Environmentally Friendly Bricks & Blocks from Recycled Aggregates

In Hong Kong, a huge quantity of construction and demolition (C&D) wastes is produced every day representing a large fraction of the total solid waste stream. The disposal of the wastes has become a severe social and environmental problem in the territory. Government sources have indicated that there are shortages of both public filling area and landfill space in Hong Kong. Our landfills are expected to be full within 10 years' time. With the rapid economic growth and pressure for redevelopment, the management of construction and demolition waste is becoming a major problem in Hong Kong as well as in cities in the Mainland. The possibility of recycling these wastes in the construction industry is thus of increasing importance. In addition to the environmental benefits in reducing the demand on land for disposing the waste, the recycling of C&D wastes can also help to conserve natural materials.

C&D wastes are normally composed of concrete rubble, brick, tile, sand, dust, timber, plastic, cardboard, paper, and metal. Concrete rubbles usually constitute the largest proportion of C&D waste. It has been shown that crushed concrete rubble, after separated from other C&D wastes and sieved, can be used as a substitute for natural coarse aggregates in concrete or as a sub-base or base layer in pavements. But the fine fraction is not commonly used due to its higher contamination and waste absorption levels.

The Hong Kong Polytechnic University (PolyU) has successfully produced bricks and blocks using recycled construction wastes, in particular, with the fine fraction that is not usually reused, and registered two patents for this environmental technology. This technology can provide an environmentally friendly solution to the disposal of construction waste, and alleviate the shortage of landfill and public filling area, as well as recycle some of the C&D material into good use.

The technology uses a mechanized molding method for producing concrete bricks and paving blocks. The method can replace both the fine and coarse natural aggregates by recycled aggregates in making the paving blocks. Using such a method, the mixed materials are molded under a combined vibrating and compacting action so that the requirement for maintaining a workable mix is not so important as that in normal concretes. Only a minimal amount of water is needed to make the mixture fluid enough to be fed into the molding machine.

A series of stringent tests have been conducted on the bricks and blocks to test their compressive strength, transverse strength, drying shrinkage, skid resistance and other durability properties. The test results showed that using this technique, concrete paving blocks made are just as good as those made with virgin materials in the market.

Reject fly ashes and other wastes materials such as furnace bottom ash and flue gas desulphurization sludge from coal-fired power generating plants can also be incorporated in these bricks and blocks.

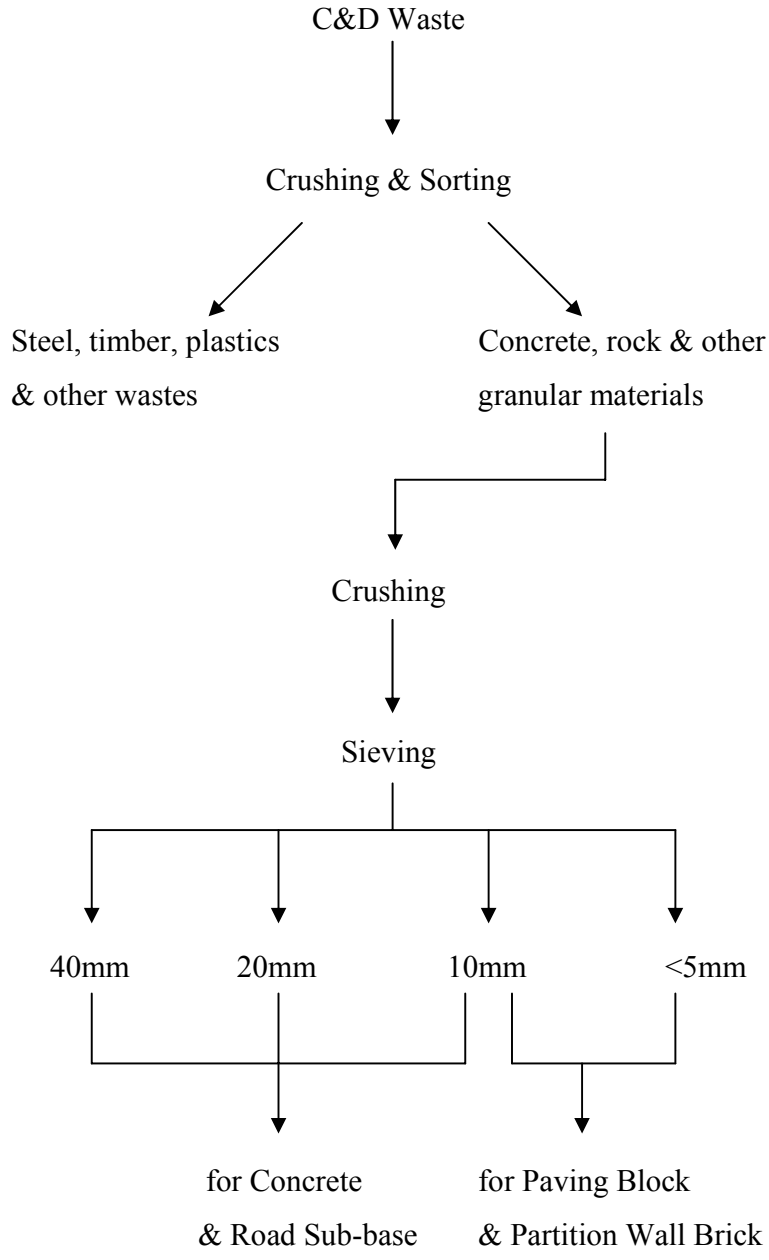
These paving blocks produced have already been put into successful trial use at four different sites, including the Housing Authority's Oi Man Estate, Cheung Sha Wan Road, West Rail's Kam Tin Station, and a primary school in Yuen Long.

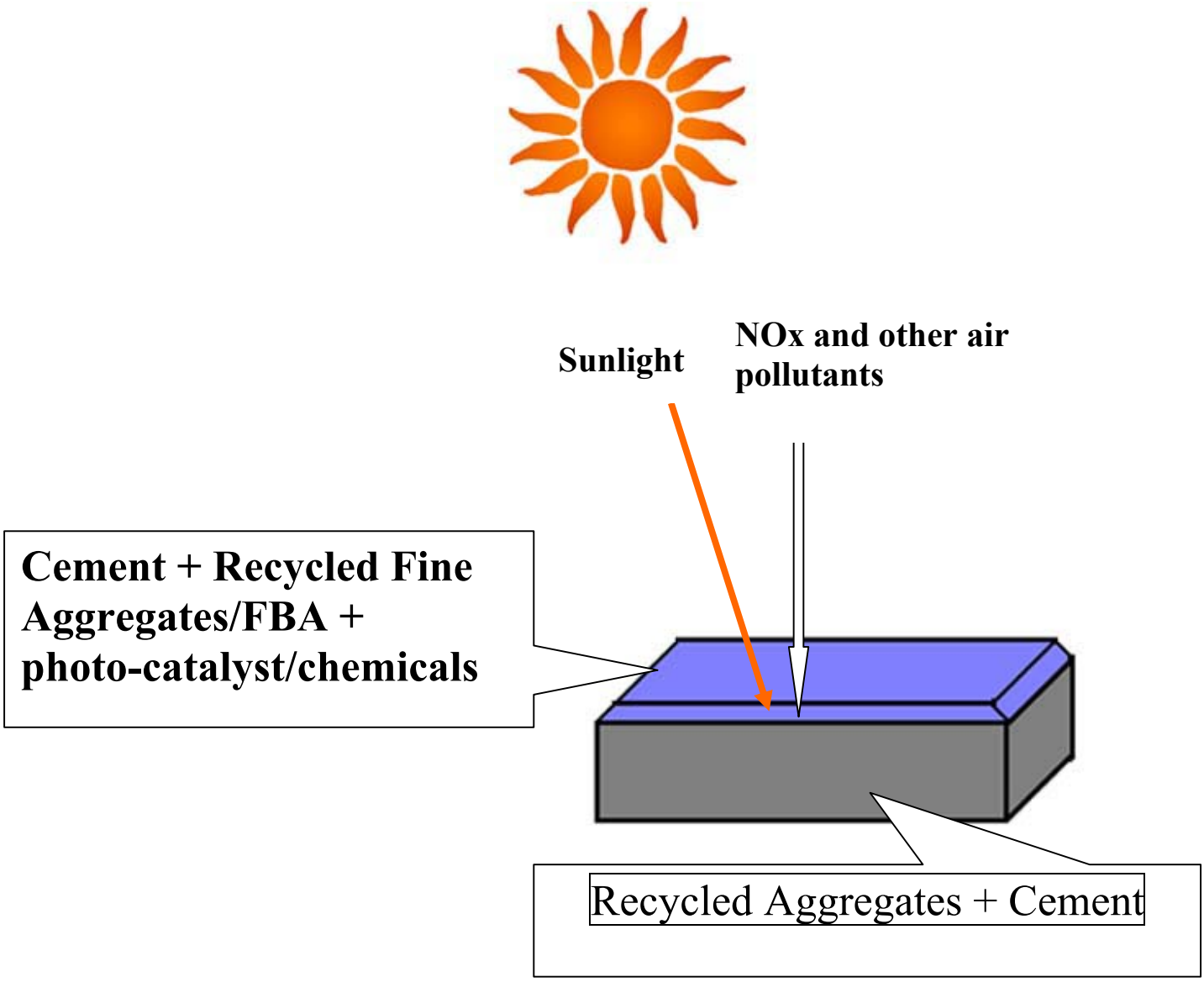
In addition, the research team at PolyU is also looking into ways to tackle the growing air pollution problems in Hong Kong using the above developed technology. Hong Kong

faces similar serious air pollution problems as other major international cities such as Los Angeles, Mexico City, Tokyo and London. The growing concern is largely due to having to provide habitats and transportation for a high population density of seven million people within an area of about 1,000 square kilometers. The numerous buildings in the city hinder and prevent the circulation of air at the street level.

To tackle this problem, the team has tried and successfully developed an air-cleaning paving block by the combined use of recycled aggregates with the incorporation of a small quantity of photo-catalyst. The block is able to remove low concentration air pollutants such as NOx via the photocatalytical reaction. The removal of Nox begins when the surface of the block is irradiated by sunlight. Active oxygen as a result is generated. Active oxygen has a strong oxidising efficiency and oxidises NOx in the air into nitrate ions. The resultant nitrate ion would then be washed away by rain. This technology requires no driving energy, minimal maintenance actions and can work throughout the year. Although the blocks have not yet been put to use, laboratory tests indicate that their Nox removal efficiency has the ability to reach about 50%.

Flow Chart Showing the Production of Environmentally Friendly Paving and Partitions Blocks from Construction and Demolition Wastes




Sunlight
NOx and other air pollutants
Cement + Recycled Fine Aggregates/FBA + photo-catalyst/chemicals
Recycled Aggregates + Cement


DANGER

Photographic records of Paving Blocks (Cheung Sha Wan Road).

Comparison of recycled aggregate pavers(pink colour) with Correctional Services Department's pavers(red colour).