STUDY ON CONSTRUCTION & DEMOLITION WASTE MANAGEMENT IN CONSTRUCTION SITE

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ABSTRACT

The Malaysia construction industry nowadays generates a large quantity of construction and demolition waste. Construction and demolition waste defined as a mixture of surplus materials arising from any excavation, civil or building construction, site clearance, demolition activities , road works, and building renovation. The disposal of construction and demolition waste at landfills has caused major environmental concerns and government sources indicate that there is an acute shortage of landfill space ion Malaysia. The aims of this study are to give background information on C&D waste problems in Malaysia and propose a practical guidance to building professional on how to manage and minimise C&D waste. Construction site waste management is not the major issues in construction site nowadays. But, with the new development of town and country, it probably will increase time to time and it is also effect directly into environmental issues. Further developments are recommended to develop a scientific methodology to quantify construction & demolition waste. Furthermore, more practical support is required to enforce the implantation of Construction & Demolition Waste management scheme in the construction and building field. It is also recommended to extend research on the area of recycling technique of building materials to induct feasibility studies, including cost and payback period analysis for each technique.

ABSTRAK

Sektor pembinaan di Malaysia pada masa kini menghasilkan jumlah bahan buangan yang banyak di tapak pembinaan .Bahan buangan di tapak pembinaan yang dimaksudkan adalah bahan –bahan lebihan daripada kerja-kerja penggalian , pembinaan bangunan, pembersihan kawasan, aktiviti pemusnahan bangunan, pembinaan jalan dan pembaharuan bangunan. Pelupusan bahan-bahan buangan ini di tapak pelupusan akan mendatangkan kesan terhadap alam sekitar. Sumber daripada kerajaan menunjukkan bahawa kawasan pelupusan bahan buangan di Malaysia pasa masa kini adalah semakin berkurangan. Kajian yang dijalankan ini adalah bertujuan untuk memberi gambaran terhadap masalah bahan buangan ditapak pembinaan pada masa kini dan mencadangkan satu kaedah yang berkesan dalam menguruskan bahan buangan di tapak pembinaan. Kajian mendapati pengurusan bahan buangan di tapak pembinaan masih tidak menjadi isu yang besar pada masa kini. Terapi, dengan pertambahan pembangunan, perkara ini tidak boleh dipandang ringan kerana jumlah bahan buangan ini akan meningkat dari masa ke semasa dan akan mendatangkan kesan terhadap alam sekitar. Kajian lebih lanjut dicadangkan bagi mengenal pasti kaedah yang lebih berkesan untuk mengukur jumlah bahan buangan di tapak pembinaan dengan lebih tepat. Seterusnya, sokongan lebih daripada pihak kerajaan diperlukan untuk memastikan undang-undang yang sedia ada dijalankan dengan betul bagi memastikan pengurusan bahan buangan ini tidak diabaikan. Akhir sekali, kajian yang lebih terhadap kaedah kitar semula bahan buangan di tapak pembinaan juga dicangkan.

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INTRODUCTION

1.1 Introduction

The Malaysia construction industry generates a large quantity of construction and demolition waste nowadays. It is important to study and identifying the ways to provide a practical guidance for the professional in the building industry about waste management in construction site.

Construction and demolition waste defined as a mixture of surplus materials arising from any excavation, civil or building construction, site clearance, demolition activities, road works and building renovation. The disposal of construction and demolition waste at landfills has caused major environmental concerns. Government sources indicate that there is an acute shortage of landfill space in Malaysia and the continuation of disposal of construction and demolition waste at landfills would risk to the strategic use of landfills for the disposal of the more demanding waste types such as domestic refuse and hazardous waste.

The aims of this study are to give a background information on the C&D waste problems in Malaysia and propose a practical guidance to building professionals on how to manage and minimise C&D waste.

1.2 Ojectives

In recognition of the need to reduce waste, the objective of this study is developed to provide practical guidance for the professionals in the building industry. It focuses on the following areas:

a) Determine and identify the quantities of C&D Waste produce during new construction.

b) Avoiding and minimising building waste through better management and operating practices.

c) Avoiding and minimising building waste through better construction technologies.

d) Avoiding and minimising building waste through reduce, reuse and recycle method.

1.3 Problem Statement

Waste management in construction site may be not the major issues in construction site nowadays. But with the new developement of town and county, it probably will increase time to time and it is also effect directly into environmental issues. Moving from straight disposal to waste management can reduce the risk of environmental isssues and make business more resource-efficient.

Construction waste can and should be managed in the same way as other home building operations. Reduce, reuse, and recycle construction waste may save money, reduce liability, keep job sites cleaner and safer, and conserve valuable landfill space.

1.4 Scope Of Study

This study focus on the waste management at construction site in Kuantan which are through interview and questionaire to the contactor and project manager at construction site.This study also would be co-operate with Majlis Perbadaran Kuantan (MPK), Jabatan Kerja Raya (JKR),Construction Industry Develops Board (CIDB) and others to gets more information about method used in waste management construction at Kuantan and laws for contractor

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

During new construction, Construction & Demolition (C & D) Waste is produced by refurbishment or renovation of building. In Malaysia, C&D Waste will increase time to time with the development of the town and country. Thus, the C&D Waste management should be study to finding solution of C&D waste destination.

Construction and Demolition (C&D) Material is defined as a mixture of waste materials arising from any excavation, civil or building construction, site clearance, demolition activities, road works and building renovation. Over 80% of C&D materials are inert and are further defined as public fill. Public fill includes debris, rubble, earth and concrete which are suitable for land reclamation and site formation.

According to the Board's 1999 waste characterization study, (California Integrated Waste Management Board, 1999) construction and demolition (C&D) materials make up approximately 12 percent of waste disposal.

In this study, inert material (e.g. concrete and asphalt) accounted for most of the material classified as C&D waste. Waste generated in construction or demolition activities also includes large quantities of material found in the general waste stream. For example, the C&D waste stream also includes corrugated cardboard (OCC) from packaging, a variety of plastics (PVC pipe, packaging, etc), glass, and yard wastes from site work and clearing.

Wood waste also represents one component of C&D waste. About 25 percent of C&D waste is wood waste (California Integrated Waste Management Board, 1999). The portion of wood waste that can be reused as lumber is considerably less, but no accurate estimates are currently available. When managed properly, materials such as clean concrete and asphalt can be recycled for use in construction. The non-inert substances in C&D material are called C&D waste which includes bamboo, timber, vegetation, packaging waste and other organic materials. In contrast to public fill, C&D waste is not suitable for land reclamation and is disposed of at landfills.

2.2 Benefits Of C& D Waste Management

Recycling and reuse of materials have long been associated with wise construction practices. Experienced contractors are now reaping the economic advantages of Construction Waste Management. Communities are also seeing the side benefits as listed below.

2.2.1 Trim Cost

Recycling, reusing, and reducing construction waste can save money. Many of the contractors have made changes to their operations and practices to take advantage of reduced waste disposal costs from recycle, reuse and reduce materials. Utilizing reuse and salvage methods on site reduce the need for new materials, reduces materials that end up in the landfill, creates a cleaner and safer project site, and improves community relations. (General Administation, 2001)

2.2.2 Create Environmental Benefits

Recycling and waste prevention programs also benefits to the environment. In the long run, preventing waste reduces dependence on natural resources such as trees, oil, and minerals plus creates less pollution by reducing manufacturing and transportation related emissions. Reduction of the energy and water required to produce building supplies from virgin materials contributes to reduced greenhouse gasses related to the manufacturing and transportation of those materials.

2.2.3 Help the Economy

Recycling and reuse of construction waste can also help the economy through the creation of jobs related to salvaging and recycling of construction waste. New products create jobs through the manufacture of recycled content materials.

2.3 Common C&D Waste Materials

There are three types of common C & D waste material at construction site which is recycle aggregate, wood and wallboard (drywall).

2.3.1 Recycled Aggregate

Recycled aggregate is produced by crushing concrete, and sometimes asphalt, to reclaim the aggregate. Aggregate consists of hard, graduated fragments of inert mineral materials, including sand, gravel, crushed stone, slag, rock dust, or powder. Recycled aggregate can be used for many purposes. The primary market is road base.

2.3.2 Wood

Urban wood waste is the portion of the wood waste stream that can include sawn lumber, pruned branches, stumps, and whole trees from street and park maintenance. The primary constituents of urban wood waste are used lumber, trim, shipping pallets, trees, branches, and other wood debris from construction and demolition clearing and grubbing activities.

2.3.3 Wallboard (Drywall)

Drywall made of a sheet of gypsum covered on both sides with a paper facing and a paperboard backing. Drywall is also referred to as gypsum board, wallboard, plasterboard, gypboard, and rock. Gypsum is calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$), a naturally occurring mineral that is mined in dried ancient sea beds.

Drywall can be recycled into new products, thereby:

a) Creating business opportunities.

b) Saving money for builders, contractors, and home renovators.

c) Helping local governments meet their goal of reducing disposal by 50 percent.

2.4 The Problem And The Need To Reduce C&D Waste

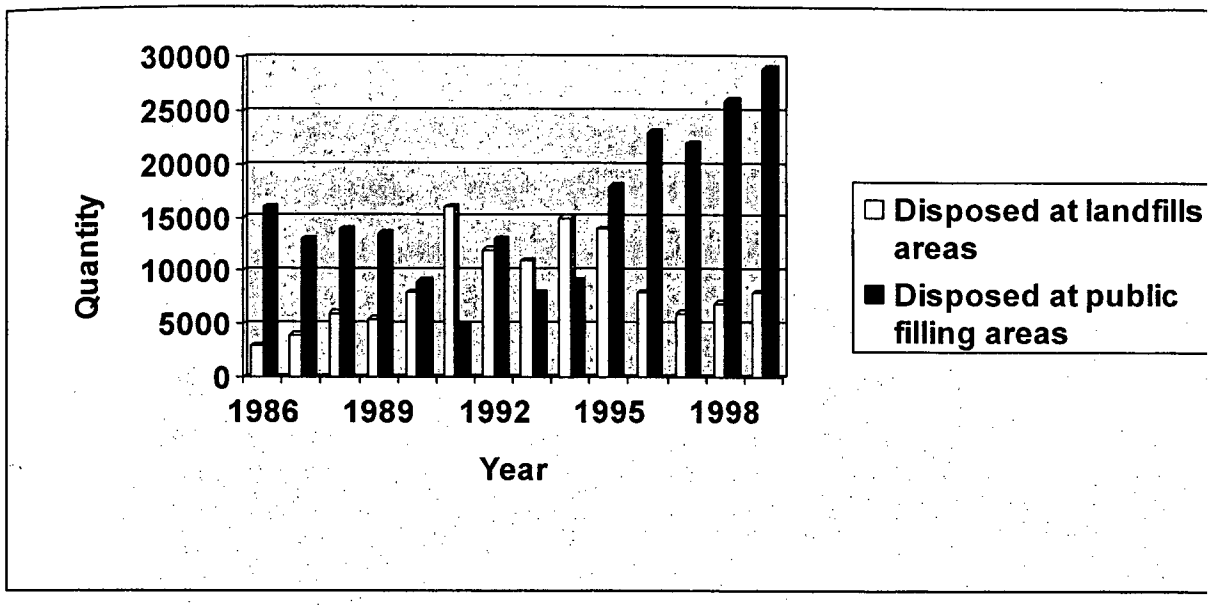

Figure 2.1: Quantities of C& D material generated from 1986 to 1999 (Source: Yuen 1999)

The construction industry is the major solid waste generator in Malaysia. The extensive building and infrastructure development projects as well as redevelopment of old districts have led to an increase in C&D material generation in the last decade. Figure 2.1 shows the quantities of C&D material generated from 1986 to 1999. According to the Department Of Environmental (DOE, 2000), a daily average of about 37,110 tonnes of C&D material was generated in 1999, which was 4 times as much as that of municipal solid waste. Of this total amount, 7890 tonnes (21%) was disposed of at landfills while the remainder was disposed to public filling areas (Figure 1.2).

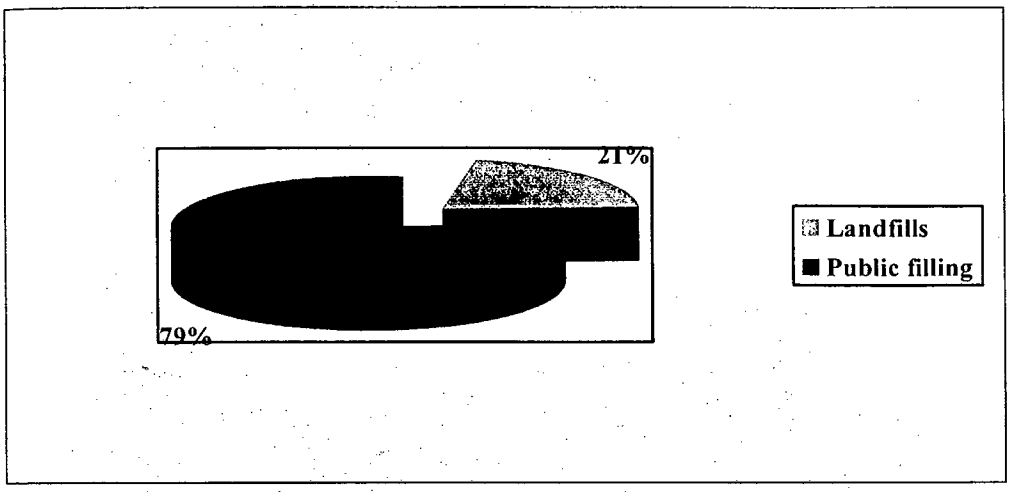

Figure 2.2: Quantity of C&D waste delivered to public filling areas and landfills in 1999

(Source: DOE 2000)

Currently, inert C&D materials (e.g. sand, bricks and concrete) suitable for reclamation and land formation works is disposed of at the public filling areas and the non-inert portion (e.g. plastics, wood and paper) at municipal solid waste landfills. The strategy aims at reusing the inert C&D materials and minimizing the amount requiring landfill disposal so that the life span of the landfills in Malaysia can be extended. However, in recent years, public concerns and objections have often delayed, stopped or reduced the scale of the implementation of planned reclamation projects, particularly those within Public Work Department (PWD) or Jabatan Kerja Raya (JKR) and there has been a shortfall in reclamation sites. Approved reclamation projects will only provide outlet for inert materials until 2004. For a sustainable waste management strategy, we can no longer rely on reclamations to accept most of the C&D material.

On the other hand, 18040 tonnes of all solid waste disposed of daily at the three municipal waste landfill sites, 44% is C&D materials (DOE, 2000). This C&D material has been taking up valuable landfill space at a rate of more than 3,500m3 per day. If we

do nothing to reverse this trend, the landfills in Malaysia will be exhausted in 10 to 15 years. As land in Malaysia is valuable, it is important for Malaysia to adopt a strategy to reduce and recycle C&D materials and to handle the problem in a more environmentally responsible way.

2.5 Sources Of C&D Waste

Construction and demolition waste can be classified according to its source, or type of works from which it is generated. Five broad waste materials source categories were identified.

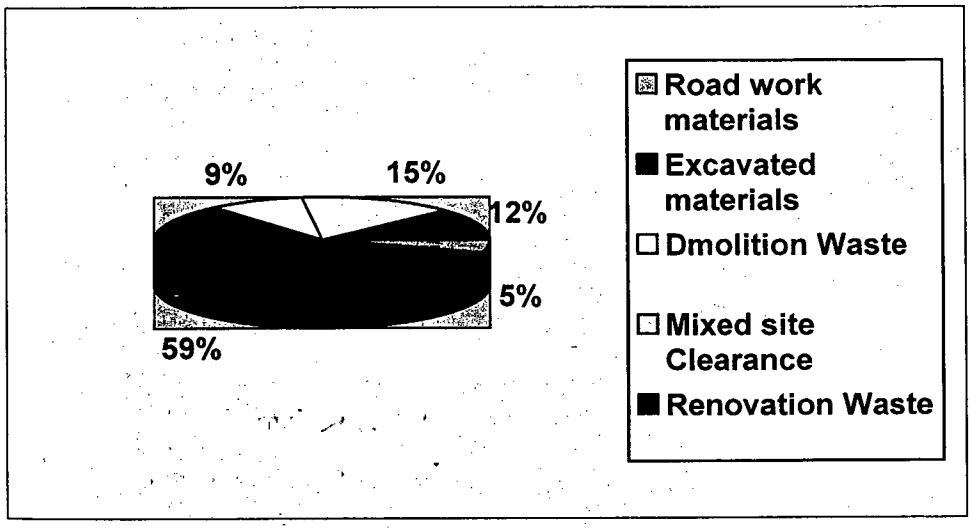

Figure 2.3: Analysis of Source of C&D Waste Received at Landfills (Source: EPD 2005)

Nature and proportions of C&D material delivered to public filling areas and landfills is classified C&D material according to its source according to a joint survey by the Civil Engineering Department Environment Protection Department (2000) shows in Table 2.1

Table 2.1: Summaries on C&D Material Generation (Source: EPD, 2000)

	C& D Material 100%			
	C & D Waste 16.5%		Public Fill 83.5%	
	Private projects 8.7%	Public Projects 7.8%	Private Projects 44.6%	Public Projects 38.8%
Civil works	0.4%	1.5%	31.9%	26.9%
Fitting out new buildings	0.6%	0.2%	1.4%	1.5%
Renovation old buildings	2.9%	0.7%	2.1%	1.2%
Construction new building	4.3%	5.1%	9.2%	9.2%
Demolishing old buildings	0.6%	0.3%		

Each of these categories of material (waste) requires a different set of criteria for its management. For example, waste material generated from civil engineering works such as site formation, is mainly soil, sand, and rubble. This source of waste is usually minimized by balancing cutting and filling on a project basis. A set of engineering standards is already available to govern the use of excavated materials for filling (refer to General Specifications of Civil Engineering Works). Therefore, this thesis is mainly concerned with measures for the reduction of waste generated from the other building works categories.

2.6 Constituents Of C&D Waste

According to a study conducted by EPD in 1995, 12 sub-categories of waste constitute the bulk of C&D waste received at landfills (EPD 1995). Table 2.2 shows indicate the composition of each category.

Table 2.2: Composition of construction & demolition waste disposed of at landfills in 1995 (Source: EPD 1995)

Component	Composition of each category of construction & demolition waste received at landfill sites (% by weight)				
	Road work material	Excavated soil	Demolition waste	Site clearance	Renovation waste
Soil/sand	23.0	73.8	21.5	33.0	19.4
Concrete/mortar	16.9	1.2	10.8	4.6	7.4
Rock/Rubble	14.4	12.5	27.7	15.0	38.8
Reinforced concrete	14.2	0.4	5.8	0.9	7.0
Bricks/tiles	0.8	0.4	12.1	1.4	9.6
Slurry & mud	1.8	9.7	1.5	1.0	3.1
Asphalt	24.7	0.0	0.0	0.2	0.0
Cement contaminated	1.7	0.4	3.2	15.6	3.3
Wood	0.6	0.9	10.5	13.3	7.1
Ferrous metals	0.5	0.0	0.6	1.0	1.3
Non-ferrous metals	0.0	0.0	0.7	0.2	0.1
Others(include bamboo, trees, glass, plastics, bulky waste/fixtures, organics & garbage	1.4	0.7	5.6	13.8	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Percentage of total quantity of C & D waste landfill	5.2	59.4	8.5	14.6	12.3

2.7 The Waste Management Hierarchy

A comprehensive waste minimisation plan should consist of the components "Avoidance", "Minimisation", "Reuse" and "Recycle". The first priority is waste avoidance that is not producing wastes in the first place. If wastes must be produced, the quantities should be minimised. The next priority is to maximize recovery, reuse and recycling of suitable waste materials. When these possibilities have been exhausted, the next priority is to reduce the bulk volume of residual waste being passed on to the last option of is final disposal at landfill.

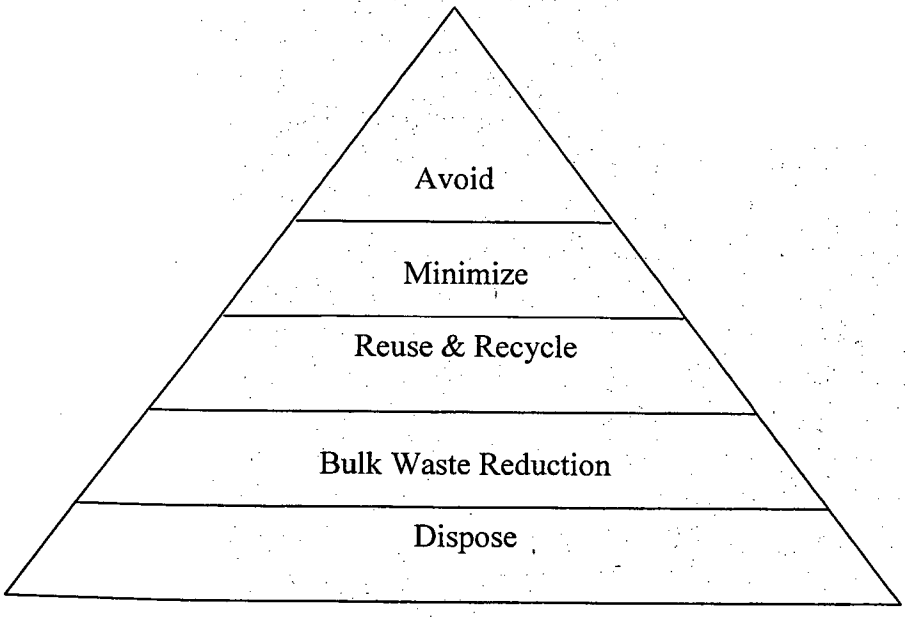

Figure 2.4: Waste management hierarchies

2.8 Waste Minimisation Technique

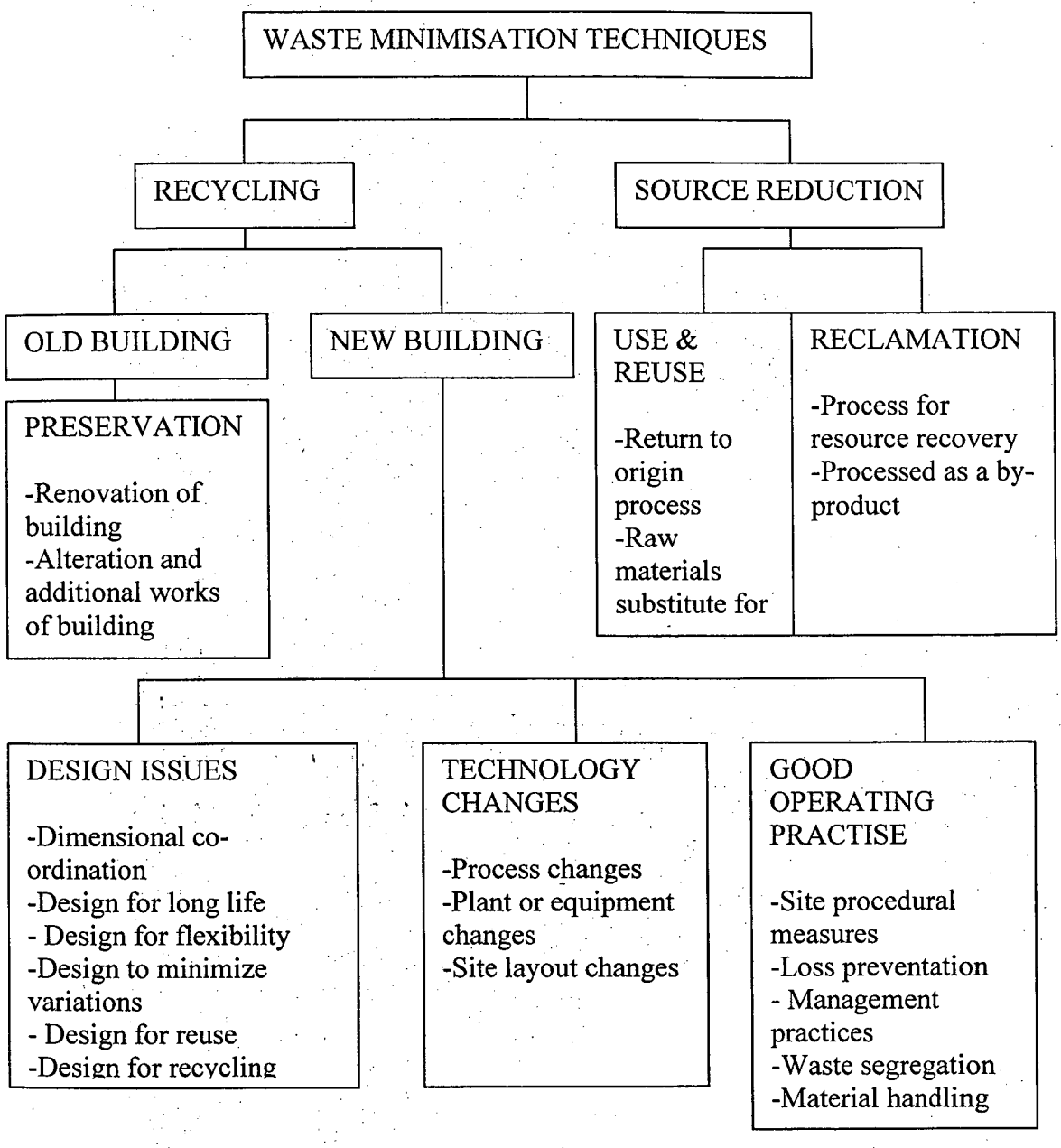

Figure 2.5: Waste Minimization Techniques in Construction (Modified from Ciambrone, 1996)

2.9 Minimising And Managing Demolition Waste

2.9.1 Demolition Waste

In a building demolition project, almost the whole building structure including the substructure, superstructure and external landscape will become demolition waste. This is 10-20 times by weight of the waste generated from the construction of a new building. The waste usually consists of high percentages of inert materials such as bricks, sand and concrete. If this huge quantity of demolition debris is not properly managed for reuse or recycling, it would surely further aggravate the landfill shortage problem or severely shorten the life of the public filling areas.

The characteristics of the demolition waste may vary depending on the types of structures demolished and the demolition technique used. For instance, a large quantity of reusable materials such as timber and ferrous metal can be recovered by using selective demolition techniques, whereas an intermingled pile of mixed demolition waste will result when implosion or heavy mechanical demolition is used. The success of waste separation is highly dependent on the demolition method used.