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Proposed ‘’M’’ Shape Holder for IBS Panel Transportation: A Conceptual Study

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Abstract

In the midst of the Fourth Industrial Revolution, Malaysia is one of the countries that is striving to advance, particularly in the building industry. The adoption of the Industrialized Building System (IBS) in Malaysia signals that the nation is prepared to accommodate significant shifts in its commercial construction sector. However, the A-frame IBS panel holder had a problem in terms of the limited space that was provided by the conventional method. Additionally, there was a possibility that the precast panel could have been of poor quality while it was being transported to its final location. The aim of this paper is to proposed the M-framed design holder to optimise the quantity of the IBS module transportation and subsequently, reduce the cost of transportation. The objective of the study is to identify the issues in the A-frame IBS panel transportation and assembling method. In order to achieve the objective , a thorough review of the relevant literature on the transportation method in the IBS and a simulation has been adopted. The results shows that the proposed M-framed design was able to optimize the quantity of IBS panel been transported and consequently reduce the cost of transportation.

Keywords: IBS Panel, IBS Transportation, A-framed Holder

Introduction

Construction technology has begun to demonstrate the impact of Industry 4.0 in terms of advanced technology in a number of different areas, including green building construction, building technology modelling (BIM), drone technology that has been employed in surveying operations such as site mapping, site monitoring, and survey image detailing, and not to mention the industrialised building system (IBS) (CIDB, 2020). IBS is characterised by the fact that its components are made in a controlled environment (either on or off site) before being transported and assembled on site (CIDB, 2017). Because of the positive impact they have and the numerous benefits they offer in comparison to more traditional methods of building,

IBS techniques have been successful in attracting a significant amount of attention from the construction sector (Rashid et al., 2021).
However, this benefit had resulted the increase in the cost of IBS panel transportation, specifically the quantity of the panel than can be transported. The current approach of utilising the A-framed holder restricts the number of precast that can be transported in a single trip to a maximum of two for large panels and four for small panels (Innella et al., 2020). As a consequence of this, it appears that consolidating as many precast panels as possible into a single trip is critical. This has the potential to lower overall venture costs by reducing transportation costs as well as the time spent transporting precast panels from the factory to the development site (Yusof et al., 2015). The aim of this study is to propose the M-framed holder to optimise the quantity of the IBS panel transportation and subsequently, reduce the cost of transportation.

Literature Review

There are a limited number of reliable sources and studies available on the subject of shipping precast concrete panels and assuring panel quality while in transit from the precast facility to the installation site (Zawawi et al., 2020). The casting of a large floor panel system is one of the IBS elements that pertains to transportation. This feature has the potential to cut down on labour costs by up to thirty percent or more. These cost reductions, however, are somewhat cancelled out by the costs of delivery (Innella et al., 2020). Bringing precast concrete floor panels from the factory where they were made to the location where they will be installed while maintaining their quality. However, a large portion of these cost advantages are eaten up by the expense of transportation. In addition, the administration of the country's transportation system does not permit the shipment of huge panels due to safety issues (Musa et al., 2018).

The current practise of IBS module transportation is by using the A-frame design trailer (Figure 1). This kind of transportation holder is one of the best suited for and most commonly used in Malaysia, particularly for transporting concrete panel modules for the IBS (CIDB, 2021). A-frames have to be fastened to the vehicle in a manner that is separate from the concrete panel restraint system, and appropriate blocking has to be used if there is to be no movement on the deck (CIDB, 2021). In most cases, modular panels are transported from the place of manufacture to the location where they will be installed using this mode of transport (Ismail et al., 2012). A-frames can either be standalone units or a collection of smaller frames that have been connected together to form a bigger unit. In any event, the components need to be fastened to the vehicle in some way. It is recommended that A-frames be fastened to the deck utilising positive methods such as bolts, pins, or twist locks (CIDB, 2021). Even while using an A-frame panel holder to carry a precast concrete panel would appear to be a workable solution, there is a possibility that using this method will result in the panel being damaged because the holder is unable to efficiently and firmly keep the panel in place (Kong et al., 2017). According to the current A-design framework, the concrete panels need to be stacked and leaning on each other when they are assembled. This can cause a crack in the concrete panel as it is being transported, in addition to making the journey take longer because the vehicle can only carry a certain number of concrete panels at one time. The precast panel holder has the capacity to hold numerous panels at once and ensures that the concrete panel holder does not lean against one other, hence avoiding cracks from occurring (Lee et al., 2022; Shabeen & Krishnan, 2022).

The proposed innovation concept has the potential to enhance the production of modular components by allowing for additional space to be used in the transport of these components and by preventing them from leaning against one another, which can result in cracks and reduce the overall performance of the component. In addition to this, it will be in compliance with a variety of load restriction regulations, such as having loads properly secured on transport trucks. These criteria are essential for lowering the risk of accidents and injuries that occur when working with concrete panels. When loading concrete panels, it is important to do it in a way that is consistent with the unloading process that will be necessary at their final location. When the precast concrete floor panel reaches its final destination, a crane will be used to help remove it from the transport vehicle and put it away in storage before the installation procedure can begin.

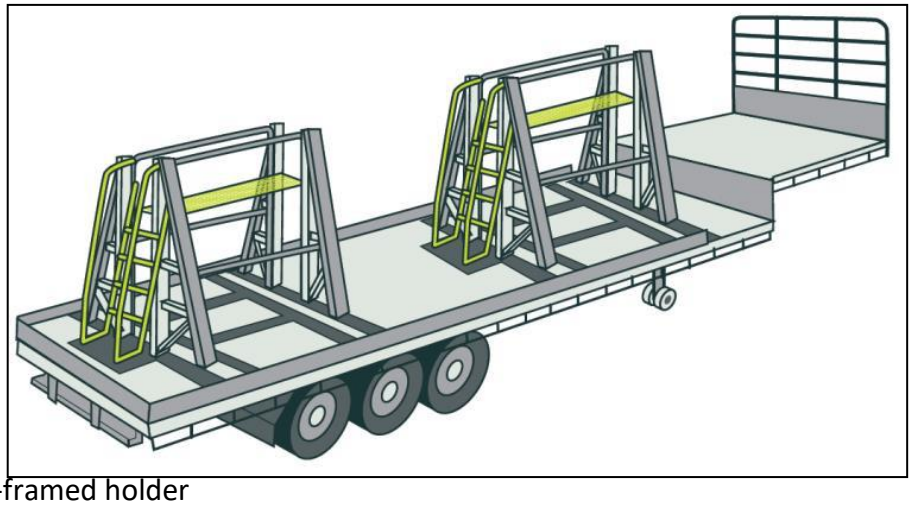

Figure 1: A-framed holder

Methodology

The methodology adopted is primarily based on a thorough review of the relevant literature on the transportation method in the Industrialised Building System (IBS). All the data and information gathered directly from libraries, books, articles and other printed materials searched in the international and national journals, proceeding and bulletin. On top of that, the simulation also been use to understand and visualise the proposed concept. This is due to the fact that it increases one's knowledge of the concept and design of the project. The simulation method for this project is divided into two parts: the first is an application for the product, and the second is an assembly technique for the prototype. There are several different kinds of visualisation media tools available for use in Building Information Modelling (BIM), such as AutoCAD and Revit, amongst others. For the purpose of this study, the Sketchup software was utilised as the instrument.

Results and Discussion

The A-frame precast holder was the method that was being used prior to the invention of the precast panel holder for transportation, which is a machine that is both straightforward and efficient. This was the method that was being used to transport precast panels before the invention of the precast panel holder. It was envisioned as a solution to the issue that had been brought about by the strategy that came before it. Due to the fact that the major goal of the revolutionary product is to maximise the utilisation of the available space in a precast

floor concrete panel in a single voyage, the product must be transported in such a way as to accomplish this goal. Modifications are going to be made to the positioning of the precast concrete panel on the heavy work vehicle so that it can make the best possible use of the space that is available. As a consequence of this, the quantity of precast concrete panels that will need to be transported will increase, which will lead to a reduction in the costs associated with both the shipping and the delivery of the panels.

On the other hand, it is essential to maintain the high quality of the precast, and the right method of upkeep will be incorporated into this forward-thinking approach. To increase and maximise the use of space during a single journey on a conveyance, an M-shape will be proposed as an alternative to the use of a design frame in the A shape, which is depicted in figure 2. This will be done in order to increase the amount of space that can be utilised during the journey. A barrier made of rubber and steel will be attached to each steel frame in order to prevent accidental contact with the high-duty steel. This contact could potentially cause a crack in the high-duty steel if the two materials came into contact with one another or, even worse, collided while being carried. Because of this, the safety of the precast concrete panel, the driver, and any other people who might be using the road will all be improved, which will result in a lower risk of an accident happening (Hamid et al., 2019)

Additionally, it is able to transfer multiple concrete panels of varying sizes depending on the panel. The system is very adaptable because it enables the manufacturing elements to be transported in the safest way possible despite their varying thicknesses, widths, and lengths. It also has the potential to reduce the amount of damage that is caused to the floor panel while it is being transported to the location where it will be installed.

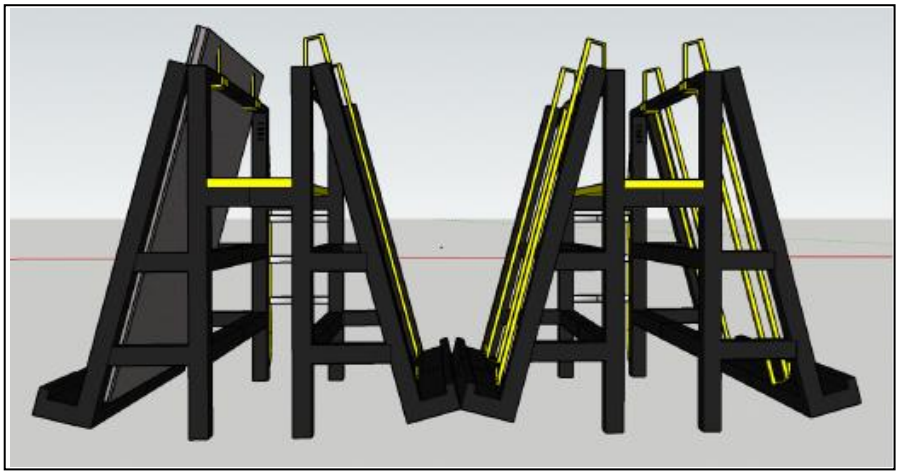

Figure 2: The proposed M-framed Holder

Increasing panel retention is made easier by the utilization of a precast panel holder in the shape of a "M." In addition to that, it may move additional concrete panels, the dimensions of which vary depending on the panel that is being moved. Because of this technique, it is possible to transport modular sections that range in thickness, width, and length without putting anyone in danger. Following these steps, there is a significantly increased in number of panels been transported and reduced chance that the modular panel will experience any damage while being transported to the location where it will be installed.

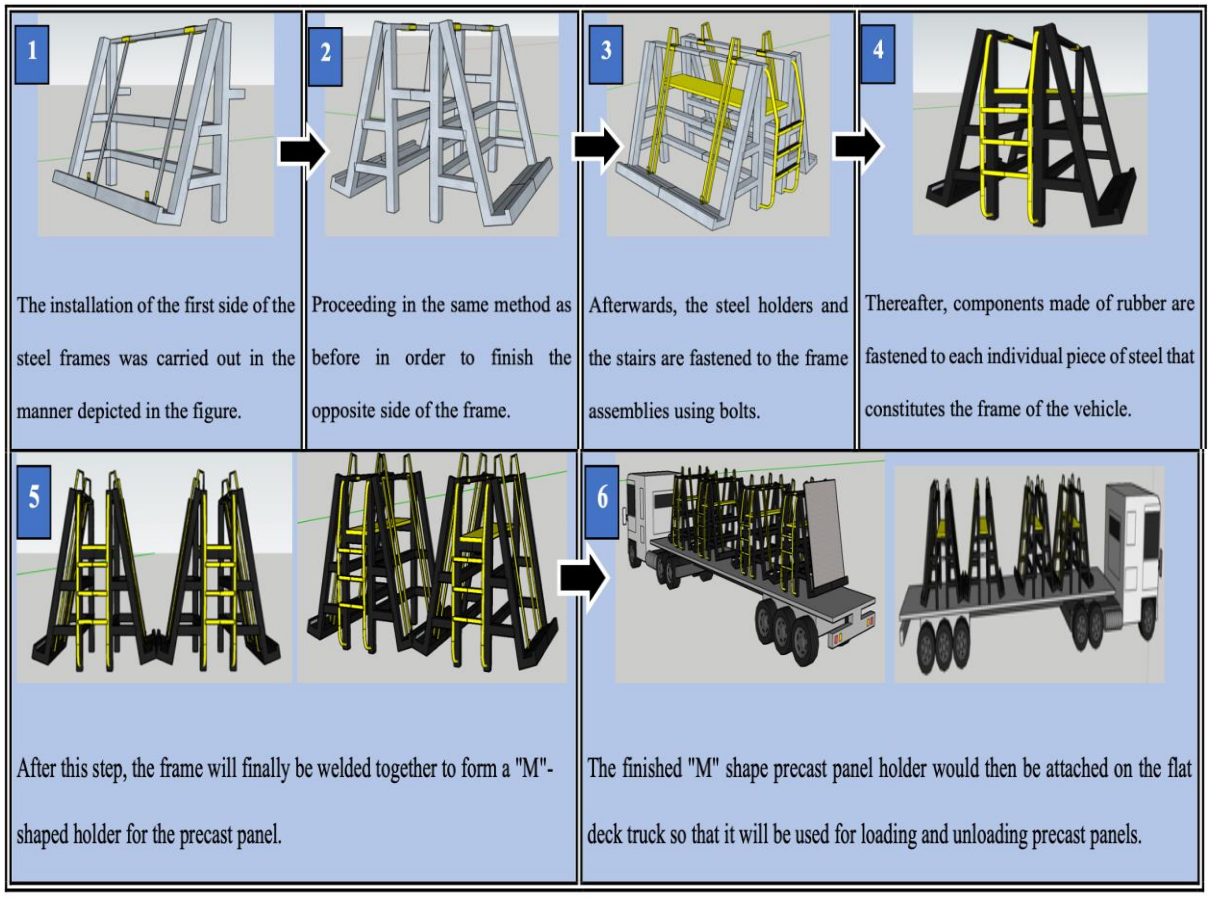

Figure 3: Step by step of the assembling of M-framed Holder

A current approach can be revitalised and brought up to date by making use of newly developed methodologies, putting into action newly developed strategies, or developing concepts that are proven to be effective in order to provide new value (CIDB, 2021). By utilising this cutting-edge idea and technique, the M-frame holders of precast panels will be able to transport a greater quantity of precast panels in a single journey, hence reducing the amount of money spent on transportation as compared to the A-framed holder. This technique has been simulated and proved to be significant in the construction industry (Innella et al., 2020; Lee et al., 2022).

Conclusion

The innovation concept has the potential to enhance the production of modular components by allowing for additional space to be used in the transport of these components and by preventing them from leaning against one another, which can result in cracks and reduce the overall performance of the component. In addition to this, it will be in compliance with a variety of load restriction regulations, such as having loads properly secured on transport trucks. These criteria are essential for lowering the risk of accidents and injuries that occur when working with concrete panels. When loading concrete panels, it is important to do it in a way that is consistent with the unloading process that will be necessary at their final location. When the precast concrete floor panel reaches its final destination, a crane will be used to help remove it from the transport vehicle and put it away in storage before the installation procedure can begin.

This innovation will contribute to the reduction of the amount of time required to complete the project as it optimizes the quantity of the precast panel being transported. Consequently, the innovative idea will contribute to an improvement in term of the quality of the precast concrete panel by assisting in the development of a unique holder that will maintain the precast panel in a better position while it is being transported. This will results a reduce amount of damage that occurs to the precast concrete panel, which will result in total cost reduction for the overall project cost.

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