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CAST STONE
FIRST CHOICE SOLUTIONS FOR ARCHITECTS, SPECIFIERS AND CONTRACTORS

Understanding Cast Stone

A Guide to Cast Stone Products for Specifiers

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Cast Stone

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A Guide for Specifiers

Introduction

Cast stone products enable architects to incorporate high-quality detail features such as cills, mullions, copings, quoins, columns, pilasters, porticos, arches steps and balustrade in a range of colours to match those of quarried stone. An alternative application for cast stone is walling, either in the form of smooth ashlar or as units with a choice of textured surfaces. Many manufacturers offer both standard ranges and the ability to produce bespoke designs. In terms of appearance and performance, cast stone is comparable with quarried stone. However, the cost of cast stone can be significantly less than that of quarried stone, especially where repetitive work is concerned.

Cast stone achieves the following…

- Provides maximum impact for minimum effort and cost
- Adds value to housing developments, enabling properties to command higher prices
- Incorporates styling features within prestigious projects
- Mimics traditional details in infill developments or alterations to period properties
- Cost-effectively creates bespoke internal features such as fireplace surrounds
- Substantially reduces costs where repetitive work is required

Design Considerations

Aesthetics

Almost any three-dimensional geometric form can be cast, enabling architects to design elegant curves as well as straight-edged features. Additional detail can also be incorporated into the surface, such as brick-effects or channels, and the edges of units can be square, bevelled or radiused. Cast stone units can be used to complement brickwork, quarried stone, flint or rendering.

Standard colours are available to match those of quarried stone, such as York stone, Bathstone, Red Sandstone or Portland stone, while non-standard colours can also be produced to meet a client's specific requirements. Procter Cast Stone offers a PDF datasheet with photographs of samples in standard colours, or colour sample packs are available on request. Unlike quarried stone, the colour of cast stone is very consistent, both within a batch and from one batch to the next. If required, however, controlled variation can be introduced to mimic the effect found in quarried stone. Over time, cast stone weathers the same way as quarried stone.

Note that cast stone has been used successfully on listed buildings in conservation areas. If there is resistance to the use of cast stone in such projects, Procter Cast Stone can assist architects and developers in discussing the issue with planners.

Surface finish

A variety of surface finishes and textures can be achieved using the cast stone process, so it is essential that specifiers discuss their requirements with the manufacturer. This is especially so if exceptionally smooth surfaces are being considered, as the type of finish has a significant effect on the overall appearance of the product.

Slenderness ratio

To provide sufficient inherent strength during manufacture and handling, there is a limit to the slenderness ratio for a cast stone product. The slenderness ratio (S) is defined as the ratio of the length (L) to the diameter (d) , where the diameter refers to an inscribed or superscribed circle on the section of the product, determined by the support plane (ie S=L/d) . Unless otherwise agreed between the specifier and manufacturer, S should be less than or equal to 12, though alternative ratios can be used by agreement with the manufacturer.

Large openings

Where large openings are required, due consideration should be given to incorporating bed joint reinforcement above and below. It is recommended that the maximum distance between vertical movement joints should be 6m. To reduce the risk of cracking in stooled cills only, the ends should be bedded in mortar; the joint below should be left open and, upon completion of the brickwork, the joint should be pointed.

Mechanical and structural strength

Where possible, all units are cast in a two-stage process. A facing mix provides the stone appearance on the exposed faces and a backing mix adds strength and forms a good bond with the facing mix and reinforcement, where used.

Products intended for use in compression, such as quoins, string courses and walling units, can be readily used as structural units.

Where a steel lintel is used, the lintel would normally be positioned beneath the head to support the entire lintel and brickwork load. However, if the lintel is to be installed over a self-supporting cast stone head such that the lintel supports the brickwork load only, the manufacturer of the cast stone should be consulted first.

Three cube samples shall be tested to ensure that the material meets the requirements specified in BS EN 12390-3:2009 (Testing hardened concrete. Compressive strength of test specimens).Following a recent investment in new computer-controlled batching equipment and a climate-controlled curing chamber, Procter's cast stone products are now even stronger.

Differential movement

It is essential to consider the possible effects of differential movement between various types of building materials. As a matter of principle, the details should be checked to ensure that differential movement can take place freely.

Damp proofing

To prevent the ingress of rainwater and damp, attention should be paid to the design and detailing of damp proof membranes and/or cavity trays. Good site practice is also essential.

For cills, a horizontal damp proof membrane should be provided for the full length and width of the cill bed. This membrane should be turned upward to cover the vertical inner face of the cill and extend as far as the cavity tray or window board.

Beneath copings to freestanding walls, parapet walls and similar structures, it is good building practice to provide a continuous damp proof membrane sandwiched in mortar and projecting beyond each face of the wall by at least 5mm.

Design for long-term maintenance of good appearance

To avoid staining, projections should incorporate a drip groove. Cills and heads should also be provided with drip grooves in the soffit.

Care should be taken to avoid the possibility of water running onto cast stone from lead or copper flashing. Alternatively, non-metallic flashing may be used, but the manufacturer of the cast stone should be consulted prior to specifying the flashing.

Good building practice

It is essential to use good building practice when designing all building materials - including cast stone. General guidance can be sought from manufacturers, and relevant standards should be consulted.

Design-for-manufacture

Cast stone, which is sometimes known as reconstituted stone, simulated stone or Artstone, is normally produced in a mould that is open on one side; the product is turned out onto this side for finishing. It is therefore advisable to design cast stone products such that there is one major flat unexposed surface, otherwise the cost will rise to take account of the additional manufacturing difficulty.

Because of the way cast stone is moulded, certain design details can be easier or more difficult to produce in bespoke components — and the difference is reflected in the price. The manufacturer should therefore be consulted at the design stage in order to avoid unnecessary costs being incurred.

Larger components are normally produced with integral threaded sockets to enable lifting hooks to be inserted for moving and positioning the units on site. The manufacturer will locate the threaded sockets to suit the functional requirements and the production process, while taking care to avoid faces that will be visible once construction is complete. It is therefore important that unit drawings clearly show which faces will and will not be visible.

CAD file exchange

If architects wish to incorporate standard units within their designs, then Procter Cast Stone can supply drawings in the form of PDFs or CAD files. On the other hand, if bespoke units are designed by the architect, Procter Cast Stone can import these drawings and use them when creating the moulds.

Site practice

Delivery

To ensure that every cast stone unit arrives on site in the best condition possible, Procter Cast Stone only uses its own transport. Deliveries are made to agreed schedules to ensure that the products do not spend any longer than necessary on site, which helps to minimise the risk of damage. If the project is delayed for any reason, deliveries can be rescheduled accordingly.

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

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

Storage

As with all other building materials, cast stone units must be stored with care to avoid damage such as staining, chipping and cracking — particularly items with fine detail or sharp arrises. Slender units should be handled and stored in the plain in which they are to be installed unless the manufacturer provides alternative instructions.

Cast stone products should preferably be stored well away from areas of heavy traffic. Palletised products should be stored on flat, level, dry ground, and pallets should never be stacked. Individual items should also be stored on flat, level, dry ground, supported by suitable bearers placed one-quarter to one-third of the way in from each end to provide adequate support while preventing point loading.

On-site handling

As with quarried stone, careful handling of cast stone is essential in order to avoid damage. If additional handling instructions are required, these can be provided by the manufacturer.

Exterior strapping and packaging should be cut away with a sharp knife, taking care to avoid scoring the surface of the cast stone. Once the packaging has been opened, the cast stone should be loosely covered with polythene to prevent contamination while maintaining an adequate airflow to avoid the formation of condensation.

Interior packing should be reused to protect faces and arrises during site handling. Additional packaging materials can be provided upon request.

Suitable plant should always be used for moving cast stone products 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.

If any machinery is to be used to handle the cast stone units, contact the manufacturer to discuss the best types of grabs to use. Threaded sockets are often incorporated within cast stone units to facilitate movement using threaded eyes and appropriate lifting equipment.

Shock loading can cause damage to cast stone and should therefore 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.

Installation

Cast stone should only be installed by suitably experienced operatives who have been made aware of the guidelines below.

When units are removed from storage they should be protected until they have been installed.

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

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

Cast stone products are generally designed to be fixed with 6mm joints between units. Locating holes for dowel joints should be completely filled with an appropriate material such as a proprietary resin mortar.

Constructions should be braced to avoid freshly assembled materials being damaged.

At the end of each day it is recommended that the top 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. Mortar, in particular, is difficult to remove.

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

Fixings

Due consideration should be given to the type and size of fixings at the design stage. It is recommended that the cast stone manufacturer be consulted on the applicability of various alternative fixings.

Mortars

It is essential to use the correct grade of mortar when installing cast stone, as incorrect mortars can result in cracks appearing in long units due to differential movement. While these cracks are seldom of any structural significance, they detract from the visual appearance.

Note that the mortar is frequently 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:

Exposure conditions	masonry cement : sand	plasticised cement : sand	cement : lime : sand
severe	1 : 4.5	1 : 6	1 : 1 : 6
moderate	1 : 6	1 : 8	1 : 2 : 9

Installation service

Individual cast stone products can be installed by suitably experienced operatives but, for more complex cast stone structures such as porticos, steps and balustrade, Procter Cast Stone offers an installation service. This comprehensive service is available throughout the UK and overseas for both standard and bespoke products. By using the installation service, clients can be certain that the cast stone will be correctly installed, pointed and cleaned. Furthermore, the work will be carried out as quickly as possible and with minimal risk because the cast stone remains Procter's responsibility until installation is complete. All of Procter's installers are employed directly, rather than being sub-contractors, to maintain the highest possible quality.

Aftercare and maintenance

Efflorescence

Efflorescence is a temporary, naturally-occurring phenomenon that manifests as a white deposit on all or part of the surface. It occurs to varying extents on all items containing cementitious binders, and mortar is particularly susceptible to efflorescence. While it can affect other materials, such as brick or cast stone, it is not detrimental to the materials' structural integrity.

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.

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, lasting for many decades given reasonable care and maintenance. For the 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 quarried stone and will require no maintenance for many years. However, it may be desirable to clean cast stone, in which case the main methods that can be used are: water washing, mechanical cleaning, air abrasives, the proprietary JOS method, chemical cleaning, alkaline cleaning, acid cleaning, and soaps and poultices. Most techniques have both advantages and disadvantages, so it is recommended that the manufacturer be consulted prior to the selection of any cleaning treatment.

Repairs

Small repairs can often be carried out on site by the manufacturer, with the colour of the repair soon weathering to match that of the surrounding material. During installation, if a unit is damaged beyond repair then a complete replacement unit can usually be manufactured and delivered to site within two weeks, provided the mould is available.

Standards

The following British Standards and Eurocodes relate to the design, manufacture and use of cast stone products in the UK.

BS 743:1970	Specification for materials for damp proof courses
BS 1217:2008	Specification for cast stone
BS 5642	Sills, copings and cappings Part 1:1978+A1:2014 Specification for window sills of precast concrete, cast stone, clayware, slate and natural stone Part 2:1983+A1:2014 Specification for copings and cappings of precast concrete, cast stone, clayware, slate and natural stone
BS 6073	Precast concrete masonry units Part 2:2008 Guide for specifying precast concrete masonry units
BS 6093:2006+A!:2013	Design of joints and jointing in building construction. Guide
BS 6100	Building and civil engineering Part 0:2010 Vocabulary. Introduction and index Part 3:2007 Vocabulary. Civil engineering. General Part 6:2008 Vocabulary. Construction parts Part 9:2007 Vocabulary. Work with concrete and plaster Part 11:2007 Vocabulary. Performance characteristics, measurement and joints
BS 6213:2000+A1:2010	Selection of constructional sealants. Guide
BS 6398:1983	Specification for bitumen damp-proof courses for masonry
BS 6515:1984	Specification for polyethylene damp-proof courses for masonry

BS 8000	Workmanship on building sites Part 0:2014 Introduction and general principles Part 3:2001 Code of practice for masonry
BS 8215:1991	Code of practice for design and installation of damp-proof courses in masonry construction
BS 8221	Code of practice for cleaning and surface repair of buildings Part 1:2012 Cleaning of natural stone, brick, terracotta and concrete Part 2:2000 Surface repair of natural stones, brick and terracotta
BS EN 197	Cement Part 1:2011 Composition, specifications and conformity criteria for common cements Part 2:2014 Conformity evaluation
BS EN 450	Fly ash for concrete. Part 1:2012 Definition, specifications and conformity criteria
BS EN 771	Specification for masonry units Part 3:2011+A1:2015 Aggregate concrete masonry units (dense and lightweight aggregates) Part 5:2011+A1:2015 Manufactured stone masonry units
BS EN 772	Methods of test for masonry units Part 2:1998 Determination of percentage area of voids in masonry units (by paper indentation)
BS EN 845	Part 2:2013 Specification for ancillary components for masonry. Lintels
BS EN 1744	Tests for chemical properties of aggregates Part 1:2009+A1:2012 Chemical analysis
BS EN 1991	Eurocode 1. Actions on structures Part 1-1:2002 General actions. Densities, self-weight, imposed loads for buildings Part 1-7:2006+A1:2014 General actions. Accidental actions
NA to BS EN 1991	UK National Annex to Eurocode 1: Actions on structures Part 1-1:2002 General actions. Densities, self-weight, imposed loads for buildings
BS EN 1992	Eurocode 2: Design of concrete structures Part 1-1:2004+A1:2014 General rules and rules for buildings
NA+A2:2014 to BS EN 1992	UK National Annex to Eurocode 2: Design of concrete structures. Part 1-1:2004+A1:2014 General rules and rules for buildings

BS EN 1996	Eurocode 6. Design of masonry structures Part 1-1:2005+A1:2012 General rules for reinforced and unreinforced masonry structures Part 1-2:2005 General rules. Structural fire design Part 2:2006 Design considerations, selection of materials and execution of masonry Part 3:2006 Simplified calculation methods for unreinforced masonry structures
NA to BS EN 1996	UK National Annex to Eurocode 6. Design of masonry structures Part 1-1:2005+A1:2012 General rules for reinforced and unreinforced masonry structures Part 1-2:2005 General rules. Structural fire design Part 2:2006 Design considerations, selection of materials and execution of masonry Part 3:2006 Simplified calculation methods for unreinforced masonry structures
BS EN 12390	Part 3:2009 Testing hardened concrete. Compressive strength of test specimens
BS EN 12878:2014	Pigments for the colouring of building materials based on cement and/or lime. Specifications and methods of test
BS EN 13055:2016	Lightweight aggregates
BS EN 15167	Ground granulated blast furnace slag for use in concrete, mortar and grout Part 1:2006 Definitions, specifications and conformity criteria Part 2:2006 Conformity evaluation
BS ISO 6707-1:2014	Buildings and civil engineering works. Vocabulary. General terms

CE marking

The EU Construction Products Regulation 305/2011 (CPR) came into force in July 2013, replacing the Construction Products Directive (CPD). Initially there was confusion and conflicting advice over which standards should be applied, and whether cast stone products should be CE marked to the CPR. However, following an extensive UK-wide consultation led by UKCSA and involving BSI, there is now industry consensus on the circumstances under which cast stone products should be CE marked. Guidance documents are now available but, in simple terms, the advice is that there is no need to CE mark cast stone products unless they are standard ashlar walling blocks manufactured to BS EN 771-5, regardless of whether they are being manufactured for stock or to fulfil a specific order.

Supplier selection

It is vital to select the right supplier of cast stone products to ensure that the units are correctly manufactured to the agreed specification and will perform as required. Procter Cast Stone provides free technical consultations to assist architects and specifiers in selecting and designing cast stone features. Site meetings can be arranged, and specialists can attend meetings with developers, architects and planners in the early stages of a project. Further advice is available regarding handling, installation and cleaning.

Fully detailed quotations are prepared against architects' drawings or bills of materials in a timely fashion to suit customers' tender dates. Alternatively, budget prices can be provided on request.

For every project Procter Cast Stone appoints a contract manager who acts as the single point of contact for the customer and ensures that all aspects of the project are performed to the highest possible standards.

Useful resources

The following are all available via the Downloads section of the Procter Cast Stone website or on request using the contact details here:

Tel: 0113 286 3329 — Fax: 0113 286 7376 — Email: sales@proctergarforth.co.uk

Website: www.caststoneuk.co.uk

Cast stone tips for architects

A 9-page illustrated guide with tips and advice to help architects get the most out of cast stone, whether for new builds, renovations, conversions or extensions, including homes, commercial properties, schools or places of worship.

Self-builders' guide to cast stone

A very useful document for self-builders, explaining what cast stone is, where it can be used, and how best to incorporate cast stone features within properties to achieve maximum impact for minimum cost.

Cast stone colours and shades

A downloadable and printable PDF showing the standard colours available from Procter Cast Stone — though bear in mind that custom colours can be manufactured to order.

Standards and CE marking requirements for cast stone

A helpful information sheet listing different types of cast stone product, the applicable standards, and whether CE marking to the Construction Products Regulations is required.

Cast stone CE marking checklist

This information sheet uses a 'decision tree' to help users decided whether or not cast stone products need to be CE marked to the Construction Products Regulations.

UKCSA cast stone technical manual

This substantial handbook has been produced by UKCSA and contains a wealth of information, including the UKCSA Standard for cast stone.

Handling instructions for cast stone

A useful leaflet with written information about site handling, plus an illustrated sheet that can be printed for use on site.

Installation instructions for cast stone

This guidance will be invaluable for any operative or site foreman or manager who is not familiar with cast stone, as it outlines everything form delivery and unloading, through inspection, storage and site handling, to installation and aftercare.

Aftercare for cast stone

This is a web page – which can, of course, be printed – with information about cleaning, weathering, efflorescence, repair work and surface treatments.

Cleaning of cast stone

A one-page leaflet with guidance on cleaning cast stone safely and efficiently, and without causing damage to either the cast stone surface or surrounding area.

Cast stone standard products drawings and CAD files

PDF drawings of Procter Cast Stone's standard cast stone products can be downloaded directly, and CAD files are available free of charge via the FastrackCAD website.

Procter Cast Stone brochure

This new brochure is packed with information about cast stone, the company, standard and bespoke cast stone products, quality standards and the different types of projects on which Procter Cast Stone works. There are also photographs showing dozens of previous projects.

Further information

Procter Cast Stone

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