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Research paper

Feasibility of Using ISO Shipping Container to Build Low Cost House in Malaysia

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Abstract

The idea of shipping container house is no longer a revolutionized to western country but in Asia country particularly in Malaysia it is relatively new. The idea of container house is relatively new and there is no clear sign of how far does Malaysian citizen can accept this idea. There is no indicator of what are the expectations from Malaysian citizen about the container house. This research serves as basic references for both government and private sector to the future property industry development of shipping container house as well as shipping container non-residential building in Malaysia to pursue Malaysia's unity, economic and national integration. The purpose of this study is to test the feasibility of using ISO shipping container to build low cost house. Four set of questionnaires are prepared to assess the opinion of respondents about the acceptance of shipping container house. The result obtained is that the acceptance level of the idea to live inside a container house is only 45% but the acceptance level of using shipping container as means of storage, office, and business development is highly acceptable by Malaysian citizen.

Keywords: *Shipping container; low cost house; acceptance level*

1. Introduction

Containerization is a specially designed system to transport trade goods from place to place. This system is based on usage of unique steel container. These shipping containers are made in uniform dimensions so that they can be easily loaded, off loaded, transported and stacked all over the world. These ISO-recognized shipping containers provide an economic mode of transport to trade goods across nation. As the result, the demand of ISO shipping container had increased due to the soaring of import and export activities.

Malaysia is a strategic location for many international corporations which had their trading hub centered at Port of Tanjung Pelepas [PTP] and Port Klang. It strategically locates within the world busiest shipping lines between Europe and Asia. However, the revolution of the containerization had also led to massive excess of these containers. There are countless of empty unused shipping containers which are left idled at the port, sitting on the deck and taking up the space. This is because shipping back an empty container back to its origin mainland is costly. In most cases it is cheaper to buy a new shipping container, especially in Asian country. This leads to an extremely high surplus of empty containers, which have potential to become house, offices hostel, hotel and emergency protection shelter.

One man's trash is said to be another man's treasure, and now these used ISO shipping containers can become a treasure in construction industry. People had made use the used ISO Shipping container as building material. Builder in western country had found alternative way to convert used ISO shipping container into building materials. Shipping container is made of special steel material that can resist rusting. By utilizing this advantageous property together with expertise of the designer, they would able to transform these used shipping containers into valuable material for the construction industry. These containers will not only provide an alternative fast erection but also provide opportunity to promote green construction. Conventional building materials often produce a lot of debris and dust during construction and demolition.

The ideas of ISO shipping container house had been revolutionized in European country for years. ISO shipping container house construction had become one of the biggest house and office construction trends globally. In recent years shipping containers house began to appeal in many major cities in the United States, Canada, Netherlands, China, Australia, New Zealand, and much of Europe. Building made from shipping container had become popular not only for houses, but for offices, hotels, student housing, safe rooms, and emergency shelter. In Malaysia, there are few companies which are currently operating container hotel at prime location includes Capsule Container Hotel at Kuala Lumpur, Kuala Lumpur International Airport 2 [KLIA 2], and Container Gardenstay at Bangkok Village at Johor Bahru. Not only that, there are also few projects done by some local construction company which use shipping container to replace conventional construction materials like NAZA Car Showroom at Plentong Johor, Modular Police Station at Damansara and Container Resort Home, Pahang.

On the other hand, real estate property industry at some location continues to grow rapidly. For example, a series of construction projects that had launched recently at Iskandar Regional Development Area [IRDA], Nusajaya had boosted the housing estate price around it. Hence, citizen with low income groups are forced to find alternative cheaper and yet comfortable housing shelter, which is difficult to be found at nearby area.

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Today container architecture house might represent a totally new option in structural design. Unfortunately, container buildings are something completely new to Malaysian citizen since its history only traced back to recent years. Container house is getting popularity in western country due to its faster construction time, relative low cost and able to produce lower carbon footprint. However, in Malaysia, the idea of container house is rather new to the society. Since container house is still new to Malaysia, there is no clear-cut sign of the acceptance level of the public towards living inside a container house.

The objective of this study is to define the possibility of developing container house soon in Malaysia. Structured and informative questionnaire are used to collect the primary data to define the feasibility of using ISO shipping container to build low cost house and the structural design aspect of container house. In this research, the researcher tries to identify the potential of using ISO container to build low cost house in Malaysia. This includes the study of acceptance level from Malaysian future generation on the ideas of container house practically in next 10 years.

This study will be a significant endeavor in promoting the development of container house in Malaysia in the future. This research contributes to the social by showing the degree of acceptability of Malaysian citizen towards living inside a container house and interest of Malaysian citizen if a container house is being constructed. The values of the container house will be most important aspect for a designer to model the architectural perspective design. Besides, this research would also provide an opportunity for government sector to identify and to develop container house to replace conventional construction.

2. Literature Review

2.1. History of Shipping Container

The history of Shipping Container can be dated back to 1950's. Before 1956, most of the world's mode of transporting goods between ports and piers use general cargo. This tradition system in which goods were being loaded and unloaded individually was inefficient, expensive, and unsafe and time consuming. However, on April 1956, a vessel filled with fifty-eight shipping containers set out from the port of Newark to Houston[1]. This simple loading system was the beginning of the history of ISO shipping Container.

Mc Lean, known as the father of containerization realized that it takes too much effort to loading and unloading individual piece of freight container, he has an idea to make the whole operation become easier. His idea was to hook the trailers from truck and lift them straight onto the vessels, this principle provides more flexibility in term of transportation of container compared to freight cargo and cost much more cheaply. He was right. According to Colin Davies [2],

"…Mc Lean started by simply loading the trailers of his trucks onto the decks of ships instead of unloading small boxes one at a time from truck to hold. There were a lot of advantages to the new method. It was faster, more secure and required much less labor. But to get the most out of it, to achieve real transport "intermodality", investment was required in new handling equipment and bigger ships. In 1956 the first true container ship, the ideal-x, sailed from Newark, New Jersey, and the tooling-up of Port Elizabeth, the first true container port, began."

Why are shipping containers so important? [1] explained that "the container is at the core of a highly automated system for moving goods from anywhere, to anywhere, with a minimum of cost and complication on the way." Shipping Container is part of integrated complex intermodal system which permits the loading and unloading of freight cargo from any types of mode of transportation includes vessels, trucks, trains in an efficient manner. This has begun the containerization industry. Containerization is a process where the transport industry is being modernized and developed to a system which use internationally recognized standard sized of steel boxes or containers. These steel boxes or container were specially designed to carry goods and easy to interchange between ships, trucks and trains. It is then widely accepted and adopted by major transport hub in the United State, and across worldwide. According to[3]

"...Containers were quickly adopted for land transportation, and the reduction in loading time and transhipment cost lowered rates for goods that moved entirely by land. As shipping lines built huge vessels specially designed to handle containers, ocean freight rates plummeted as container shipping became intermodal, with a seamless shifting of containers among ships and trucks and trains."

2.2. Development History of Shipping Container House Industry in Malaysia

The development of shipping container house construction industry in Malaysia is relatively slow and there is no clear indicator of how far does the idea of living inside shipping container house as permanent housing structure is acceptable to Malaysian citizen. There is not much literature publicly discuss on the development of container house as low-cost house in Malaysia.

Literally, there is one very distinct residential container house project design by Ken Kwok and build by Anand Bungalows Sdn Bhd at Berjaya Hills, Bukit Tinggi Pahang a famous holiday spot at year 2009. This very first recycled container house covers an area of more than 2500 square feet consists of six stacked shipping containers, four of which are oriented north and south and two oriented east and west. The four containers are stacked to create a two-story volume with the doors oriented to the north to form partial enclosures for the balconies and windows. In between the container volumes, a double height atrium was constructed allowing for proper ventilation - hot air rises and the windows on opposing sides encourage cross ventilation as being explained by Architect Ken Kwok [4]. This green shipping container building has been designed using four core principles which are smart design, recycle and reuse of rain water, water and energy efficient container building design and good air circulation and ventilation. Ken claimed that perhaps the greatest achievement of this newly completed first shipping container house in Malaysia based on the four core principles is the fact that they don't require air conditioning or even a fan to achieve a very comfortable stable 25oC. He further explained that it's all because of the openings and placements of the building on the site. The carefully placed doors and windows allow natural circulation plus cross ventilation. This shipping container house that built on a concrete pier foundation, the shipping container house has a light footprint on the surrounding land. The large shed roofs keep sun off the containers and minimize heat gain, while directing rainwater into a large cistern underneath the house. Grey water is recycled and used along with the rainwater in the gardens. Moreover, low flow water fixtures, energy-efficient appliances and natural daylighting help reduce the footprint of the house even further. Based on these design concepts, the estimated construction cost of this container house is approximately RM45 per square feet excluding land acquiring cost during year 2009.

2.3. Shipping Container Construction as Modular Housing System

Modular construction is linked to rapid construction and integration of system [5]. The motivation for using modular construction system generally arises because of client requirements for speed of construction, improved quality, and for early return of investment. [6] had stated in his report, "In a rapidly changing environment, both clients and the supply side are increasingly looking to improve performance and reduce and hopefully, eliminate conflict and disputes through a teamwork approach" [6]. Modular construction is widely used in Japan, Scandinavia and the USA [7]. [7] had researched from case studies of seven modular construction projects as the structural option, From the data obtained, some key advantages that may be attributed to modular construction are

short build time typically 50-60% less than traditional on-site construction, superior quality product, low weight as modular construction is about 30% of the weight of conventional masonry construction, economy scale, environmentally less sensitive, safer construction, reduced site labor requirement and reduced professional fees. [5] in his studies concern that common people often mistaken between the steel modular building which packed in a rectangular steel box [for transportation] as shipping container architecture. He also summarized the similarity and difference between shipping container house and steel modular building. Compared to steel modular house which has more flexibility in terms of size and shape, shipping container house has a predefined standard size and shapes. The weaknesses of shipping container house would be the fixed height [2393mm] and width [2438mm] limitation that do not comply with architectural requirements. Furthermore, the wall and roof are not designed for residential purpose thus modification has to be made for opening [windows, doors and service pipeline], wall and roof insulation, and fire resistance design. When modifying a shipping container or removing any part of the paneling, its structural integrity is weakened and compromised. Without reinforcement, the container deforms and then fails structurally. Generally, if any part of the corrugation panel is removed steel framing will be required to frame out the opening. Extra internal steel supports and bracings are required if the shipping container house are stacked or supported not in accordance to the standard procedures.

As part of the innovation to steel modular construction, Rapid Building-in-Box System [RaBiB] was introduced which utilize both cold-formed steel sections and lightweight concrete panels. The idea of RaBiB is very simple. Every building component will be packed into a transportable big box/container, deliver to the construction site, open as ready-slab and installation in a considerable short period of time. RaBiB system came across as a simple, lock up solutions to help contractor compete and stay afloat in a competitive market[5].

3. Methodology/Materials

3.1. Research Respondent

Malaysia is a multiracial nation which comprises of 29 million citizens. In this research, respondents are divided into four categories in which different sampling techniques will be used. Each category will have different sets of questions. Category one is for container stock keeper [Johor Port, Tanjung Pelepas etc.]; category two is for the designer of container structure; category three is designed for the developer, owner or contractor while the category four is designed for the public. Slovin's formula was used to analyze the number of respondent needed for this research. 400 citizens comprise of different race and different gender from the age of 18- 30 years old from different state of Malaysia will be picked randomly and be invited to answer the questionnaire through Google Docs and distributed survey questionnaire throughout Universiti Teknologi Malaysia.

Slowin's Formula,

n=N/[1+NL^2]=100000/[1+100000*0.05^2]=400

Where: n = sample size

N = population

L = margin of error

Besides, a face to face interview is conducted to gain inside perspective knowledge of design aspect of container house. The targeted person to be interviewed would be those company who has already done their container building project which includes following but not limited to container hotel or container café. In this research, the targeted company would be Container GardenStay @Bangkok Village at Johor Bahru, ZU Container Sdn Bhd, Anand Bungalow Group and Portland Arena Sdn Bhd group. An invitation letter is sent to them through emails to ask for the permission to accept for an interview/knowledge session at their convenient time and place.

3.2. Research Instruments

To study this research more effectively, three types of primary data collections system were adopted. All these three unique data instruments system were incorporated together to specifically answer the research question. It focuses on the feasibility of using ISO Shipping Container to build low cost house. All the primary data collected through interviews and questionnaire is strictly private and confidential. The database collected is not to be disclosed, distributed and will not be revealed to any third party without obtaining prior consent from the ownership. This survey takes 200 days to complete. The survey questionnaire is a structured questionnaire which contained a set of relevant questions with choices of answers that the respondents would choose from.

The primary data collected through questionnaire is divided into four [4] sections. Each section is specifically designed to cater the different types of respondent, different types of research purpose and to answer different types of research question. Section A is designed for Stock Keeper of ISO Shipping Container; section B is designed for Designer of Container House Project; Section C is designed for the developer/ Owner/Contractor of the Container House Project and Section D is designed to test the acceptability of the public towards living inside a Container House.

In this research, the instruments used are survey questionnaire with variety types of question. In general, of all four sections, open ended question, closed-ended Likert scale question, dichotomous questions and open format questions were used in order to obtain the necessary data from the aspiring business persons, knowledgeable designer and also the public. The survey questionnaire was designed in such a way to get all the necessary information about the feasibility of container house as alternative to conventional building materials [etc. concrete]. The survey questions in Section A, B and C will be conducted face to face with prior written approval from the industry while Section D were created in the Google Docs, and invited to participate in this survey. Researcher will also distribute hardcopy of survey questionnaire to university students in UTM. The questions prepared by the interviewees were followed and during the interview session some extra questions were added if necessary. The questions were listed in such a way that it will provide a free and lenient flow of information which is needed in the study. Pre-testing of interview questions was done as the succeeding interviews progressed. The researcher noted the questions that needed improvements or modification and were appropriately executed all throughout the succeeding interviews.

4. Results and Findings

This chapter provides the data gathered and the researcher's analysis and interpretation of the results of the distributed surveys and structural performance of container model under different loading situation. The presentation of data is systematically linked to the format of the self-developed questionnaire attached in the appendix A. The data were presented in clear and concise forms, most of which using tables, graph and also diagram. Also, this chapter will present the information gathered from the interviews conducted by the researchers to the selected company. Researcher have interviewed four companies [Gardenstay Container Hotel, Chaiwalla and Co Café, Zu Container Sdn Bhd and Portland Arena Sdn Bhd] and collected 454 respondents from the age of 18 to 30 years old for the surveys.

4.1. Data from Interview Questionnaires

Table 1 below shows the comparison of interview data obtained whereas Table 2 shows the price list of ISO shipping container obtained. The researcher has conducted face to face interview on four companies namely Gardenstay Hotel [Developer], Chaiwalla Café [Owner], Portland Arena Sdn Bhd [Contractor and Designer] and Zu Container [Stock Keeper and Developer].

From the interview result, almost all the company stated the motivation behind the usage of Shipping Container instead of conventional building materials is innovative. The owner of Gardenstay Hotel stated that most of the hotels in Malaysia are made from reinforced concrete. To distinguish his hotel from other hotel operator, special material/ idea must be adopted. With the introduction of Container hotel in Malaysia particularly in Johor Bahru, this could bring a totally different experience for traveler at affordable rate. On the other hand, the owner of Chaiwalla Container Café [Mr. Nazrul Hakim] added that they are the first registered container café company in Malaysia. With this revolutionized new idea, he saw the market potential to promote container architecture in Malaysia since 2012. He was right. With his passion to promote container café in Malaysia, he won an award in Alliance Bank's Biz Smart Academy SME Innovative Challenge in 2014. This award further proved workability of this revolutionized idea.

When the researcher asked how does the container housing different from the traditional construction methods in terms of durability and sustainability, all the company agreed that construction methods is more simpler and create less wastage. It does not require large number of skilled workers. The owner of Gardenstay hotel further added that without proper design of the areas that exposed to water contact, the container will get rust after 1 or 2 years. He suggested installing waterproof membrane as protective layer at most common areas are the kitchen and toilet. The owner of Chaiwalla Café also agreed with the rusting issue. He declared that the container café at Johor Bahru get rust after 1.5 years of operation.

As the respondents were asked about their opinion on future development of container house project in Malaysia, the owner of Gardenstay Hotel has 100% trusts in his container project in Johor Bahru. He added that in the near future, phase two extension of Container Hotel will begin. He is also expecting to operate Container Karaoke, Container Café within Gardenstay hotel. Chaiwalla café, Zu Container and Portland Arena rated 90% trust to invest in container commercial building. However, all four companies rated 50% trust to invest in residential project. When the researcher further explained about a statement from Minister of Urban Wellbeing, Housing and Local Government Dato Abdul Rahman Dahlan "in the long run, the government does hope to modify containers into living spaces. By doing so, it will allow the younger generation to purchase their first property at a more affordable price". The result from the four companies is surprisingly. The owner of Gardenstay Hotel and Chaiwalla Café do not recommend Malaysia government to implement container house. The owner of Gardenstay hotel explained that even with separate roof system, his container hotel somehow in the afternoon the room still will be very hot, and rusting will occur as long as any part of container are in contact with water which indirectly increase maintenance cost. Portland Arena on the other hand rated 50% for the implementation of container to build low cost house as people are skeptical about container house. Zu container replied that it might have the difficulty to market the container house due to the Malaysian culture of having a permanent shelter. He further explained that In Korea, people will not purchase or stay in a Container structure as this will reflect their financial capabilities. Only those who is really in bad financial status would choose to stay in container [Korean culture].

Table 1: Comparison of survey data interview

	Gardenstay Hotel	**Chaiwalla Café**	**Portland Arena Sdn Bhd**	**Zu Container**
Motivation to use container	Innovative ideas	Sustainable, bringing revolutionized new idea	Innovative ideas	Innovative ideas
How to maintain the temperature of a container house to a desirable temperature?	Use separate roof system. The roof must not connect with container since there is a layer of air ventilation between roof and top of container.	Use open air concept, use extra wood as flooring, walls, and roofs.	Use Primax, a new special coasting to minimize the difference between internal and external temperature of container house.	No answer
Does opening of container [windows and doors] affect overall structural performance?	The opening of the windows and doors must not too close to frame. Additional reinforcement is required.	Consult engineer	It won't affect overall structural integrity since most of the opening will be reinforced with additional column.	No answer
Does the lighting issue affect the overall building structural performance?	-4 Earthing point - it won't affect overall structural performance	Consult engineer	Follow normal building design, guideline in UBBL /DDEC	No answer
What is the standard procedure of the design of the connection?	-Use cement paste to interlock container for more rigidity	Consult engineer	No answer	No answer
The code of practice that should be adheres to when designing a container building?	consult architect and Engineer	All the design must be approved by MBJBT,	All the design must meet the requirement listed in DDEC/ UBBL. The biggest challenge is to get the approval from BOMBA department. Solution: use fire rated board	For Residential purpose-not more than 2 stories. For Commercial purpose-container project can have more than 2 stories.
Does any inspection been carried out before each used ISO Shipping container is being selected?	Yes, the container must not be too severely damage and choose better plywood floor since wood replacement is expensive.	Yes, select containers which are not severely damage, plywood floor must be in good condition, minor rust is acceptable.	Yes, the container structure must not be severely damaged. Plywood is not an issue since the floor will be cemented.	Inspection was carried out on the areas are outlook of the container, walls, flooring and the main structure or frame of container.
How is container housing different from the traditional construction methods in terms of durability and sustainability?	It will rust if the area exposed to water contact. The solution is to use water proof membrane or waterproof insulation as protective layer.	Rusting is the most dominant issue, container café at JB have minor rust after 1.5 years of operation. The only solution is repainting the container.	Not much different. Repainting.	No answer
Malaysia government is planning to build container house as low cost house. What is your opinion?	Not recommended. Ventilation issues. Even with separate roof system, sometime at the afternoon container room also will	Not recommended	50% as people are still speculating about the development and comfort level of container house.	It might have the difficulty to market the product due to the Malaysian culture. In Korea, people will not purchase or stay in a Container structure

	be hot also,			as this will reflect their financial capabilities. Only those who is in bad financial status would choose to stay in container [Korean culture].
Cost analysis	RM600k	RM40k	The cost for container building is almost the same as normal conventional building materials.	The cost is very much depend on the specification, either economic or luxury. If is economic, it will be at least 20% cheaper.
Time analysis	Required 3 months unskilled worker	Required 1 week skilled worker to complete	Is 50% faster if compared to normal conventional building materials	At least 50% - 70 % faster compared to normal conventional building material

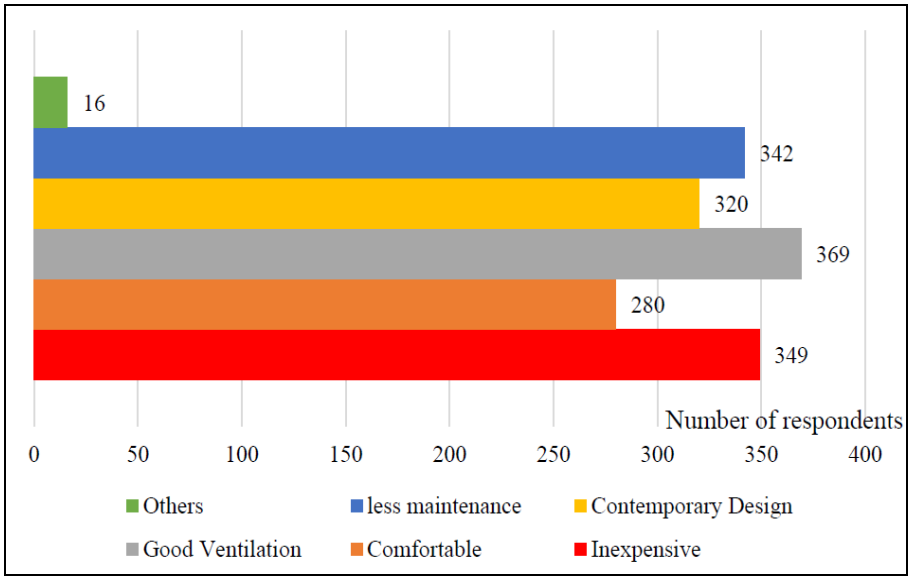


Fig. 1: Expectation from the public about container house

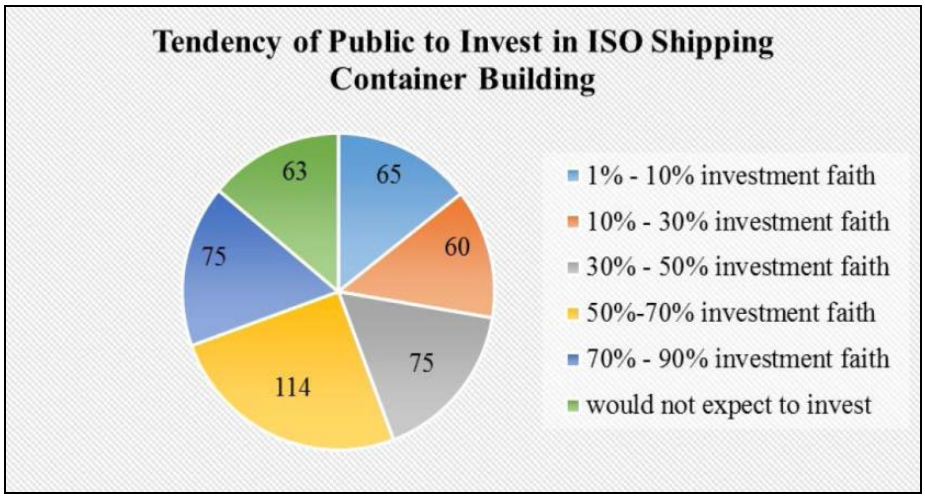


Fig. 2: Perception of public towards future industry development of container house

4.2. Data from Survey Questionnaires

Table 2 shows the survey respondents from different states in Malaysia. This questionnaire survey is conducted from December 2014 until April 2015 to 454 respondents from the age of 18 to 30 years old. Researcher assumes that Malaysian citizen from the age of 18 to 30 years old will be the future prospect container house buyer, with the projection of 5 to 10 years from the actual implementation of container project. The respondents from different states are almost equally distributed as to represent the whole Malaysia citizen.

From the Table 3, it can be clearly seen that container house will be more acceptable for public comes from Sarawak, Sabah, Perlis, Kelantan, Pahang and Terengganu with an average of more than 50% likely to invest in container house. In contrast, we can also clearly see that the container house will be more difficult to be developed at Johor, Melaka, Negeri Sembilan, Perak, Kedah, Penang Selangor and Wilayah Persekutuan with an average of more than 50% unlikely to invest in container house. In general, Malaysian citizen has a tendency not to invest in container house as nearly 55% of the respondent does not expect to invest in container house. The outcome of this survey match with the result from survey interview conducted on the four companies. From the survey interview conducted on four company, all the company rated 50% trust in container house development in Malaysia. This could be due to the reason that people are sceptical about the development of container house and the perception of staying in a container structure will reflect one's person financial capabilities as being explained by Zu Container Sdn Bhd. Furthermore, people will concern about the comfortability of living inside container

house given that container structure are all made from steel and Malaysia is located at the equator whereby it expose to tropical weather throughout the whole year.

Table 2: Number of respondent from different states in Malaysia

Sarawak	48	11%
Sabah	29	7%
Johor	32	7%
Melaka	26	6%
Negeri Sembilan	31	7%
Perak	42	9%
Kedah	29	6%
Perlis	29	6%
Kelantan	31	7%
Pahang	30	7%
Terengganu	29	6%
Penang	28	7%
Selangor	29	6%
Wilayah Persekutuan	39	9%
Total	**454**	**100%**

Table 3: Tendency of respondent to buy container house in percentage

States	**Respondents**	**Yes**	**Percentage**	**No**	**Percentage**
Sarawak	48	24	50%	24	50%
Sabah	29	18	62%	11	38%
Johor	32	13	41%	19	59%
Melaka	26	10	38%	16	62%
Negeri Sembilan	31	12	39%	19	61%
Perak	42	13	31%	29	69%
Kedah	29	13	45%	16	55%
Perlis	29	18	62%	11	38%
Kelantan	31	19	61%	12	39%
Pahang	30	15	50%	15	50%
Terengganu	29	19	66%	10	34%
Penang	28	11	39%	17	61%
Selangor	29	9	31%	20	69%
Wilayah Persekutuan	39	9	23%	30	77%
Total	**454**	**205**	**44.9%**	**249**	**55.1%**

Figure 1 shows the expectation from the respondent about Container House. From the figures, it can be clearly seen that most of the respondents are very concern about having a good ventilation system [81.3%] in container house. Container Structure is a good conductor of heat. It can transfer heat from atmosphere to the inner wall of container and this makes the container structure very hot and creates a much undesired living environment. Without proper insulation material and installation on the container wall and roof, it will create a very unsuitable living environment. Besides a good ventilation system, respondents are also expecting the container house to be relatively inexpensive [76.9%] and the cost of maintenance [75.3%] keep to minimum. Although most of the shipping container structure is made from rust resistance steel, outer part of container structure will still get rust after few years of direct in contact with water. This is true as the owner of Chaiwalla Café also declared that the container café get rust after 1.5 years of operation. The only solution to solve rusting issue is repainting which indirectly increase maintenance cost.

Figure 2 shows the tendency of public to invest in Shipping Container building [includes both residential and non-residential project]. From the figures it can be clearly seen that 114 respondents [25%] will have 50% -70% faiths to invest in container building. This result is in line with the result obtained from figures 4.7 and survey interview conducted on four companies who think that it has moderately good potential development of container house. This can be further serves as a basic guideline to all the local contractor company as well as government sector to develop container buildings project in residential and non-residential project across Malaysia soon.

Figures 3, 4, 5 and 6 show the response from the respondent. From Figure 3, it can be clearly seen that most of the respondents have a perception that they will not feel comfortable living inside container house. 126 people agree with this statement followed by 115 respondents who feels neutral to this statement. This figure is crucial to this research as the result from this survey questionnaire can directly influence the outcome and deliverables of this research. Respondents do not feel comfortable living inside a container house because could be due to the reason that they don't feel secured as being described in Figure 3. Both Figures 3 and Figures 4 share similar trend that is they tend to skew to "Disagree" Zone. As being explained by Zu Container, due to the influence of Korean culture among Malaysian recently living inside container house reflects one's person financial capabilities. Nevertheless, there are also people who feel neutral to live inside container house.

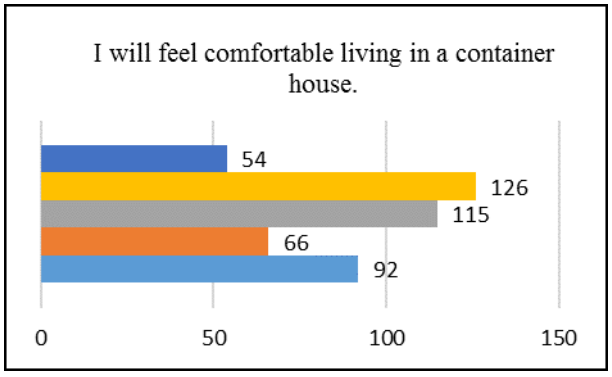


Fig. 3: Comfortability of container house

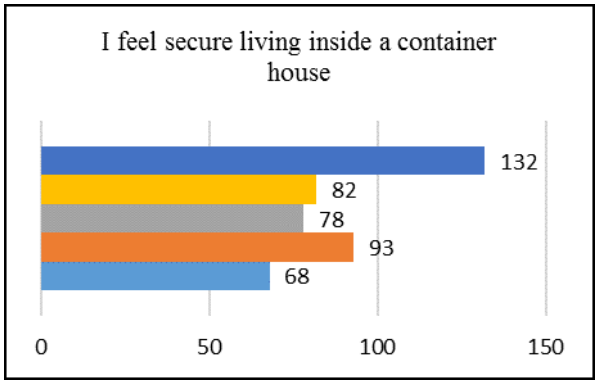


Fig. 4: Security level of container house

I feel container house is a new revolution idea & acceptable to me.

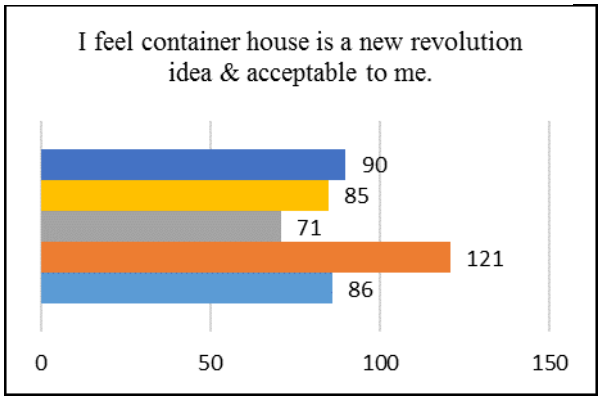


Fig. 5: Acceptable level of Container house

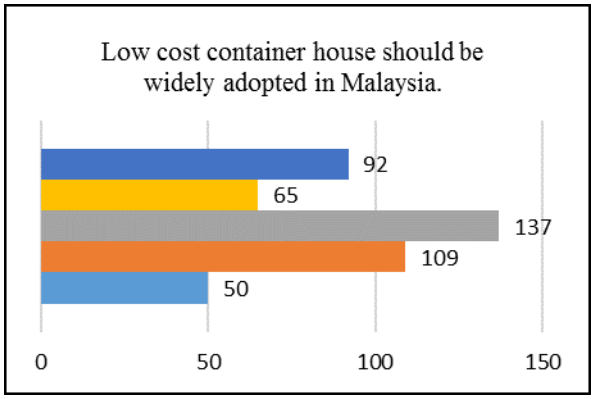
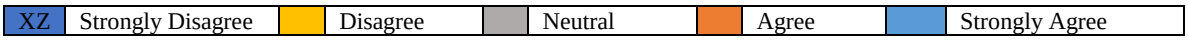


Fig. 6: Adaptation of container house



5. Conclusion

The research aimed to produce a base point studies for using used ISO shipping container as structural building application in Malaysia. There is not much literature publicly discuss on the development of container house as low-cost house in Malaysia. The development of container house in Malaysia is partially recommended as there are 45% of Malaysian citizen can accept the idea of living inside a container house and all the four companies rated 50% trust in the development of container house in Malaysia. As recommendation, future research should also investigate the perception of government sector about the feasible development of container house in Malaysia.

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