing and care of work building is very important and carried on preconstruction stage, construction stage and post-construction stage in the aftermath of routinely, continous and periodic by taking into account technical specification material. With the routine maintenance, it is expected that the damage occurs does not require for cost of repair / high maintenance. The government have standard of maintenance building in regulation Minister of Public Work no.24/PRT/M/2008, but in fact the application of the rule often inconsistency. Therefore this research needed to identification and comparing between maintenance in apartment and office building in Jakarta. This research using validity and reliability test, method analysis factor used for grouping every components, the correlation test used to know related coefficient of components in maintenance building. Data obtained from 36 respondents apartment priority components of maintenance are maintenance of panel alarm, electricity panel and pumps. 37 respondents office building priority components of maintenance are ceiling maintenance, vertical transportation system and pumps. Differences of the priority components caused by difference of maintenance level interest, function building, the ownership and intensity of using the components.

1. Introduction

The maintenance of building must be met primarily in the function of commercial buildings consistantly. Since the process detail design of building, it should be an aspect of consideration. The more significant the maintenance of the building will affect with amount of cost maintenance each year[1]. Damage of building will increase with the length of the building. In this case building maintenance work becomes important, both from the pre-construction stage, construction and post-construction phase continuously taking into account the technical specifications of the materials used. So it does not causing for high of cost maintenance[2]. Each building is designed and built in such a way for a particular function. Based on data reported by Skyscraper Center (2017), high rise buildings in DKI Jakarta mostly functioned as office (41%), apartment / residence (38%), multifunction / mixed-use (20%), and the rest is a hotel building. DKI Jakarta ranks 14th as a city in the world with the highest number of high-rise building [5]. Seeing the needs of the urban community for living space and activities area, DKI Jakarta will be strategis area for developers and investors to continue for build other multi-storey buildings to meet the needs of consumers. The case of the collapse of the hall on the Indonesia Stock Exchange Building is suspected that the construction of the hallway is not feasible to accommodate the burden or large number of people and as a result of the incident, dozens of people were injured. Data from the Jakarta Fire and Rescue Agency show that of 780 buildings, only 558 buildings meet the safety requirements by the end of 2017. The remaining 222 buildings or 28% have not met. The high number of high buildings that do not meet the safety and security requirements is considered a mirror of the condition of buildings in the Capital Jakarta [4]. In 2016, several fire incidents occurred in Jakarta, ranging from the fire of Parama apartments in South Jakarta,
the Neo Soho Building in West Jakarta, the Casa Domaine Apartment in Tanah Abang, to the burning of the Swiss Bell Hotel in Kelapa Gading. A similar case also occurred in November 2017, a room on the second floor of Gedung Nusantara III DPR was also burned. Temporary suspicion of the cause of the burning room is shorted on the cooling machine contained in the chamber [3]. Based on the exposure, the building manager should to implementing a good maintenance system, so that every building component still in proper condition, especially it related for life safety aspect. Because of a building manager helped to determining a good maintenance system, makes this research has needed. It conducting based on the components of maintenance are listed in Regulation Minister of Public and Works No.24/PRT/M/2008.

The purpose of this study to identifying of priority and neglected components in maintenance activities of high-rise apartment buildings and offices in Jakarta, to find out which aspects are prioritized in maintenance of high-rise apartment buildings and offices in Jakarta, to knowing the order or priority scale in maintenance activities in high-rise apartment buildings and offices in Jakarta by reviewing aspects of life safety, component of damage, and comfort, to determine the cause of priority component differences and neglected components between high-rise apartment buildings and offices in Jakarta, as well as an additional reference to complement guidelines or research on maintenance buildings published previously.

2. Research Method

This research as a survey research category with descriptive quantitative research method. Researchers will conduct direct data retrieval to high-rise apartment buildings and offices in DKI Jakarta. A research method can be explaining in flow chart ;
Start

Literature study and identification of problems

Secondary data

Development of questionnaires (based on PERMEN PU No. 24/PRT/M/2008)

Expert Judgement (Validation of variable)

YES

Questionnaire Distribution

Collect questionnaire data

Validity test? (r score > r table)

Reliability test? (Coef value > 0.6)

YES

A

NO

- valid variable < unvalid variable

- valid variable > unvalid variable

- amount of respondent < 30
Figure 1. Flowchart research method
2.1. Sample
This research will be taken from the population of high rise apartment buildings and office buildings in DKI Jakarta with a minimum service period of 5 years. 50 apartment buildings and 38 office buildings suitable with the study criteria. The number of buildings sampled has found at least 10% of the total population, with a minimum of 30 respondents. Thus the number of buildings that can be used as a minimum sample of 6 apartment buildings and 4 office buildings.

2.2. Respondent
The expected criteria of respondent are the building management, especially the manager, chief, supervisor / leader, or engineering staff. Minimum education level of Diploma and has been in more than 2 (two) years in the field of maintenance of buildings experience.

2.3. Data Instrument Test - Apartment
From the validity test result that there are 8 (eight) questions that are not valid and must be eliminated. The eight sub-variables are considered invalid because they have Pearson Correlation under r table for 36 respondents with a significance level of 5% that is 0.329. The eight invalid sub-variables are X2.2, X3.1, X5.2, X6.2, X7.1, X7.3, X19.1 and X23.1. The reliability test is performed to the sub-variable question remaining after passing the validity test. The instrument is considered to be reliable if it has Cronbach's Alpha greater than or equal to 0.6. From the reliability test performed, Cronbach's Alpha was obtained for the remaining sub-variables valued at 0.935. The results show very well tested data because Cronbach's Alpha has more than 0.9 for 44 questions. So the data is feasible to be used in the process of factor analysis.

2.4. Statistics Descriptive Data - Apartment
The respondents' answers range from 1-5 to 15, 2-5 in 14 questions, 3-5 ranges in 11 questions, range 1-4 on 2 questions, range 2-4 on 1 question, and 4- 5 on 1 question as well. The minimum and maximum ranges affect the standard deviation value of each question.

2.5. Priority Scale in High-Rise Apartment Buildings Maintenance
Here is a priority scale in high-rise apartment buildings in Jakarta, the following results have been sorted by interest rate coefficients ranging from the most important to the least important:

- X25.1: Checking panel alarm such as bell, smoke detector, heat detector, and sprinkler every day
- X22.2: Service weight on machine and vital components of pump every 1 year by technician
- X13.1: The surface of the stone wall is cleaned by brushing with soapy water at least every 6 months
- X13.2: Painting of stone walls using varnish or other paint to avoid dirty and not overgrown with moss
- X12.1: Cleaning of red / light brick walls from dirt or moss situatively
- X14.1: Cleaning the exposed surface of concrete walls using non-destructive substances and rinse thoroughly 2 times a year.
- X14.2: Painting using doff / un-glossy material on all parts of the exposed concrete wall component
- X21.3: Weighing service on machines and components of vital fire protection systems every 1 year by technicians
• X24.1: Cleaning of electrical panels made once every 1 month
• X22.1: Lightweight service of pump components once every 3 months
• X10.1: Keep steel structures from being exposed to corrosive materials
• X10.3: Cleansing dots that potentially hold water at joints of steel structures
• X10.2: Provision of coating paints such as ironwork on steel structures, especially on parts exposed to direct sunlight and rainwater
• X20.1: Lightweight service and check of vertical transport system components once every 6 months
• X20.2: Service weight on the machine and vital components of the vertical transport system once every 1 year by technician
• X16.3: Cleaning of plumbing / open water channels once every 1 month
• X16.4: In plumbing / drains that may be dirt, iron bars / bars are used as a catcher to prevent clogging
• X18.2: Service to the water heater component performed by the technician under the terms recommended by the manufacturer or at least every 4 years
• X19.2: Checking and maintenance of system air conditioning components by technicians on a regular basis or at least every 1 year
• X15.1: Wood wall surface cleaning at least once every 1 month
• X11.1: Cleaning of undue objects on the exposed concrete structure
• X11.2: The outer part of the concrete structure is re-coated with a chemical liquid such as emulsion paint or other anti-acidic material
• X21.1: Cleaning and servicing fire protection system components once every 6 months
• X10.4: Cleaning of drainage holes in steel structures
• X11.3: In parts of the concrete structure damaged by impact, clean it in a rough condition, then apply a special adhesive tape
• X11.4: On concrete plate or wall crack, patch by injection method and material
• X16.2: Repair if there is leakage on pipes and plumbing / plumbing connections
• X21.2: Recharging fire poison at APAR every 1 year
• X5.1: Checking and filling of oil / lubricant on key parts, latches, hinges, and door closers that move every 2 months
• X6.1: Cleansing dirt attached to sliding door, rolling door, and folding door every 2 months
• X7.2: Inspection of sealent / rubber glass clamp with aluminum wall and frame
• X8.1: Cleanup of dirt attached to UPVC frame and iron frame every day
• X16.1: Checking on plumbing / PVC-based water channels
• X17.1: Inspection of components of sanitary equipment (eg bolt and sealent / rubber) at least every 2 months
• X4.1: Cleansing the gypsum ceiling surface of the impurities attached once every 2 months
• X4.2: Repairs / replacement of defective gypsum ceiling
• X3.2: Sealent and backup checks on clad aluminum composite layer connection every 6 Months

From the results, it is known that there are 8 (eight) or 40% aspects of life safety, there are 7 (seven) or 35% aspects of component damage, and there are 5 (five) or 25% aspect of comfort. This shows that maintenance activities in high-rise apartment buildings in Jakarta in accordance with the theory and assumptions used in previous research. That is the aspect of the safety of the soul is on the first priority, the aspect of component damage in second place and the comfort aspect in third place.
2.6. Data Instrument Test - Office

All respondents' answers are tested first, then there are 4 (four) questions that are not valid and must be eliminated. The four sub-variables are invalid because they have Pearson Correlation smaller than $r$ table for 37 respondents with significance level of 5% that is 0.325. The four invalid sub-variables are X1.1 with $r$ count of 0.200; X5.2 with $r$ arithmetic 0.266; X20.2 with $r$ count 0.273; and X21.2 with $r$ arithmetic 0.293. Then sub-variable question remaining will be tested its reliability. Similarly, for apartment data, the instrument is considered to be reliable if it has Cronbach's Alpha greater than or equal to 0.6. The test results show that the office data has a reliability of 0.958. The results also mean the data tested is very good because it has Cronbach's Alpha more than 0.9 for 48 questions. So the data is very feasible for use in the process of further analysis.

2.7. Statistics Descriptive Data - Apartment

Respondents provided fairly varied answers, range 2-5 scales on 20 questions, range 3-5 on 16 questions and range 1-5 on 12 questions. The minimum and maximum ranges affect the standard deviation value of each question. The farther minimum and maximum range in standard deviation value will be greater, apply also vice versa.

2.8. Priority Scale in High-Rise Office Buildings Maintenance

Here is a priority scale in maintenance systems at high-rise office buildings in Jakarta, the following results have been sorted by interest rate coefficients ranging from the most important to the least important:

- X4.2: Repairs / replacement of defective gypsum ceiling
- X4.1: Cleansing the gypsum ceiling surface of the impurities attached once every 2 months
- X20.1: Lightweight service and check of vertical transport system components once every 6 months
- X22.1: Lightweight service of pump components once every 3 months
- X17.1: Inspection of components of sanitary equipment (e.g. bolt and sealent / rubber) at least every 2 months
- X17.2: Cleaning of sanitary equipment after each use, and periodic cleaning using soap that does not cause corrosion and damage, rubbed with sponge / brush
- X6.1: Cleansing dirt attached to sliding door, rolling door, and folding door every 2 months
- X6.2: Lubrication on parts of sliding door, rolling door, and folding door moving every 2 months
- X16.4: In plumbing / drains that may be dirt, iron bars / bars are used as a catcher to prevent clogging
- X21.1: Cleaning and servicing fire protection system components once every 6 months
- X10.1: Keep steel structures from being exposed to corrosive materials
- X10.3: Cleansing dots that potentially hold water at joints of steel structures
- X11.1: Cleaning of undue objects on the exposed concrete structure
- X11.3: In parts of the concrete structure damaged by impact, clean it in a rough condition, then apply a special adhesive tape
- X11.2: The outer part of the concrete structure is re-coated with a chemical liquid such as emulsion paint or other anti-acidic material
• X14.2: Painting using a doff / un-glossy material on all parts of the exposed concrete wall component
• X10.4: Cleaning of drainage holes in steel structures
• X14.1: Cleaning the exposed surface of concrete walls using non-destructive substances and rinse thoroughly 2 times a year
• X7.1: Cleaning of aluminum foil from impurities attached daily
• X8.1: Cleanup of dirt attached to UPVC frame and iron frame every day
• X19.1: Lightweight service and air system cleaning every 3 months
• X19.2: Checking and maintenance of system air conditioning components by technicians on a regular basis or at least every 1 year
• X11.4: On concrete plate or wall crack, patch by injection method and material
• X10.2: Provision of coating paints such as ironwork on steel structures, especially on parts exposed to direct sunlight and rainwater
• X13.1: The surface of the stone wall is cleaned by brushing with soapy water at least every 6 months
• X13.2: Painting of stone walls using varnish or other paint to avoid dirty and not overgrown with moss
• X15.1: Wood wall surface cleaning at least once every 1 month
• X3.1: Cleaning the surface of cladding aluminum composite layer once every 3 months
• X7.2: Inspection of sealent / rubber glass clamp with aluminum wall and frame
• X7.3: Cleaning aluminum frame with finishing powder coating once every month
• X3.2: Sealent and backup checks on clad aluminum composite layer connection every 6 months
• X12.2: Repairs on the part of the brick wall / red brick / brick seeped or cracked in a way scraped and plastered using waterproof mortar, then cleaned as before
• X21.3: Weighing service on machines and components of vital fire protection systems every 1 year by technicians
• X25.1: Checking alarm panel such as bell, smoke detector, heat detector, and sprinkler every day
• X2.1: Sealent inspection / rubber adhesive of glass / tempered glass wall
• X2.2: Prepared a safe gondola for checking glass / tempered glass walls, service gondola once every 3 months
• X12.1: Cleaning of red / light brick walls from dirt or moss situatively
• X16.3: Cleaning of plumbing / open water channels once every 1 month
• X18.1: The water heater tank is drained with hot water for 10 minutes for inner cleaning
• X23.1: Oil engine turnover generator is done every 6 months
• X24.1: Cleaning of electrical panels made once every 1 month
• X5.1: Checking and filling of oil / lubricant on key parts, latches, hinges, and door closers that move every 2 months
• X22.2: Service weight on machine and vital components of pump every 1 year by technician • •
• X9.1: Cleaning of the area around the foundation of the tree roots that can be disruptive situatively
• X18.2: Service to the water heater component performed by the technician under the terms recommended by the manufacturer or at least every 4 years

Of the 38 sub-variables included in the important category, it is known that there are 13 (thirteen) or 34.21% aspects of life safety, there are 12 (twelve) or 31.58% aspects of component damage, and there are 13 (thirteen) or 34.21% comfort aspect. These results indicate that maintenance in high-rise
office buildings in Jakarta are less in line with the theories and assumptions used in previous research. The order of priority aspect is the safety of the soul in the first order as much as the comfort aspect in the second place, and the component damage aspect in the third place. The above results can certainly be influenced by various things such as the intensity of the use of components, building use patterns, brands or vendor service providers, and others.

2.9. Priority Scale Comparison between Apartment Building and Office Building
After the priority scale maintenance of office and maintenance of apartment buildings are known, a comparison of the two results is made. The difference of priority scale in some components such as maintenance of glass wall / tempered glass component, Aluminium Composit Clading layer, gypsum ceiling, door (sliding door, rolling door, and folding door), frame (aluminum, UPVC, and iron) improvements to red brick / light brick walls, sanitary appliances, air-conditioning service / cleaning and genset in office buildings are more priority than in apartment buildings. While maintenance of plumbing components, water heater service, vertical transportation system (elevator, and travelator), fire protection system, pump service, and electrical panel inspection in apartment building are more priority than office building.

3. Conclusion and Further Research

After all the research process is done, it can be taken some conclusions as follows:

a) Here are some of the priority and neglected factors:
   • 65.8% of apartment buildings in Jakarta have good fire protection systems (alarms, smoke detectors, heat detectors, hydrants, APARs and sprinklers) in anticipation of a relatively greater number of potential fires (kitchen / stove). Meanwhile, 80.4% of office buildings in Jakarta are not good protection, prevention, and fire prevention systems.
   • 80.4% of office buildings in Jakarta have gypsum ceilings that are in good condition because the condition of gypsum ceiling is visible and can interfere with comfort, and can endanger the lives of building users if at any time the ceiling collapsed and hit the user of the building. While 65.8% of apartment management in Jakarta does not do maintenance of ceiling significantly, because the majority of the component is the responsibility of the owners of apartment units.
   • The attention of high-rise building managers in Jakarta to structural components is minimal, it shown only 25% in apartment buildings and 26.3% in office buildings.

b) Life safety aspect (40%) becomes priority in apartment building, followed by component damage aspect (35%), and comfort aspect (25%). This is in accordance with the initial hypothesis / assumption related to the degree of importance of the component. In the office building there are two priority aspects, namely life and comfort (34.21%), followed by component damage (31.58%). It states that the manager of the office building places the comfort aspect as important as the aspect of life safety, then the aspect of component damage in the next sequence.

c) Here is the priority scale of maintenance and maintenance of the building by reviewing important components related to the safety aspects of the soul:
   • In the apartment building –
     - Checking alarm panel such as bell, smoke detector, heat detector, and sprinkler every day.
     - Weighing service on machine and vital components of pump every 1 year by technician
     - Weighing service on machine and fire protection system components that are vital every 1 year by technician
   • In an office building - Repairs / replacement of damaged gypsum ceiling.
- Lightweight service and check of vertical transportation system components once every 6 months.
- Lightweight service of pump components every 3 months.

d) Some of the things that make a difference of priority scale in maintenance and maintenance systems of apartment and office buildings are likely to be due to differences in building function, differentiation of ownership level (lease / strata), and intensity of component use.

e) Need to be reviewed on PERMEN PU no. 24 Year 2008 related material / type of components and intervals maintenance and maintenance activities listed therein.

For further research to be considered or improved from this research are as follows:

a) The management of apartment buildings and office buildings is expected to pay more attention to the priority components listed in the results of this study, especially those relating to the safety of life so that in the future there will be no more casualties or other losses due to negligence in the system of maintenance and maintenance of buildings.

b) It is necessary to review the PERMEN PU no. 24 Year 2008, the building management may also use other guidelines or standards from abroad to improve the system maintenance and maintenance of the building. It is necessary to add guidelines for each building function in particular.

c) Needs further studies or studies of maintenance and maintenance activities taking into consideration the more diverse building classifications, building quality, and other restrictive limits using the same guidelines or other guidelines.

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