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Recycling of Demolished Concrete as Aggregates  
Final Report

1. COST OF RECYCLING

Figures obtained by Mr Tony C.C. YEUNG (DSD)

These are based on the cost estimates in the Final Report of Study on Recycling of Construction Waste Received at Landfills. The unit cost varies from HK\$5.75/tonne to HK\$6.89/tonne depending on the assumed service life span of the plant. The following points should be noted:-

1. the estimate is based on June 1991 price;
2. a full-swing operation (15 hours per day at an output rate of 300 tonnes per hour) with sufficient supply of construction waste (not less 4,500 tonnes per day) is assumed;
3. all the product output is assumed to be 100% usable without wastage; and
4. other costs, such as transportation, sorting/screening and stockpiling, are not included.

2. REPLY FROM VARIOUS PARTIES

2.1 Dr. P.R.S. Speare of City University, United Kingdom

According to the DOE Report "Managing Demolition and Construction Wastes", the charge for accepting clean, hard material at a recycling site is £1 - £3/tonne, and the price of processed material is in the range £2.50 - £7/tonne for as-crushed and Type I sub-base material respectively. If no charge is made for acceptance of material at the recycling plant, the minimum profitable sale price would be £5/tonne.

2.2 Galliford Roadstone, United Kingdom

The recycling process using a mixture of concrete, general masonry and other hard inert material generally produces materials used in the lower grade uses such as road capping layer and bulk fill. There is a small amount of recycling using pure concrete which tends to produce material fit for Type 1 sub-base layer. The unit cost is about £2.00 - £2.50 per tonne using mobile plant.

2.3 HT Hughes & Sons (Transport) Ltd, United Kingdom

The production costs of recycled concrete as Type I material and as-crushed material are £4.50 per tonne and £3.00 per tonne respectively. The resale value of as-crushed material is approximately £4.50 per tonne. The company recycles about 200,000 tonnes of concrete per annum.

#### 2.4 Pinden Plant and Processing Co. Ltd, United Kingdom

The production cost of recycled aggregate from demolition material is in the range of £1.75 to £2.50 per tonne. It mentions that the British Government is at present showing an eagerness for recycling wherever possible, and with the introduction of "Landfill Levy", the need to recycle will become even more vital.

#### 2.5 RGS 90 in Copenhagen, Denmark

No estimate on the cost of recycling concrete is provided as recycled material is provided free of charge to users in Denmark. A waste tax has been imposed on incineration and landfill waste. It mentions that 2.2 million tonnes of construction and demolition waste are produced annually in Denmark and 80% of the waste are recycled. The use of recycled aggregates has saved the expenses in procurement of new raw materials.

#### 2.6 Comments from Highways Department (by Mr Y.H. CHAK)

If recycled aggregates from locally crushed concrete are to be used as sub-base material, the properties of the recycled aggregates should be checked against the requirements in the General Specification for Civil Engineering Works. As mentioned in the literature, there is a problem in combining the use of recycled aggregates and natural aggregates as sub-base material since they have different specific gravities, which causes difficulty in the determination of the grading and the relative compaction of the mixed material.

### 3. LITERATURE REVIEW

The following is a list of literature obtained :-

- a. Hansen TC (Ed). Recycling of Demolished Concrete and Masonry. RILEM Report No. 6. London, E & FN Spon. 1992, 316 pages. Available in Public Works Central Laboratory Library, Acc. No. C298.
- b. Lauritzen EK (Ed). Demolition and Reuse of Concrete and Masonry. Proceedings 3rd International RILEM Symposium, Odense, Denmark, 24 - 27 October 1993. London, E & FN Spon. 1994. Available in CE Library, Acc. No. B43-IS-DR03-62647.
- c. de Vries P. Concrete recycled : Crushed concrete as aggregate. Concrete, 1993, 27(3), pages 9 - 13. Available in Public Works Central Laboratory, file ref. 44/2/23.
- d. Building Research Establishment. Efficient use of aggregates and bulk construction materials. Vols 1 & 2. Building Research Establishment Report. Garston, BRE 1993. 43 pages & 148 pages. Available in Public Works Central Laboratory Library, Acc. No. C296 and C297.
- e. Speare R.S. Recycling of structural materials. The Structural Engineer, Vol. 73, No. 13, July 1995, page 220 - 222. Available in Public Works Central Laboratory, file ref. 44/2/23.

#### 4. CONCLUSION

According to Dr. Speare of UK, the European experience revealed that constraints were encountered in promoting the use of recycled aggregates from construction and demolition waste. No unified specification has been established. Recycling has been encouraged by the use of "Landfill Levy" in some European countries, such as Denmark and the Netherlands. Both countries have a shortage of suitable natural aggregates.

In view of the situation in Hong Kong, as there are sufficient sources of aggregates from the nearby quarries in mainland China, it is clear that unless there is a cost saving in using recycled aggregates or an expensive charge for using landfill for the disposal of construction waste, the promotion of using recycled aggregates will be a very difficult task. In addition, the technical viability of using recycled aggregates and quality control on production of recycled aggregates still need further considerations. With the alkali aggregate reaction considerations, the use of recycled aggregates in structural concrete is not considered as suitable. However, its use as general fill and sub-base materials in road construction needed further investigation.

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