BRITISH STANDARD

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Monuments within burial grounds and memorial sites – Specification

ICS 91.100.15

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British Standards

Committees responsible for this British Standard

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Association of Consulting Engineers

English Heritage

Institution of Civil Engineers

Institute of Clerks of Works of Great Britain Incorporated

National Association of Memorial Masons

National Paving and Kerb Association

ODPM — represented by BRE

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15639	18 May 2005	Correction to Annex reference in Clause **8** and amendment to notes in **B.10**.
Amd. 1	30 June 2009	See foreword
A2	30 April 2012	See foreword

Contents

Foreword

This British Standard is published by BSI Standards Limited (2012) and has been prepared by Technical Committee B/545.

The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tags [A1] 〈A1〉.

The start and finish of text introduced or altered by Amendment No. 2 is indicated in the text by tags [A2〉 and 〈A2].

BS 8415:2005+A2:2012 supersedes BS 8415:2005+A1:2009, which is withdrawn.

It has been assumed in the drafting of this specification that the selection of components together with the design and construction of the monuments is entrusted to appropriately qualified and experienced persons, and the execution of the work is carried out under the direction of appropriately qualified supervisors.

Reference is made in this standard to the *Code of Working Practice* [1] published by the National Association of Memorial Masons. Clause **5.3** and the tensile pull test in Annex F derive from this Code.

This British Standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage. In particular attention is drawn to risks involving the lifting of components and equipment and those involved should be aware of this. In this respect the following publications are available from the HSE (Health and Safety Executive):

— *Manual Handling — Guidance on Regulations* [2];

— *Getting to grips with manual handling* [3];

[A1〉 — *Stone dust and you — Guidance for stonemasons INDG 315* [4];

— COSHH essentials for stonemasons: Silica (available in five parts) [5], [6], [7], [8], [9];

— *Controlling exposure to stonemasonry dust* [10];

— *Hand-arm vibration in the cast stone industry (MISC 493)* [11]. 〈A1]

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

[A1〉 **Attention is drawn to the the following statutory regulations:**

— Manual Handling Operations Regulations 1992 (as amended) [12];

— Control of Substances Hazardous to Health Regulations 2002 (as amended) [13]; and

— The Provision and Use of Work Equipment Regulations 1998 [14]. 〈A1]

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 23, and a back cover.

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1 Scope

This British Standard specifies the minimum structural design criteria and performance requirements for new and reinstated monolithic and multi-component monuments in burial grounds and memorial sites in which monuments are:

a) fabricated from natural stone and/or concrete; and

b) installed above and below the natural ground surface; and

c) whose total mass does not exceed 4 t.

It also specifies requirements for checking the condition of existing monuments.

This British Standard is intended for use by burial authorities and monumental masons concerned with the installation and reinstatement of monuments and the checking of existing monuments within burial grounds or memorial sites. It does not set out to constrain artistic endeavour.

NOTE Annex A of this standard contains recommended inscription information on monuments. Annex B contains requirements for the checking of existing monuments.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4449, *Specification for carbon steel bars for the reinforcement of concrete.*

BS 6100, *Glossary of building and civil engineering terms.*

BS 6744, *Stainless steel bars for the reinforcement of and use in concrete — Requirements and test methods.*

BS 8004, *Code of practice for foundations.*

BS 8110-1, *Structural use of concrete — Part 1: Code of practice for design and construction.*

BS EN 197-1:2000, *Cement — Part 1: Composition, specifications and conformity criteria for common cements.*

BS EN 206-1, *Concrete — Part 1: Specification, performance, production and conformity.*

BS EN 447, *Grout for prestressing tendons — Specification for common grout.*

BS EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate, plate and strip for general purposes.*

BS EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, and sections for general purposes.*

BS EN 12370, *Natural stone test methods — Determination of resistance to salt crystallization.*

BS EN 12371, *Natural stone test methods — Determination of frost resistance.*

BS EN 12407, *Natural stone test methods — Petrographic examination.*

BS EN 13919, *Natural stone test methods — Determination of resistance to ageing by SO_2 action in the presence of humidity.*

BS EN ISO 11600, *Building construction — Jointing products — Classification and requirements for sealants.*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 6100 and the following apply.

NOTE Other terms and definitions (not used in this standard) are given for information only in Annex C.

3.1
base
support structure for a monument

3.2
canopy
roof-like covering on a monument

3.3
burial ground
area set aside for interment

NOTE A memorial garden, A1 churchyard A1 and cemetery are types of burial ground.

3.4
memorial site
area set aside in the memory of the deceased upon which a monument is erected

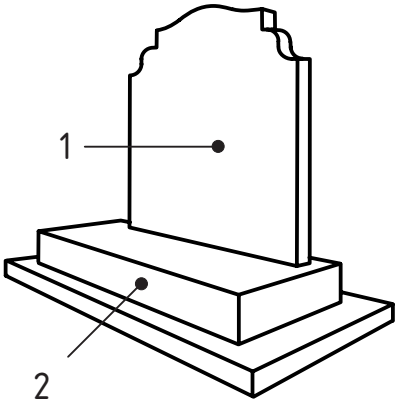
3.5
monument
freestanding object installed in a burial ground or memorial site in memory of the deceased

3.6
characteristic compressive strength
compressive strength of a material, as assessed by standard test, which is exceeded by 95 % of the material

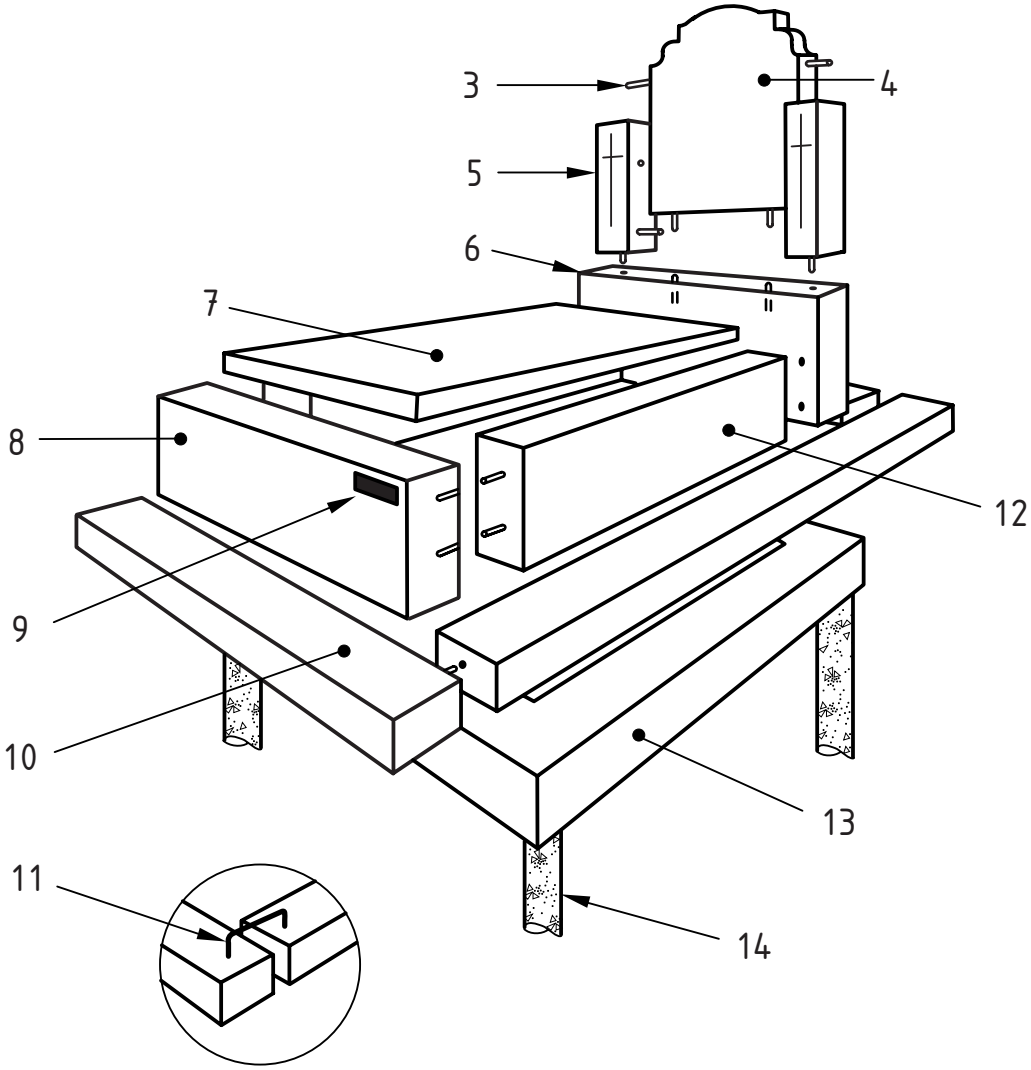
3.7
cramp
shaped piece of metal, suitably bedded into sinkings cut in stone units, to tie them to one another or to their backing

3.8
dowel
short piece of material sunk or cast into adjacent hidden faces to align or prevent movement, or both (see Figure 1)

3.9
foundation
construction to transmit forces to the supporting ground (see Figure 1)



a) Lawn monument



b) Full grave monument

Key

1	Inscription plate	8	Front kerb
2	Base	9	Plot identification to burial ground specifications
3	Dowel	10	Plinth
4	Inscription plate	11	Cramp
5	Pillar	12	Side kerb
6	Back kerb	13	Foundation
7	Cover slab	14	Pier

Figure 1 – Typical components of a monument

3.10
ground
soil, rock and fill existing in place prior to the execution of construction works

3.11
grave
place of burial below ground level which may or may not be lined

3.12
inscription
dedication recorded on a monument
NOTE For inscription information see Annex A.

3.13
inscription [A1] **plate** [A1]
inscribed stone on a monument (see Figure 1)
[A1] NOTE Commonly known as "headstone", see Figure 1. [A1]

3.14
kerb
kerbing
edging stone used in connection with a monument (see Figure 1)

3.15
ledger
horizontal slab used in connection with a monument (see Figure 1)

3.16
monumental work
construction and reinstatement of monuments by monumental masons

3.17
natural stone
naturally occurring, consolidated aggregation of one or more minerals constituting the crust of the earth

3.18
ornament
decoration on a monument

3.19
pier
vertical element supporting a structure which is subjected primarily to both compressive axial loads and seismic forces

3.20
plinth
projecting base, either part of the monument or part of the foundation (see Figure 1)

3.21
plot
land upon which a monument is to be erected

3.22
reinstated monument
monument which has been reinstated following removal from a burial ground or memorial site for refurbishment

[A1] **3.23**
burial authority
body appointed to administer the affairs of a burial ground or memorial site on behalf of its constituent owners [A1]

4 Materials

NOTE The structural materials used to construct monuments should exhibit high atmospheric-corrosion-resistant properties.

4.1 Cement

Cement used in monuments within burial grounds and memorial sites shall be in accordance with BS EN 197-1 type CEM I, strength class 42.5.

4.2 Natural stone

4.2.1 *General*

Natural stone used in the construction of monuments within burial grounds and memorial sites shall be sound, durable and free from defects likely to affect durability and structural stability (see **4.2.2**). Limestone and cast stone made with limestone shall not be used in conjunction with sandstone, if water can drain from the former onto the latter.

4.2.2 *Assessment of durability*

An assessment of the predicted service life of any particular type of natural stone shall be undertaken in accordance with at least one of the following methods:

a) past performance in monumental work in the United Kingdom;

b) mineralogical and physical characteristics of the material in accordance with the tests in BS EN 12407;

c) accelerated weathering testing in accordance with BS EN 13919 and comparison with materials of known performance in accordance with BS EN 12370 and BS EN 12371.

4.3 Concrete

Concrete used in monuments within burial grounds and memorial sites shall conform to BS EN 206-1. The characteristic compressive strength of the concrete at 28 days shall be not less than 30 N/mm^2.

4.4 Materials for dowels and cramps

4.4.1 *Metal fixings*

Materials for [A1] *Text deleted* [A1] fixings shall conform to Table 1.

Table 1 – Materials for metal dowels and cramps

Material	Standard	Grade
Stainless steel	BS EN 10088-2 or BS EN 10088-3	BS 6744

[A1] **4.4.2 *Fixings not made from metal***

It shall be permissible for other materials, having similar or greater strength than stainless steel, to be used if their viability is shown by design and calculation of testing. [A1]

4.5 Reinforcing steel

Reinforcing steel used in monuments within burial grounds and memorial sites shall conform to the requirements of BS 4449.

4.6 Jointing and pointing

Jointing and pointing materials used in monuments within burial grounds and memorial sites shall conform to BS EN 447.

4.7 Flexible compound bonding and sealing agents for joints

Flexible bonding and sealing agents selected shall meet a performance class specified in BS EN ISO 11600 and appropriate to the expected joint movements.

NOTE Usually the class compliance is stated in the product data sheet. BS EN ISO 11600 does not specify chemical type and this may be selected in consultation with the sealant manufacturer.

For non staining applications, the sealant manufacturer shall provide, as requested, evidence of non staining characteristics using test data to [A1] BS ISO 16938-1 or BS ISO 16938-2 [A1] for the selected sealant with recommended priming, if any, on a relevant substrate.

[A1] **4.8 *Text deleted*** [A1]

5 Design and construction

5.1 General

NOTE 1 See Annex D for recommendations on the installation of monuments and Annex A for recommendations on inscriptions on monuments. Typical design details for monuments are shown in Annex E.

NOTE 2 Recommendations are given in **5.4** for the construction of monuments using dowels for joining to vertical components.

New and reinstated monuments (see **3.22**) shall be designed and constructed to provide a stable structure that is serviceable and which provides satisfactory performance for the life of the monument.

For monuments in which the highest part of any component is greater than [A1] 625 mm [A1] above ground level this component shall be designed to withstand a horizontal load of 70 kg applied at its apex or 1.5 m from the ground, whichever is the lower, when installed with the load being applied in the most critical direction. Monument components necessary to the structural integrity and their associated fixing systems shall be tested:

a) using the smallest base and foundation declared to be representative of the type of monument;

b) using the component configuration and pull direction that is predicted to produce the lowest failure load.

For monuments which are greater than [A1] 625 mm [A1] above ground level the requirements for foundations shall apply (see **5.3**).

[A1] *Text deleted* [A1]

[A2] When a ground support system is used it shall be tested in accordance with Annex F. System failure shall be deemed unacceptable except where it is progressive and controlled between loads of 1 kN and 1.5 kN.

NOTE This is known as progressive failure; it is unlikely to cause harm.

Substrate failure or sudden brittle collapse shall be deemed unacceptable. [A2]

5.2 Mass of monument

The mass of the monument excluding any foundations shall not exceed 4 t.

5.3 Foundations

5.3.1 *General*

Foundations for monuments which are greater than [A1] 625 mm [A1] high shall be designed in accordance with sound engineering principles having regard to the size and load imposed by the monument. Local soil conditions, foundation movement and any special performance requirements shall be considered in the design of the monument.

NOTE 1 BS 8004 may be referred to for guidance.

NOTE 2 Individual burial [A1] *Text deleted* [A1] authority requirements may also be applicable.

Foundations shall either be level or as the design/type of monument dictates and drainage shall be provided to resist water accumulation within the structure.

5.3.2 *Soils*

5.3.2.1 *Sands and gravels*

[A1] *Text deleted* [A1]

[A1] For the purposes of the footing requirements given in Table 2, sands and gravels shall be classified as follows. [A1]

a) Medium sand and gravel: Sand or gravel deposits removable by vigorous shovelling and into which a sharp pointed wooden post 50 mm square can with some difficulty be driven with a hammer (with a mass not exceeding 5 kg).

b) Dense sand or gravel: Sand or gravel deposits requiring picking for removal, and offering high resistance to penetration by excavating tools.

5.3.2.2 *Clays*

[A1] *Text deleted* [A1]

[A1] For the purposes of the footing requirements given in Table 2, clays shall be classified as follows.[A1]

a) Firm clay: Soil which can, with moderate effort, be penetrated to a depth of 50 mm by the thumb.

b) Stiff clay: Soil which can be readily indented by the thumb, but penetrated by the thumb only with great effort.

c) Very stiff clay: Soil which can be readily indented by the thumbnail.

5.3.2.3 *Rock*

[A1] *Text deleted* [A1]

[A1] For the purposes of the footing requirements given in Table 2, rock shall be classified as follows. [A1]

a) Highly weathered rock: Rock of predominately earthy colours (particularly yellows, reds and browns) with numerous clay seams, and pieces of which can generally be broken by hand.

b) Moderately weathered rock: Rock showing some earth colour predominately surrounding the joints with some clay seams, and pieces of which can generally be broken by hand.

5.3.3 ***Pier design for full grave monuments*** (see Figure 1)

5.3.3.1 *Piers supporting foundation beams*

The size and depth of piers supporting foundation beams for a single grave shall be in accordance with the requirements given in Table 2 and Figure 2, for the following types of monument:

a) full grave construction (usually less than 1 t, maximum 2 t);

b) inscription plate and part canopy (max. 3 t);

c) canopy type (max 4 t);

Tolerances on foundations and reinforcement placement shall conform to BS 8110-1 and shall follow the appropriate recommendations of BS 8004. Reinforcement shall be accurately located using purpose-made bar chairs or cover spacers.

NOTE 1 It is recommended that 4 piers per grave are used.

NOTE 2 The main benefit gained from the use of reinforcement is improvement in the pier's capacity to resist lateral ground pressures.

5.3.3.2 *Soil types other than those in 5.3.2*

For soil types other than those listed in **5.3.2**, e.g. loose sands and silts, soft clays, full engineering computations shall be submitted with the application form for burial authority approval.

NOTE Table 2 and Figure 2 give the requirements for piers and pier size where parameters fall within the limits of **5.3.2** and **5.3.3.1**.

Table 2 – Minimum footing requirements

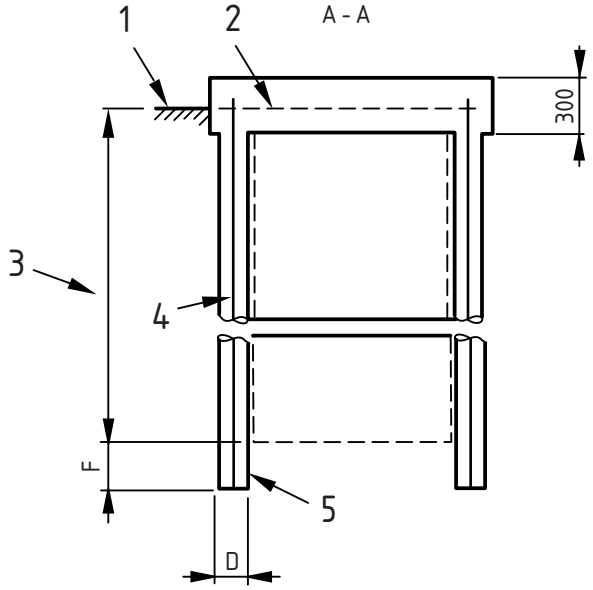
Foundation type	Description	Mass of monument					
		<2 t		≥2 t and ≤ 4 t		> 4 t	
		D (see Figure 2) mm	Depth below ground level mm	D (see Figure 2) mm	F (see Figure 2) mm	D (see Figure 2) mm	F (see Figure 2) mm
Sands and gravels	Medium sand and gravels	150	600	150	100	150	600
	Dense sand and gravels	150	600	150	100	150	300
Clays	Firm	150	600	150	600	150	1 200
	Stiff	No piers required	No piers required	50	200	150	400
	Very stiff to hard	No piers required	No piers required	No piers required	No piers required	150	100
Rock	Highly to moderately weathered	No piers required	No piers required	No piers required	No piers required	150	100

5.4 Requirements for the construction of monuments using dowels for joining vertical components

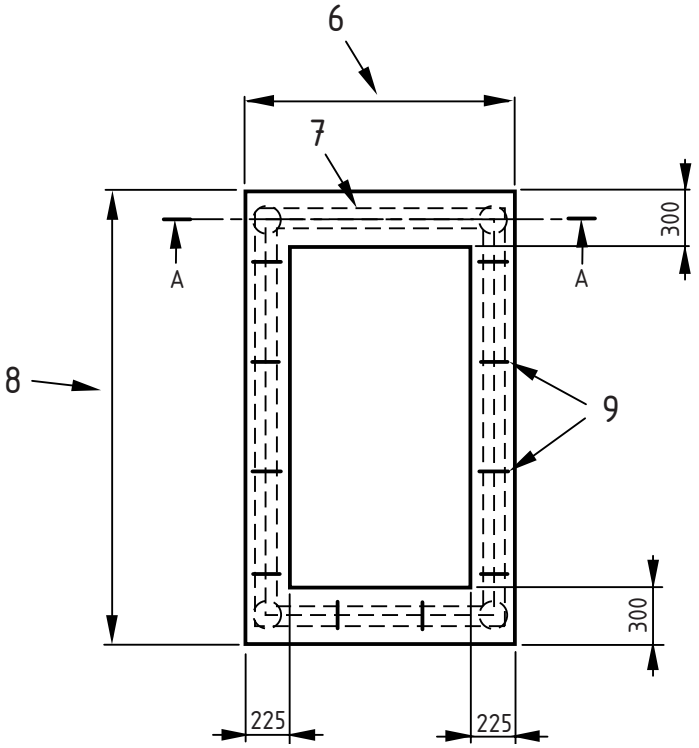
5.4.1 ***General***

Where dowels are used for permanent alignment of vertical components of monuments, they shall be in accordance with Table 3.

Dimensions in millimetres



a) Section



b) Plan

Key

1 Ground level varies
2 4 – D10 bars (50 mm cover above bottom)
3 Grave depth
4 1 – D12 bar centrally placed
5 Cast-in-situ concrete pier (typical)
6 Width as directed
7 4 – D10 bars
8 Length as directed
9 R6 stirrups at 600 mm centres

Figure 2 – Typical foundation details

Table 3 – Size of dowels and dowel holes

Monument – size		Dowels – size		Maximum [A1] difference between [A1] dowel hole and dowel	
Overall height to apex (h)	Thickness of inscription plate	[A1] Nominal [A1] diameter	Minimum length in inscription plate and monument base	In inscription plate	In monument base
mm	mm	mm	mm	mm	mm
[A1] h ≤ 625 [A1]	≤ 63	12	50	[A1] 4 [A1]	[A1] 8 [A1]
	> 63	16	50	4	8
[A1] 625 < h ≤ 900 [A1]	> 63	16	75	4	8
900 < h ≤ 1 200	> 75	16	100	4	8
> 1 200	> 100	25	100	5	10

5.4.2 *Number of dowels*

The design of the monument shall, through the provision of a dowel or dowels and location of dowel holes, ensure the correct alignment and security of each element of the monument.

Vertical elements using a single dowel shall be fitted additionally with a locating peg and which prevents rotation. The requirements of Table 3 shall not apply to such locating pegs.

5.5 Joints

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.

[A1] 5.6 Lettering and ornamentation

Where lettering, numerals, plaques or ornamentation is applied or fixed to a monument, the materials, methods for fixing, finish and adhesion shall be consistent with the predicted service life of the monument (see **4.2.2**).

NOTE 1 Gold infill or paints on inscriptions are not required to exhibit the same durability as the materials on which they are used. It is recommended that 23 carat gold leaf be used for all gold lettering.

NOTE 2 A type test for fixings can be found in Annex F. [A1]

6 Pre-installation

Prior to installation, components for monuments shall be protected against damage while in transit to the burial ground, memorial site or place of storage (for full recommendations on installation see Annex D).

7 Siting of monuments

7.1 Undisturbed ground for fixing lawn-type monuments

The minimum width of undisturbed ground to permit proper fixing for a lawn-type monument at the end of the grave shall be 600 mm on the longitudinal axis of the grave.

7.2 Plot identification

The plot identification shall be indelibly and legibly marked on each monument.

NOTE This identification should be carried out in accordance with the requirements of the burial [A1] *Text deleted* [A1] authority.

8 Checking the condition of existing monuments

NOTE It is important that monuments, once installed, do not become neglected from the point of view of their structural condition and stability.

Once the need has been established for a monument to be checked for structural condition and stability the [A2] assessment method set out in [A2] Annex B shall be followed and the monument allotted the appropriate risk assessment category. This category shall be used in the determination of any corrective action to be taken.

Annex A (informative)
Recommended inscription information on monuments

A.1 General

Inscriptions on monuments are desirable for genealogical purposes. A comprehensive inscription provides a convenient source of information.

A.2 Inscription information

If an inscription is to be provided on a monument the following information should be considered for inclusion:

a) full name;

b) date of birth;

c) date of death and age at death;

d) other family members' names;

e) additional inscription.

A2

Annex B (normative)
Existing memorials: Managing safety risk assessments

*COMMENTARY ON **Annex B***

The accident and incident history relating to memorials suggests the risk of serious injury from unstable memorials is extremely low. However, those responsible for burial grounds should have a simple system in place to control the risks from memorials.

This annex summarizes the good practice guidance in 'Managing the Safety of Burial Ground Memorials" issued by the Ministry of Justice in January 2009 [15]. Operators and other duty holders are advised to consult the guidance in full before deciding on action needed to manage the risks from memorials.

B.1 Assessment of risk

*COMMENTARY ON **B.1***

A risk based approach enables a proportionate response to managing the risks associated with memorials. A knowledge of the different types of memorial, their design and materials, the burial ground environment and the likely presence of staff or visitors in their vicinity, are essential elements of the management system and should be used to inform the risk assessment process.

The Health and Safety Executive suggests a simple 5 step approach to risk assessment.

1) *Identify the hazard – e.g. a potentially unstable memorial.*
2) *Identify who might be harmed and how, e.g. cemetery employees, contractors or members of the public.*
3) *Evaluate the risk of a memorial falling and harming someone, and decide on the precautions, if any, needed to control this risk.*
4) *Record the significant findings of the assessment and implement any precautions needed.*
5) *Review the risk assessment periodically and update it if necessary. Risk assessment is an ongoing management process and operators should decide how often it is appropriate to review their assessment.*

B.1.1 *Identifying risk factors for memorials*

The following shall be considered in prioritizing memorials:

a) Memorials alongside or within a short distance of well-used paths. [A)]

b) Memorials of well-known people and memorials that have architectural or aesthetic qualities. [A)]

c) Areas less frequented by staff or visitors that might attract anti-social behaviour.

d) Memorials situated on sloping or uneven ground.

e) Areas containing multi-part memorials that depend on bonding for stability and where age indicates the joints could be liable to failure.

f) Areas containing memorials made of material which erodes and could become unsafe.

NOTE There might also be other local factors to consider.

All memorials shall be assessed. Memorials that are most likely to present the greatest risk of serious injury shall be assessed before those considered lower priority.

B.1.2 *Records*

A record of the assessment shall be including the following:

a) prioritization;

b) which checks were made;

c) details of any memorials that were found to be at high risk of collapse; and

d) any action taken or planned to deal with significant risks presented by such memorials with timescales.

NOTE Operators may also keep records of the management system they have followed to assess and control the risks. Where a more detailed record of a monument is required a table such as Table B.1 may be used.

Where detailed records have already been made they shall be added to the risk assessment record.

B.1.3 *Inspection of memorials*

A visual check to assess the likelihood of a memorial falling shall be carried out.

The following factors shall be used to determine whether a monument stone constitutes a danger:

a) the physical shape, height and slenderness of the monument;

NOTE 1 Taller, larger monuments can fall with more devastating effect, and the ratio of height to thickness can give a useful indication of stability. Monuments less than 625 mm height are unlikely to cause injury if they fall, and may therefore be excluded from detailed assessment or application of a load.

b) the condition of the stone;

NOTE 2 E.g. the stone could be leaning, cracked, perished, frost damaged or otherwise weakened.

c) the condition of any joints;

NOTE 3 The joints between separate pieces of stone, or between the stone and the foundation (if any), could be formed of weathered mortar in need of repointing and might have loose or corroded dowels or no dowels at all. Rusted dowels can cause cracking of the stone due to rust expansion. Open joints are prone to frost attack and can allow rocking movement.

d) the condition and adequacy of the foundation;

NOTE 4 Different types of monument stone have different types of foundation. The area of the foundation and the depth to the underside are crucial in determining the overall stability of the stone. Where brickwork has been used as a foundation, the condition of the bricks and the pointing can deteriorate allowing voids to form under the foundation stone. In many cases, it is difficult to inspect for these factors.

e) the condition of the ground around the monument stone; and

NOTE 5 Sloping ground or ground recently disturbed by excavation and the use of weedkiller and vigorous weeding programmes can, over a period of time, expose the foundation and lead to deterioration.

f) changes to the original structure.

NOTE 6 The stability of the monument can be affected by the removal of some components, e.g. kerbs.

[A)] Where these features are considered to increase or encourage the presence of visitors or others.

B.1.4 *Assessment*

COMMENTARY ON B.1.4. *Checking by hand is recommended for many memorials, such as modern, lawn type, and smaller stepped designs or tiered crosses where specialist knowledge or skills are not required.*

Where appropriate, a hand check shall be carried out by standing to one side of the memorial and applying a firm but steady pressure in different directions to determine to what degree any of the sections of the memorial are loose.

If instability is detected following the hand check, movement shall be limited to 15° and the memorial shall lock on the support system.

If there is no movement, no further assessment or testing shall be carried out.

If the stability of the memorial is uncertain a pressure test shall be carried out by subjecting the memorial to a smoothly increased load up to a maximum of 25 kg. The load shall be applied 1.1 m above the ground or at the top of the headstone in accordance with the instructions of the producer of the load testing equipment.

NOTE A load of 25 kg is consistent with the load specified in BS EN 1991-1-1 for domestic and residential parapets, barriers and balustrades.

The results of the assessment of each memorial shall be recorded and the memorial shall be classified in accordance with Table B.1.

Table B.1 — Classification of the memorial on the basis of their assessment

Class	Assessment of movement	Suggested action(s)
(a)	Significant movement when hand load applied	Take immediate steps to reduce the risk, e.g attach warning sign or make safe/lay down/ cordon off. Alternatively the memorial may be repaired immediately.
(b i)	Significant movement when loaded to 25 kg	Take immediate steps to reduce the risk, e.g attach warning sign or make safe/lay down/ cordon off. Alternatively the memorial may be repaired immediately.
(b ii)	Limited movement when loaded to 25 kg	Re-assess after 2 years.
(c)	No movement	Re-assess after 5 years.

Large, heavy memorials e.g. multi-component structures such as columns or obelisk types, shall be assessed by a specialist engineer or memorial mason.

Except where re-instatement has been undertaken in accordance with this standard, memorials shall be re-assessed every five years, or more frequently if there has been some change, e.g. an adjacent plot has been opened for burial.

NOTE The regular or repeated use of mechanical test instruments as inspection tools is not advisable.

B.2 Precautions

COMMENTARY ON B.2. *A memorial might be so unstable it poses an imminent risk of toppling. Where this could result in serious injury, immediate steps might be necessary to reduce the risk, e.g. restricting access or laying the memorial flat.*

Any precautions taken shall be proportionate to the risk of people suffering harm.

NOTE 1 Often, the actual level of risk is very low and a sign alerting visitors to the potential danger suffices until repair has been arranged.

Where it is necessary to use a stake it shall be used for a maximum of 18 months, as a temporary measure. The memorial shall either be refixed or its risk lessened as quickly as possible.

NOTE 2 The routine staking of memorials is not recommended but it is acceptable as a method for securing memorials that require temporary measures to reduce the risk of injury. Stakes driven in at an angle are particularly dangerous as they are a trip hazard and could damage the top of the memorial.

Where other temporary measures are taken to make a memorial safe, steps to effect permanent repairs shall be implemented within six months.

NOTE 3 Operators should consider how they would obtain specialist assistance for remedial action if necessary.

When memorials are declared unsafe a strategy for a more permanent solution shall be developed.

NOTE 4 This is to avoid the memorial further deteriorating and assures that it is either restored or placed in a permanent safe position.

B.3 Communication

COMMENTARY ON B.3. *Good communication of the inspection and assessment process and the results of this is crucial to obtaining the support of the local community. The bereaved, memorial owners, friends' groups and members of the public generally accept the need for an inspection and assessment programme if they are properly informed.*

Where a memorial has been deemed at immediate risk and work needs to be undertaken, clear information regarding this shall be posted in burial grounds. Notice shall be placed on or near to memorials affected, giving contact details and the period within which contact may be made.

NOTE 1 Where the grave owner is known, it is good practice to notify them to give them the opportunity to repair the memorial.

NOTE 2 Notices may be displayed at entrances to the burial ground concerned and in other prominent places within it. Given the infrequency of individual visits, other communication channels could include local radio, the council's website, advertisements in the press, articles, letter drops etc.

NOTE 3 Listed building or scheduled monument consent is also needed for memorials of special historic interest. Approval might be needed from other bodies.

〈A2

Annex C (informative)
Glossary

C.1 General

This annex lists terms and definitions which, although not used in the main body of this standard, may be of use to those using the standard. The terms are divided into administrative terms and technical terms.

C.2 Administrative terms

C.2.1
approved drawings
drawings approved by the relevant burial authority administration for the construction of monumental work

C.2.2 〈A1〉 *Text deleted* 〈A1〉

C.2.3
regulatory authority
body having statutory powers to control the design and installation of monuments within its precincts

C.3 Technical terms

C.3.1
columbarium
structure containing niches or a grouping of niche walls for the deposit of cremated remains

C.3.2
mausoleum
enclosed and secured chamber, containing crypts or shelves, typically for the placement of members of a family

C.3.3
catacomb
accumulation of sealed crypts in an enclosed structure of one or more storeys, the crypts being individually allocated

C.3.4
niche
recess for the placement of cremated remains

C.3.5
niche wall
wall of brick, stone, granite or other material for the memorialization of a number of sets of cremated remains

C.3.6
ossuary
place for the common burial or deposit of the bones of the dead after their removal from a previous place of deposit

C.3.7
sarcophagus
stone container for a coffin, often bearing sculpture and/or inscription, and displayed as a monument

C.3.8
crematorium memorial garden
area set aside for the interment of cremated remains

C.3.9
full-grave construction
monument that covers the whole area of the grave

C.3.10
post
corner element joining two lengths of kerb

C.3.11
slate
rock derived from argillaceous sediments or volcanic ash by metamorphism, characterized by cleavage planes independent of original stratification

C.3.12
obelisk
tall four-sided tapered monument

C.3.13
veneer
stone in the form of a thin layer of uniform thickness

C.3.14
column
vertical structure, slender in proportion to height and used as a support or ornament (see Figure 1)

Annex D (informative)
Recommendations on the installation of monuments

D.1 Handling

Components of monuments 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.

D.2 Installation

D.2.1 ***Full grave monuments*** (see Figure 1)

D.2.1.1 *Plinth*

Where a plinth is required it should be pre-fixed, squared and allowed to set before any further component is installed.

D.2.1.2 *Kerbs*

The inscription plate/monument should be installed and squared on the plinth, or directly onto the concrete foundations where no plinth exists. Then the kerbs and other components should be fixed into place ensuring that they are fully grouted.

D.2.2 ***Fixing for all monuments***

D.2.2.1 *Dowel method*

NOTE 1 Attention should be given to the careful drilling, filling and sealing of all dowel holes. An adhesive or cement should be used.

To ensure the complete encapsulation of the dowel it should be installed as follows.

a) All dowel holes should be drilled with great care to ensure the sides of the holes are not fractured in any way.

b) The dowel holes should be cleaned to ensure they are free of dust.

c) The dowel holes should be pre-wetted before inserting the cement ▌A1⟩ *Text deleted* ⟨A1▐.

d) The cement/adhesive should be spread on the upward facing joint surface.

e) The components should be assembled.

f) The components should not be disturbed during the initial set of the mortar.

g) Excess cement/adhesive should be removed.

NOTE 2 Fixing the dowel into small monuments can be carried out in the workshop. For larger monuments it is usual to install the dowel on site.

NOTE 3 Adhesion between the dowel surface and the cement/adhesive can be increased dramatically by spreading both ends of the dowel or by profiling the dowel surface incorporating notching or burrs in the opposite direction to the tensile forces. To increase adhesion between the dowel hole surface and the cement/adhesive, roughening of the hole is adopted.

D.2.2.2 *Studding method* (see ⟩A1⟨ Figure E.3 ⟩A1⟨)

The following method should be used.

a) *Fixing the studs*. The studs should be fixed into one of the elements in the workshop. The stud holes should be dust free and dry when fixing takes place.

b) *Resin*. The resin should be applied with great care in accordance with the manufacturer's instructions.

c) *Nuts and washers*. A washer or washers should be used to a minimum total thickness of 3 mm and a minimum of the diameter of the hole size plus 10mm.

d) *Countersinking*. The nuts and washers should either be countersunk in the appropriate component using a 40 mm diameter and 25 mm depth or accommodated in any adjacent component. Care should be taken when doing this not to weaken the foundation.

NOTE 1 It is essential that the threaded dowels (rods) and nuts are of different grades of stainless steel ⟩A1⟨(e.g. A2 grade nuts, A4 grade dowels to avoid threads binding). ⟩A1⟨

e) *Fixing components*. A suitable membrane should be placed between the components to prevent movement and impact damage to both.

NOTE 2 In the process of fixing the inscription plate to the base the torque should be not less than 40 N·m.

D.3 Thermal movement in ledgers/cover slabs

To reduce the risk of ledgers moving on the top of monuments due to the expanding and contracting of granite during temperature changes, small pieces of lead approximately 20 mm square should be placed between the ledger and the kerbs prior to the pointing up of the monument.

D.4 Wall plaques

Wall plaques should be fixed with stainless steel fixing pins which should slope at least 10° from the horizontal.

D.5 Crosses

The cross should be dowelled and fully bedded to the top block of the monument and the dowel holes should be filled and sealed carefully. Two dowels or a single dowel used in conjunction with a locating peg should be used in order to prevent twisting, the centre dowel should be cemented and the other fitted dry and be of minimum 10 mm diameter.

Each block should be independently dowelled to the block below, with two dowels of not less than 100 mm in length × 12 mm in diameter, and the bottom step should be dowelled to the foundation.

D.6 Concreting

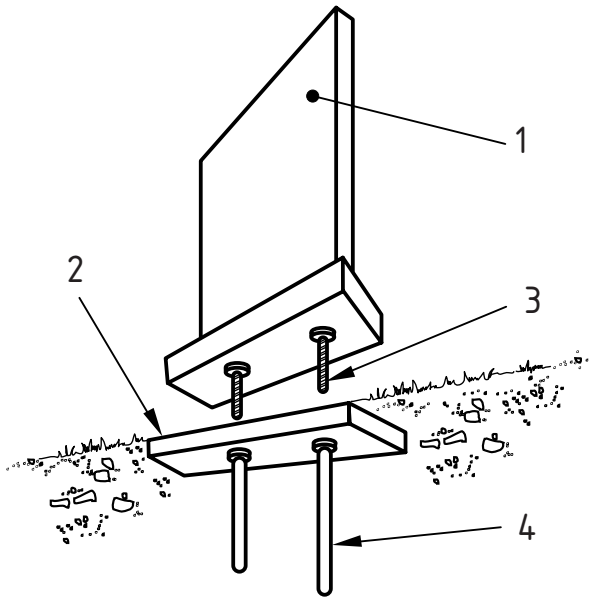
For wet conditions, water should be pumped out immediately before pouring and the use of sleeves may be appropriate.

NOTE Concrete of the proportions by volume of cement: 1, sand: 2, aggregate: 4 and water/cement ratio: 0.5, has been found to be suitable.

Annex E (informative)
Typical design details for monuments

This annex contains typical design details for monuments.

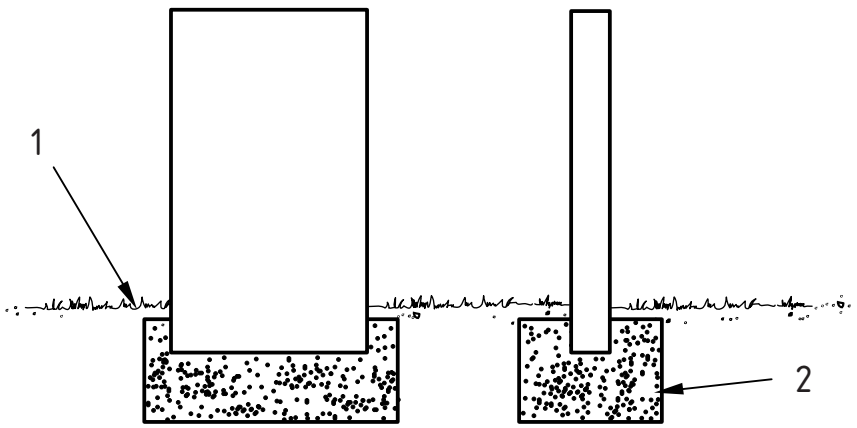
Figure E.1 shows a typical ground support system for lawn type monuments. Figure E.2 shows typical fixing for an inscription plate.



Key

1 Inscription plate
2 Foundation
3 Threaded stud or dowel
4 Support tube

Figure E.1 – Typical ground support system for lawn type monuments

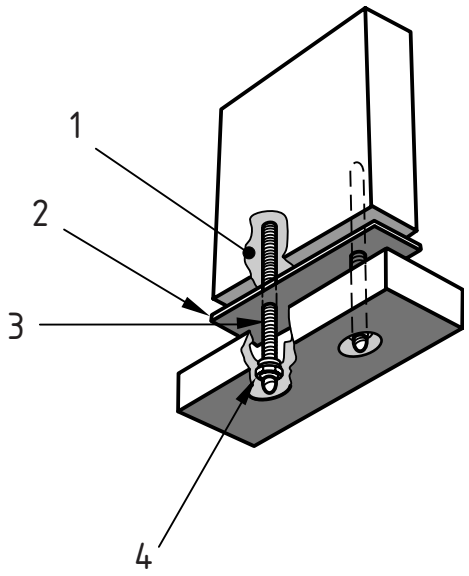


Key

1 Ground level
2 Concrete shoe

Figure E.2 – Typical fixing for inscription plate only

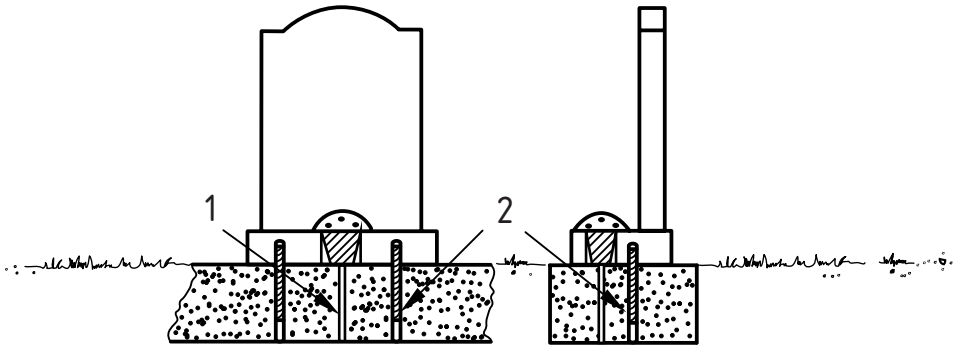
Figure E.3 shows the recommended bolting method for fixing an insciption plate to the base. Figure E.4 shows the typical fixing on concrete beams.



Key

1 Resin
2 Plastics membrane
3 [A1] *Text deleted* [A1] Threaded stud or dowel
4 Nut and washers

Figure E.3 – [A1] Studding [A1] method of fixing inscription plate to base



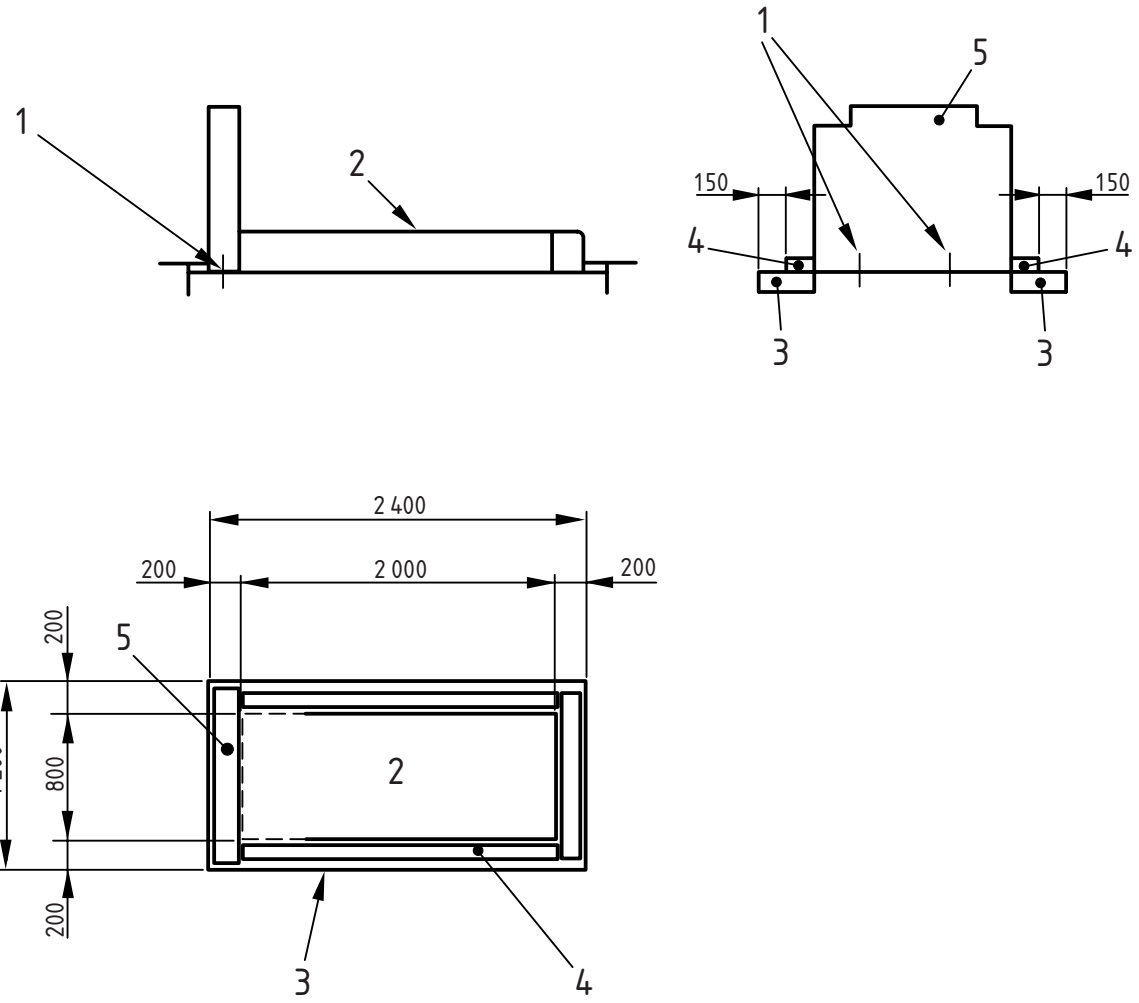
Key

1 Drain hole
2 [A1] *Text deleted* [A1] Dowels

Figure E.4 – Typical fixing on concrete beams

Figure E.5 shows a typical inscription plate with a kerb surround. Figure E.6 shows an inscription plate with double space kerbs. Figure E.7 shows a double section obelisk monument and base.

Dimensions in millimetres

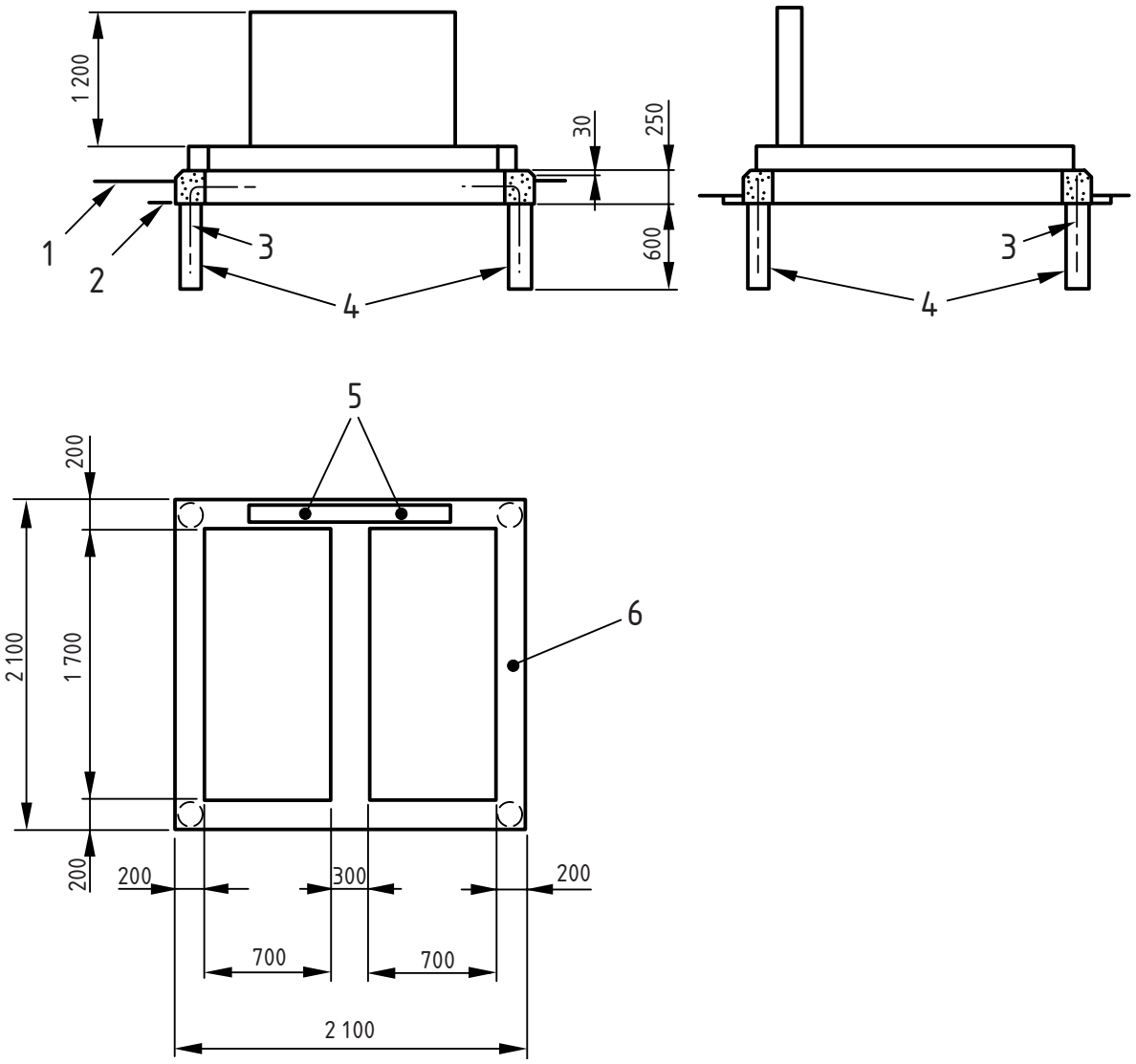


Key

1 16 mm diameter minimum dowel, refer detail
2 Cover slab/chipping bed
3 150 mm wide mowing strip
4 Kerb
5 Inscription plate

Figure E.5 — Typical inscription plate with kerb surround

Dimensions in millimetres

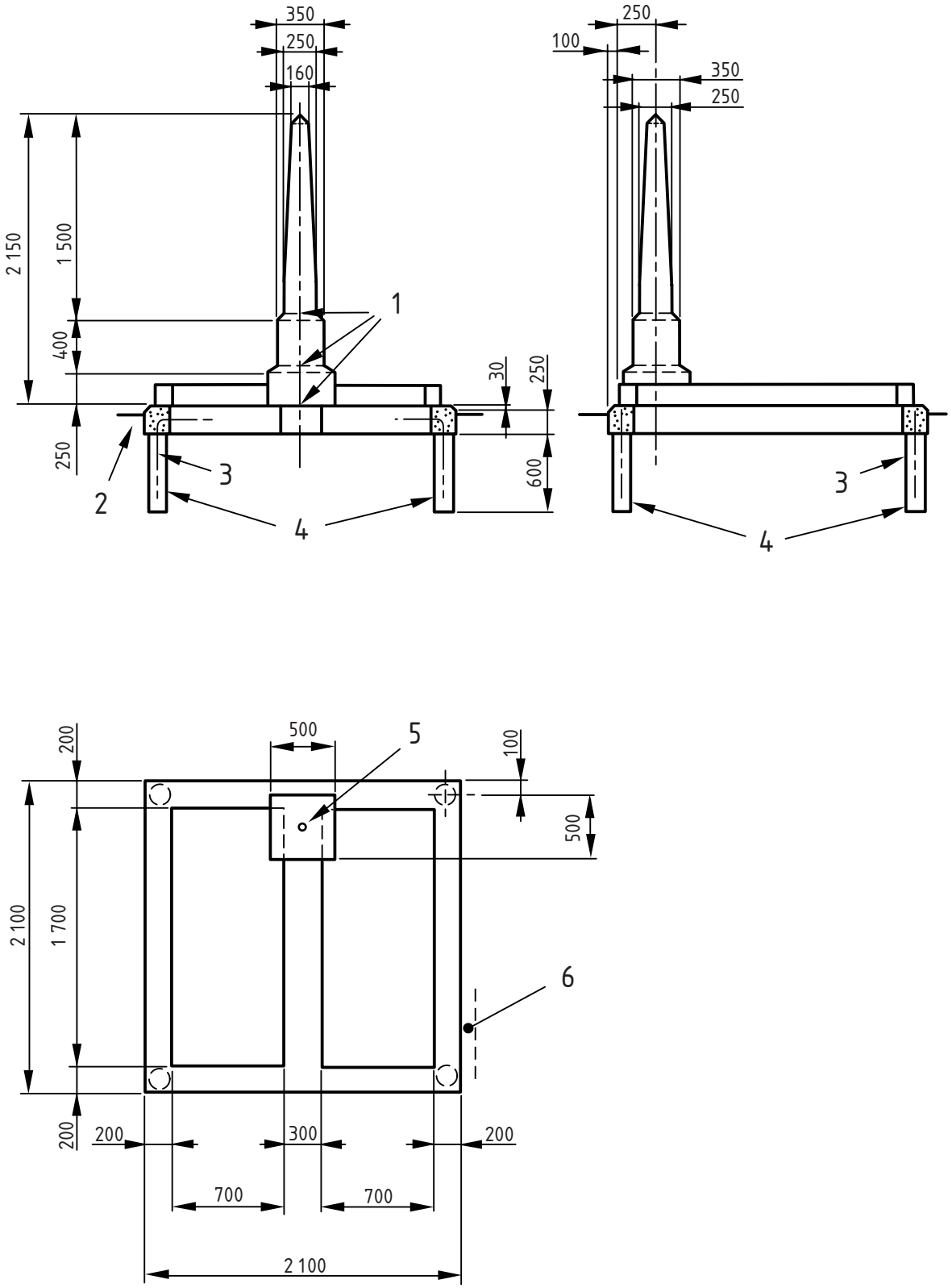


Key

1 Ground level
2 150 mm wide concrete mowing strip
3 D12 bar
4 150 mm diameter concrete piers
5 [A1] *Text deleted* [A1] Dowels (refer to detail)
6 Reinforced concrete beam (refer to detail)

Figure E.6 – [A1] Typical [A1] double space kerbs and inscription plate

Dimensions in millimetres



Key

1 R20 [A1] *Text deleted* [A1] dowel, refer to detail
2 150 mm wide concrete mowing strip
3 D12 bar
4 150 mm diamter concrete piers
5 R20 [A1] *Text deleted* [A1] dowel
6 150 mm wide concrete mowing strip

Figure E.7 – [A1] Typical [A1] double section obelisk monument and base

A2

Annex F (normative)
Horizontal load test – fixing and anchorage system verification

F.1 General

The load test in this annex shall be carried out under the supervision of a chartered or incorporated civil or structural engineer. A photographic record of the test shall be made and included in the test report. The ground used for the test shall be medium sand or gravel as set out in **5.3.2.1**a).

NOTE A comprehensive, but not exclusive, list of fixing systems that have met the requirements of this annex is available on the NAMM website at www.namm.org.uk.

F.2 Principle

A horizontal force is applied to a monument fixing and anchor system and the results observed and recorded.

F.3 Apparatus

F.3.1 *Test rig and reaction system*, that enables load to be applied at the required height and allows movement at the monument apex to be measured.

F.3.2 *System for applying the required horizontal force.*

NOTE Suitable systems include a hydraulic jack or a lever ratchet system.

F.3.3 *Calibrated load gauge*, capable of measuring up to 2 kN (200 kg).

F.4 Procedure

F.4.1 Assemble a test monument using the fixing and anchor system to be tested.

F.4.2 Steadily apply a horizontal force to the monument at either:

a) its defined apex; or

b) at a point not more than 1.5 m above the base or back kerb.

F.4.3 Apply the force at a rate not exceeding 0.02 kN/s (2 kg/s), up to a force of 1 kN (100 kg). Maintain this load whilst examining the monument for any failure as defined in **5.3.1**.

F.4.4 Steadily increase the force to 1.5 kN (150 kg) and sustain this force for 1 min. During this time examine the assembly for signs of failure.

F.4.5 Repeat **F.4.1** to **F.4.4** with the force applied in the opposite direction.

F.4.6 Record any failures.

F.5 Test report

The test report shall include:

a) The force at which any failure occurs;

b) whether the failure is progressive and controlled (e.g. due to bending of ductile material such as a steel dowel);

c) if substrate failure occurs;

d) if sudden brittle collapse occurs;

e) full details, including dimensions and materials of all parts of the test specimen and test apparatus.

A2

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