

A Study of Construction and Demolition Waste Management in Hong Kong

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Abstract

The construction industry is the major solid waste generator in the world. For the national sustainable development strategy, construction and demolition (C&D) waste management is very important and has become one of hottest research topic in recent years. Successfully managing C&D waste has a significant impact for Hong Kong's due to the limited land resource. This paper begins with a brief review of C&D waste in Hong Kong. Then, the current measures for waste management adopted in Hong Kong are analyzed. Some strategic plans for better performance of waste management are suggested based on a critical study of the C&D waste management in Hong Kong. It is hoped the experience in Hong Kong also can provide some useful information for Mainland China in C&D management.

Keywords: Construction and demolition waste, Hong Kong, Construction industry

1. Introduction

The mission of sustainable development has led to a pressure demand for improving environmental performance in the construction process. There is rising concern about the amount of waste generated by construction activities and the consequent disposal of that waste in landfill sites. The construction industry is the major solid waste generator in Hong Kong. Over next five years, it is expected that HK\$235 billion will be spent on civil engineering projects. Any of these construction projects generates an enormous amount of waste. According to the Environment Protection Department, a daily average of about 37, 690 tonnes of construction and demolition (C & D) material was generated in 2000, within which 30, 210 tonnes (80%) were delivered to public fill areas and the rest of 7480 tonnes (20%) were disposed of at

landfills [1]. Given the small territorial extent and the high population density, it is an urgent task to effectively and efficiently manage the huge amount of solid waste generated from construction and demolition activities. Due to the potential for environmental damage from landfill sites, the decreasing landfill space and the growing public opposition in Hong Kong, reclamation should no longer be the way to accept most of C & D waste. The reduction of C & D waste not only yields significant benefit to the environment but also reduces landfill space and cost saving for the project [2].

2. Background of C & D waste management

2.1 C & D waste definition

According to the EPD [3], construction waste comprises of unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements, and materials, which have been used and discarded. Waste arises from a number of different activities carried out by the contractor during construction and maintenance. Demolition wastes are generated as a result of site clearance and site formation works.

Depending upon the nature of structures and activities, which have been undertaken, demolition waste may be inert, mixed with putrescible or contaminated. The uncontaminated waste should be reused if found to be suitable, otherwise this material should be delivered to landfills for disposal.

2.2 Waste minimization

Waste minimization is defined as any method that reduces the volume or toxicity of a waste that requires disposal. In a practical sense, it is any method that reduces the amount of waste. Government regulations, as well as internal cost

effectiveness, require that the production and therefore the disposal of all wastes, and particularly hazardous wastes, be kept to a minimum.” C & D waste accounts a larger proportion of municipal solid waste, for example, the percentage is 20% in America [5] and 30% in Canada [6]. From these data, it can be seen that C & D waste is an inevitable subject for any waste minimization program.

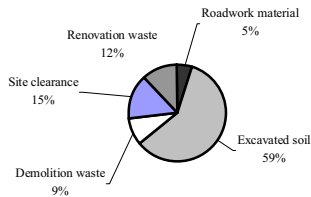


Figure 1. Percentage of sources of C & D waste (Adapted from EPD, 1995)

According to the technical report of EEA, a waste minimization plan should consist of the components “Avoidance”, “Reduce”, “Reuse”, “Recycle” and “Bulk waste reduction” in order of priority (Figure 2). The first priority is to prevent the generation of wastes in the first place. If wastes must be produced, the quantities should be reduced. The next priority is to select suitable waste materials for reuse and recycle. After the aforementioned measures, the next step is to reduce the bulk volume of waste materials before disposal.

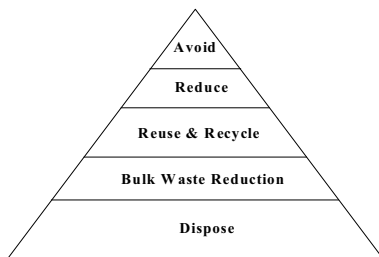


Figure 2. Waste management Hierarchy [7]

The waste minimization techniques in construction are illustrated in Figure 3. McDonald and Smithers [8] described that there are two distinct procedures in reducing the amount of waste through the construction process, which are to reduce the amount of waste generated though source reduction techniques both on site and during the design and procurement phases of a building project, and to improve the management of that waste that is generated on site.

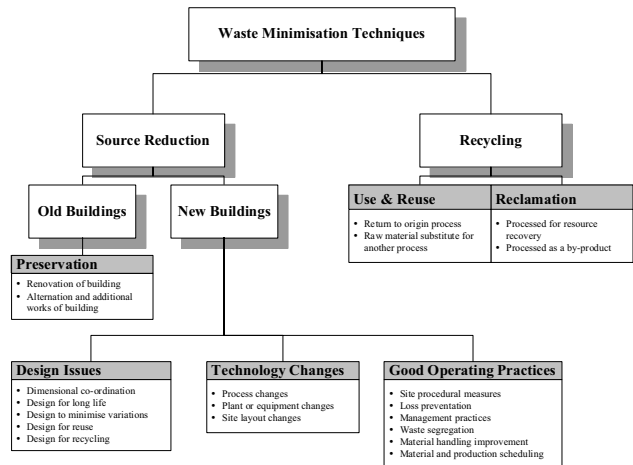


Figure 3. Construction waste minimization techniques [9]

3. C & D Waste Management in Hong Kong

3.1 The Need for Better C & D Waste Management

Over the past 15 years, C & D materials in Hong Kong have been increasing. Figure 4 shows the quantities of C & D material generated from 1986 to 2000 in Hong Kong. The expected trend in next decade is a continuation of the present increase. Although Hong Kong is not generating an exceptionally high quality of C & D waste per capita comparing with other big cities, given its small territorial extent, the C & D waste disposal required is creating an enormous pressure on the waste disposal facilities in Hong Kong.

Currently, about 80% of C & D waste is delivered to public filling areas for land reclamation in Hong Kong. Nevertheless, before any land reclamation is carried out at sea for waste disposal purpose, it is necessary to remove the mud from seabed since the marine mud is highly shrinkable. If it is not removed, the claimed land will have stability problems. Since contaminated mud is hazardous to marine life and other negative impact on environment caused by reclamation projects, dumping C & D waste at sea incur intensive public criticism. Approved reclamation projects will only provide outlet for inert materials until 2004.

The rest of 20% C & D waste is going to be landfilling. But land landfilling is a very land intensive way to dispose of waste. As the EPD [1] mentioned “In recent years, the C & D waste accounts for more than 40% of the total intake at the three strategic landfills. If there are insufficient public filling areas and no waste reduction measures, more public fill will be diverted to landfills and the landfill lives will be shortened.” It is estimated that the landfills space will run out until 2004. If the current rate of more 3,500 m³ /day C & D waste disposed of at landfills cannot be decreased with

effective measures. To minimize waste, it is essential to take preventive initiatives by reducing waste before it is generated at the design stage, as it is less difficult and less expensive.

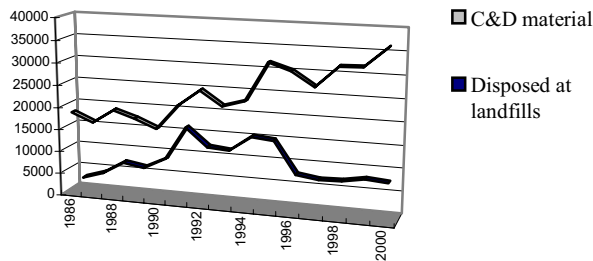


Figure 4 Quantities of C & D material generated and disposed of at landfills [10]

3.2 Strategies and Actions for C & D Management in Hong Kong

According to the waste reduction framework plan, which is published by EPD in November 1998 to arouse the public's concern on the importance of waste reduction and set targets to achieve an efficient and environmentally friendly waste management plan for the next 10 years, the strategy for C & D material management is to avoid, minimize, reuse, recycle and finally dispose of waste with the desirability decreasing in this order. In accordance with this strategy, three main objectives for C & D material management in Hong Kong are (i) to reduce the generation of C & D material, (ii) to maximize reuse and recycling and (iii) to reduce the intake of mixed C & D waste at landfills. In order to realize these objectives, the key actions identified by EPD [1] are as follows:

- Provide an adequate number of conveniently located barging points from where the public fill is taken to reclamation.
- Impose charges on C & D material taken to landfills.
- Provide on-site sorting facilities for future public demolition contracts.
- Encourage on-site sorting facilities on private construction sites.
- Develop guidelines and codes of practice to reduce C & D material generation.
- Recycle as much as possible for use in less demanding construction works, for example as aggregates.
- Minimize the use of imported marine sand or other fill for reclamation projects.
- Identify new outlets for the waste materials.

There are some regulations, code of practices, technical circulars from works bureau, guidelines concerning C & D waste management in Hong Kong, including Practice Notes for Authorized Persons and Registered Structural Engineers

(PNAP), Practice Notes for Registered Contractors (PNRC), On Site Sorting of Construction Waste on Demolition Sites (No.5/98), Hong Kong Building Environmental Assessment Method, etc. With the directing and supporting of these regulations, codes, circulars and guidelines, it is hoped that the annual waste management costs will be reduced by about \$750 million, and extend the life of landfills from 2015 to 2019 through C & D minimization actions.

3.3 Critiques on C & D Waste Management in Hong Kong

The need to minimize C & D waste has been officially recognized but more effective measures, e.g. legislative and economic measures, are yet to be developed for its implementation.

3.3.1 Legislative measures

As showed in section 3.2, there are limited regulations and codes worked out to facilitate C & D waste management. This may be attributed to the Government maintaining its view that the use of such legislative measures would not be consist with Government's general approach of the positive non-intervention policy for maintaining prosperous economy. However, the current fact of the continuous growth in waste volume in Hong Kong has evidenced that it is difficult to successfully control C & D material without a well-built legislative mechanism.

In Hong Kong, the official effort to waste management focuses on the promotion and encouragement of recycling through environmental education. While environmental education is indispensable in the course of promoting C & D waste minimization, the use of top-down measures, such as legislation and fiscal policies, may be needed for a sustainable waste management. The experience from other countries shows that the reasonable regulation requirement is considered effective and justifiable. In Japan, in order to promote the use of recycled C & D waste, a mandatory regulation requires that a business entity under the category of construction shall endeavor to maintain the function demanded by the work and to use recyclable resources to the extent technically and economically possible.

The review of the existing legislative regulations and codes reveal that they only can provide the minimum requirement of C & D waste management policy objective [7]. Despite that prevention is better than cure, Hong Kong is slow in putting this belief into practice. By highlighting the need to satisfactorily store, collect, treat and dispose of all wastes, legislative measures in Hong Kong can thus be described as reactive rather than proactive.

3.3.2 Economic measures

In line with the general discipline of the "Polluter Pays Principle" [PPP], the Hong Kong SAR Government is

proposing to introduce a charge for C & D waste disposal and the charges, initially at HK\$ 55/t (US\$ 7/t), will be increased gradually. It is hoped that the proposed charge is able to reduce the amount of inert C & D waste to be disposed of at the landfills and motivate the contractors to separate waste at source. However, a recent survey by Poon et al. [7] revealed that over 50% of the contractors covered by the survey would not perform on-site waste sorting in construction sites when the full charge of HK\$ 110/t is imposed unless it is specified in the contract. In other words, only contract terms and conditions can set bounds for the contractors in building waste management.

According to Jakobsen and Elle [11], the typical obstacles impeding the adoption of C & D waste minimization options are 1) virgin resources of gravel are inexpensive and easily accessible, 2) disposal of waste on landfill is usually inexpensive and without limitations, 3) the C & D works are not designed for materials recovery, making the resulting mixed waste materials unsuitable for utilization, and 4) the need for technical guidelines or standards for utilization of recovered C & D waste. Besides these four reasons, the reservation attitude in the construction industry in Hong Kong seems to be deteriorated by the worry of the waste minimization may interfere with normal construction activities.

Land for building in Hong Kong is very scarce and government land is usually allocated to the highest bidder. The price of land is driven to an extremely high level. As the most important objective of most clients is releasing the property to the market as soon as possible, such that the investment can be repaid and generate profit, they fear that C & D minimization process would prolong the design period and adversely affect their investment plans. Thus, even though there are considerable benefits in recovering materials from C & D materials, not surprisingly, the contractors put timing as their first priority that they always concentrate on completing the contract in the shortest period, without any consideration for the environment. Considering the industry still has little incentive to perform C & D waste minimization, C & D waste can be only effectively managed by imposing a much higher landfill charging level, combining the mandatory requirements based on contractual terms and/or legislation.

4. Conclusions

The large-scale construction activities in Hong Kong produce an enormous amount of C & D waste and subsequently put a huge pressure on waste disposal facilities. The government has recognized the need to effectively manage C & D waste in order to implement the strategy of

sustainable development in Hong Kong. Some initial efforts have been made to minimize the quantity of C & D waste, but more actions are needed to facilitate the minimization process. On the aspect of legislation, the extension of the positive non-intervention policy in the area of waste management should be rethought. On the aspect of economy, the proposed charging scheme for waste disposed of at landfills does not seem to effectively promote the implementation of C & D waste minimization in construction and demolition process. In order to successfully manage C & D waste, both legislative control and economic measures should be adopted. Some measures such as appropriate legislation controlling the generation and disposal of C & D waste, specific C & D management clauses incorporated into the Government's General Conditions of Contract, encouraging the reuse of recycled aggregates through policy should be considered.

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