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Sustainable Development in Civil Engineering – The Hong Kong Experience

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Abstract
Concern about sustainable development has grown in Hong Kong in recent years especially for infrastructural projects and construction activities. This paper examines sustainability issues of a railway project which was refused an Environmental Permit in its first application and a highway project which initiated a public uproar when its noise barriers were being installed. It also describes how the Government and the engineering industry are attempting to reduce inert construction and demolition material being disposed in landfill. The experience gained in Hong Kong may be applicable to elsewhere.

Keywords
Sustainable development, sustainability, civil engineering, Hong Kong experience.

1. Introduction

Hong Kong is sometimes considered to be the civil engineer's paradise. There has been continuous intensive infrastructure development in Hong Kong since the 1970s when Government decided to develop the new towns in the New Territories. Since then, the mass transit system, the relocation of the international airport, the ambitious public housing programme, the highway and railway development strategies all provided ample opportunities for civil engineers to make their contribution to the development of Hong Kong.

With limited natural resources and high population densities in Hong Kong, how can civil engineers ensure that their work is compatible with sustainable development? In Hong Kong, sustainable development balances social, economic, environmental and resource needs, both for present and future generations, simultaneously achieving a vibrant economy, social progress and a high quality environment, locally and internationally, through the efforts of the community and the Government (ERM, 2000).

Since 1998, the Environmental Impact Assessment Ordinance (EIAO) has come into effect in Hong Kong. Under the EIAO, designated projects, that may have a significant impact on the environment, are required to obtain an Environmental Permit (EP). The EP serves as a safeguard to the environmental aspects of sustainability.

This paper examines the sustainability issues of a civil engineering project at its planning stage and another at the implementation stage and the lessons learned. It also describes how construction and demolition (C&D) material, a major concern of the Government and the public in Hong Kong, is being tackled with the aim of achieving sustainability.

2. Sheung Shui to Lok Ma Chau Spur Line

Due to the increasing economic activities and social interaction between Hong Kong and Guangdong in recent years, there has been an urgent need to increase the border-crossing facilities. The Kowloon-Canton Railway Corporation (KCRC), in accordance with Government's Railway Development Strategy, proposed in 1998 to build a spur line from Sheung Shui Station to Lok Ma Chau to relieve congestion at Lo Wu, which is presently the only rail-accessible crossing. The viaduct alignment of the proposed spur line, however, cuts across Long Valley, an ecologically sensitive wetland with a high diversity of bird species including some of conservation importance.

As the spur line is a designated project under the EIAO, an EP issued by the Director of Environmental Protection (DEP) is required before construction can begin. The EIAO process was followed with KCRC submitting a project profile (on 23 December 1998), the Environomental Protection Department (EPD) defining the study brief, KCRC presenting a draft EIA report followed by a final report to EPD. Then followed a public consultation exercise during which EPD requested comments on the report from the public (225 sets from the public received) and KCRC supplied more information. EPD also solicited comments from the Advisory Council on the Environment and the Agriculture, Fisheries and Conservation Department (AFCD). On 16 October 2000, DEP decided not to approve the EIA Report and therefore did not issue an EP. The main reasons given were the high potential direct environmental impacts, in particular during the construction stage, the doubtful effectiveness of the proposed mitigation measures and the availability of practical and reasonable alternatives (EPD, 2000).

The KCRC appealed the DEP's first ever EP refusal to the EIA Appeal Board. A three-member board was formed and chaired by retired High Court Justice Barry Mortimer, QC. It heard arguments from both sides from 4 April to 24 June 2001. In the hearing, KCRC submitted much new information on construction methods, mitigation measures and changed circumstances. As the new information had not been subject to the normal EIAO process, especially public scrutiny, and that the Appeal Board sat as an appellate tribunal, not a tribunal of enquiry, KCRC's appeal was dismissed on 30 July 2001 (Cocking, 2001).

Following the Appeal Board decision, KCRC held extensive consultation with EPD and AFCD and selected a bored tunnel on the same alignment to pass through Long Valley (Figure 1). A renewed EIAO process with a revised project profile submitted in September 2001 was eventually completed with the approval of a new EIA Report and the issuance of EP No. EP-129/2002/A on 11 December 2002. The bored tunnel option will cost about HK$2 billion more than the original design and the spur line will open in 2006/07 instead of 2004 as originally planned.

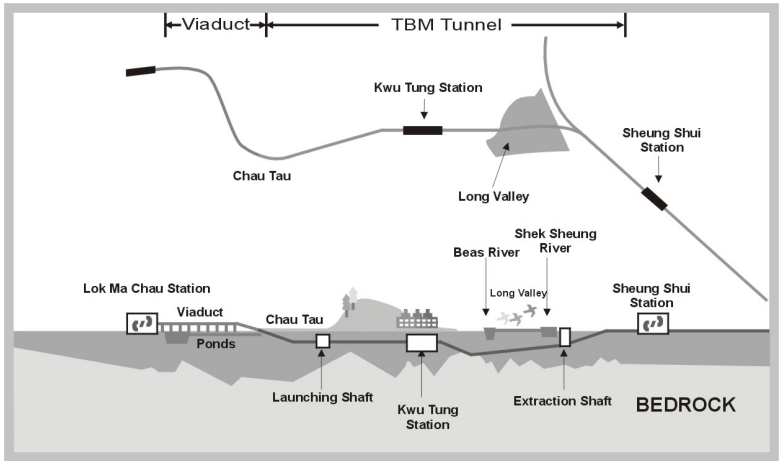

Figure 1: Lok Ma Chau Spur Line (adopted from KCRC, 2003)

The spur line episode is a valuable experience for Hong Kong. It highlights the concerns of the public about the impacts of civil engineering projects on the environment, the need for improved communication between the regulator and the project proponents to enable the EIA report to better address the environmental issues, and the possible high economic penalty of an appeal process in terms of delayed project completion.

3. Tolo Highway Noise Barriers

Tolo Highway is one of Hong Kong's major trunk roads. Due to increased traffic, especially from cross-border activities, it is being widened from dual-three to dual-four lanes.

As part of the widening works, noise barriers were installed at the end of 2002. As required by the EIAO, these barriers were designed to take into account planned developments within the next 15 years to mitigate the traffic noise effects on the adjacent communities. Their installation, however, initiated an uproar from the public; the motorists on the highway complained about the loss of views, the spatial aspect and the visual impact of the excessive barriers; the residents of hillside dwellings nearby complained about the obstruction of their views over Tolo Harbour. Ironically, the barriers were designed to mitigate traffic noise levels for these occupants, who were considered to be Noise Sensitive Receivers (NSRs).

As some of the barriers installed were for the shielding of traffic noise from buildings which will not be constructed for some time, and as there are alternative provisions to cater for localised NSRs, the excess barriers were removed to be reused in other highways projects.

In a Legislative Council (LegCo) joint meeting of the Panel on Enviornmental Affairs and the Panel on Transport convened to consider the case, the following guidelines for road traffic noise mitigation were affirmed (LC, 2003):

- Comply with existing statutory requirements.
- Implement mitigation measures at the appropriate time.
- Consider cost-effectiveness of noise barriers for existing roads and set priority in retrofitting.
- Pay attention to the aesthetic design of noise barriers.

It is hoped that by adopting these guidelines, Hong Kong will be able to strike "the right balance among economic development, environmental protection and social acceptability" (LC, 2003).

4. Construction and Demolition Material

Tackling inert C&D material is an important component of the Environment, Transport and Works Bureau's (ETWB) overall waste management strategy. Inert C&D material is generated from civil engineering and other construction activities that should not be disposed of to landfill because of its inert and generally voluminous nature. In 2002, the total waste generation in Hong Kong was in excess of 20M tonnes, of which some 16M tonnes was classed as mixed C&D material. Of this, almost 13M tonnes (77%) was inert material comprising soil, building debris, broken rock, brick, asphalt, etc and more than 3m tonnes (23%) was non-inert C&D waste comprising timber, bamboo, plastics, packaging, etc. (EPD, 2003).

In Hong Kong, inert C&D material is used mainly as public fill for reclamation and non-inert C&D waste is disposed at landfills. In recent years, however, the mixed C&D material accounted for almost 50% of the total waste intake at Hong Kong's three strategic landfills. The current estimate is that these landfills will be filled up in 10 to 15 years (Chan and Fong, 2002) unless significant measures are taken to reduce the amount of mixed C&D material disposed there.

To ensure sustainable development in Hong Kong, there is an urgent need to reduce the generation of C&D material while achieving the economic and social needs of the community. There is also a need to recycle and reuse suitable C&D material to prolong the usefulness of these materials, to save virgin materials and to reserve the valuable landfill space for other wastes which are more difficult to recycle or reuse.

4.1 Reduction of C&D Material

Reduction of C&D material should start at the project conception stage. Can we come up with a durable yet adaptable scheme recognising the rapid changes of the need of society? "Flexibility of use, purpose and design" should be a key consideration for sustainable development if we do not "seek to impose solutions on future generations" (Brooke, 2003). Can we rehabilitate rather than demolish and rebuild a building?

Design engineers play an important role in reducing C&D material. They should, where appropriate, use lean construction, balance cut and fill, adopt modular and precast units, and incorporate recycled materials. They should also consider the constructability and de-commissioning of their designs in relation to safety, temporary work and waste generation. These considerations are compatible with sustainable construction promoted elsewhere (Guthrie and Coventry, 1998).

To enhance waste management requirements on construction sites, ETWB issued Technical Circular (Works) No. 15/2003 with an effective date of 1 July 2003. This circular requires contractors of Government capital works contracts with an estimated contract sum of HK$20M or more to prepare and update a comprehensive Waste Management Plan (WMP) with payment for its implementation under the "Pay for Safety and Environmental Scheme". The WMP has to include waste management policy, organisation structure of the environmental team, measures to reduce/minimize generation of C&D material, on-site sorting, temporary storage, recycling arrangements, record keeping, performance monitoring and provision of training. It is hoped that with Government taking the lead, similar requirements for waste management will be extended to contracts awarded by non-government developers.

4.2 Recycling C&D Material

Hong Kong is in the early stages of recycling C&D materials but has made some progress in establishing off-site sorting facilities, testing and trials of recycled aggregates, using recycled aggregates in low grade concrete and researching into recycled road pavements. Temporary recycling facilities in Tuen Mun Area 38 and Tseung Kwan O Area 137 have already been established.

While there are plenty of applications for recylced inert C&D material in concrete production, granular filters, road sub-base, blockworks etc., there are also many barriers encountered to recycling. These include readily available virgin aggregates from neighbouring areas, insufficient market for recycled materials, unfamiliar specification of recycled aggregates, limited recycling facilities and free use of landfills to dispose C&D material (Chan and Fong 2002). Government has prepared a scheme for implementing landfill charging for C&D material and has circulated this for comment within the industry, it hopes to submit this to LegCo later this year and use the funds so raised to provide incentives to help recycling.

4.3 Reuse of C&D Material

Sustainability encourages reuse of materials so as to conserve virgin natural resources. In Hong Kong, timber hoardings are now no longer acceptable by the authorities. Reusable steel hoardings are the norm in construction sites. Metal scaffoldings are encouraged as they can be reused. Friends of the Earth, a green group in Hong Kong, initiated a programme to collect surplus tiles from contingency orders by contractors to be given to organisations that are in need of them. Such a programme helped to reduce useful C&D material being disposed of in landfills (Beardsley et al, 2002).

The more common reuse of inert C&D materials in Hong Kong is for soft inert C&D material to be used as fill materials in reclamation. To co-ordinate the use of the suitable C&D material and need for reclamation fill, the Government has set up a Fill Management Committee and a website to facilitate contractors' exchange of information.

5. Conclusions

Civil engineering projects often have significant impacts on the sustainable development in Hong Kong. Careful consideration is required during each of the project planning, implementation, operation and demolition stages to balance the social, economical and environmental aspects of the projects.

Some lessons we learn from the Hong Kong experience presented in this paper are:

- Engage the community early in project development
- Listen to stakeholder views
- Enhance communication between the regulator and project promoters
- Install mitigation measures at the appropriate time
- Adopt lean construction
- Reduce, recycle and reuse.

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