

**For discussion
on 24 June 2011**

Legislative Council Panel on Transport

**Improvements in the Design of
Block Paving for Pavements and Its Foundation**

PURPOSE

This paper briefs Members on the improvements in the design of block paving for pavements in Hong Kong and its foundation.

EVOLUTION OF BLOCK PAVING

2. In the early 1980s, over 90% of pedestrian pavements in Hong Kong were cast insitu concrete. Other materials such as granolithic paving, concrete blocks or concrete slabs were not commonly used. Insitu concrete is a versatile footpath surfacing material for general purpose, offering simple, cheap and basically satisfactory results, particularly for sites which are congested with many manholes and columns, leaving very small pavement areas for paving.

3. However, despite the practicality of insitu concrete, it is monotonous as variation in design is difficult due to technical and material constraints. Moreover, insitu concrete reflects dazzling sunlight, causing discomfort to the eyesight of pedestrians in the strong glare of the sun. More importantly, utility trench works are quite common as there are many underground utilities over the territory. Breaking up the insitu concrete pavement creates construction wastes and excessive noises. Moreover, considerable time is required for the concrete to set and cure in the course of reinstatement. These cause inconvenience and nuisance to the general public. After reinstatement, uneven colour in the concrete pavement also makes the pavement even more unsightly.

4. To address the above problems, the then Highways Office¹ began to study the quality and performance of pedestrian pavements in Hong Kong in 1982. It conducted survey of existing literature and inquired of overseas specialists and suppliers to carry out an overall assessment of trends and practices of pedestrian paving works at that time. The study revealed that there was a trend towards building pedestrian pavement using precast paving units bedded on sand, which was quite popular overseas.

5. To determine whether the use of precast paving units was suitable for Hong Kong's conditions, the then Highways Office arranged for trials on their use under different local conditions, including central business areas (such as D'Aguilar Street in Central), market areas (such as Luen Wo Market in Fanling), and areas where there were a large variety of street furniture (such as tree grilles, pedestrian railings, posts that support traffic lights, traffic signs, speed enforcement camera etc.). Site trials revealed that precast unit paving was generally suitable in the Hong Kong context. Contractors could cope well with laying the precast units, and the pavement performed well after laying and remained in good condition even after utility trench excavation and reinstatement. Based on the findings, Highways Department (HyD) decided to promote the use of precast block paving in pavement construction and prepared specification and standard drawings on the basis of the outcome of the trials. Since then, block paving has steadily become the commonly adopted method for the construction and reinstatement of pavements.

PROS AND CONS OF BLOCK PAVING

6. Nowadays, paving blocks are manufactured in a wide range of sizes, shapes, thickness, colours, surface textures, and patterns. Paving blocks can be made of concrete, clay and rock quarry products (predominantly granite), depending on the natural resources available and the aesthetics requirements. As concrete paving blocks are relatively cheaper than other types of paving blocks, and with the introduction of various environmentally friendly techniques in their production in recent years (see paragraphs 12 to 15 below), designers are encouraged to use the more common concrete paving blocks. Examples of the use of concrete block paving are in **Annex I**.

¹ The work on improving the design of block paving for pavements and the foundation was the responsibility of the then Highways Office in Engineering Development Department up to 31 May 1986. Since 1 June of the same year, the Highways Office became a separate department, i.e. the current Highways Department.

7. Block paving is particularly suitable for applications at the following locations :

(a) Areas frequently disturbed by utility openings

Paving blocks used in pedestrian pavements can be lifted and re-laid without the need to use noisy concrete breaking machines to break the concrete. This can minimise the noise and dust nuisance associated with the breaking of insitu concrete pavements. Such arrangement is not only low in cost but also more environmentally friendly.

The block paving pavements can be re-opened for public use immediately after reinstatement. Given the environment in Hong Kong which rarely allows sufficient time for the curing of cast insitu concrete for pavements, the time required for the curing of cast insitu concrete pavements and the cooling of bituminous materials for road surface can be avoided by using paving blocks. This advantage is particularly relevant to Hong Kong's conditions.

(b) Locations where aesthetic appearance of the paved surface is important

Paving blocks offer unique aesthetic benefits by the introduction of a wide range of shapes, colours, texture or patterns which harmonize with and enhance the aesthetics of our cityscape, contributing to a pleasant environment. In addition, there is no noticeable colour or texture difference between the original and the reinstated areas of the pavement, thus enable the maintenance of the original appearance of the pavement.

RECENT DEVELOPMENTS

Measures to address stepping

8. Concrete block paving is commonly laid on a layer of sand bedding of 20 to 30 mm thick with joints between paving blocks also filled with sand. Experience however shows that stepping could gradually develop between adjacent paving blocks, and could cause inconvenience to

pedestrians if the stepping becomes large. Common causes of stepping include the settlement of service trenches, as well as frequent heavy loading/unloading activities and illegal parking on pavements, causing stress to the surfaces.

9. HyD therefore carried out relevant study to address the problem. From laboratory testing, site trials and reference to overseas experience, it was found that stability of the bedding can be greatly improved by adding a small amount of cement to the sand. As this can effectively address many stepping problems, since 2008, HyD has made it a standard practice to add cement to the sand bedding of block paving.

10. There are special circumstances where stepping persists due to poor soil conditions. To cope with these extraordinarily difficult spots, HyD conducted studies and a series of site trials on the use of geogrids to reinforce the bedding of block paving. A geogrid is a net made of durable textile that can interlock with surrounding soil to reinforce the bedding. HyD found that stability of the bedding can be effectively enhanced by adding a layer of geogrid reinforcement thereunder. This technique can restrict stepping between the paving blocks to within a few millimetres.

Introduction of environmentally friendly techniques

11. Use of paving blocks itself is an environmentally friendly measure that can minimise the noise and reduce the construction time of trench works. Paving blocks can be reused after being lifted from the pavement for the works and hence reduce wastage. Nevertheless, HyD continues to look for opportunities to further improve the relevant techniques with a view to enhancing the environmental friendliness of block paving.

Use of recycled aggregates in concrete paving blocks

12. Local construction activities produce a large volume of construction and demolition (C&D) materials each year. The hard cores of the C&D materials (e.g. broken concrete) are suitable for replacing part of the virgin aggregates in the production of concrete paving blocks. For this, HyD has specified the use of recycled aggregates in concrete paving blocks in its maintenance contracts since 2003, and subsequently extended this requirement to all works contracts since December 2004.

Use of recycled glass in concrete paving blocks

13. Separately, glass is one of the major municipal wastes in Hong Kong (over 7 000 tonnes produced on a monthly basis) with limited recycling channels. Since all commercial glass consists of over 90% chemical element silica, which is quite similar to natural aggregates, HyD in collaboration with the Environmental Protection Department and the Hong Kong Polytechnic University conducted a research to investigate the feasibility of replacing some of the aggregates in concrete paving blocks with recycled glass. The performance of the blocks after adding different amounts of recycled glass was tested and site trials were carried out.

14. The study and the site trials concluded that fine aggregates in the concrete paving blocks, of weight not exceeding 25% of the total aggregates, could be replaced by recycled glass. There was no difference in appearance, physical properties or durability between concrete paving blocks with recycled glass and the conventional ones.

15. Having regard to the above, HyD specified the use of recycled glass together with recycled aggregates in concrete paving blocks in road maintenance contracts since October 2010. Up to March 2011, about 630 tonnes of glass were used in producing the concrete paving blocks.

Use of "featured concrete paving blocks" in areas requiring special aesthetics

16. To enhance the aesthetics of our city, HyD makes use of paving blocks of different finishes and patterns for public pavements. For locations such as central business districts and tourist areas, paving blocks of a very high quality with pleasant appearance and unique finishes, such as artificial granite blocks, are currently used.

17. With advancement in production techniques of concrete paving blocks in recent years, there is greater scope in the production of featured concrete paving blocks. When compared with the conventional concrete paving blocks, "featured concrete paving blocks" offer wider range of shapes, colours, texture and patterns that can allow the pavements to demonstrate unique aesthetics, creating a pleasing environment. They are suitable for use in areas where aesthetics requirement is of special importance. These paving blocks are more environmentally friendly, when

compared with clay pavers and granite pavers, in that they are more durable and, subject to research findings, there is room to make use of recycled aggregates and recycled glass in the production. HyD is exploring the way forward in this direction and site trial is being implemented.

18. Photos showing the “featured concrete paving blocks” are at **Annex II.**
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WAY FORWARD

19. Up to now, more than 30% of our pavements are block paving. Highways Department will continue to adopt a gradual and orderly approach, taking into account the impacts of the works on local traffic, in replacing the paving of suitable sections of pavements from cast insitu concrete to paving blocks. At the same time, HyD will continue to look for further opportunities to enhance the quality and aesthetics of block paving, and to further explore and promote the use of recycled materials in the production of concrete paving blocks to make the technique more environmentally friendly.

Highways Department
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Annex I

Examples of Concrete Block Paving

Concrete block paving with simple pattern



Concrete block paving with special pattern



Annex II

Featured Concrete Paving Blocks

