



Guidelines for Specifying and Using CCS Pigments for Full Depth, Integrally Coloured Concrete



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Toll Free 1800 077 744
www.concretecoloursystems.com.au

brilliant colours
outstanding *results*



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Introduction



Welcome to Coloured Concrete!

Congratulations on considering coloured concrete for your project.

As specialist manufacturers of products for colouring concrete, we would be delighted to assist you in developing the ideal finish for your project.

Six systems for colouring concrete are described in the following pages. These systems can be used in isolation or combined to provide a greater variety of finishes on your project, whether it be for commercial, retail, hospitality, health, landscaping or streetscape applications. They are:

1. Full depth coloured concrete
2. Stylepave concrete resurfacing
3. Galaxy epoxy and flake flooring
4. Pattern stamped concrete
5. Concrete stains
6. Stencilled concrete

Due to the importance of sealing decorative concrete, we have also included a section describing the various types of sealers that we manufacture. We also provide recommendations as to where and when each type of sealer should be used.

Call our Technical Help Line for Assistance

This folder is designed as a starting point and ongoing reference for you.

In addition to this information our technical sales staff are available to provide you with advice or recommendations on any aspect of colouring concrete.

For advice please contact us at the following numbers:

Sydney	02 9756 1711
Melbourne	03 9311 9225
Brisbane	07 3287 6444
Gold Coast	1800 077 744
Perth	0423 023 164
Adelaide	1800 077 744

or go to our website www.concretecoloursystems.com.au

CCS Products are available throughout Australia

In addition to sales offices in four states, we have an extensive distributor base established in most regional centres throughout the country.

For projects in other locations, CCS products can be delivered to site within three days of order placement.

Introduction



Specify CCS Products with Confidence!

For specifiers who are considering recommending CCS products for the first time, you can be assured that these products are manufactured in accordance with a Quality Management System certified to ISO 9001. This system has been in place since 1994.

By way of further background, Concrete Colour Systems is a fully owned division of River Sands Pty Ltd.

River Sands commenced operations in 1974 and is based on a 300 acre site at Carbrook on the south side of Brisbane. The 100 plus person company operates in all states of Australia and throughout Asia.

In addition to decorative concrete products we are a leading manufacturer of water filtration media, bio-retention sand, packaged concrete, render, mortar and sports turf products.

We realise that our continued success depends on supplying excellent products and service – that's why you can be certain that when you specify CCS products your clients will be satisfied with our service and product performance.

We look forward to working with you!



Full Depth Coloured Concrete Guidelines for use

system > description



A Brief Description on How Full Depth Colouring of Concrete Occurs

CCS Pigment Concentrates are blends of high tinting strength iron oxides, titanium dioxide and chrome oxide pigments specially formulated for permanently colouring concrete.

A variety of pigments are blended in set formulations at our factory and upon demand delivered directly to the concrete plant in bag lots formulated for colouring one cubic metre of concrete.

Bags of the CCS Pigment Concentrates are added to the mixer bowl of the concrete truck in predetermined quantities and mixed for 10 minutes to ensure that all of the concrete is tinted to the agreed colour.

This coloured concrete is delivered to the site and then carefully placed and finished by experienced applicators in a similar manner to normal grey concrete.

Simply specify your preferred colour and we will arrange for the correct quantities to be delivered within three days to the concrete company plant nominated by your client.

uses >

What Can be Coloured With CCS Pigment Concentrates?

Just about any new concrete structure including pedestrian precincts, roadways, precast walls, buildings, interior floors, exposed aggregate, polished concrete floors, tilt up panels, renders, asphalt, floor screeds, pavers, mortars and grout.

benefits >

Colour is much much better than Grey!

The most obvious benefit of coloured concrete is that it is far more attractive than conventional grey concrete or bitumen.

It provides designers with the ability to utilise colour in all aspects of their design ensuring that the outside areas complement and enhance the appearance of the project!

Long Term Colour Performance

As a general rule the surface of concrete pavements are subjected to continual wear and tear from pedestrians, vehicles and weather. Over time, the cumulative effect of this abrasion will result in the gradual erosion of the very top 1-2mm surface layer of the concrete.

This can sometimes be a problem where the surface colouring method is used.

In contrast, the full depth colouring of the slab ensures that there is 100mm of coloured concrete so regardless of weathering and abrasion, long term colour performance is assured.

Full Depth Coloured Concrete Guidelines for use



*indoors or
outdoors*

strength >

It Allows You to Combine Colour and Texture for Maximum Effect

Combining concrete colour with aggregates or different surface textures extensively broadens the design options. The coloured concrete can be used on its own or combined with contrasting or matching coloured aggregates for greater variety.

As an additional option, the surface texture can be broomed or trowelled to create character and anti skid properties – or acid etched or polished after the completion of placement for a smoother and more elegant look.

Can Coloured Concrete be Used for Commercial Projects?

Just about any new concrete structure including pedestrian precincts and malls, roadways, precast walls, asphalt, freeway sound barriers, building facades, public art, interior shop and café floors, polished concrete floors, renders and floor screeds or toppings can be created using full depth colouring of concrete.

Can Coloured Concrete be Used in Indoor Environments?

Certainly, polished coloured concrete or burnished coloured concrete is a very popular and successful method for finishing interior floors – be it a commercial or domestic setting.

Do CCS Pigments Affect The Strength of Concrete?

Due to the extremely high tinting strength of the CCS Pigment Concentrates – you only need to add approximately 12-18 kilograms of the material to completely colour two tonnes (i.e. one cubic metre) of 25 MPa strength concrete!

At such low dose rates there is no detrimental effect on the strength of the concrete. In some instances the use of yellowish pigments will increase the water demand however, concrete companies adjust their mix formulations to allow for this factor.



Full Depth Coloured Concrete Guidelines for use

*colour >
changes
over time*



Weather Resistance of the CCS Pigment Concentrates

CCS Pigment Concentrates are combinations of synthetic iron oxides, titanium dioxides, chrome oxides and cobalt aluminium spinels.

These fine particle pigments are well proven and are absolutely weather resistant, lightfast and stable in the highly alkaline conditions of concrete.

Sometimes there is an incorrect perception that iron oxide pigments fade over time. This perception is usually due to the following three events:

Drying of concrete

When coloured concrete is placed the very high moisture content of the concrete causes the colour to be much darker or intense than when it is dry. As the concrete dries over the first seven days the initial colour reduces in intensity, however when the moisture has finally finished evaporating (approx. 28 days) the colour remains consistent.

Abrasion of the surface layer

When coloured concrete is placed, the normal trowelling technique tends to draw a pigment and cement-rich slurry to the surface. This slurry is normally only a millimetre thick and is slightly weaker than the main part of the concrete slab. As this top slurry coat is eroded with abrasion, the true, but slightly less intensely coloured part of the slab is exposed.

This phenomenon is usually only noticeable where a steel trowel finish is used. It doesn't occur where an exposed, honed, broomed, acid etched or stipple finish is used as there is no "artificial" surface layer remaining after completion of finishing.

Formation of white 'efflorescence' deposits on surface

As part of the natural curing process of concrete, excess lime from the cement migrates to the surface of the concrete. This lime sometimes reacts with carbon dioxide to form calcium carbonate. This deposit can create a white shimmer effect, which due to its whitish colour, is far more noticeable on dark colours.

Fortunately this material will gradually erode away with rain and abrasion. Alternatively the incidence of efflorescence can be minimised by applying a coat of CCS Same Day Sealer or Slab Clad R (a curing compound on the actual day of concrete placement).

Note: Same Day Sealer cannot be applied if a penetrating sealer is to be applied as the final sealer. Instead, use Slab Clad R to cure the concrete, then remove it after 21-28 days and apply the penetrative sealer.

Full Depth Coloured Concrete Guidelines for use

*colour >
selection*

How to Choose Colours

The most accurate way to choose colours is to view mock ups where the desired aggregates and finishing techniques are used and then allowed to cure for 14-28 days.

With the exception of major projects, this approach may not be feasible.

The next best alternative is to view the true to life, textured CCS colour card. The colour card is enclosed in this folder and displays our standard range of 58 colours as they will appear after mixing with grey concrete. Colours are also displayed where standard CCS pigments have been mixed with 'off white' cement.

Where actual coloured concrete samples are required please call our helpline (1800 077 744) and we will forward a small sample in the desired colour.

*off white >
cement
colours*

Can CCS Pigments be Mixed With Off White Cement?

CCS Pigments can be used with all types of cement whether it is grey, white, off white, slag or fly ash blends. Most of the colours represented in the CCS Colour Card have been created using the grey fly ash blended concrete – the most commonly used concrete around Australia. Likewise, the CCS pigment blends have been specially formulated so you can achieve light colours even when grey concrete is used.

There are numerous projects around Australia where the CCS pigments have been used with off white cement. If you wish to mix the pigments with different coloured cements it can be easily achieved.

From a practical point of view most concrete companies only have limited silo storage for cement, hence they can usually only offer one colour of cement. In most instances this is grey, however for major projects or pours the concrete companies can arrange for the off white cement to be used.

*colour >
matching
service*

Can CCS Develop Special Colours for My Project?

As specialist blenders of pigments for many years, we are constantly developing and creating new concrete colours.

Simply contact our office (or our helpline on 1800 077 744) and provide us with a sample swatch so we can colour match it in concrete. Alternatively, advise us of the closest paint colour (using the major paint company colour fan decks) and we will immediately commence work on the project.

Due to the earthy tones of concrete, very bright paint colours are sometimes unable to be created in concrete. Nevertheless, advise us of your desired colour and we will do our best to produce it for you.

Due to machinery limitations a minimum order of 500kg of pigment (sufficient for 500 square metres of concrete) is necessary for special colours.



Full Depth Coloured Concrete Guidelines for use



background >
to coloured
concrete
production



suggested >
finishing
guidelines
for
applicators

How is the Coloured Concrete Produced?

Batching of coloured concrete at the Pre-Mixed Concrete Plant

To facilitate easy manufacture of coloured concrete, the CCS Pigment Concentrates are packed in fast melt plastic bags, which are in turn, each packed in a protective paper sack.

Each bag of pigment is specially formulated so that it can be added to one cubic metre of concrete. When used at this rate it will duplicate one of the standard colours that appear in the CCS Colour Card.

Concrete plant personnel carry out the following steps during manufacture:

1. Ensure that the water-soluble plastic bag full of pigment is added to the concrete mixer in conjunction with initial water and aggregate and then the remaining materials, ie. cement.
2. Once sufficient bags have been added to the concrete mixer, the mixer turns for 10 minutes at full speed.
3. To ensure colour consistency the same water cement ratio and raw materials are used for each load of concrete of the same colour.

Finishing – the Following Guidelines Should be Added to Your Specification to Assist in Ensuring the Concrete is Finished Correctly.

Applicators Must Carry Out the Following Procedures During Placement.

- Place and consolidate all coloured concrete over a well drained and consolidated subgrade.
- The concrete slump should be kept consistent at 100mm or less and should not exceed 125mm for any load.
- No water should be added after a portion of the load has been discharged.
- For colour uniformity, consistent finishing practices should be used.
- Do not add water to the concrete while placing or finishing.
- Do not over-trowel, as this will cause discolouration.
- All final hand finishing should be done in the same direction.
- Where a broom finish is used the surface must be broomed in a consistent direction.
- Ensure that all adequate measures are taken particularly during hot or windy weather to ensure that the concrete surface does not cure at an inappropriate rate. Apply aliphatic alcohol during trowelling and use curing compounds (that don't affect the surface colour) after placement. This is also beneficial when the application of a sealer on the same day is required.
- To minimise surface blemishing do not cure with plastic sheeting or intermittent wetting and drying. We recommend the use of CCS Same Day Sealer or CCS Slab Clad R curing compound to minimise efflorescence, depending on final sealer chosen.

Full Depth Coloured Concrete Guidelines for use

slip >
resistance

If curing compounds are not used, apply one or two coats of CCS Same Day Sealer after all surface water has evaporated. This special acrylic sealer is designed for application to fresh concrete and penetrates into the concrete pores to inhibit the flow of free lime to the surface. This minimises the incidence of the white blushing effect called efflorescence.

It also protects the concrete surface from the ingress of dirt and grease.

Note: CCS Same Day Sealer should not be used as a top coat, or if using a penetrating sealer.

Slip Resistance of Coloured Concrete

In evaluating the slip resistance of coloured concrete it must be understood that the surface finish will vary from job to job. The reason for this variance is simply that coloured concrete is a 'custom made' product. In particular the surface finish is dependent on the methods used by the applicators for each particular job.

As a point of reference we have tested a number of 'typical' coloured concrete finishes for their slip resistance.

The values presented below should only be used as an indicative guide.

Testing methodology and interpretation of results

Concrete samples were evaluated in accordance with AS/NZS4586.1999 – Slip Resistance Classification of New Pedestrian Surface Materials Appendix A – Wet Pendulum Test Method (Stanley Portable Skid Resistance Tester).

This test measures the friction resistance of a wetted surface using a pendulum testing apparatus. The resulting value is compared to a table in the Standard to arrive at a relative guide to the risks of someone slipping on the tested surface.

Note: Please refer to the Standards Australia Handbook HB197 for guidance on slip resistance standards.

A 'relative' guide is the operative word as the conditions and use of the concrete surface has a significant bearing on the appropriateness of the surface finish. Elements to consider, amongst many, include the likely use of the surface; for example will people be running or walking over it, will the surface be exposed to oils from cooking, will the surface be wet or dry, and so on.

The table from Appendix A is reproduced below. It details the risk factors of slipping on a surface, which, after wet pendulum testing, has the following MBPN (Mean British Pendulum Number) values.

Class	Mean British Pendulum Number Four S rubber	Contribution of the floor surface to the risk of slipping when wet
v	>54	Very Low
w	45 – 54	Low
x	35 – 44	Moderate
y	25 – 34	High
z	<25	Very High



Full Depth Coloured Concrete Guidelines for use

Results of in-house tests conducted by CCS and the relative risk factor for slipping follows.

Indicative Slip Resistance of Various Concrete Finishes

Concrete Finish	Mean BPN value	Contribution to the risk of slipping when wet
Broom finish	66	Very Low
Broom finish with sealer	65	Very Low
Hard steel trowel with sealer	26	High
Smoothly Honed finish with sealer	33	High
Machine polished with sealer	26	High
Exposed aggregate finish	56	Very Low
Exposed aggregate with sealer	54	Low
Acid etched and sealed	60	Very Low
Salt Rock finish and sealed	56	Very Low
Stamped concrete and sealed	39	Moderate
Stencil Concrete, broom finish, sealed	59	Very Low
Resurfacing Compound, sealed	58	Very Low

Conclusion

With the exception of pattern stamped concrete and polished concrete (such as honed, hard steel trowel and machined), coloured concrete can be used with a low to very low contribution to slip resistance.

Where honed, machined, or hand trowel finishes are created with smooth finishes, the surface is very likely to contribute to the risk of slipping. In such instances the use of anti skid media in the coats of sealer can reduce this risk (see Sealer Section).

Where a honed surface is required, coarse grinding pads generally provide more texture and an improved slip resistance rating.

To be certain of a result we recommend that you cast a one square metre sample using the ingredients and intended applicators in the desired finish. This sample can then be evaluated using the pendulum friction test.

Full Depth Coloured Concrete Guidelines for use

luminance > requirements



What is luminance and why consider it?

Luminance can be defined as a measure (in candelas per square metre) of the brightness of a point on a surface that is radiating or reflecting light. Sufficient luminance contrast of surfaces can visually warn people of impending hazards such as kerb ramps, stairs, bus stops and railway station platform edges.

Using CCS Pigments to colour on or within concrete can greatly assist in improving the luminance factor of these areas, particularly for visually impaired people.

Requirements under the Disability Discrimination Act

Section 23 and 24 of the Disability Discrimination Act seeks to ensure that people with a disability have equal access to premises, goods, services and facilities. The Building Code of Australia (BCA) includes the Australian Standards for access and mobility, AS 1428.1 which requires that surfaces required to comply with disabled access, have sufficient luminance contrast such as stair nosings to clearly delineate the step edge.

Testing the luminance of your building will help to ensure that your building complies with disabled access requirements for visually impaired people. Luminance Contrast Testing involves testing the difference in how black or white a colour is (luminance reflectance) compared with adjacent colours, using a colour meter. A formula is then used to determine the contrast using the two luminance reflectance values.

For further assistance and advice on the luminance of your proposed coloured concrete surfaces, as well as testing procedures, please contact us on **1800 077 744** or **07 3287 6444**



Full Depth Coloured Concrete Guidelines for use

colouring >
precast
concrete



CCS Pigment Concentrates are ideal for colouring precast panels as well as on site panel construction. Building facades as well as exteriors and freeway barrier walls are commonly constructed with coloured concrete, due to its permanent naturally coloured appearance which then requires very little maintenance.

Considerations in specifying coloured precast

Successfully colouring precast panels requires fastidious and consistent manufacturing techniques. Form preparation, release agents, sand and aggregate selection, vibration techniques and the use of sealers can all have a dramatic influence on the final colour.

Manufacturers experienced in coloured work may tend to be more highly priced, however quality of workmanship rather than profit margins are the usual reasons for any potential price premium.

Consequently, we recommend that consideration be given (in specifications) to manufacturers who are experienced in producing coloured concrete. As a minimum requirement, the prospective precaster should be commissioned to produce a sample panel for subsequent review by all concerned parties.

Off form finishes

This smooth surface finish is the most difficult to achieve as any variance in form preparation, release agent and its application, raw materials, curing practice and vibration technique can cause some sort of colour variance or blemishing on the surface.

Consequently, consideration needs to be given to the level of colour consistency that can realistically be achieved, prior to job commencement. Extremely demanding standards in surface finish may cause project costs to escalate unnecessarily.

Certainly very good off form finishes are regularly achieved however it would be helpful for specifiers to view previous projects to understand what is an acceptable standard with such a demanding surface finish.

Australian Standard 3610 - Concrete Formwork, provides guidance on how to correctly specify coloured off form concrete. Class 2 is the most common standard for coloured precast and insitu concrete.

Sandblasting, honing, acid etching or exposed aggregate finishes

It is much easier to create a consistent coloured finish when using these methods for precast concrete. As the surface layer is removed, the colour of the sand and aggregates will have almost as much bearing on the final colour as the pigment used. As a result, precast manufacturers may be more likely to produce panels to a budget using a combination of colour and aggregate.

Full Depth Coloured Concrete Guidelines for use

rendering >

Effects of aggregates on final colour appearance

Where the aggregates are exposed to view, the actual pigment colour is much less noticeable than when a smooth off form finish is created.

If an exposed aggregate finish is desired, early consultation with experienced precast manufacturers is recommended to assist in realistic colour selection.

Rendering or 'bagging' with pigments

The use of pigments for colouring render is ideal where a weathered or naturally toned finish is desired.

If a perfectly consistent coloured finish is desired then it is better to use paint rather than pigmented render.

As the normal procedure for applying coloured render is fraught with many job site problems, it should be expected that a somewhat mottled and variable colour finish will be achieved.

Inconsistencies that can produce the mottled effect include:

- Inaccurate or inconsistent mixing of any of water, cement, sand and pigment for each particular 'batch' of render.
- Retrowelling of render after initial set.
- The use of additional water to assist in developing an acceptable trowel finish.
- The variance in drying time due to the aspect of the walls relative to the exposure to sunlight.
- The incidence of efflorescence (free lime migrating to the surface) in an indiscriminate and inconsistent manner across the surface of the rendered walls.

Notwithstanding the above, if an aged appearance is desired then the coloured render finish is an excellent method of achieving it.



Full Depth Coloured Concrete Specifications

new >
concrete



Suggested Specification For New Concrete

- Concrete is to be integrally coloured with Concrete Colour Systems _____ (nominate colour eg. Onyx) Pigment Concentrate (phone 07 3287 6444, 02 9756 1711, 03 9311 9255 or toll free 1800 0777 44), at the dose rate of _____ %
(Refer to % written under colour swatch) per cementitious content. % dose rate
- _____ cement (refer to CCS colour card and nominate Grey or off white) should be used to achieve the desired colour. (please note that the majority of CCS colours which appear in our colour chart are achieved by using the more economical grey concrete)
- All surfaces should be finished uniformly using a _____ (eg. Steel trowel, broom, sandblasted etc) finish.
- CCS Aliphatic Alcohol can be used to help reduce evaporation during the placement and finishing (trowelling) stage. CCS Aliphatic Alcohol should be applied in a consistent manner following product label instructions.
- Coloured concrete should then be cured in accordance with Australian Standards such as AS 3799-1998. To prevent surface blemishing, do not cure with plastic sheeting, intermittent wetting and drying, membranes, paper, sodium or fluoro-silicate hardeners and other compounds which can cause discolouration.
- Apply a curing compound such as CCS Slab Clad R or alternatively, CCS Same Day Sealer, as soon as the surface will allow.
- Finally, apply a suitable coating, compatible to the curing system following guidelines for sealing application. (ie. Apply CCS Streetscape Seal over a surface where CCS Slab Clad R has been removed or apply CCS Hardseal Advanced over CCS Same Day Sealer.

finishing >

Finishing – the following guidelines should be added to your specification to ensure the concrete is finished correctly.

Placement: Applicators must carry out the following procedures during placement.

- Place and consolidate all coloured concrete over a well drained and consolidated subgrade.
- The concrete slump should be kept consistent at 100mm or less and should not exceed 125mm for any load.
- For colour uniformity, consistent finishing practices should be used.
- No water should be added after a portion of the load has been discharged.
- Do not add water to the concrete while placing or finishing or overtrowel, as this will cause discolouration.
- All final hand finishing should be done in the same direction.

* Concrete should not be sealed until it has a uniform colour and there is no apparent moisture.

Full Depth Coloured Concrete Specifications

- Where a broom finish is used the surface must be broomed in a consistent direction.
- Ensure that all adequate measures are taken during hot or windy weather to ensure that the concrete surface does not cure at an inappropriate rate. Apply CCS Aliphatic Alcohol during trowelling and use curing compounds, such as CCS Slab Clad R (that won't affect the surface colour) after placement.

To prevent surface blemishing do not cure with plastic sheeting or intermittent wetting and drying.

If curing compounds are not used, apply one or two coats of CCS Same Day Sealer after all surface water has evaporated. This special acrylic sealer is designed for application to fresh concrete and penetrates into the concrete pores to inhibit the flow of free lime to the surface. This minimises the incidence of the white blushing effect called efflorescence.

It also assists in curing and protects the concrete surface from the subsequent ingress of dirt and grease.

Suggested Specification for Coloured Render

1. Render is to be integrally coloured with Concrete Colour Systems _____ (nominate colour eg. Onyx) Pigment Concentrate (phone 1800 077 744 or 07 3287 6444).
2. Add pigment to the render mixture at the prescribed dose rate. Pigment and cement must be apportioned by weight, as volumetric measuring will result in inconsistent colour.
3. To assist in maintaining the colour uniformity of the render ensure that the same sands and the same water quantity is added for mixing the render throughout the whole job.
4. Do not retrowel or rewet any render after it has been applied to the wall as this will cause that section of the render to appear lighter than other areas.
5. Once dry, seal the surface by applying two coats of CCS Natural Seal Supreme HV.

coloured >
render