

Implications of Using Salvaged Materials for Building Construction in Sri Lankan Context

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Abstract— As the biggest contributor for global environmental concerns construction industry has under gone through many transformations in the recent pass. During last quarter of the millennium principles for building design has been re interpreted forcing the design processes to evolve accordingly. Standards were introduced globally to evaluate the performance of the buildings considering its life cycle. There are many aspects covered in these standards and embodied energy of a building is one of the factors accepted by most of the accepted standardization systems. Salvaged material of dilapidated buildings has gone through its intended life span making it minimal when it comes to calculating embodied energy of the material. This study is a review of an experimental construction project which explored the potentials using salvaged material for contemporary construction. The emphasis is given to practical implementations affecting the practice using quantities as a parameter.

Methodology is of few steps. Initially an unpretentious tabulation of building material demand is estimated in accordance with British Standards. Second step is to identify the potentials opportunities to use salvaged materials based on theoretical parameters. Conventional construction cost of an item is taken down as an upper sealing limitation to use any material. If the salvaged product is expensive than the conventional material it is to be taken as a limitation which excludes the usage of the material. Finally, the construction of the house is to go ahead. The materials which actually used are also tabulated against estimate with reasoning for the deviations. The outcomes are mixed results, which revealed unexpected potentials and limitations

Keywords— Salvaged Materials, Contemporary Construction, Architecture

I. INTRODUCTION

Cities are being rebuilt every day changing its skyline frequently. Large scale buildings are being added to the built mass of the city replacing the old. In most instances such old buildings become construction derbies which will often end up at a land fill site. Though the amount of construction debris produced is small in single project amount of such production of a city can add up to a considerable magnitude. In Sri Lankan context it is no exception. There for it is worth while to explore in to potentials of using salvaged materials, components, products, for construction works in local context. In principle this practice is accepted by many green movement organizations such as L.E.E.D. certification and Green building council of Sri Lanka (GBCSL). Hence the above mentioned experiment is carried out in order to investigate the particle potentials of using salvaged material for construction in Sri Lankan context. It was an open ended exploration to identify the issues associated with construction industry, architecture and usage of salvaged material.

Methodology

Methodology of executing experiment is of six steps,

1. Background studies on potentials of executing the experimental construction project.
2. Selection of project and location:

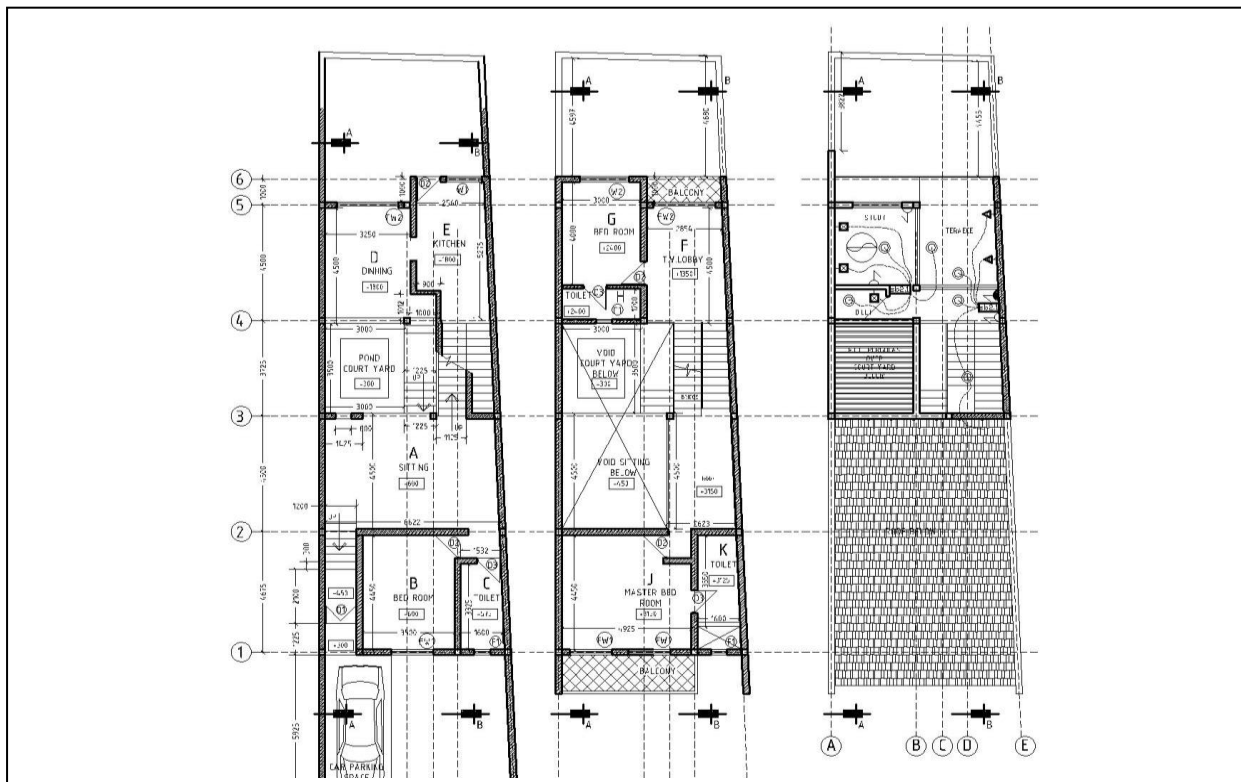
In order to explore the practicality of using the outcome of the experiment standard house has to be constructed. Hence a 2000 + sq.ft. multi storied urban house is to be selected as a modal house for above project. Location of the project has to be in close proximity Colombo city where most of the re-construction projects are located. This also result in reduction of the cost of the salvaged material making the project feasible.

3. Identification of material demand and materials / articles which can be re used in construction
 4. Defining the limitations and parameters for construction project
 - a. Not to compromise the aesthetics, architectural or structural aspects of the construction project
 - b. Cost of the salvaged material/ article should not exceed the contemporary construction cost.
 - c. At any given occasion construction speed is not to be compromised in order to search for salvaged products.
 5. Construction of the house and collection of data.
 6. Exploration of out come
1. Salvaged material has gone through its intended lifespan at initial buildings. Therefore, its embodied energy content at the building is zero. Hence the embodied energy of such material is limited to following
 - a. Energy incurred at dismantling or demolishing of building
 - b. Energy incurred on all forms of transportation
 - c. Energy incurred on refurbishments, repairing and preparations such as protective coatings.
 2. Reduction of construction related waste generation.
 3. Ability to harness aesthetically pleasing properties of traditional materials at an affordable price.

II.BACKGROUND

As discussed in the above the usage of salvaged material has several advantages. Hence it is promoted by green rating systems. There for acceptance of the usage is such

Usage of old building components is not accepted by some of the traditionally practiced norms of the society. But it was noted that there many antique shops and used material dealers can be found around Colombo city, giving



provision to assume the availability of salvaged materials. Hence an open ended experimental construction project was to be executed to calculate maximum possible products not an issue to be considered. The advantages are,

salvaged material percentage that can be used in a contemporary construction project.

III.BACKGROUND DETAILS OF THE PROJECT

A 2200 square feet house which is to be built at place close to the administrative capital which is 10km from, Colombo was selected for the construction.

Rationale of selection is based on,

- the scale of the house which is in par with middle class houses which are being built in the city.
- close proximity to Colombo where salvaged material and components are commonly available.

III.OUTCOME OF THE CONSTRUCTION PROJECT (DATA)

Table 1. Comparison of Material Usage

item	Usage of salvaged material as a percentage		
	Description (item/ material/ component)	Intended %	Achieved %
Substructure	Material for concrete work	0%	0%
	Rubble	100%	0%
Superstructure	Material for concrete work	0%	0%
	Bricks	100%	47.86%
Joinery	Doors and Windows	100%	100%
	Handrail and balustrades	100%	100%
Finishes	Paving (external)	100%	100%
	Wooden flooring	100%	36%
	Non slip porcelain tiles (bathrooms)	0%	35%
	Wall tiles/ Granite (pantry)	0%	44%
	Wall tiles (toilets)	0%	15%
Roof structure	Roof cladding	100%	0%
	Timber for Ceiling	100%	0%
	Timber for roof structure	100%	0%
Electrical installations	Lamp shades	100%	40% +?
	Ceiling fans	100%	0%
Plumbing	Pressure boosting pump	100%	100%
	Cold water pipes and accessories	50%	0%
	Hot water pipes and accessories	50%	67%
	Hot water geyser	100%	100%
	Waste water pipes	50%	16%

Fixed Furniture	Closets	50%	41%
	Pantry	100%	50%+?
Loose Furniture		100%	100%

IV. DISCUSSION

As for the chart above its clear that expected outcome was not achievable for many of the probable materials. It was due to many of reasons.

1. Concrete : Using of salvaged steel is not accepted by structural engineers. Therefore no salvaged material is used for concrete structure of the building. Even the usage of crushed concrete as coarse aggregate is not accepted.
2. Rubble for Foundation work : Rubble walls are hardly found even in old buildings except for foundations. Such salvaged rubble is often contaminated by soil. Therefore it is found out that it is a troublesome and costly to restore salvaged rubble to usable conditions.
3. Bricks : salvaging of bricks is not practiced in the construction industry at the time of the construction due financial reasons. The cost of recovering a brick exceeded the production + transportation cost of standard brick available in the market. But a slight market condition change can make salvaging bricks from old buildings economical. Therefore it is worth while exploring the potential of such scenarios.
4. Doors, Windows and Hand rails : Usage of antique doors and windows is common practice. It is considered fashionable and trendy. Hence there is a huge demand for such components making the prices high. Yet the availability of salvaged doors and windows makes it easy for the construction works.
5. Finishes : Most of the finishing product gets damaged at demolishing. Therefore it has been extremely difficult find materials. But wherever it is found the cost the product is considerably lower than new products.
6. Timber for roof structure: I was found out that all the timber members which are in good condition gets recycled in the industry. In most of the old buildings large sections of good quality timber is used and these are used to manufacture doors and windows. Hence the intended outcome could not be at all.

7. Electrical Installations : To keep up with safety standards cabling of the electrical system is free of used products. Lamp shades and old fans also has a huge demand since they are considered architecturally pleasing. Hence the salvaged components are expensive than the new products.
8. Plumbing : Hotels are refurbished frequently to keep up with the competition. As a result, most of the finishes as well as furniture gets replaced. These products can be bought at an affordable price from the auctioneers. Plumbing related electrical products such as pressure pumps geysers can also be found in the market. Due to lesser value demolition workers does not salvage cold water supply lines which are embedded in the walls. Only pipes laid on surfaces are salvaged. Hot water supply lines and its accessories are salvaged at site. But these products are hard to purchase from the market. Connections and accessories made out brass gets melted for production of raw material
9. Furniture : Used furniture is readily available in the market and can be restored economically. It was found out that it is a popular common practice.

advantageous if the general community can be educated on potentials of using salvaged material for building construction.

I. References

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IV. CONCLUSION

As a result of above findings it was found out that there is a gap between the theoretical principals and its application in the practice. The process which the construction projects adopt is influenced by many factors which make it complex and dynamic, such as

- Economic Factors and market trends
- Ignorance
- Technological limitations

In the mean time it was also evident that re using of salvaged materials is practiced in the industry. This is limited to expensive components such as timber and electrical items. It can bring out considerable reduction in construction cost. At the moment limited amount of salvaged components and product come to market. Bulk of the reusable materials such as bricks gets destroyed. Some of the components gets recycled for production raw materials ignoring its potential to be reused. Hence it's clear that more research is required develop technology to salvage materials at the demolition. Furthered more it is