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SUSTAINABLE BUILT ENVIRONMENT

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COMMON DEFECTS RANKING ON APARTMENT AND TERRACE BUILDING IN BUKIT MERTAJAM, PENANG.

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ABSTRACT

Building defect is the common issue in apartment and terrace residential building. The defect is due to imperfect building materials, development strategies, poor workmanship, and lacking supervision. In this research focused on analising and developing ranking on common defect comparison between apartment and terrace houses. Generally, this research utilise quantitative approach where an online questionnaire has been distributed to respondents and the data collected was analysed through mean statistical analysis. It was found that are six common defect that usually occur at both apartment and terrace houses with the most common defect is crack on building façade. The result of the research helps to gain the futher findings on the particular topic and to guide public to understand futhers on defect issue plaguing on residential properties. The ranking system helps to understand futher on the level of awareness of respondents. This shows that a problem can be avoided by doing good inspection practice to ensure that no significant effects arise.

Keywords: *Defect, building crack, residential, quantitative approach, mean analysis*

INTRODUCTION

The global construction sector is constantly evolving, modernizing, and growing. The construction business faces a serious problem, mainly building defects, notwithstanding its development. A defect is a structural weakness or a design mistake that devalues the structure and poses a risk to the public. Two examples of the many causes of building defects are shoddy craftsmanship and the use of inferior materials. (Singh, 2022).

Buildings housing apartments and terraces are being constructed swiftly in response to the great demand. These studies and others show that there are problems with apartment and terrace structures that need to be fixed, and doing so will be very expensive. The government's program for low-cost housing also has concerns with both quality and defects. Some homeowners make improvements to their homes to raise comfort and property value since such poor building work has a negative impact on client satisfaction. (Rotimi, 2015, January 9).

This study's primary focus is on common defects in building in apartment and terrace homes. Constructed apartment and terrace homes are inspected to compile any relevant problem information. These data were subsequently analyzed to rank the major defects based on the superstructure components of both residential buildings, which are apartments and terrace houses, and to evaluate the various types of defects that are present in both residential buildings.

Background of Study

The focus of this study is on the typical construction defects in apartment and terrace housing. To gather all of the building's problem information, constructed apartment and terrace residences undergo inspection. These data were subsequently evaluated to various types of defect present in both residential building which are apartment and terrace house, to study the level of knowledge of home owners about defects that occur and to analysing and developing ranking the common defect.

Building defects are often regarded as malfunctions or capacity failures with regard to the standards or specifications for the building established by tenants. These specifications may apply to the building's framework, fabric, services, and other features (Ismail, 2015).

The most common defect in apartment building and terrace building are cracking on building façade, peeling of paint, dampness, rusty, roof leakage and gutter clogged. However, serious cracks can harm consumers. In Malaysia, shrinkage cracks, joint cracks, and other non-structural types of cracks are common in buildings. Besides,

the most frequent guttering defect include clogged rainwater outputs, corroded gutters, broken gutters, and failure of rainwater goods below ground (Ismail, 2015).

METHODOLOGY

Generally, this research utilise quantitative approach where an online questionnaire has been distributed to respondents and the data collected was analysed through mean statistical analysis. All the data collected has made an evidence to my case study. Moreover, this research also need homeowner from different types of residential such as apartment and terrace house. This research methodology have 2 phases. The first phases was when the questionnaire is made with the guidance of the expertise such as supervisor lecturer. Meanwhile, another phase was during the distribution of the questionnaire.

Pilot Study

Before the main data collection being conducted, ther researcher conducted a pilot study to test the instrument reliability and validity. So, the researcher had test for 10 respondents and the results of the pilot study found that, the researcher had seen where the improvement can be meet to the researcher instrument and prior to the main data collection.

Figure 1: Result of Pilot Study

Table 1: Analysis of Pilot Study

Most Typical Defect	Frequencies for Likert's Scale							Mean Score
	1	2	3	4	5	6	Total	
Crack	3	0	2	1	1	3	10	3.60
Dampness	0	3	1	1	3	1	9	3.78
Peeling of Paint	1	1	4	0	3	1	10	3.60
Roof Leakage	2	1	2	2	2	1	10	3.40
Gutter Clogged	4	0	1	3	0	1	9	2.78
Rusty	0	1	2	5	1	0	9	3.67

(Crack) Mean Score $= \dfrac{(1x3)+(2x0)+(3x2)+(4x1)+(5x1)+(6x3)}{3+0+2+1+1+3}$

$$= \frac{36}{10}$$

$$= 3.60$$

(Dampness) Mean Score $= \dfrac{(1x0)+(2x3)+(3x1)+(4x1)+(5x3)+(6x1)}{0+3+1+1+3+1}$

$$= \frac{34}{9}$$

$$= 3.78$$

(Peeling Paint) Mean Score $= \dfrac{(1x1)+(2x1)+(3x4)+(4x0)+(5x3)+(6x1)}{1+1+4+0+3+1}$

$$= \frac{36}{10}$$

$$= 3.60$$

(Roof Leakage) Mean Score $= \dfrac{(1x2)+(2x1)+(3x2)+(4x2)+(5x2)+(6x1)}{2+1+2+2+2+1}$

$$= \frac{34}{10}$$

$$= 3.40$$

(Gutter Clogged) Mean Score $= \dfrac{(1x4)+(2x0)+(3x1)+(4x3)+(5x0)+(6x1)}{4+0+1+3+0+1}$

$$= \frac{25}{9}$$

$$= 2.78$$

(Rusty) Mean Score $= \dfrac{(1x0)+(2x1)+(3x2)+(4x5)+(5x1)+(6x0)}{0+1+2+5+1+0}$

$$= \frac{33}{9}$$

$$= 3.67$$

Table 2: Pilot Study of Common Building Defect

No	Common Building Defect	Mean Score
1	Dampness	3.78
2	Rusty	3.67
3	Crack	3.60
4	Peeling Paint	3.60
5	Roof Leakage	3.40
6	Gutter Clogged	2.78

The researcher can infer from the above table that, according to a pilot study that was conducted, building dampness which received a mean score of 3.78 from 9 respondents is the most typical problem detected in both buildings and apartments as well as terrace houses. Rusty also has the second-highest defect, with a mean score of 3.67 from 9 those who responded. The mean score for cracks and peeling paint was 3.60. Last but not least, gutter clogged came in last with a 2.78 average. So, based on the votes of 9 respondents, we can say that gutter clogging is the least frequent building defect, while dampness is the most frequent.

Quantitative Data

Three sections make up the online survey questionnaire, which contains a total of 16 structured questions that are meant to gather information in order to meet the study's goals. The provided Google form received responses from 76 people. Four (4) questions make up Section A. The first asks about the respondent's background,

including their gender, age, type of residence, and occupation. Building Profiling, which is the Respondents' Level of Knowledge of Building Defects, is the subject of six (6) questions in Section B. Six (6) questions about respondents' knowledge of building defect are included in Section C, along with one open-ended inquiry about the homeowner's perspective. To obtain the mean value, a formula based on the selected scale will be used to compute the frequency of each score. Then, by adding the mean value and dividing it by the number of questions, the average of the overall scores obtained for each question in the section is determined. Following is the formula:

$$\text{Weighted mean} = \frac{\Sigma \text{ (no of the respondents chose the rating X rating scale)}}{\text{Total number of respondents}}$$

$$\text{Mean range} = \frac{\text{large scale} - \text{small scale}}{\text{Number of scales}}$$

Figure 2: Formula Means Analysis

Question 1: Respondents' Housing Types

Figure 3: Housing Types

The respondents' housing types are displayed in Photo 1.2 above. The respondents were classified into two housing categories, apartments, and terrace homes, based on the data gathered. A total of 41 respondents, or 53.9% of the total, reside in terrace homes in Taman Camellia, Bandar Perda, as opposed to 35 respondents, or 46.1%, who live in Apartment Permata, Bandar Perda. This means that more information about terrace homes than apartments was gathered.

Question 2: Year was the Building Built

7. What year was the building built? / Tahun berapakah bangunan tersebut dibina?

76 responses

- Year 1950 - 1984 / Tahun 1950 - 1984
- Year 1985 - 2000 / Tahun 1985 - 2000
- year 2001 - 2023 / Tahun 2001 - 2023

46.1%

48.7%

Figure 4: Year of Respondents' House Build

In Figure 4 above shown that majority of the respondent's house which is 48.7% was built on year 1985 - 2000. It is because the apartment house located at Bandar Perda Bukit Mertajam was built on year 1998. Besides, on year 2001 - 2023 is 46.1% respondents which is Taman Camellia, Bukit Mertajam was built on year 2016. The rest is from Apartment Idaman, Bukit Mertajam which the building was built around year 1984. This is means that, a house that has been built for a long time has more building defects than a new house.

Question 3: General Understanding on Building Defect

5. What is your general understanding about building defect? / Apakah pemahaman umum anda tentang kecacatan bangunan?

76 responses

- The result of work that does not adhere to the terms of the contract / Hasil kerj...
- The non-conformity of a component with a standard of specified characteristic /...
- A deficiency in appereance, performance, or function of constructi...
- Aesthetic, functional or performance defect in a building element that reduc...
- The lack of something required for completion / Kekurangan sesuatu yan...

36.8%

13.2%

17.1%

Figure 5: General Understanding of Building Defects

The percentage numbers for voting on building defect knowledge are shown on the graph. The definition of a building defect that received the most responses 36.8%

was "Aesthetic, functional or performance defects in a building element that reduce the values of the home." This was followed by "A deficiency in appearance, performance, or function of construction, services, and other amenities in a building," which received 30.3% of responses. This shows that, generally speaking, the respondents are knowledgeable with and have dealt with building issues. The review, which determined that the defect is an aesthetically pleasing and functional defect in a construction component that affects the value of the dwellings, is consistent with the survey's findings (Karim, 2006).
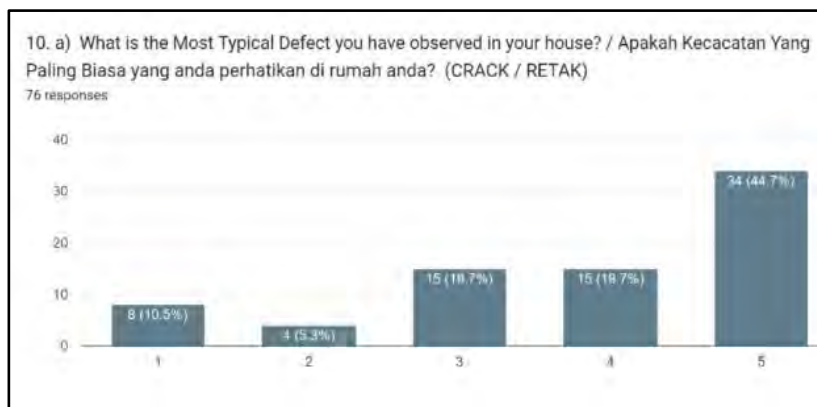
Question 4a: Most Typical Defect - Crack

10. a) What is the Most Typical Defect you have observed in your house? / Apakah Kecacatan Yang Paling Biasa yang anda perhatikan di rumah anda? (CRACK / RETAK)

76 responses

Figure 6: Most Typical Defect – Crack

Most Typical Defect	Frequencies for Likert's Scale						Mean Score
	1	2	3	4	5	Total	
Crack	8	4	15	15	34	76	3.83

$$\text{Mean Score} = \frac{(1x8)+(2x4)+(3x15)+(4x15)+(5x34)}{8+4+15+15+34}$$

$$= \frac{291}{76}$$

$$= 3.83$$

The column chart above depicts the respondents' assessment of the most typical defect for building crack for the home they live in. According to the graph, the majority of respondent which is 44.7% consider crack is most common which the most defects found in the house. Another 19.7% respondents chose common and neutral as their answer. The rest is voted for least common and strongly least common which are 5.3% and 10.5% of respondents. This is means that according to (Headquaters, 2011), in Malaysia, shrinkage cracks, joint cracks, and other non-structural types of cracks are common in buildings. These occur due to incorrect design, faulty construction or overloading. The mean score for building crack is 3.83.

Question 4b: Most Typical Defect - Dampness
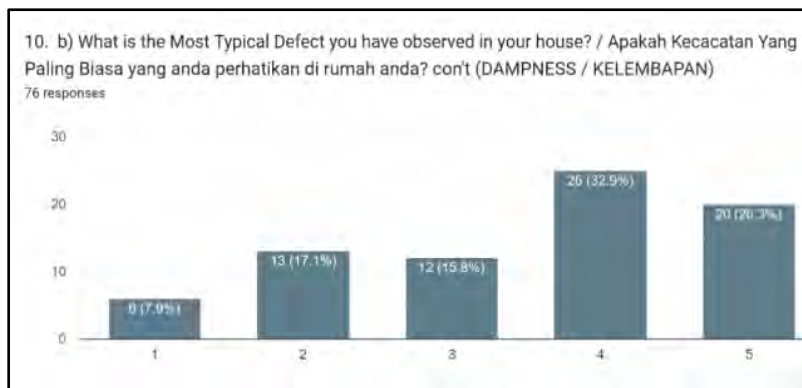
Figure 7: Most Typical Defect – Dampness

Most Typical Defect	Frequencies for Likert's Scale						Mean Score
	1	2	3	4	5	Total	
Dampness	6	13	12	25	20	76	3.53

$$\text{Mean Score} = \frac{(1x6)+(2x13)+(3x12)+(4x25)+(5x20)}{6+13+12+25+20}$$

$$= \frac{268}{76}$$

$$= 3.53$$

The column chart above depicts the respondents' assessment of the most typical defect for building dampness for the homes they live in. According to the graph, the majority of respondent which is 32.9% consider dampness is common which the most defects found in the house. Besides, some of the respondents voted for most common defect found in their house which is 26.3% of respondents. The rest is voted for neutral, least common and strongly least common is 15.8%, 17.1% and 7.9% of respondents. It indicates that one of the causes of dampness is excessive moisture. Moisture enters the air in homes through commonplace activities including cooking, cleaning, taking showers, and drying clothes. According to this survey, dampness is the second most common problem after cracks, meaning that their home has more cracks overall than dampness. The mean score for building dampness is 3.53.

Question 4c: Most Typical Defect – Peeling Paint
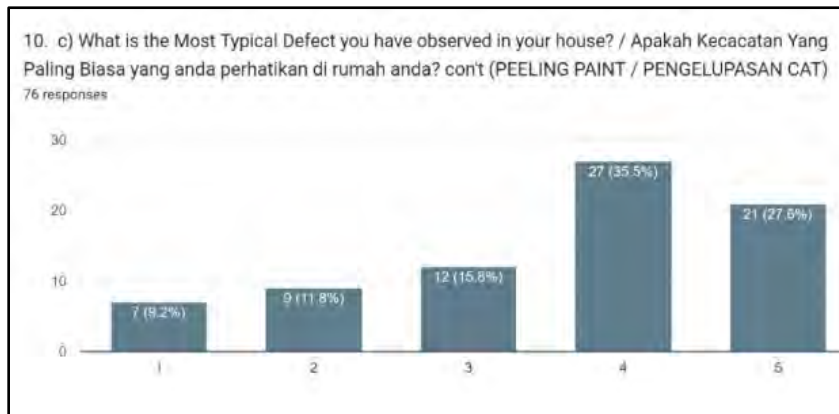
Figure 8: Most Typical Defect – Peeling Paint

Most Typical Defect	Frequencies for Likert's Scale						Mean Score
	1	2	3	4	5	Total	
Peeling Paint	7	9	12	27	21	76	3.61

$$\text{Mean Score} = \frac{(1x7)+(2x9)+(3x12)+(4x27)+(5x21)}{7+9+12+27+21}$$

$$= \frac{274}{76}$$

$$= 3.61$$

The respondents' perception of the most common defect for the house they reside in, peeling paint, as seen in the column chart above. According to the graph, the majority of respondents, or 35.5%, believe that peeling paint is a common home defect. In addition, some respondents, 27.6% of them choose paint peeling as the most prevalent problem in their homes. Peeling paint was cited as neutral by 15.8% of respondents, which is not a high percentage of cases in homes. While 16 more respondents chose the least common and strongly least frequent options, representing 11.8% and 9.2% respectively. In this survey, respondents identified dampness as the most common problem, with paint peeling coming in second. The mean score for building peeling paint is 3.61.

Question 4d: Most Typical Defect – Roofing Leakage

10. d) What is the Most Typical Defect you have observed in your house? / Apakah Kecacatan Yang Paling Biasa yang anda perhatikan di rumah anda? con't (ROOF LEAKAGE / BUMBUNG BOCOR)
76 responses
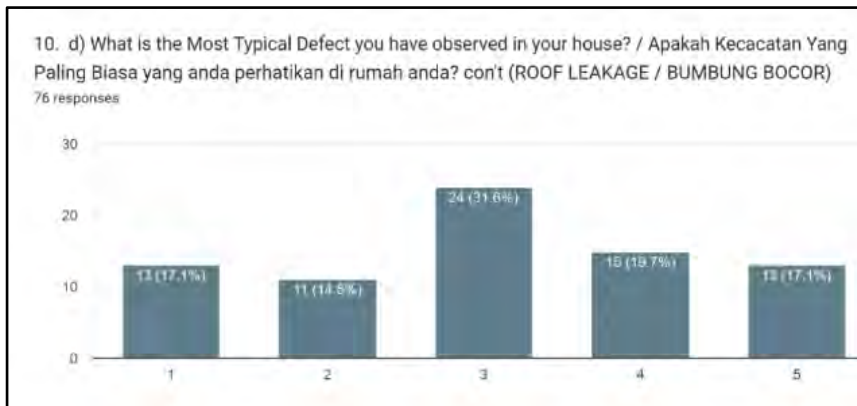
Figure 9: Most Typical Defect – Roof Leakage

Most Typical Defect	Frequencies for Likert's Scale						Mean Score
	1	2	3	4	5	Total	
Roof Leakage	13	11	24	15	13	76	3.05

$$\text{Mean Score} = \frac{(1x13)+(2x11)+(3x24)+(4x15)+(5x13)}{13+11+24+15+13}$$

$$= \frac{232}{76}$$

$$= 3.05$$

The respondents' perception of the most common defect leading to roof leaks for the residence they call home is shown in the column chart above. The bulk of respondents, or 31.6%, claim that their home is neutral, meaning that minor roof leaks occasionally occur. It's because terrace houses require annual maintenance on the roof, which is commonly done. In order to lessen the roof leaking. In addition, a roof leak needs to be fixed right away to keep the structure in good shape before it becomes worse. The next minority of respondents, 14.5%, claim that roof leakage in their home is merely common and infrequent. The mean score for building roof leakage is 3.05 which is less than the crack and dampness.

Question 4e: Most Typical Defect – Gutter Clogged

10. e) What is the Most Typical Defect you have observed in your house? / Apakah Kecacatan Yang Paling Biasa yang anda perhatikan di rumah an... con't (GUTTER CLOGGED / LONGKANG TERSUMBAT)
76 responses
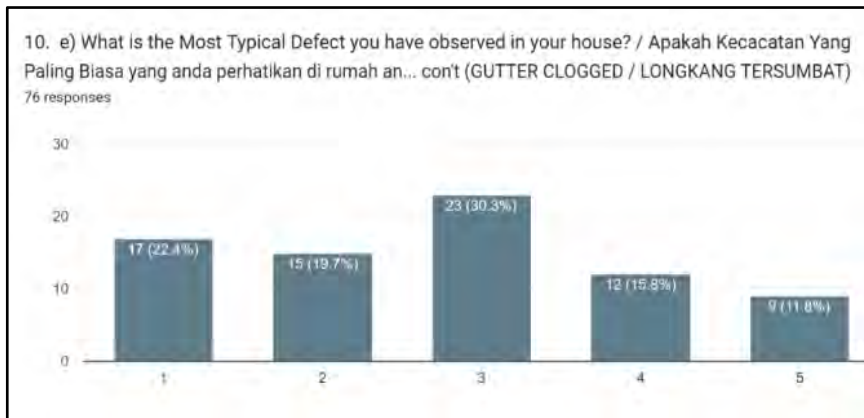
Figure 10: Most Typical Defect – Gutter Clogged

Most Typical Defect	Frequencies for Likert's Scale						Mean Score
	1	2	3	4	5	Total	
Gutter Clogged	17	15	23	12	9	76	2.75

$$\text{Mean Score} = \frac{(1x17)+(2x15)+(3x23)+(4x12)+(5x9)}{17+15+23+12+9}$$

$$= \frac{209}{76}$$

$$= 2.75$$

According to the responses, as seen in the column table above, clogged gutters are the most typical defect for the home they live in. Blocked gutters received the same amount of votes as roof leaks, which is unfavorable to 30.3% of respondents. This suggests that gutter blockages don't always happen in their homes, don't happen often, and might only happen in a few locations that aren't risky like wetness and fractures. Only 11.8% of survey participants, the majority of whom resided in terrace houses, said that gutter obstructions occurred regularly in their residences. Gutter clogging has a mean score of 2.75, which is lower than the other defects.
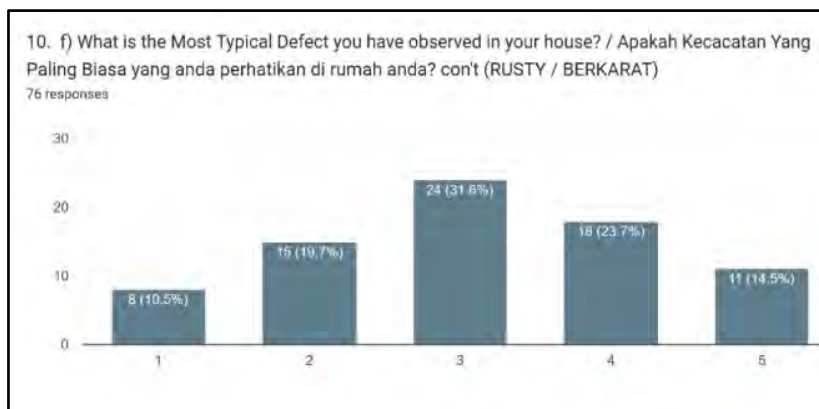
Question 4f: Most Typical Defect – Rusty

10. f) What is the Most Typical Defect you have observed in your house? / Apakah Kecacatan Yang Paling Biasa yang anda perhatikan di rumah anda? con't (RUSTY / BERKARAT)

76 responses

Figure 11: Most Typical Defect – Rusty

Most Typical Defect	Frequencies for Likert's Scale						Mean Score
	1	2	3	4	5	Total	
Rusty	8	15	24	18	11	76	3.12

$$\text{Mean Score} = \frac{(1x8)+(2x15)+(3x24)+(4x18)+(5x11)}{8+15+24+18+11}$$

$$= \frac{237}{76}$$

$$= 3.12$$

According to the responses, clogged gutters are the most typical defect for the house they reside in, as seen in the column chart above. Only 31.6% of all respondents, or a relatively small percentage when compared to dampness and crack, indicated that rusty was neutral in their home, according to the survey's findings. 14.5% of respondents chose the most frequent defect for rusting, which might be that their home is always getting wet from rain, their roof leaks, and other factors. According to (Services, 2022), structural cracks, soil erosion, and building settlement are serious defects that cannot be compared to non-structural cracks, wall dents, water leaks, corrosion, and general deterioration. As a result, whenever an insignificant problem is discovered, it will also be fixed. The mean score for building rusty is 3.12.

Following is a summary of the mean score:

Table 3: List of Common Defects

No	Common Building Defect	Mean Score
1	Crack	3.83
2	Peeling Paint	3.61
3	Dampness	3.53
4	Rusty	3.12
5	Roof Leakage	3.05
6	Gutter Clogged	2.75

Based on the aforementioned conclusion, it should be underlined that the researcher discovered that the most typical problem in buildings, apartments, and terrace homes in this case study is a building crack. However, significant fissures may harm the public, according to (Headquaters, 2011), buildings in Malaysia frequently have shrinkage cracks, joint cracks, and other non-structural types of cracks. In addition, gutter clogging ranks last, with a mean score of 2.75. (Colorado, Why Clogged Gutters Are Bad, 2023), claims that Flooding and water leaking into the foundation might occur as a result of clogged gutters directing water into the basement. The foundation of the house may crack as a result of the water, shifting the building over time and jeopardizing its stability.

DISCUSSION AND ANALYSIS

Based on the information received from the questionnaire, the research can determine the homeowner's awareness of and understanding of building defects. The data collected from the different questionnaire parts will be thoroughly examined and analyzed. It is acceptable to suppose that the respondents will be able to identify a building defect in the most specific manner possible: a severe aesthetic, functional, or performance defect in a construction component that reduces the value of the residences. According to all of the respondents, a construction problem that can lead to a building's functional defect is primarily brought on by lack of general maintenance services.

Next, according to the mean analysis that was performed, the building crack that 34 respondents chose as the most prevalent problem and received a mean score of 3.84 is the most common; the gutter clog that received a mean score of 2.75 is the least common. Therefore, it is clear from this section that the fracture was the main defect in their dwellings. According to (Headquaters, 2011), both residents could be harmed by a significant crack.The vast majority of respondents agreed that it is important to treat building defects seriously since they may put residents in risk. They further claimed that they employ general contractors to fix any building issues that arise, which ultimately leads to a completed defect.

CONCLUSION

The majority of respondents, according to the study, think that the lack of general maintenance services, which focus more on the aesthetics components of buildings, is what makes defects more obvious and makes them unsightly to users which is the majority of respondents are from non-built environment person since they just examine defects from the outside that are evident without properly comprehending what occurs on the inside. The respondents admit that the building is need for maintenance as said by (Haines, August 3, 2021), regular maintenance is not only good for the building but can also help ensure the health and safety of the family, pets and more. Inspecting the interior and exterior for cracks, leaks and other damage can help to keep everyone comfortable and prevent people from getting sick or injured.

As a result, due to aesthetic factors and respondents who lack competence, it is possible for them to notice a defect and become aware of when general maintenance is lacking. They recognize the importance of maintenance in managing buildings which can be relate that most of the respondent which is 36.6% voted for defect is the aesthetic, functional or performance defects in a building element that reduces the values of the home. Besides, the minority of the respondent think that design.

faulty can results to the building defect. Again, from the perspective of the people from non-built environment person, especially young people aged between 21-30 years, inclined toward the assumption that defect may occur from faulty design and lack of something that required for completion during construction stage. Apart from that, every respondent is aware of the defects in structure in their home and have the basic knowledge about building defect.

RECOMMENDATION

This section focus on the recommendation for the future research that are made based on the three (3) research objectives. Based on the objectives and their findings and analysis, a recommendation towards an improvement should be made by the researcher.

Scope 1: Involves Competent Person

This study only addressed common defects and evaluated respondents' level of awareness; it did not address specific issues, solutions, or respondents' perceptions of solutions regarding real correction. The researcher suggests that this study be expanded to include individuals from the built and environmental sectors, as well as contractors and consultants, who can respond to a questionnaire about how they assess building defects and the defect that they consistently see in the construction of buildings from the perspective of knowledgeable people. There's a good chance that their viewpoints diverge. For instance, whereas the general population thinks that cracks are the most common problem, knowledgeable people could think that water seeping is the most common defect. From there, we can observe that knowledgeable people's perspectives and those of the general public diverge.

Scope 2: Involves to Other Categories of Defect

The limitation that only frequent defects were taken into account in the analysis leads to the other scope. It is suggested that the research be expanded to encompass major, particular, and critical defects. Examples include foundation fissures, building structure failure, and soil subsidence. The many perspectives in terms of defect categories can then be seen from there. For instance, serious defects might potentially cause the entire structure or simply a piece of it to collapse or be destroyed. In contrast, the majority of typical defects are minor and non-structural in character, and they only affect the structural safety of the structures.

Scope 3: Involves Effective Solution Toward Building Defect

The sole focus of this research was homeowners' assessments of building defect awareness and understanding. The optimal fix for each of the above-mentioned common defects can be found by extending the scope of this investigation. Determine the primary cause of the condition before performing any required repairs.

ACKNOWLEDGEMENT

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