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Study on Optimum Use of Materials and Waste Minimization and Reuse Management

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Abstract: ***Construction industry has been developing rapidly around the world. The development has led to serious problem in generation of construction wastes in many developing countries and expectation of the natural resources to large extend. The construction wastes clustered into physical and non-physical waste and it has greater impact to environment, economy and social of each country. Before it can be managed well, it is important to understand the root cause of the generation. This paper identifies and detects factors contributed to the generation of construction waste. Mapping technique was applied for identification works and interview was conducted to detect the physical and non-physical waste. The questionnaire survey will be carried out in many companies, after the completion of the survey, the results will be analyzed. By the result analysis the waste minimization, reuse and recycling will be found and the mitigation measures will be provided. From these factors, physical waste and non-physical waste. These factors were grouped into seven categories: Design, Handling, Worker, Management, Site condition, Procurement and External factor. The significant factors of each category of waste were determined. The findings will help construction players to avoid, reduce and recycling the physical and non physical wastes. Furthermore, the paper has put forward some recommendations for better improvements in construction.***

Keywords: Physical waste Non- Physical waste Reuse material, Recycle material, Methodology

I. INTRODUCTION

Construction and demolition waste management has become one of the major environmental problems in many municipalities (Faniran and Caban, 1988; Kibert, 1994; Ferguson *et al*., 1995; Graham and Smithers, 1996; Guthrie *et al*., 1999; Symonds, 1999; Lawson and Douglas, 2001). It has been a pressing issue in India since the late nineties due to the running out of disposal sites to manage the huge amount of waste generated (Poon, 1997). The building industry is consuming a considerable amount of resources, from the most common material sand to the valuable natural assets like timber. If the life cycle of the material on site, from its transportation and delivery to the end fate, is closely examined, it is generally known that there is a relatively large portion of the materials being wasted because of poor material control on building sites. There are two main kinds of building construction waste, structure waste and finishing waste (Skoyles and Skoyles, 1987).Finishing waste (including a wide range of waste materials) is generated during the finishing stage of a building. For instance, surplus cement mortar arising from screeding scatters over the floors inside the building. Broken raw materials like mosaic, tiles, ceramics, paints and plastering materials are wasted because of careless use.

II. CONSTRUCTION WASTE

Construction waste can be defined as any materials by product of human and industrial activity that has no residual value. Waste is a product or material that is unwanted. Construction waste clustered into two groups namely the physical and non-physical waste. Classification of physical and non-physical construction waste are given.

III. WASTE MINIMIZATION & RECYCLING GOALS

Starting with a goal will help guide the decision-making process, as well as provide direction for subcontractors and suppliers. It is also provides a baseline for measuring how well the project succeeded with waste minimization and recycling. This provides you with “boasting rights.” As will be discussed in the final section of this document, in addition to the cost savings and environmental good that is achieved through waste minimization and recycling, it positions your business in a unique niche that can benefit your overall business development. Being able to prove that you have succeeded in the past is therefore essential. Having a goal and measuring your results provides that proof.

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IV. WASTE MINIMIZATION STRATEGIES

Using only those materials that you need;
Decreasing the amount of material that has to be disposed of as trash; and
Diverting materials from disposal to reuse or recycling.

V. PHYSICAL WASTE

Physical construction waste is defined as waste which arises from construction, renovation and demolition activities including land excavation or formation, civil and building construction, site clearance, demolition activities, roadwork, and building renovation. However, some defined directly to solid waste: the inert waste which comprises mainly sand, bricks, blocks, steel, concrete debris, tiles, bamboo, plastics, glass, wood, paper, vegetation and other organic materials. Another way to understand the physical waste or construction debris can be seen in construction site. This type of waste consists a complete loss of materials, due to the fact that they are irreparably damaged or simply lost. The wastage usually removed from the site to landfills.

VI. NON PHYSICAL WASTE

The Non-physical waste normally occurs during the construction process. By contrast with material waste, non-physical waste are time and cost overrun for a construction projects. Similarly, researchers from Indonesia defined waste as not only associated with waste of materials but also other activities such as repair, waiting time and delays. Besides that, the waste can be considered as any inefficiency that results in the use of equipment, materials, labor and money in the construction process. In other words, waste in construction is not only focused on the quantity of materials on-site, but also overproduction, waiting time, material handling, inventories and unnecessary movement of workers. From the interview it was found that least attention was given for this type of waste in construction industry.

VII. REUSE MATERIAL AND RECYCLING MATERIALS

A. Asphalt shingles
B. Batteries (including rechargeable tools)
C. Bottles and cans (glass, plastic, metal)
D. Brush and trees (yard and landscaping waste)
E. Buckets (5-gallon)
F. Cardboard and paper (must be kept 5dry)
G. Ceiling tiles9
H. Asphalt shingles
I. Fixtures
J. Insulation
K. Masonry
L. Lumber/wood
M. Metal
N. Paint, stain, solvents, sealants

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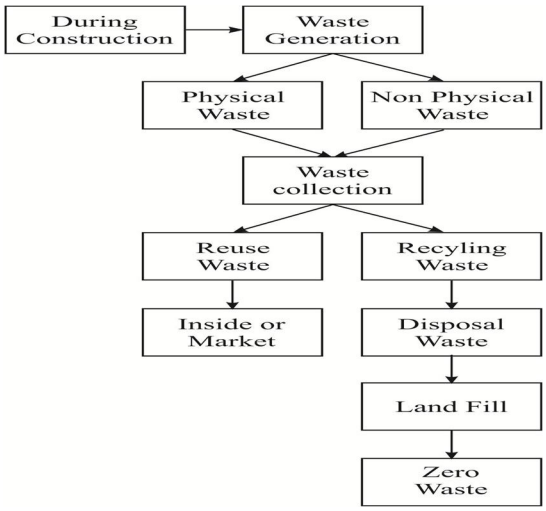
VIII. METHODOLOGY

A. Flow Chart



X.CAUSES OF WASTE

S.NO	CASUSE OF WASTE	RII	RANK	REMARKS
1	Frequent design changes	4.05	17	-
2	Design errors	3.79	18	-
3	Lack of design information	3.70	20	-
4	Poor design quality	3.45	26	-
5	Slow drawing distribution	3.42	28	-
6	Incomplete contract document	3.40	29	-
7	Complicated design	3.35	30	-
8	Inexperience designer	3.32	32	-
9	Error in contract documentation	3.1	36	-
10	Interaction between various specialists	3.0	37	-
11	Poor coordination of parties during design stage	2.8	38	-
12	Last minute client requirements	5.9	2	-
13	Wrong material storage	5.8	3	-
14	Poor material handling	5.6	4	-
15	Damage during transportation	5.42	5	-
16	Poor quality of materials	5.38	6	-
17	Equipment failure	5.371	7	-
18	Delay during delivery	5.287	8	-
19	Tools not suitable used	5.103	9	-
20	Inefficient methods of unloading	5.002	10	-
21	Materials supplied in loose form	3.254	33	-
22	Workers' mistakes during construction	6.574	1	-

23	Incompetent worker	3.24	34	-
24	Poor attitudes of workers	1.54	59	-
25	Damage caused by workers	1.38	64	-
26	Insufficient training for workers	3.61	21	-
27	Lack of experience	2.62	41	-
28	Shortage of skilled workers	4.21	16	-
29	Inappropriate use of materials	3.48	25	-
30	Poor workmanship	5.47	77	-
31	Worker's no enthusiasm	2.14	45	-
32	Inventory of materials not well documented	1.37	65	-
33	Abnormal wear of equipment	2.11	46	-
34	Lack of awareness among the workers	1.59	57	-
35	Too much overtime for workers	2.44	43	-
36	Poor planning	3.54	23	-
37	Poor controlling	4.86	12	-
38	Poor site management	3.45	26	-
39	Poor supervision	4.78	14	-
40	Inappropriate construction methods	4.56	15	-
41	Lack of coordination among parties	3.74	19	-
42	Poor information quality	2.76	40	-
43	Late information flow among parties	3.57	22	-
44	Scarcity of equipment	1.84	50	-
45	Lack of waste management plans	3.34	31	-
46	Resources problem	1.09	72	-
47	Rework	2.44	43	-
48	Waiting periods	3.54	23	-
49	Communication problems	4.87	11	-
50	Outdated equipment	1.12	71	-
51	Non availability of equipment	2.48	42	-
52	Lack of knowledge about construction	4.81	13	-
53	Long project duration	3.22	35	-
54	Lack of influence of contractors	1.55	58	-
55	Lack of environmental awareness	1.67	55	-
56	Leftover materials on site	1.97	48	-
57	Waste resulting from packaging	1.29	66	-
58	Poor site condition	1.51	61	-
59	Congestion of the site	1.08	73	-
60	Lighting problem	1.74	52	-
61	Difficulties accessing construction sites	1.84	50	-
62	Unforeseen ground conditions	1.54	59	-

63	Interference of others crews at site	1.74	52	-
64	Ordering errors	2.0	47	-
65	Items not in compliance with specification	1.22	69	-
66	Error in shipping	1.45	63	-
67	Mistakes in quantity surveys	0.98	74	-
68	Supplier errors	1.27	68	-
69	Wrong material delivery procedures	1.97	48	-
70	Over allowances	1.46	62	-
71	Frequent variation orders	1.29	66	-
72	Different methods used for estimation	1.72	54	-
73	Waiting for replacement	0.78	81	-
74	Effect of weather	0.87	79	-
75	Accidents	1.93	49	-
76	Pilferage	0.41	76	-
77	Lack of legislative enforcement	2.8	38	-
78	Vandalism	0.72	75	-
79	damages caused by third parties	0.86	80	-
80	Festival celebration	1.22	69	-
81	Unpredictable local conditions	1.64	56	-

IX. MAJOR COMPONENT OF CONSTRUCTION

A. Major Component Of Construction Waste

1) Dimension lumber
2) Ply woods
3) Concrete / masonry
4) Metals
5) Drywall plastics
6) Carpet
7) Cardboard
8) Foam installation
9) Fiber glass
10) Soil and land clearing waste
11) Hazardous waste (solvent oils)
12) Others

B. Major Component Of Demolition Waste

13) Dimension lumber
14) Ply woods
15) Concrete / masonry
16) Asphalt
17) Reusable fixtures
18) Metals
19) Appliances
20) Dry wall
21) Carpet
22) Cardboard
23) Others

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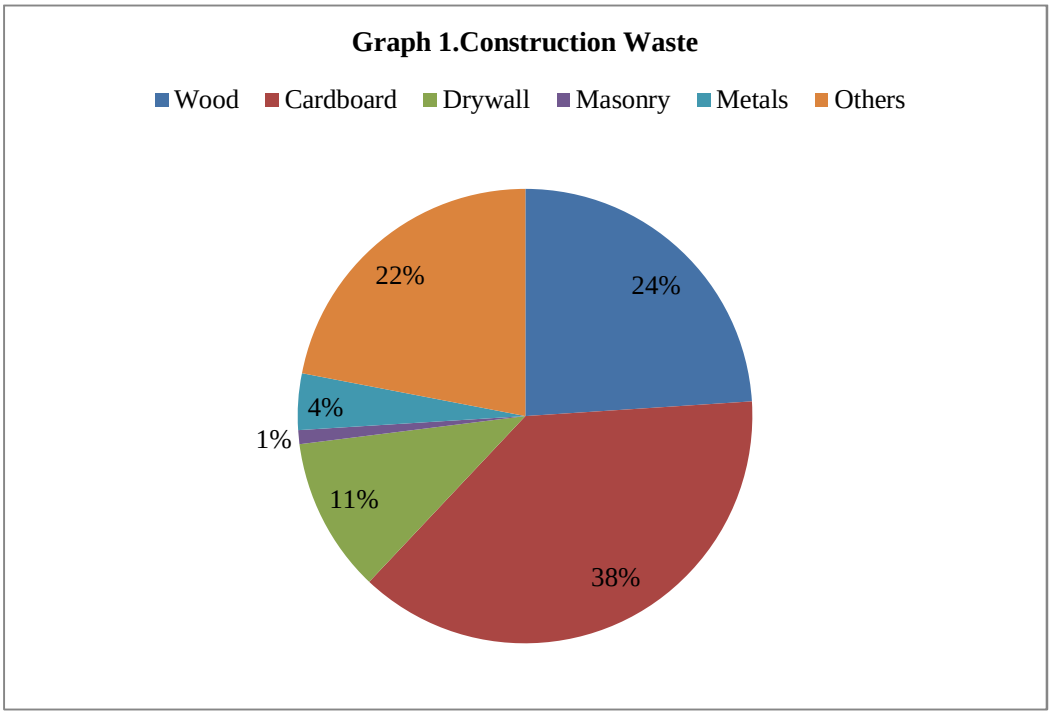
Graph 1.Construction Waste



Graph 2.Construction Waste in India

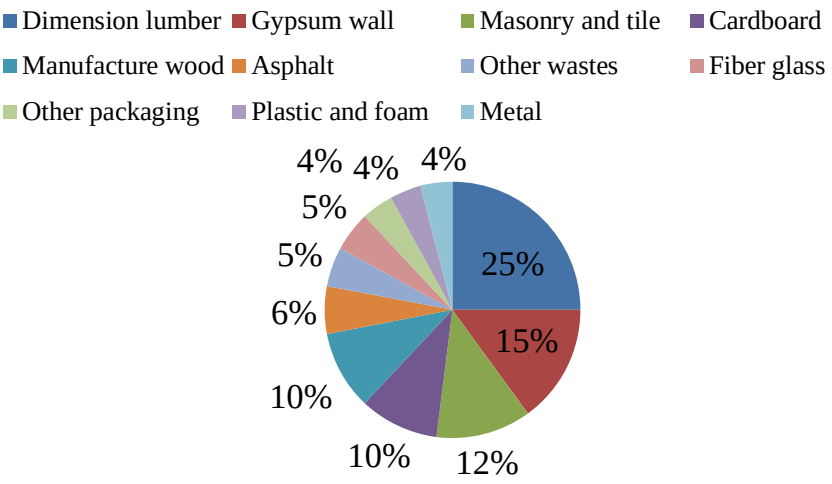


Table:1Estimated Composition Of Demolition Wastes In India

Waste Type	Percent(%) by volume
Wood products	25
Masonry and tile	12
Others	5
Concrete	5
Total	100

Graph 3.Demolition Waste in India

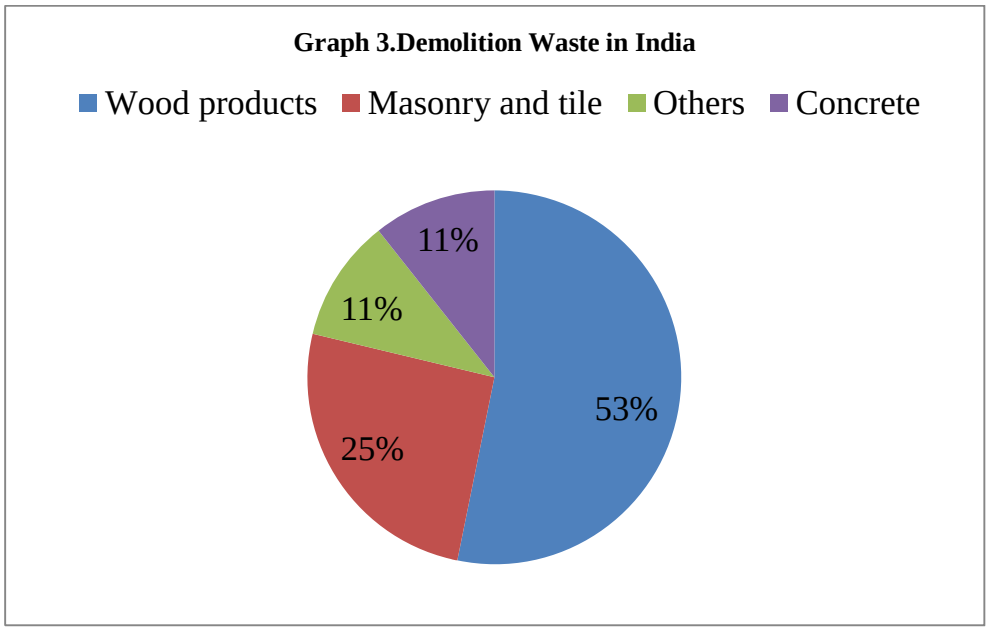


Table:2construction Waste Generation

Project Phase	Cause of Waste
Design	Plan Errors
	Dental Errors
	Design changes
Procurement	Shipping error
	ordering errors
Material Handling	improper storage
	Deterioration
	improper Handling (on-site or off -site)
Construction / Renovation	Human error
	Other labour
	Equipment error
Demolition	Tipping

X. CONCLUSION

Construction waste management is required for a country to develop in a sustainable manner. It helps to address issues related to environment, social and economy. Once the root causes of waste generation are notified, it can either be avoided or minimized to benefit the world for better future. This study has identified significant factors contributing to waste in construction projects. By identifying the significant factors in construction process, construction players are able to notice the best ways to apply new practice for reducing material waste, time delay and cost overrun in any project. Based on the results and findings of this study, the following recommendations are made to reduce the construction waste generation in any construction projects. The aim of this study is to investigate the waste recycling and reuse in the construction industry. It can be concluded that generally the construction personnel are Zero waste of the construction waste. The objectives stated in chapter one which are to identify the construction materials that

can be recycled and reused, to identify the methods used to dispose of the construction waste in India and to identify the advantages of recycling the construction waste have been met. Finally concluded to Zero waste in construction industry.

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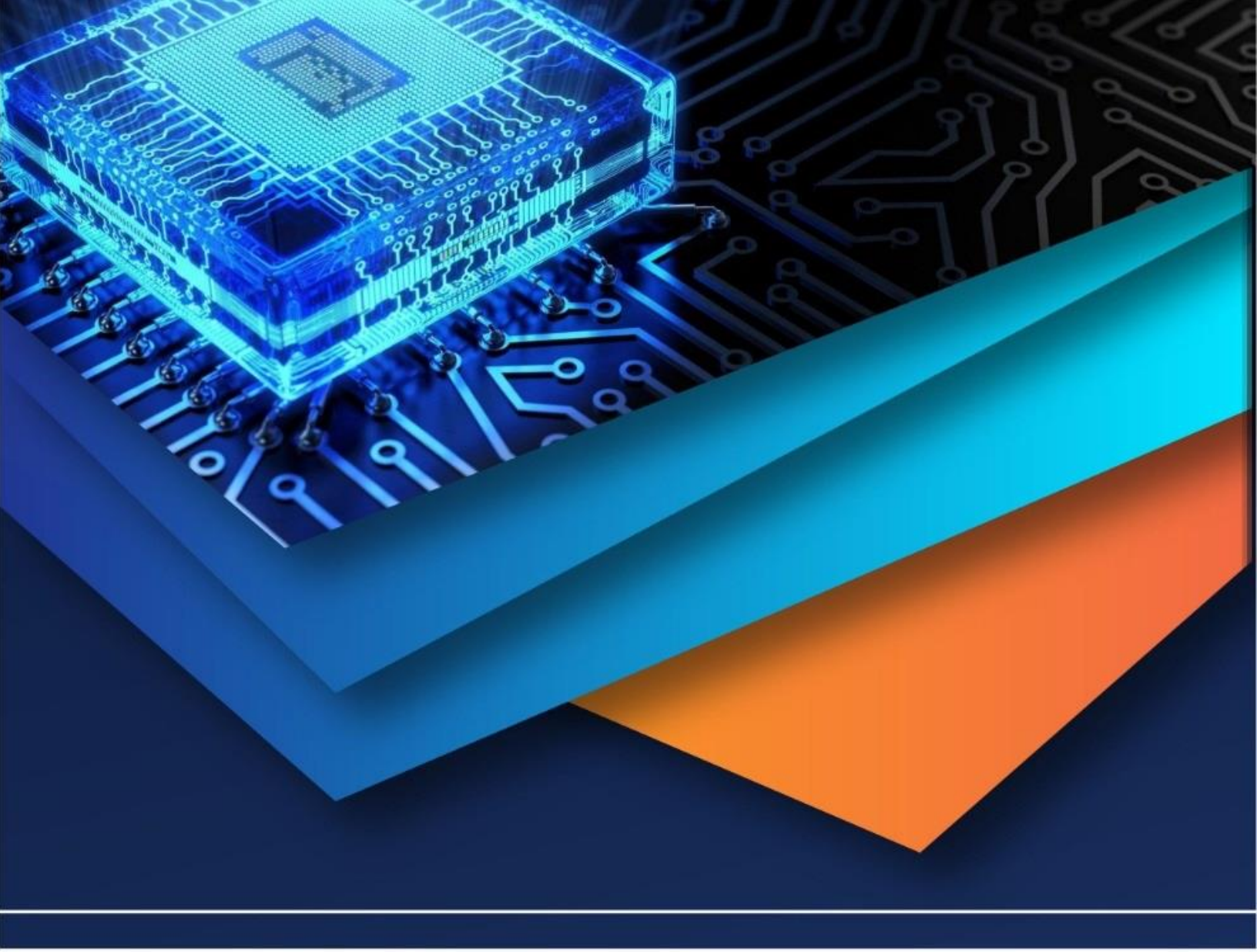

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