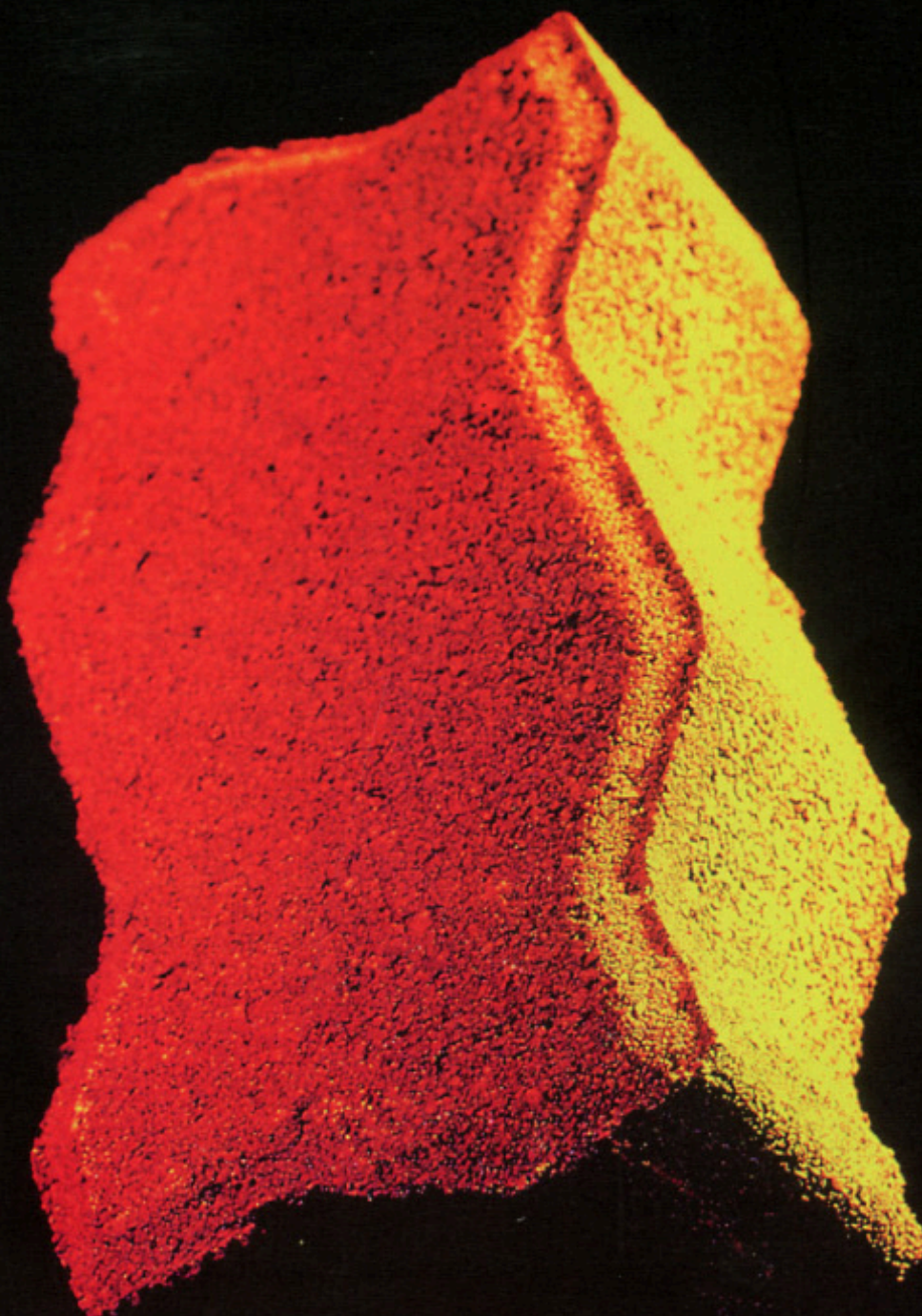


CONCRETE BLOCK PAVING

Book 1 – Introduction



A walk-over in cost, looks and
durability for Concrete Block Paving





Concrete Block Paving
Book 1: Introduction
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1 INTRODUCTION

Segmented concrete paving is a system of individual shaped blocks arranged to form a continuous hard-wearing surface overlay.

Over the past two decades, paving composed of segmental blocks has become a feature of our towns and cities. It is to be found in commercial industrial and residential areas, in the paving malls, plazas, parking areas and bus stops. It has been successfully used for embankment walls, slope protection 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 bus traffic and industrial loads have been monitored and their service life shown to be satisfactory. The South African Bureau of Standards has published specifications relating to the quality of concrete paving blocks and required standards of construction. The Committee of Urban Transport Authorities has published a catalogue of designs for segmental block pavements.

The engineering and specification aspects have 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 improve our urban landscape is only now being appreciated.

HISTORY

Although pavers made out of concrete may be a new product, the use of paving blocks as a surfacing material is anything but new. The first record of stone paving dates back to 4000 BC in Assyria and by 2000 BC, flagstones were being used to pave village streets. Cobblestones were the traditional method of stone paving, being uncut and often water-worn stones or large pebbles about 150mm in size. Later hand-cut stone blocks were introduced.

Road-making using brick was common in Mesopotamia in 2000 BC and clay brick paving was in use in India in 300 BC. It was the Romans who introduced hexagonal-shaped flagstones as a surface course, so the concept of shaped, rather than rectangular blocks, is certainly not new.

Perhaps the most famous of all Roman roads is the Appian Way, built by Roman engineers in 312 BC. The 377 kilometre road was surfaced with tight-fitting paving stones that still carries traffic between Rome and Italy's south-eastern port of Brindisi.



Roman road built 2000 years ago using segmented paving. These are still in existence today.

Concrete paving blocks were first manufactured in the Netherlands in 1924. It was probably World War II that led to the growth of concrete blocks as a paving material. Large areas of the Netherlands were destroyed during the War and, because clay bricks were in short supply (and what was available was being used to rebuild housing), concrete blocks were introduced as an alternative. Subsequently, concrete block paving (cbp) became recognised as a paving material in its own right.

The research carried out by Shackel in the late '70s and early '80s remains the most comprehensive yet conducted into the performance of concrete block paving. A hierarchy of block shapes was developed, the existing design curves were examined, the role of the bedding and jointing sands was investigated in earnest, and various base and sub-base materials were tested. Most of the research by Shackel was carried out at the CSIR in South Africa. This has resulted in South Africa being recognised as a world leader in concrete block paving.



Some of the best known earlier installations in South Africa, Aggeneys and Harrismith Phuhaditjhaba Roads are still performing well.

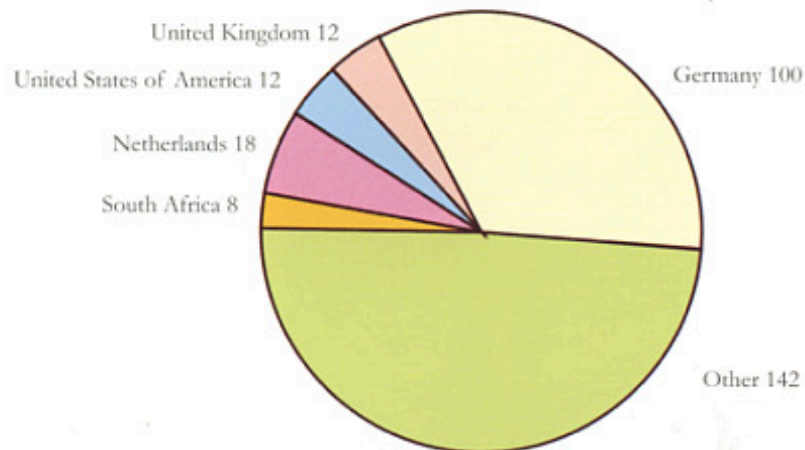


Figure 1: Use of pavers worldwide (in millions of square metres per annum).



2 APPLICATIONS OF CONCRETE BLOCK PAVING

Concrete pavers are a versatile paving material, which due to the availability of many shapes, sizes and colours, has endless streetscape design possibilities.

The use of concrete block paving can be divided into the following categories:

ROADS

- Main roads
- Residential roads
- Urban renewal
- Intersections
- Toll plazas
- Pedestrian crossings
- Taxi ranks
- Steep slopes
- Pavements (sidewalks)

COMMERCIAL PROJECTS

- Car parks
- Shopping centres and malls
- Parks and recreation centres
- Golf courses and country clubs
- Zoos
- Office parks
- Service stations
- Bus termini

- Indoor areas
- Places of worship

INDUSTRIAL AREAS

- Factories and warehouses
- Container depots
- Military applications
- Mines
- Wastewater reduction works
- Quarries
- Airports and harbours

DOMESTIC PAVING

- Pool surrounds
- Driveways
- Patios
- Townhouses and cluster homes

SPECIALISED APPLICATIONS

- Cladding vertical surfaces
- Stormwater channels
- Embankment protection under freeways
- Roof decks

The change in texture of the road surface at **intersections** produces an audible change in road noise, thereby alerting drivers to the fact that they are approaching the intersection. The surface characteristics of the blocks offer a greater resistance to skidding in wet weather, largely due to the chamfered joints of the blocks and the rapid dissipation of surface water. Should remedial work be necessary, e.g. on underground services, blocks can be removed and replaced without impairing the overall appearance of the road pavement. The use of red blocks on roads at the approaches to the intersection produces a distinct visual difference, thereby promoting care and awareness among drivers.

Major road construction using concrete block paving. A technically excellent surfacing, which also provides community upliftment in the form of job creation during construction (see section 3).

At **pedestrian crossings**, a designer can place a different texture or colour from that of the street or parking area. This distinguishes pedestrian areas from vehicular areas, providing a safe haven for the pedestrian, especially those with physical handicaps.





ROADS

Sidewalks *accommodate foot traffic and other activities such as vending public art, outdoor cafes, etc.*



Main roads *More and more municipal roads are being paved with concrete block paving. Not only does concrete block paving provide a functional, hard-wearing surface requiring minimum maintenance, but it also harmonises with the environment.*



Toll plazas *By using concrete block paving differing in colour from that of the conventional road surfacing, the pay toll section becomes highly visible, even from a distance, alerting the driver to the pay point.*

Differences in texture resulting from the shape and laying pattern of the blocks produces changes in the noise level, further increasing driver awareness.

The concrete block paving also provides a safer road surface for braking than conventional surfacing materials.

ROADS

*Concrete block paving is the ideal material for use in the construction of **steep slopes**.*



*Concrete block paving has been used successfully on a number of **urban renewal** projects (both locally and overseas) to uplift the city centre.*



*Concrete block paving is used to enhance the most prestigious **residential areas**.*





COMMERCIAL PROJECTS

Car parks are typically exposed to the full rigours of sun and rain. Unlike asphalt surfaces, concrete block paving shows little weathering or deterioration under these circumstances and yields low maintenance costs. An imaginative designer can overcome the drab monotony too often characteristic of parking lots, by exploiting the wide range of colours and textures provided by concrete pavers. Another advantage of concrete block paving is the maintenance-free demarcation of parking areas.



At **shopping centres**, concrete block paving offers a clear demarcation to help channel pedestrian traffic and to blend in with the shopping environment.



Taxi ranks are areas which require hard-wearing surfaces and, if properly constructed, should last decades with minimum maintenance. Concrete block paving is a lighter colour than asphalt, which keeps temperatures lower during hot summer days. Demarcated lanes ensure orderly queuing, loading and unloading of passengers.

COMMERCIAL PROJECTS

*Concrete block paving provides an attractive hard-wearing surface for **parks**. It blends with the environment and breaks up the harshness of conventional hard landscaping.*



*Concrete block paving blends in perfectly with the environment, making it the ideal material for landscaping at **golf courses and country clubs**.*





COMMERCIAL PROJECTS

*Coloured pavers can be put to good use to create **patterns** and even **pictures**.*



*An increasing number of **office complexes** are being constructed in residential areas and concrete block paving plays an important role in blending the offices with the surrounding environment. This helps foster a neighbourly spirit.*

COMMERCIAL PROJECTS

*Concrete block paving is used extensively for **service station** forecourts not only because it resists the oil and petrol spillages, but also because of its load bearing capacity and ability to accommodate slewing stopping and starting movements of vehicles.*



*To the municipal engineer, **bus termini** present a perennial design problem. Typically buses comprise some of the heaviest vehicles on normal roads and streets. These slow-moving vehicles continually stop and start at the same locations and can quickly cause rutting in flexible pavements. This problem is aggravated by the spillage of oil and lubricants typical of bus operations, which leads to fluxing and softening of asphaltic materials. To overcome these problems, engineers are increasingly turning to the use of interlocking concrete block paving.*





COMMERCIAL PROJECTS

*Concrete block paving provides a functional, attractive and cost effective floor at **education centres**.*



*Concrete block paving provides a cost effective yet aesthetically pleasing solution to the extensive parking areas required for **places of worship**.*

INDUSTRIAL AREAS

At factories and warehouses concrete block paving has the ability to withstand concentrated heavy loads and to resist the wheel loads of off-road vehicles such as cranes and forklifts.



Container depots are subjected to some of the heaviest traffic loading as well as heavy long-term static loading. Throughout the world, concrete block paving is recognised as the most suitable and cost effective method of surfacing these areas.



At factories and warehouses, concrete block paving has the ability to withstand concentrated heavy loads and resist the wheel loads of off-road vehicle such as cranes and forklifts.





INDUSTRIAL AREAS

*Even the tremendous forces induced by the slewing and turning of tanks in **military applications** do not damage concrete block paving.*



Mechanised mining requires a hard-wearing surface capable of carrying extremely high loads and a surface that can be laid and opened to traffic immediately. Concrete block paving is the logical choice.



*Concrete block paving reduces the maintenance of **wastewater reduction works** and other similar amenities.*

INDUSTRIAL AREAS

Airports and harbours use concrete pavers because they halve the construction time when compared to removing and replacing asphalt. Pavers can be used to mark a distinct location for the pilot to park. Chamfers on the pavers contribute to their ability to shed surface water quickly.



Concrete block paving provides a tough hard-wearing surface. Used for roads in **quarries**, it reduces maintenance of the vehicles as well as lowering the dust level. A further major advantage is that when the road alignment needs to be altered to suit the quarry operation, the block can be lifted and relaid along the new route.





DOMESTIC PAVING

*Concrete block paving provides functional yet very attractive **pool surrounds**.*



*A **driveway** paved with concrete block paving will enhance the value of property. Concrete block paving is both attractive and functional.*



DOMESTIC PAVING

Concrete block paving blends in with the landscape and increases the attractiveness and value of townhouses and cluster homes.





SPECIALISED APPLICATIONS

Concrete block paving is not limited to flat, level surfaces, but can be laid on near-vertical surfaces to create interesting **architectural features** as shown in the water feature on the left and the island below.



The **crocodile farm** near Brits used concrete block paving extensively to pave the entire area. Concrete block paving was chosen because it provided a non-destructible, non-slip surface.

SPECIALISED APPLICATIONS

Embankment protection alongside freeways. The use of concrete block paving is a very effective and quick method of slope protection.



Concrete block paving using specially developed blocks has been used successfully in lining stormwater channels.



Century City roof deck with a good detail across the expansion joint.





3 LABOUR-BASED CONSTRUCTION

The Reconstruction and Development Programme (RDP) sets out many goals aimed at bringing about fundamental change in South Africa. Amongst these goals are:

- *Development of infrastructure*
- *The creation of employment*
- *The development of entrepreneurial skills and empowerment of the people.*

The construction of roads using concrete block paving (cbp) satisfies many of the goals of the RDP. Concrete block paved roads are more labour-intensive and less capital-intensive than alternative methods of surfacing. The construction process is relatively straightforward and can be divided into a number of tasks.

Furthermore, the skills acquired can be used not only for paving, but for other building and masonry work.

The advantage of constructing roads using concrete block paving is that the methods of construction do not need to be adjusted to make it labour-intensive, it already is so.

The construction of roads using concrete block paving provides benefits to the community, which extend much further than the provision of roads and the creation of employment. It develops a sense of pride and ownership amongst the community. As a result, the sidewalks are grassed, houses painted and the entire area is uplifted. This is a phenomenon observed not only here in South Africa, but also overseas in countries such as Australia and Colombia.

A number of major projects in South Africa have already been successfully completed, and the improvement in the community and the neighbourhood is remarkable.

Experience has shown that where the community is involved in the planning and construction of a concrete block roadway, 25—40% of the total project cost will remain in the community. This will help spawn secondary and tertiary industries resulting in an economically self-sufficient community.



Township roads being constructed in Ntuzuma, near Durban, using concrete block paving. Not only does this provide a high-quality long-lasting road with low maintenance, but the construction of roads using concrete block paving creates employment and develops a sense of pride and ownership in the community.

3 LABOUR-BASED CONSTRUCTION

Many South African township roads are unpaved, resulting in unhealthy and squalid living condition. The quality of life is poor and the determination to improve one's lifestyle is low.



Concrete block paving provides an attractive, long lasting maintenance free road. Belabela is a good example of what can be achieved.

Besides the obvious visible benefits that a road brings to a township, where the people have been involved in the reconstruction of these roads, there is a sense of ownership and pride in the neighbourhood, resulting in a total upliftment of the area as is evident from these photographs in Belabela, taken two years after the road was completed.





4 PATTERNS IN CONCRETE BLOCK PAVING

Concrete block pavers come in a variety of shapes and sizes (See Figure 2 for a list of shapes available).

If we consider for a moment the aesthetics of concrete block paving, three fundamental aspects present themselves:

- Shapes
- Colours
- Patterns

Applying just a few variables to each aspect presents a myriad of options from which even the most discerning client may happily choose.

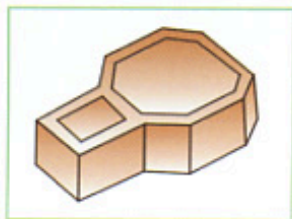
No amount of text or visual material could do full justice to these options; accordingly, this self-explanatory presentation serves purely to stir the imagination regarding the limitless possibilities of concrete block paving.

Indeed, based on the above technical elements, together with aesthetic and economic criteria, producers worldwide and in South Africa undertake continuing research to develop new concrete paving products that enlarge these choices further.

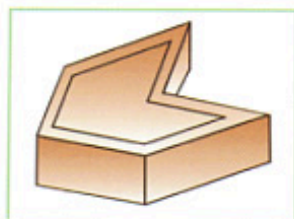
Only a few of the shapes available to the South African market are presented here and details of those not shown may be obtained from the manufacturers.

SHAPES

The illustration below shows the range of available shapes and trade names.

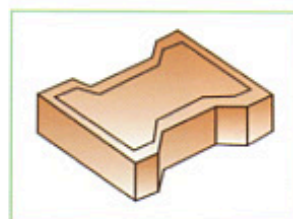


Corolink
Keystone
Uni-Decor

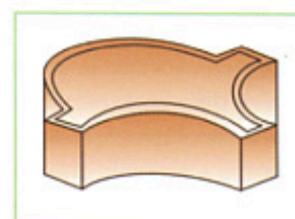


Unique
Romanpave

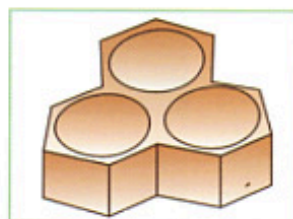
Aristocrat



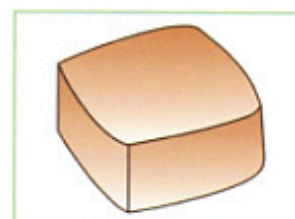
Satinpave



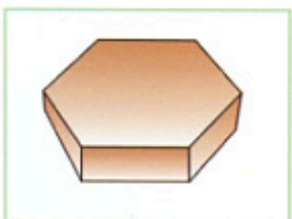
Conleaf



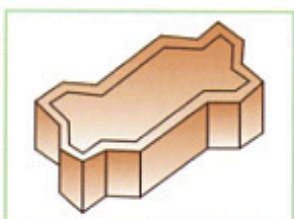
Clover
Tiffany



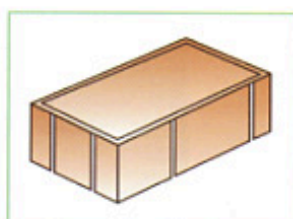
Classic Cobble Cape Cobble
Cobble Craz 'E' Classic Cobble
Concobble Double Cobble
Village Cobble Court Stone



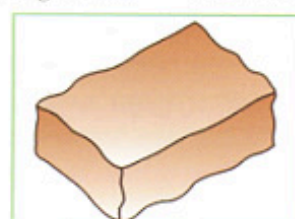
Honeystyle



Corolock Double zig zag
Double Lock Vibrolock
G-Blok Craz 'E' G-Blok
Roadliner



Bevel Brick Masonique
Bond Brick Rectangular
Classipave Stylepave
Corostone Traditional



Bush Stone Footstone
Coroplaza Rumblestone
Corovilla Trojan
CottageStone Savannah
Country Block Spartan

Figure 2: Summary of shapes available

COLOURS

Illustrated below are some of the range of standard colours available. Many pigments are used by South African paving block manufacturers which, together with aggregates from different areas and various

cements, produce a huge variety of colours from which to choose. Multiblends are produced by the incomplete mixing of pigments and give a pleasing effect when laid over large areas.



Red



Charcoal



Grey



Tan



Brown

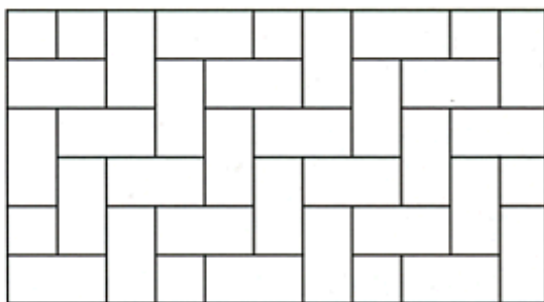
PATTERNS

Patterns are determined by the shape of a specific paving block. The three patterns shown below are the basic patterns for the more traditional oblong or interlocking blocks.

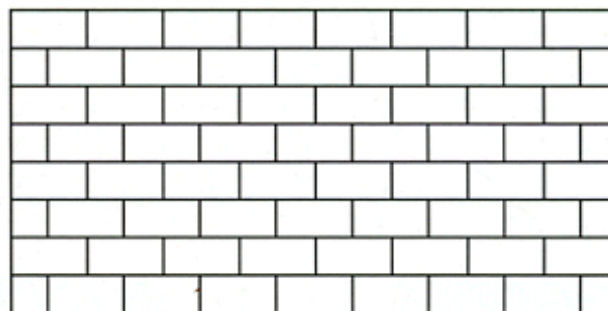
The laying pattern is an important factor in the performance of block pavements and, based on tests and field observations, it is widely accepted that blocks

laid in herringbone bond do perform better under traffic loads than pavements laid in stretcher bond or basket weave.

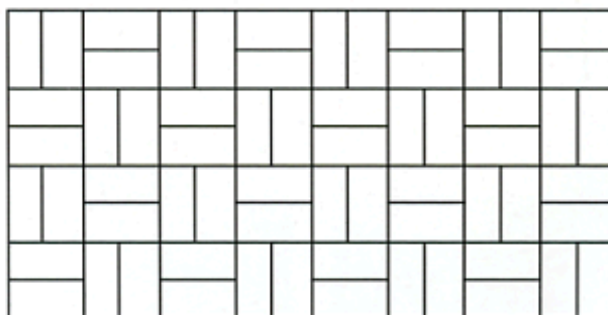
Other blocks, because of their different geometry, can produce a far greater variety of patterns. Even the simplest block, however, is perceived to produce a multitude of patterns when two or more colours are used.



Herringbone



Stretcher



Basket Weave

Figure 3: The three basic laying patterns for paving in South Africa.



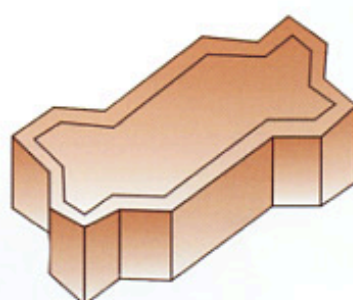
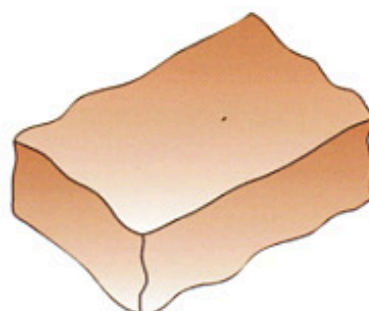
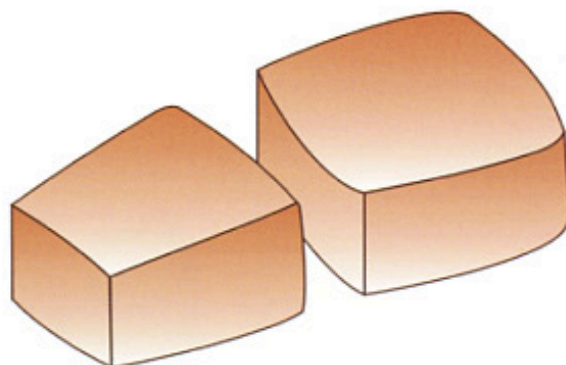
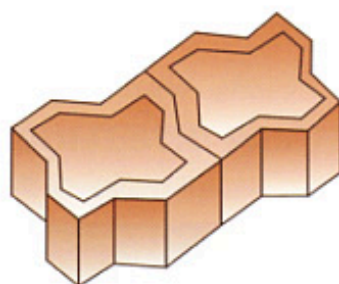
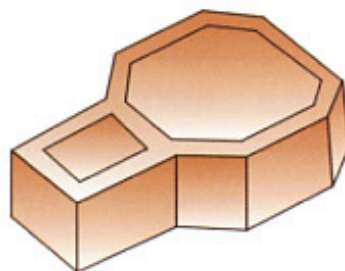
MONTAGE OF PATTERNS

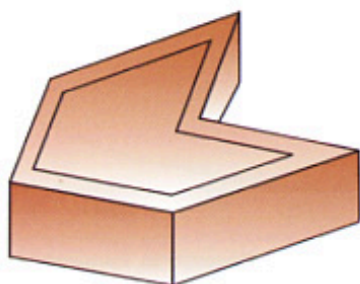
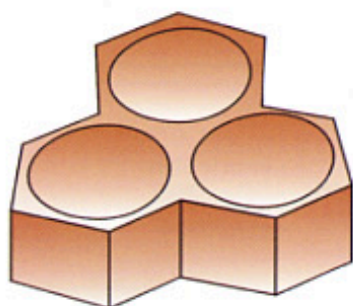
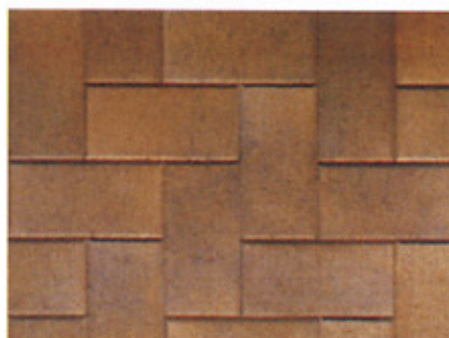
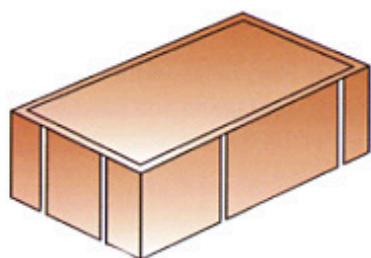
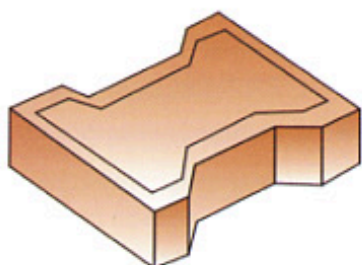
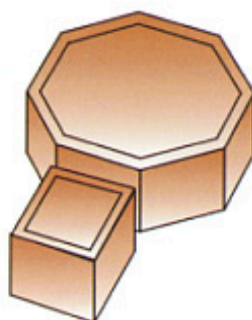
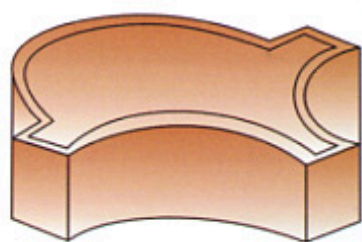






MONTAGE OF PATTERNS







5 COMPARISON OF CONCRETE BLOCK PAVING WITH OTHER TYPES OF PAVEMENT

In certain specific areas of application, block paving, with its cost-effectiveness, aesthetic qualities, ease of construction and maintenance and in-service advantages, is the paving of choice. In Table 2, a comparison with conventional flexible and rigid pavements, based on these attributes is given.

In general, it can be said that concrete block paving excels in terms of cost and 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 spillage 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 sub-base.

ADVANTAGES OF CONCRETE BLOCK OVER ASPHALT AND RIGID CONCRETE PAVING

- High abrasion and skid resistance.
- No damage from petroleum products.
- No damage from concentrated point loads or high temperatures.
- No damage by soap or detergents.

A feature of many modern pavements is the incorporation of design patterns such as coats of arms, maps, insignia, crests, animals, birds, etc, in the paving by using different coloured blocks. These artistic mosaics can be used to depict and commemorate historical events by means of maps and diagrams, patterns can be utilised to control traffic flow, while coloured blocks in playgrounds can demarcate game and boundary lines.

6 FUTURE OF CONCRETE BLOCK PAVING

The market for paving blocks is, at present, a growing one. One of the main reasons for the growth of this very specialised market would seem to be the worldwide tendency for beautification of cities, parks and gardens. This requires a modern concrete paving product, which is quick and easy to lay, and besides being aesthetically pleasing, has the advantage of excellent performance under traffic.

Figure 4 shows the growth in the concrete block paving market since its inception in the late 1950s. Because of its greater acceptance, not only for roads, driveways and parking areas, but also for other applications such as airports, harbours and mines, it is expected that this market will continue to grow. One area which promises the greatest potential, is the paving of township roads as part of the employment creation programme.

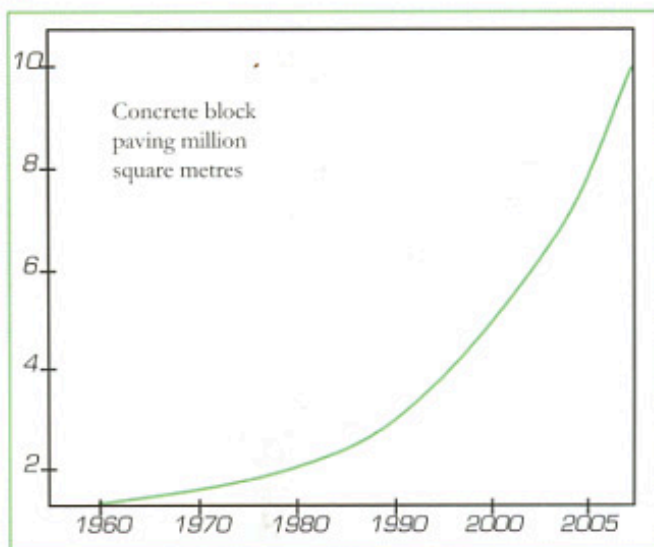


Figure 4: Growth in concrete block paving in South Africa.

PAVING DIVISION MEMBERS (FEBRUARY 2009)

PRODUCER MEMBERS

<i>Bafokeng Concor Technicrete</i>	<i>014 538 0818</i>
<i>Baybrick</i>	<i>035 792 5218</i>
<i>Bosun Brick Midrand</i>	<i>011 310 1176</i>
<i>Brick & Concrete Industries (Namibia)</i>	<i>0026 461 321 3009</i>
<i>Brickcast Industries</i>	<i>031 507 5525</i>
<i>Brickbuild T/A Panda (Botswana)</i>	<i>0026 724 42106</i>
<i>Cape Brick</i>	<i>021 511 2006</i>
<i>C.E.L. Paving Products</i>	<i>022 905 5998</i>
<i>Cast Industries</i>	<i>011 316 2375</i>
<i>Columbia DBL</i>	<i>021 905 1665</i>
<i>Concor Technicrete</i>	<i>011 495 2200</i>
<i>Concor Technicrete P.E.</i>	<i>041 372 2230</i>
<i>Conframat</i>	<i>016 987 3381</i>
<i>Corobrik</i>	<i>031 560 3911</i>
<i>Deranco Paving</i>	<i>041 933 2755</i>
<i>Inca Concrete Products</i>	<i>021 904 1620</i>
<i>Inca Masonry Products</i>	<i>043 745 1215</i>
<i>Infrasat Gauteng</i>	<i>011 652 0000</i>
<i>KZN</i>	<i>031 569 6900</i>
<i>Kopano</i>	<i>016 363 0340</i>
<i>Mobicast Mossel Bay</i>	<i>044 874 2268</i>
<i>MVA Bricks</i>	<i>012 386 0050</i>
<i>Neat Contech</i>	<i>046 624 3377</i>
<i>Stanger Brick & Tile</i>	<i>032 457 0237</i>
<i>Stone Age Concepts</i>	<i>011 740 0910</i>
<i>Vanstone Precast</i>	<i>012 541 2056</i>
<i>Watson Concrete</i>	<i>011 704 0910</i>
<i>West End Bricks</i>	<i>011 851 1828</i>
<i>Zenzele Brix</i>	<i>012 803 6884</i>

ASSOCIATE MEMBERS

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<i>Smartstone</i>	<i>011 310 1161</i>

CONTRACTOR MEMBERS

<i>Daron Construction</i>	<i>034 955 1333</i>
<i>Galaxy Paving</i>	<i>011 815 1175</i>
<i>Mondo Paving & Retaining Walls</i>	<i>011 467 1111</i>
<i>PYW Paving</i>	<i>031 763 5771</i>
<i>Roadstone Civil & Paving</i>	<i>011 683 7080</i>
<i>S A Paving Gauteng</i>	<i>031 705 5123</i>
<i>The Paving Creations</i>	<i>031 765 4083</i>
<i>Vesles Civils</i>	<i>012 662 3030/1</i>
<i>Valcal International</i>	<i>011 867 2471</i>

