

Utilization of IBS Waste Material for the Production of Concrete Pedestrian Block (CPB)

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ABSTRACT: Industrialised Building Systems (IBS) has been touted as an efficient solution to project demand in the future to increase efficiency and reduce waste compare to conventional method in construction. However, the disposal of waste from IBS will still create problems to the industry due to increasingly stringent environmental regulations and industrial growth that have markedly increased the disposal requirements. A study on waste management is significant to promote the use of IBS in local construction. Most of the construction waste, conventional and IBS is disposed of by land filling, and, spreading on reclaimed land, while recycling only reduces the volume of the waste, and the remaining residues would still require ultimate disposal in the landfill. All these disposal methods have varying degrees of environmental impact. Hence, there is a need for alternative methods of waste disposal to be developed. Studies have been carried out by various researchers into the possible applications of construction waste and as construction materials. The reuse of alternative aggregate into the reproduction of other construction product not only alleviate disposal problems but also has economic, ecological and energy saving advantages. One of the products is Concrete Pedestrian Block (CPB). Utilization of these waste materials is necessary so as to produce paving blocks which is durable, less expensive (low material cost and easy to manufacture) and absorb higher energy impact. It also increases environmental consciousness, protection of natural resources and sustainable development.

This paper will highlight the needs of policy, strategy, guideline and good practice to be adopted by IBS Waste Management Framework in order to integrate with CPB's production circle. It also highlights the need to commercialize the product with proper marketing strategies. As a result, it gives more value to IBS industry and helping the industry towards sustainable construction.

Keywords: Environment, Industrial Building system (IBS), Re-cycle Aggregates and Concrete Pedestrian Block (CBP)

1 INTRODUCTION

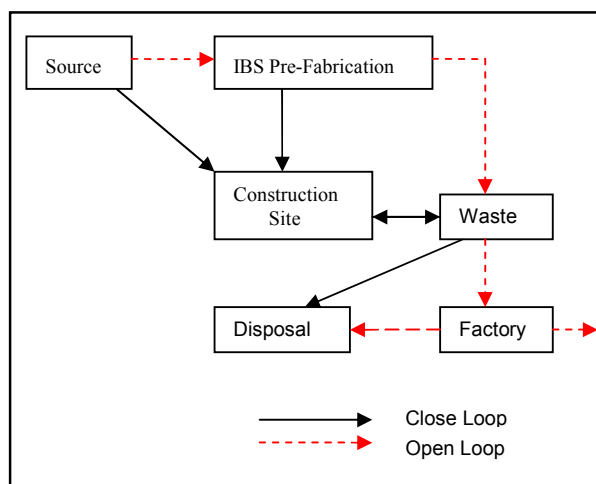
1.1 IBS and Environment; problem statement

Industrialized Building Systems (IBS) has been touted as an efficient solution to project demand in the future while increasing efficiency and reducing waste compare to conventional method in construction. However, it is not known the physical and chemical characteristic compare to conventional method and how much waste reduction actually occurs. The study is important in order to analysis the potential of IBS waste as a substitute of natural aggregates. Hence, the identification of IBS waste cha-

acteristics and framework will allow the assessment on how to use the waste in a better way. This is to ensure more recycling, and reduction of construction waste being disposed of in landfills and dumpsites. By taking a holistic view of recycling approach, non-renewable material consumption can be optimized and wastage can be reduced, allowing the industry to commence the drive for the concept of zero waste in construction. This research will focus on the connection and application of IBS Waste Management Framework to the production of concrete pedestrian block using re-cycling aggregates.

1.2 Recycling Approach

One of the methods to deal with construction waste is recycling. Recycling defined as a recovery and/or reuse of would otherwise be wasted material. It can be the process of re-using material at site or as reclamation and utilization process. Reclamation and utilization process is defined as an open loop where the product of a system can be exploited in another system. It is differ than re-use because it commonly refers to close-system, where a product of a site is recycled for new use within the same construction site. Reclamation or utilization involves process, where materials are processed as by-product. It may need some form of significant physical, chemical or biological processing for producing by-product. The process generally involves collecting the material, reprocessing /remanufacturing and using the final product (Flowchart 1)



Flowchart 1: Waste Management Framework

This research is solely dedicated to address the availability of reclamation or utilization process of IBS waste. In order to assess their potential of recycling, detail characteristic and estimate of construction waste are critical. Unfortunately thus data is not available in Malaysia. In IBS for instant, there are no such data to estimate the waste although the productions of the component are in a very close process. Nonetheless, CIDB and Lestari-UKM is conducting a study on mineral security and waste minimization on IBS which then produce a guideline, framework and best practice on IBS waste management issues.

1.3 Recycle Aggregate in CBP Production

The major component in IBS waste is concrete debris and can be crush to form a recycling aggregate. Recycling aggregate is being use to produce low technology product and lightweight component. One of the studies conducted by USM- CIDB is Utiliza-

tion of Waste Material for the Production of Concrete Pedestrian Block (CPB). The research highlight the process of utilization of recycled aggregates incorporated with granulated waste use as alternative method to produce pedestrian block. The key activity to this method is to remanufacture and utilize construction waste as a substitute to natural aggregate. The product should be durable and cost – effective as the use of waste can reduce the total cost of raw material.

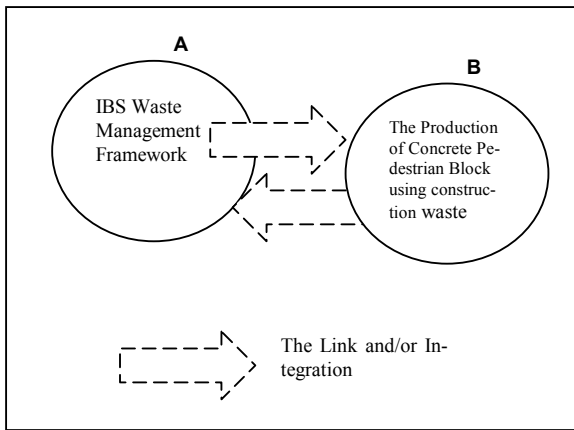
2 GUIDELINE AND APPROACH

2.1 The need of the industry

Nonetheless, what is need in the industry is to synergies the research and create proper climate on introducing nationwide use of recycling waste material. Due to the heterogeneous composition of used construction material coming from IBS waste, a qualified recycling, with the aim to get secondary products, requires a field of management actions and responsible. However, for the time being, industry has no clear guideline, and data to encourage the process of utilizing waste into the industrial use. Still, there are no recycle frameworks to channel the IBS waste to the reclamation and utilization process. Moreover, the industry needs to put greater effort to generate marketing strategy for the recycled waste products

2.2 The Missing Link

As we discussed earlier, cooperation from industry player is significant in implementation IBS waste management framework. However, the concept of utilization may seem isolated from the framework. It seems to be the ‘missing link’ between the domains as shown in *flowchart 2* below. The industry need constructive policy, strategy, and guideline and good practice to be adopted by IBS Waste Management Framework in order to integrate with the CPB’s production circle. Those strategies will help to enhance commercial part of the product with a proper marketing strategy. As a result, it gives more value to IBS industry and helping the industry move towards sustainable construction. It significantly to highlight the open loop process where the waste are converted into other product rather than close loop as shown in the *flowchart 1*. Hence, the research suggesting an integrated approach between the management of IBS wastes and the production of pavement block as shown in *flowchart 2*



Flowchart 2: The Link

2.3 Suggestions & Recommendations

The framework consist the combination of nine (9) strategic recommendations (SR) which are as follows:

- SR 1:** Innovation and Technology enhancement in disseminating and hauling process
- SR 2:** Strategically planning for the location of factory to manufacture the re-cycle product
- SR 3:** Enforcement from authorities to discourage the use of natural resources
- SR 4:** Strategic information on IBS waste and supply-demand for by-product
- SR 5:** Development of database on IBS waste
- SR 6:** Framework, good practice and adoption of standard regulation to promote increased use of recycling IBS component
- SR 7:** Association such as CMRA (Construction Material Recycle Association) in United State that working closely to waste management issues.
- SR 8:** Waste management agency
- SR 9:** Education; provide designers, developers, practitioners and competent authorities with an agreed basis for determining the adequacy of IBS waste management plans.

All the strategic recommendation ought to be established by CIDB. The organization on behalf of the government shall create the database, framework and guideline and put an effort to educate the people in the industry. It is very significant to put all the recommendation into one action plan with a designated time frame. At the same time, policy makers shall create the policies to encourage the implementation of 9 strategic recommendations as stated above. More study need to be done by local researcher to elaborate the recommendations and create the proper syllabus/data/ guideline. Currently CIDB established an R&D wing in their organization to coordinate all the research.

2.4 Benefit

The implementation of strategic recommendations will give benefit to the industry by giving the different perspective on IBS framework. It gives more emphasis on the reclamation and utilization process of IBS waste to produce end product. Strategic recommendations can support the concept of sustainable development and mineral security by utilizing all the material and channeling a very minimal waste to the landfill. Sustainability generally means having no negative impact on the environment. The strategies will also give benefit to the CPB manufacturing company by providing the guideline on waste collecting process and the strategy to market back their product into the industry. Moreover, the construction industry will also have the better waste management process and local contractors can have an option to purchase a cost effective re-cycling product. The establishment of strategic recommendations will create a new industry based on the process of collecting and disseminating IBS waste. Based on the research conducting by Lesrari-UKM, 68 % of the contractor surveyed reported a positive willingness to pay for improve a construction waste management. Hence, in average, the contractors are willing to pay maximum amount of RM 69.88 per tonne of waste collection services. Additionally, the government will have the useful database of IBS waste material. It will also help the government to promote and support adoption of IBS in local construction industry and a guide to improve some standard and legislation

2.5 The Way Forward

By straightening capabilities to utilize IBS technology, IBS can be seen as environmental friendly

process as well as other advantages. The utilization process will reduce dependency on natural aggregate and support the material security awareness. Besides, there are also a great opportunities now to apply the design for environment concept. Having a greater value for IBS waste will also help to increase local use of IBS concept. The model of utilization of construction waste will create a new added value industry or based on the process of recycling IBS waste. The company in this business shall provide consultancy for the IBS's factory operator in order to choose the aggregates for recycling, testing or assessing the material/product for durability and strength and giving quality control advice for the product. IBS waste and recycling can best be managed operationally by nominating a manager who is appropriately trained, to take responsibility for all waste management on IBS factory. Specifically, the manager's function will be to communicate with the relevant personnel; ensure correct storage and handling of construction materials to minimise damaged materials/waste; to ensure correct sequencing of operations and advise on disseminating waste. It is certain that IBS operator should create this post or give the responsibility to relevant personnel.

3.0 CONCLUSION

The project will support the emphasis on integrating the construction industry with competitive value chain to enhance efficiency, improve productivity and striving for environment friendly construction. Utilization of IBS waste is attractive option IBS operator in this age for greater environmental awareness, more environmental laws, and the desire to keep the costs down. More study should be conducted to elaborate the suggestion and recommendation above. It also important to develop our know-how on the process of reused and recycled waste from current conventional methods so it can be to form a new resource base for IBS, given a scenario where transformation to IBS in the country will take a period of time.

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