



Case studies on construction defects on different types of walling system for building

Low Cheau Ming and Md Azree Othuman Mydin

School of Housing, Building and Planning, Universiti Sains Malaysia, 11800, Penang, Malaysia.

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ABSTRACT

This paper will focus on construction defects analysis on different types of walling system for building. There are various types of construction building defects on the main structure of building. This study is conducted based on 3 buildings located at Universiti Sains Malaysia. The chosen buildings are Hamzah Sendut 3 Library, Aman Damai Hostel and Restu Hostel. Observation and monitoring the defects at the buildings are the methodologies used in this study. Information is recorded and supported by photographic and digital documentation. Furthermore, the interview with those expert and professional in this field will be another critical element of this study. Lastly, the analysis will be done according to the data collected through observation and monitoring, and interview. Based on the obtained information, there are three types of building defects took place which are crack, dampness and paint peeling. These defects are not dangerous as they do not affect the structure of the building and there is no symptom which shows that the building is going to collapse. This research provides the solution for the building defect of the existing building.

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Introduction

Many projects are implemented in Malaysia as it is a developing country. This is due to high demand of public to residential building. Nation economy growth well as the construction industries can generate benefits to all of the construction companies. Buildings can be divided into a few categories which are residential, commercial, and industries building. Basic elements are needed to be fulfilling to have a complete and stable building. The elements include roof, wall, beam, ceiling and floor. Wall is the most important parts to support the roof and ceiling of the building. This study is conducted due to many wall defect are found in a building which may affect human safety. The study is conducted at 3 buildings located in Universiti Sains Malaysia campus which are Hamzah Sendut 3 Library, Aman Damai Hostel and Restu Hostel

Walls are mostly solid and are used to protect an area. Building walls can become an external or internal design. Walls can be partition walls, boundary walls, separation walls, shared walls, portable walls and retaining walls. They are many types of walling system for different usage on residential building such as masonry wall, prefabricated timber panel, precast concrete panel, and in-situ concrete with reusable system formwork and others.

However, defects that can be found in a building due to certain reasons. The most common defect can be found on the wall system are cracks, dampness, paint peeling, algae and fungi growth, and plaster crack. Although these defects are minor defects but if does not undergo any maintenance procedure, it will become serious. For example, if the constructors do not repair the cracks on the walls of the building, it may cause the wall to collapse.

Improper design of building, workmanship, quality of materials, and weathering will affect the structure of the wall. There are many types of cracks namely vertical crack, horizontal

crack and diagonal crack. Different situations and symptoms will cause cracks in buildings. Besides that, dampness will be the secondary damage to a building. Dampness actually happen due to rising damp, penetration damp, falling damp, and condensation. The unwanted moisture will help the growth of fungi in wood which may lead to human health issues and also cracks in the building.

Last but not least, paint peeling is one of the defects that can be found in all buildings. Poor workmanship and inferior materials that are badly applied on the wall influence the condition of the wall. Paint peeling will caused to building to be wrinkling, blistering, chalking, crazing and peeling appear. Thus, necessary skill and experiences are required to minimize the problem that facing on the defect of the building.

Maintenance works should be well maintained from time to time to prevent the defects from occurring and becoming worst so much as to lead to the collapse of the building. The root cause, usage of materials and the method of building defect will be discussed further in the following section.

Methodology

In order to conduct building defects survey at these properties, a few procedures are followed. First of all, select topic of study related to the types of defect of wall. In order to achieve the aim and objective, qualitative approach is used in this study because more unknown and unexpected extra information can be gained through conservation with experienced professional respondents. As mentioned earlier, case study has been conducted at Hamzah Sendut 3 Library, Hostel of Aman Damai and Restu. All the defects were observed by visual observation. The defects were captured with the aid of digital camera and the data are recorded manually. An important and authorities method of collecting information in the field, professional bodies and academics bodies will be targeted respondents of this research. The purpose of the interview is to

gather information from a person with firsthand knowledge. The data will then be analysed by gathering information from literature review and through interview sessions. Solution for the defects will be provided to achieve the aim of the study.

Observation, Result and Discussion

Data collection will be presented by visual observation on three case studies on the common walling system defects on buildings located at Universiti Sains Malaysia

Case Study 1: Hamzah Sendut 3 Library

In Hamzah Sendut 3 Library, there is a problem of crack at external wall as shown in Figure 1. The crack was within 1 meter long. It was a crack from the top of the pipe. The condition of the crack is small and does not affect the structure of the wall and the building. Therefore, it is a minor defect.



Figure 1: Diagonal cracks on external wall at Hamzah Sendut 3 Library

As for Hamzah Sendut 3 Library, there is a store which houses the hose reel system as shown in Figure 2. It shows a vertical crack from the top to the bottom of the wall. The crack was serious at the middle part and the plaster is falling off. This means the condition of the wall is bad and it must be repaired and plastered back with cement plaster.



Figure 2: Vertical cracks from the top to the bottom of the wall at Hamzah Sendut 3 Library

Another problem was a horizontal crack that can be seen on the sides of the light as shown in Figure 3. The defect was located at the exterior wall beside the corridor on the second floor. The crack was probably horizontal and straight across the wall.



Figure 3: Horizontal cracks at wall on the sides of the light at Hamzah Sendut 3 Library

Next, paint peeling on the surface can also be found in the building (Figure 4). This defect was located at the exterior wall on the first floor. It is located beside the electric plug. The obvious sign of the defect can be seen through the different colour of the paint. The original colour of the paint was white and now light pink is visible on the wall. There is also paint overlapping on the defect. The area of this defect is small if compared to other buildings.



Figure 4: Paint peeling on wall surface at Hamzah Sendut 3 Library

Case study 2: Aman Damai Hostel

There was a vertical crack on the wall surface as shown in Figure 5. It is at the exterior wall beside the downpipe of K07 building. The defect is not very serious. Other than that, there are many tiny cracks beside the vertical crack. The width of the crack is about 0.3 cm. This shows that the defect will not affect to a building. The crack occurs due to thermal expansion and poor workmanship. Inferior material can also cause the occurrence of crack.



Figure 5: Vertical cracks on the wall surface at Aman Damai Hostel

Besides that, another crack appears at the top corner of the wall as been illustrated in Figure 6. It was located in the toilet on second floor. The crack was a long horizontal crack. There was a brown colour mark on the wall surface. This surface of the wall is defined as the symptom of discoloured paint.



Figure 6: Horizontal cracks at the top corner of the wall at Aman Damai Hostel

Figure 7 shows horizontal and vertical cracks. It was located at internal wall on the first floor. The cracks occur straight along the wall between joining beam and wall and between column and wall. A crack of the wall was visible outside of the room. This type crack is common at every level of the building.



Figure 7: Horizontal and vertical cracks on internal wall at Aman Damai Hostel

Next, Figure 8 shows the paint in the toilet is peeling. It is on the top of the toilet tiles. This defect was observed at the toilet on the second floor. The original colour of the wall which is pink is being casted. Therefore, we can see the wall surface which is in white colour. This occurred due to the rain water that penetrated into the wall through the window.



Figure 8: Paint peeling occurred on wall surface in the toilet area at Aman Damai Hostel

Figure 9 shows a dampness problem at the first floor toilet. The sign of the dampness on the wall shows that there was water leakage from pipe water at the second floor. The wall shows marks of discolouring on wall and a small area of paint peeling. Fungus grows along the water stain. Therefore, there are green marks (colour) on the wall. Other than that, we can see clearly the water flowing from the upper wall.



Figure 9: Dampness on wall area at first floor toilet at Aman Damai Hostel

Case study 3: Restu Hostel

The defect of the wall is discolouring on the surface. The defects are located at exterior wall on the first floor (Figure 10).

The defect is near the staircase. The defect causes the wall become chalking. The pink colour paint is faded. This defect has affected a wide area.



Figure 10: Discolouring on the surface at exterior wall on the first floor at Restu Hostel

From observation, the walling system at the other floors have similar problem of paint peeling. For example, paint was peeled at the bottom of the wall which is located at the sixth floors. It is located at the corridor as shown in Figure 11. The surface of the wall is discoloured and the original cement plasters are now visible. There is a small drain to drain the water at the bottom of the wall.



Figure 11: Paint peeling at the bottom of the wall at Restu Hostel

Besides that, almost every floor is having serious dampness problems at the exterior wall of the toilets (Figure 12). The water has leaked through the wall from the toilet. There is a sign that shows the dampness problem on the wall. Water stain is caused by dampness and it covers a wide area. Besides that, paint is peeling because of the wet condition of the wall. White paint on the wall is peeled and the surface of the wall becomes rough.



Figure 12: Serious dampness problems at the exterior wall of the toilet at Restu Hostel

There is another dampness problem on the second floor. It occurred because the water penetrates through the porous of the wall (Figure 13). This wall is located at toilet. The dampness problem affected a wide area at the top of the window. There is

vertical sign of water stain at the left corner of the window. It also shows that fungi grow on the wall. The water stains on the wall also show the brownish stain.



Figure 13: Sign of dampness on wall surface at Restu Hostel

Data Analysis

Based on the observation, the defects that occurred at the buildings are plaster cracking, dampness and paint peeling. Plaster cracking happened due to exposure to thermal expansion, poor workmanship and vibration. Thermal expansion happens when the heat stored in building cause expansion of the building surface during daytime and it will be released at night. Repetition of the contraction and expansion will cause plaster cracking on the wall.

Vibration in buildings includes Heating, Ventilation and Air-conditioning (HVAC system) and activities of occupants which are the symptoms of the plaster cracking. The external sources include wind, construction operation and road and rail traffic near the building also affected the condition of Hamzah Sendut 3 Library. Traffic can generate vibration. When the vehicle is in contact with the irregularities of the road surface, the manhole cover will crack. These loads generate stress wave, spread in the soil and reach the foundation of the buildings and cause them to vibrate (Hunaidi, 1996).

Dampness is another issue in these buildings. It is a serious matter if the dampness penetrates through the walls. It is more common at the buildings of Aman Damai and Restu Hostel as these buildings are located near the water sources. Water could enter into the buildings through different routes. Other possible reasons that might cause dampness are leaking gutters or downpipes, defective drains, and plumbing burst (Ahmad, 2004). In addition, there are some other causes of dampness. Malaysia receives sunlight and rain for the whole year. High porosity of the brick or the failure of the pointing, the formation of hairline cracks in rendering or less of adequate protection or weathering on projections outside the building are the reasons that cause penetration of rain into brickwork which eventually leads to dampness.

According to Ahmad (2004), paint peeling usually happen on the building mainly on plastered walls and the areas that are exposed to excessive rain and dampness. Besides that, for some buildings which are located near to sea may also have a high risk of paint peeling. The surface of paint will easily become chalky and wrinkled or blistered. This is due to the amount of constant wind and rain and sunshine.

There is another problem may causing paint peeling which is relation to the quantity of the paint. The thickness of the single coat of paint is only about 0.01 cm (Miles, 1976). Although thickness of the layer is very thin, it can affect in increasing the useful life of building component which it covers.

Lower quality paint will degrade faster compared to better quality paint. For example, Jotun, Nippon Paint, and ICI are the good quality paint based on their materials. Tree and Brown are the examples of low quality paint compared to Nippon and Jotun. Quality of the paint will directly affect the surface of the wall.

The paint on the wall surface can be peeled off if there is different quality of paint applied on the wall. This is because of the different substances in the paint. Paint cannot last long on the wall if the paint cannot be resolved together. At last it will cause paint peeling.

Conclusions

Wall is the main structure of the building. It is very important to maintain the present building condition to make sure it does not fall into several defects. Cleaning and servicing, rectification and repair or replacement is the function of maintenance. Under the condition survey, it is found that almost all buildings in Universiti Sains Malaysia can be considered as a well maintained. It has not shown any sign of failure structure to a wall. However, if these defects are not taken seriously it may lead to structural failure. Thus, the building have to check from time to time to make sure the buildings are safe and in conformable condition.

Aman Damai Hostel does not have maintained their original function will appear to have more problems of defects. The cracks in Aman Damai need to be repaired to avoid damage on the wall structure. External wall need to be painted to make buildings look more attractive and increase the life of underlying surface by protecting it against moisture. Therefore, it will provide a better place to live. In a few cases of dampness problems occurred at Restu Hostel and Aman Damai Hostel. Water stain, peeling paint and fungus stain are some examples that may be associated with the leaking pipe, condensation and exposure to excessive rain and sun. Therefore, the problem treatment of the building repair and maintenance should be given full consideration. As a conclusion, to general a structure stability of wall, it is important to inspect not only on the main structure of wall, other elements such as roof, beam, floor and ceiling of building have to be taken into consideration as well. It is important to make sure that buildings are handed to the next generation in good conditions.

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