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Material Waste Reduction between IBS and Conventional Construction

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Abstract: *Since last two decades, sustainable development and sustainable construction concept have been concern throughout the construction industry. The issue of minimizing construction waste which cause significant impacts on the environment is pressing for the construction industry. Many countries nowadays have serious problems concerning reducing construction materials waste. Construction materials and waste should be diminish properly especially for high rise buildings. This study will present an improvement of the construction process in term of material waste contemplation. The objective of the research is to identify the best way of reduced the number step of process in construction by comparing the common type of construction in term of utilization materials and waste generation.From the study it was directed that theIndustrialised Building System (IBS) method has less variation, reduce the waste and it is more sustainable in compare to conventional system.*

Keywords*:Construction, Material Waste,Industrialised Building System (IBS), Convention*

I. Introduction

Naturally, construction is not an environmental friendly activity. Current research proves that construction is a foremost contributor to environmental pollution. For example, research (Recon, 1996) reported that 44% of the 14 million tonnages of waste put into landfills in Australia each year is attributed to the construction industry. It shows environmental pollution which contributed by construction has been worsening as a result of rapid urban development. The major environmental impacts from construction activities are typically classified as air pollution, water pollution, waste pollution and noise pollution.

There should be different ways to reduce waste and promote contractors to use recyclable materials in their construction projects and furthermore for those who are using recycled materials in their projects have been excused from different taxes and others must be penalized by the related organization(Aadal, Rad et al. 2013). Also, utilizing new technologies could help to eliminate huge amount of construction waste (Rawshan et al. 2010).

The IBS system are more effective to reduce waste, can make the working environment safer in construction site and the construction period compared to the conventional method are already well known.

The most important benefits of this system, as mentioned in several studies (Warszawski 1999) and (Thanoonet al.2003) are quite high reducing construction time, reducing total cost, reducing the material waste and increasing quality of buildings, promoting safe, and providing cleaner and neater site. However, there is still lack in awareness of these benefits among players in the construction sector.

In developing countries, waste reduction is becoming an acute problem as urbanization and economic development increase which have led to larger quantities of waste materials requiring management in these countries. In Asia, the diminishing of construction waste requires immediate attention especially in countries such as China, South Korea and Malaysia, which have been categorized, as emerging industrialized countries.

With increasing demand for major infrastructure projects, commercial buildings and housing development programmers, large amounts of construction waste are being produced (Begum et al. 2009),expressed that the current environmental concerns have forced developed and developing countries to reduce air, water and land pollution for sustainable growth.(Awomeso et al. 2010) also emphasized to be introduced and utilized of appropriate technologies and efficient facilities that are suitable for environmental protection. Therefore, government efforts to promote usage of Industrialised Building Systems (IBS) have been an alternative to the conventional, labor intensive and wasteful construction method even material waste could be used in preparing light weight concrete as IBS components (Mehmannavaz, Sumadi et al. 2013).

Whereas by using IBS the construction material waste expected to reduce, the term waste is usually relates to materials produced by human activity, and are generally managed to reduce their effect on health, the environment or aesthetics. Waste is exists as solid, liquid or gaseous, so management calls for different methods and fields of expertise. Construction waste is definite as relatively clean, heterogeneous building material generated from the various construction activities (Tchobanaglouset al.1997).

II. Objective Of Study

This research has been undertaken to explore the degree of sustainability in waste reduction and compare amount of waste between conventional system and IBS system construction.

III. Methodology

In current study, the Delphi method was performed to identify and prioritize the percentage of produced material waste during construction project between IBS and Conventionalsystem.

3.1 Delphi method

Delphi is a method used in order to perform a systematic judgment and making decision about a particular topic. A group of expert people called Delphi panels participate in Delphi study. They should have enough knowledge and experience about the subject. Furthermore, they must be ready and have enough time to participate in the research(Jamshidi, Harirchian et al. 2014). Panelists of current research included eighteen people who are construction managers and also have more than ten years job experience in construction industries.

3.1.1 Defining consensus

One of the most critical stages in Delphi study is defining consensus(Jamshidi, Harirchian et al. 2014) .Likert scale is the most commonly used technique to analyze data in Delphi survey (Mir Hadi Moazen Jamshidi 2012). Some researchers have used standard division (SD) to assess the consensus. Stronger consensus is shown with smaller SD, and scores will cluster more closely around the mean(Jamshidi, Harirchian et al. 2014). A commonly used method to determine consensus is Kendall's coefficient of concordance (W) which is calculated after second and other rounds of Delphi to evaluate the level of consensus among the Delphi panelists. A significant W (close to 1) and a low P-value (less than 0.05) implies the panelists are in consensus and used the same standards in determining the importance of factors (Mir Hadi Moazen Jamshidi 2012).

IV. Result And Discussion

In order to measure the level of consensus among the experts for the factors proposed, the Kendall's Coefficient of Concordance (W) was measured based on the completion for second and third rounds of the Delphi survey. The Kendall's Coefficients of Concordance and p-value for scored ranking were calculated at0.078 and 0.460 respectively.

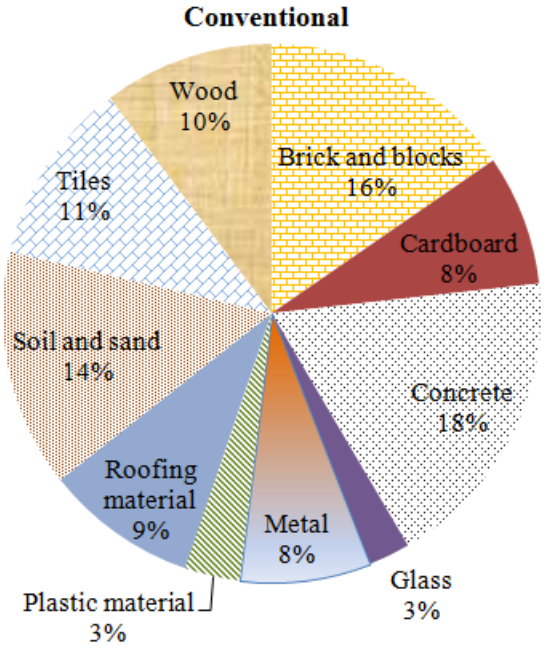

Figure 1. Approximation of material waste in Conventional

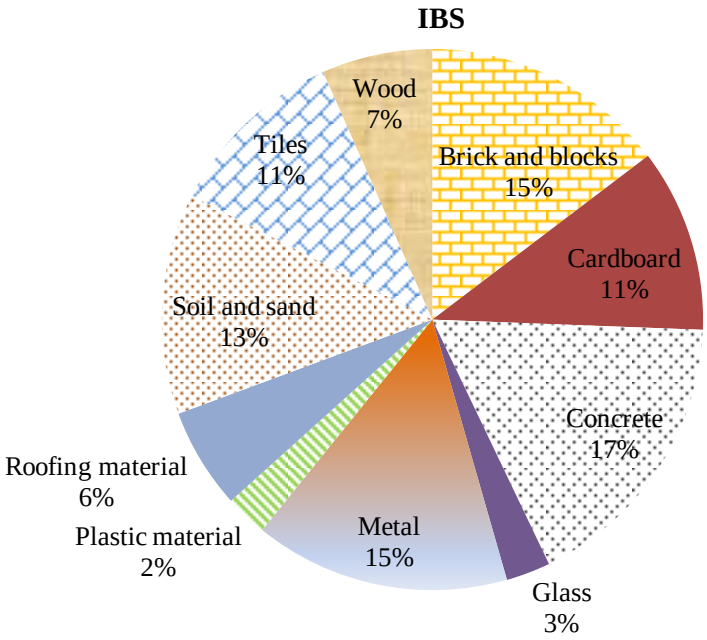

Figure 2. Approximation of material waste in IBS

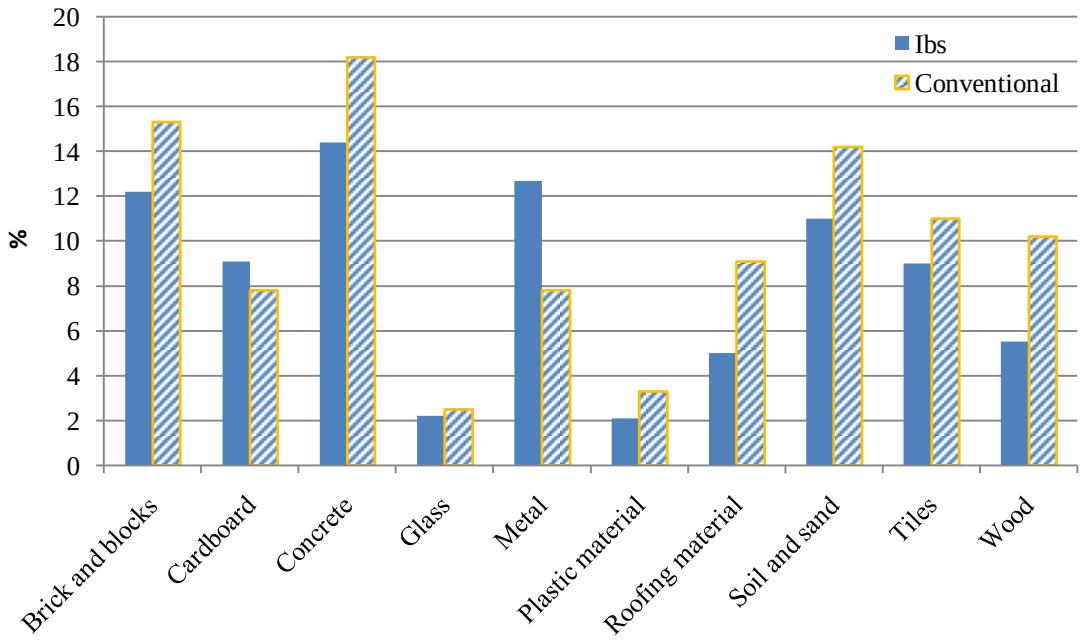

Figure 3. Comparison of waste between IBS and Conventional

Figure 1 and Figure 2 haveshown the estimation of waste based on the Delphi panel's experience and evaluation for conventional and IBS system. As most of the material waste in construction are Brick and blocks, Cardboard, Concrete, Glass,Metal, Plastic material, Roofing material, Soil and sand, Tiles and Wood, thus in this paper the main comparison is about these material during construction activities in IBS and Conventional.

Figure 3, shows the percentage of produced material waste according to the expert's opinion which has been compared between two system. As it compare IBS and conventional it could be mention here that the amount of wasted concrete is the most wastage in conventional and bricks are the second biggest amount of waste in conventional construction. In IBS the highest wastage is for concrete again and relatively metal which probably wasted during pre-casting process in manufactory.

By comparing materials from Figure 3, it comes up that in all the materials during construction activities IBS has less wastage and that amount was reduced except in Metal which could be because of metal moulds or reinforcement used in IBS components.

V. Conclusion

The government policy in encouraging the use of IBS has managed to change the perception of the construction industry to use IBS. It is an effective construction method for waste minimisation. The IBS components are effective in reducing the waste, saving the cost of materials and improve the environmental performance for overall site conditions. Although technology is vital to accelerate the development of a country, it requires the appropriate technology as one of the major factors in contributing to environmental sustainability. The stakeholders are highly recommended to use the 3Rs (reduce, reuse, recycle) to minimise the disposal of construction industry solid waste and eliminate the negative perception of construction industry as 3-D Syndrome (Dirty, Difficult & Dangerous). The study will verify whether IBS formwork system in construction is more Sustainable than conventional formwork system in construction and reduce material waste.

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