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INVESTIGATING ISSUES ARISE IN CONCRETE FLAT ROOF IN PERAK

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ABSTRACT

This research conducted an investigated concrete flat roof issues in a residential building in Seri Iskandar, Perak, and its impact on Aeon Mall Ipoh Station 18 occupants. It comprehensively analyzed the structural integrity, material quality, and construction practices of concrete flat roofs in both residential and commercial buildings. The aim was to identify issues and their effects on safety. The findings highlighted potential vulnerabilities in roof design and proposed safety improvements. The article focuses on problems associated with concrete flat roofs, popular for their affordability and practicality. Over time, problems like leaks and fractures emerge, requiring maintenance. The study examines common defects, causes, and improvements, and lack of professional organizations and contractors in Perak affects flat roof longevity. Regular maintenance is vital for waterproofing, as hardened membranes, rain-induced changes, and expansion lead to problems. Data was collected through surveys and secondary sources, using questionnaires distributed to residents and Aeon Mall Ipoh Station 18 occupants. The majority of respondents expressed satisfaction with their building's flat roof. This study emphasizes the significance of concrete flat roof issues and their resolution.

Keywords: Concrete flat roof, residential building, commercial building, Perak

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INTRODUCTION

This research is about the issues arising from concrete flat roofs and the way to overcome them. In the past few years, it has been a trend for building developers to implement concrete flat roof systems instead of pitched roofs. The main reason is due to its aesthetic value, lower construction cost, and as a usable space for car parks. However, the issues approached the building owners after a period of time, where issues such as waterproofing issues and cracks are frequently reported and lead to serious maintenance problems.

Therefore, the aim of this research is to investigate the issues arising from the concrete flat and find ways to overcome the issues. The research aims to identify the main factor behind the common defects in the concrete flat roof, to investigate the reason people still choose to invest in property that uses flat roof despite knowing the downside of it, and to determine the remedies towards this issue in order to suit the system itself with Perak weather condition, as well as to improve the quality of construction industry in Perak and the satisfaction of the occupants.

The primary data of this research will be collected through a questionnaire distributed to property owner residential building in Seri Iskandar and occupants of Aeon Mall Ipoh Station 18, Perak. Meanwhile, the secondary data will be obtained through journals and articles. By the end of this research, we can determine the issues of concrete flat roofs, the main factor behind the common defects, and the way to overcome the issues. Hopefully, this research will solve the problems arising from concrete flat roofs and less issues will occur in the future.

LITERATURE REVIEW

Flat roofs come in various types and grades which individually share the same purpose in terms of function. A flat roof consists of a slope which angles around approximately 10°. The main purpose of the flat roof is to protect the structure from external elements such as humid and hot temperatures into the compounds of the structure. According to Sarman et al. (2015), various structures in Malaysia has implement the use of flat roofs into their design compared to the mainstreamed pitched roofs which is usually found in residential buildings. Structure-wise, the roof is suitable for corporate designs as it tends to keep facility equipment in check and at bay in terms of resourcing and financing.

Construction of flat roofing in Perak is difficult since there aren't many companies, organisations, or contractors that are experts in this industry. The longevity of the roof is substantially impacted by the installation technique. Workmanship problems mostly affect smaller contractors who lack adequate construction expertise. Flat roofs are less advantageous in Perak's tropical environment, which is distinguished by year-

round sun and rain. According to Sarman et al. (2015), they are more susceptible to difficulties because they receive more direct sunlight than sloping roofs. According to Sarman et al. (2015), the hardness, displacement, and expansion brought on by sun and rain threaten the waterproofing layer's integrity. Furthermore, waterproofing maintenance, as was noted by Morgado et al. (2017), affects faults and forces early replacements because of frequent damage.

One of the main issues of the uses of flat roof here in Malaysia are the surface defects produced by the damaged water proofing membranes which is present in flat roofs. Defects are common on roofs and parapet walls hence needing almost immediate and constant corrective and preventive maintenance. Presence of mould on the surfaces, cracks and damaged waterproofing membranes are one of the common defects on the use of flat roofs here in Malaysia. Moreover, the flat surfaces of the flat roof result in the presence of stagnant water on the surfaces. The enhances the presence of mold due to high humidity due to minimal slope present on the surface therefor minimalizing the movement of fluids present on the roof. (Sarman et al., 2015).

Uses Of Flat Roof

The article discusses the advantages and challenges of using flat roofs in both residential and commercial buildings, particularly in the tropical climate of Malaysia. The primary benefit of flat roofs is their cost-effectiveness compared to pitched roofs with more expensive roofing materials. Additionally, flat roofs offer versatile use of space for installing equipment and creating rooftop decks. They are commonly found in commercial constructions due to easier installation, maintenance, and accessibility. (RoofSlope, 2016)

The research focuses on the prevalent defects found in concrete flat roof construction in the equatorial region. Two case study buildings were inspected to analyse waterproofing, parapet wall, rainwater drainage, and surface profile. The investigation emphasized the importance of appropriate roof slope and parapet wall design to prevent failures and membrane damage.

The tropical climate poses challenges, as intense sun radiation and humidity lead to high temperatures. Inadequate ventilation in low-income housing designs results in trapped heat in the attic, leading to increased reliance on air conditioning, which raises operational and maintenance costs. The study highlights the need for better thermal comfort in homes to reduce energy consumption and improve living conditions in Malaysia's hot climate (Mark Akers, 2020).

Types Of Flat Roof

- **Build up roofs (BUR)**

Build up roofs (BUR) are flat roofs being built from the ground up and consist of layers of bitumen, ply sheets and one or more surfacing materials. This is one of the oldest methods of flat roofing as it has a history of use of more than 100 years.

- **Concrete flat roof**

A concrete roof is essentially a slab of concrete used to construct the roof of a home. Pouring concrete into a shuttering framework creates the concrete roof. A shuttering structure is a structural mold that is often built of wood planks and boards and is used to mold concrete into a slab shape.

- **Metal Flat Roof**

Many facility managers like metal roofs because they are robust, non-combustible, and can reflect some heat away from your roof. When the sun shines down on the surface, it can become incredibly hot, but much of that heat is kept from entering the structure, saving you money on energy expenditures.

Advantages of Flat Roof

Flat roofs offer several significant benefits, with cost being a primary advantage. They are cost-effective to construct and install, using affordable materials such as flat roof insulation boards. The simplicity of flat roof installation reduces labour expenses, and their durability leads to lower repair costs over time. Additionally, flat roofs provide space that can be utilized for various purposes. Air conditioning units or solar panels can be easily placed on flat rooftops. These roofs also offer design flexibility for creating outdoor lounges, gardens, or additional living spaces.

Flat roofs can be attractive and practical, especially in small buildings where space utilization is crucial. They are safer and easier to inspect, contributing to cost-effective maintenance. The extra usable outdoor area they provide makes them appealing for residences with limited yard space. In summary, the advantages of flat roofs include cost-effectiveness, ease of installation, reduced maintenance expenses, and the opportunity to create usable outdoor spaces. Properly maintained flat roofs can be a viable and attractive option for certain types of buildings and climates.

Disadvantages of Flat Roof

Flat roofs come with both advantages and disadvantages. While they are cost-effective and offer additional usable space for various purposes, their stability decreases as the roof area increases. Industrial buildings with flat roofs must consider the weight on the interior and may require additional structural reinforcement. The lack of proper drainage can lead to water accumulation and rot, making regular inspection and maintenance crucial (Professional Roofers, 2016).

Flat roofs are more susceptible to extreme temperature changes due to limited insulation space, and they may not fit aesthetically with the surroundings. Moreover, they offer less internal living space as they lack lofts or attics. Proper sealing and roof coating inspections are essential to maintain the integrity of flat roofs, especially in warm climates where they are commonly installed.

Common Defect of Concrete Flat Roof

The most common issues with flat roofs and their potential consequences are outlined. Neglecting regular maintenance and inspections can lead to premature roof failure, making fluid-applied roof repair necessary. Flat roofs are susceptible to blistering due to overexposure to the sun or saturated insulation. Ponding water is a problem as flat roofs may lack proper drainage, causing rainwater to accumulate and potentially lead to roof sagging and leaks, reducing roof reflectivity and affecting interior and exterior temperatures.

Leaks are a frequent occurrence in poorly maintained flat roofs, as they lose their ability to shed water effectively. Delayed repairs can worsen the situation. Debris accumulation, including leaves, tree limbs, and garbage, can clog drains and cause damage, especially on flat roofs without natural drainage slopes.

METHODOLOGY

The data collection method for this research will primarily involve a literature review to gather secondary data from sources such as journals, articles, websites, and previous studies. This approach will provide valuable insights and knowledge on the issue arising on concrete flat roofs at Perak. Additionally, a quantitative data collection method will be used through a survey questionnaire by using google form. The objectives of the study are to identify the common causes/defects for concrete flat roofs in residential and commercial buildings. The questionnaire will gather specific information on the key to issue concrete flat roofs in residential and commercial buildings, allowing for the collection of direct responses from individuals involved in flat roofs initiatives. This combined approach will provide a comprehensive

understanding to be relevant to the assessment of occupant satisfaction for buildings using concrete flat roofs in Perak.

CASE STUDY

The study looks at two distinct case studies, each of which addresses flat roof difficulties in a different building form. This method offers a thorough picture of flat roof issues in a variety of contexts. The first research focuses on a Seri Iskandar residential structure, putting light on frequent difficulties that residents confront, such as leaks and fractures. Such issues have an influence on property value and tenant comfort.

The second study examines Aeon Mall Ipoh Station 18, a commercial facility that faces particular issues as a result of significant foot traffic and utility services. Ponding water influencing business operations and customer experience is highlighted in this study. The research acknowledges the different complexity of flat roof challenges in residential and commercial contexts by merging both scenarios, providing to a comprehensive understanding of solutions and potential improvements.



Figure 1: Aeon Mall Station 18

Aeon Mall Station 18 is a commercial building with a rooftop parking facility located at 2 Susunan Stesen 18, Station 18, 31650 Ipoh, Perak. The three-story building, which was built in 2009 and finished in 2012, has a large Gross Floor Area (GFA) of 72,700 m². The mall in Ipoh, which opened on March 29, 2012, seeks to create an adaptive retail environment that caters to changing customer wants and market trends.



Figure 2: Residential Building at Seri Iskandar

Lavender Bandar Universiti is a 2-story residential building located at Jalan LakeVille, 32610 Seri Iskandar, Perak. It was built in 2014 and finished in 2016, with a 228.4 m² Gross Floor Area (GFA) and began operations on October 30, 2016. The project, developed by HUAYANG Sdn. Bhd., benefits from a strategic location between Perak's capital and the state's southernmost point, some 35 kilometres southwest of Ipoh City. Lavender Bandar Universiti is an appealing alternative for potential homeowners since it is located within a thriving township with great amenities like as schools and medical facilities.

DATA ANALYSIS

The aim for the research is to identify the issues for concrete flat roof in residential and commercial building. The question is divided into 4 parts starting with demographic part which include building information and respondent's background in Part A. For the next question is include identification of issues using flat roof on Residential Building at Seri Iskandar and Aeon Mall Ipoh Station 18 in Part B and the perception and satisfaction level of occupants building using flat roof and parking at the rooftop in Part C. The last question is the suggestions to improvements issues arise on flat roof in residential and commercial building in Part D.

Table 1: Research Question Instrument

SECTION	DESCRIPTION	TOTAL QUESTION
A	Respondents' Background	6
B	Identification of Issues Using Flat Roof on Residential Building	5
C	The Perception and Satisfaction Level of Occupants Building Using Flat Roof and Parking at The Rooftop.	5
D	Suggestions to Improvements Issues Flat Roof in Residential and Commercial Building	2

RESULT AND FINDINGS

The survey analysis covered two buildings which the total of respondents is 56 persons, the major for two buildings of the respondents are the Residential Building Seri Iskandar is 60.7% of the respondents which is 34 persons, meanwhile Aeon Mall Ipoh Station 18, Perak recorded only 39.3% with a total of respondents is 22 persons.

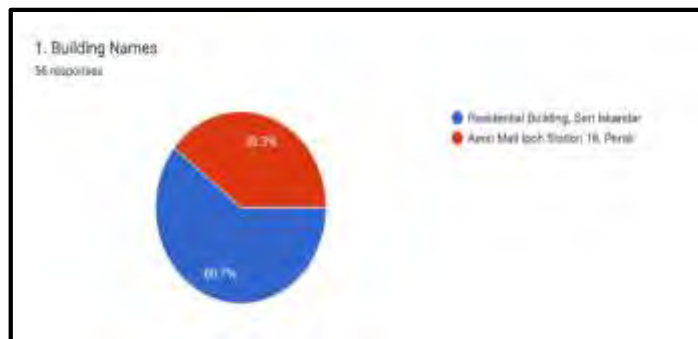


Figure 3: Case Study

Most respondents were male, aged between 21 and 30, and occupants or users of the buildings, with most having lived or worked there for three years or longer. The data analysis shows the most respondents are from full-time with a total respondent is 23 persons. However, 18 persons is recorded with a total respondent from unemployment and from part-time with a total respondent is 12 persons. Finally, only 3 persons is recorded from retired with a total respondent. This shows, full-time employment is the most contribute to this research with 23 persons for both buildings.

They visit the buildings 1 to 2 times a month, spending around 3 to 4 hours per day during office hours.

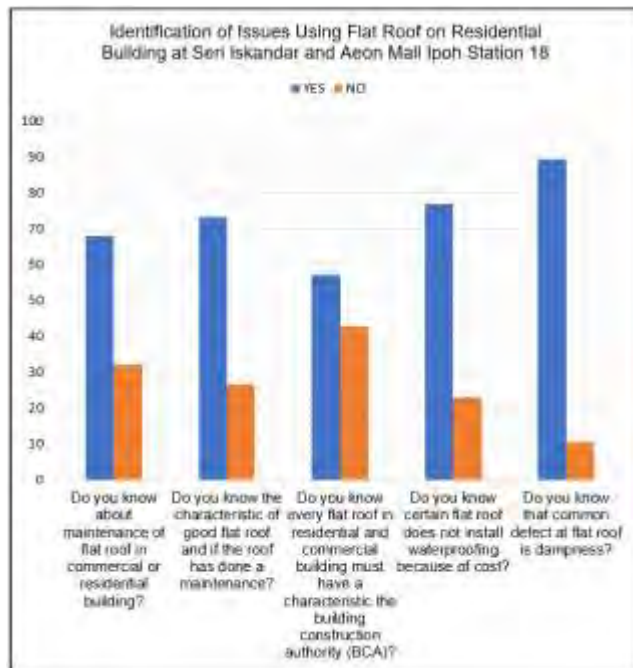


Figure 4: Identification of Issues Using Flat Roof on Residential Building at Seri Iskandar and Aeon Mall Ipoh Station 18

From the analysis of identification of issues using flat roof on residential building at Seri Iskandar and Aeon Mall Ipoh Station 18, most respondents are aware with all requirements for maintaining of flat roof. The occupants for both buildings are well aware of a common defect at flat roof which is dampness in the building with result is 89.3% vote for yes. Regarding issues with flat roofs, most respondents were aware of the requirements for maintaining flat roofs, but they lacked knowledge about the building construction authority (BCA) characteristics.

The survey indicated high satisfaction with the flat roofs of both buildings, leading to the highest mean score which is 4.91 for flat roofs and the usage of the rooftop area. Respondents expressed satisfaction when the rooftop area was functioning correctly, contributing to a sense of safety.

Table 1: Overall Result for Satisfaction Level on Both Buildings

NO	ITEM	MEANS SCORE
1.	Is your building that using flat roof being a good place to visit?	3.46
2.	Are flat roof maintenance costs too expensive?	3.46
3.	Are you feel safe if the building has a good security system at the roof parking?	3.91
4.	Does your car feel safe when parking at rooftop parking at this building?	3.77
5.	Is the rooftop parking being the easier parking to use for you to move without any obstacles?	3.84
AVERAGE RESULT		3.69

The open-ended section offered suggestions for improvements related to flat roofs. Some respondents preferred flat roofs for aesthetics and space, while others favoured gable roofs for better water flow and lower maintenance costs. Visitors to Aeon Mall Ipoh Station 18 mentioned easier parking, accessibility, safety due to gates, and the need for waterproofing to maintain quality. The survey highlighted overall satisfaction with the flat roofs in the buildings, identified common defects, and provided valuable suggestions for improvement to enhance occupant satisfaction and safety.

CONCLUSION

This research study's purpose and data are derived from a literature review, previous research, and surveys. The study's research aims led to the achievement of the research questions. Furthermore, this study is more likely to concentrate on challenges that develop with concrete flat roofs. The major goal of this research is to identify problems with flat roofs in two buildings. The findings demonstrate that by combining information from diverse parts, the study efficiently fulfils its goal. The survey provides a comprehensive overview of respondents' profiles, awareness, contentment, and enhancement recommendations, as well as significant insights for improving operational efficiency and effectiveness. Future research will provide important data for resolving potential flat roof problems. It is essential to look at typical issues including leaks, cracks, and structural deterioration, as well as their root causes and long-term effects. For reliable results, give priority to thorough literature research and exact questionnaire construction. The goal is to identify and repair

common flat roof failure areas. Examine various roofing layouts, materials, and stress reactions for best results under certain circumstances. Human factors are important as well; for useful insights, collect opinions from tenants and maintenance personnel through surveys or case studies. Analyse the costs of repairs, their impact on the environment, their energy efficiency, their potential for waste, and their sustainability. Innovative, durable, energy-efficient, and environmentally friendly flat roofing solutions will be generated by integrating fields including technology, materials science, environment, and social sciences.

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