Lay paving blocks as a BCATS project

Unit Standard – 12938

Level 2, Credit 4

Name: _____

>>B CONSTRUCTIVE

Contents

Published by: **Building and Construction Industry Training Organisation (BCITO)**
Level 5, 234 Wakefield Street
PO Box 2615
Wellington

What you need to do

By the end of this module, you should be able to:

- calculate quantities and prepare an order for materials for a paved area;
- excavate, compact and lay paving blocks; and
- complete work operations.

How you will be assessed

You need to show your teacher/tutor that you can:

- calculate materials correctly and prepare an order for materials including bedding sand, cement (if used), base course and paving;
- excavate the area to be paved correctly;
- lay and compact base course and sand correctly;
- lay, compact and finish paving correctly;
- complete all operations safely;
- clean the work area and dispose of waste; and
- clean and store tools, plant and equipment correctly.

Glossary of Terms

Term	Meaning
Aggregate	A combination of sand and gravel or crushed rock used to make concrete
Base course	A compacted layer which provides a solid foundation for paving
Bedding layer	A sand bedding course providing a base for pavers
Bulking factor	The volume increase of excavated material in relation to the excavation volume from which it came
Edge restraints	Term used for the outside row of pavers secured with concrete to prevent sideways movement
Geotextile fabric	A cloth which filters out fine particles of backfill when laid over the drainage preventing blockage of the system
Haunching	A layer of mortar or concrete placed against the outside row
Joint sand	Fine sand – swept into paving joints to 'lock up' all paving into one solid mass
Plant	Fixed equipment
Screed	A straight edge used to level concrete, sand, plaster etc.
Work operations	How you do a job

Paving

Concrete pavers are used for paths, patios, courtyards and driveways. They can be laid in stages and lifted if drains, cables or pipes underneath need servicing.

To achieve this unit standard, you need to be able to lay paving blocks.

For any construction job you carry out, it's also important to:

- select and use appropriate personal protective equipment (PPE);
- use tools correctly and safely;
- clean the work area and dispose of waste; and
- clean, store and maintain tools correctly.

For any product or tool you use, make sure you read and understand any manufacturer's instructions that come with it before you start using it.

Materials

Pavers are manufactured in clay and concrete, in a range of shapes, sizes and strengths. Shape and size should suit the area being paved. Strength should suit the weight of traffic, from pedestrian use, to light vehicle traffic, to heavy vehicles.

Base course material should be crushed rock including particles of all sizes. No particles should have a diameter more than one third of the thickness of the required base course layer – for example, if the base course layer is 75mm, no particles should be bigger than 25mm across. For layers of 100mm thick or more, use 40mm aggregate. The material should not contain any soil or plant material. If the sub-grade is very soft (such as clay), lay geotextile fabric first to prevent the sub-grade pushing through the base course material. Bedding sand should be coarse river sand (not beach sand), which should be damp but not wet.

Jointing sand should be fine dry plaster sand with angular particles that lock well together. Some types incorporate a weed preventative. It is also sold as paving sand.

Special sealers are also available to protect paving.

Laying patterns

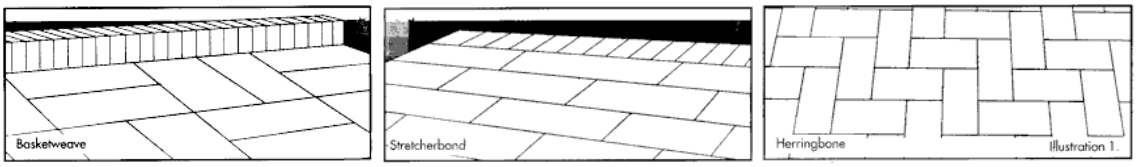


Illustration 1.

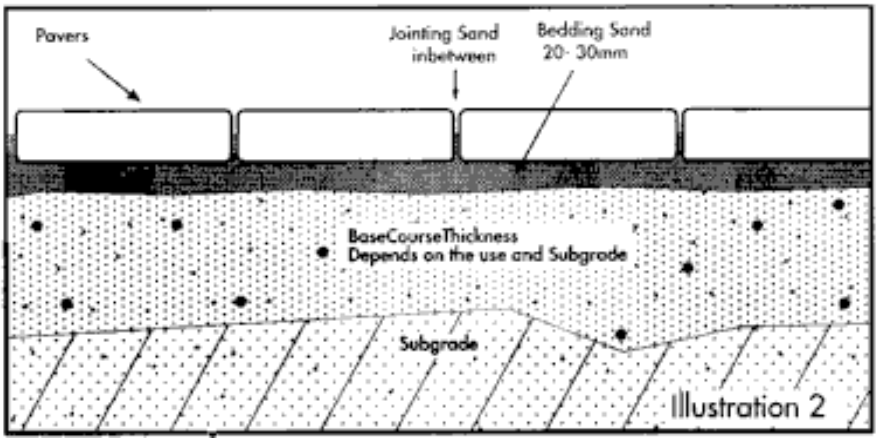
The laying pattern should suit the type of paver chosen and the area being paved. Options include 45° herringbone, stretcher bond, basket weave and soldier courses along the edges.

Tools required

- Tape measure
- Pencil
- String line
- Spirit level
- Spade
- Shovel
- Rake
- Broom
- Screed board
- Plate compactor (hired)
- Concrete saw/paver splitter/bolster

Calculating Quantities

Draw a scaled plan of the area you want to pave. From this plan, you can calculate the quantities of the various materials you need.



Quantities of base course material and bedding sand are calculated in volume of cubic metres (m^3) – length x width x depth. (You also need to allow a bulking factor for bedding sand and base course material so that you achieve correct depth once they are compacted. The supplier can tell you what percentage to allow.)

Paver quantities are calculated in area of square metres (m^2, i.e. length x width). Divide the total area by the area of a single paver to work out the number of pavers you need. If any pavers need to be cut because of the laying pattern, allow for some wastage and order a few extra pavers.

Jointing sand is generally sold pre-packed. Follow the manufacturer's instructions on the bag about how much is required.

Example

Calculate the volume of materials required for the following:

Area to be paved measures 5.4 metres x 2.1 metres
Base course laid to depth of 150mm
Bedding sand laid to depth of 30mm
Pavers measure 150 x 150 x 40mm
Total depth of excavation = combined height of bedding sand, base course and paver (150 + 30 + 40mm) = 220mm.

Calculation

Base course	(l x w x d) + bulking factor	= m^3
	(5.400 x 2.100 x 0.150) + 15%	= m^3
	1.701 + 0.255	= 1.956m^3
Bedding sand	(l x w x d) + bulking factor	= m^3
	(5.400 x 2.100 x 0.030) + 5%	= m^3
	0.340 + 0.017	= 0.357m^3
Pavers	number of pavers required	= total area / paver area
		= 5.400 x 2.100 / 0.150 x 0.150
		= 11.340 / 0.0225
		= 504

When ordering materials, you also need to consider that some materials may only be available in particular amounts. In the example above, you may need to order 2m^3 of base course material and 0.4m^3 of bedding sand.

Preparing an Order for Materials

It's important to buy all your pavers from one outlet, and from the same batch if possible. That avoids differences in colour that can result from different batches. If you can't buy all from one batch, mix the pavers up before laying.

Storage of all the paving materials can be a problem, particularly if the site is small. It may be a good idea to excavate first, then order and lay base course material, then order and lay the paving sand and pavers.

When placing an order with a supply merchant for building material, you need to provide the following information. This will ensure that the right material is supplied to the right place at the right time, and the correct information is supplied for budget and accounting purposes.

The order should be clearly written or typed, and include the following information:

- date of order
- customer's name and billing address;
- customer account number;
- job identification or number;
- order number;
- supply merchant's name;
- description of goods required and quantity;
- address where the order should be delivered;
- date and time required;
- any other delivery details; and
- authorised purchaser's signature.

Send the order to the supplier, allowing enough time for them to prepare and deliver it. (You should also keep a copy of the order for your records.) It's a good idea to follow up with a phone call if you don't receive confirmation that the order has been received.

Excavating

Before you start paving, the area must be excavated to the correct level.

Calculating the amount of excavated material

Depending on the area being paved, the amount of material excavated can be significant. Once it has been excavated, it needs to be removed from the site, either by wheelbarrow to another area close by, or by filling a skip or bin which is then taken away by truck.

As with all compact material that is loosened, the actual volume can also increase by varying amounts, depending on:

- the method used to excavate;
- the type of material being excavated; and
- the moisture content of the material.

This is called the bulking factor. Soil has a bulking factor of between 10 to 30%.

Example

Calculate the volume of excavated material, plus a bulking factor of 20%, for an area measuring 5.4 metres x 2.1 metres with a total depth of excavation of 220mm:

Calculation

Volume	= length x width x height = 5.400 x 2.100 x 0.220 = 2.494m^3
Bulking factor	= 2.494 x 20% = 0.498
Volume of excavated material	= 2.494 + 0.498 = 2.992m^3

Therefore, approximately 3m^3 of excavated material needs to be removed from the site.

Testing the sub-grade

Test the firmness of the sub-grade (underlying ground) to determine how thick the base course should be. (Soft sub-grade needs a thicker base course than hard sub-grade, so has to be dug out deeper.)

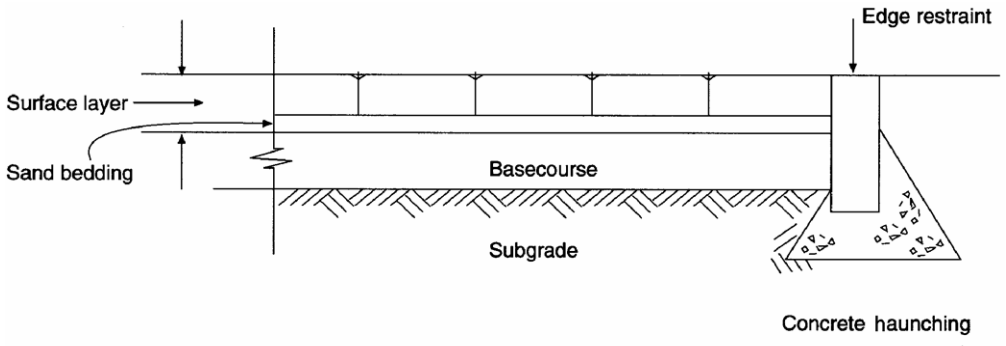
To test the sub-grade:

- Dig down to about 200mm in several places within the planned paved area.
- Walk on the sub-grade and stamp your heel into it.
- On a weak sub-grade, walking leaves distinct footprints. You therefore need 75mm base course for pedestrian use, and 175mm for driveways (light vehicle traffic).
- On a moderate weak sub-grade, your heel leaves an impression. You therefore need 50mm base course for pedestrian use, and 125mm for driveways.
- On a strong sub-grade, no impression is left. This requires no base course for pedestrian use, and 75mm for driveways.

Excavation

Determine the finished level of the highest part of your paving. Against buildings, that should be at least 150mm below the level of concrete floors, or below the ground level under timber floors. Your paving should slope away from the building, at a rate of between 15 to 30mm per metre, to prevent water ponding or running under buildings.

Mark and dig out the area to be paved to the combined depth of the three layers – pavers, bedding sand and base course. Paver thickness depends on the expected weight of traffic, bedding sand is laid between 20-30mm thick and base course thickness depends on the firmness of the sub-grade.



Paving Installation

Laying Paving

Preparing the sub-grade

The finished sub-grade level should match the contour of the finished paving within 20mm. After excavating, the sub-grade may have holes that need to be filled to even out the surface or match the contour. Fill any gaps with base course material, and compact with a plate compactor or rammer in layers no more than 100mm thick.

Preparing the base course

Lay the base course in layers, no thicker than 100mm, and compact evenly, especially around manholes and kerbs. The finished texture of the base course should not allow bedding sand to filter through.

The final surface of the base course should match the contour of the finished paving with no bumps and no holes deeper than 10mm.

Placing the edging

Edging prevents sideways movement of pavers and stops bedding sand leaking out.

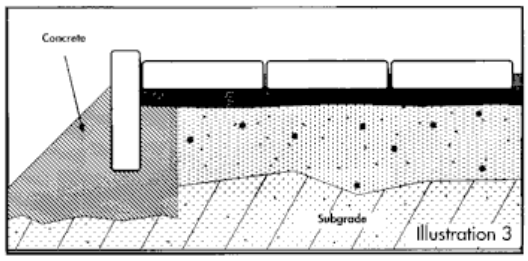


Illustration 3

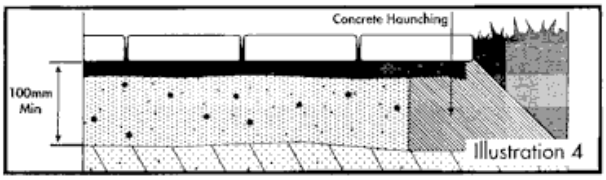


Illustration 4

Existing pathways, or other permanent structures (such as house foundations), can be used to retain both the bedding sand and pavers. For many projects other methods of edge restraint must be used to ensure the paved area remains level.

There are a number of alternatives which can be used to provide an edge restraint. These include:

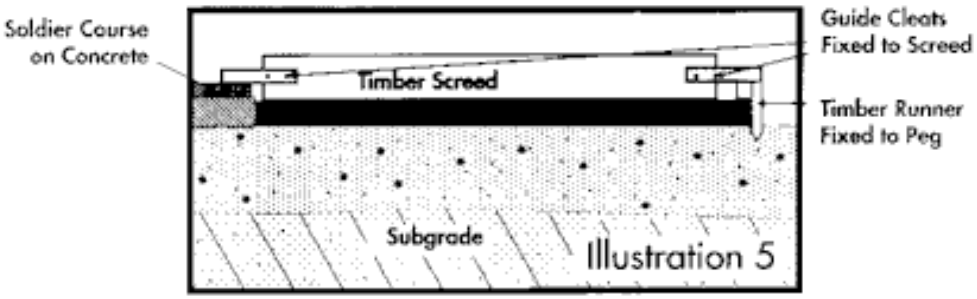
- soldier course of either standing or flat pavers;
- paving kerb – segmented raised kerbing;
- paving edge – concealed, underground PVC strip; and
- haunching – concealed concrete strip.
- a timber form-work type restraint
- proprietary edging products.

Preparing the bedding sand base

Bedding sand supports your pavers, but will not hide irregularities in the base course.

To test how much the thickness of the sand will reduce, spread some sand over a small area. Lay a paver on top, and hit it with a rubber hammer. The reduction in sand thickness will indicate how much the sand compacts. (Do not compact the bedding sand directly. It compacts under the pavers.)

Only an area of bedding sand is put down at a time, then pavers are laid on top, before moving on to the next area. Spread sand only over an area that can be finished in one session. Spread the sand to slightly more than the depth the rubber hammer test indicated. (This will usually be 35-40mm.)



Screed the sand to a uniform level. When screeding, guides or runners are needed on each side to run the screed board on. If there is already a soldier or kerb course of pavers for edging in place, this can be used to support the runners. If not, drive pegs and fix runners to them, just like concrete boxing.

Laying the pavers

If the area is sloped, lay the pavers from the lowest point first if possible.

Start from the straightest convenient edge, and lay the pavers with a space of 2mm to 4mm between them. (Some pavers have spacer nibs which do this automatically.) The space allows joint sand to penetrate around the pavers.

Lay all full pavers first, then cut and lay any pieces. Cut the pavers with a diamond toothed concrete saw blade, a paver splitter (both available from hire centres), or a brick bolster for smaller areas.

Avoid placing any weight on the paving area. Do not allow vehicles on to the paving until it's completely finished. Use heavy planks as running boards for pedestrian and wheelbarrow access.

Compacting the pavers

The pavers now need to be compacted evenly over the whole area. For a small area, use a rubber hammer on a short length of heavy timber such as a piece of 50 x 50mm. For larger areas, use a vibrating plate compactor available from the local hire centre.

When the pavers are all compacted, sweep jointing sand over the whole area and compact again to drive the sand into the joints. Keep sweeping and compacting until all joints are filled.

Activity

1. Calculate the volume of materials required for the following:

Area to be paved measures 6.200m x 3.400m
Base course laid to depth of 0.150m (bulking factor of 15%)
Bedding sand laid to depth of 0.050m (bulking factor of 5%)
Pavers measure 0.150 x 0.150 x 0.040m

Material	Amount required

2. Calculate the volume of excavated material, plus a bulking factor of 20%, for an area measuring 6 metres x 3.5 metres with a total depth of excavation of 240mm. Show your working.

3. What method is used to determine whether a sub-grade is weak?

4. What size particles should the base course material have if the base course layer is 90mm?

5. Give 3 examples of laying patterns.

6. What methods can be used to compact pavers once they are laid?