



# Concrete for NZILA

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## Topics-

### Dene

- Concrete as a material, admixtures, additives etc
- Colour and oxides oxide- what are they?
- Finishes and texture
- Common issues
- Sources of information
- Firth and environmental

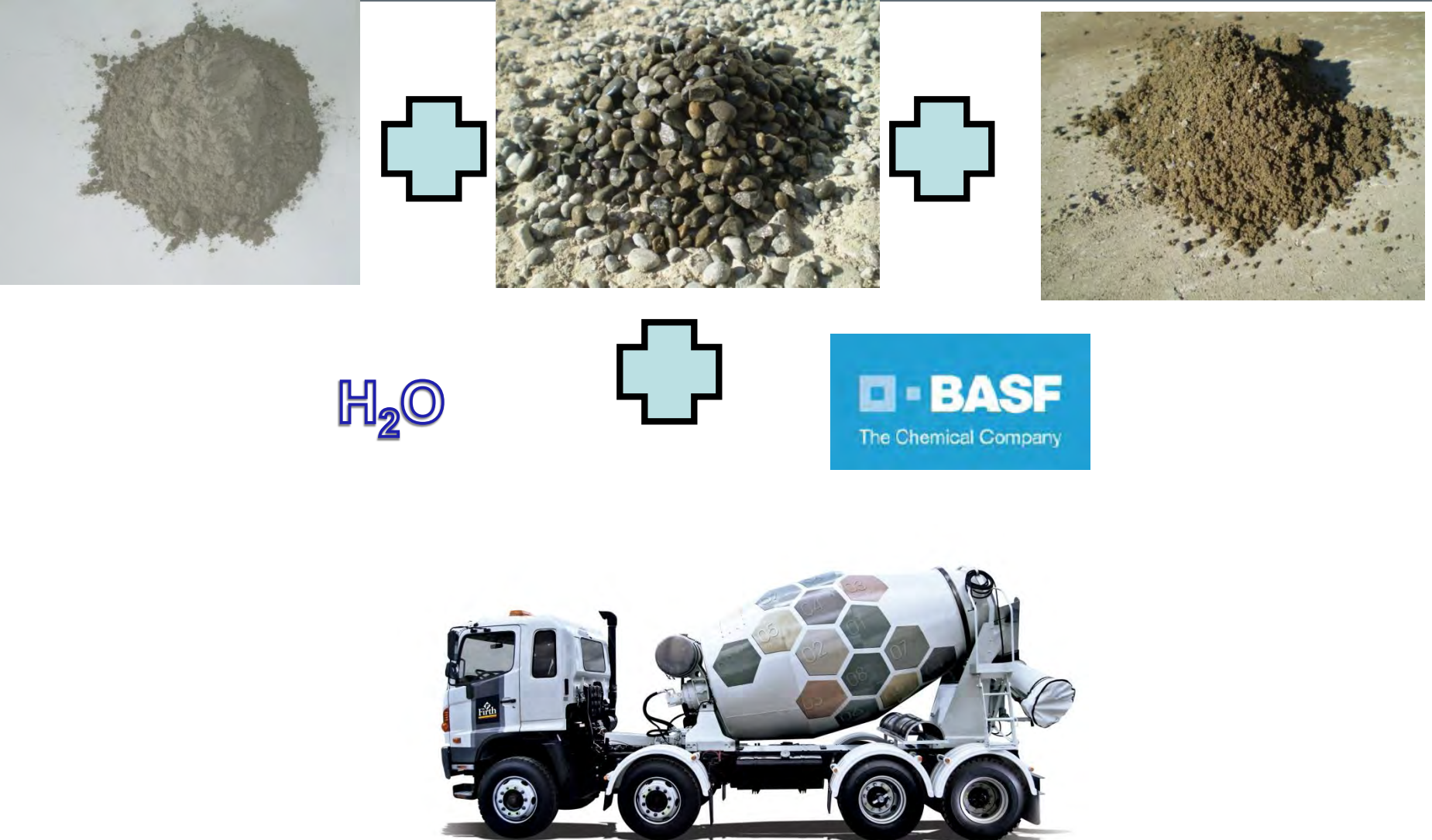
### Stuart

- Permeable concrete and paving



- What is concrete?

# What is concrete?



# Binders



GP CEMENT



FLY ASH



MICRO SILICA 600

# What do admixture do?

| Function                                       | Examples   |
|--|--|
| Air entrainment                                | Micro Air 905  |
| Water reducer                                  | Pozzolith 450  |
| Mid range water reduce                         | Polyheed 915N  |
| High range water reducer<br>(superplasticiser) | Glenium 79<br>Glenium 8100 (High early strength)<br>Glenium 6600SDC (smart dynamic concrete) |
| Slump retention                                | Rheomac 1008 SURETEC   |
| Viscosity modifiers                            | Rheomac 614 (pump aid)<br>Rheomac VMA 362 (viscosity modifier)                               |
| Shrinkage control                              | Tetraguard AS21  |

| Function          | Examples   |
|-------------------|--|
| Accelerators      | Pozzolith 595 (chloride)<br>Pozzolith NC534 (non chloride) |
| Retarder          | Pozzolith 122Ri  |
| Foaming agent     | Rheocell Rheofill (up to 30% air)                          |
| Pore blockers     | Rheomac 739 (water resistance)                             |
| Surface retarders | Rheofinish 380 EXPOSE                                      |
|                   |  |

# Colour





Colour achieved by  
adding oxides to the  
concrete



01 Sea breeze  
02 Sand storm  
03 Heat wave  
04 Monsoon  
05 Indian summer  
06 Ice storm  
07 Cloud burst  
08 Thunder cloud

- Colour should be specified a dose percentage by weight of cement. Trial best if important. Sand colour, cement , water can cause variation.
- Liquid vs granular colour can also make slight difference





# Pigment Basics



- **Tinting Strength**
  - The ability of a pigment to change the color of a given mix. If a pigment changes the color of a mix substantially with a small addition of color, that pigment is said to have a high tinting strength. The tinting strength of a pigment depends on the iron content and the fineness of that particular pigment.



- **Saturation Point**
  - The point at which color intensity stops rising proportionally to the rate of addition of the pigment.

## Effect of Cement Color on Final Color





## Impact of Pigment Loading



1%      3%      5%      7%      9%





# Effect of Color of Sand on Final Concrete Color

3% Pigment Loading

Not Pigmented

Yellow Iron Oxide

Red Iron Oxide

Cobalt Blue

Chrome Oxide Green



Light Sand



Dark Sand



# Water / Cement Ratio

**Consequences – Change in Color / Texture**

*Water / Cement Ratio*

0.25

0.32

0.39



Grey – No  
Pigment

3% Red  
Iron Oxide

## Firth, Coloured Concrete, Planner - Concrete - Sand storm

HOW TO  
VIDEOS &  
DESIGN TOOLS

HOW-TO  
VIDEOS

TOOLS

[EcoPave Planner](#)

[EcoPave  
Calculator](#)

[Paving Planner](#)

[Paving  
Calculator](#)

[Masonry](#)

[Veneers Planner](#)

[Coloured  
Concrete Planner](#)

ASK US A  
QUESTION

Select Scene:



Colour: Sand storm



Product Details

[Coloured Concrete](#)



Important Notes

[Coloured Concrete](#)

- Finishes and Texture



# Texture- colour



- Formwork prep very important
- Joints and saw cutting need consideration.
- Viewing distance 3m



# Colour- saw cutting



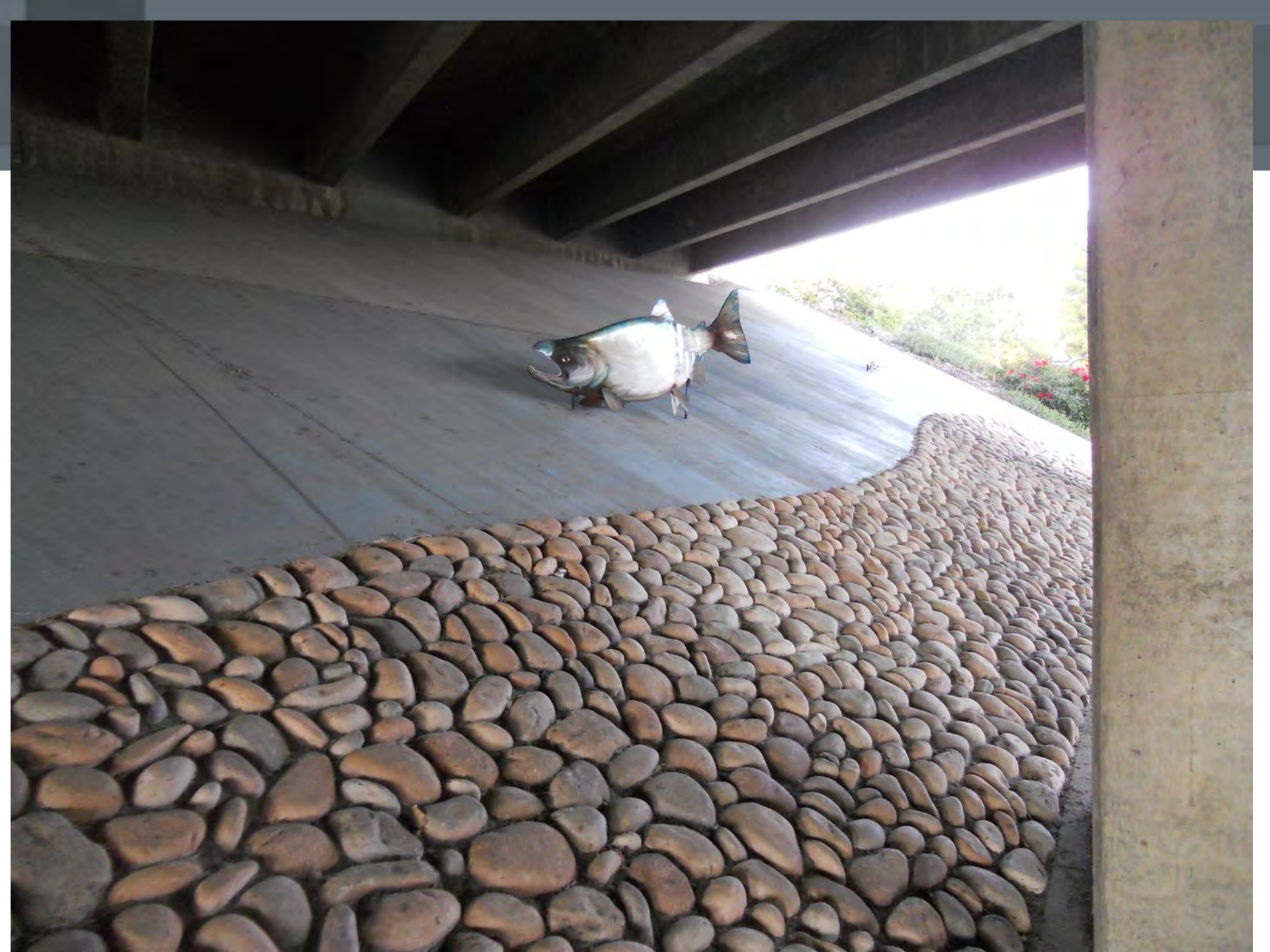
- Colour used
- Tooled joints
- Note crack on frame

# Colour exposed aggrrgates



- Exposed agg finish with borders
- Achieving consistent exposure a skill
- View from 3m
- Consider pour sequence







# Plan saw cuts-



- Thought put into saw cut locations



# Concrete structures











# Exposed Aggrgate



Typically used for  
drives and paths not  
floors





Concrete has natural variations sometimes get mottled effect







# Polished Concrete





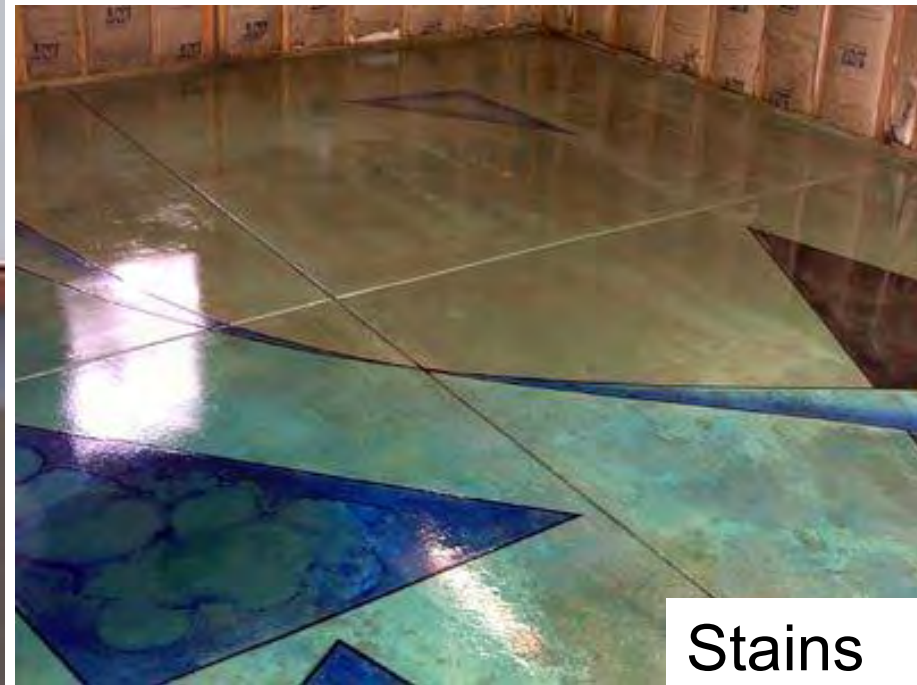








# Painted



Stains



# Coloured Concrete - Finishes

A close-up photograph of a grey concrete surface with a highly textured, pitted appearance, characteristic of an acid-etched finish.

**Acid Etch**

A close-up photograph of a light brown concrete surface with a fine, uniform texture, achieved using a sponge trowel.

**Texture  
Trowel  
(sponge)**

A close-up photograph of a light brown concrete surface with a smooth, slightly mottled texture, typical of a power float finish.

**Power Float**

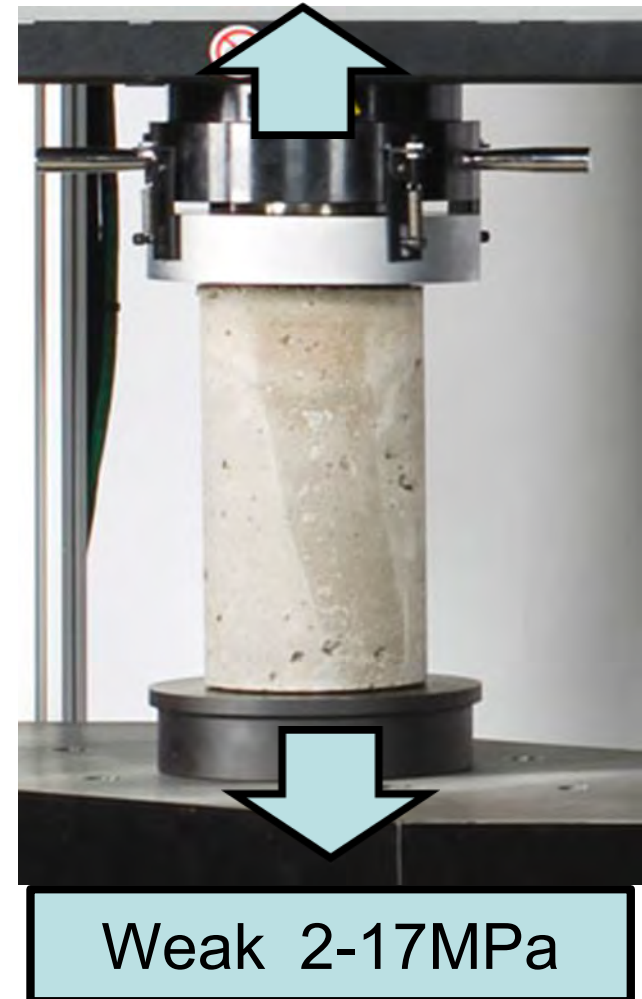
← Most  
common for  
floors

A close-up photograph of a light brown concrete surface with a very fine, uniform texture, achieved using a roller.

**Roller Finish**

- Lesson Learnt

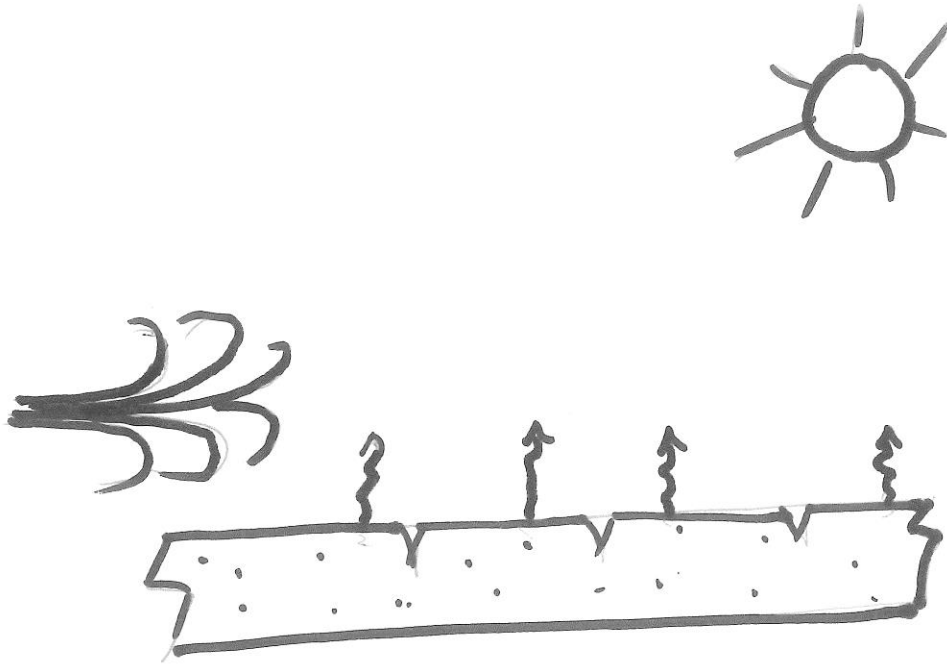
# Concrete cracks!



When exceed tensile strength-cracks shearing load to reinforcement

- 3 main reason concrete cracks

# Plastic Shrinkage cracking

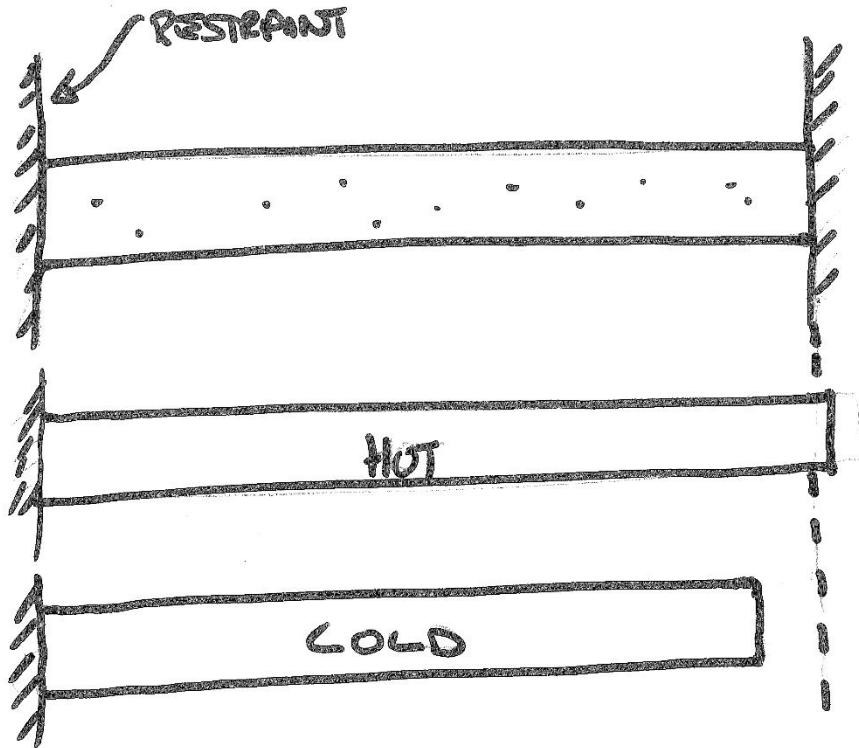


Curing- good placing technique, do not let the top surface dry out

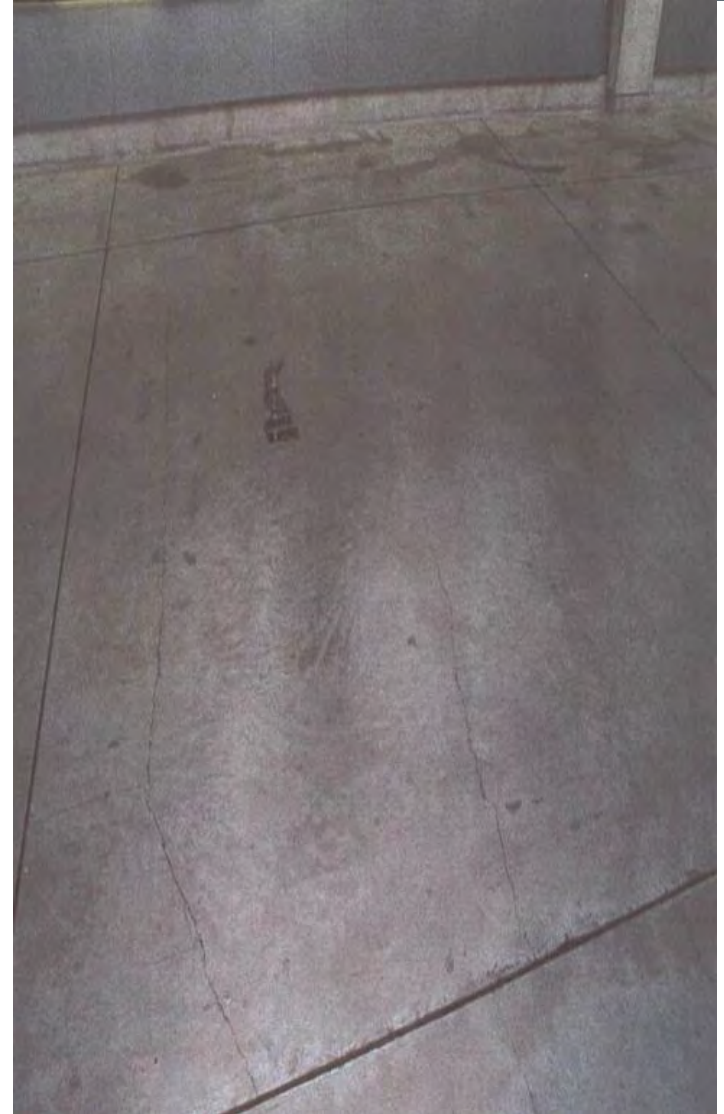




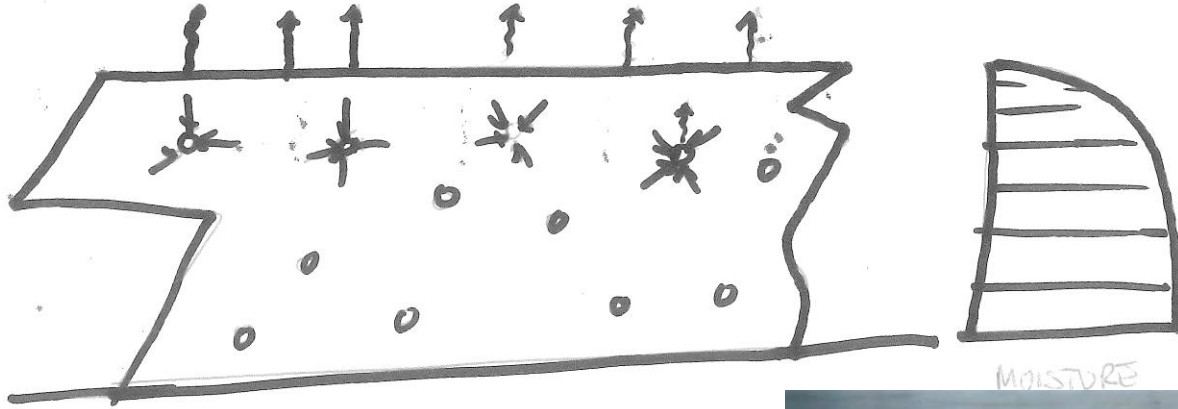
# Restrained Early contraction



Cure- get joints in before first evening, (tooled or early entry saw)



# Drying shrinkage



Cure- careful  
thought for saw cut  
locations





# Natural variation

Expect variation unless using painted surface



# Extreme variation- pinto concrete





## Efflorescence

### Cure-

- eradicate source of water
- seal
- Avoid polythene curing



# Firth and Environmental



# Declare.

## Firth Standard Concrete Mix Firth

**Final Assembly:** New Zealand

**Life Expectancy:** 50+ Years

**End of Life Options:** Recyclable (100%)

### Ingredients:

**Golden Bay Cement GP/HE Cement [GBC-0001]:**  
**Limestone, Iron Sand, Gypsum, Grinding Aid**  
**(<0.03%)<sup>1</sup>; Sand; Recycled Water; Aggregates:**  
**Greywacke/Basalt; Proprietary Admixtures**  
**(<0.40%)<sup>1</sup>; Flyash**

<sup>1</sup>LBC Temp Exception I10-E4 Proprietary Ingredients <1%

### Living Building Challenge Criteria:

FIR-0001

VOC Content: N/A

#### Declaration Status

EXP. 01 FEB 2018

VOC Emissions: N/A

☐ LBC Red List Free

☒ LBC Compliant

☐ Declared

MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY  
INTERNATIONAL LIVING FUTURE INSTITUTE™ [declareproducts.com](http://declareproducts.com)



## MAT-7 Concrete and Aggregate

Pre-requisite requires water recycling at concrete plant.

**Criteria A - enables concrete that holds one of a spectrum of sustainability initiative to be recognised.**

Criteria B - recognises reduction in cement - 2 points are available, the benchmarks for this have changed from 2009. **It also introduces 1 point to recognise cement that is sourced from manufacturers using 10% alternative fuels.**

Criteria C - the benchmark has increased for recycled aggregate in the concrete mix.

Criteria D - introduces recognition for use of recycled aggregate in hardfill and backfill applications.





[www.cca.org.nz](http://www.cca.org.nz)

# CCANZ CP 01:2014

## Code of Practice for Weathertight Concrete and Concrete Masonry Construction



Cement & Concrete Association of New Zealand

January 2014



# Apartment Design Guide

## Guidelines for the Design of Multi-Storey Apartment Buildings in New Zealand



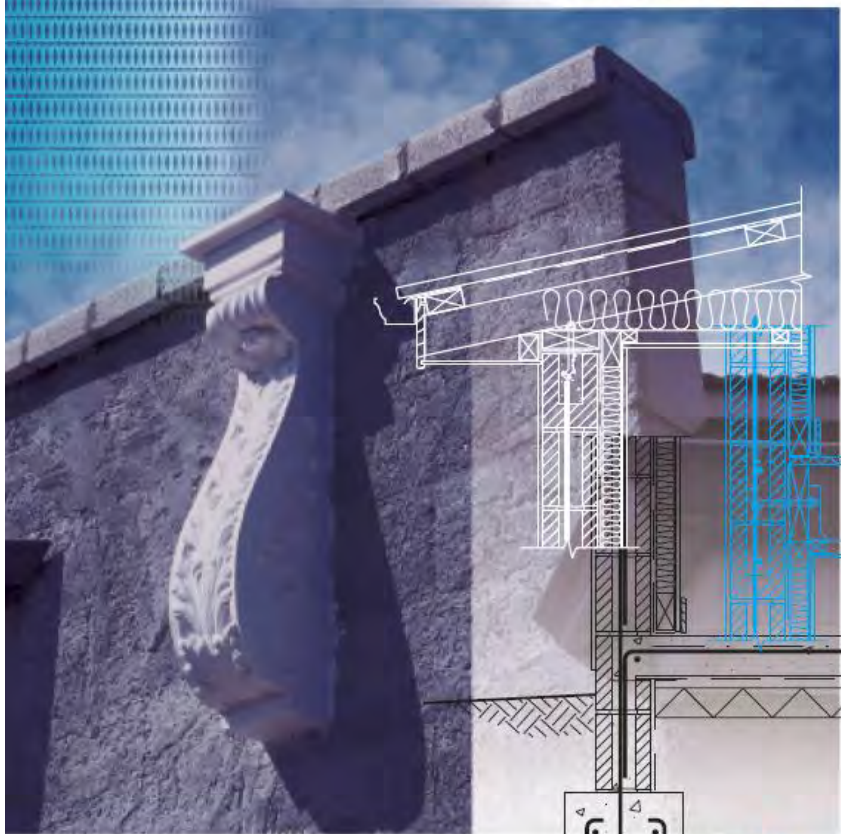
Cement & Concrete Association of New Zealand

June 2013





**RESIDENTIAL CONCRETE  
DETAILING AND SPECIFICATION GUIDE**



2<sup>nd</sup> Edition

# Designing Comfortable Homes

GUIDELINES ON THE USE OF GLASS, MASS  
AND INSULATION FOR ENERGY EFFICIENCY





# RESIDENTIAL CONCRETE

## SLAB-ON-GROUND FLOORS

Producing a quality concrete slab on ground is easy if some basic rules are followed. This leaflet is intended to assist builders to produce a quality slab. The cost of rework is very high, so follow the suggestions in this leaflet to save time and money.



IN ASSOCIATION WITH



## INFORMATION BULLETIN: IB 18

### Architectural Surface Finishes



## INTRODUCTION

Reinforced concrete is unique among the ever-increasing range of building materials the designer can choose from. When used as a massive element in a building it can provide the required structural capacity, can define space and be seen as the architectural surface, all in one. It is also the only contemporary construction material that in the hands of the contractor passes through a plastic state that allows it to take on the shape of the formwork into which it is cast. Moreover, the process allows the surface to be rendered as the negative of the surface it is cast against.

surface finishes evident over the past decade designers are also exploring how concrete can be expressed as an architectural element.

When concrete is exposed as the visible architectural surface it is most likely contributing to the:

- cost efficiency of the initial building project by not requiring the application of surface finishes costing time and money,
- thermal and energy efficiency by allowing the density of the material to dampen temperature swings over the course of a day.

It is also likely that the exposed concrete will be more durable over its life than any other lightweight cladding or finish.

## OBJECTIVE OF THIS I.B.

To provide general information to specifiers and builders on the many various concrete surface finishes that can be achieved.

This bulletin is not intended to provide all the technical information necessary to achieve these finishes nor is it possible to present all the various finishes that can be achieved. Many of the references given at the end of this bulletin are a useful source of further technical background.

## GENERAL BACKGROUND

The care exercised in the selection of the raw materials and in the shaping of the formwork will be reflected in the quality of the final surface. It is therefore important before selecting the forms, materials or mixes to have a clear understanding of the different modes of treatment possible. The presentation of information in this bulletin is grouped under the three categories for finishes established by NZS 3114: 1987 Specification for Concrete Surface Finishes.

These three categories are:



Jubilee Church, Rome. (Architect: Richard Meier).  
White De-poluting Concrete.

The appropriate use of exposed concrete elements can enhance a building in many ways, among them the architectural qualities. Concrete can be produced with a broad range of surface finishes, making it ever more attractive to architects and designers. With renewed interest in materials and

- Extra slides if time permits

# Guidance

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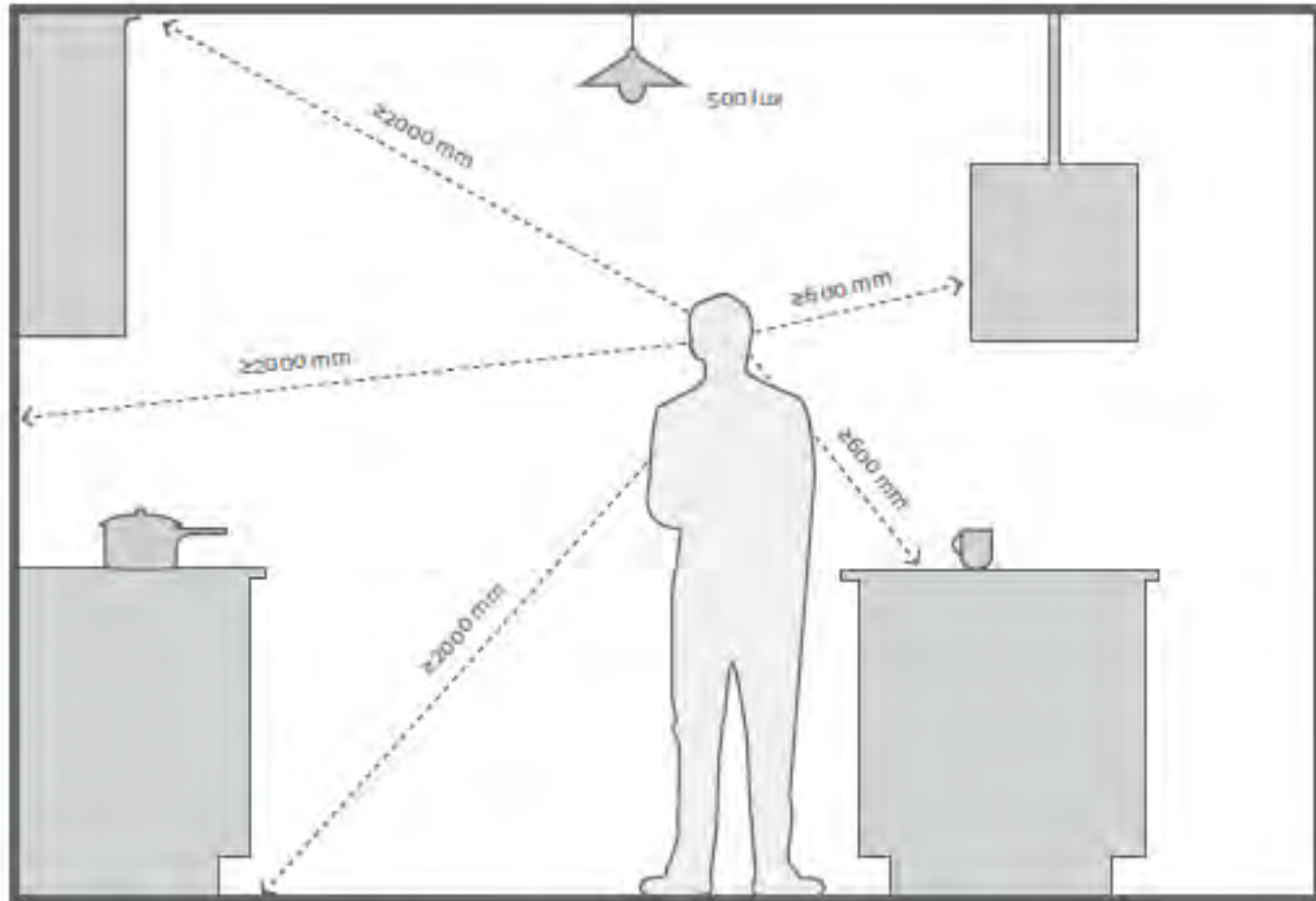
**Guide to** tolerances, materials  
and workmanship in new  
residential construction **2015**

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HŌKINA WHAKATUTUKI





**Figure 1** Normal viewing positions vary depending on the type of surface being inspected.

## Critical lighting

Unless specifically outlined in the contract specifications, imperfections that are only visible under critical light do not indicate defective workmanship.

## 1.4 Concreted driveways and paths

Damage caused by vehicles is the main contractor's responsibility if the damage occurred during work done as part of the contract. It is not the main contractor's responsibility if the damage was caused by trades or persons that do not fall under their contractual control.

### 1.4 CONCRETED DRIVEWAYS AND PATHS

#### CRACKS

- ✗ Unrepaired gaps greater than 3 mm wide.
- ✓ Cracks in a concrete driveway, patio or path up to 3 mm wide.

Note: Cracking in concrete is common and is not necessarily a sign of poor workmanship.

#### FINISH

- ✗ Concrete surface does not conform to the specified level of finish<sup>13</sup>.
- ✗ Variations in surface texture (e.g. discolouration, unevenness or pitting) that can be seen from normal viewing position.
- ✗ Colour loss or fading resulting from recurring efflorescence.
- ✗ Abrupt changes and gradual variations on concrete surfaces exceed specifications for the relevant surface type as per NZS 3114:1987<sup>14</sup>.
- ✓ A slight cross fall or camber to drain water.
- ✓ Other colour loss or fading.
- ✓ Discolouring from oil from vehicles outside of the control of the main contractor.
- ✓ Variations in surface texture which are not clearly visible from normal viewing position.

## 2.2 Concrete floors

The normal viewing position distance for concrete floors is 3 m (see Inspecting surfaces and fixtures).

### 2.2 CONCRETE FLOORS

#### CONSTRUCTION

- ✗ Concrete floor has hollows or mounds exceeding those allowed for in NZS 3114:1987 (Part 3)<sup>16</sup>.
- ✗ Cracks which rupture or significantly impair the appearance or performance of the finishing floor materials – see NZS 3114:1987 (Part 3).
- ✗ Unrepaired concrete floor cracks of 3 mm or more in width or vertical displacement.
- ✗ Visible reinforcing or bony (poorly vibrated) concrete along the edge of the slab.
- ✓ Deviations in the floor plane are within the applicable tolerances set in NZS 3109:1997: Concrete Construction.
- ✓ Defined crack control joints (saw cuts or other means of inducing cracks) are usually specified and are accepted trade practice (unless in locations different to the specification).

Note: Some cracking in a concrete slab is common and is not necessarily a sign of poor workmanship.

#### FINISH

- ✓ Exposed concrete floors are free of stains on handover (unless otherwise specified).



## 2.3 Polished concrete floors

The normal viewing position distance for concrete floors is 3 m (see Inspecting surfaces and fixtures).

### 2.3 POLISHED CONCRETE FLOORS

|   |  |
|---|--|
| ✗ | Ground and polished concrete have trowel and grinding marks unless otherwise specified.  |
| ✗ | Patchy finish where a clear coating has been applied to exposed concrete.  |
| ✓ | Clear coatings have an even appearance.  |
| ✓ | Some variation in appearance across an exposed concrete floor in accordance with specifications. Where the acceptable colour range is not specified, refer to the colour variation tolerances within NZS 3114:1987 (Part 3).                   |
| ✓ | Where river-run materials are used, the presence of driftwood or seeds is acceptable provided there is less than one piece of material smaller than 20 mm by 30 mm in size for every square metre, averaged across the total area of the slab. |

## Specification and Production of Concrete Surface Finishes

NZS 3114, which was revised in 1987, provides the format which enables the statement of the concrete finishing requirements of the specifier to be translated, through contract documentation, to the contractor. The standard is divided into three parts:

1. Off-the-form surfaces.
2. Exposed aggregate surfaces.
3. Floors, exterior pavements and inverts.

**Table 1 Summary of specification requirements for formed finishes.**

|    |  |   | Surface Plane Variation          |             |              | Colour        |               |         |             |               |                         | Physical Irregularities |                     |                  |          |                |           |          |          |                     |        | Surface Dressings |  |  |
|----|--|---|----------------------------------|-------------|--------------|---------------|---------------|---------|-------------|---------------|-------------------------|-------------------------|---------------------|------------------|----------|----------------|-----------|----------|----------|---------------------|--------|-------------------|--|--|
|    |  |   | Sample reference panels required | Abrupt (mm) | Gradual (mm) | Discoloration | Contamination | Dusting | Retardation | Efflorescence | Acceptable Shade Range* | Blowhole Limits         | Formwork Deflection | Grout Loss/Scour | Form Tie | Sheet Location | Scabbling | Chipping | Spalling | Filling Composition | Method | Action            |  |  |
| F6 | Surface of high importance. Alignment, appearance very important.        | Architectural or feature panels. High velocity water channels.                                    | R                                | 1<br>3      | 4            | P             | P             | P       | P           | P             | *                       | 2                       | 2 mm<br>1/360       | E                | A        | A              | P         | P        | P        | S                   | A      | A                 |  |  |
| F5 | Structural surfaces of importance. Frequent close scrutiny.              | Walls, panels, columns, beams, piers, soffits, parapets, railings, offices, foyers, public areas. | R                                | 3           | 6            | P             | P             | P       | P           | P             | *                       | 3                       | 3 mm<br>1/270       | P                | A        | A              | P         | P        | P        | S                   | A      |                   |  |  |
| F4 | Structural surfaces of moderate importance observed frequently.          | Walls, panels, columns, in secondary areas (e.g. basements, car parks).                           | R                                | 4           | 6            | P             | P             | P       | P           | P             | *                       | 4                       | 3 mm<br>1/270       | P                | A        | A              | P         | P        | P        | S                   | A      |                   |  |  |
| F3 | Exposed surfaces not subjected to close scrutiny.                        | Building and engineering structures viewed from afar.   |                                  | 6           | 6            |               |               | P       |             | P             |                         | 5                       |                     | P                |          |                | P         | P        | P        |                     | A      |                   |  |  |
| F2 | Keying surfaces for plaster and other thick coatings.                    | Interior and exterior surfaces to be coated.  |                                  | 6           | 6            |               |               | P       |             | P             |                         | 7                       |                     |                  |          |                |           |          |          |                     |        |                   |  |  |
| F1 | Roughness permitted: Fill tieholes, defects. Colour variation permitted. | Concealed surfaces. Foundations, lined walls, upstream dam surfaces.                              |                                  |             |              |               |               |         |             |               |                         | 7                       |                     |                  |          |                |           |          |          |                     |        |                   |  |  |

R = Required

S = Specifier to Stipulate

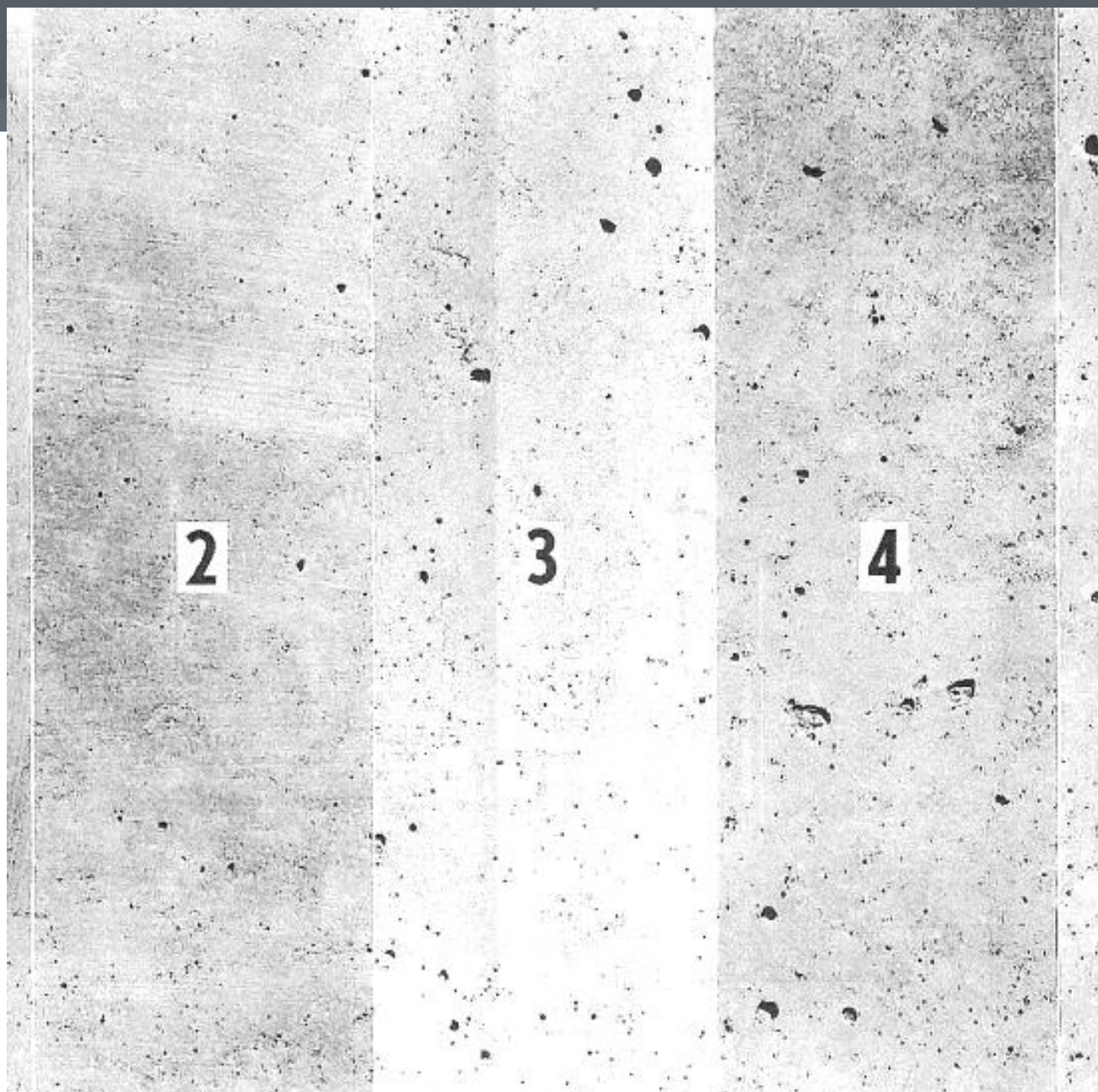
P = Precautions to Minimise Effects

E = Prevent Occurrence

A = Approval Required

\* If specified shade range required, the finish must be designated with X suffix.





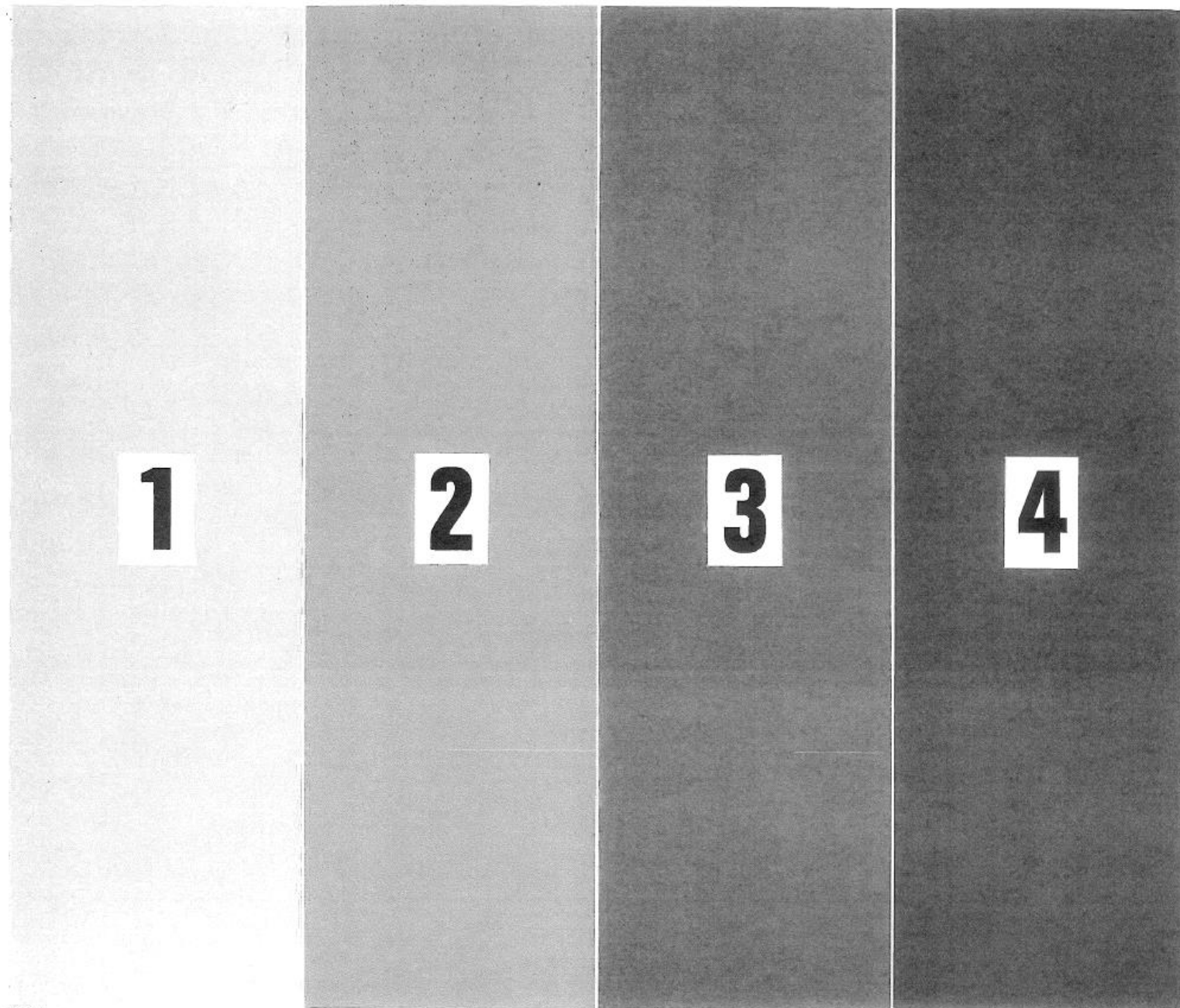


Fig. 24  
GREY SCALE



## 104.4 Sample reference panels

### 104.4.1.3

The sample panels shall:

- (a) Be cast in the same orientation as the finished work is to be cast
- (b) Be cast in formwork equal in all respects to that to be used in the finished work
- (c) Be cast using the specified concrete mix for the finished work
- (d) Be compacted using vibration methods to be used in the work and shall incorporate reinforcement similar to the proposed construction
- (e) Have formwork struck at an agreed time after casting consistent with proposed work practice
- (f) Be cured by a specific method for a specified period of time, all as consistent with the proposed work practice
- (g) Include any rebates required, features, joints between sheeting materials, construction joints and treatment at the hole positions.



#### 104.4.1.5

If the sample panels, when viewed at a distance of 3 m, are truly representative of the finish specified, and the constructor considers that finish capable of being produced they shall be used as an agreed standard between the parties before permanent construction commences. As such, they shall also be used for assessing compliance of the finish on matters not covered by 104.2 and 104.3.