UNITED KINGDOM
CAST STONE ASSOCIATION ®

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CAST STONE & CONCRETE PRODUCTS

Cast Stone Installation Guide

Cast Stone

First Choice Solutions for Architects, Specifiers & Contractors

EST 1740

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Cast stone is a remarkably versatile material that is suitable for all types of construction project, from renovations, conversions and extensions, through to commercial properties, schools and places of worship. While it is often used to replicate natural stone features, cast stone is equally effective for adding striking details to contemporary designs.

Extensive ranges of standard products are available either for delivery from stock or on short lead times, or bespoke products can be manufactured to order in specific colours and finishes. Cast stone also offers an exceptional degree of design freedom; almost any three-dimensional geometric form can be cast, incorporating elegant curves as well as straight-edged features and intricate details.

What is cast stone?

Cast stone, which is sometimes referred to as reconstituted stone or simulated stone, starts with a drawing, from which subsidiary drawings are prepared so that a skilled pattern maker can create a wooden mould. Depending on the product and finish required, cast stone is made using a semi-dry mix of white and/or grey cements with natural or manufactured sands. The appearance of natural stone is achieved using crushed natural stone, well graded natural gravels and mineral pigments. A waterproofer is added to minimise moisture absorption and improve resistance to frost damage.

On larger components, a coloured facing mix is used on the outside of the mould, with a higher-strength, non-coloured backing mix in the interior. Cores are sometimes used to reduce the volume of cast stone used and, therefore, the weight of the final product; reinforcement can also be incorporated to enhance the structural strength. Additionally, bosses for lifting loops can be set within the casting to ease handling.

During mould-filling, the semi-dry mix is compacted using a vibratory ram. The casting is turned out almost immediately, enabling the mould to be reused straight away if required, and the cast unit is allowed to cure initially in a controlled environment and then naturally. In extreme circumstances, cast stone products can be manufactured and delivered to site within approximately two weeks, provided the correct mould is available.

After installation, cast stone weathers in the same way as natural stone. If required, it can also be cleaned or repaired, and conventional masonry fixings can be used to attach other items.

Products intended for use in compression - such as quoins, string courses and walling units - can be structural. However, cast stone lintels and other units that might experience tensile loads should be used in conjunction with a suitable structural lintel.

As far as installation is concerned, cast stone should generally be treated as natural stone.

Does cast stone need special attention?

Cast stone is robust and hardwearing. Compared with dressed natural stone, cast stone units typically cost less and are available on shorter, more reliable deliveries. Nevertheless, cast stone units are more expensive than the equivalent volume in brickwork, and replacing damaged units will be inconvenient, costly, and could delay the project. It is therefore worthwhile taking care when handling and installing cast stone units in order to minimise the risk of damage.

Another reason for taking particular care with cast stone units is that they are often highly visible. Because they are used as eye-catching features, any chips, cracks or stains also tend to be more obvious than they might otherwise be.

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Delivery and unloading

Palletised deliveries of cast stone products should be unloaded using a grab or forklift with suitable forks. Grabs should be used on the pallet, not the cast stone units. Slings, scaffold poles and similar arrangements should not be used.

Cast stone units are normally delivered securely packaged on pallets. These should be placed on firm, even, dry ground, preferably away from areas of heavy traffic. Individual items should also be placed on firm, even, dry ground, supported by suitable bearers placed one-quarter to one-third of the way in from each end to provide adequate support while avoiding point loading.

Note that Procter Cast Stone can arrange deliveries to site according to an agreed schedule. This ensures the cast stone units do not spend any more time on site than is necessary, which aids site logistics and minimises the risk of damage. Of course, if the project is delayed for any reason, deliveries can be rescheduled accordingly.

Inspection

Palletised loads are best left in their protective packaging until required, but individual items should be inspected visually upon delivery. Any damage should be noted on the delivery note and reported to the manufacturer by telephone, fax or email.

Note that the United Kingdom Cast Stone Association (UKCSA) Standard states that chips, scuffs, blemishes, hairline cracks and crazing shall not be obvious under direct daylight illumination from a distance of 6m. And all surfaces intended to be exposed to view shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination from a distance of 3m. In addition, the Standard explains that small variations in colour can result from the manufacturing process, and initial variations are often due to differences in the age of the cast stone units, or differences in water content. Colour variation should therefore not be a cause for rejection.

When opening the outer packaging, use a knife rather than 'bursting' open the packaging with a shovel or other inappropriate tool that could damage the cast stone. Even when using a knife, care should be taken to avoid damaging the surface of the cast stone. After inspection, the cast stone should be with covered loosely with sheets of heavy-gauge polythene to protect against contamination and maintain adequate airflow to prevent the formation of condensation.

Site storage

Pallets of cast stone units should be stored on firm, even, dry ground, preferably away from areas of heavy traffic. Palletised loads are best left in their protective packaging until required. Individual items should also be stored on firm, even, dry ground, supported by suitable bearers placed one-quarter to one-third of the way in from each end to provide adequate support while avoiding point loading.

Nothing should be stacked on top of the pallets of cast stone, and they should not be used as a workbench. Never stand on individual cast stone units or pallets of cast stone.

Site handling

Cast stone units are often heavy, so they must be handled in accordance with health and safety requirements for lifting loads. For example, manual handling assessments should be carried out prior to moving pallets or individual units.

Interior packing should be reused to protect faces and arrises during site handling. Procter Cast Stone can provide additional packaging materials upon request.

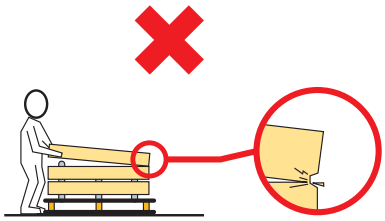
Suitable plant should always be used for moving cast stone units around the site. Wherever possible, units should be delivered to the work area before any obstructions are put in the way. Cast stone should not be moved around a site in mechanical plant, as unpackaged units can be easily damaged.

Shock loading can cause damage to cast stone, so this should be avoided at all times - such as when pallets are being moved. Units should be adequately supported to ease handling and eliminate the need to 'drop' the product if being handled manually.

Individual units should not be slid across any supporting surface or across each other.

If any mechanical handling equipment is to be used to move the cast stone units, contact the manufacturer to discuss the best types of grabs to use.

Threaded sockets can be incorporated within cast stone units during manufacture so lifting hooks can be used on site. Where provided, lifting points should always be used, as other handling procedures could damage the units and contravene health and safety rules. Ensure that lifting loops are screwed fully into the threaded bosses to prevent the thread from stripping and the load being dropped. To avoid side loads on the sockets, a lifting beam (spreader bar) may be necessary.



In particular, when lifting cast stone units from one end care must be taken not to damage arrises at the far end.

Note also that cast stone units are often stronger in one plane than another, so units delivered in one orientation should not be laid down or lifted in an orientation other than that in which they were delivered and in which they are to be installed, unless specific handling instructions have been provided.

Handling would normally be discussed during a pre-site meeting to ensure that the requirements and precautions are fully understood before the cast stone is delivered to site.

Installing cast stone

Cast stone units should only be installed by suitably qualified and experienced personnel.

On all but the simplest of projects, cast stone units are labelled so that they can be individually identified, enabling their positions to be determined unambiguously from unit location plans issued by the manufacturer.

Movement joints should be shown on the site drawings, but they should generally be no more than 10mm wide and positioned on a maximum of 6m centres, dependent on various factors.

During hot, dry weather the faces to be jointed should be dampened with clean water to reduce initial suction and to prevent the cast stone from drawing too much water from the mortar and resulting in an inadequately cured, weakened joint.

All units should be laid and adjusted to their final position while the mortar is still plastic. Mortar exuded from joints should be cut away, taking care not to smear the face of the cast stone.

Cast stone products are generally designed to be fixed with 5-10mm joints between units; plastic load-shedding spacers can be used to help support heavy units until the mortar has cured. Locating holes for dowel joints should be completely filled with an appropriate material such as a proprietary resin mortar. Other fixings will have been specified at the design stage, and these should be used as shown on the drawings.

Constructions should be braced to avoid freshly assembled materials being damaged. It is also advised that the height and number of courses constructed in a single day be limited - typically individual lifts would be restricted to 1.2m per day unless restrained, though this depends on various factors relating to the structural design and construction of the cast stone units.

When installing cills, only the ends (directly beneath the stool) should be bedded on mortar. The remaining joint should be left open and pointed only. This will help to avoid cracking due to differential movement. Slip cills and heads should always be fully bedded on mortar. One-piece cills can benefit from a piece of damp-proof course being wrapped around the stooled ends to help prevent cracking due to natural shrinkage.

When pointing, it is advisable to tape adjacent edges with weak adhesive tape to avoid staining the surface of the cast stone. The tape should be removed a few hours later.

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Cutting

Cutting on site should not be necessary. However, if cutting is essential, a diamond-tipped masonry saw should be used, preferably water-fed, and any dust on the cast stone unit should be removed with water as soon as cutting is finished to prevent staining. If reinforcing bars are exposed, there is a risk of corrosion starting at the exposed steel, resulting in rust staining on the face of the cast stone units and adjacent surfaces. Note that cut faces will have a slightly different appearance to as-supplied cast faces.

If drilling is required, a diamond-tipped drill bit should be used, with the drill operating in non-hammer mode. As with cutting, dust should be removed afterwards.

Contact the manufacture if there is a risk that reinforcing bars will be exposed by cutting or drilling, as the manufacturer should be able to state where within each cast stone unit the reinforcing bars are located

Fixings

Due consideration should have been given to the type and size of fixings at the design stage, which might include cast-in fixings. Dowels, ties, anchors, straps and other fixings must be used as shown on the drawings.

Mortars

It is essential to use the correct grade of mortar when installing cast stone units, otherwise cracks can occur in the cast stone and/or mortar due to differential movement. While these cracks are seldom structurally significant, they detract from the visual appearance.

Note that the mortar for cast stone units is usually different from that used in surrounding brickwork; plain sand and cement mortars are not recommended. However, mortars containing lime are strongly recommended, as they are, to a certain extent, self-healing.

Exposed joints may benefit from the water-repellence imparted by proprietary water-proofers added to mortars. The following table gives recommended mortars for different exposure conditions:

Types of mortar	**Binder constituents**	**Designation** (proportions by volume)
Cement : Lime : Sand	A Portland cement and lime with or without an air entraining additive	(iii) 1:1:5 to 6 (iv) 1:2:8 to 9
Masonry cement : Sand	Masonry cement containing Portland cement and lime in the approximate ratio 1:1 and an air entraining additive	(iii) 1:3.5 to 4 (iv) 1:4.5
	Masonry cement containing a Portland cement and inorganic materials other than lime and an air entraining additive	(iii) 1:4 to 5 (iv) 1:5.5 to 6.5
Cement : Sand (plasticised)	A Portland cement and an air entraining additive	(iii) 1:5 to 6 (iv) 1:7 to 8

For further information please refer to NA to BS EN 1996-1-1: 2005

Protection

During cold weather, fresh mortar should be protected from frost damage.

At the end of each day it is recommended that the top of all of that day's work should be protected to prevent contamination and the ingress of water. Nevertheless, airflow around the cast stone units should not be restricted, and on no account should anything be stuck directly to the unit faces.

It is recommended that finished work be protected with appropriate gauge polythene sheeting to avoid mortar drips, mastic, paint and other construction materials from staining or adhering to the cast stone, as some can be extremely difficult to remove. Projecting features, such as cills and cornices, are best protected using timber formers and coverings.

Unprotected items such as scaffold poles and planks should not be supported directly on cast stone.

Aftercare and maintenance

Efflorescence

Efflorescence (cement bloom) is a temporary, naturally-occurring phenomenon that manifests as a white deposit on the surface. It occurs to varying extents on all items containing cementitious binders but is not detrimental to the structural integrity of cast stone.

Generally it is recommended that the phenomenon be allowed to disappear naturally but, should chemical treatment be deemed necessary, the manufacturer of the cast stone should be consulted prior to any chemicals being applied to its products.

Note that the risk of efflorescence occurring is reduced by protection on site before and during installation.

Maintenance and cleaning

High-quality cast stone is remarkably durable, being capable of lasting for many decades given reasonable care and maintenance. For best results, it is particularly important to avoid contamination during transit, storage, installation and completion of surrounding construction works.

Under most conditions, cast stone will weather in a similar way to natural stone and will require no maintenance for many years. However, it may be desirable to clean cast stone, in which case the main methods are:

- dry brushing with a bristle, fibreglass or plastic brush (not wire brush)
- water washing (not jet washing), and avoid over-wetting
- mechanical cleaning
- air abrasives
- the proprietary JOS method
- chemical cleaning
- alkaline cleaning
- acid cleaning (typically 7-10% hydrochloric acid)
- soaps and poultices

Most techniques have both advantages and disadvantages, and it is recommended that the manufacturer of the cast stone be consulted prior to the selection of any cleaning treatment. Furthermore, the chosen method should first be trialled on an inconspicuous area to ensure that there is no detrimental effect on the surface of the cast stone.

In all cases, cleaning should be carried out by experienced operatives and in accordance with the procedures and specifications contained in BS 8221-1:2000, *Code of practice for cleaning and surface repair of buildings. Cleaning of natural stones, brick, terracotta and concrete*. Health and safety should also be taken into consideration, based on the cleaning process employed.

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Repairs

Following the guidelines above for storage, handling and installation will minimise the risk of damage. However, minor damage to cast stone can often be repaired on site by the manufacturer, with the colour of the repair soon weathering to match that of the surrounding material.

Replacement

If a cast stone unit sustains irreparable damage, a replacement can be manufactured and delivered to site within around two weeks, provided the correct mould is available. Note that some colour variation may be observed with the replacement item, most likely due to the difference in age between it and the surrounding units, but weathering will soon result in a good colour match.

Fixing to cast stone

Cast stone can generally be treated as natural stone in terms of attaching other items such as window and doors, lights or name plates. A diamond-tipped drill bit should be used, with the drill operating in non-hammer mode, and dust should be removed afterwards to prevent staining. If there is a risk that the drill will contact the reinforcing bars, the manufacturer should be able to identify where within each cast stone unit these are located. Select plugs and anchors that are suitable for use in stone with the chosen fixing.

Supplier selection

The above guidance will assist with ensuring that cast stone units are installed so as to make the best of this versatile material. However, there are over 150 manufacturers of cast stone in the UK and product quality can vary enormously between suppliers. The guidelines above will produce good results provided the quality of the cast stone units is high; poor-quality units may be manufactured from a weaker mix and contain insufficient reinforcement, which makes them more susceptible to damage, even if proper care is taken during site handling and installation.

Cast stone units should be manufactured to British Standard BS 1217:2008, *Cast stone. Specification* and, preferably, the more stringent standard published by UKCSA. Cast stone units manufactured in accordance with the UKCSA standard can be expected to be around 40 per cent stronger than those manufactured only to BS 1217. The UKCSA Technical Manual also describes steps to be taken when packaging and transporting cast stone to ensure that the units are in first-rate condition when they arrive on site.

In light of the above, therefore, it is recommended that cast stone units be sourced only from manufactures that are full members of UKCSA.

Further Information

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