GENERAL CONSIDERATIONS IN THE CHOICE OF CONCRETE BLOCK PAVING

J W LANE

DIRECTOR : CONCRETE MASONRY ASSOCIATION

SUMMARY

The paper reviews some factors influencing the choice of concrete block paving in South Africa and comments on the contribution CBP can make to improving the urban environment.

INTRODUCTION

Over the past two decades segmental block paving has become a feature of our towns and cities. It is to be found in commercial, industrial and residential areas, in the paving of roads, driveways, footpaths, sidewalks, cycle tracks, shopping malls, plazas, parking areas and bus stops. It has also been successfully used for embankment walls, slope paving and erosion control. During this period extensive research has been carried out on the engineering characteristics and structural performance of segmental block paving. Existing pavements subjected to heavy vehicle traffic and industrial loads have been monitored and their service life shown to be satisfactory. The South African Bureau of Standards has published specifications[1],[2] relating to the quality of concrete paving blocks and permissible standards of construction. The National Institute for Transport and Road Research has published a catalogue of designs for segmental block pavements.[3]
The engineering and specification aspects have generally been satisfactorily solved, and this type of paving has a proven performance and service record, but the aesthetic use of segmented paving and the contribution it can make to improving our urban landscape is only now being appreciated.

COMPARISON OF CONCRETE BLOCKS WITH OTHER FORMS OF PAVEMENT

In certain specific areas of application block paving, with its cost effectiveness, ease of construction and maintenance, aesthetic qualities and in-service advantages, is the paving of choice.
In general it can be said that concrete block paving excels in terms of either cost or performance in the following circumstances:

* Where heavy or concentrated wheel loads are to be carried and especially where a high frequency of turning or slewing movements is expected.
* Where volume of traffic is high.
* Where subgrade conditions are poor.
* Where the pavement must withstand severe in-service conditions such as considerable temperature variations, frequent fuel, oil or lubricant spillages or extensive, significant and sustained settlement.
* Where ready access to underground services is required.
* Where the appearance and aesthetic qualities of the pavement are major design considerations.
* Where planning may require alterations in the pavement layout within the effective service life of the blocks, base or subbase.[4]

"Blocks can be manufactured either from cementitious materials e.g. lime, cement, blastfurnace slag (in the case of concrete blocks), or from a fired material e.g. clay (in the case of clay blocks). Concrete and clay blocks differ as regards tolerances, porosity, surface wear, durability, brittleness, moisture expansion and shrinkage. It is possible to obtain fine tolerances with cementitious materials which is an important factor in maintaining specified joint widths".[4]
A more detailed comparison of clay and concrete paving units used in segmental block paving is given in Appendix A.

AESTHETIC ASPECTS OF CONCRETE BLOCK PAVING

There is growing concern for the aesthetic quality of the public environment - areas such as pedestrian malls, sidewalks and carriageways - which constitute a significant proportion of the urban fabric and therefore impinge on the lives of a great many urban dwellers. It is here that CBP is making an important contribution.
Arlene Segal, in her paper "Paving the way for better environments"[5] states: "Concrete block paving has become an important tool for the urban designer in the endeavour to create better environments".
Concrete block pavers, in addition to providing a paved surface for vehicular traffic, may be used in conventional streets to emphasise important aspects such as defining space and scale. Using blocks of varying colour and texture, patterns can be created which are not only aesthetically pleasing but can lend character and distinction.
In the Hillbrow area of Johannesburg one of the most densely populated areas in the world,

a design solution involved "the upgrading of the environment through the use of coloured concrete blocks - which also provided identity i.e. the road reserve became an extension of the semi-private - space of the buildings; reduced the scale of the space through the definition of area by change in colour, re-organised the parking area more effectively, demarcated the parking bays in coloured block and used colours to symbolise different elements on the surface e.g. road/charcoal, parking bays/grey, pedestrian area/red - vehicular access/plum. The whole integrated with landscaping and lighting to produce an aeshetic environment of quality".(5)

In the re-development of an historic square, which had been used as a parking area for heavy vehicles and was in a state of disrepair, the design solution required that the scale of the square be reduced to improve the proportions. Concrete pavers in a variety of colours and of varying shape - square, cobblestone and bevelled - were used with dramatic effect to depict the historic character of the square.

In the re-development of Lenasia Town Centre concrete pavers and bricks were used throughout. The coloured blocks provided a sense of scale and formality, defining specific areas and integrating a previously fragmented environment into a cohesive whole.

The above examples reflect but a few of the many ways in which CBP can be used to upgrade existing public spaces, while in the designing of new areas and streetscapes its visual impact is receiving increasing recognition.

CONSTRUCTION

It is generally accepted that one of the greatest problems confronting South Africa is the creation of job opportunities for a rapidly growing population, especially for those people in our society who do not have marketable skills in a new technological age.

The laying of paving blocks has not yet been mechanised in this country and is therefore a labour intensive operation. This, coupled with the fact that capital outlay is minimal, makes CBP particularly acceptable to government and semi-government agencies.

Generally speaking production rates of laying in open areas such as roads is 300 to 400 m² per day with a workforce consisting of one supervisor with ten to fifteen semi- or unskilled workers. The work commences with laying ofthe bedding sand on the compacted and levelled formation and is completed with the opening of the area for use.

OVERALL TRENDS IN THE USE OF CONCRETE BLOCK PAVING

An analysis of sales statistics for the period 1982-1987, which were made available by Concrete Masonry Association member companies, reveal the following:

In 1983 50mm thick coloured pavers of rectangular shape accounted for 50% of the market, their main use being in domestic driveways, sidewalks and pedestrian areas. In 1987 the percentage had dropped to 16%, the same percentage as 60mm thick coloured blocks of the indented type. At present 60 and 80mm thick uncoloured pavers of indented shape comprise 50% of the market. These are mainly used in industrial hardstandings and in parking areas for commercial and shopping complexes. 100mm thick blocks are rarely used. Most 50mm thick blocks are coloured while 80mm blocks are a natural grey colour.

Basic pigment colours are black, brown, red and yellow which are combined in various proportions to produce different standard colours such as dark grey, charcoal, light brown, dark brown, purple brown, brown-red, light red, beige and ochre. Exotic colours such as whites, yellows, greens, blues, oranges and reds, though expensive, are available to order.

CONCLUSION

The paving block market is steadily increasing. The performance to date of CBP in providing a durable, low maintenance surface for pedestrian and vehicular traffic has resulted in wide acceptance. Though it forms only a small part of the overall market, the aesthetic use of CBP holds promise for increased use.

BIBLIOGRAPHY

1. SOUTH AFRICAN BUREAU OF STANDARDS. **Standard specification for concrete paving blocks.** SABS 1058-1985.
2. SOUTH AFRICAN BUREAU OF STANDARDS. **Standard specification for civil engineering construction. Segmented paving.** SABS 1200MJ-1984.
3. CLIFFORD, J M. **Structural design of segmental block pavements for southern Africa.** Pretoria, National Institute for Transport and Road Research, 1984. RP/9/84.
4. SHACKEL, Brian. (University of New South Wales, Sydney.) Personal communication.
5. SEGAL, A. **Paving the way for better environments.** Paper, unpublished, presented at Concrete Masonry Association Symposium, Aesthetic aspects of paving block usage, Halfway House, 1987.

Appendix A

Comparison of paving units of different materials as used in segmented paving (SABS 1200 MJ)[1]

ATTRIBUTE	MATERIAL	
	BURNT CLAY	CONCRETE
General quality	No SABS specification on burnt clay paving units. Muted, earth, more natural colours	SABS 1058 'Concrete paving blocks'[2] Can be bright - sometimes artificial (exotic). Easier to vary colour in manufacture. Important in design of artistic mosaics and demarcating lines in paving. (Importance of using contrasting colours, such as red against grey)
Texture	Smooth	Smooth to coarse
Shape	Mainly rectangular (S-C). Chamfers only on limited number of pavers	Variety of shapes (S-A, S-B, S-C)[3] With or without chamfers[4]
Dimensional accuracy	Average to poor (±7mm length ±4mm width for class FBS)[5]	Good (±2mm)[2] See note (6)
Ease of laying	Difficult to maintain line and joint width with Shape S-C	Joint widths (2-6mm) easy to maintain. Shape S-A easiest to lay and maintain in position on compacting
Laying patterns	Mainly stretcher, otherwise wide joints result	More variety - herringbone, stretcher, basket weave
Durability		
Moisture movement	Likelihood of moisture expansion - may cause uplift of paving laid between rigid restraints	Moisture loss causes shrinkage - not significant
Wear resistance	Varies but generally good while surface veneer intact	Varies
Skid resistance	Varies. Some pavers become slippery with wear	Varies (generally better than clay)
Chipping/spalling	High if units touching	Satisfactorily low
Creep (horizontal movement)	High	Low
Luminance (daylight and artificial light)	-	High with light colours - important in pedestrian road crossings
Replacements	Units should be kept in stock for replacements in aesthetically important paving	Matching possible at later stage but may require experimentation and allowance for colour shift[7]
Cost		
Materials	Varies	Varies
Labour	Requires more labour because of difficulty in laying	
Construction		
Laying	Difficult to lay to line because of shape, and bowing and jutting of units	Easier to lay because of dimensional accuracy. Interlocking shapes permit easier laying to line
Compaction	Vibrating compactor spoils surface, causes chipping. Units move under compaction	Suitable for compaction by vibration
Standards	Not covered in SABS code	Covered in SABS 1200MJ - "Segmented paving"

NOTES

(1) Segmented paving is a method of construction by which paving units are laid on bedding sand, with a joint width between adjacent blocks of 2-6mm and the joints filled with sand.

(2) South African Bureau of Standards. **Standard specification for concrete paving blocks.** SABS 1058:1985.

(3) Type S-A: Allows geometrical interlock between all vertical faces of adjacent blocks.
Type S-B: Allows geometrical interlock between some vertical faces of adjacent blocks.
Type S-C: Allows no geometrical interlock between the vertical faces of adjacent blocks.

(4) Chamfers permit easier handling and laying of units, reduce likelihood of spalling and chipping of surfaces and reduce suction of joint sand.

(5) South African Bureau of Standards. **Standard specification for burnt clay masonry units.** 3rd rev. SABS 227:1986. There is no SABS standard specification on "Burnt clay paving units" and masonry unit tolerances apply in practice.

(6) Paving laid to close tolerance joint widths of 2-6mm permits stiffening of pavement and better distribution of traffic loadings.

(7) Under weathering and abrasion a colour shift occurs.