



Concrete  
Manufacturers  
Association

PROJECT REVIEW

# HEAVY DUTY APPLICATIONS OF CONCRETE BLOCK PAVING





# INTRODUCTION

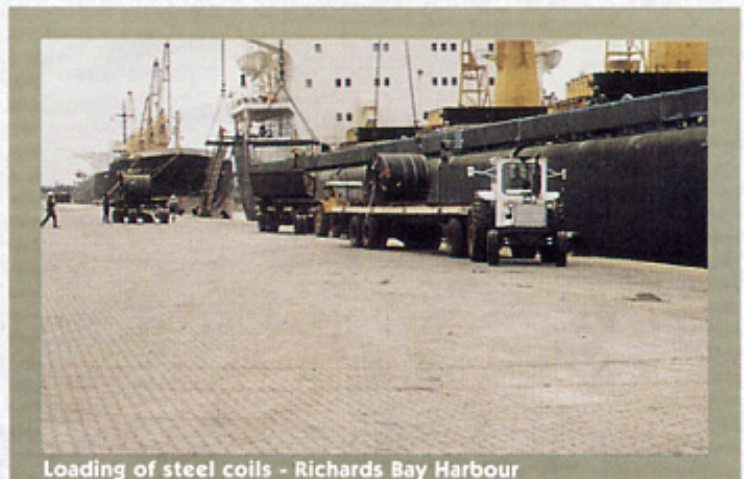
## PROJECT REVIEW - HEAVY DUTY APPLICATION OF CONCRETE BLOCK PAVING

Although concrete block paving (cbp) is receiving wide acceptance for many uses of paving, from driveways and footpaths to busy roadways, it is in the heavy duty applications where the full potential of cbp capabilities is clearly shown. Cbp has a number of characteristics that make it ideal for such applications namely:

- cbp has a hard wearing surface, able to resist abrasion from the traffic:
- cbp is resistant to most chemicals, including petrol, diesel and oil spillage:
- cbp has a low initial cost combined with the low maintenance cost.

This project review looks at a number of pavements which have been constructed in very harsh environments.

After decades, under very high traffic and with virtually no maintenance, these cbp pavements are performing very well, and will continue to perform well into the next century.





## BELLVILLE GOODS YARD

Bellville Goods Yard is the central handling depot for most of SATS cargo traffic between Cape Town and the hinterland. Typical daily traffic includes +/- 220 thirty tonne vehicles as well as 54 fork-lifts of 10,5 and 14 tonne. Besides the normal movements there is static loading under parked vehicles. The design chosen to accommodate this traffic includes 150 mm cement stabilised crusher run base with 80 mm grey interlocking (type S-A) concrete block pavers laid in herringbone pattern (see figure 1 for details).

36 500 m<sup>2</sup> of paving was designed and installed during 1987 / 88. To date, the maintenance has been nil and the paving has performed very well, as the photographs below will testify.

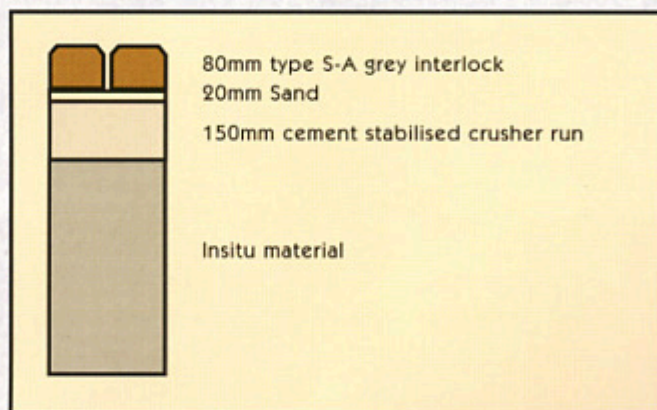


figure 1





## HIPPO QUARRIES / PENINSULA QUARRIES

This project involved the laying of 5000m<sup>2</sup> of concrete paving blocks for an extremely heavily trafficked area. Loads from 10 to 20 tonne per truck traverse this route hourly. Dump trucks with chains over the tyres rumble over the surface with loads of up to 25 tonne. No sign of cracking is evident. Since the laying of the pavements in 1982 nearly 10 million tonne have driven over the paving.

The pavement was constructed of 1m of crushed rock from the quarry which was spread and compacted with a final layer of crusher run. 80mm grey interlocking blocks (35MPa) were laid in herringbone pattern on top of a 35mm bedding sand layer.

The concrete paving blocks which were laid 13 years ago and which have also been subjected to adverse weather conditions during the winter rains show no signs of excessive wear or abrasion. To date not one paver has been replaced.





## COAL MINE - EASTERN TRANSVAAL

Open cast coal mining requires numerous haulage roads to be constructed in order to transport the coal from the open-cast mine to the stockpile areas. While some of these roads are operational for only relatively short durations, the main haulage roads are required to serve the mine for design lives of up to 20 years.

Traditionally, these roads which are now required to support coal haulers of up to 240 tonne capacity, have been well constructed but left unsurfaced. Therefore, they require a great deal of expensive maintenance in order to minimise the wear and tear on the coal hauling vehicles and in particular the tyres which cost approximately R40 000 each (1986).

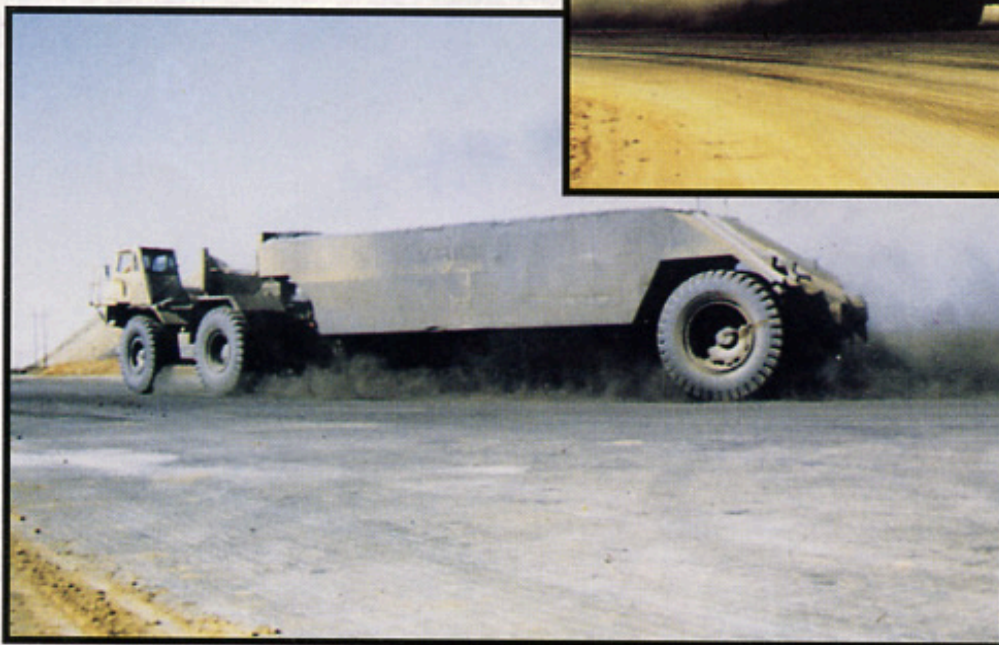
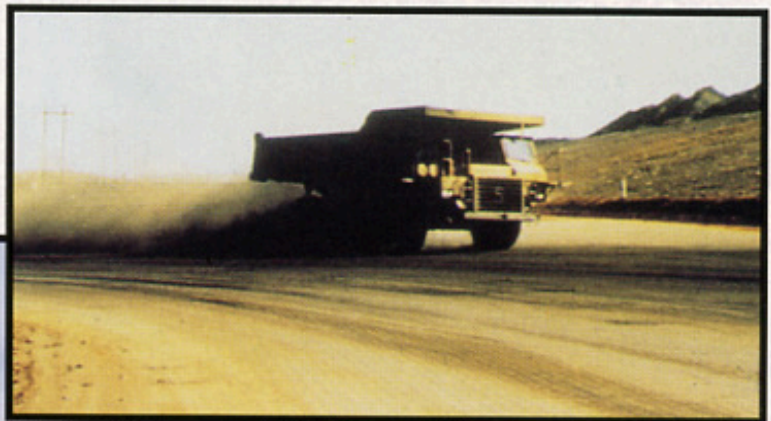
Many coal mines in the Eastern Transvaal have decided to use concrete block paving to surface their haulage route. Generally the pavement is performing exceptionally well under the extremely harsh and heavy duty conditions. Another advantage of using concrete block paving for haulage roads is that if the road becomes disused due to changes in the mine operation, the blocks can be uplifted and reused on another haulage route.

### DESIGN CONSIDERATIONS

The vehicles using the haul road are predominantly very heavy, off-highway trucks and tractors. The loading data required for the structural design of the pavement was compiled from the manufacturer's specification and information from the mines themselves. The estimated traffic loading for a typical mine included 800 000 repetitions of a Hauler CAT 7777 with a gross load of 237 tonne as well as other traffic.

### VEHICLE LOADING CHARACTERISTICS

After careful consideration of the loading and the conditions under which the pavement would perform, it was decided to specify the use of 80mm interlocking Type S-A blocks of 25MPa. Of particular importance in the pavement performance is the integrity of the edge restraints. Due to the expected excessive horizontal thrusts imposed by the vehicles, it was necessary to evaluate the structural stability of the restraints to be used.





## ROOIKOP

Ultra heavy haulage vehicles used by Transnet (or SATS as they used to be called) are serviced and maintained at the Rooikop Depot. Transnet experience has shown that the scuffing action of the tyres due to the size of the wheels on the rear axle, and the sliding of the front wheels due to the power of the drive wheels was causing damage to existing surfaces. A further problem was the very high wheel and axle loads.

Tests were carried out in the 1970's at the CSIR and at existing Transnet depots using high strength (35MPa) interlocking blocks in order to improve the abrasion resistance of the surface.

The design, based on the extensive research carried out by Dr Brian Shackel at the CSIR, incorporated cement stabilised layers and was done in-house by Transnet.

The pavement has now been in service continuously for many years and has shown that the initial assumptions made in the planning and design stages to use a high strength interlocking block was correct and a highly practical, serviceable and long life working pavement has resulted. Maintenance costs over the period have been almost nil.



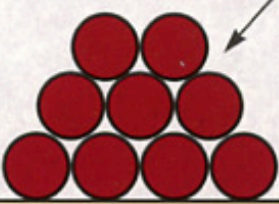
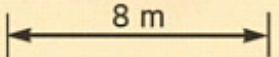


## TRIDENT STEEL MAXMEAD PINETOWN

The Trident Steel site is situated in the Industrial Township of Maxmead in Pinetown. The earthworks on this 10 000m<sup>2</sup> area, consisted of an engineered cut to fill of a clay having a CBR of between 1% and 4%. The insitu material was stabilised with lime to provide a working platform and three imported layers as detailed below, were constructed. The main structural steel building is founded on augured friction piles to a depth of between 8m and 12m.

A box culvert transversed the site 10m below the final surface to collect the natural stormwater run off. From geotechnical testing it was established that considerable settlement in the order of 200mm was likely. With the high load & low subgrading conditions, no cost effective pavement could be constructed to distribute the load further and hence reduce settlements.

**DESIGN LOADS - THE PAVEMENT IS SUBJECTED TO THE FOLLOWING STATIC AND DYNAMIC LOADING.**

<p><b>STATIC</b></p>  <p>2m Ø coils x 1m long 18 tonne each, max 162 tonne per stack</p>	<p><b>DYNAMIC</b> Steel coils delivered by road vehicles with a maximum load of 45 tonne per truck and 12 to 15 vehicles per day</p>
 <p>8 m</p>	

To accommodate this loading, a pavement has been designed as per figure 2.


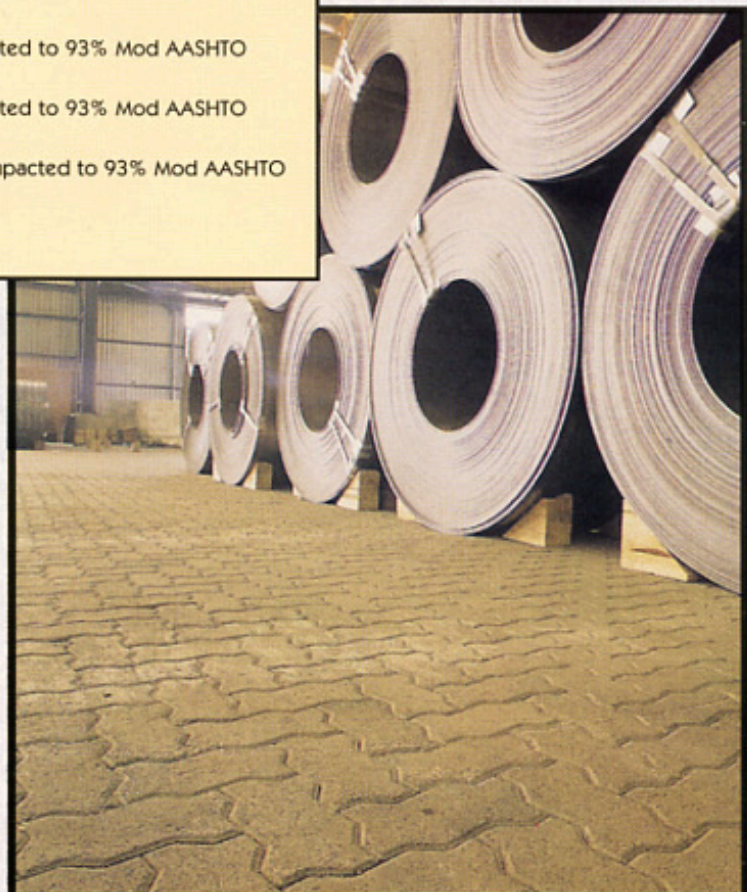
	<p>80mm cbp 35 MPa 20mm sand 150mm crusher run compacted to 98% Mod AASHTO 150mm imported G5 min CBR45 compacted to 93% Mod AASHTO 200mm imported G7 min CBR15 compacted to 93% Mod AASHTO 200mm stabilised subgrade 4% lime compacted to 93% Mod AASHTO insitu material CBR 1-4</p>
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figure 2

As a large area was to be used for stacking only, the block paving was "locked up" with 4 passes of a pneumatic tyred roller. After several years of use the area is performing exceptionally well with no major settlements experienced.







## CREDITS

project	client	consultant	contractor	area	date built	paving block supplier
Hippo/Peninsula Quarries	Hippo Quarries	Hippo Quarries	Power Construction	5000m <sup>2</sup>	1984	Concor Precast, Cape
Belville Goods Yard	Spoornet	SATS	Savage & Lovemore	36500m <sup>2</sup>	1988	Inca, Cape
Rooikop	Transnet (SATS)	Transnet	Grinaker Precast		1977	Grinaker Precast
Trident Steel Maxmead, Pinetown	Trident Steel		Grinaker Projects Natal	9000m <sup>2</sup>	1992	Grinaker Precast
Coal mine, Eastern Transvaal	Rand Mines		Concor Technicrete			Concor Technicrete

## CMA PAVING - MEMBERSHIP LIST

### Producer Members

Bafokeng Brick & Tile	(014)	538 0842
Bamburi Special Products Ltd (Kenya)	(09254)	253 0504
* Bosun Brick (Pty) Ltd	(011)	310 1161
* Brickcast Industries cc	(031)	507 7094
* Cast Industries	(011)	316 2375
* Concor Technicrete (Pty) Ltd	(011)	495 2200
* Corobrik (Pty) Ltd	(031)	560 3911
* Deranco Blocks (Pty) Ltd	(041)	463 3338
False Bay Bricks	(021)	904 1620
* Grinaker Precast (Pty) Ltd	(012)	652 0000
* Grinaker Precast (KZN)(Pty) Ltd	(031)	564 1304
* Inca Masonry Products (Pty) Ltd	(043)	745 1215
* Neat Contech	(046)	648 1359
Precast Concrete Industries (Namibia)	(09264)	61 280 4103
* Stanger Brick & Tile (Pty) Ltd	(032)	457 0237
* Vanstone	(012)	541 2056
* Vibro Bricks (Pty) Ltd	(012)	374 2032

\* Companies, which hold the SABS Mark

### Non-Producer/Contractor Members

Brick King & Associates	(021)	948 6218
Inca (Cape)	(021)	904 1620
Natal Pavings (Pty) Ltd	(031)	209 3115
Pave Show cc	(012)	346 6958
PYW Paving cc	(031)	903 2104
Randpave Industrial Contracts	(011)	805 1894
SA Paving Gauteng (Pty) Ltd	(011)	483 1350
Sun Paving	(031)	705 5123

### Cement Producer Members

Alpha Cement	(011)	670 5500
Cement & Concrete Institute	(011)	315 0300
Lafarge	(011)	328 9800
Natal Portland Cement	(031)	450 4411
PPC Cement	(011)	488 1700



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Manufacturers  
Association**

### ADMINISTRATIVE ADDRESS

168 Halfway House 1685  
+ 27 11 315-0300  
Fax: + 27 11 315-4683  
e-mail: cma@cis.co.za  
Web Site: <http://www.cma.org.za>