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Reuse of Construction, Demolition and Excavating Materials

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Abstract-In this paper I have examined whether the construction materials can be reused or not. I have gone through few research papers determining the reuse of the construction, demolition and excavating materials. By using more recycled and reused materials on construction project, we can reduce our overall costs. There are two sources of potential cost savings - reusing of construction, demolition and excavation materials, and importing recovered and recycled materials. The paper mainly aims towards the few questions which are very much necessary for the construction purposes.
What are the top actions to reuse materials on site and import recovered materials?
Is space available for materials storage and processing, and what will happen to volumes of waste materials which cannot be reused?
Will the materials be available in sufficient quantities?
Will the benefits outweigh the costs? For example, site reuse of aggregates avoids the cost of importing new material, but this must exceed the cost of hiring processing equipment.
The most common applications of reused and recycled products are:

Reusing excavation materials - for example, by stabilizing soils using hydraulic binders, or manufacturing quality soils by adding 'green' compost.
Processing demolition arising on site - for example, using mobile crushing plant to provide recycled aggregates for fill, capping and sub-base layers.
Importing recycled aggregates that meet the same quality standards as the primary aggregates they replace.
Improving engineering properties of materials - for example, by using bonding composites to rehabilitate existing structures.
Using products with a high recycled content, such as recycled asphalt or cement replacement in concrete products.
Reusing materials in smaller projects
Space, time and equipment can restrict opportunities to reuse materials on smaller projects. However, opportunities still exist to import materials from other sites, which may only be available in limited quantities and therefore better suited to small projects.
Increasing growth of population has increased the demand in real estate.
Keywords – Construction; Demolition; Excavating; Recycled Aggregates.

I. INTRODUCTION

The construction industry of India has generated over 10 million tonnes of construction waste each year. Although apparently there has been reduction in generation in 2005 to 2007 due to economic downturn, the generation has increased from 2007 and is expected to continue as more mega-projects like the express rail, the Bridge, the cruise terminal and development of the District are rolling out in the next few years. In the past, the inert portion of the construction waste such as rock, concrete and soil has been used as fill materials for reclamation and formation of lands for development. However, with the increasing sentiment against reclamation projects, many planned reclamations projects are delayed or reduced in size or even held in abeyance. India can no longer solely rely on location reclamation to resolve the accommodation of the surplus inert construction waste. To ensure sustainable development of India, there is a need to manage the construction waste systematically and maximize their utilization. Methods include the implementation of waste management plan, reducing the generation at source, charging on disposal of construction waste, recycling of inert hard construction waste and reuse of inert construction waste in local reclamation works and also beneficial reuse of construction waste as fill in reclamation in India.

II. CONSTRUCTION AND DEMOLITION (C&D) MATERIALS

C&D materials means any substance, matter or thing which is generated as a result of construction work and abandoned whether or not it has been processed or stockpiled before being abandoned. It is a mixture of surplus materials arising from site clearance, excavation, construction, refurbishment, renovation, demolition and road works. Over 80% of C&D materials are inert and are known as public fill. Public fill includes debris, rubble, earth and concrete which is suitable for land reclamation and can be used as filling material for site formation. When properly sorted, materials such as concrete and asphalt can be recycled for use in construction. The remaining non-inert substances are known as C&D wastes which include bamboo, timber, vegetation, packing waste and other organic materials. In contrast to public fill, non-inert waste is not suitable for land reclamation and subject to recovery of reusable or recyclable items, is disposed of at landfills.

Challenges -- In the old days, when the materials were scare and expensive in comparison to labour costs, lots of these C&D materials had been salvaged and reused through balance cut and fill, rehabilitation, reclamation, reuse of brick and masonry, reuse of timber and wood to its maximum potential. With the prosperity and rapid development of India, the society has become more and more extravagant and less concern on conservation of natural resources. The following factors contributes to the current situation:

Lower cost in exploiting natural resources due to invention of modern machineries;

Low import cost of aggregates from neighboring developing regions including Bangladesh;

Demolition of buildings and structures long before the end of their designed and useful life for redevelopment to high rise buildings when the height restriction in urban area is removed after relocation of the airport;

Inherited bad “use and throw away” habit;

Fast development programme for quick financial return; and

Poor or lack of waste management concept.

As a result, lots of natural resources were drained away as waste and required extra expense and resources to handle and accommodate. Worst still, it will not only create environmental and social problems, the society will consume the remaining natural resources at a much faster rate than is necessary, thus jeopardizing the well-being of our next generation. There is a need for proper waste management for the sustainable development. For the C&D wastes, they are disposed of at municipal solid waste landfills. It can be observed from Figure 1 that the disposal of construction waste to municipal landfills is gradually decreasing and major portion is being disposed of at public fill reception facilities for later use in reclamation.

In the past, public fill were used as filling material in reclamation. Reclamations have been widely used to form lands to cope with the on-going development in India. These reclamations have provided an outlet to accommodate huge volume of public fill generated from the local construction activities. However, the recent public sentiment against reclamation projects has caused many planned reclamation projects to be delayed, reduced in size or even held in Abeyance. Reclamation is no longer regarded a reliable option for accommodating surplus public fill. Table 1 shows the cumulative reclamation areas in India since the mid-19th century. It is noted that substantial reclamations were taken place during 70s to 90s when the satellite towns at Mumbai, Delhi, Kolkata etc. were being developed followed by Airport Core Projects being carried out in full speed. After the judgement made by the Court of Final Appeal on the Protection of Harbour Ordinance in early 2004, the total area of completed reclamation has substantially reduced and has nearly come to a halt in recent years except the remaining on-going reclamation project for the construction of the Central to Delhi Bypass. In view of depletion of reclamation projects to receive public fill, a holistic waste management strategy is need for C&D materials management to alleviate the demand for disposal sites.

III. MANAGEMENT STRATEGY FOR CONSTRUCTION WASTE

In view of limited capacity for further reclamation and the sustainable development of India, the Government of India Special Administrative Region (the Government) has implemented waste management strategy in both public works projects and promoted the same in private projects. The strategy is indicated in Figure 3 in the order of desirability which includes :

Avoid and minimizing the generation of construction waste at source;

Reusing the construction waste in its original form as far as possible;

Recycling with minimal input of energy;

Disposing of the construction waste in environmental friendly manner, with non-inert waste to landfills.

The strategy also aims at achieving three objectives (i) to reduce the generation of construction waste, (ii) to maximise reuse and recycling and (iii) to reduce the intake of mixed construction waste at landfills.

The essence is to:

Maintain a well-managed public filling programme with sufficient public fill reception facilities and barging points at convenient

locations;
Encourage sorting, preferably on site sorting, of mixed construction waste;
Encourage reuse and recycling of construction waste;
Avoid and minimise construction waste through better design and construction management; and
Introduce construction waste disposal charging scheme as an economic incentive to encourage waste reduction.

IV. FACILITIES FOR HANDLING CONSTRUCTION WASTE

A. Public Fill Reception Facilities

Public filling areas, public filling barging points, public fill stockpiling areas, fill banks and C&D material recycling facility are collectively regarded as public fill reception facilities and are managed by the Civil Engineering and Development Department to accept public fill. Each facility has its own function. Public filling area is a designated part of a development project that accepts public fill for reclamation purpose. Public fill stockpiling area is a newly reclaimed land where public fill is stockpiled
as surcharging material to accelerate the settlement process. After they have achieved the required settlement, the public fill will be removed and deposited in other reclamation. As I mentioned earlier, these filling areas/stockpiling areas have been depleted either due to public sentiment against reclamation or due to ecological reasons such
as protection of breeding ground for wild life including Chinese White Dolphins and Finless Porpoise and feeding grounds for birds including White-bellied Eagle. Public filling barging point is a strategically located public fill reception facility that utilizes barge transportation to transfer public fill. Fill bank is an area allocated for temporary stockpile of public fill for later use. C&D Recycling facility (Figure 3) processes hard inert materials into recycled aggregates and granular materials for use in construction activities.

B. Construction Waste Sorting Facilities

Mixed construction waste containing more than 50% by weight of inert construction waste can be delivered to the sorting facilities. Public fill recovered will be disposed of at fill bank while non-inert construction waste will be disposed of at landfills. This arrangement helps waste producers, particularly small construction sites that do not have enough space to carry out on-site sorting.

C. Landfills

Mixed construction waste containing not more than 50% by weight of inert construction waste can be disposed of at the three strategic landfills, viz. the West New Territories (WENT) Landfill, the South East New Territories (SENT) Landfill and the North East New Territories (NENT) Landfill which are managed by the Environmental Protection Department.

V. REDUCTION

Space for accommodation of construction waste is not unlimited. Every effort should be made to avoid and minimize the generation of construction waste at source. Minimization of waste should commence at the onset of the project. This includes better planning layout, balanced cut and fill, use of precast construction, reuse and recycling of construction waste on site with minimal import and export.

A. C&D Management Plan And Waste Management Plan

In order to manage the inert construction waste, i.e. public fill, the Government has set up a Public Fill Committee (PFC) to implement measures to promote avoidance, minimization, reuse and recycling of inert construction waste, and to oversee the management of public filling operation and facilities and the use of land-based fill reserves. All public works projects are required to implement waste management, with proper presorting on site to separate construction wastes into severable categories for proper disposal to the appropriate disposal facilities and recyclable materials to the recycler for processing. Government project offices in the planning and design should actively seek to minimize C&D material generation and to reuse inert material generated including rock, as far as possible. To achieve this, the project office is required to draw up a Construction and Demolition Materials Management Plan (C&DMMP) at the feasibility study or preliminary design stage for each project, which generates more than 50,000 m3 of C&D material including rock or that requiring imported fill in excess of 50,000 m3. Projects generating C&D material less than 50,000 m3 or importing fill material less than 50,000 m3 are exempt from the C&DMMP. However, the project office should establish a system similar to the C&DMMP in order to minimise C&D material generation.

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VI. FIGURES AND TABLES

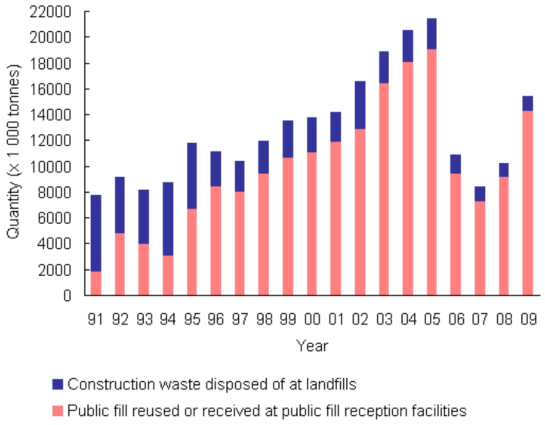

Figure 1

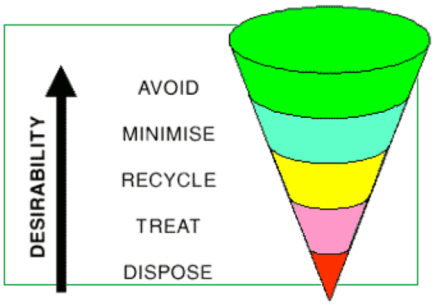

Figure 2

Figure 3

Year	Cumulative Reclaimed Area (ha)
1887	159
1888 to 1924	581
1925 to 1945	780
1946 to 1967	1,486
1968 to 1976	1,772
1977 to 1996	6,067
1997 to 2004	6,802
2005 to 2010	6,823

Table 1

VII. CONCLUSION

The success of management of construction waste relies on the co-operation amongst all stakeholders, including the Government, the society, town planner, developers, designers, the contractors and the waste haulers. As landfill space is not unlimited, every effort should be made to reduce the generation of construction waste, extend the potential use of surplus waste and minimize the need for disposal at landfill so that India's development can be sustainable. The reuse of recycled materials derived from construction and demolition waste is growing all over the world. India Government is actively promoting policies aimed at reducing the use of primary resources and increasing reuse and recycling. One of the most environmentally responsible ways of meeting the challenges of sustainability in construction is the use of recycled concrete or masonry waste as aggregate in new construction.

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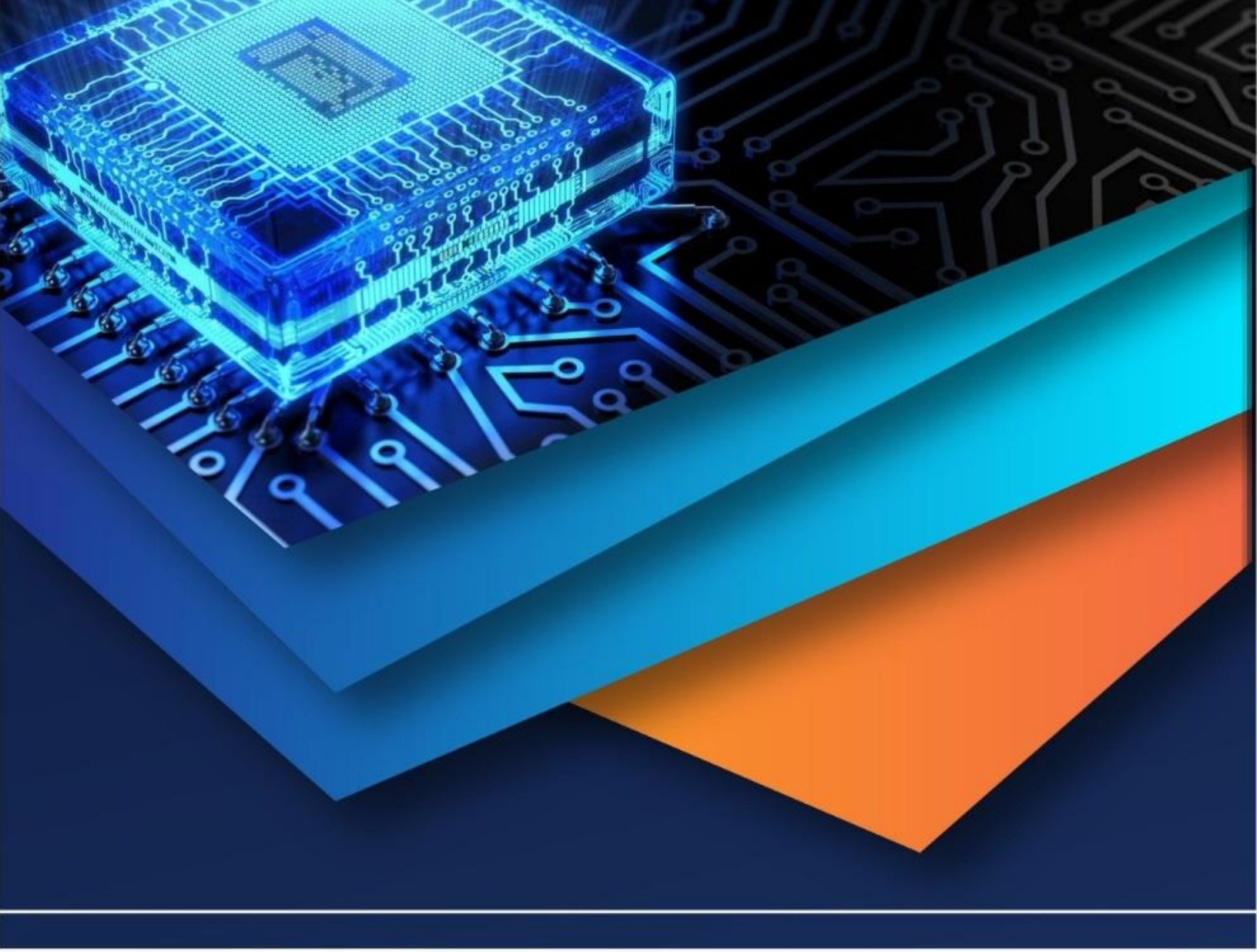

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