

## Concrete At Home

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### INTRODUCTION

Concrete isn't just for dams and motorways, bridges and office blocks. It's one of the least expensive, easiest to use and certainly the most versatile material the DIY-minded householder or gardener could wish for.

You can mix your own concrete from separate ingredients or from prepacked dry mixes, or buy fresh concrete ready-mixed and delivered to your doorstep ready to use.

For garden paving, terraces, walls and a host of other attractive and useful projects you can choose from a vast selection of 'off the peg' precast concrete building and garden products in an almost limitless variety of colours, shapes and textures. Above all, you can create what you want in your own time and to your own budget.

This Information Bulletin will give you the start. It begins with some basic information on what concrete is and how it works, what you'll need in the way of materials and tools, and how to plan the job.

#### Before you start ....

When reading what follows, planning the job and

carrying out the work, here are a few things to bear in mind.

#### *Take your time:*

Concrete is a permanent material, and oversights are difficult to correct or disguise. Plan carefully and work methodically at a pace you can keep up with. A sound, lasting and good-looking job is worth the extra few minutes.

#### *Safety first:*

Concrete is safer to work with than most other common DIY materials, and avoiding injuries or damage is largely a matter of good housekeeping.

Concrete – whether fresh or in the form of manufactured precast products – is heavy, so use care in lifting and handling. Make sure that stored materials, mixers and newly built masonry are secure and stable - prop them if necessary.

Cement powders are harmless in normal use. However, alkali is released when they are mixed with water so direct contact of freshly mixed concrete or mortar with the skin should be avoided. Any concrete or mortar on the skin should be removed by washing with soap and water within one hour. If cement enters the eye it should be washed out thoroughly with clean water and medical treatment sought without delay.

### CONCRETE BASICS

#### What concrete is ....

Concrete is simply a blend of aggregates (normally natural sand and gravel or crushed stone) bound together in a dense, stone-like mass by hardened Portland cement.

Aggregates are classed as 'coarse' or 'fine'

depending on whether or not they will pass a 5 mm mesh sieve - most concrete contains both.

## .... and how it works

When the ingredients are mixed with water, the cement and water react to form a dense, stone-like mass which adheres strongly to the particles of aggregate.

This takes time. For two hours after mixing (less on a hot summer day – heat speeds up the cement-water reaction) concrete or mortar remains workable - it can be placed, moulded, compacted and finished without too much difficulty.

After concrete or mortar ‘goes off’ and becomes unworkable it is still weak and easily damaged. It takes about three days to develop any useful strength, and a week or so to reach half its final

strength. Concrete goes on getting stronger more or less indefinitely, but for all practical purposes full strength is reached in a month.

The important thing to remember when working with fresh concrete is that it will only gain in strength if moisture is present. Concrete does not harden by drying out, and in fact it is usually necessary to take special precautions to ‘cure’ it by keeping it sufficiently moist during the first few days when the cement-water reaction is most vigorous.

## Ready-mixed or site-mixed?

For fresh concrete, you have the choice of mixing it yourself or buying it ready-mixed from a local supplier. Ready-mixed is easier and quicker, it is also often cheaper than the cost of just the materials for mixing your own provided you need a reasonable quantity and can use it all at once.

**Table 1: Concrete mixes for DIY jobs**

Use		Mix Your Own: Proportions (Volume)	Bulk Amount per m <sup>3</sup> of Compacted Concrete	Yield per Bag of Cement	Mix Quantities for 50 Litre Mix			Ready Mix Specification
General purpose concrete: footpaths, mowing strips, etc.	or	Cement (Sand (20 mm aggregate Builders mix	1 4 4 7	6 bags 0.70 m <sup>3</sup> 0.70 m <sup>3</sup> 1.25 m <sup>3</sup>	0.165 m <sup>3</sup>	12 kg 35 litres 35 litres 65 litres	1 bucket* 4 buckets 4 buckets 7 buckets	15 MPa Nominal 100 mm slump
7.5 litres approx added water								
Paving concrete: driveways, etc. (Use of ready mix preferred)	or	Cement (Sand (20 mm aggregate Builders mix	1 3 3½ 5½	7½ bags 0.65 m <sup>3</sup> 0.70 m <sup>3</sup> 1.20 m <sup>3</sup>	0.135 m <sup>3</sup>	15 kg 35 litres 35 litres 60 litres	1¼ buckets 4 buckets 4 buckets 6½ buckets	20 MPa; 6-8% air entrain- ment; nominal 80 mm slump
7.5 litres approx added water								
Bedding concrete: bedding fence posts, clothes lines, etc.	or	Cement (Sand (20 mm aggregate Builders mix	1 4½ 4½ 8½	5 bags 0.70 m <sup>3</sup> 0.70 m <sup>3</sup> 1.25 m <sup>3</sup>	0.200 m <sup>3</sup>	10 kg 35 litres 35 litres 65 litres	¾ bucket 4 buckets 4 buckets 7 buckets	10 MPa
7.5 litres approx added water								
Bylaw concrete: Buildings and fountains where Local Authority approval must be sought	or	Cement (Sand (20 mm aggregate Builders mix	1 2¾ 3 5¼	8 bags 0.65 m <sup>3</sup> 0.70 m <sup>3</sup> 1.20 m <sup>3</sup>	0.125 m <sup>3</sup>	16 kg 35 litres 35 litres 60 litres	1¼ buckets 4 buckets 4 buckets 6½ buckets	17.5 MPa Nominal 100 mm slump
7 litres approx added water								
*using 9 litre (2 gallon) bucket								

**Note:** Sand and aggregate contain some moisture and the amount of added water takes an average condition into account. In wet weather, less water may be required to produce a good mix. In dry weather slightly more water may be required. If the builders mix is poorly graded it may be necessary to increase the amount of cement; for each additional ½ bucket of cement used the water may be increased by 3 litres.

## Ready-mixed

Ready-mixed concrete is available from depots throughout the country. If you think ready-mixed is the answer for your job, look up suppliers in the Yellow Pages and discuss prices, quantities and delivery details with them. Basic prices may not differ very much but some suppliers may be more accommodating than others when asked to deliver less than a full truckload.

The supplier will mix the concrete to your instructions - see **Table 1**.

Most suppliers deliver in large lorries capable of handling 6 m<sup>3</sup> or so at a time. Prices are quoted per cubic metre but it is quite common to add an extra charge for loads of less than the set quantity. Practice varies between suppliers, even in the same area, so it makes sense to obtain several quotes.

A number of specialist firms, however, now cater for the 'small job' market; some use smaller versions of the conventional truck mixer while others employ special vehicles to mix on the spot the exact quantity required.

If you decide to use ready-mixed concrete do bear in mind that even with chemicals added to retard setting, all the concrete must be used within about four hours at the very most from the time of mixing. If the delivery cannot be made at the working site itself you will have to shift the load yourself as well as use it in that time. This is not a small job – each cubic metre of concrete will make 25 to 30 barrow-loads of an easily manageable weight.

## Materials for site-mixing

If you decide to mix your own, you will need cement and aggregates. There are several different ways you can buy them.

**Cement** - you will need ordinary Portland cement and you can buy it in 40 kg bags from builders' suppliers, DIY centres, some garden centres and even many hardware shops. Many DIY and similar outlets also sell cement in smaller quantities (2.5 kg upwards) for repairs and other small jobs. Brand names don't matter - all ordinary Portland cement made in New Zealand is manufactured to the same New Zealand Standard, NZS 3122. White Portland cement, though about four times the price

of ordinary Portland cement, is useful for some kinds of work. Colour apart, it is basically the same as ordinary Portland.

Masonry cement is specially made for bricklaying and blocklaying mortar and is not suitable for concrete.

**Aggregates** are available in bulk from builders' suppliers and many DIY and garden centres. Full loads can also usually be purchased direct from the pit or quarry. You'll get the best results if you buy coarse and fine aggregates separately and proportion them yourself. When buying sand, make sure you get the right sort. For concrete you want 'concreting' or 'sharp' sand – not builder's (bricklayer's or 'soft') sand.

The alternative to separately purchased aggregates is combined or 'all-in' aggregate, containing both fine and coarse material. Generally referred to as 'builders mix' it varies widely in quality and needs some care in buying. Have a look at it before you order - it should be clean, without much dust or silt and well graded, with about 60% of the particles over 5 mm. If the builders' mix is too sandy or too gravelly, you can improve it by adding extra coarse aggregate or sand.

Some retailers supply aggregates in heavy-gauge plastic bags - the cost is higher but aggregate purchased this way is much easier to store and keep clean.

Stone chippings and other special aggregates are available from some garden centres and from stone suppliers and monumental masons.

**Dry-packed mixes** are extremely handy for repairs and smaller jobs. They contain cement and aggregates in carefully measured proportions and are widely available from hardware shops and other retailers as well as builders' suppliers, DIY or garden centres. They do need thorough remixing prior to use since there is a tendency of material separating out in the bag. A major advantage of dry-packed mixes is that they can be taken, in the bag, right to the job and mixed there without making a mess of the garden or the house.

**Colouring pigments** for concrete and mortar are sold by most builders' suppliers but great care is needed in batching and mixing if unsightly variations in shade and intensity are to be avoided from one batch to the next. Stains for use on

hardened concrete are likely to give a patchy appearance and are not recommended.

## Estimating, ordering and storing

Estimating the volume of concrete you need is easy - simply measure the area to be concreted and multiply by the thickness to be laid. Make sure you use the same units for all calculations. If you're laying a path 1.2 metres wide, 10 metres long and 100 millimetres thick, the calculation will be  $1.2 \times 10 \times 0.1$  metres to give you the number of cubic metres of concrete required. Use the quantities given in **Table 1** under 'Amount per cubic metre' to work out how much you need and then add about 10% for wastage to tell you how much to buy.

If you are mixing the concrete yourself, order aggregates in plenty of time and store them in separate piles on a hard surface. Aggregates can be stored indefinitely if they are kept clean so you can order enough for several small jobs at one time, but it's a good idea to keep them sheeted over and out-of-bounds to children and animals. Do not, however, order more cement than you can use in a week's work - as moisture in the air can penetrate the paper bags and cause 'air-hardening' - don't use cement that has gone off in the bag. If you run short, it isn't usually very difficult to get another bag or two at short notice.

Stack cement bags flat on a hard dry surface, under cover if possible. If you have to store them in the open, keep them on a raised platform of planks clear of the ground, securely covered with plastic sheeting.

## Concrete mixes

**Table 1** specifies three different concrete mixes:

**General purpose concrete mix** is suitable for most jobs where there will not be any excessive localised wear or loading.

**Paving concrete mix** is recommended for paving areas where there will be excessive wear and localised loading, i.e. driveways. It is recommended that ready mixed concrete should be supplied to ensure the consistent quality of concrete. In the summer months it is also recommended that a retarder be specified for inclusion in the mix.

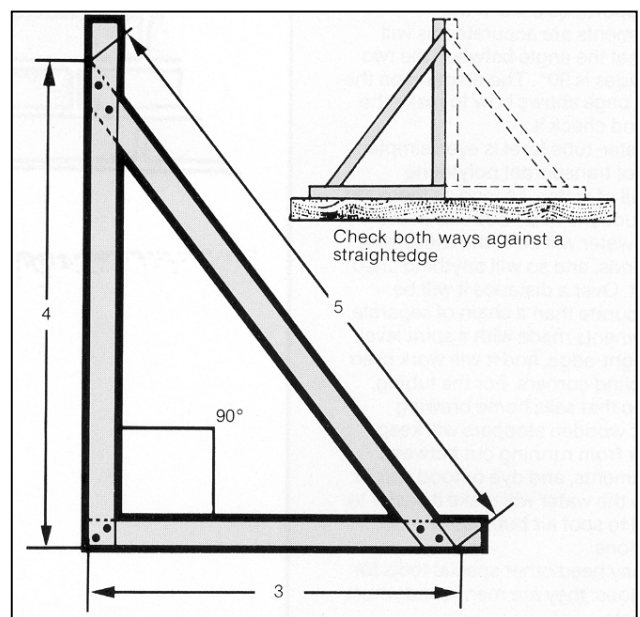
**Bedding concrete** is more economical for jobs like

concreting in fence posts, clothes lines, etc.

## Tools

Most of the tools you'll need for concrete work are ones you probably already have - hammer, mallet, handsaw, shovels (at least two if you are mixing your own concrete), rakes, linen or steel builder's tape measure, wheelbarrow and so on. The rest you should be able to hire, borrow or make up for yourself without great expense or trouble. You'll need a good builder's spirit level with tubes for both horizontal and vertical levelling, a straightedge, timber for setting-out pegs and an improvised tamping beam, buckets for measuring materials (good stout ones - the nine litre heavy-duty type sold for building and farm use is ideal - but make sure they are all the same size), and a large try-square.

Two improvised tools you'll find invaluable are a timber builder's square and a water level. The square is simply three lengths of strip fastened together in the proportions 3:4:5. If the measurements are accurate this will ensure that the angle between the two shorter sides is  $90^\circ$ . **Figure 1** shows how to make the square and check it.

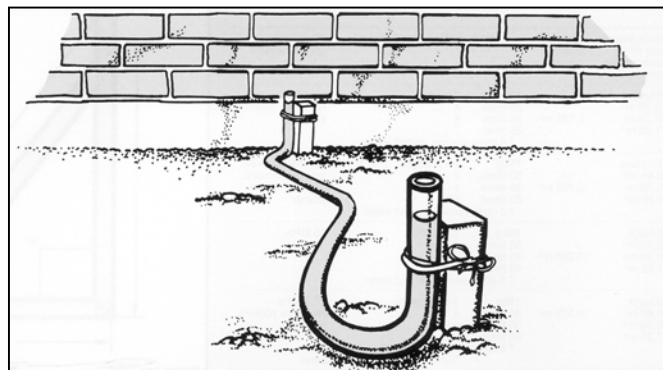


**Figure 1: Making a three-four-five builder's square.**

The water-tube level is even simpler - a length of transparent polythene tubing full of water (**Figure 2**). As long as there are no obstructions or air bubbles in the tube, the water will be at the same level at both ends, and so will anything lined up with it. Over a distance it will be more accurate than a chain of separate measurements made with



a spirit level and straight-edge, and it will work even around blind corners. For the tubing, try a shop that sells home brewing supplies - wooden stoppers will keep the water from running out between measurements, and dye or food colour added to the water will make it easier to read and to spot air bubbles or other obstructions.



**Figure 2: Using a water-tube level.**

You may need other special tools for specific jobs; these are mentioned where appropriate.

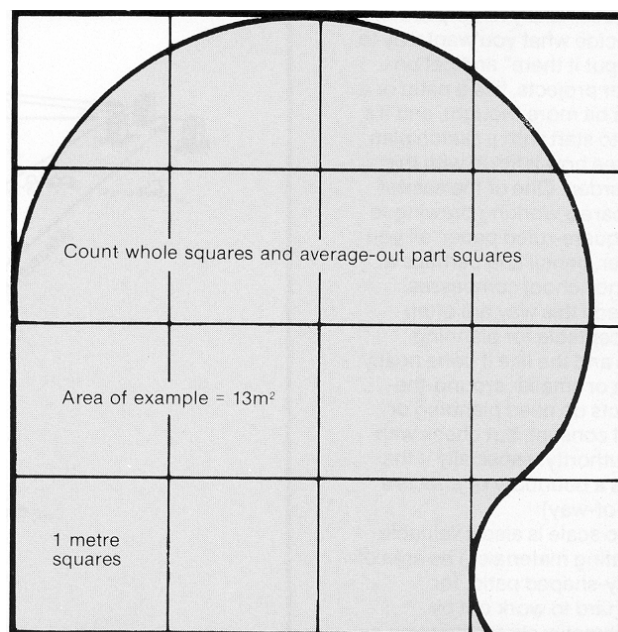
## Planning and setting-out

Many small jobs hardly need ‘planning’ at all - just decide what you want, say to yourself, “I’ll put it there” and get on with it. Bigger projects, like a patio or a drive, need a bit more thought, and it’s a good idea to start with a sketch plan so you can see how it fits in with the rest of the garden. One of the easiest ways to prepare a working drawing to scale is on square-ruled paper. All you need is a ruler, pencil and perhaps a protractor and school compass. Drawings made this way are acceptable for planning applications if done neatly. (Few garden or smaller around-the-house projects do need planning or other official consent, but check with your local authority, especially if the work adjoins a boundary or affects a public right-of-way).

A sketch to scale is also a valuable aid to estimating materials. The area of an irregularly-shaped patio, for example, is hard to work out by ordinary arithmetic - sketch it out on a grid of one-metre squares and it’s easy – see **Figure 3**. (Average out the part-squares or count the left-over part-squares as wastage).

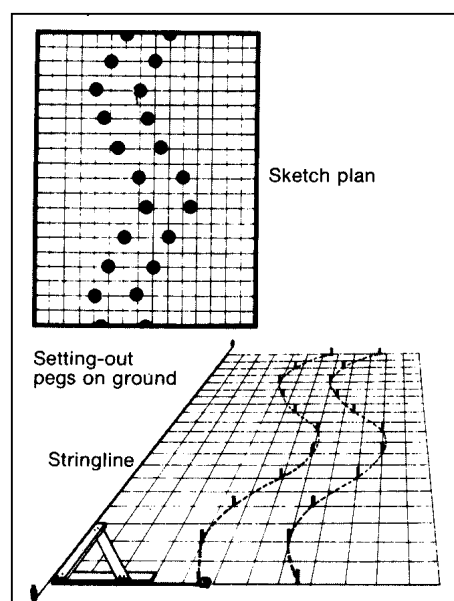
Once you have done the planning the next step is to ‘set out’ the job on the ground so that alignment and levels end up as you meant them to be. For a small job you can simply do this as you get on with the work: for a bigger project it should be done in

advance with pegs and string lines.



**Figure 3: Estimating an irregularly shaped area.**

**Construction lines** should be set out from a known reference such as a boundary fence or a building wall. Start with pegs at both ends of one side of the work. Drive nails in the tops of the pegs for exact location and to hold one end of the tape when measuring. Stretch a stringline across the nails and fasten it to nails in pegs driven well outside the working area where they will not be disturbed by later work. Make sure the stringline is good and taut (bright-coloured synthetic cord is easier to see than ordinary string or twine and won’t shrink or slacken as much). (**Figure 4**).



**Figure 4: Setting out pegs and stringlines.**

Next, for a square or rectangle, set up stringlines for the two sides at right angles to the first, using a builders' square, and locate the other two corners. Finally set the stringline for the fourth side, with pegs outside the working area (to check for squareness, measure the diagonals: they should be the same). Once the stringlines are accurately set, the pegs at the corners can be removed. The stringlines themselves can be taken down during site preparation etc., and set up again as needed to check the work. (Figure 5).

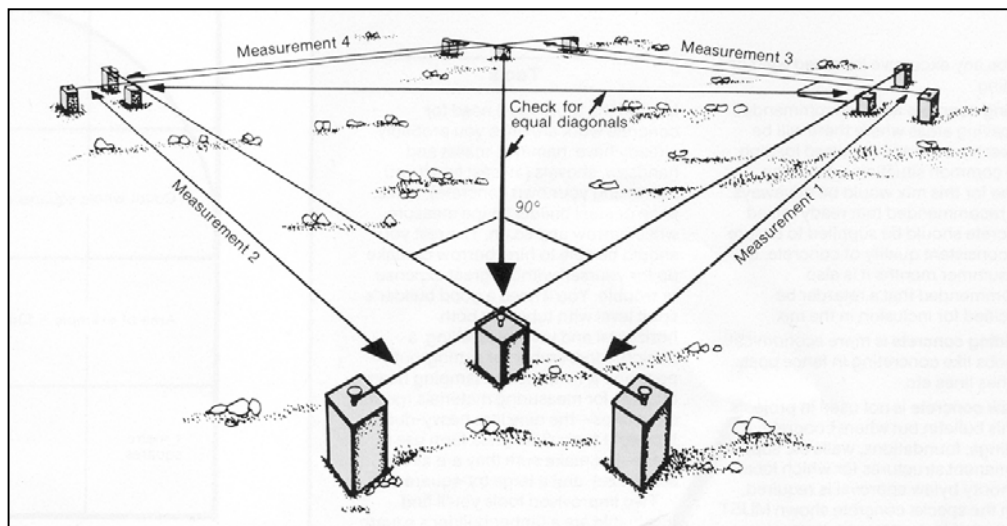


Figure 5: Setting-out construction lines for a square or rectangle.

Irregular areas are a little trickier. Set up a stringline for the longest side (or simply for reference if none of the sides are straight) and locate all the other pegs – at corners or at intervals along a curve – by measuring along the stringline and at right angles to it. Use a scale sketch plan to work out the measurements.

Levels should be measured from a single reference point – the damp-proof course of a house, the floor of a garage, etc. If the level of the finished job does not have to match anything else, just drive a peg at one corner of the work to what you think the level ought to be and set other pegs from it.

Over short distances levels can be set from your primary reference by using the spirit level on a straight-edge (measure and sight along it to make sure it really is straight and parallel). Double-check for inaccuracies by reversing the level and straightedge and repeating the reading. Over greater lengths, working from one pair of pegs to the next along a line can multiply small errors, the water level really comes into its own here.

Large exposed areas of paving should be given a 'fall' to one side so that water will run off easily. One in 40 (25 mm per metre run) is good, but you can get by with 1 in 50 (20 mm in 1 metre) if the surface is smooth and accurately finished.

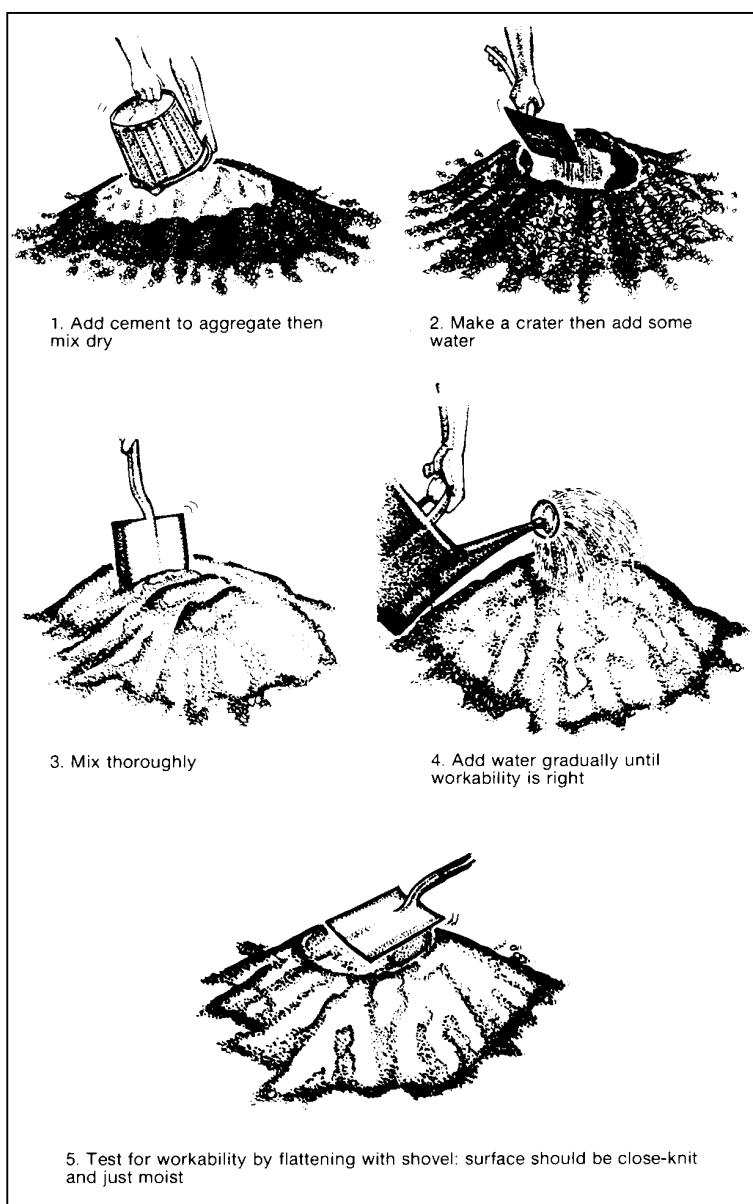


Figure 6: Hand mixing.

To get an accurate slope, set levels on the high side first and then do the low side. You can either set the pegs level and measure down the required amount from the top of the low-side peg, or use a wooden spacer block under the 'low' end of the straightedge, equal in thickness to the difference in level.

## Mixing your own concrete

If you are not going to use ready-mix, you have a choice of hand or machine mixing.

**Hand mixing** is perfectly suitable if it's done well, and not too arduous if you are only using a small quantity at a time. All you need is a couple of shovels, a couple of buckets (always use separate buckets and shovels for cement only and keep them absolutely dry - otherwise cement will build up and harden on them), a watering can and a hard surface. (Figure 6).

Measure out the sand and gravel into a heap, filling the buckets level with the rim. Make a crater in the centre of the heap and add the cement (fill the bucket level with cement, knock the bucket two or three times so the cement packs down a bit, and then top it up - cement 'fluffs up' when handled).

Turn the heap methodically until the whole pile is uniform in colour, without streaks. (If you're using a dry-packed mix, tip out the entire bag and mix it dry in the same way. The coarse and fine material is likely to have separated out somewhat in storage and handling).

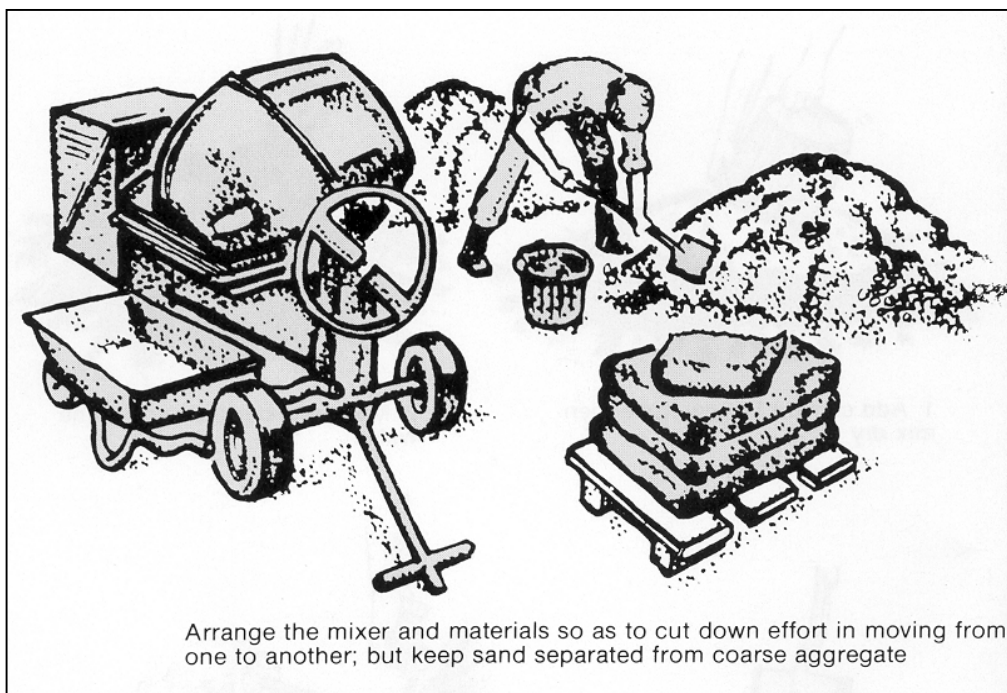
Make a crater in the thoroughly-mixed heap and add some of the water. Bring dry material to the water from around the edge and keep mixing, adding water as necessary until the whole pile is well mixed and easily workable without being either crumbly or sloppy. To test, 'trowel' it with the back of the shovel; the surface should be close-knit and moist but not showing an excess of cement-and-water 'fat'.

**Machine mixing** takes a lot of effort out of the job, but unless you can borrow one, the cost of hiring the machine will have to be taken into account. You don't need a large mixer, the common 100 litre ('half-bag' or 5/3½) power mixer is ideal and widely available from hire firms. (Figure 7).

Start by putting half the coarse aggregate and half the amount of water you think you'll need in the drum. Let it turn over for a while, especially when mixing the first batch after starting the machine. Then add most of the cement and sand. Add materials alternately, keeping the mix fairly wet until the final addition of aggregates. This will ensure thorough mixing and reduce possible build-ups of dry or hardened materials in the drum. When finished mixing, the concrete should fall cleanly off the mixer blades without being over-wet (until you learn to judge it by eye, the workability can be tested by tipping a bit of the mix on to a board and applying the shovel-back test).

Total mixing time should be at least two minutes, but don't overdo it. Empty the drum into wheelbarrows, or if it isn't high enough to get a barrow under it, onto a sheet of plywood for shovelling into the barrow (a full 100 litre mixer will fill at least three ordinary garden barrows). When empty, put a measured amount of coarse aggregate and water in the drum and let it turn over while you're waiting to start the next batch.

Figure 7: Machine mixing.





## Preparing for ready-mix

If you decide to use ready-mixed concrete, make sure everything is clearly agreed with the supplier. Specify the mix you want in precise terms (quote the 'ready-mix' details in **Table 1**) and the quantity, remember to allow about 10% for wastage. Agree the delivery time and make sure everything is ready to receive the concrete ahead of time. Be as accommodating as possible, the morning rush-hour is often the supplier's busiest period, and they may find it easier to deliver smaller quantities during a slack period. Make firm arrangements about how and where the concrete is to be unloaded, and discuss access.

The chances are that you will have to receive the load at the front of the house or on the drive and move it to the job yourself. To get the maximum handling and working time, ask for 'medium' to 'high' workability and for the mix to be retarded for two hours with an admixture – on a mild day this should give you three to four hours from the time of mixing. Make sure you have plenty of barrows and helpers on hand when the load arrives.

## Handling fresh concrete

Unless you can mix the concrete or receive a load of ready-mix right next to the job, you'll have to get the fresh concrete from one place to the other. Buckets will do for very small quantities but a barrow is much handier. If you have a lot of concreting or other heavy garden work to do, a proper builder's barrow with a large, wide tyre is ideal – it's built for heavier use and is easier to handle on soft, rough ground than an ordinary light garden barrow.

On poor ground, or if you have to barrow loads across the lawn, lay a 'barrow run' of planks or hard sheet material – builders' scaffolding planks are ideal and easy to hire. Don't overload the barrow - fresh concrete is heavy. Start by under loading and work up to a comfortable amount.

If you're mixing your own concrete, make sure each batch is used completely before starting the next, so that no old concrete is left to go hard, and make sure buckets or barrows are completely emptied.

## Keep it clean

Concrete and cement paste stick tenaciously to

most other materials. If even a small amount is allowed to harden on tools or equipment more will build up on it. Wash all tools and scrub them down if necessary as you go, and especially when you finish work.

Hardened material on shovels and other metal tools can be removed by wire-brushing. A piece of brick or concrete block can be used to rub tools down before finishing with a wire brush.

When using a mixer a useful dodge is to put the first half of the aggregate and some water, but no cement, into the drum as soon as it has been emptied and let it run while you're removing or using the concrete - this will help to keep it well scoured. Do the same, letting it run for ten or 15 minutes, before shutting down the mixer, then clean the inside thoroughly by hand. Places to watch particularly are the centre of the drum and the base of the mixer blades. Take care that slurry and cement-dirtied water don't get in the drains.

## CONCRETE ON THE GROUND

### In situ paving

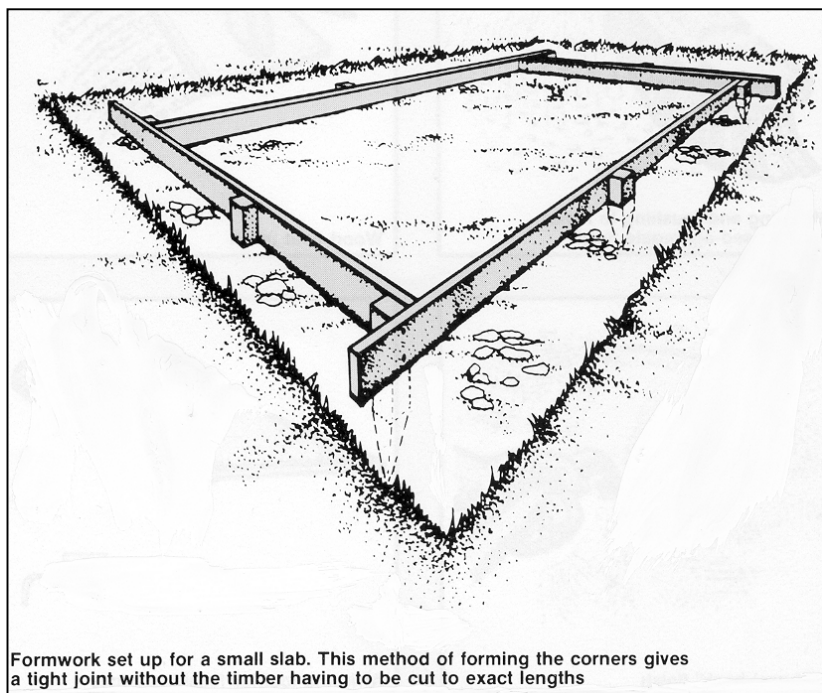
Many of the jobs you may want to do around the house and garden start with laying fresh concrete, either for paving a path, drive, hardstanding or as a base for something else (i.e. shed, sectional garage, etc.). It's a simple job and a good one to start with if you are not used to working with concrete.

### Preparing the site

The first thing to do is strip all vegetable matter and topsoil to approximate level, and cut back any large roots that might cause trouble later. On most soils and for most purposes the concrete can be laid direct on well-compacted ground, but on clay or peaty soils, or for drives or hardstandings, you'll need a sub-base of 'imported' material.

Clear the site 150 mm or more beyond the edges of the slab to give room for setting out pegs and timber forms to support the edge of the fresh concrete. Dig out the required depth, to the thickness of the slab plus the thickness of the sub-base (if you use one) below the finished slab level. Compact the soil thoroughly with a heavy garden roller or a rammer.





Formwork set up for a small slab. This method of forming the corners gives a tight joint without the timber having to be cut to exact lengths

**Figure 8: Formwork set up for a small slab.**

If a sub-base is required, place and thoroughly compact a 100 mm thick lay of crushed or broken stone. Avoid using builders' or demolition rubble.

## Laying a small slab

A simple small slab is very easy to lay, but to reduce the risk of cracking it shouldn't be too big. The basic rule is to keep the longest dimension to no more than 40 times the slab thickness, or to 3 metres, whichever is the least, and the length to no more than  $1\frac{1}{2}$ , or at most twice, the width. Thickness should be 75 mm. Side forms are needed to support the edge of the slab during construction and while it's curing - use boards equal in width to the thickness of the slab. Old fencing or floorboards cut to width are fine, but they should be at least 20 mm thick - the smoother the better.

Set the boards up along the edges of the slab, solidly pegged to the ground and accurately levelled. Besides supporting the edges, the top of the formwork is the reference for the surface of the slab. Make sure the corners are tight and that the pegs don't project above the top of the boards. With the arrangement shown in **Figure 8**, the boards need not be cut to exact length.

### Laying the concrete

Use paving mix (**Table 1**) if the slab is exposed to

the weather, otherwise general purpose mix. Spread the concrete evenly between the forms and rake smooth to a level about 15 mm higher than the finished surface. Make sure the concrete gets right into corners, tamp it in with the shovel or your boot.

Use a length of 50 mm thick timber on edge as a tamping beam. A simple piece of smooth 100 x 50 mm is fine for a slab up to about a metre or a metre and a half wide. For a wider slab use 150 x 50 mm timber with cross-handles fixed in place with screws.

### Finishes

Left 'as tamped' the surface will have a sort of 'washboard' finish, how neat depends on how steady you are with the final tamping. A smoother rippled surface can be produced by a final slow steady back-and-forth pass with the beam. A deeper non-skid texture can be obtained by drawing a stiff bass or nylon broom across the slab, or a finer finish by using a soft broom.

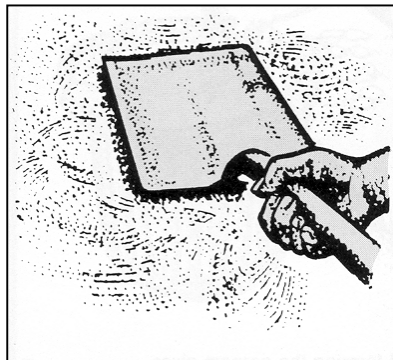
A layer of water will often form on the surface 20-30 minutes after placing. Re-finishing should not be attempted until this water has evaporated.

If a soft broom is used first and the concrete is then left to go stiff but not too hard, a combination of gentle brushing and spraying with water can be used to wash away the fine material and leave the coarse aggregate standing slightly proud of the surface for an attractive finish. It's a good idea to experiment first on a small, out of the way slab where results won't be important.

You can also use a wood or steel 'float' to finish the surface. Unless the slab is very narrow (about 1 metre or less) this will have to be done from a moveable bridge of planks supported clear of the concrete. A wood float used on very fresh, 'sticky' concrete will give a textured finish that will be most pronounced. This is particularly attractive if the float is used in overlapping semi-circles to give a 'fish-scale' appearance. A similar but even more rustic finish can be produced by using the back of a shovel in the same way. (See **Figure 9**).

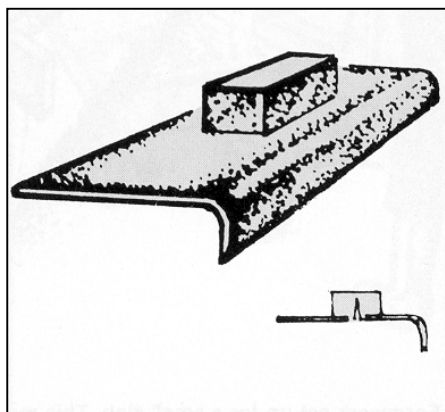
A completely different finish is produced by using a wood float after the fresh concrete has been soft-

broomed and allowed to stiffen up a bit – the result will be an even ‘sand-paper’ finish. For a smooth finish use a steel float. It should almost literally be ‘floated’ over the fresh concrete or it will leave marks. Going over the surface again after the concrete has ‘gone off’ a bit will give an even smoother, almost ‘polished’ finish.



*Figure 9:  
‘Shovel-back’  
finish.*

As well as the surface, the edges should be finished while the forms are still in place so that they end up slightly rounded, without sharp corners or fins. You can use a proper floor-layer’s sheet metal ‘arissing tool’ (see **Figure 10**), or better still improvise one from a piece of sheet metal bent to 90° around a piece of rod or dowel. Run the tool along the edge between the concrete and the timber so that it leaves a radius on the edge and a slight mark on the surface. If the mark left is objectionable it can be made good by trowelling.



*Figure 10:  
Arissing tool.*

### **Curing and frost protection**

As soon as the concrete has hardened enough not to be marked, it should be covered with polythene or similar plastic sheeting, well weighted down outside the slab at the edges, to keep it from drying out too fast. (Sprinkle a thin layer of sand on the sheeting to keep it from ‘ballooning’ in windy weather). The sheeting should be left in place for about three days.

Besides being kept from drying out too fast, it is essential that fresh or ‘green’ concrete should be kept from freezing. Don’t lay concrete when frosts are likely. If a cold snap occurs insulate the concrete with a ‘quilt’ of straw between two sheets of polythene, or a layer of earth, sand or compost on top of the curing sheet.

You can start building on a concrete base after a couple of days, or walk on a slab if necessary, but be careful of edges and corners. If you can, leave the form timbers in place until the concrete is thoroughly hard. But don’t put it into full use for at least seven days (ten in winter).

### **Larger slabs**

If the area to be concreted is bigger than the maximum dimensions given above, all you need to do is split it into smaller areas or ‘bays’ with joints between them. Keep the bays as nearly as possible the same size and shape. If you’re mixing your own concrete, simply lay one bay at a time. When that has hardened for a day or two you can lay the adjoining one, using the adjacent edge of the first as part of the formwork. Because concrete shrinks slightly on drying out and the joint will be weaker than the rest of the slab, it will pull apart enough to allow for expansion and contraction later on as the temperature changes.

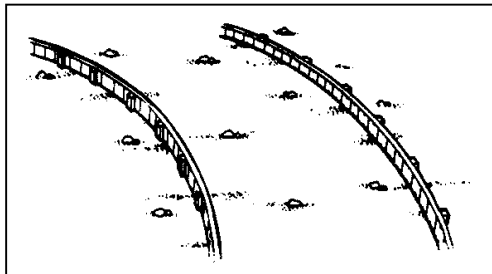
If you’re using ready-mix, this method isn’t always practical since the largest area you can safely concrete in one jointless piece won’t use more than about a cubic metre of concrete and you may have difficulty finding a supplier willing to deliver that little.

The best answer then is to concrete the whole area at once and form the joint with a strip of hardboard left in place. The strip should be the same depth as the side forms. Hold it upright in position by any convenient means while you shovel concrete against both sides. When enough concrete has been placed to support the strip any temporary props or pins can be removed. Just remember to place concrete on opposite sides alternately so it doesn’t push the filler strip out of line. Follow the same rule when tamping the concrete, working the beam toward the joint from first one side and then the other. So long as the strip doesn’t project above the forms, final finishing passes should be made across the joint in one direction. Use an arissing tool on both sides of the strip to give a neat finish.

## Laying a path

An insitu garden path is just a long thin slab and it's laid in exactly the same way. Use paving mix 75 mm thick, with joints. You won't need a sub-base except on clay or peaty soil.

A curving path is likely to suit an informally laid-out garden better than a straight one. To form curves, cut saw-notches at regular intervals on the face of the timber forming the side of the curve – the sharper the curve the closer the spacing – and soak the timber thoroughly before bending it close the cuts and fixing it to the pegs (these should be more closely spaced than for a straight path) – see **Figure 11**. For really sharp bends use hardboard strips, bend and fix one strip at a time until you've built up a thickness substantial enough to stand up to tamping – two strips should be ample.



*Figure 11: Laying a curving path.*

## Drives and hardstandings

A drive or hardstanding is still just a slab, but it needs to be more substantial than most other slabs to take the load of a vehicle.

It should have a sub-base for a start. So long as the added thickness doesn't cause problems with levels you can lay concrete directly on an existing drive of granular fill or blacktop if ruts or potholes are made good with well-compacted material - but not on a concrete one that has cracked or started to break up. Cracks in the old one will simply appear in the new. Break the old concrete up as finely as you can and use it as a sub-base after 'binding' it with sand or granular fill. If the drive is completely new, prepare the site as for any other slab and lay a 100 mm thick sub-base.

The drive itself should be at least 100 mm thick. Increase the thickness to 150 mm on clay or other poor soil, or if it will be regularly used by heavier vehicles. Use ready-mixed paving mix concrete (see **Table 1**).

Set the levels to give a fall of 1 in 40 across the drive, away from buildings. A stiff-broomed finish across the slab will help water run off quickly.

Joints should be included at least every 4 metres for a 100 mm slab (5 metres for 150 mm) and shouldn't meet the edge of the slab at anything less than a 75° angle. You can put a kink in the joint if necessary at awkward spots so both ends meet the slab edge at a right angle.

## 'OFF THE PEG' PRECAST PAVING

Much of the concrete in outside paving isn't DIY but is bought 'made to measure' from garden centres, DIY outlets or suppliers, in the form of factory-made precast concrete paving. The range is huge and it's emphatically not a case of 'any colour you like so long as it's grey'. There is a wide choice not only of colour but of pattern, shape and texture, including 'reconstructed' stone so like the natural material that it is used in restoring and maintaining famous historic buildings and gardens.

Most garden, DIY centres, and many other outlets have helpful displays of the paving they stock.

## Precast paving types

Precast paving units are available in a variety of shapes and sizes. Rectangular, square and hexagonal flags are the most common, but there are several others. Typical thicknesses are 40-60 mm. Thinner units are fine for paths and patios but thicker ones should be used for drives and hardstandings.

Hydraulically pressed flags are the strongest, but are not available in as wide a range of surface finishes as moulded slabs.

## Picking a pattern

By combining sizes and colours of concrete paving you can create patterns almost without limit for patios, path and drives. Most of the larger manufacturers produce leaflets or information sheets showing patterns that can be laid using their products, with indications of how many of each size you'll need. Some even offer paving already selected for a few popular patterns, all you have to do is order enough for the area to be covered and the right number of each type will be included.



## Ordering and storing

Most suppliers keep a fairly limited range of paving in stock, so for a large area or a particular type or pattern, you may have to order in advance and wait for delivery from the manufacturer. Allow some extra for breakage - this shouldn't be great if the units are carefully handled. Be on hand when the paving is delivered to make sure it is stacked properly and in the right place. Normally the driver will do no more than unload and you'll have to do the final handling and stacking yourself.

Store each side and colour separately, on edge leaning against a wall (not painted surfaces or light timber structures) or other firm support and on a hard surface or lengths of timber so the bottom edges don't become stained.

## Preparing the site

Prepare the site as you would for insitu paving (see page 8). Set out in the same way larger areas should be laid to a fall for rainwater run off. For paths and small paved areas you won't usually need a sub-base except on clay or peaty soil, but you may need to use sub-base material to build up to the required level. The level of the compacted soil or sub-base should allow for the thickness of the slabs plus about 25 mm for the bedding mortar.

Drive pegs to the finished surface level, allowing for any fall in the surface, around the edges of the paved area where they can remain undisturbed for reference while the paving is being laid. If the area is too big to be easily spanned by a straightedge, drive additional temporary pegs using those around the edge as references.

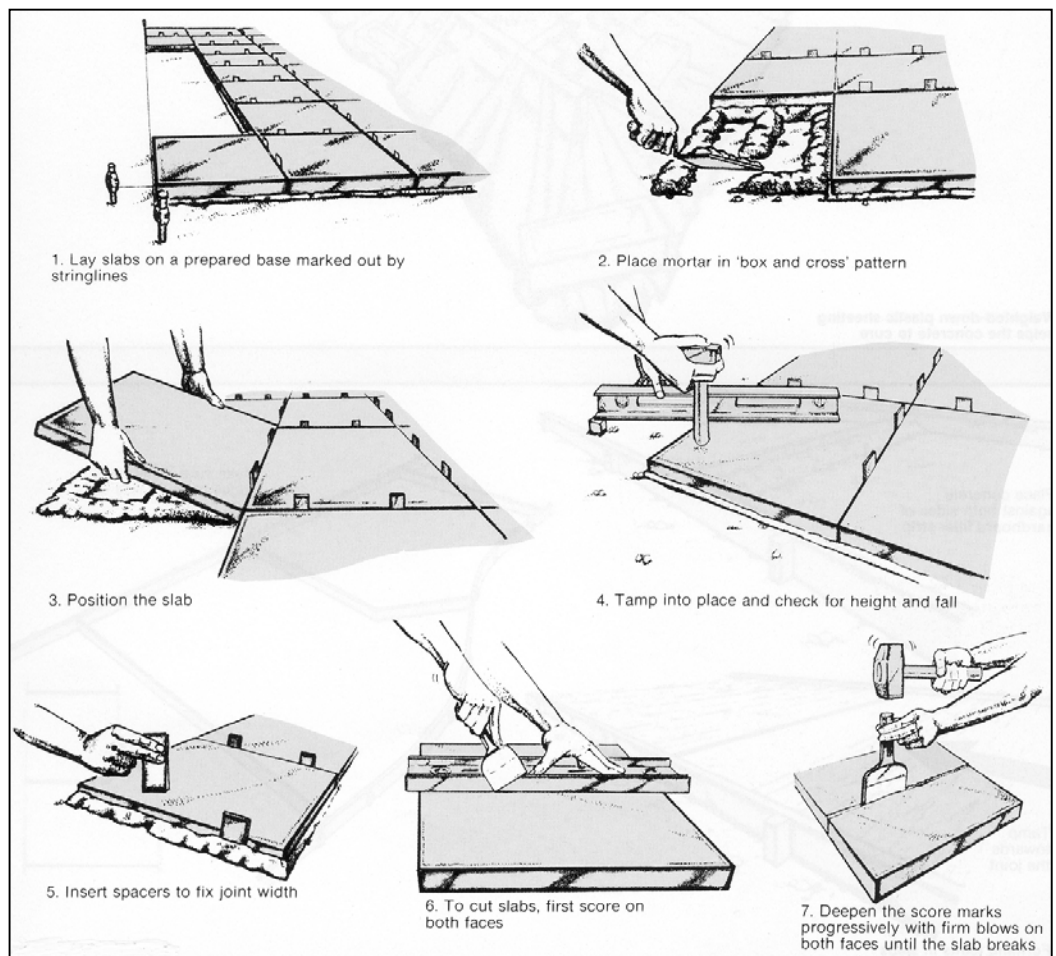
## Laying the units

Use a fairly dry bedding mortar made either of 1 part cement to 5 parts concreting sand or from a dry-packed sand-cement (not masonry) mix. 'Spot bedding' with a small mound of mortar at each corner and one in the middle (corners only for 300 x 300 mm slabs or smaller) is simplest, but is not as strong as other types of bedding. The best compromise between strength and ease of laying is 'box and cross' beddings.

Start from the end of a path or drive, or one side of a larger area. If the paved area is bounded by an existing wall, start there to avoid gaps or cutting.

Place strips of mortar about 40 mm high with a bricklayer's trowel in a box-and-cross pattern slightly smaller than the slab. Position the first unit and tamp it into place with a wooden mallet or a length of timber, it should not rock in any direction. Check for accuracy against the level pegs with a straightedge and spirit level.

*Figure 12: Laying paving slabs.*





Repeat with successive units using small pieces of wood as spacers for the joint width, offering each slab edge-on to the one laid previously. Joint width will depend on the slab size and the pattern and will usually be either 10 mm or 12.7 mm (½ inch). Check alignment and level against adjoining slabs with a spirit level and straightedge (for large areas use stringlines as well, rather than relying solely on the straightedge for alignment). (*Figure 12*).

## Cutting slabs

Most ranges of precast paving include enough different sizes of slab to make cutting unnecessary. If you do need to cut a slab, use a bolster (a bricklayer's or mason's broad-bladed cold chisel) and club hammer. Start by scoring along the entire line to be cut, working both faces and both edges in turn with the corner of the bolster, using a straight strip of wood to guide it. Work over the scored line two or three times with increasingly firm strokes until the slab breaks cleanly. (Hydraulically pressed flags are easier to cut neatly this way than plain moulded ones).

Edges cut with a bolster will be rougher than the edges of the manufactured units but they can be disguised quite effectively if they are laid at the edge of the paved area against edging or a raised planting bed. If a lot of cutting is involved, consider hiring a power-masonry saw, but be sure to observe safety precautions.

## Filling the joints

After a day or so, fill the joints with a very stiff, dry mortar mix well rammed in - use a damp sponge to clean any excess from the slab surface. Finishing the joints to a level 1 or 2 mm below the slabs will improve appearance and drainage without leaving a deep groove.

## Patios and terraces

For large areas of formal paving it's a good idea to lay a concrete base before laying the flags. This will keep uneven settlement to a minimum and help maintain a near even surface. Use bedding mix 75 mm thick laid as for insitu paving (page 8) but without joints.

## Drives and hardstandings

For a drive or other paving which will carry vehicles

use thick (50 mm or more) hydraulically pressed flags no larger than 450 mm square, laid on a 75 mm base of bedding mix concrete and a 100 mm sub-base of granular fill or other suitable material fully compacted down onto the formation soil. Use box-and-cross bedding with plenty of mortar and tamp the units down firmly so the mortar spreads and gives plenty of support.

## CONCRETE BLOCK PAVING

Block paving combines the strength of insitu concrete paving with the attractive finish and colour possibilities of precast paving, and is in many ways the easiest of all ways for the DIYer to lay a drive, path or patio.

### The structure of block paving

Concrete block paving consists simply of individual blocks about the size of a common brick, laid without mortar in an interlocking pattern on a bed of sand between edge strips. Once laid in position the blocks are bedded into the sand with a plate vibrator, and additional sand is vibrated into the narrow joints between the blocks to lock them in position and prevent shifting under traffic. If you have to get at buried drains or services in the future it is only necessary to break out one or two blocks and the rest can be lifted, set aside for the time being and re-used when paving is reinstated.

### Materials and tools

Concrete paving blocks are made in both rectangular and special 'keying' shapes. Either way they measure about the same – 200 x 100 mm if rectangular or with the same overall bedding area if shaped. Blocks 60-65 mm thick are suitable for all domestic paving.

Sharp (concreting) sand for bedding the blocks and granular fill or other suitable material for a sub-base if needed are obtainable from builders' merchants and many DIY outlets.

Precast concrete path edging units 50 x 150 mm make attractive and durable edge restraints for the block paving and are available from suppliers of paving slabs. They will need to be bedded and backed up with insitu general-purpose concrete – dry-packed mix is ideal. Alternatively you can use timber strips pegged down on edge and well treated with creosote or other preservative - the

strips should be 100 mm wide and 35-40 mm thick. For hand laying, the tools used for laying precast paving slabs are fine, but you will get much better results and save a lot of time and effort, especially on larger areas, with a mechanical plate vibrator. If the layout and pattern require cutting a lot of blocks, a hired hand-operated hydraulic stone-splitter will save time and waste.

## Blocklaying patterns

The laying pattern you choose will affect not only the performance and finished appearance but also the methods of laying. For vehicular use, a pattern or bond in which the blocks interlock with each other will give the best results.

**Parquet** pattern is easiest to lay in a rectangular area, provided overall dimensions are kept in multiples of 200 mm, since no cutting is required, but the blocks may shift slightly under vehicle traffic.

**Running bond** pattern is fairly easy to lay but requires considerable cutting unless the particular range of blocks includes half-units or special edge blocks. The rows or 'courses' of blocks should run crosswise to the centreline of a path or drive.

**Herringbone** blocklaying is best suited to irregular areas and is the best to use for a hardstanding or drive, but requires a bit of thought to get the laying sequence started off right. (Figure 13).

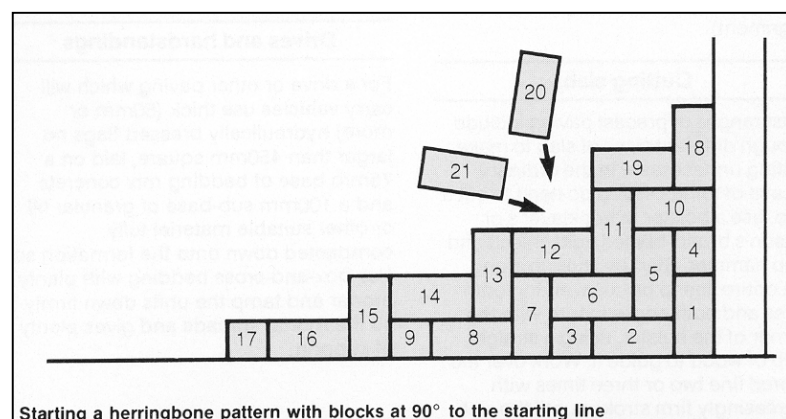


Figure 13: Herringbone blockpaving.

## Preparation

Prepare the site exactly as for an insitu slab or drive (page 8). Lay a 100 mm thick sub-base if the paving is to be used by vehicles or is on clay or peaty soils. If a crossfall is required, it should be formed in the surface of the sub-base or formation, and the edge strips set to match.

Unless existing walls or paving provide a ready-made edge restraint, construct edge strips of precast units or timber. If you use timber, fix it in position as you would side forms of insitu paving, with pegs at 1 metre intervals. Take care to set out the edge strips in multiples of the block dimensions so cutting is kept to a minimum.

Trim the base to an even surface and compact it thoroughly (if you'll be using a vibrator to lay the blocks, use it to compact the base as well). Place piles of sand along the site at intervals so that it can be spread ahead of blocklaying without having to be barrowed over the newly laid work.

## Laying block paving with a vibrator

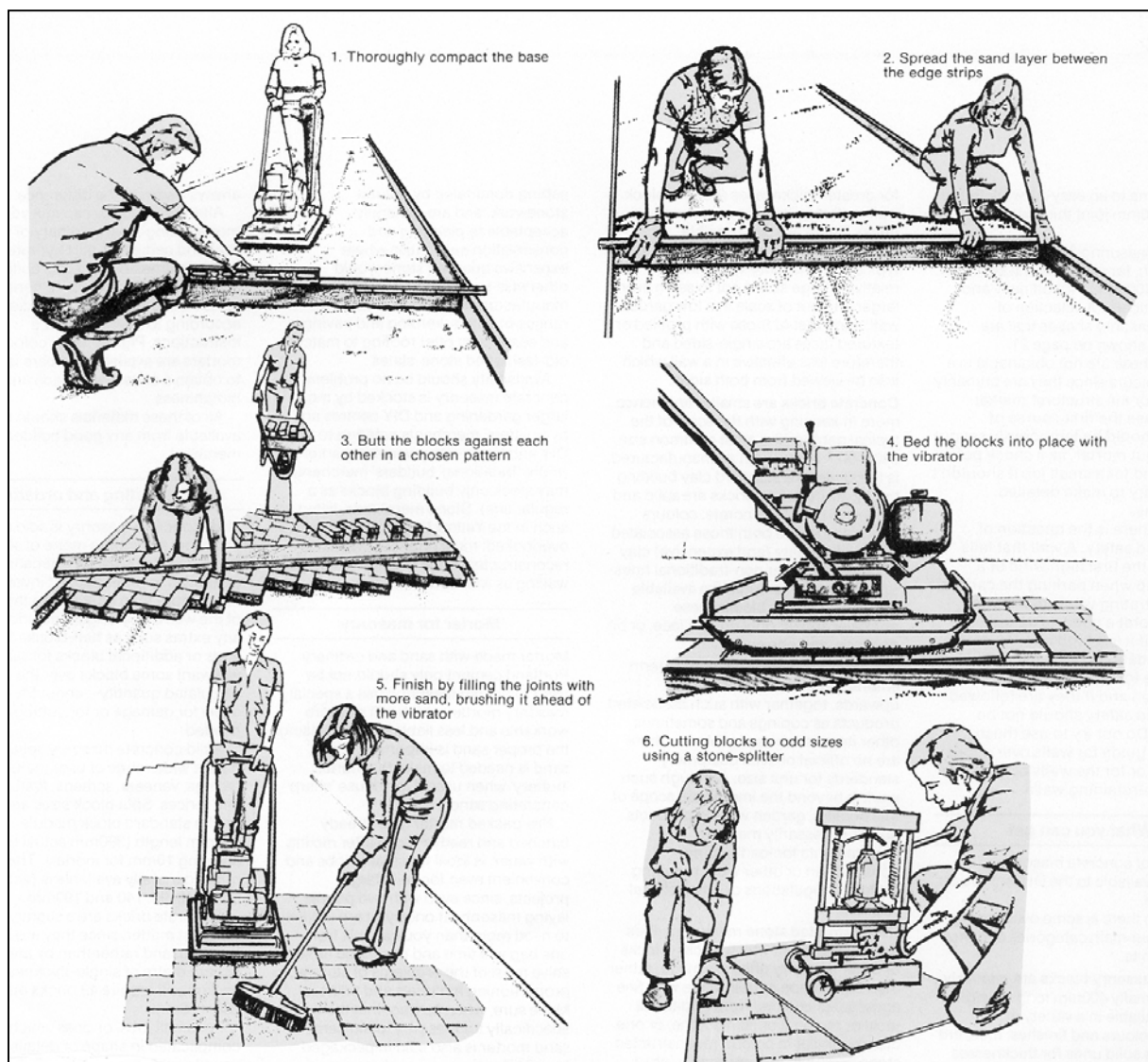
Spread the sand between the edge strips with a rake and use a straight-edged board to strike off the surface to the required level – 45 mm below the finished pavement level with 60 mm blocks. (Figure 14).

Use a board notched at the ends so the edge strips serve as level references. If a wall or fence serves as the boundary, set up a temporary 'screeding rail' of timber batten or angle iron on a strip of sand and use that for levelling, then remove it and fill in the groove. Only spread the sand a metre or two ahead of the blocklaying face at a time, and don't disturb the smoothed-off sand.

Start laying the blocks from the edge nearest the supply; make sure they have a neat joint of approximately 3 mm between the edge restraint and each other. At edges or around obstacles such as inspection covers or gullies, lay whole blocks first wherever possible then go back and cut blocks to size and shape to fill the gaps, using the stone-splitter or a hammer and bolster.

It is a good idea to use a kneeling board of ply or hardboard and lay plank runs for barrowing the blocks to the laying position. This will prevent blocks already laid, but not bedded into final position, from tilting or being displaced.

When two or three metres of blocks have been laid, bed them into place with the vibrator. Two or three passes should drive them down to the required level. Make sure the movement of the vibrator covers the area evenly, but keep the vibrator at least a metre back from the laying face.



**Figure 14:**  
*Laying concrete block paving.*

Finally, spread a thin layer of sand on the surface of the paving and make two or three more passes with the vibrator. Keep brushing sand under the leading edge of the vibrator plate as you go. If the sand or blocks are damp you may have trouble getting the sand to penetrate the joints. Do the best you can with the vibrator and finish off by working sand in with a broom and a watering can with a fine rose.

Once this has been completed the paving is ready for immediate use. There is no need to complete the entire job before part of it is used, so long as traffic is kept away from the unfinished edges by not less than 1 metre.

### Laying paving by hand

For small areas used only by foot traffic, you can do an acceptable job without a vibrator, though the result will not be as good as with one. The sand

bedding layer should be thinner than if a vibrator were being used, since it won't be as thoroughly compacted.

Dampen the sand with a watering can and fine rose until it holds together in a ball when squeezed in the hand, then level and compact the sand with a timber tamping beam – a straight-edged 50 x 100 mm length is fine.

Use a wooden mallet or a club hammer and off-cut of board to tamp the blocks into position and finish off by using the watering can to wash sand into the joints.

## CONCRETE MASONRY

The variety of concrete blocks, bricks and other walling materials is immense. There are concrete



facing blocks and bricks in a wide range of colours, textures and patterns. Reconstructed stone masonry made to blend with traditional natural-stone construction; screen wall blocks with many uses; and an almost endless variety of decorative garden-wall masonry.

## The long and the short of masonry

Most concrete masonry units are oblong with a length usually two to three times the height. This is because they are normally laid in an overlapping pattern, with the individual units in each layer or 'course' staggered so that the vertical joints are not continuous. This overlap or 'bond' is the main source of strength in walls or other masonry.

When working with masonry of any kind, and especially when planning and setting-out the job, it is important to remember that the overall dimensions of the finished work will not simply be a sum or multiple of individual unit sizes - allowance must be made for mortar joints. This is less trouble than it sounds, since the standard joint thickness is 10 mm and blocks, bricks and other walling units are normally dimensioned so that lengths and heights come to an easy-to-work figure when the 10 mm joint thickness is added.

Blocks measuring 390 mm long by 190 mm high, for example, will be laid at centres of 400 mm longitudinally and 200 mm vertically. A selection of concrete masonry shapes that are available is shown in **Figure 15**. Generally these are not obtainable in a range of colours since they are primarily produced for the structural market.

In any case the first course of masonry should be temporarily set out 'dry', without mortar, as a check before starting, and for a small job it shouldn't be necessary to make detailed calculations.

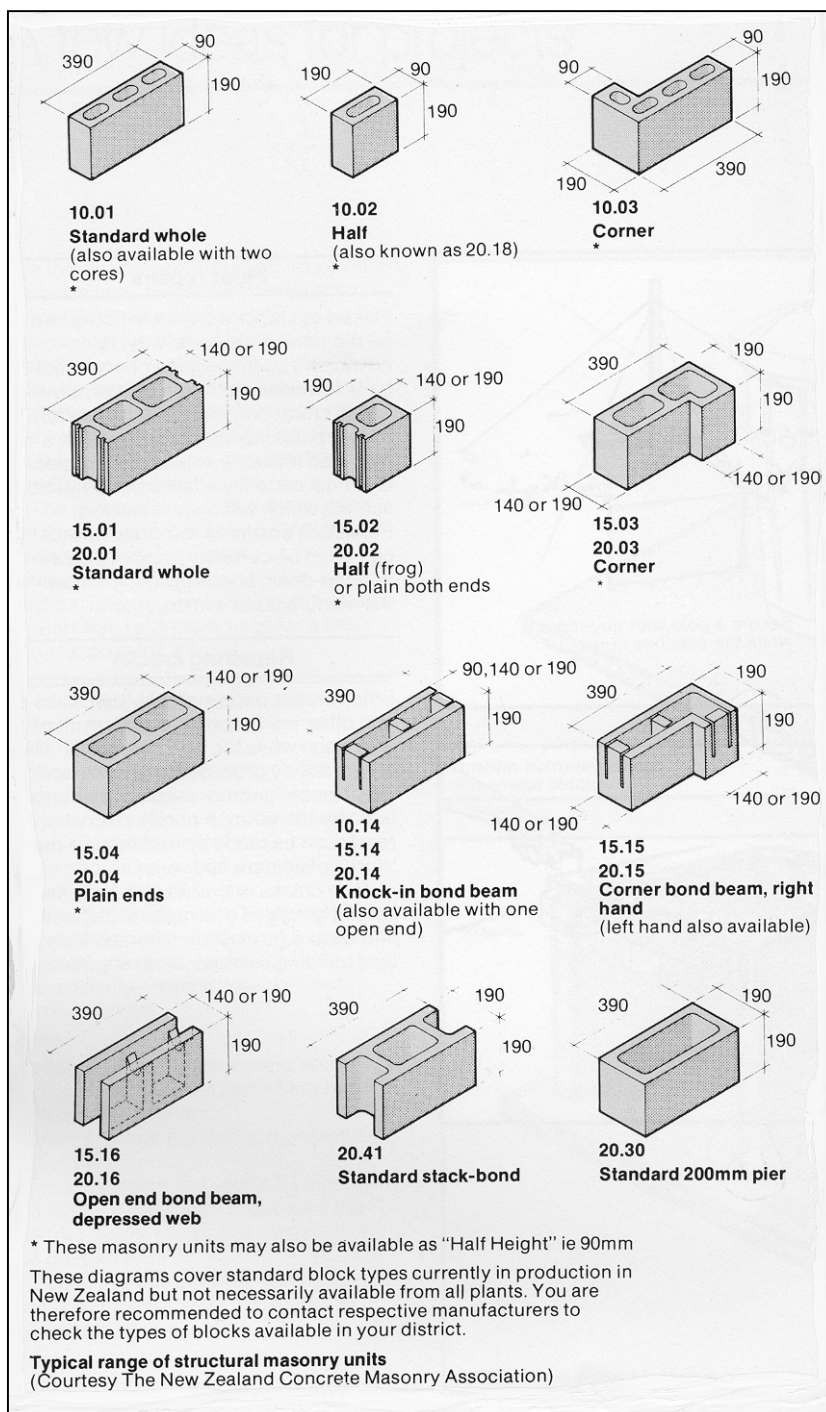
Finally, there is the question of stability and safety. All of the recommendations given in this Information Bulletin are for relatively low construction and if they are followed, stability and safety should

not be an issue. Do not try to use these pages as a guide for walls over about 1.2 metres high, for the walls of buildings, or for earth-retaining walls.

## What you can get

The range of concrete masonry products available for DIY is very wide. Although there is some overlapping, there are four main categories of dense masonry units.

**Figure 15: Concrete masonry shapes.**





**Concrete masonry** blocks are relatively large – normally 400 mm long as laid – and are available in a variety of attractive colours and finishes. Most are available as solid units for thicknesses of 90 to 100 mm and hollow or slotted for greater thicknesses (hollow-block walls will require separate coping units). There are two possible drawbacks to using facing blocks in typical DIY masonry work. Their relatively large size is apt to seem even larger and out of scale in a low garden wall, and most of those with profiled or textured faces are single-sided and therefore less effective in a wall which is to be viewed from both sides.

**Concrete bricks** are smaller and hence more in keeping with the scale of the typical garden (the most common size, 230 x 90 x 75 mm high as manufactured, is the same as a standard clay building brick). All concrete bricks are solid and made with dense concrete. Colours available include both those associated with high-quality (and expensive) clay brick and brighter non-traditional hues. Split and other textures are available but as with facing blocks these normally appear only on one face, or on one face and one end.

**Decorative walling** is a catch-all term embracing units from brick size upwards, together with such associated products as copings and sometimes other items such as pier blocks. There are no official or even customary standards for unit size. Although such work is beyond the immediate scope of this Information Bulletin, garden walling products do not necessarily meet the requirements for load bearing construction or other work requiring Building Regulations or other official approval.

**Reconstructed stone** really describes the material from which bricks, blocks or other masonry units are made, rather than their shape or use. Made with fine aggregates crushed from traditional local or regional building stone, or one closely similar in colour, reconstructed stone products fit comfortably into a setting dominated by natural stonework, and are generally acceptable to planning and conservation authorities where expensive quarried stone would otherwise be required. Most manufacturers produce matching ranges of lintels, kerbing and paving and some even offer roofing to match old-fashioned stone 'slates'.

Availability should be no problem - concrete

masonry is stocked by most larger gardening DIY centres and by suppliers catering to the DIY and home-improvement market.

## Mortar for masonry

Mortar made with sand and ordinary Portland cement only should not be used for laying masonry. Use a special masonry mortar, which will be more workable and less liable to crack. Using the proper sand is important, a 'soft' sand is needed to make the mortar 'buttery' when used. Do not use 'sharp' concreting sand.

Pre-packed mortar mix, already batched and ready for use after mixing with water, is ideal for smaller jobs and convenient even for quite large projects. Since even with two people laying masonry at once you are unlikely to need more than you can mix from one bag at a time and packaged mixes solve most of the problems of storage, proportioning materials and tidiness. Make sure, when buying, that the mix is specifically for masonry, plain cement-sand mortar is also sold in packaged form and sales personnel are not always aware of the difference.

Alternatively, you can mix your own mortar using:

- 1 part ordinary or white Portland cement, 1 part hydrated builder's lime and 5½ parts builder's sand; or
- 1 part Portland cement and 5½ parts sand plus mortar plasticiser according to the manufacturer's instructions.

Pigments for coloured mortars are available but care is needed to obtain a consistent shade and avoid blotchiness.

All of these materials should be available from any good builders' merchant.

## Estimating and ordering

Most concrete masonry is sold and priced by the square metre of single-thickness wall area, so estimating the quantities to order doesn't involve much more than multiplying the length of the wall by its height and adding up any extras such as half-blocks for wall ends or additional blocks for piers. You will want some blocks over the calculated quantity (about 5%) to allow for damage or for cutting where needed.

Solid concrete masonry split blocks have a wide range of uses including facings, veneers, screens, feature walls and fences. Split block sizes are based on the standard block module of 400 mm length (390 mm actual size allowing 10 mm for mortar). The height range generally available is (actual sizes) 40, 90, 140 and 190 mm.

Concrete bricks are a slightly different matter, since they are sold by the thousand rather than by area. Each square metre of single-thickness walling will require 49 bricks measuring 230 x 75 mm.

For small jobs, or ones which are complicated in shape or details, it's usually easier to make a dimensioned sketch drawing and actually count the number of units needed.

In order to avoid variations in appearance it is important to obtain all the units at once, since slight differences may appear between different manufacturing batches, or as a result of being stored for different lengths of time. Few retail outlets keep a large stock in hand and they will have to order any sizable quantity from the works, so allow plenty of time for delivery. If the blocks or bricks come strapped or shrink-wrapped in cubes, leave them in the cubes if possible until time for use. Otherwise stack them firmly and protect against staining or damage. (Metal strapping should be removed to avoid rust-stains).

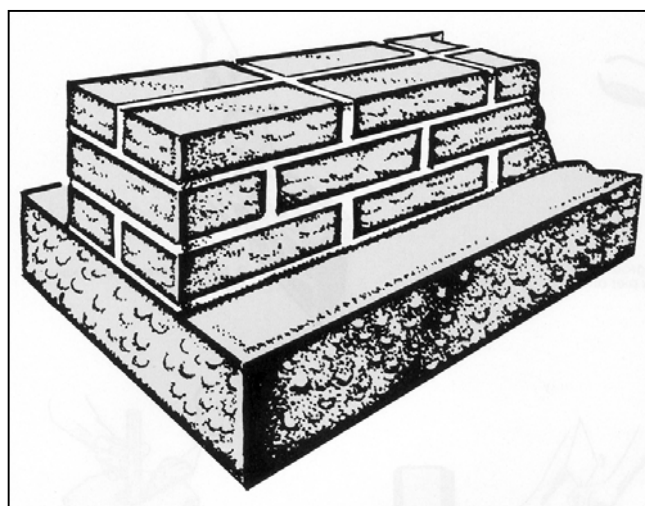
There isn't a lot of point in trying to make a detailed estimate of mortar materials. If you use dry-packed mortar mix you can buy it pretty much as required. If you decide to mix your own you can do the same for cement (and lime, if used) but try to buy the sand all in one lot to avoid variations in colour and grading.

## Foundations

Solid, lasting masonry needs a good foundation. Very low walls and small structures such as barbecues, dustbin surrounds and the like can be built up from a hard paved surface – either an insitu slab or precast paving on a firm base. Otherwise walls should have a strip footing extending down into sound, firm subsoil. (**Figure 16**).

Masonry built on a paved area should not be laid right on the edge, set it back at least 150 mm or the thickness of the wall, whichever is greater. If walls are to be built on precast paving, the slabs should

be firmly bedded. Strip footings should generally be three times the width of the wall and 150 mm thick. Twice the wide of the wall and 100 mm thick should be suitable for walls under 750 mm high, but a thicker footing is recommended on clay or peaty soil. Use a bedding grade concrete (**Table 1**), well compacted and struck off approximately level with a length of timber (slight irregularities can be compensated for when bedding the bottom course of masonry).



**Figure 16:** All masonry needs a solid foundation. Here, a strip footing is used.

## Building a low block wall

A low garden or terrace wall is a good 'starter' exercise in DIY masonry construction. Materials are masonry units of your choice, coping units (optional) and foundation grade concrete for the footings if used.

The wall in **Figure 17** has piers at either end for stability, since free-standing wall ends are especially prone to damage. Piers should also be provided at gateways. If the wall height is kept to 750 mm when using 100 mm thick masonry, or 1.2 metres with 150 mm wall thickness and does not exceed 6 metres in length, additional piers are not strictly necessary. They do break up a long expanse of plain walling visually, as well as providing extra strength.

It is possible to bond the wall panels into the piers but it is much easier to construct the piers separately, using strips of expanded metal lathing in the bedding joints to tie the thinner wall panels to them. Depending on the size and shape of the masonry units the piers can be built solid or hollow and filled later with concrete.

A wall of 6 metres in length should have joints at intervals to allow for movement. The easiest way to do this is to use lengths of flat galvanized steel strip instead of expanded metal between the wall panel and a pier. Use in the same positions but coat the end extending into the panel with grease so it will not bond, but will allow some movement.

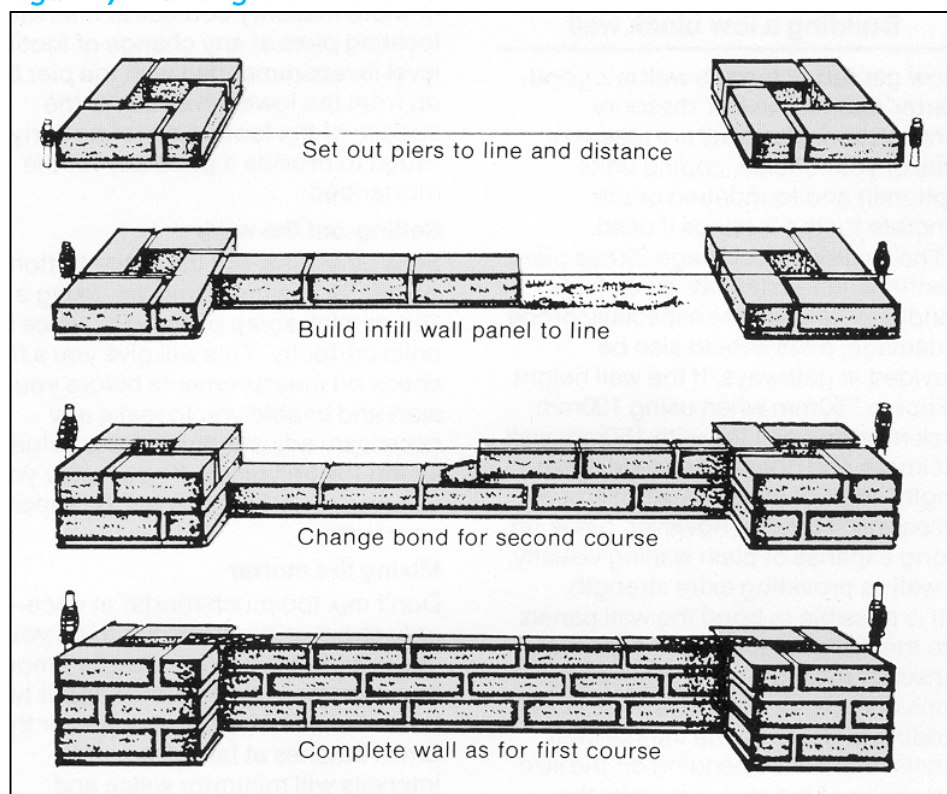
### Foundation

If the wall is not to be built up from a paved surface construct a concrete strip footing as described above. If the wall is on sloping ground the footing should be stepped by the height of one or more masonry courses at intervals. Locating piers at any change of footing level is recommended with the pier built up from the lower level. Leave the surface of the footing concrete fairly rough to provide a good key for the mortar bed.

### Setting-out the work

Start by setting-out the entire bottom course 'dry', without mortar, using a 10 mm thick scrap of wood to space the units correctly. This will give you a final check on measurements before you start and enable you to make any necessary adjustments before actually laying the first block. If necessary you can also lay at least part of the second course dry.

Figure 17: Building a low block wall.



### Mixing the mortar

Don't mix too much mortar at once – only about as much as you think you'll use in an hour. A good masonry mortar should remain workable for about two hours but must be discarded after that. Small batches at fairly frequent intervals will minimize waste and provide a change of activity, especially welcome if you're doing the job single-handed.

Good mortar should be similar in consistency to soft butter. It will stick to a damp wood surface but not to a clean, wet face.

### Laying the masonry

Using a bricklayer's trowel, lay bedding mortar in a fairly thick strip for the pier masonry. Place the first unit and tap firmly into position with the handle of the trowel so that it is accurately aligned and level.

'Butter' the end of the next unit, offer it up to the first and tap into place, checking with stringline, straightedge and spirit level. Complete the bottom course of each pier in the wall, then stretch a stringline between the piers and lay the bottom courses of the panels in between. Trim away excess mortar as you go with the edge of the trowel.

Continue by building up a course at a time. In each course of blockwork (every three courses of concrete brickwork) lay a strip of expanded metal on the fresh mortar across the joints between the piers and the wall panel masonry and tap it in with the edge of the trowel to serve as a tie. If the piers are hollow, fill in with general purpose concrete mix the following day, tamping the concrete in firmly with the end of a piece of timber or a steel rod.

### Cutting blocks and bricks

Probably the majority of ranges of facing blocks, as well as garden walling units, include half-blocks, which you will need at the piers. If you're using concrete bricks or a range of blocks that doesn't include ready-made halves,



cutting will be necessary (some blocks are made with slots at the half and quarter points to make cutting easier).

Using a club hammer and bolster – a cold chisel will do at a pinch but won't produce as neat a job – score around the block with the corner of the cutting tool, deepening the cut with progressively firmer strokes until the block breaks easily.

### Finishing the joints

As you lay the masonry units in each course, trim off any excess mortar at the face with an upward cutting motion of the trowel. If this is done neatly and the mortar is not too wet the mortar should come away cleanly, but if necessary use a stiff brush to remove any smears from the face of the work later. Then, when the mortar is 'thumb-print' hard, 'iron' the face of the joint with a bent length of round bar or tubing to form a smooth concave recess – a length of plastic water pipe is ideal.

### Final touches

A coping puts the finishing touch on a masonry wall, and purpose-made concrete units should be available from the same source as the masonry. Bed the coping in the same way as the masonry units themselves but take extra-special care to get them absolutely straight and level. If the coping is laid true it will help draw attention away from any minor irregularities in the walling itself.

Set out the coping units 'dry' alongside the job before starting, to make sure they fit properly, and measure as you lay them to make sure you don't close up the space accidentally by making the joints too wide. Use a stronger mortar mix – 1:3 masonry cement:sand, 1:1½:4 cement:lime:sand or 1:3½ ordinary Portland cement:sand with plasticizer – in the top course and for copings.

## A double thickness concrete brick wall

If you like the appearance of concrete brickwork but want a wall thicker than 100 mm, you will either have to use a traditional brickwork bonding pattern with some of the bricks laid end-on to the face to act as ties through the wall, or use two leaves of running bond with metal ties and mortar infilling between them. You may want to use this type of construction in any case with some kinds of facing brick or block so that both sides of the wall present the same appearance.

Double running bond construction is simple enough. Raise both leaves together, with a full mortar joint between them, and press formed wire wall ties into the bedding mortar at the intervals shown.

Instead of precast coping units, bricks laid on edge can be used to finish off the top of the wall, but make sure the length of the bricks matches the thickness of the wall, and use the stronger mortar mix.

## Building a screen wall

Building a screen wall with pierced concrete blocks requires a somewhat different approach from ordinary masonry. This is mainly because screen blocks are normally square and are 'stack-bonded' without any overlap and with continuous vertical joints. (*Figure 18*).

Screen wall blocks are made in a variety of patterns. Some patterns are complete in themselves, some become complete only when a number of blocks (usually four) are laid together, and some can be used either way. Depending on the particular design, some screen block walling presents an attractive appearance only when viewed from one side, and because of the way they are made most blocks have a crisper, neater finish on one side than the other – something to bear in mind when planning the job and choosing the pattern.

Stack-bonding isn't nearly as strong as true bonding with over-lapping units, so for anything over about 600 mm piers are required, and it may be necessary to include reinforcement in the piers and the bedding joints.

Piers can be constructed either of ordinary walling blocks or bricks as for the plain wall as described on page 18 (Building a low block wall).

For low screen walls, or for screen-block panels along the top of a facing-masonry wall, the blocks are laid in very much the same way as ordinary masonry, but follow the manufacturer's instructions regarding special pier blocks. Extra care is needed in aligning and levelling the blocks and in finishing the joints as the square grid pattern will accentuate any irregularities.

Many screen blocks are made from white concrete and will require either a mortar made with white



cement and selected sand or a darker, contrasting mortar.

The light grey colour of plain mortar made with ordinary Portland cement does not offer sufficient contrast for most eyes and tends merely to look dirty.

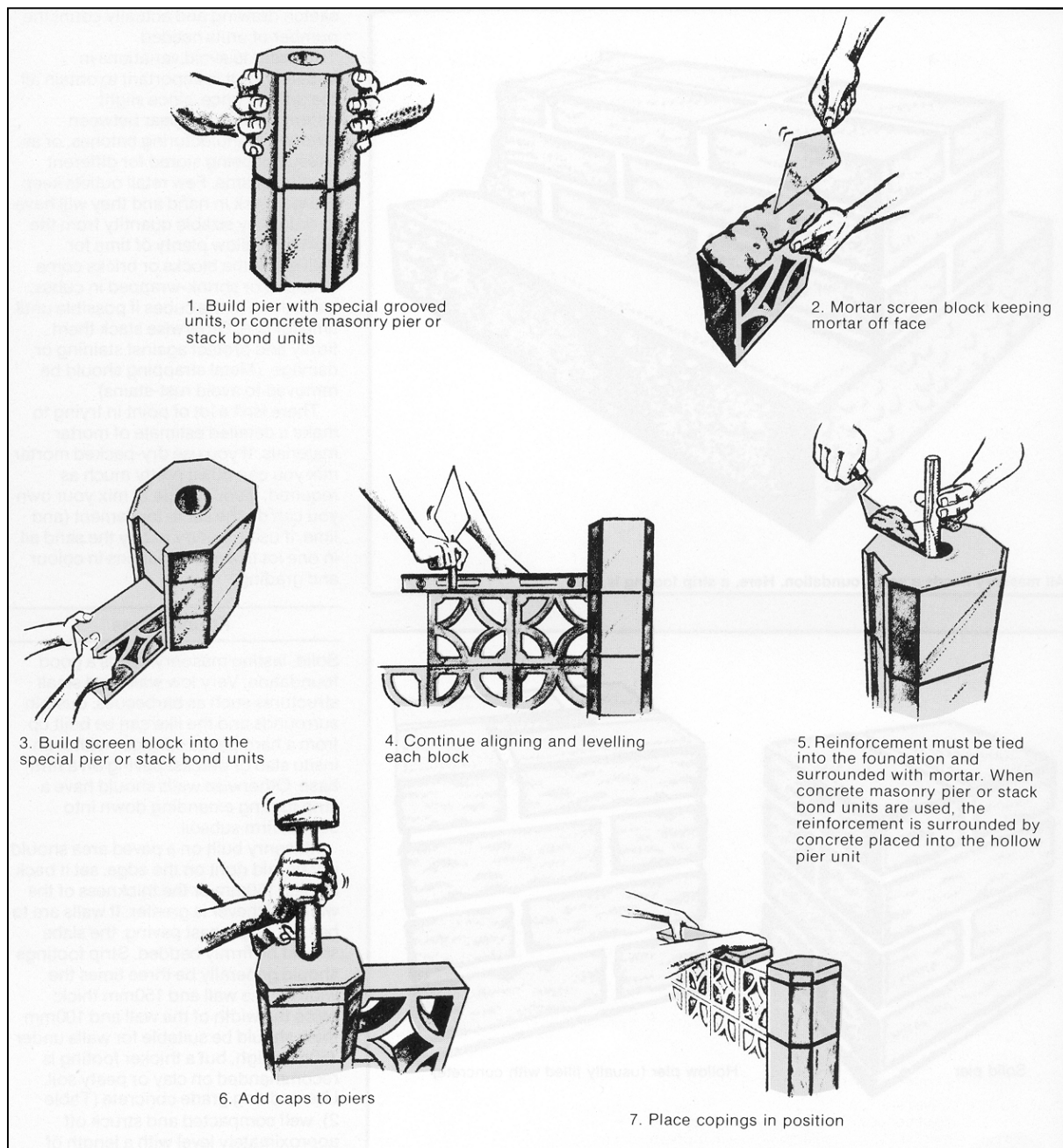
For screen walls over 1.2 metres high, up to 1.8 metres which is the maximum height permissible for a free standing wall or fence without a building permit being required, follow the manufacturer's instructions regarding pier spacing and reinforcement.

## ODD JOBS AND REPAIRS

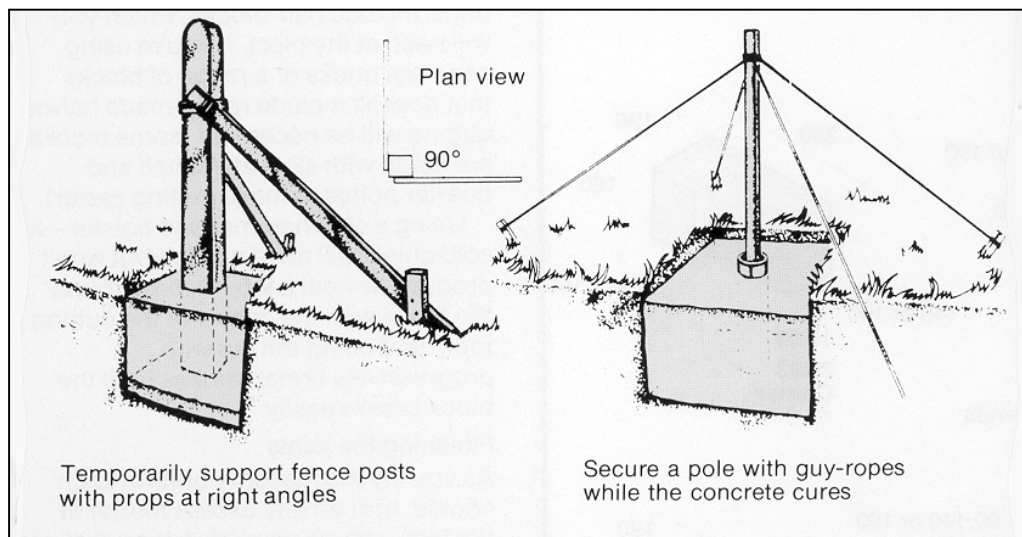
Small jobs, often requiring literally a breakfast-cup full of concrete or mortar, are the most common ones faced by the average DIYer. These are ideal jobs for dry-bagged mixes since they require small quantities, and materials can be taken to the job and mixed there without bother or mess.

### Setting a fence post

This is a simple and common job whether for new fencing or when replacing rotted timber posts.



**Figure 18:**  
**Building a screen wall.**



**Figure 19:**  
*Setting posts and poles.*

1. Dig a hole at least 400 mm square to a depth of approximately one-third the height of the post above ground level. Compact the soil in the bottom.
2. Put the post in the hole and adjust the height with dry concrete mix in the bottom. Adjust the position until the post is correctly lined up with the rest of the fence and dead vertical. Spacing may be critical for some kinds of post-and-panel fencing. Use timber props or temporary guy-ropes to hold it in position during concreting.
3. Fill the hold with dry-bagged coarse concrete or bedding grade concrete, mixed fairly dry. Ram the concrete in firmly with a length of timber to just below ground level and cover with soil to help retain moisture during the curing period.
4. Leave for at least seven days before straining wires or fixing fencing panels.

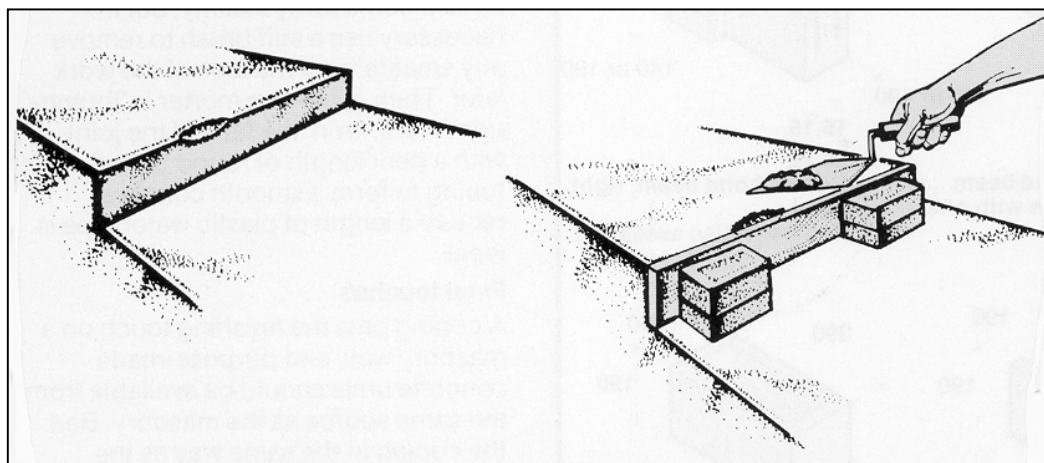
### Setting a clothesline pole or rotary drier

This is done in essentially the same fashion as setting a fence post but the foundation will have to be larger to resist the sideways pull of the loaded line or drier. Getting the socket truly vertical is a lot easier if an insert of timber lath is used.

### Repairing chipped concrete

Flaked patches on concrete floors, chipped concrete steps, windowsills and other minor damage can be repaired without a great deal of difficulty using dry-bagged cement-sand mortar. (*Figure 20*).

1. Remove all unsound material, cut back to as square an edge as possible and hack the face to provide a good key for the repair. Use a hammer and cold chisel.
2. Keep the surface to be repaired damp for at least 12 hours.



**Figure 20:**  
*Repairing chipped concrete.*



3. Apply a bonding agent like artificial rubber latex (SBR) or polyvinyl acetate (PVA) according to the manufacturer's instructions. Ordinary house-hold PVA white glue can be used for small areas – dilute with 1 part water to 3 or 4 parts PVA. Note PVA is not suitable where the concrete is exposed to water or the weather.
4. A length of board can be used to support the mortar on the vertical face of a chipped step or sill edge. Fill the damaged area with a cement-sand mortar (not masonry mortar), compact it and smooth with a wood float and finish with a steel trowel and/or an arissing tool when it is sufficiently firm to take a good finish.
5. Keep damp for three days.

## Floor repairs

Flaked or chipped concrete floors can be repaired in the same way. If you find when you try to cut back to sound material that it simply keeps crumbling away with little effort, simply patching the damage will be a stop-gap measure at best. The problem is almost certainly a failed or badly laid screed, which will need replacing. Persistent dustiness in a floor surface can often be cured by brushing on a thinned-down bonding agent. Follow the manufacturer's instructions.

## Repairing cracks

Small cracks often occur in floor slabs and other insitu concrete as a result of shrinkage while the concrete is still green. If they grow no worse with age they can be ignored unless appearance is a consideration. A purely cosmetic repair can be made by rubbing in a fluid 'slurry' of cement and water.

Wide cracks or cracks that grow and spread are signs of structural damage and should be inspected immediately by a building surveyor or an engineer.

## A FEW IDEAS FOR PROJECTS

The things you can build and make with concrete are limited only by your imagination and experience. There are plenty of useful and

attractive smaller projects that you can use to develop not only the skills but the confidence needed for something more ambitious.

The projects included in this section will give you some ideas. Use them to develop your own projects. Here are a few you can try for starters, using a combination of a small ground slab or precast flags for a base and masonry for the rest.

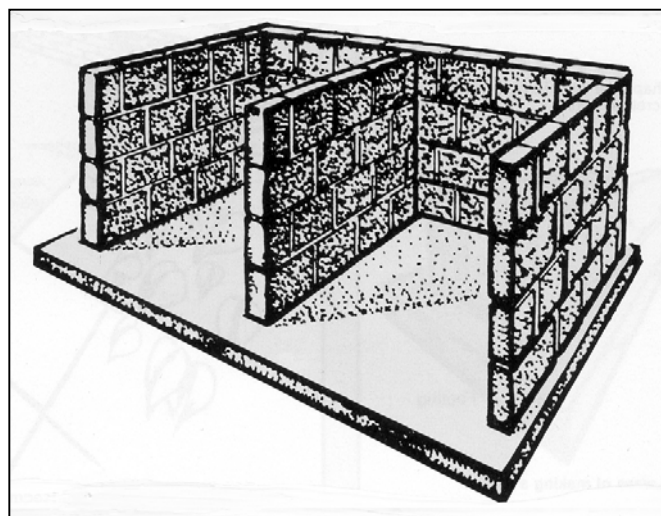
### A compost bin

#### Floor

Insitu ground slab (see page 8) 100 mm thick with smooth trowelled finish, one in fifty fall to the front (use bottom bed joint mortar to make up levels for masonry). (*Figure 21*).

#### Walls

150 mm dense concrete blockwork or 225 mm brickwork. Form weep-holes by omitting some mortar in vertical joints in the bottom course. Flush joints internally, corners may be tied or bonded.



*Figure 21: Compost bins using blockwork.*

### A barbecue

#### Base

100 mm insitu slab or paving slabs. (*Figure 22*).

#### Masonry

Concrete brick, facing block, or reconstructed stone for facing. Fill in with plain blocks, or insitu concrete or rubble bedded in mortar.



## Firebox

Use firebricks or fireplace cement for lining. Concrete should not come in contact with the fire or coals. The iron grid should be loose-fitting so expansion will not damage the masonry.

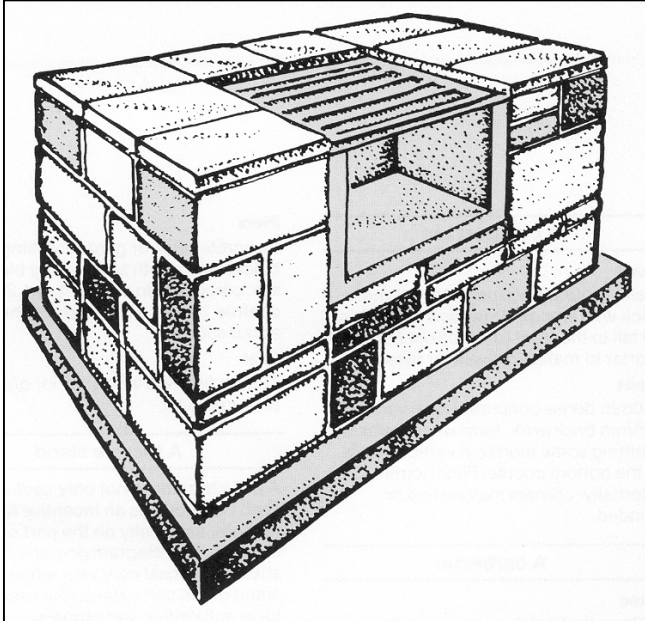


Figure 22: One example of barbecue construction.

## Worktop

Small smooth concrete slabs or terrazzo tiles, close-jointed and bedded on 1:4 cement:sand mortar. **Figure 22** is one example of barbecue construction - there are lots more styles and shapes you can build yourself.

## A garden bench

### Foundations

Shallow footings (approximately 150 mm into subsoil) extending by 150 mm beyond edge of masonry; bedding grade concrete.

### Piers

Concrete brick or garden walling blocks stack-bonded on side, at 1 to 1.2 metre centres, to give a finished seat height of about 450 mm.

### Seat

Timber finished with exterior grade polyurethane. (**Figure 23**).

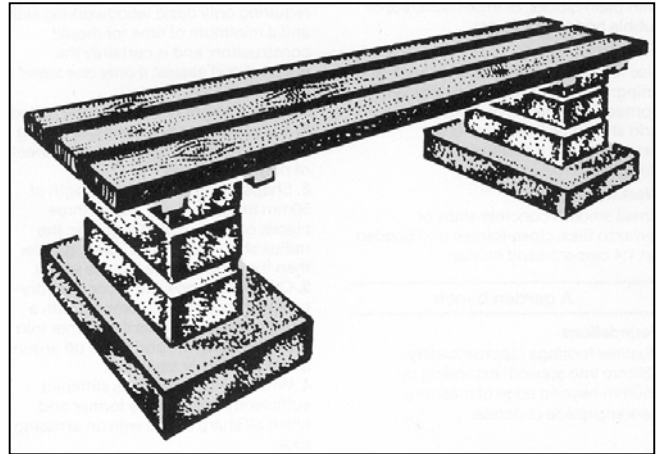


Figure 23: Simple garden bench for a quite corner.

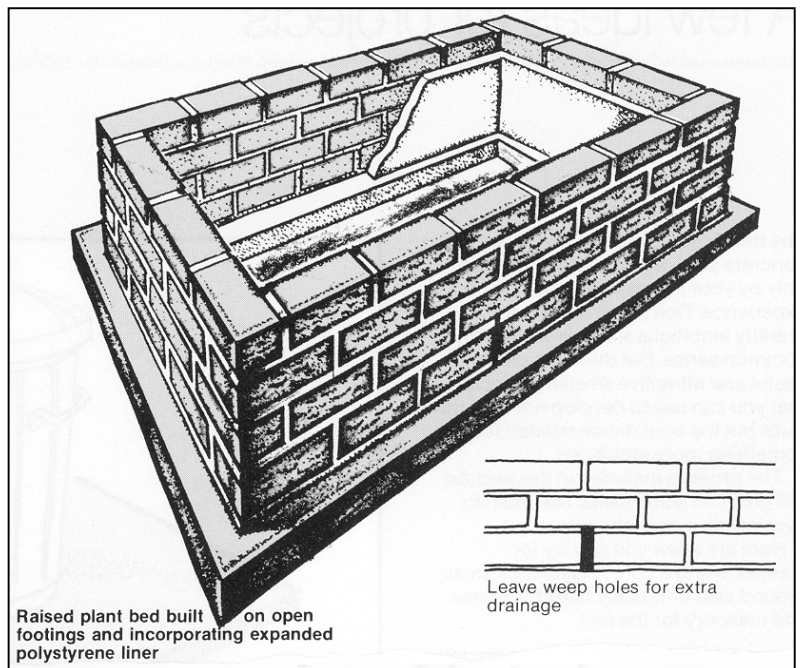
## Raised plant beds

Raised beds are not difficult to create using readily available precast concrete products.

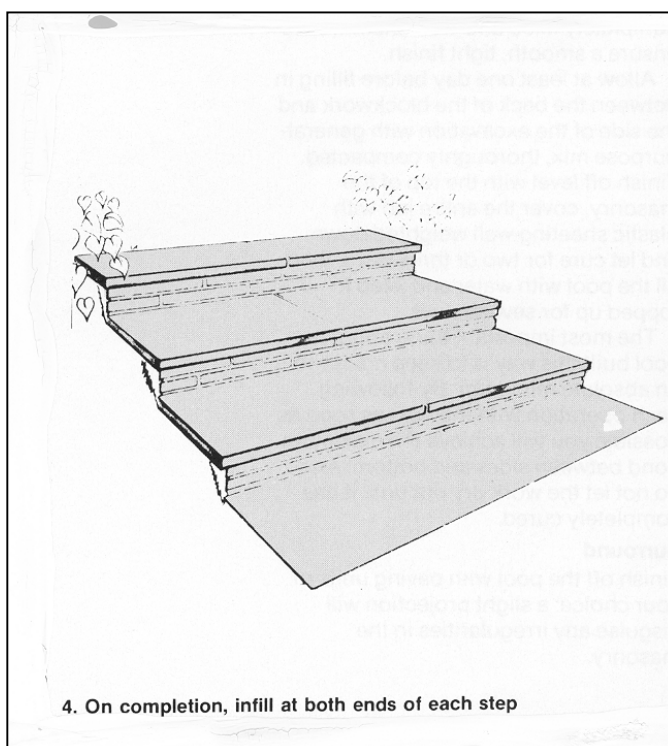
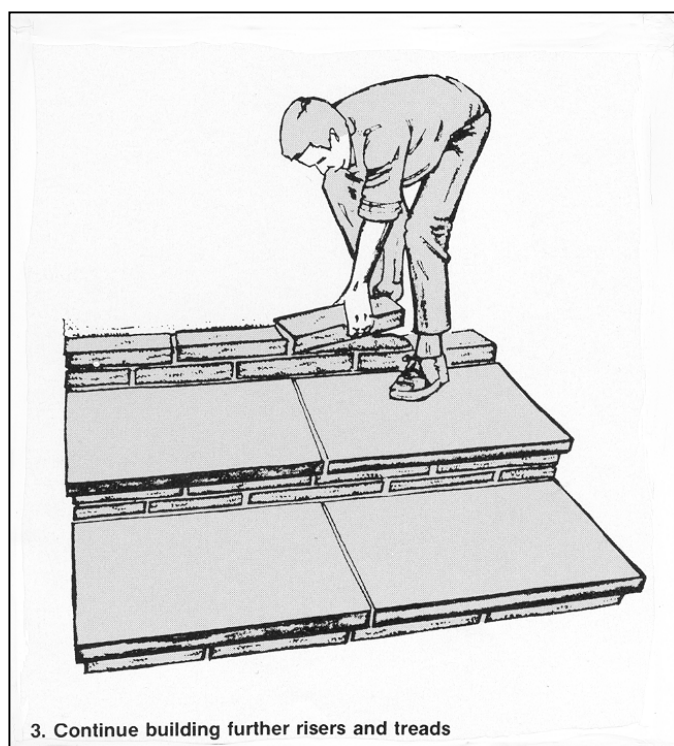
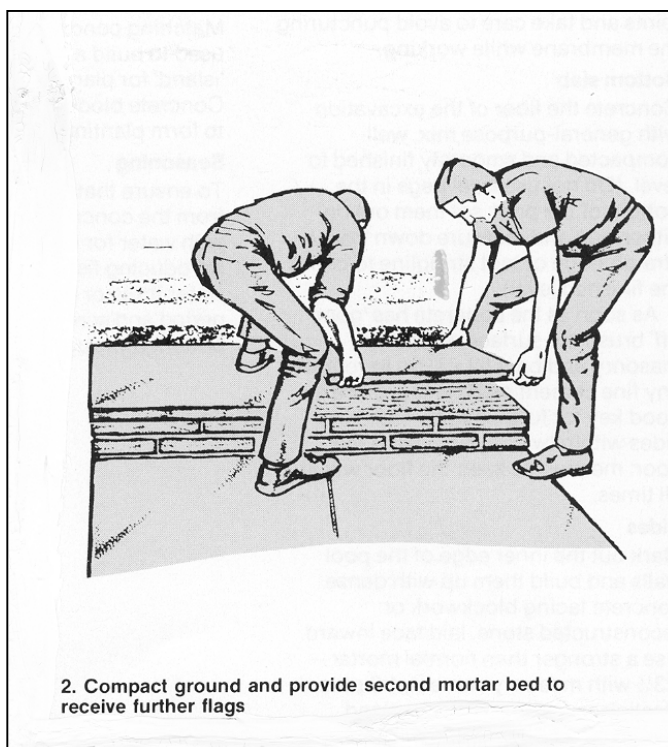
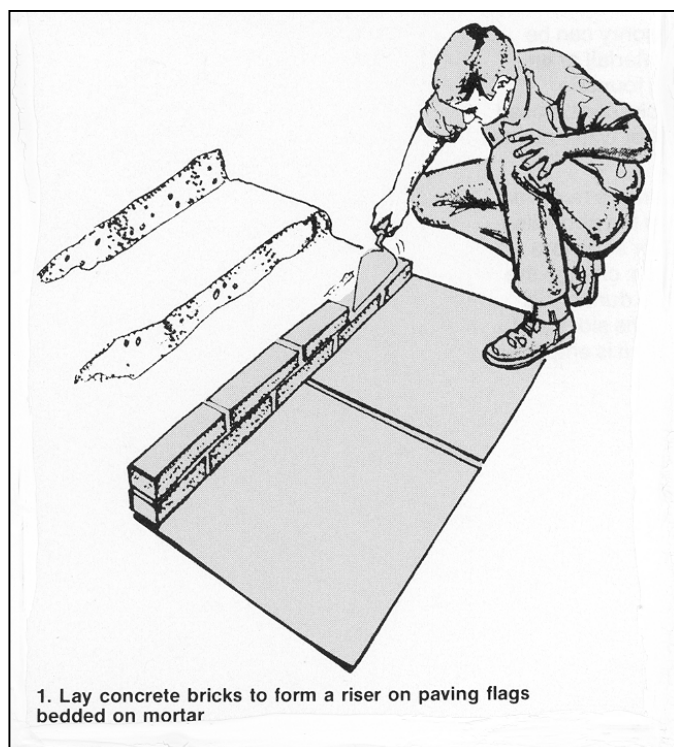
On some types of ground – very stony soils, sites reclaimed with builders' rubble, chalkland with thin soil cover – raised beds may be the easiest or even the only way of providing sufficient depth of good growing soil. They prove an attractive visual focal point or change of level and if kept narrow and built high enough they can take a lot of the backache out of gardening even for a reasonably fit enthusiast.

Beds with concrete masonry (see **Figure 24**) present no problems in building. Use small-sized units for the best appearance.

Figure 24: Raised plant bed.







**Figure 25: Garden or terrace steps.**

For any given thickness of walling, build lower than you would for a freestanding wall, since the masonry will have to withstand the outward pressure of the soil in the bed. For 100 mm masonry keep walls below 600 mm in height.

Shape and horizontal dimensions are important. You can build higher if the distance between right-

angle walls is short, than you can if they are further apart. A thicker wall (or two parallel thin walls) can be topped with smooth paving flags to serve as a bench while working on the bed.

Preferably build the walls on strip footings so that moisture can drain into or rise from the main garden soil. If the bed is built on a concrete slab or

badly-drained soil, leave some of the vertical joints at ground level unmortared for drainage. If the bed drains out too rapidly, some of the weep-holes can be filled with mortar later until drainage is just sufficient to prevent water logging.

Lining the inside faces of the walls with expanded polystyrene board 25-50 mm thick will help prevent the soil in the bed from freezing and pushing the walls outward.

## Garden or terrace steps

Concrete masonry and precast paving slabs can be combined to build attractive garden or terrace steps. The simplest form is where the steps are let into the bank. *Figure 25* shows the steps being built.

Where the steps stand forward of the bank the riser must return into the bank to retain the material under the tread at each end of the step. In this case a small footing is required under each end to carry this extra wall or 'string'.

## A simple garden pool

A simple pool can add an attractive feature to any garden. For a flat-bottomed formal or semi-formal pool, simply combine an insitu ground slab (see page 8) laid below ground level, for the bottom; facing masonry (see page 15) with an insitu backing for the sides; and precast paving slabs for the surround.

### Preparation

Dig out to the desired depth, plus 100 mm for the bottom slab. Dimensions of the excavation should be those of the finished pool plus the thickness of the blocks all round, plus a further 100-150 mm all round for the concrete backing. Keep the sides of the excavation as sharp and vertical as possible.

Line the excavation with 250 micron polythene or polythene-bitumen damp-course membrane material, neatly folded and tucked into corners and carried up and over the edge. Seal any joints and take care to avoid puncturing the membrane while working.

### Bottom slab

Concrete the floor of the excavation with general-purpose mix, well-compacted and smoothly

finished to level. (Do not use level pegs in the bottom of the pool, set them out on either side and measure down from a straightedge or taut stringline to check the finished level).

As soon as the concrete has 'gone off' brush the surface where the masonry and backfill will go to remove any fine cement paste and provide a good key for further work. Build the sides within two days of laying the floor, meanwhile keep the floor wet at all times.

### Sides

Mark out the inner edge of the pool walls and build them up with dense concrete facing blockwork or reconstructed stone, laid face inward. Use a stronger than normal mortar:

- 1:3½ with masonry cement, or
- 1:3 plus plasticiser with ordinary Portland cement, or
- 1:½:4½ using cement, lime and sand.

Make sure mortar joints are completely filled and 'iron' them well to ensure a smooth, tight finish.

Allow at least one day before filling in between the back of the blockwork and the side of the excavation with general-purpose mix, thoroughly compacted. Finish off level with the top of the masonry, over the entire job with plastic sheeting well weighted down and let cure for two or three days, then fill the pool with water and keep it topped up for several days.

The most important thing about a pool built this way is to keep cracks to an absolute minimum. By following each operation with the next as soon as possible you will achieve the maximum bond between sides and bottom. And do not let the work dry out until it has completely cured.

### Surround

Finish off the pool with paving units of your choice. A slight projection will disguise any irregularities in the masonry. (*Figure 26*).

### Miscellaneous details

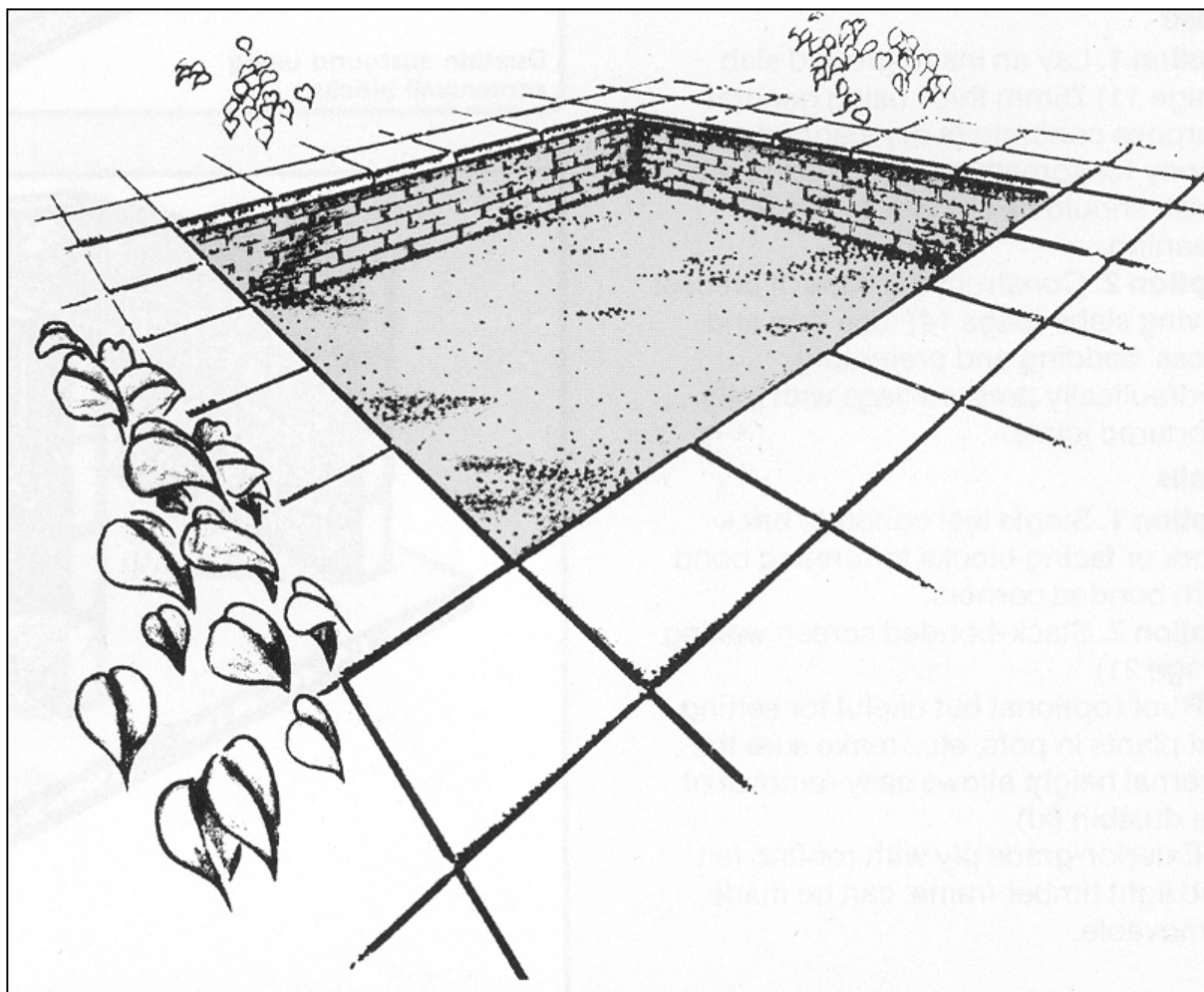
Matching concrete masonry can be used to build a small waterfall or an 'island' for planting or a fountain. Concrete blocks or bricks can be used to form planting boxes for water plants.



## Seasoning

To ensure that all free lime is removed from the concrete, keep the pool filled with water for a

month or so before introducing fish or plants. Change the water three or four times during this period and scrub down the sides and bottom thoroughly while it is empty.



*Figure 26: A flat-bottomed formal pool, surrounded by precast paving units.*

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