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Hong Kong Experience in Construction Waste Management

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***Abstract*:** Many countries and regions are suffering from huge amounts of construction waste, which is a heavy burden on the sustainable urban development. Efficient legal and regulatory measures and effective public policies and guidelines should be established and best waste management practices taken to address the waste problem. This paper critically reviews construction waste management practices in Hong Kong (a special administrative region of China) and draws experience and learns lessons from these practices with an objective to improve future practices in this region and to share some insights on sustainable waste management for other parts of the world.

Keywords: construction waste, laws and regulations, management, policies and guidelines, practices

I. Introduction

Construction waste refers to various kinds of materials generated from site clearance, excavation, construction, refurbishment, renovation, and demolition of different types of structures. Many countries and regions are suffering from huge amounts of construction waste although they are quite different in economic, social and cultural characteristics. Construction waste is an important source of solid waste in urban areas and frequently comprises 30% or more of the total waste received at many landfills around the world.

In Hong Kong, in the period of 1986 to 2011, the daily generation of construction waste ranges from 17,290 ton/day to 58,767 ton/day, with an average of 32,846 ton/day. In other words, the annual generation of construction waste ranges from 6,310,850 ton/year to 21,449,955 ton/year, with an average of 11,988,636 ton/year. In percentage, construction waste constitutes 22.7% to 67.9% of the total solid waste generated each year in this period, with an average of 67.9%.

The large amount of construction waste generated each year is a heavy burden on the sustainable urban development in many parts of the world. Efficient legal and regulatory measures and effective public policies and guidelines should be established and best waste management practices taken to solve this problem. This paper draws the experience and learns the lessons of construction waste management practices in Hong Kong with an objective to improve the future practices in this region and to share some insights on sustainable waste management for other parts of the world.

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II. Legal and Regulatory Framework

A. *The Waste Disposal Ordinance*

The Waste Disposal Ordinance was enacted in 1980 and amended in 2004. This ordinance sets up a statutory foundation for the regulations and practices in construction waste management, particularly, regarding the designated waste disposal facilities and the consequent introduction of the Construction Waste Disposal Charging Scheme (CWDCS). Specifically, this ordinance provides a legal basis for establishing the charging levels for construction waste disposed at designated public facilities and defining the types of construction waste acceptable at these facilities in terms of the content of construction waste.

B. *Construction Waste Disposal Charging Scheme*

Coming into operation on December 1, 2005, CWDCS (Environmental Protection Department 2011) requires construction waste producers (e.g., construction contractors, renovation contractors or premises owners) to pay for the disposal charge if they use public waste disposal facilities. Construction waste producers are required to open a billing account with the Environment Protection Department within 21 days after the contract is awarded; failing to do this will incur a penalty of $5,000 per day.

There are four types of public facilities associated with waste disposal: public fill reception facilities, sorting facilities, landfills and outlying islands transfer facilities. According to the "polluter pays principle", the charges for construction waste disposed at public facilities are set at a level that would allow a full recovery of the construction and operation costs of the facilities. Specifically, levels of charge at these four types of public facilities are as follows (Environmental Protection Department 2011):

(1) Public fill reception facilities charge HK$27/ton for

waste consisting entirely of inert construction waste;
(2) Sorting facilities charge HK$100/ton for waste containing more than 50% by weight of inert construction waste;
(3) Landfills charge HK$125/ton for waste containing not more than 50% by weight of inert construction waste;
(4) Outlying islands transfer facilities charge HK$125/ton for waste containing any percentage of inert construction waste.

C. Waste Reduction Framework Plan

In 1998, a waste reduction framework plan (WRFP) was launched (Environmental Protection Department 1998) with the objectives to extend the useful life of existing landfills, to minimize the amount of waste produced that requires disposal, and to increase the waste recycling rate. This plan was intended to shift the emphasis from collecting and transporting waste to landfills for disposal to waste prevention and reuse of waste materials. WRFP set up the targets of diverting 30% and 58% of the municipal solid waste away from landfills by 1997 and 2007 respectively, and diverting away 80% and 84% of construction waste by 1997 and 2007 respectively. It was expected that meeting these targets would extend the life span of the existing landfills from 2015 to 2019.

Three integrated action programs were established in order to achieve these targets. In specific, a prevention of waste program aims to reduce municipal solid waste generated at source and increase the amount of waste materials to be recovered, recycled or re-used; an institutional program coordinates the implementation of the waste reduction measures; and a waste bulk reduction program will develop waste-to-energy incinerators and composting plants.

D. Incentives for Green and Innovative Building Practices

Buildings Department, Lands Department and Planning Department (2001; 2002) issued Joint Practice Notes 1 and 2 in 2001 and 2002 respectively to promote green and innovative buildings. The two practice notes have four objectives: (1) adopting a holistic life cycle approach to planning, design, construction and maintenance, (2) maximizing the use of natural renewable resources and recycled/green building materials, (3) minimizing the consumption of energy, in particular those non-renewable types, and (4) reducing construction waste. Incentives are provided for green and innovative building practices that contribute to these objectives, that is, green features can be exempted from gross floor area and/or site coverage calculation.

E. Practice Note on Using Recycled Materials

In 2003, the Buildings Department issued a practice note for structural engineers entitled “Use of Recycled Aggregates in Concrete”, according to which prescribed mix concrete and designed mix concrete may adopt 100% and 20% recycled aggregates respectively (Buildings Department 2005). Recycled aggregates refer to hard inert materials mostly originated from construction waste. A recycling plant was set up at Tuen Mun Area 38 in mid-2002 to recycle the inert portions of construction waste into useful aggregates. Recycled aggregates have been used in different areas. In general, slightly lower grade recycled aggregates are used as road sub-base and drainage bedding layers and higher quality recycled aggregates are used for asphalt production and in minor concrete structures (Housing Authority 2011).

III. Waste Disposal Practices

A. Construction Waste Classification

In general, construction waste is classified into two types in Hong Kong: inert and non-inert. Inert construction waste includes construction debris, rubble, earth, bitumen and concrete. Non-inert construction waste includes bamboo, timber, vegetation, and packaging waste. Around 80% of construction waste in Hong Kong is inert while 20% is non-inert (Government of the Hong Kong Special Administrative Region).

B. Construction Waste Disposal

The normal practice in dealing with construction waste is to transport inert waste to public filling areas for land reclamation and site formation and to dispose of non-inert waste at landfills. Public filling areas are designated from time to time according to the development needs of Hong Kong. In contrast, it is very difficult to find a landfill space due to strong public objection.

C. Three Existing Strategic Landfills

In 1989, a waste disposal plan was implemented, setting out a strategy for municipal solid waste disposal in Hong Kong. Under this plan, old waste management facilities were gradually phased out and new facilities at higher environmental standards were built. The new facilities include three strategic landfills that have a total design capacity of 139 million m3 (Environmental Protection Department 2005a): West New Territories Landfill (WENT, located in Nim Wan, Tuen Mun), South East New Territories Landfill (SENT, located in Tai Chik Sha, Tseung Kwan O) and North East New Territories Landfill (NENT, located in Ta Kwu Ling).

IV. Some Observations of Existing Waste Management Practices

A. On-site Sorting and Reuse of Construction Waste

On-site sorting and reuse is an important step in the construction waste management chain and an effective measure in reducing, recovering and reusing various types of

waste materials. Before the start of CWDCS, the construction industry was reluctant to carry out on-site sorting even when a high tipping fee is imposed (Poon et al. 2001). Low financial incentive and increase in overhead cost are considered as the major barriers (Tam 2008). However, since the implementation of CWDCS, this attitude towards on-site sorting and reuse has changed (Yuan et al. 2013). Nonetheless, the availability of site space and a market of recycled materials are still a concern of construction stakeholders regarding on-site waste sorting and reuse.

B. *Effect of Construction Waste Disposal Charging Scheme*

CWDCS has effectively motivated construction waste producers to minimize their disposal costs by reducing, sorting, recycling and reusing construction waste, and consequently, construction waste disposed at landfills has been significantly reduced. For example, average daily construction waste intake at landfills dropped dramatically from 6,556 ton/day in 2005 to 4,125 ton/day (i.e., a decrease by 37.1%) after the actual start of waste charging in January 2006. Furthermore, the effectiveness of CWDCS is also indicated in the change of the five-year average daily construction waste intake at landfills immediately before and after the start of CWDCS. The average five-year daily intake dropped from 7,298 ton/day in the period of 2001 – 2005 to 3,416 ton/day in the period of 2006 – 2010, that is, a decrease of 53.2%.

C. *Effect of Prefabrication*

Prefabrication is a green building practice that is frequently adopted in Hong Kong due to the common characteristics of limited site space and time requirement of various types of construction projects. A study by Tam et al. (2004) indicated that prefabrication could save more than 70% of the total waste in typical trades compared to traditional in-situ construction. Residential projects are the most suitable to apply prefabrication techniques effectively and the design-build procurement method facilitates the application of such techniques (Tam et al. 2007).

D. *Control of Fly-tipping Activities*

Fly-tipping refers to illegal depositing of construction waste without the consent of the concerned land owner. Usually scattered in small quantities in urban built-up areas and rural locations with good vehicular access (e.g., side roads branched off from main roads), fly-tipped construction waste is an eyesore and may also cause adverse environmental impacts, hygiene problems or even safety risks to adjacent buildings or land. There are many public complaints on fly-tipping activities (Environmental Protection Department 2005b).

Environmental Protection Department, as the Authority of the Waste Disposal Ordinance, has played an important role in controlling fly-tipping activities. Closed-circuit television monitoring systems have been installed at serious fly-tipping black spots, such as at remote locations or access roads leading to landfills. These systems can capture essential information of fly-tipping activities (such as the occurring time and the plate number of the dump truck). Environmental Protection Department may undertake prosecution action against an offender and/or remove the waste itself first and recover the cost from the offender later.

V. Conclusions

Construction waste is an important source of solid waste generated in a region or city and has become a heavy burden on the sustainable urban development in many parts of the world. Efficient legal and regulatory measures and effective public policies and guidelines should be established and best waste management practices taken to address the waste problem. A critical review of the construction waste management practices in Hong Kong has made the following findings:

(1) The Waste Disposal Ordinance was very efficient in setting up a statutory foundation for the regulations and practices in construction waste management, particularly, regarding the designated waste disposal facilities and the consequent introduction of CWDCS;
(2) CWDCS has effectively motivated construction waste producers to reduce, sort, recycle and reuse construction waste and significantly reduced construction waste disposed at landfills;
(3) Low financial incentive, increase in overhead cost, the availability of site space and a market of recycled materials are the major concerns of construction stakeholders regarding on-site waste sorting and reuse;
(4) Prefabrication can substantially reduce construction waste, and residential projects are the most suitable to apply prefabrication techniques effectively and the design-build procurement method facilitates the application of such techniques;
(5) Fly-tipping activities may be a serious issue that can cause adverse environmental impacts, hygiene problems or even safety risks to adjacent buildings or land, against which effective countermeasures should be taken.

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