

Coloured concrete

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Cement Admixtures Association

Concrete Industry Alliance

Concrete Society

Glanville Consultants

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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 coloured concrete and it should be read in conjunction with another publication in this series, *Visual concrete*. Guidance on the quality of concrete required for structural and durability purposes is given in other publications in this series. The specification for coloured concrete should embrace the appropriate requirements for strength and durability as well as the requirements given below for the aspects related to colour.

Coloured concrete may be produced in one of four ways:

- integral colour: colour introduced during the batching of concrete or wearing screeds;
- 'dry shake': colour applied after placing and often incorporating hardeners (horizontal surfaces only). NOTE. The use of hardeners may increase the abrasion resistance of the concrete surface and may provide slip resistance;
- penetrating reactive chemical stains;
- paints and coatings (not covered in this publication).

These production methods result in different colour effects as given in Table 1.

BS EN 206–1, *Concrete. Part 1: Specification, performance, production and conformity* treats pigments as a Type I addition, i.e. an addition that contributes little to strength. The pigment should conform to BS EN 12878, *Pigments for colouring building materials based on cement and lime - Specifications and methods of test*. As pigments are very fine powders, it is normal to use admixtures to disperse them. Many proprietary colouring agents already contain the necessary admixtures.

Table 1: Colour effects

Method	Applications
Integral colour	For earth tones and less intense colours. Where the concrete quality is adequate for abrasion
Dry shake	Where intense colours are required. Includes textured finishes to give slip resistance For stamped or pattern-imprinted slabs Where enhanced abrasion resistance is required
Reactive chemical stains	For creating a variegated patina. Where the requirement is purely decorative An alternative to painting
Paints	Provide a wide range of colours Where the requirement is purely decorative
Coatings	Limited range of colours To enhance some other property, e.g. acid resistance

This publication covers only the specification of coloured concrete or concrete to be coloured, its production and transport to the point of delivery. The achievement of the intended performance on site requires equal attention and care with all aspects of execution.

SPECIFICATION

The specification to be adopted depends on the method selected for colouring the concrete.

Integral colour

The recommended approach is to produce trial mixes. These should be assessed and refined until the concrete satisfies the requirements for strength, durability, colour and finishability. These mix proportions are then used to specify a **prescribed** concrete and the sources of all the constituent materials. Alternatively, the trial

mixes can be used as the basis for developing a **designed** concrete specification. In this case the specification will have to contain a strength class, maximum w/c ratio, minimum cement content and defined sources for all constituent materials. You should not specify the actual w/c ratio and cement content as these may have to vary to achieve the specified strength.

A change in the source of a constituent material may affect the colour of the concrete and therefore the specification should not permit the sources of materials to be changed without prior agreement (and further trial mixes).

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

- Trial mixes. These are required to establish the mix proportions for a concrete to satisfy:
 - strength class;
 - maximum w/c ratio;
 - minimum cement content;
 - 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);
 - colour required or type and make of colouring agent to be used.

The trial mixes will lead to the specification of either a prescribed or designed concrete.

- Material sources. The sources of the constituent materials shall not be changed without further trial mixes and the prior approval of the specifier.
- Re-cycled water. Re-cycled water shall not be used (as it can affect the colour).
- Plant. All equipment for the manufacture, transport, compaction and finishing shall be clean immediately prior to the production of the coloured concrete;
- Mixing. The mixing process shall be sufficient to ensure the effective dispersal of the pigment.

The type of cement used will affect the colour of the concrete. For example, different sources of CEM I 42.5 will produce concrete of different shades of grey. Information on the colour of

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.

The use of coloured water reducing, or set controlling admixtures is a good way of achieving the intended colour as these products are designed to overcome any effects of the pigment on the performance of the concrete.

The use of dirty equipment can lead to patches of different colour.

Concrete for dry shake application and treatment with penetrating reactive chemical stains

Specify a designed concrete suitable for the structural and durability requirements; see the other publications in this series for guidance.

When using dry shake colour, any wear on the surface will expose the aggregate and depending on the aggregate type, this can be very apparent. Therefore care should be taken when selecting the colour to be applied and the type of aggregate to be used in the concrete. Changing the aggregate type from that normally stocked can be very expensive.

If the concrete is to be stamped or pattern imprinted, specify a nominal upper aggregate size of 10 mm.

FURTHER READING

The other publications from this series will be helpful. Visit 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

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