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Measures to reduce construction waste through better building design and management

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Last year 12 million tonnes of construction and demolition waste was generated in Hong Kong. This comprises about 50% of waste going to landfills in Hong Kong. Given that it is estimated that the costs to taxpayers of landfilling represent $200/tonne, the potential savings, in avoided disposal costs, that could accrue if substantial amounts of this waste were reduced or reused are enormous.

Much of this waste can be reused. Between 1995 and 1997, 1260 tonnes per day of construction waste, most of it inert fill, was recycled at the Government's construction waste sorting site at Tseung Kwan O. The biggest incentive to encourage waste reduction or recycling is landfill charging. Hong Kong is one of the only places in the world where landfilling is free. In other developed countries high tipping fees provide a strong incentive for waste reduction and innovation in design.

Since much of the construction and demolition waste comes from buildings, waste can be avoided by better building design and management. Quality buildings tend to be more resource-efficient, less wasteful and better managed. Hong Kong could become a world leader in quality building development and reduce capital and operational costs in the process[1]. There are at least 5 design elements that can help reduce the generation of C&D waste.[2]

1. Reusing Existing Buildings and Materials

Reusing and renovating a building instead of building a new one can reduce materials use and waste, as well as saving money. Faced with many vacant and obsolete office buildings in lower Manhattan, New York City provided tax incentives for the conversions of commercial buildings to residential use.[3] Electricity rebates were also provided. Similarly, in Hong Kong many of the obsolete industrial buildings can be converted into commercial or other uses. However, some mechanism or incentives are required to relocate or compensate existing industries.

2. Designing and Managing for Durability

Longevity of a building is determined by the durability of materials and construction, and also by a building's adaptability to changing needs. Buildings should be built for durability to ensure that maximum value and use is obtained from our building structures. The average lifespan of a building in Hong Kong is less than 30 years and many existing buildings are reaching obsolescence. Much of the problem is caused by poor maintenance.

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[1] Citizens Party (1998) Building Better, Building Greener http://www.citizensparty.org

[2] Fishbein B K (1998) Building for the Future: Strategies to Reduce Construction and Demolition Waste in Municipal Projects. INFORM Special Report,

[3] ibid

Inadequate maintenance can shorten the life span of a building and increase the need for renovation and new construction. A culture of maintenance needs to be developed in Hong Kong through education and regulation. The Building Management (Amendment) Ordinance gave owners incorporations the power to carry out renovation works. However some buildings do not have owners incorporations which makes it more difficult to conduct maintenance if owners do not agree or are absent.

In New York, a city charter requires agencies to inventory the condition of their buildings and prepare maintenance schedules.[4] This has been used as a model of asset reporting by other cities. The Provisional Legislative Council rejected a scheme that would have required building owners to carry out inspections and undertake maintenance works - while this scheme is still under review, there is no timetable for its introduction.

Good quality fittings can also help reduce obsolescence and waste. In Hong Kong, the poor quality of finishes can be seen from the frequency of poor lining-up of walls and floors, largely due to poor workmanship and race to complete projects at breakneck speed. Architects in Hong Kong complain of rejection rates on finish as high as 50%.[5]

3. Designing for Adaptability

There is no point in making a building more durable if it is not adaptable and needs to be demolished before the end of its projected life. Another way to make buildings last longer is to increase the interior flexibility, allowing flats to be converted into smaller or bigger residences as demographics change. Factories and commercial buildings are already rented out as shells. Perhaps residential buildings should have the same approach to enable future variation. The ever increasing demands for new Information Technology (IT) systems require accessible, expandable network-capable floors and walls. Higher floor to floor height permits, raised floor/suspended ceilings for servicing and more window area for daylighting will help future buildings to adapt to changing needs.

4. Designing for Disassembly

Buildings should be designed for disassembly, rather than demolition at the end of their useful life. This means thinking about how the structure will be handled during renovation or disassembly rather than focussing on getting the project built as quickly and cheaply as possible. This involves using materials that can be recycled or reused, reducing the number of different materials used and eliminating toxic components where possible. In Europe, buildings are cut into sections, taken out and processed in non-sensitive areas elsewhere, which also reduces safety risks to workers. In London, whole facades are removed during deconstruction. This will require changes to Building Regulations in Hong Kong.

5. Using less materials

Material use can be reduced in a number of ways at the design stage - the use of efficient framing techniques, standard size supplies, prefabricated materials and the incorporation of salvaged or recycled materials into the design.

A. Concrete

The majority of buildings in Hong Kong are made of concrete. Under the current building code on wind loading it is estimated that excessive amounts of concrete are specified due

[4] ibid

[5] Citizens Party (1999) Quality Buildings. http://www.citizensparty.org/housingpp7.html

to unduly conservative criteria. Tall buildings in Hong Kong are required to conform to wind load factors twice those of New York or Chicago, and four times the earthquake equivalent of Los Angeles. These requirements increase construction costs by some 20%. Design codes should be developed along with the appropriate risk assessments. Use of recycled aggregate in concrete should also be encouraged. This requires a change in the specifications for concrete.

B. Timber

Hong Kong is one of the main importers of tropical timber, much of it used in the construction industry for formwork, falsework and hoardings. Formwork for *in-situ* concrete works is one of the predominant uses of tropical hardwoods in the building industry.[6] After minimal use it is often discarded as construction waste. Metal formwork can be used as an environmentally-friendlier replacement. Hong Kong can significantly reduce the need for timber for formwork by employing more pre-fabricated construction techniques that require less on-site production. Structural elements, external cladding/panelling and wall and ceiling systems can all be pre-fabricated[7].

C. Other Materials

Using standard sizes in the design prevents the creation of cutoff waste and optimises the use of materials. A few more innovative developments in Hong Kong have specified that building materials have to have a certain recycled content.[8] Government should set an example by requiring its own building stock to use only demountable partitions with a minimum recycled content, installing carpets made from recycled PET, furniture from recycled plastic etc[9]. All Government briefs for new works should include these.

For the above measures to work in Hong Kong legislative changes are needed as well as improving overall building management. The Building Ordinance was enacted in 1955 and has basically remained unchanged since. It needs to be modernised based on a new quality vision that takes into account the whole life cycle of a building.

Hong Kong also lacks an effective building management system that integrates every aspect involved in producing a building. In a modern project development system, the project manager (PM) plays a much more central role than the Authorised Person (AP) but there is no system of accreditation for PMs in Hong Kong. If PMs are held legally responsible for coordination of a development project, this will reduce the need to over-engineer buildings which results in wastage.

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[6] Ng H H (1997) Sustainable Housing Design in Hong Kong: Verbena Heights and Beyond. HKIA Journal 9/2nd quarter, 56-65

[7] The Hong Kong Housing Authority are moving towards standardised designs that allow installation of standard components such as doors and stairways, that can help to minimise wastage.

[8] Lincoln House, Verbena Heights

[9] Dougherty E (1999) A Recycled Product Procurement Program for Hong Kong. Paper prepared for the Office of Christine Loh.