

# Visual concrete

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British Cement Association  
British Standards Institution  
Building Research Establishment  
Cement Admixtures Association  
Cementitious Slag Makers Association  
Concrete Industry Alliance  
Concrete Society  
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Quarry Products Association  
Ready-mixed Concrete Bureau  
RMC Readymix Ltd  
L M Scofield Ltd  
United Kingdom Quality Ash Association

A full list of the publications in this series is given on the back page.

## INTRODUCTION

This publication gives guidance on the specification of concrete where its appearance is important. In some cases, the requirements needed to achieve a high quality finish are more onerous than those needed for structural or durability aspects. The specification of coloured concrete, a type of visual concrete, is covered by another publication in this series, *Coloured concrete*. Guidance on the basic quality of concrete required for structural and durability purposes is given in other publications in this series.

There are many types of architectural finishes that can be achieved with concrete; they can be grouped under the following headings:

- finish obtained on striking formwork;
- finish obtained by working the fresh concrete surface e.g. trowelling, imprinting;
- exposed aggregate finishes;
- tooled finishes;
- applied finishes e.g. dry shake, rendering, painting etc.

Details of the first four groups of finishes and how they may be achieved are described in a British Cement Association series of publications, *Appearance matters*.

Some applied finishes are purely decorative whilst others have a role in improving durability e.g. they increase carbonation resistance. Reference should be made to the specialist literature on the intended applied finish to determine the extent to which it can contribute to durability.

This publication covers the first four groups of finishes, but it does not include the other essential aspects, for example those related to execution. For concretes that are to have an applied finish, see other publications in this series as there are no additional requirements for concrete that is to have an applied finish.

Achieving a high quality concrete surface requires attention to detail and care with all

aspects of construction. The use of full-size trial panels is strongly recommended to verify that the concrete, formwork and execution can achieve the intended finish and as a reference for subsequent construction.

With all four types of finishes, the basic approach is the same. Trial mixes followed by a trial panel are used to determine the mix proportions for a prescribed concrete or mix limitations for a designed concrete. Once agreed, the types, classes and sources of the constituent materials cannot be changed without prior agreement between the parties. Alternatively, where the scale of construction does not warrant the use of trial panels, experience with the local materials will be useful and this publication and other specialist literature should be consulted to establish a designed concrete specification.

## SPECIFICATION

Specify that the concrete shall be produced in accordance with the relevant clauses of BS EN 206-1/BS 8500 and the following:

- where appropriate at this stage, the type and class of constituent materials (at a latter stage, agree sources of constituent materials);
- that before the visual concrete is incorporated into the works, a trial panel is required and specify the requirements for this trial panel. Alternatively for finishes obtained on striking formwork, cite as a benchmark the nearest Construct reference panels (see *Framework Issue 1/99* for locations, or ring Construct on (01344) 725744).
- where a **prescribed** concrete is to be specified, use your experience of the local materials or specify trial mixes to establish the mix proportions with the following properties:
  - the type of finish the concrete should be capable of achieving;
  - intended strength class;
  - w/c ratio (this should be at least 0.02 less than any required maximum and not more than 0.50);
  - a cement content not less than 320 kg/m<sup>3</sup>;
  - nominal upper aggregate size;
  - chloride content class;
  - consistence class;
  - cement type (specify if you want white cement to be used as this will have both practical and cost implications);

- other requirements depending on the type of finish required e.g. aggregate grading (see *Appearance matters* series). These trial mixes will lead to the specification of a prescribed concrete.

- where a **designed** concrete is to be specified, use your experience of the local materials and include the following properties:
  - the type of finish the concrete should be capable of achieving;
  - compressive strength class;
  - a maximum w/c ratio  $\leq 0.50$ ;
  - a minimum cement content  $\geq 320$  kg/m<sup>3</sup>;
  - nominal upper aggregate size;
  - chloride content class;
  - consistence class;
  - cement type (specify if you want white cement to be used as this will have both practical and cost implications);
  - other requirements depending on the type of finish required e.g. aggregate grading (see *Appearance matters*).
- that the sources of the constituent materials shall not be changed without the prior approval of the specifier.

The specifier may wish to provide guidance on the selection of mix proportions or to give references where such information may be found. This should not be needed for major concrete producers.

## SOURCES OF CONSTITUENT MATERIALS

The practical solution is to use the producer's existing sources of materials. The normal situation should be that sources of materials are not specified until the trial mixes have been completed. There are some exceptions such as the case where an exposed aggregate finish is required with a special type of aggregate e.g. one that is not a local material. In this case it is essential that this be specified at the tender stage so that it can be sourced, samples obtained for the trial mixes and priced.

Some aggregate sources can contain small quantities of materials that can mar the surface appearance of concrete e.g. iron pyrites and lignite. If practical, select sources that are free of such materials and if this is not practical, discuss with the producer ways of minimising the content of such materials.

## PREScribed CONCRETE

Any prescribed concrete should have adequate strength to resist the designed loading and sufficient durability to resist the environmental actions (exposure). In this respect, it is recommended that the mix proportions are those needed to give a target strength that is at least 10 N/mm<sup>2</sup> above any required characteristic strength and that the w/c ratio is 0.02 less than any associated maximum value.

The normal practice for prescribed concrete in the UK is to specify the quantities of all the constituent materials except for the water, and to specify the consistence. This is the recommended approach. An alternative approach is to specify the w/c ratio and not the consistence. You should not specify both the w/c ratio and the consistence.

## CEMENT TYPE

The type of cement used will affect the colour of the concrete. For example, all sources of CEM I 42.5 do not produce concrete of the same shade of grey. Information on the colour produced by different sources of Portland cement is available from the cement manufacturer. Using a different type of cement to that normally stocked by the concrete producer e.g. a white cement, will create difficulties for the producer and increase the costs. So, as a first step, try to use the normally stocked cements. Do not permit the use of fly ash or cements containing fly ash unless the producer can guarantee that this will not lead to variations in colour (changes in the loss on ignition of the fly ash can have a significant effect on colour).

An alternative to using white cement to obtain a light colour, is to use a blastfurnace cement (CEM III) or a combination of CEM I and ground granulated blastfurnace slag conforming to BS 6699.

## MIX PROPORTIONS

The mix proportions for visual concrete may be different from those needed for normal structural concrete. In particular, exposed aggregate and some tooled finishes look better if the concrete is gap graded and contains a relatively high proportion of 20 mm aggregate.

The basic guidelines for mix proportions are:

- the fine aggregate (sand) content should not be more than twice the cement content;
- the coarse aggregate (20/5) should not contain more than 20% that passes the 10 mm sieve. The ideal is to use a single-sized 20 mm aggregate and eliminate the 10/5 size;
- the total aggregate content should not be more than six times the cement content;
- use admixtures to obtain the consistence needed for placing and for any necessary control of setting time.

This general guidance is a suitable starting point for the trial mixes, but note should be taken of the producer's experience with the materials.

## CONFORMITY OF PRESCRIBED CONCRETE

Conformity of a prescribed concrete is based on the producer using the specified materials in the specified quantities. Increasingly, ready-mixed concrete plants are being fitted with autographic recorders and these can be used by the producer to demonstrate conformity.

## FURTHER READING

The other publications from this series will be helpful. Visit [www.cementindustry.co.uk](http://www.cementindustry.co.uk) and click 'information'/'library'/'BCA publications' to check availability and for free download.

*Standards for fresh concrete – a composite of BS EN 206-1 and BS 8500*

*Specifying concrete to BS EN 206-1/BS 8500:*

*Concrete for normal uses*

*Concrete resistant to chemical attack*

*Guide to the selection of concrete quality and cover for reinforcement for normal concrete structures*

*Examples of the specification of designated concrete*

*Examples of the specification of designed concrete*

*Guidance on additional requirements for designed concrete*

*Lightweight concrete*

*Visual concrete*

*Coloured concrete*

*Concrete for industrial floors*

*Specifying constituent materials for concrete to  
BS EN 206-1/BS 8500:*

*Cements*

*Additions*

*Admixtures*

*European replacements for British Standards:  
Concrete and its constituent materials*

**Specifying concrete to BS EN 206-1/BS 8500:**

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