Midland Brick

Laying Recommendations for Paved Crossovers and Driveways

This guide has been prepared primarily to assist in the proper construction of crossovers using brick pavers. However, the construction principles employed here are also recommended for driveways within property boundaries.

The use of a sub-base layer is required for all crossovers. It is left to the discretion of the property owners as to whether a sub-base is also used inside the property boundary. However, the Local Authority (Council) **may** require a sub-base inside the property boundary where development approval is required for multi-unit residential use, (Multi-unit developments are generally those consisting of more than 2-3 units), or commercial properties. **Midland Brick recommends that all brick pavements subject to vehicular trafficking be laid on a sub-base.**

This guide is based on extensive research carried out on paving bricks manufactured by Midland Brick to suit site conditions found within Western Australia.

The long term performance of the crossover which may be subjected to heavier loads than anticipated, depends upon the quality of materials used in the construction of the pavement, and the proficiency with which each component is laid within the total structure.

In some instances, the Local Authority may contribute towards the cost of an approved first domestic crossover to a limit, provided that it meets the standards set out in this guide and/or the Local Authority's own requirements. Please refer to your Local Authority for details. Local Authority specification shall take precedence in all instances.

Note: *If construction varies considerably from their specification, the Local Authority may require the crossing to be removed and replaced correctly. Please consult your Local Authority with regard to surface elevation and drainage requirements. The location of public utility services should be ascertained prior to commencement of excavation works, and if alterations are required, the applicant shall make arrangements and pay all costs to the appropriate authority. If the crossover is to intersect an existing footpath, the crossover level must match that of the footpath.*

FOR COMMERCIAL APPLICATIONS SUCH AS ROADWAYS, CAR PARKS, HARD STAND AREAS ETC., PLEASE CONTACT MIDLAND BRICK COMPANY'S TECHNICAL PAVING REPRESENTATIVES.

Pavement structure

A brick pavement shall incorporate the following: (Refer page six, figures 3, 4 and 5)

(a) Sub-grade – the upper part of the soil, natural or constructed, which supports the loads transmitted by the overlying pavement, compacted to required density.*

(b) Sub-base layer – a layer of granular road building material such as crushed limestone, fine crushed rock (rock-base), selected gravel or cement stabilised sand, compacted to required density, * placed over the sub-grade material, where the sub-grade is of insufficient strength to provide a stable base. Some existing gravel sub-grades or rocky ground may be suitable for use as a sub-base. Please consult Local Authority to determine if this is so.

Note: **Sub-grade and sub-base should be compacted to a density of at least 95% of the Modified Maximum Dry Density, determined in accordance with Australian Standard 1289. If in doubt as to whether this level of compaction has been achieved, it may be necessary to contact your Local Authority and have tests carried out to determine this. Cost of testing is to be borne by the applicant.*

(c) Edge restraints – a restraining barrier at the outer edges of the brick pavement robust enough to withstand vehicle impact and prevent any lateral movement of the paving bricks.

(d) Bedding sand – a layer of uncompacted clean siliceous sand spread to a uniform depth over the sub-grade or sub-base, onto which the paving bricks are laid (bedded).

(e) Paving bricks – strong, durable pavers manufactured for use in vehicular traffic areas, forming the surface course of the pavement.

(f) Joint filling sand – dry siliceous sand that is swept into the gaps between the paving bricks to ensure interlock.

Note: *Compaction of sand sub-grade can be determined by using a Perth sand penetrometer in compliance with Australian Standard 1289. Please consult Local Authority for details of accepted values indicating satisfactory compaction densities. (Generally a minimum value of 7 blows per 300mm would be required.) Perth sand penetrometers are available from most construction equipment hire outlets.*

Drainage

Provision of adequate grades of at least 2% are recommended. The surface profiles of the pavement should be such that crossfalls prevent ponding of water. Initially some surface water will drain through the joints, but these will eventually become full and sealed with oil, tyre rubber, grime etc., with subsequent flow of water over pavement surface, as occurs with conventional bitumen pavements.

Due to the difficulties in compacting the sub-grade adjacent to stormwater drains in driveways, provision should be made for the addition of ordinary Portland cement at a rate of approximately 6% by weight to a depth of 100mm, in the area approximately 1-2 metres surrounding the drain. (This equates to approximately 1/4 of a bag or 11kg per square metre; cement bag weight 40kg. Please refer to page 5 for cement stabilisation method). Laying of paving units over drainage grates is NOT recommended.

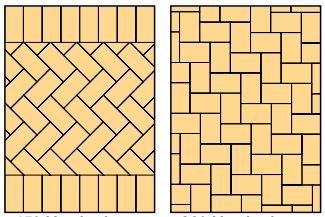
It is common for paving units to settle slightly around drains resulting in ponding of water. In order to eliminate this, pavers should be laid approximately 6mm higher than drains and falls increased in the vicinity.

Sloping driveways, steep gradients

Pavements with gradients of up to approximately one in ten (10%) can normally be achieved without difficulty.

For steeper gradients, and/or sloping pavements subject to the breaking, accelerating and/or turning action of vehicular traffic, it is advisable to divide the pavements into short lengths of approximately 10 metres with the use of intermediate concrete beams. These beams can be concealed to allow for the paving units to be grouted onto their surface, and should be of sufficient dimensions and strength to key into the sub-base material and edge restraints, to prevent slipping/shunting of paving units down the gradient. For further details please contact Midland Brick Company's Technical Paving Representatives.

Laying Patterns



In areas subject to vehicular trafficking, paving bricks should be laid in herringbone bond, with either a 45 or 90 degree configuration. Laying patterns offering continuous straight lines through the wearing surface, such as basket weave, stretcher bond, and stack bond, are susceptible to a loss of interlock and subsequent pavement failure, and are therefore not considered suitable in this application.

Construction Method

(a) Site Preparation/Excavation – the sub-grade, if necessary, shall be excavated (boxed out) and shaped to the required dimensions and levels to allow for the total pavement thickness. All excavations shall be executed cleanly and efficiently to provide for a consolidated, sound base, free of depressions, soft spots or any deleterious materials, such as tree roots, builders rubble, etc.

Compaction of the new surface level of the sub-grade shall be carried out using overlapping passes of a vibrating plate compactor. Ensure that the sub-grade material has sufficient moisture content to aid in achieving the required density without being over wet and becoming spongy. An indication that a soil has reached its optimum moisture content and can therefore be compacted to its maximum density, is indicated by squeezing a ball of the soil in the palm of one hand. If the soil is too wet it will be soft and spongy; wait till soil dries out to optimum moisture content. If the soil is at or near optimum content, after squeezing, the ball will retain its shape and hold together. Proceed with compaction.

(b) Sub-base placement – the sub-base material should be loosely spread in one layer of 100mm on a sand sub-grade, or two layers of 75mm, forming 150mm on a clay sub-grade. The loose sub-base should be of sufficient thickness to allow for a slight reduction in its level during compaction. After compaction the sub-base should be at the correct level for placement of a uniform layer of bedding sand.

Compaction of the sub-base material shall be carried out using overlapping passes of a vibrating plate compactor. Ensure that the sub-base material has sufficient moisture content to aid in achieving required density, without being over wet and becoming spongy.

In order to avoid ponding, the sub-base finished surface shall be levelled and trimmed to requirements, so that the completed brick pavement surface does not deviate by more than 10mm from the base of a 3m long straight edge placed in any direction on the finished surface.

Wherever vehicular traffic is driven over paved areas a sub-base must be installed. The sub-base must extend approximately 100mm beyond extremities of paved areas.

(c) Edge restraints placement – the outer edge of all brick paved areas must have a restraining barrier. The sub-grade and sub-base must be compacted beneath the edge restraint and extend at least 100mm beyond the outer edge of the restraint.

Mountable road kerbs provide adequate restraint at the crossover/road interface (refer figure 2). The remaining sides however, must be supported with suitable barriers.

Please refer to Local Authority specification for details of acceptable edge restraints. The following designs are recommended by Midland Brick, however, other designs have also been found to be satisfactory. Exposed or concealed concrete beam, generally being a minimum of 200mm wide x 100mm deep (refer figures 3 & 4).

Alternatively, an edge restraint barrier can be installed using pre-mixed concrete (20:14) i.e 20 mpa, 14mm aggregate size or a site-mixed equivalent. This barrier must extend under the brick approximately 100mm to a depth of 100mm and should extend beyond the header course approximately 100mm. Finished barrier must finish approximately 20mm up from bottom of header course, thus creating a “lip” (refer figure 5).

(d) Bedding sand placement and screeding – the bedding sand must be well graded, clean sand. The sand should be non-plastic and free from any deleterious materials such as stones, fibrous matter, clay or soluble salts which could contribute to efflorescence.

A well graded concreting or plasterers sand is considered suitable, however, bricklayers and single sized dune sands are not suitable. Sand should have a uniform moisture content without being over wet at the time of screeding. The sand shall be spread loosely to a uniform depth over the sub-base material, and should be approximately 35-50mm thick.

The surface of this material should then be accurately screeded to the required level for laying the pavers. The bedding sand shall only be screeded slightly ahead of the laying of the paving units.

Note: *After compaction of the paving units the bedding sand thickness should be 30mm (±5mm). Bedding sand should not be used to fill undulations in sub-base surface as this may result in an uneven surface in the completed pavement due to varying levels of compaction. It should be recognised that thinner levels of bedding sand will perform better under load.*

If accidental pre-compaction occurs due to foot traffic, rain or where sand is left uncovered overnight, the sand layer must be brought back to its loose condition before further paving proceeds, to avoid undue surface irregularities.

Note: *The alternative practice of partial pre-compaction of the bedding sand with a single pass of a plate compactor is acceptible provided that it does not fully compact the bedding sand.*

(e) Laying of paving bricks – rectangular pavers achieve maximum interlock when laid in a herringbone pattern of either 45 or 90 degree configuration. Laying of paving units should commence from the edge restraint at the lowest level to prevent spreading of units prior to lock up.

Paving units should be laid so that they do not come into contact with adjoining units. A joint width of 2-3mm is desirable. If units are placed directly against each other it may be difficult to maintain an even laying pattern and to compact the pavers without causing edge chipping.

The use of stringlines is recommended.

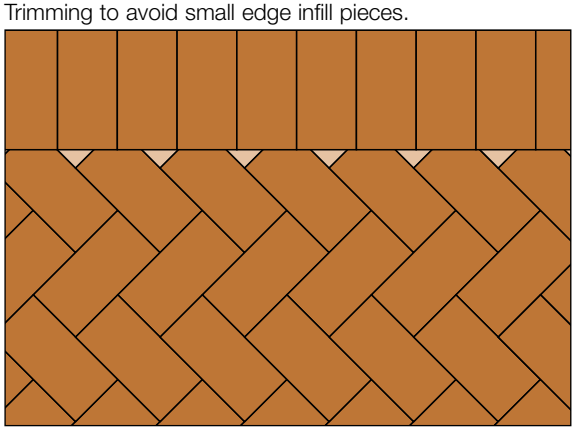
The average length of the pavers should be determined by randomly selecting 20 pavers and placing them end to end in contact in a straight line on a level surface. Any blisters or other small projections should be removed before the overall measurements are taken. The average length of the pavers is the overall measurement divided by 20, and the average width is similarly obtained after laying the 20 pavers side by side.

The laying gauge for the paving should be determined for the laying pattern of either 45° or 90° herringbone, using the average size of the pavers together with the nominal joint width of 2-3mm. A grid of string lines set out using this method enables each paver to be laid in its correct position according to the pattern and gauge. No paver should have its position dictated by the position of its neighbour.

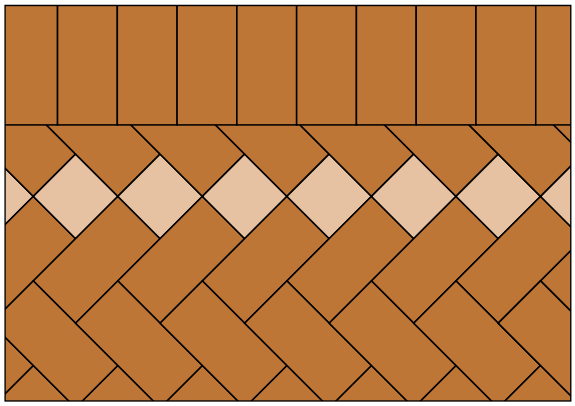
Note: *Some variation in the line of the joints is to be expected and should be regarded as an inherent characteristic of a flexible brick pavement.*

All full bricks should be laid first. Closure bricks (bricks cut to fill gaps adjacent to edges) should then be laid subsequently.

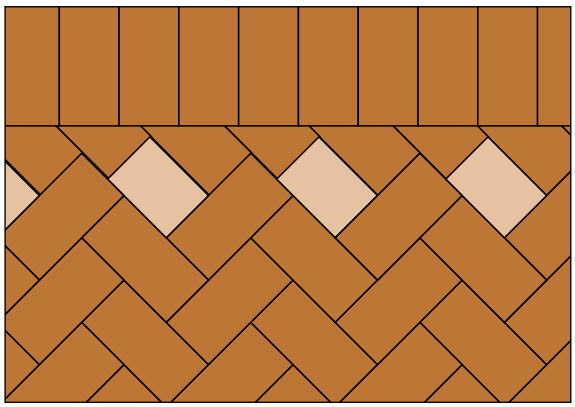
FIGURE 1:
Trimming to avoid small edge infill pieces.



Small edge pieces not recommended.



Recommended insertion of pavers cut to half length.



Alternative recommendation – insertion of pavers cut to three quarter length.

Infill piece

(f) Cutting – When cutting pavers, please ensure that the product is fully wetted, to reduce the chance of discolouration from cutting slurry entering the product surface. Similarly, ensure all slurry is washed from any cut product before laying. Ensure that no cutting slurry falls on surface of product already laid.

Cutting of paving bricks to less than 25% of whole paver size should be avoided. Please refer to Figure 1 for alternative cutting-in method, using half or three quarter paving bricks.

Pavers that have been damaged should be placed to one side and used for cuts, thereby minimising waste.

(g) Compaction and joint filling – immediately after completion of laying of paving bricks and fitting of closure units, the pavers should be compacted and brought to level by not less than three passes of a high frequency low amplitude plate compactor. The compactor should have sufficient area to simultaneously cover 12 units. Its metal base should be covered to prevent it coming into direct contact with the surface of the paving bricks and causing damage. A plywood sheet with a minimum thickness of 12mm, or a thick rubber backed carpet square, attached to the base of the compactor, can be used to provide a cushioning effect.

(A thin layer of joint filling sand spread evenly over the paving bricks prior to compaction will aid the movement of the compactor and further minimise surface damage.)

During the compaction process the paving bricks are vibrated into the bedding sand, with some of this sand being forced upwards into the joints creating initial lock-up between adjacent units. The plate compactor should not be used closer than one metre from any unrestrained edge.

As soon as possible after compaction and prior to the acceptance of vehicular traffic, further joint filling sand should be spread over the pavement and broomed back and forward until all the joints are filled. This is more likely to occur if joint filling sand and pavement surface are dry.

Topping up of the joint filling sand may be necessary at a later date; the pavement should be monitored to check if this is necessary, particularly during the early life of the pavement and after prolonged heavy rain.

Note: *Joint filling sand should be well graded and finer than the bedding sand. Sand should be free from contaminants such as clay, which are likely to cause staining or efflorescence of the paving units. A washed white sand is recommended.*

Compaction should be completed prior to the acceptance of any vehicular traffic. Any paving bricks damaged during this compaction process shall be immediately removed and replaced.

If it is not possible to complete the laying, cutting, compacting and sanding process in one day, care must be taken to ensure that any uncompleted areas are protected from trafficking. Particular care should be taken with regards to unrestrained edges. Temporary restraints (such as running boards placed against the edges of the pavers) is recommended.

(h) **Pavers in service – opening to traffic** – brick pavements respond favourably to early trafficking, and is therefore recommended, provided that vehicle loadings do not exceed design limits. Traffic should be encouraged to use the pavement immediately on completion of compaction and joint filling, with vehicle wheel paths varying to cover the greatest possible area. Any deformation tends to occur in the early life of the pavement, with the pavement gaining rigidity with repeated load applications.

However, the commencement of trafficking may need to be delayed in periods of prolonged heavy rain if the sub-grade has become saturated.

Cement Stabilised Sand

(Alternative Sub-base Construction)

Sand to be stabilised with cement shall be free from deleterious materials which could reduce the strength of the pavement. The sand should comply with the "Bedding Sand" requirements.

For each layer of cement stabilised sand, the required number of bags of cement shall be placed on the levelled sand at even spacings. The cement shall then be uniformly spread over the whole surface and thoroughly mixed to the required depth, ideally with a rotary hoe, or rake. Water shall be added to bring the sand-cement to its optimum moisture content.

The mixture should then be compacted using overlapping passes of a vibrating plate compactor, to 95% of its Modified Maximum Dry Density.

Cement Content and Placement Techniques

100mm Thickness Sand-Cement Sub-base:
Level the loose sand 25mm higher than the required finished level. Add 11kg (slightly more than 1/4 of a bag) of cement per square metre of pavement, mixing the cement uniformly into the sand to a depth of approximately 130mm. Add the required amount of water and compact the mixture to form approximately 100mm of sand-cement sub-base.

150mm Thickness Sand-Cement Sub-base:
Construct in to two layers of 75mm compacted thickness. Spread loose sand 95mm in depth, add 8kg (1/5 of a bag) of cement per square metre of pavement, mix sand cement to a depth of 95mm. After adding required amount of water and compaction, a 75mm thick layer of sand-cement sub-base will be formed. When this first layer has stiffened sufficiently the process should be repeated in full to complete the total compacted sub-base thickness of 150mm.

Upon completion of the compaction of the cement stabilised sand, it is advisable to lightly spray the entire surface area with water to aid in the cement hydration process which in turn gives strength to the pavement. Be careful not to over-wet the surface.

Placement of edge restraints, bedding sand and laying, should only proceed in accordance with construction methods detailed in this guide, once the cement stabilised sand has stiffened sufficiently.

TABLE 1

Total Pavement Thickness – Crossover

	SAND SUBGRADE	CLAY SUBGRADE
Compacted Sub-base *Thickness*	100mm	150mm
Bedding Sand *Thickness (after compaction of paving bricks)*	30mm (±5mm)	30mm (±5mm)
Paving Brick *Min. Thickness*	60mm	60mm
TOTAL PAVEMENT THICKNESS	185-195mm	235-245mm

TABLE 2

Paving bricks recommended for use in domestic crossovers subjected to vehicular trafficking

PAVER DESCRIPTION	NOMINAL DIMENSIONS (MM)
Ezi-Pave '60' Pavers	232x153x60
Heavy Duty Pavers	232x115x60
'Handmade' Sandstock Pavers	Intentional size variation
Roadpave '76' Pavers	232x115x76
Villapave 60	230x150x60
Handipave 60	200x200x60
Classicpave	230x115x60
Stylestone™ 300	300x300x60
Stylestone™ 400	400x400x60
Top-Pave	232x153x60
Pavestone 60	230x150x60
Pavestone 80	230x150x80
Coachstone 60	230x150x60
Coachstone 80	230x150x80
InterPave 80	225x112x80
Dimensions are nominal and may vary slightly except 'Handmade' Sandstock pavers.	

Whilst the contents of this publication are believed to be accurate and complete, the information given is intended for general guidance and does not replace the services of professional advisors on specific projects. Specifications in this publication are subject to change without notice. Midland Brick Company, their servants or agents cannot accept any liability whatsoever in respect to the contents of this publication.

FIGURE 2: Typical design for Brick Paved Crossover and Mountable Kerb

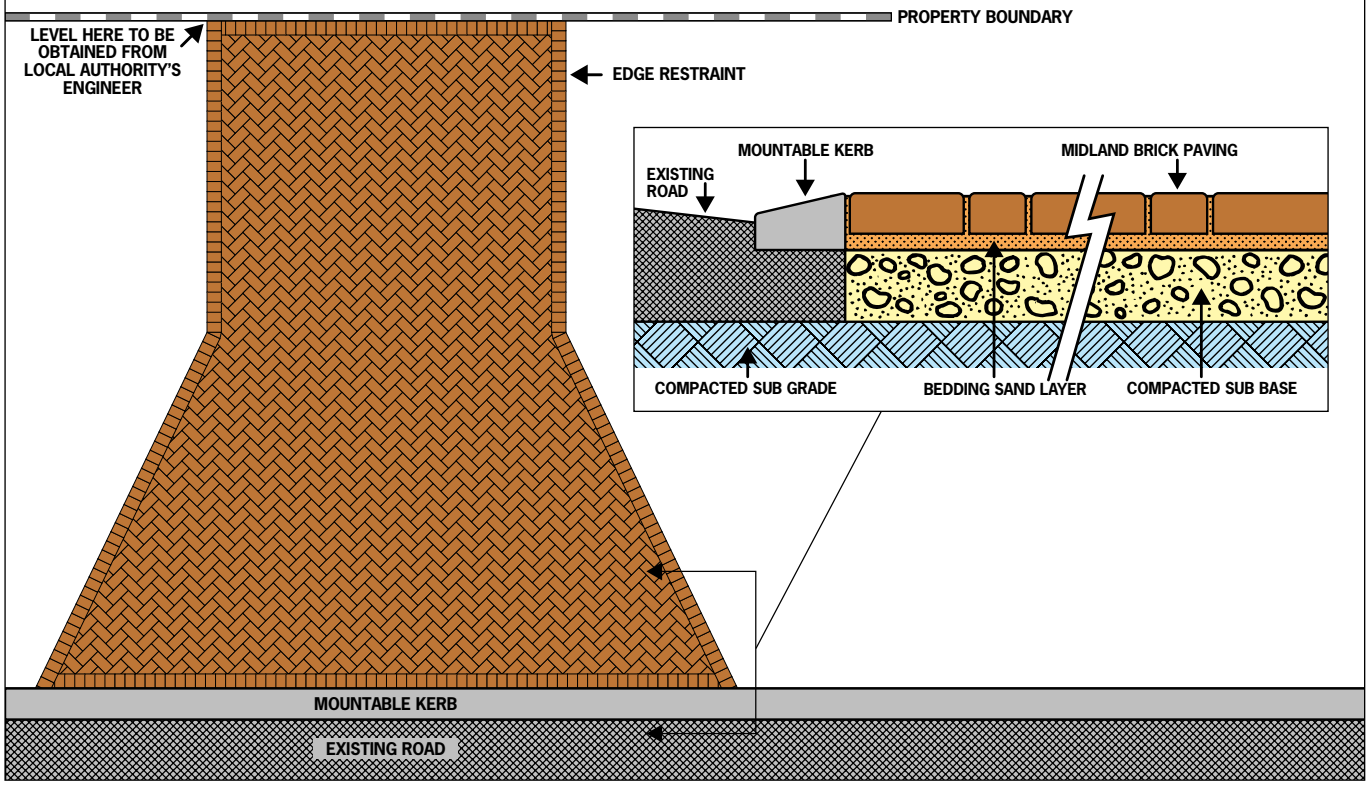


FIGURE 3: Exposed Concrete Beam

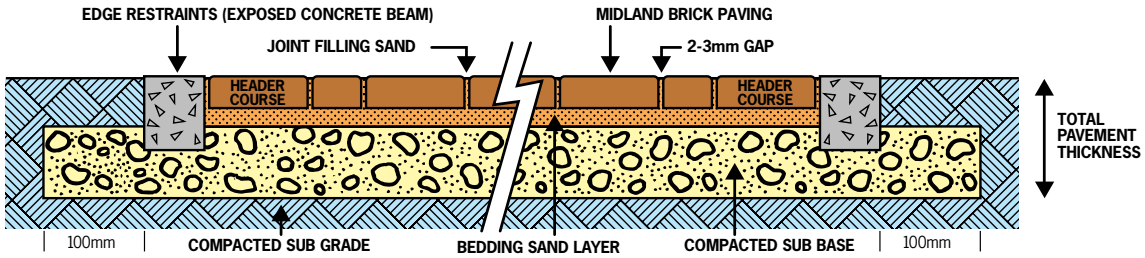


FIGURE 4: Concealed Concrete Beam

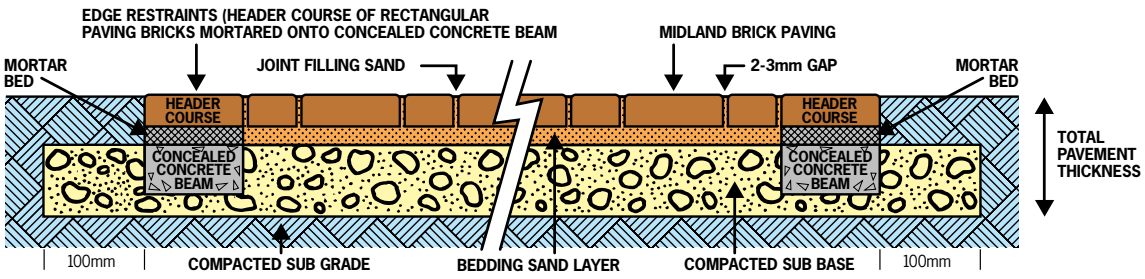
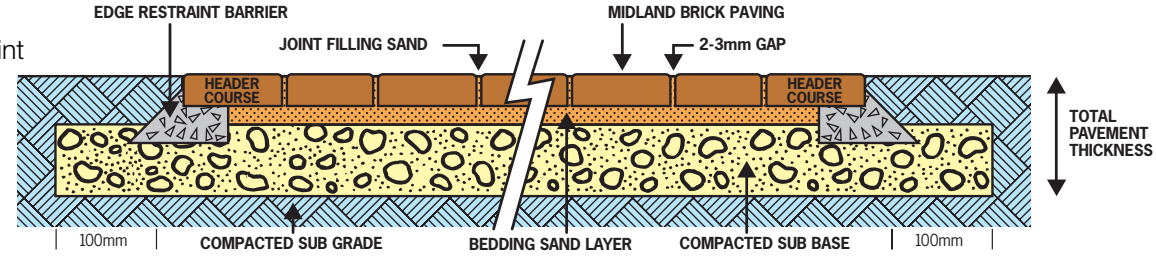


FIGURE 5: Concrete Edge Restraint



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