Concrete Block Paving
Good Earthworks Practice

Concrete
Manufacturers
Association

Introduction

Concrete Block Paving (CBP) will last for decades with little or no maintenance required, provided that the layerworks between the CBP and the natural ground (subgrade) are properly designed and constructed.

if properly designed and constructed, CBP will last for decades

Block paving, in addition to being a wearing surface, is a structural layer and therefore the number of layers (subbase) required is generally less than that required for asphalt.

The structural design of pavements is concerned with traffic, layerworks (foundations), materials, subgrade soils, environmental conditions, construction details and economics. Essentially the pavement must carry the traffic at an acceptable level of comfort and safety and at an acceptable cost. This achieved by a layered structure where each layer has sufficient strength to cope with the induced stresses without distress such as rutting, excessive settlement or deflection. See illustration to see how the pressure exerted by traffic dissipates under the road.

Although the surfacing is subjected to the highest stresses, the effect of traffic (especially heavy traffic) is felt deep into the pavement layers, sometimes up to a metre deep. The strength of these layers is as important to the long-term performance of the pavement as the surface itself.

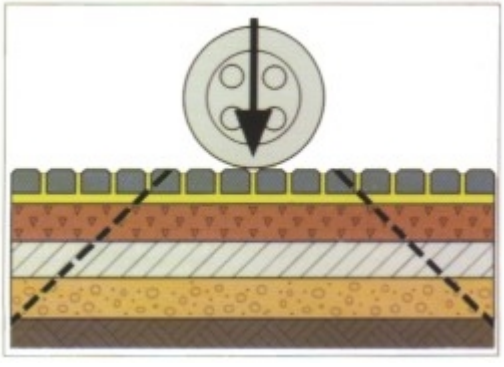
Preliminary Design Considerations for concrete block paving

In planning, specifying and designing a pavement, the following factors must be considered:

* The intended usage of the area to be paved
* They type of paving block to be used
* The expected service life of the area
* The degree of distress that can be tolerated
* Maintenance

Once these have been specified, design of the pavement may commence and the following factors should receive attention:

* The type of traffic expected
* The imposed loads
* In situ soil conditions and materials
* The availability of materials
* Climatic conditions
* Surface and sub-surface drainage



Dissipation of traffic loading

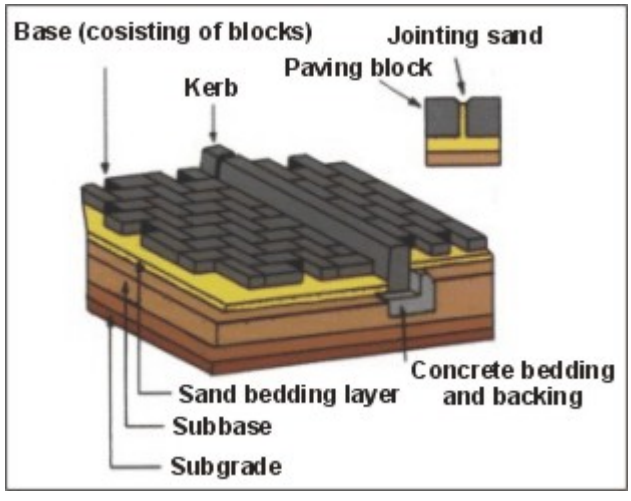
Key elements of design

for good earthworks practice

Behavior and performance requirements need to be compatible with soil conditions prevailing on site

Key elements of design are:

* The subgrade or natural earth material found on site
* The subbase, a layer or layers of road building material imported when subgrade conditions are poor and / o traffic conditions are heavy
* A thin layer of selectively graded bedding sand
* The concrete paving blocks, which form the base course as well as the surface wearing course
* The jointing sand that ills the gaps between every adjacent block
* Edge restraints, positive support placed around the perimeter of the pavement
* Drainage, both surface and subsoil, preventing the build-up of water in the pavement layers



SUBGRADE

All structures – buildings, roads and other surfaced areas – are ultimately supported by soil or rock. It is the designer's responsibility to evaluate the behaviour and performance requirements of the structure to ensure such requirements are compatible with the soil conditions prevailing on the site. Subgrade preparation would extend to the rear face of new edge restraints.

SUBBASE

Where the subgrade s of a low strength, usually CBR < 15, or the traffic is heavy, an imported subbase layer (or layers) and/or stabilizing of the subgrade may be required. The principles of design of the pavement layers are the same as for most flexible pavements. As the blocks perform a structural function, the requirements for the layerworks are less than for asphalt. In many cases the number of subbase layers can be reduced.

Where the subbase is an unbound granular layer, it may in some cases be advisable to seal the surface if it is felt that, during the early life of the pavement, a danger of water filtering through the joints and into the subgrade exists. Sealing can be achieved by spraying a low-durability bitumen emulsion at a rate of approximately 0,2l/m2. This is generally only a temporary problem, since the joints between the units will become clogged fairly quickly with road detritus and become impermeable to water.

Domestic/pedestrian and light duty pavements
Experience has shown that, for domestic driveways and block paving subjected only to pedestrian traffic, natural ground will normally provide sufficient strength for the pavement subject to the following:

- If the ground is formed from fill material, compaction will be necessary to avoid settlement
- The ground must not be subject to saturation from sub-surface water or surface water ponding
- The ground surface must be free from weeds or tree roots, etc., and finished smooth to the required tolerance

attention must be paid to ***surface drainage*** *to obviate failure in pavements*

Drainage

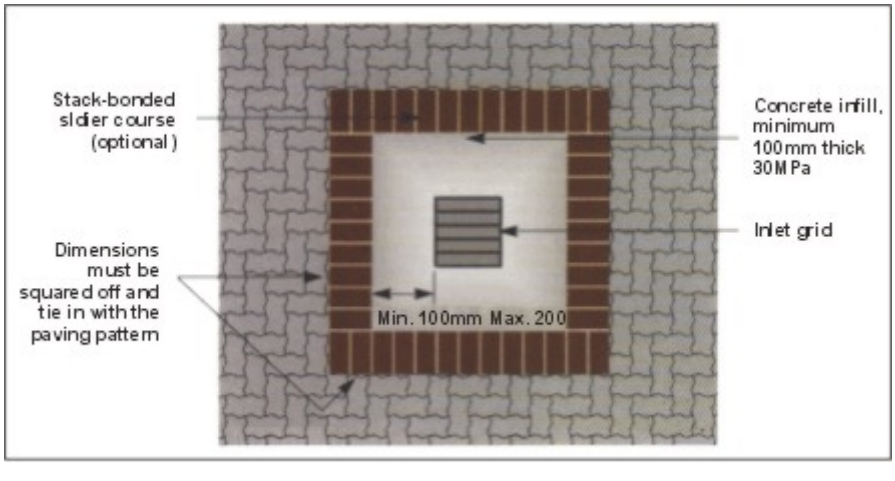
Most failures of pavements are due to ingress of water into the pavement layerwork. In order to obviate this problem, attention should be paid to surface drainage and where necessary subsoil drainage.

Adequate longitudinal falls and no undulations are necessary to prevent ponding and infiltration of water into the layerworks particularly in the early life of the pavement. A minimum fall of 2% in any direction is generally required. It is also important to ensure that the paving is laid proud of (i.e. 5-10 mm higher than) stormwater structures or channels.

Where paving is laid on a slope, water penetrating the paving can accumulate in the bedding sand at the low point. Where a high water table exists, subsoil drainage should be installed.

*Please refer to CMA Technical Note on Drainage for further specifications.

Drainage Inlet



Construction of CBP

In the construction of the paved area, it is essential that the same criteria of "good practice" in construction and control be applied to the subgrade, subbase and drainage as would apply in the case of any other type of pavement.

Where the paving is to be laid on newly constructed earthworks or an existing subgrade that is too low, the subgrade and subbase shall be constructed in accordance with the requirements of SABS 1200 DM and SABS 1200 ME, respectively, and shall conform to the tolerance requirements as set out below:

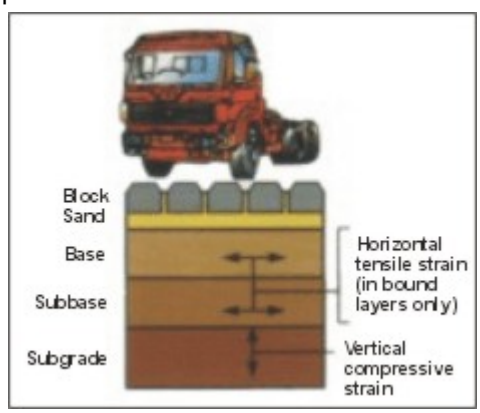
	Permissible Deviation (mm) Degree of Accuracy		
	III	II	I
FOUNDATION LAYERS			
1 Deviation of top subbase layer from designated level	*	*	+- 10
2 Smoothness of top subbase layer measured on a 3m straight line in any direction	*	*	+- 10
3 Thickness of 25mm compacted sand bedding layer	*	*	+- 10

Depressions created in the course of lowering a stabilized subbase shall be filled with stabilized subbase material and compacted to form a subbase of at least the same standard as that of the existing stabilized subbase. Alternatively, in the case of depressions of depth greater than 50 mm, concrete having a 7 day cube strength of at least 5 MPa shall be used. The falls and levels after compaction must comply to the standards set out in the table above.

'good practice' in construction and control should be applied

It must further be noted that segmented paving requires adequate edge restraint to the paved area otherwise movement of blocks and loss of performance will occur. The nature of usage will determine the appropriate edge restraint to be used. For example, a pedestrian walkway may only need a small precast concrete kerb or a premix infill, whereas in a high-traffic industrial area heavy duty concrete kerbs or a reinforced concrete ground beam may be necessary. Should any of the above items not be properly designed and constructed, excessive maintenance may be required during the life of the pavement.

A particularly useful feature of concrete block paving is that it is a "forgiving" pavement. Thus, where design or construction defects occur locally (such as at manholes, etc.) repairs are not usually difficult, time consuming or costly.
Segmented paving also permits easy access to underground services since the paving blocks in the area may be removed. The required work can then be undertaken and the same blocks replaced.



Backfilling

Edge restraints hold the pavers in position and prevent horizontal creep

After the earthworks have been completed it is often necessary to dig holes and trenches to accommodate manholes, pipes and other services. The responsibility for the backfilling of the trenches and around and around manholes is often given to the contractor installing the pipes or manholes. This contractor is both unaware of the earthworks design and unqualified to perform this operation which often results in local collapse of the CBP.

The reinstatement of the earthworks must comply with the specification and be to the same standard as the original earthworks. For this reason it is recommended that the main earthworks contractor should carry out this remedial operation.

An alternative method used in other countries and being introduced into South Africa is to backfill the trenches and manhole surrounds with lightweight foamed concrete which can be poured directly into place from a readymix concrete truck and does not require vibrating or compacting.

Edge Restraints

Edge restraints are an important element of segmented paving. Edge restraints hold the pavers in position and prevent horizontal creep and the opening of joints under traffic with the subsequent loss of integrity of the pavement. All CBP must have an edge restraint. Edge restraints may be cast in situ or precast or could be the existing structures.

Edge restraints must be installed before laying of blocks commences to prevent migration of the CBP by construction traffic.

Edge restraints installed before laying commences

Cutting blocks at edge restraints

Concrete Manufacturers Association

Portland Park
Old Pretoria Roads
Halfway House 1685
South Africa

P.O.Box 168 Halfway House 1685
Tel: +27 11 315-0300
Fax: +27 11 315-4683
Email: cma@cis.co.za
Web site: http://www.cma.org.za