

# Integrally Colouring Vertical Concrete Structures



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## Enhancing form and character with full depth colour

Integrally colouring vertical structures such as buildings, freeway sound barriers and retaining walls adds an attractive, naturally coloured appearance without the need for re-application of paints every few years.

Specialised powder or liquid oxides such as CCS pigments are added to the wet concrete mix and thoroughly dispersed throughout the concrete providing permanent UV resistant colour..

Colouring the concrete with full depth, UV resistant CCS Pigments can be done on-site (insitu) or as pre-cast panels poured off-site, using specialised forms or moulds.

The result is an array of endless finishes in a variety of colours, dimensions and textures which impart life and interest into otherwise dreary, grey structures.

\*When used in correct proportions, oxides are insoluble (prevents leaching out), chemically inert (do not interfere with the cement reaction), alkali resistant, light fast (eliminates fading) and harmless to the environment.

\* Source:- *Guide To Off-Form Concrete Finishes*, Published by Cement, Concrete and Aggregates (CCAA) Australia.

## Grey vs Off-White Cement

In general, colour oxides in off-white cement will always appear brighter than oxides in grey cement - particularly with lighter yellows and blues.

However, when using blacks, dark reds and brown pigments there is little or no difference in colour variance when using either base.

If a lighter, brighter colour is desired, the use of an off-white cement base should be considered.

At CCS, we have developed a complete range of attractive, natural looking colours for both grey and off-white cement, with colour matching available if required.

## Protective Sealers

Typically, there are two types of protective sealers for vertical walls – film forming sealers and penetrating sealers.

Both types of sealers will protect the concrete surface by minimising efflorescence (white marks) and other stains from the ingress of water, dirt and salts.

Film forming sealers provide a gloss finish to the surface, enriching and darkening the coloured concrete surface. Whereas penetrating sealers infiltrate deep into the pores of the concrete to offer a matt finish that has little to no impact on the colour of the surface.

It is particularly important to consider whether a gloss or more natural looking finish is desired, and commissioning samples with the appropriate sealer will provide the most accurate example of the final colour.



Project:- Geelong Bypass. Precast Panels coloured with CCS Ablaze.



Patterns and textures were embedded into the concrete at the pre-cast concrete plant using specially designed forms and then erected on site. Colour: CCS Honeycomb.



*Special CCS colour blends were developed in conjunction with the project architects to create a facade that complements the surrounding infrastructure.  
Project: James Foot Building, University of Queensland. Architect: Wilson Architects.*

## Integrally Coloured Insitu Buildings and Walls

Insitu coloured concrete is concrete that is both coloured and placed into formwork on-site. Insitu concrete is strong, durable, stable, readily available and relatively economic in terms of construction and life time maintenance. It is the ideal structural material in building sites that have difficult access.

Other advantages of the insitu concrete process include:-

- less limitations on the size of the final concrete panels.
- the elimination of the need for transportation of heavy concrete panels from factory to site.
- the ability to have less or no joints between panels.

## How to get the best coloured insitu concrete finish

Like any construction method involving on-site forming and design elements, it is important that pre-planning is done to ensure the best possible outcome. And while the minor colour variations inherent in integrally coloured concrete are what makes it so popular, it is nevertheless necessary to control the final outcome to ensure blemishes or major colour variations do not occur.

Below are factors to consider when specifying insitu coloured concrete walls.

## Factors Affecting Colour

The final colour of the concrete can be affected by a number of factors including:-

- water content
- cement type
- method and duration of curing
- form oils used
- the type of formwork
- methods of compaction
- release agents, and;
- aggregates used in the mix (particularly if they are exposed during the finishing process).

That is why it is important to ensure the following tasks are undertaken before the project begins.

## DO's

- ✓ Ensure on-site concrete samples are made in your desired CCS colour(s) and the concrete mix that will be used. It is also important to assess the sample at the correct time, once it has fully cured (as colour may vary before it has cured).
- ✓ Trial form releases to ensure they are compatible with the form liner material.
- ✓ Trial patching lugs to ensure colour consistency with the panel.
- ✓ Ensure your specification is detailed and correct so that the concrete is not only placed correctly but supplied, formed, cured correctly.
- ✓ Add a texture or profile to your concrete if colour consistency is important, as this will help disguise any inherent variations.

For further information please refer to the *CCS Technical Guide for Colouring and Placing Insitu and Precast Concrete Panels*.



The above picture on the left shows the timber forms in place, on-site. The coloured concrete is then poured into the formwork and the final finish is shown in the picture on the right. Photos courtesy of the CCAA.



The above photos show rope attached to the formwork and the resulting finish. Photos courtesy of the CCAA.



The subdued tone of this special CCS blended colour gives this faculties building at the Queensland University of Technology a natural appearance that blends well with surrounding bushland.



Local plant life has been encapsulated forever in this coloured feature wall. CCS Green Earth (special blend) was chosen to replicate the ambience of nearby rainforests. Landscape Architect: Landplan.



*This energy efficient building facade was created using CCS Snow pigment in off-white cement to provide a permanent, low maintenance finish. CCS Black 21 was used to provide a low glare, functional path and driveway. Architect: Atelier Group Qld.*



The light coloured pre-cast panels of this building were manufactured off-site using a low dose of CCS Corn with off-white cement. The lower level of the facade was created on-site with a special CCS Grey Amethyst pigment blend.



This feature wall has been coloured with CCS Biscuit and sandblasted for a textured effect. Architect: Edaw Australia.



Panels coloured with CCS Lemon Cream, CCS Tangerine (special blend) and CCS Black 21 combine to provide a bright, contemporary off-form wall. Architect: John Mainwaring (JMA).



A rustic, natural finish complete with authentic timber texture was created using concrete. Oregon timber was used as the formwork. CCS Panther pigment was used to colour the concrete. Architect: Brian Steenbyk.

## Colouring Precast Buildings and Walls

An endless variety of textures and colours is possible with precast concrete. The main advantage of precast concrete is that the process is undertaken under factory controlled conditions.

The other main benefits are that panels are cast horizontally to eliminate tie rod holes, and can be quality inspected prior to delivery on-site.

The major drawback of precast concrete are limitations on the size of panels which can be manufactured, transported and lifted on-site. The necessity of joints between panels or column/beam junctions may also be seen as a disadvantage to some designers.

Like insitu concrete, colouring precast concrete also involves a number of important steps to follow to ensure the desired finish is achieved.

### DO's

- ✓ Ensure on-site concrete samples are made in your desired CCS colour(s) and the concrete mix that will be used. It is also important to assess the sample at the correct time, once it has fully cured (as colour may vary before it has cured).
- ✓ Trial form releases to ensure they are compatible with the form liner material.
- ✓ Ensure your specification is detailed and correct so that the concrete is not only placed correctly but supplied, formed, cured correctly.
- ✓ Add a texture or profile to your concrete if colour consistency is important, as this will help disguise any inherent variations.

For further information please refer to the *CCS Technical Guide for Colouring and Placing Insitu and Precast Concrete Panels*.



Coloured Concrete being placed into a precast form.



A silicone rubber formliner used for texture. The coloured concrete was poured onto the horizontal and then placed vertically on site.



The resulting finish.



The photos above and below are of the same project - Brimbank Anglican Church and Hall Melbourne, where the CCS coloured precast panels have proven to be an attractive and cost effective interior and exterior walling solution.



Examples of precast moulds. (Above photos supplied courtesy of the CCAA).

## Types of Precast Finishes

All of the finishes detailed below can be successfully coloured with CCS Pigments.

### Off-Form Precast Concrete

Off-form precast concrete is produced with the use of high quality moulds which impart either a smooth, flat finish or a profiled finish. It is important to note that colour and surface imperfections will show up more on smooth finishes, rather than profiled or textured finishes.

The choice of the form liner material to be used is based on the complexity and depth of the surface as well as the number of times the form liner needs to be re-used. CCAA recommends flexible liners such as polyurethane and silicone rubber be used on undercut surfaces - as these allow the mould to be stripped without tearing any concrete from the panel.

The Australian Standard AS3610.1 – 2010 (Formwork for Concrete) defines the classes of surface finish with Class 1 being the highest standard and Class 5 the lowest. Class 2 is the most widespread specification for high quality precast off-form concrete.



### Acid Etching

Acid Etching refers to a process whereby the concrete is washed and scrubbed with an acid solution to remove the outer layer of the concrete approximately a week after the concrete has been removed from the mould. A flat sand textured surface resembling natural stone such as brownstone, limestone or sandstone is created.



### Shotblasting

Shotblasting or grit blasting involves propelling various abrasives such as glass beads against the concrete surface using compressed air, in order to impart a textured finish. During the process, the underlying aggregate is exposed.

Note:- Shotblasting is seen as a cost effective finish with good weathering characteristics.



### Honing

Precast honed concrete is created by grinding the outer surface layer of the concrete to create a smooth, flat finish featuring the aggregates within the concrete.



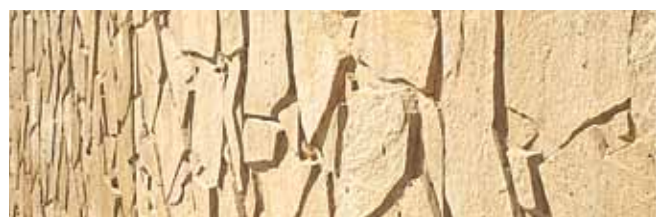
### Exposed Aggregate

As its name suggests, an exposed aggregate finish exposes the aggregate within the concrete mix via the use of chemical retarders and water washing techniques which remove the outer layer of concrete.



### Patterns and 3D Shapes

Unique textures can be created with the use of special molds or form liners featuring anything from wood and stone profiles to geometric shapes and design elements. According to the National Precast Association of Australia, 3D surfaces can have sustainability benefits by using a surface pattern that can self shade a vertical element, thereby reducing thermal conductivity from the sun.



The above wall was created with the use of CCS Bonsai (together with a reactive stain) and distinctively formed shapes made from polystyrene.  
Landscape Architect: Urban Art Projects.



*This elephant enclosure at Taronga Zoo was created with the use of rubber moulds and CCS Lizard Skin pigment.*



*Concrete sound barriers make life a lot easier for surrounding homes and enhance the commuting experience. An antique finish was achieved on the top left with an off-form mould and the darker panels in the centre were sandblasted. CCS Honeycomb and CCS Black 21 pigments were used to colour the panels.*



*The above exterior panels were manufactured on site and utilise project specific CCS colour blends to provide the green and beige colours.  
Architect: Peddle Thorp Architects.*



*Designed by Architects H2O, the theme of the external off-form façade to this building at Swinburne University is that of frothing bubbles emanating from the base of the building.*

*CCS Snow was added to off-white concrete and the moulds were assembled using steel foam, timber and rubber (the rubber and foam were selected for their ease of workability and adaptability in areas not easily formed in steel).*

*Excellent uniformity in colour has been achieved despite the panels being manufactured over 12 months and spanning four seasonal changes.*



*A rubber mould together with CCS colour creates an interesting, contrasting feature to this building.*



*A wonderful example of how a simple but highly effective pre-cast panel design adds character to a building facade. Pre-cast panels coloured with CCS Honeycomb.*



*Colour combinations reminiscent of natural sandstone yet in bold geometric form were used to create these exterior panels. A combination of several CCS pigment blends were created in conjunction with project architects and cast off site. [CCS Mountain Rose, CCS Worstead Tan, CCS Mushroom Cap and CCS Silvery Moonlight] Architects: Donovan Hill and Peddle Thorp Architects.*



*A stunning contrast between black and white using CCS Snow in off-white cement for the facade and CCS Black 21 in the entrance walkway. Architect: Richard Kirk Architects.*



*These precast panels have been coloured with CCS Pottery and honed to create a durable, weather resistant finish.*



*The above building in Sydney's CBD was coloured using a special blend of CCS Pigments and shotblasted to provide a smooth, even finish.*



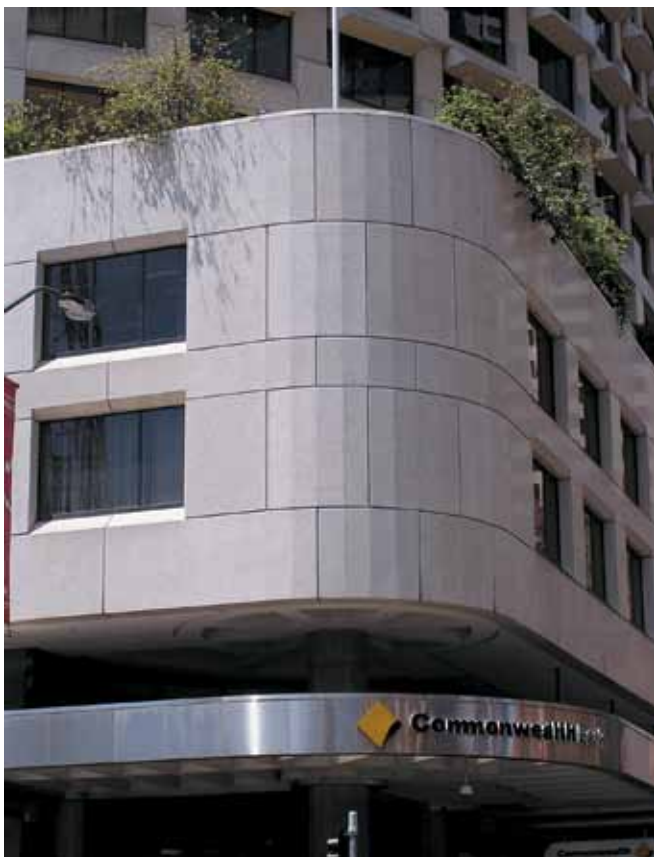
*Paper, rock or scissors? These uniquely designed pre-cast panels were achieved with the use of CCS Parchment in off-white cement and using specially designed moulds that gave an amazingly unique 'crumpled paper' look. Architect: Edaw Australia.*



*Pre-cast wall at a coastal shopping centre showcases a mixture of texture, achieved with the use of a form liner and shotblasting to emulate sand tracks and ripples.*



The above panels on Melbourne's East Link Freeway were cast in hexagonal shapes to create a unique look. Colours used:- CCS Raffia Beige, CCS Light Peach and CCS Lizard Skin.



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