

The BRAMM **Blue Book**

ABRIDGED VERSION



The British Register of Accredited
Memorial Masons
Established 2004

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Note on units

Metric units (mm, kg, Nm) are used throughout the BRAMM Blue Book. Some dimensions – but not all – are also given in their closest equivalent in inches, for example: 450mm = 18"



What is the BRAMM Blue Book?

Welcome to The BRAMM Blue Book. This is a useful guide to everyday best practice in the installation of the most common types of memorial.

It presents key technical information from British Standard 8415. The Blue Book is especially helpful for those intending to take the BRAMM Fixer License Assessment.

This shorter version of the BRAMM Blue Book does not cover all methods of fixing to be compliant to BS 8415, but does cover the most popular modern methods.

What is BRAMM?

Since 2004, the British Register of Accredited Memorial Masons has been working together with memorial masons and burial authorities to establish a recognised, uniform standard of workmanship in all burial grounds.



We are guided in this by the requirements of the current edition of British Standard 8415.

Memorial masons become accredited by completing the [BRAMM Fixer Licence Assessment](#). This demonstrates that they comply with BS 8415, thereby assuring burial authorities that a BRAMM-registered memorial mason working in their cemetery will work to the required standard and install safe memorials.



What is BS 8415?

To give it its full title, BS 8415:2018 is the British Standard covering the installation of memorials in cemeteries and churchyards.

It is the central document for our industry and includes the following key statement, which we use as our definition of a safe memorial:

For memorials (new and reinstated) greater than 625mm above ground level all components shall be designed and constructed such that, when properly installed, they withstand a horizontal load of 70kg applied at their apex or 1.5m from the ground, whichever is the lower, with the load applied in the most critical direction.



The full BS 8415 document can be purchased from www.bsigroup.com

Note that the 70kg load described here is nearly triple that used in stability tests carried out in cemeteries, where the testing load should not exceed 25kg.



BRAMM supports ICCCM in the policy of 5 year safety inspections, and that no joint should break under the inspection pressure of up to 25kg.

If a joint breaks within 10 years of the installation date, due to weathering or during a stability test, then the memorial company must make good the joint, at their own expense.

The Standard also states that:

All components of memorials (new and reinstated), including any foundation, shall be designed and constructed such that, when installed using dowels or bolts, they meet the performance requirements of this British Standard. Cement mortar or adhesives shall NOT be the sole means used for the bonding of structural connections.

To reduce the risk of join failure between the base and foundation, BRAMM recommend as Best Practice, the use

of a mechanical lockdown device. See page 11 onwards for information about these devices.

Or if the memorial is not to be removed for a second inscription, then this joint should be dowelled in exactly the same way as the headstone is fixed to the base.

Please note that a Ground Anchor is a safety device, and does not mechanically fix the base and foundation together.

BS 8415 specifies sizes and materials for memorial components, describes standards for their installation and also gives guidance on working practices. Always refer to the full Standard document for the most complete and up-to-date technical information and definitions.

BRAMM supplements the specifications in BS 8415 in some key areas – for example, in mandating sizes of foundations for memorials below 915mm (6) and ground anchors for memorials below 625mm (10).



Lawn memorials

It is useful to look in detail at the [installation of lawn memorials](#). Many of the principles apply across all types, but the lawn memorial is the specific type of memorial we ask memorial masons to install in our [Fixer Licence assessment](#), so it makes sense to focus on this.



Components of a lawn memorial

Lawn memorials generally consist of three main components (see the illustration opposite).

- Foundation slab – usually reinforced concrete
- Memorial Base
- Headstone – also known as an Inscription Plate

These parts must be mechanically fixed together to construct a strong, safe memorial that will stand the test of time. This is typically achieved on site using dowels and cement (15). An alternative method uses bolts to fix the headstone and base in the mason's workshop (16).



Foundations for lawn memorials

Foundations may be of reinforced concrete, hardstone or granite. The correct foundation must be selected for the ground conditions on site.

Foundations shall be level on both axes with drainage provided to resist water accumulation within the structure. (BS 8415:2018, section 5.5.1)

Reinforced concrete foundations may be either pre-cast or cast-in-situ, with reinforcement to meet the standards of both BS 8415 and BS 4449 ('Steel for the reinforcement of concrete'). It is the responsibility of the memorial mason to acquire evidence that the chosen foundation complies with both these standards.

Note that trough ('knock-out') pre-cast foundations no longer comply with BS 8415. They must not be used.

In all cases the base must be fixed to the foundation using either of the following methods:

- dowels compliant with BS 8415 (12)
- a recognised memorial lockdown system (11)



Pre-cast reinforced concrete foundation slabs are often supplied with holes pre-drilled for the ground anchor and bolts and washers



Trough foundations no longer comply with BS 8415
These must not be used

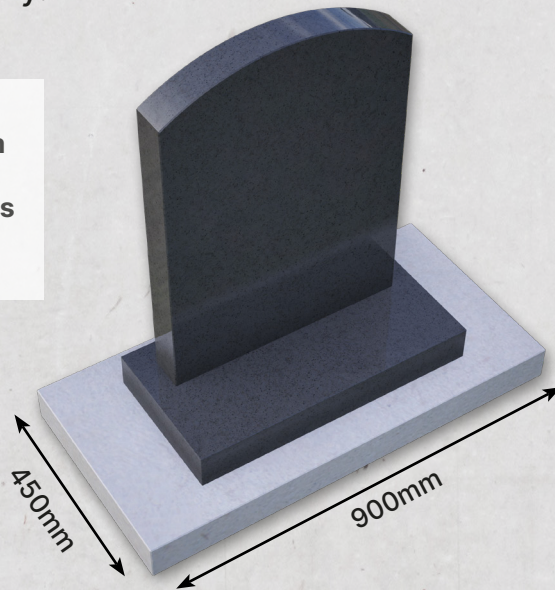
Pre-cast foundations – memorials up to 915mm

Whilst BS 8415 does not specify a minimum size of slab for lawn memorials, BRAMM recommends this should be 900mm x 450mm x 75mm (36" x 18" x 3") for memorials up to 915mm (36") in overall height.

The slab must also meet the minimum requirements of the ground anchor, according to the manufacturer's specification. The foundation slab must be appropriately sized to remain stable and avoid settlement over time.

The memorial fixer must take into account the local soil conditions and the size of the dug grave, using a larger foundation, if necessary.

Example
This memorial is 850mm in overall height, so a 75mm thick foundation is recommended, with the dimensions indicated

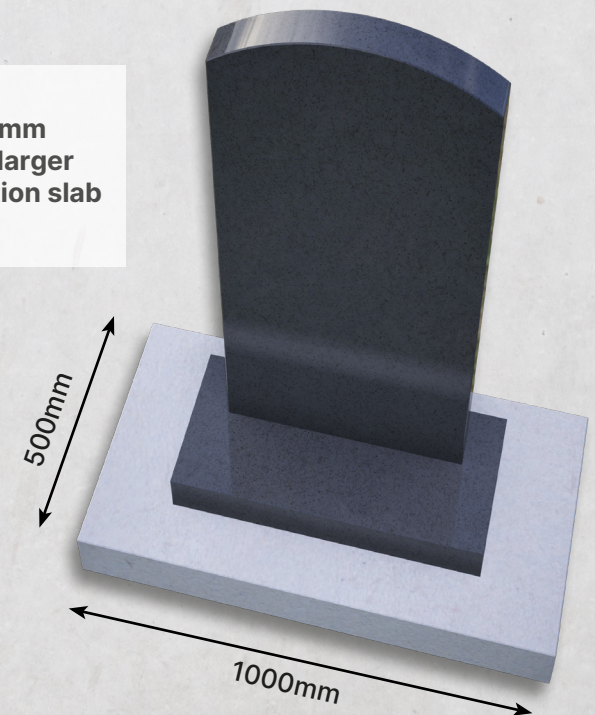


Pre-cast foundations – memorials over 915mm

For lawn memorials taller than 915mm (36"), BRAMM recommends the use of a larger, more substantial foundation to help distribute the additional weight more effectively – for example, a larger and deeper bespoke foundation slab with greater integral strength and load-bearing capacity.

Ideally, these should be the maximum width allowed in the cemetery to place as much of the weight as possible on virgin, undisturbed ground. An appropriate ground anchor must be selected; always check the manufacturer's specification to ensure compliance with BS 8415.

Example
This memorial is 1100mm in overall height, so a larger 100mm-thick foundation slab is appropriate



Ground preparation for pre-cast foundations

The foundation should be in-line with existing memorials. Once turf has been cut away, the ground must be robustly consolidated using a heavy metal rammer.



Sharp sand may be used to help make a good, level bed. The foundation slab must be laid level and square.



Foundation slabs with pre-drilled holes

Large or multiple holes in pre-cast concrete foundations for flower containers reduce contact area and strength and must be kept to a minimum.

(BS 8415:2018, section 5.5.1)

Foundation slabs are often supplied with ground anchor holes pre-drilled. A foundation with three pre-drilled holes (as shown in the previous illustration on 5) is suitable for a bolted memorial as the outer two holes accommodate the nuts, washers and excess length of threaded dowel protruding from the memorial base.

However, these foundations are not ideal for use with the traditional cement and dowel fixing method (p. 15). The dowels and cement joining the base and headstone may slip out of the base into the empty space in the foundation holes. Or, even if the dowels have been cemented into the headstone in the workshop, cement bonding the base and foundation may fall through.

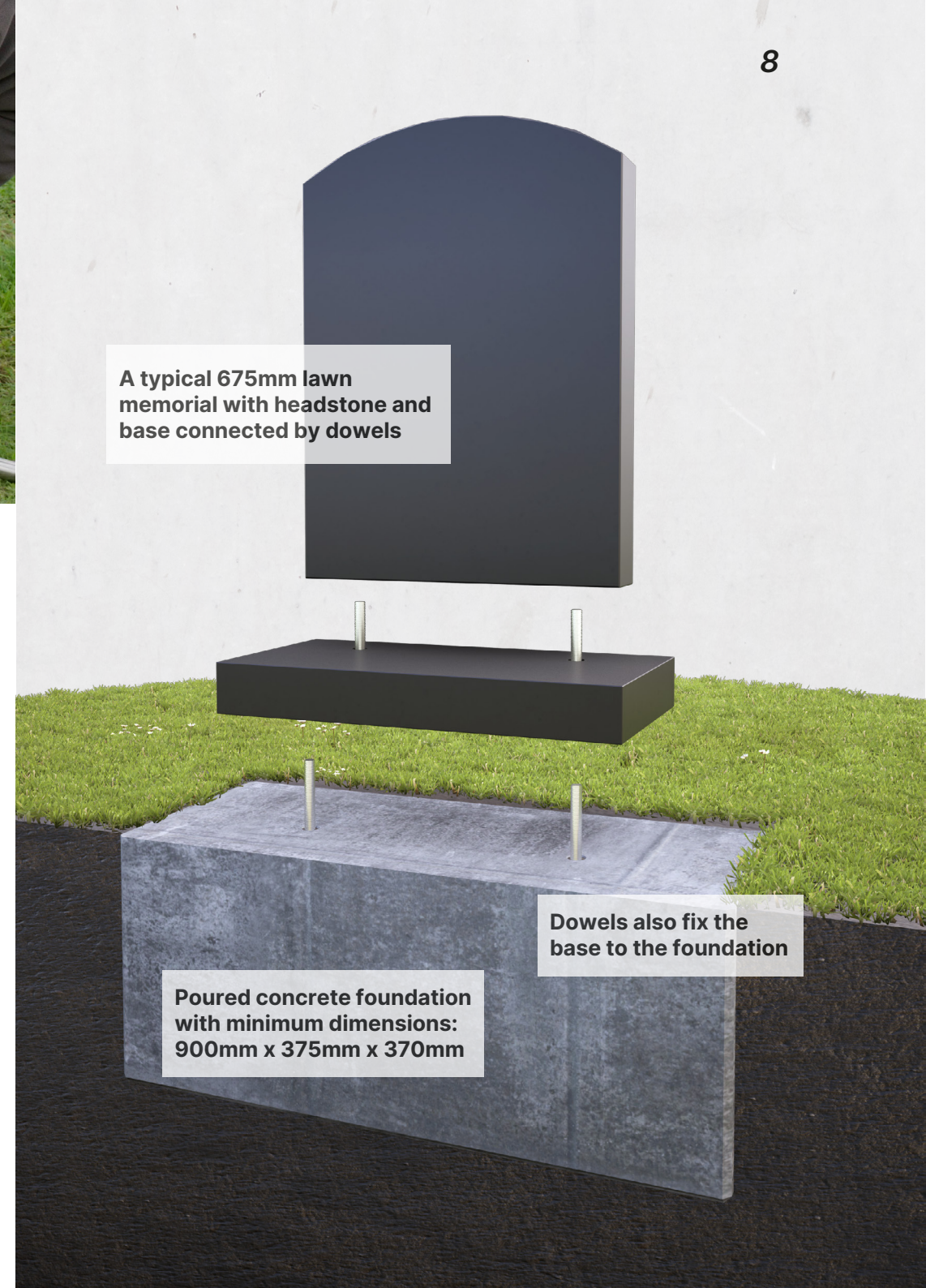
In either scenario, the bond is weakened and the memorial assembly does not comply with BS 8415. To avoid this, the two outer holes must be filled in or plugged flush to the surface.



Foundations cast-in-situ

Concrete for foundations cast in-situ must be machine mixed. The following list is a recommended guide to the necessary minimum specifications:

- The excavation size for a foundation to be poured in-situ must be a minimum of 900mm (36") wide by 450mm (18") front to back and 370mm (14.5") deep wherever possible
- Any water ingress must be pumped out of the excavation before the concrete is poured
- The sides of the excavation must be perpendicular, and its bottom must be flat



A typical 675mm lawn memorial with headstone and base connected by dowels

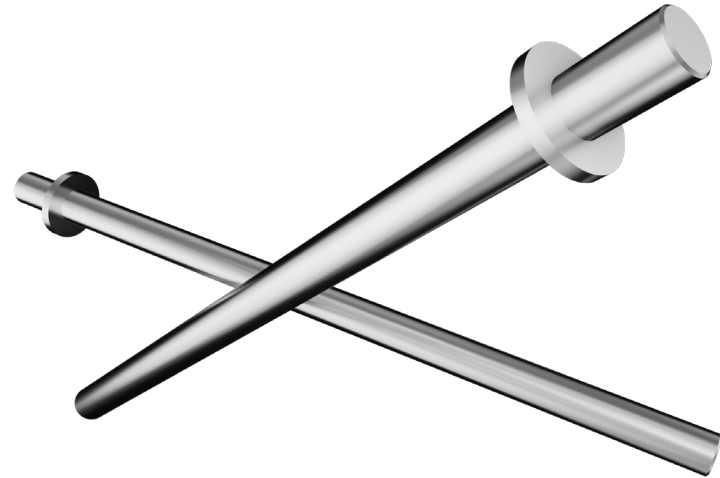
Dowels also fix the base to the foundation

Poured concrete foundation with minimum dimensions: 900mm x 375mm x 370mm

- Concrete must be thoroughly and carefully mixed using clean water
- The ratio of cement to sand to aggregate in the mix should be 1:2:4
- Appropriate reinforcement must be carefully placed during the pouring process to avoid interfering with any holes that need to be drilled
- Pouring must have been completed at least 14 days before the memorial installation to allow the concrete sufficient time to cure
- The top surface of the foundation must be trowelled level and smooth
- The memorial must be fixed to the pre-poured foundation either with dowels or using an accredited lockdown system (11), which makes subsequent removal easier and with much less risk of damage

Ground anchors

It is essential to select the correct ground anchor, determined by the type and size of memorial, and the ground conditions on site. Numerous systems are available. Always consult the manufacturer's specifications and installation instructions, to ensure that the correct ground anchor has been selected.



It is always best practice to over-specify the length of ground anchor required for the memorial and the ground conditions. When installing a memorial on sandy soil or on a steep slope with a thicker foundation, consult the ground anchor manufacturer's instructions for guidance on length and diameter of ground anchor to be used.

- It is the responsibility of the ground anchor manufacturer to ensure their products are tested in accordance with both their own printed specifications and BS 8415
- It is the responsibility of the memorial mason to select an appropriate anchor system and to ensure it is used in compliance with the manufacturer's instructions
- A ground anchor has been tested and approved; home-made, unapproved ground anchors are neither compliant with BS 8415, nor permitted and could result in your expulsion from the BRAMM register



Ground anchors for memorials up to 625mm

Memorials below 625mm (24½") in height are not covered by the structural requirements of BS 8415.

However, BRAMM states that they must be fixed to their foundations using dowels of the same specification as used to join the base and headstone.

Where possible, a mechanical means of securing the base to the foundation should be adopted.

Ground anchors for memorials over 625mm

If fixed on a reinforced concrete foundation, memorials over 625mm must use either a ground anchor **and** either:

- an approved mechanical lockdown system
- or be dowelled to a suitable foundation

Lockdowns

Several mechanical locking systems, often referred to as lockdowns, offer an alternative method for fixing a memorial to its foundation.

These cement-free systems can be a sensible choice, depending on the type of memorial and foundation being installed.

The headstone-and-base assembly is locked down to the foundation, either using an expansion bolt or a receiving plate (see below). Once the bolt is correctly tightened to a specified torque value, the memorial is held firmly in place.



Lockdown systems rely on bolts being tightened to torque values specified by the manufacturer

This method makes future removal of the memorial – such as for renovation or to add further inscriptions – much easier and with less risk of damage.

It is the mason’s responsibility to ensure the lockdown chosen has a current manufacturer’s specification sheet and instructions for use, and is accredited to BS 8415 standards.



Lockdown systems use either a receiving plate (seen here) or an expansion bolt to fix the memorial to its foundation

Joining methods

Two principal means of assembling the headstone and base are described here: the traditional dowel and cement method, and the more current bolting method. Both methods comply with BS 8415, whilst each retains its relative advantages.

Joints shall be constructed as tight as practicable. Any item that could otherwise act as a spacer, e.g. nuts or washers, shall be countersunk into one of the adjoining parts. (BS 8425:2018, section 5.7)

Dowels and dowel holes

Both methods use dowels and these must be made from either Grade A2 or A4 stainless steel. Used with cement, these may be threaded or smooth, whilst threaded dowels are used for the bolting system.

A useful rule of thumb says that the dowel length should be “two inches for every foot” of overall memorial height.

- For example, a 3'0" memorial needs 6" dowels. This allows 3" insertion into both the headstone and the base material



Dowels can be smooth or threaded, as seen here, but must be of Grade A2 or A4 stainless steel

- In metric terms, the dowel should be one sixth the height of the memorial – 150mm dowels for a 900mm memorial, allowing 75mm insertion in both parts

The general rule for dowel hole sizes is to take the diameter of the dowel and add 4mm for holes in the headstone and 8mm for holes in the base

- For example, if using 16mm dowels, use a 20mm drill bit in the headstone and a 24mm bit in the base

The following tables give **minimum dowel sizes** and **maximum dowel hole dimensions** for common memorial sizes and different materials. Always try to over-specify these requirements. Dowel holes should be drilled with great care to prevent fractures.

Table 1: Dowels for use in hard stones

This includes materials such as granite, marble and hard limestone. All dimensions are given in mm.

Memorial size		Maximum Hole Diameter		Minimum Dowel Size				
Height at apex	Headstone thickness	Headstone	Base	Diameter	Length	Insertion to headstone	Insertion to base	Number required
up to 625	50	16	16	12	125	75	50	2
	50-63	16	20	12	125	75	50	2
	over 63	20	24	16	150	75	75	2
625-915	over 63	20	24	16	150	75	75	2
915-1200	over 75	20	24	16	175	100	75	2
over 1200	over 100	30	35	25	200	100*	100	2

* For memorials over 1200mm in height, the insertion into the headstone should increase by 25mm for every 300mm. For example, a memorial with an overall height of 1500mm requires an insertion of 125mm

Table 2: Dowels for use in soft stones

This includes materials such as soft limestone. All dimensions are given in mm.

Memorial size		Maximum Hole Diameter		Minimum Dowel Size				
Height at apex	Headstone thickness	Headstone	Base	Diameter	Length	Insertion to headstone	Insertion to base	Number required
up to 625	75	16	20	12	125	75	50	3
625-915	over 75	16	20	12	175	100	75	3
915-1200	over 100	16	20	12	225	150	75	3
over 1200	<i>Memorials over 1200mm in height and made of these softer materials require special consideration</i>							

Where an existing monument is to be reinstated, the existing stone may be reused with the specified dowels appropriate to its size.

Remember that it is always better to overspecify structural components rather than relying on these minimum values.



The dowel and cement method

The dowel and cement method is a tried and tested system. For cemented joints to comply with BS 8415, the cement must be mixed and used correctly.

- The cement should be thoroughly mixed to a thick, creamy yoghurt-like consistency to achieve best results. Only mix enough for the job in hand and do this immediately before it is needed
- Once mixed, the mortar is only useable for around 30 minutes. Cement sets due to a chemical reaction with water. It does not simply dry out like mud
- If it begins to set in the bucket, adding more water to loosen it up only weakens the mix. It must instead be discarded and a new mix created



- The joint area should be roughened to provide a key, before dust from drilling and working is cleaned off
- Porous surfaces should be well damped with clean water before the cement is applied. This prevents hydraulic shock, where water is sucked out of the cement on contact with dry surfaces, resulting in a weak bond
- Cement mortar should be spread on upward-facing joint surfaces. Aim for 100% coverage, avoiding ground anchor and drainage holes
- Mortar must be applied to the dowel holes such that no air pockets remain

- Once cement mortar has been applied, components can be worked together with a twisting motion to remove air pockets and prevent water collecting, which can freeze, expand and fracture the joint
- Excess cement should be removed. Any unused mixed cement must be taken off-site and disposed of in compliance with the current COSHH Regulations (Control of Substances Hazardous to Health)

Once assembled, components should not be disturbed whilst cement sets. Even after this, cement takes up to 28 days to fully cure. The constructed memorial should not be subjected to a stability test by the burial authority until the 28-day curing period has elapsed.

Temperature affects the working and curing time of cement. Additives may be used – for example, to extend working time in very warm weather. In practice, avoid using cement if the temperature is below 5°C. If the temperature is likely to fall below this during the curing period, a frost-proofing additive should be used.

In adverse weather conditions, alternatives such as a mechanical lockdown system (11) or industry-tested adhesives may be a better choice.

The bolting method

This method relies on threaded dowels fixed into the headstone with epoxy resin, together with washers and locking nuts, to fix the headstone and base together. The headstone and base can be bolted together in the workshop, meaning work on site is less dependent on fair weather. The following procedure must be observed:

1. Dowel holes drilled in the headstone must be dust-free and keyed to aid adhesion of the epoxy resin
2. It is good practice to flare the base of the holes once drilled to depth, by angling the drill front-to-back and side-to-side. Once the resin cures, it forms a conical plug to resist the pulling force as the nut is tightened



3. The epoxy resin used must be declared suitable for memorial industry use by the manufacturer
4. The holes must be filled with resin using a suitable applicator and the threaded dowels fully inserted, leaving enough protruding for the thickness of the base, plus the washer and the nut
5. The resin must be allowed to cure fully, following the manufacturer's instruction.
6. A damp-proof membrane (a) must be fitted between the two parts, along with silicone sealant around the dowel holes, to prevent water ingress and freezing weakening the joint over time

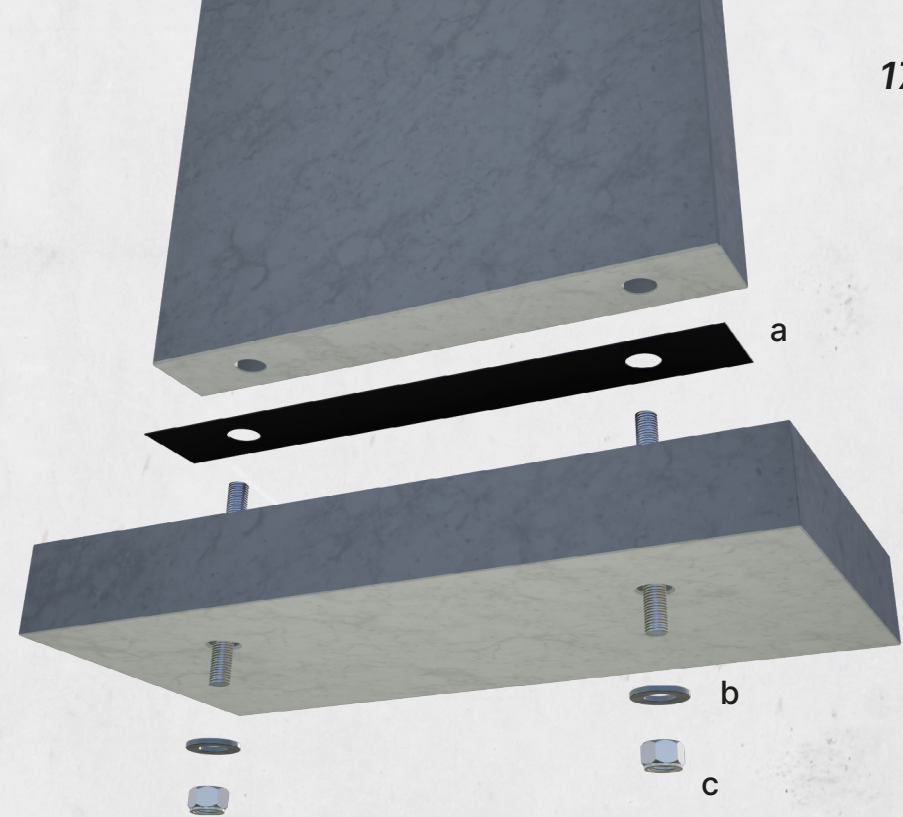


Table 3: Threaded dowels for bolted memorials

Memorial height	Dowel diameter	Number of dowels		Insertion	Torque
		Hard stone	Soft stone		
up to 915mm	12mm	2	3	75mm	40Nm
915mm-1200mm	16mm	2	3	100mm	90Nm
1200mm-1830mm	16mm	2	3	150mm	90Nm

7. A single stainless steel washer (b) must be used together with each nut
8. Washers must be a minimum 3mm thick and at least one and a half times the diameter of the base dowel hole – a 30mm washer for a 20mm hole, for example
9. Locking nuts (c) – spring washers, nylock nuts – must be used
10. Nuts must be tightened with a calibrated torque-wrench set to the appropriate value: 40Nm for 12mm dowels and 90Nm for 16mm dowels

Whilst this is a 'cement-free' method, all joints in the finished memorial installation should be pointed with cement mortar to prevent water ingress.

The table on the previous page gives the correct **minimum** size of threaded dowel, along with insertion depths and torque values required, depending on the size of memorial.

As always, it is best to over-specify the structural components of a memorial rather than sticking to these minimum values.

Other notable types of memorial

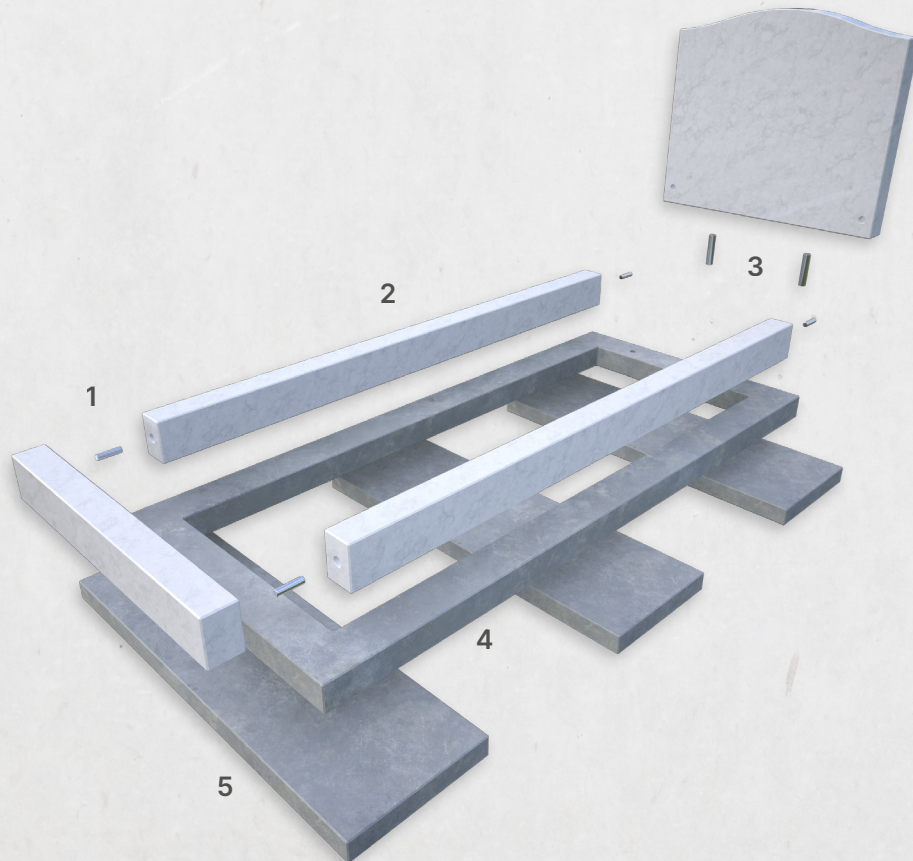
Full grave memorials

Full grave traditional memorial foundations vary widely. Methods of installation depend largely on the memorial's design, its overall size and weight and the cemetery's ground conditions.

As an example of the simplest form, the foundation for a single-width full grave memorial comprises a one-piece reinforced concrete frame landing. The footprint of the foundation should always be larger than the memorial itself.



This illustration shows as an example the construction of a standard headstone and three-kerbs set using 100mm (4") material, with a one-piece frame landing and bearers.



It is important to note as a general principle that all pieces of a memorial should be dowelled to adjoining pieces. This applies to all memorial types.

1. 10mm stainless steel dowels join the kerb sections and the headstone. These should insert a minimum of 37mm into the adjoining material
2. 100mm x 150mm granite kerbs, with dowel holes drilled at 14mm diameter
3. 16mm stainless steel dowels join the headstone to the concrete frame landing. These should insert a minimum of 75mm into both parts
4. One-piece reinforced concrete frame landing, a minimum of 75mm thick
5. Reinforced concrete bearers spreading the weight of the entire assembly beyond the grave excavation

Additional support

Frame landings may require additional support to ensure their long-term stability, such as in the following situations:

- on steeply sloping ground
- on softer, sandy soil
- on spongy ground with a high water table

Suitable additional supports may comprise of the following:

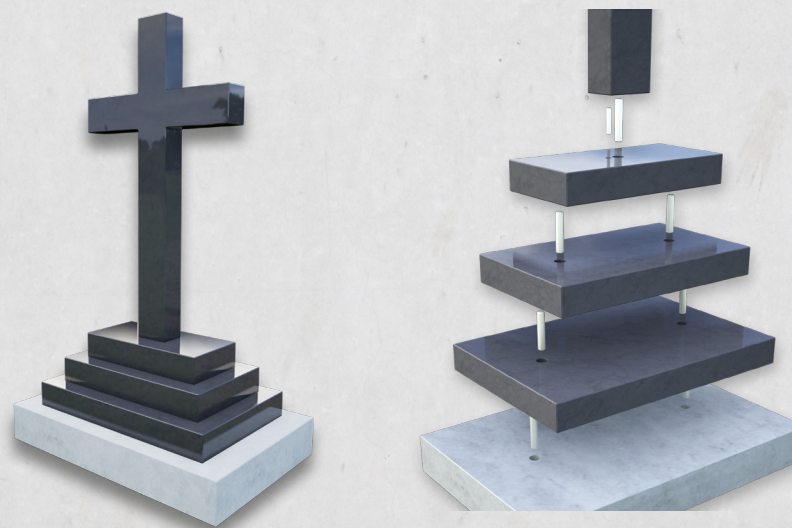
- Reinforced concrete or hardstone bearers, a minimum of 75mm (3") thick and 300mm (12") wide, spanning the maximum width of the burial plot
- One bearer each at the head and foot of the grave for normal ground conditions
- An extra bearer in the middle for very poor ground conditions
- The bearers should be over-engineered – larger in width and length – to spread the weight of the masonry onto the solid virgin ground beyond the grave excavation



Cross and die sets

The illustrations below show the components of a standard Latin cross with three blocks (also known as 'die').

A single, centre dowel is used to join the cross to the topmost block. A shorter locating peg is used in order to prevent the cross twisting on the centre dowel. The centre dowel should be fully cemented whilst the locating peg is fitted dry, with a minimum diameter of 10mm.

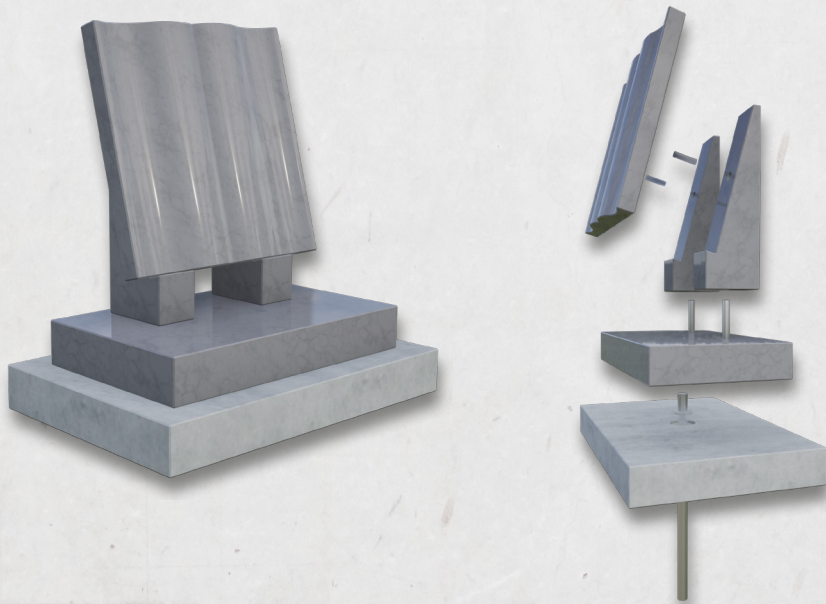


Each block should be independently dowelled to the one below, with two dowels of not less than the dimensions given in the table (13). The bottom block should be dowelled to the foundation. If the memorial is being installed with a

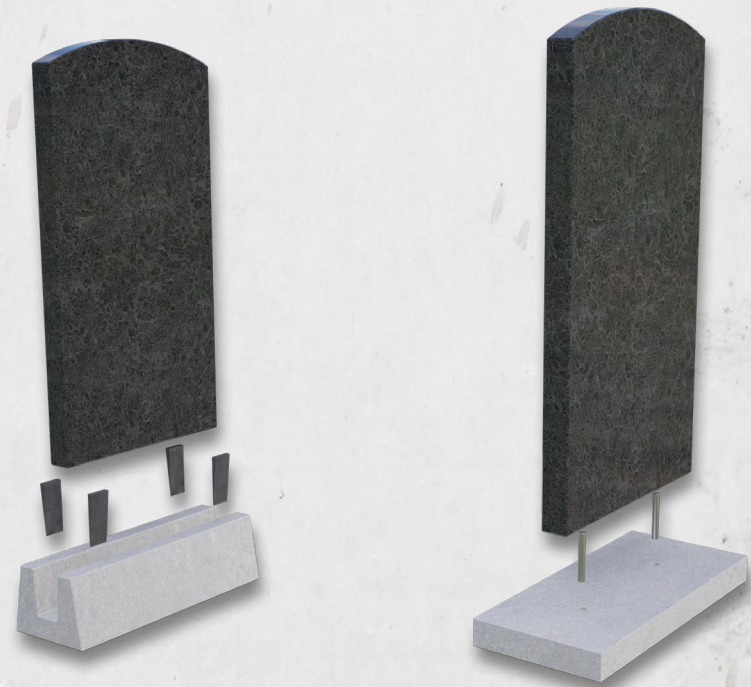
kerb, it must have a suitable support block underneath so its weight is not borne solely by the side and head kerbs.

Open book sets

Open book memorials must be joined to their tick rests using 12mm dowels. These must be threaded, not smooth, and at least 50mm (2") long, allowing 25mm (1") insertion into each component – the book and the rest. The dowel holes must be 16mm (dowel diameter + 4mm). The components of the book and the rest should be assembled in the workshop and taken to site.



The tick rests must be joined to the base using 16mm dowels 150mm (6") in length. The dowel holes should be 24mm (the dowel diameter + 8mm).



Monoliths

There are several recognised methods of installing monolith memorials with foundations below ground level. Two commonly used methods are shown in the illustration

above. The first uses a shoe foundation along with slate wedges and a stiff mix of mortar infill to align and secure the plate. The second method uses a foundation slab and dowels. The dowel size is determined by the monolith plate material, thickness and height above ground level.

The minimum depth to excavate below ground should be either 375mm (15"), or 25% of the overall height including the foundation, whichever is greater. Here are two examples:

Example A

For a 900mm (3'0") monolith plate + 75mm (3") foundation, the overall height is 975mm (3'3"). 25% of this is around 250mm (10"), which is less than 375mm (15"). So, the correct depth for the excavation is 375mm (15") below the ground level. Leaving 600mm (2'0") above ground.

Example B

For a 1800mm (6'0") monolith plate + 75mm (3") foundation, the overall height is 1875mm (6'3"). 25% of this is around 450mm (18"). So, in this example, 450mm (18") is the correct depth in the ground, leaving 1425mm (4'9") above ground

If the correct depth is not achievable due to ground conditions, monoliths may still be installed at a shallower depth providing that one third or more of the total weight of the monolith and its foundation is below ground level. In practice, this may mean using a larger foundation in order to put more weight at the bottom of the assembled memorial. Remember a memorial must withstand at least 70kg of pressure to be safe.

Refixing existing memorials to BS 8415

Where an existing memorial is to be reinstated, the existing stone may be reused. Since it cannot be known if the memorial was originally installed in a manner compliant with the current BS 8415, new dowels should be fitted, leaving any existing ones in place.

Often this means drilling through the base into the headstone from underneath. Consult the dowel size tables (12) to confirm the correct length and diameter of dowel for the size and type of memorial being refixed.

Similarly, if a ground anchor is not present, an appropriately sized new one should be fitted in the foundation.

General notes: best practice

Handling

Prior to installation, components for memorials shall be protected against damage while in transit to the burial ground, memorial site or place of storage. (BS 8415:2018, section 6)

Components of memorials should be unloaded from the truck either mechanically or by hand with the use of skids. Each component should be carefully removed from the truck and transported to the grave site. (BS 8415:2018, Annexe C)

Documentation

Local cemetery or churchyard fixing applications must be completed and approved and the correct local cemetery fees paid (where applicable) before an installation takes place.

Memorial masons must always familiarise themselves and fully comply with the local Rules and Regulations of the cemetery or churchyard they propose to work in.

During the installation

Should a funeral cortège arrive in the vicinity of the working area, all installation work should cease and any mechanical or electrical equipment should be switched off until both the cortège and all the funeral's mourners have left the cemetery.

Leaving the cemetery or churchyard

All spoil removed must be placed on a tarpaulin or in a wheelbarrow to protect the surrounding turf from any damage and ultimately removed. Ensure that both the installation and its surrounding area are left in a clean, tidy and safe state and that no tools, equipment, spoil or surplus cement have inadvertently been left behind. Report your departure to the cemetery or churchyard office, if required.





The British Register of Accredited Memorial Masons

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