

Integrally Colored Concrete

How to Achieve Consistency

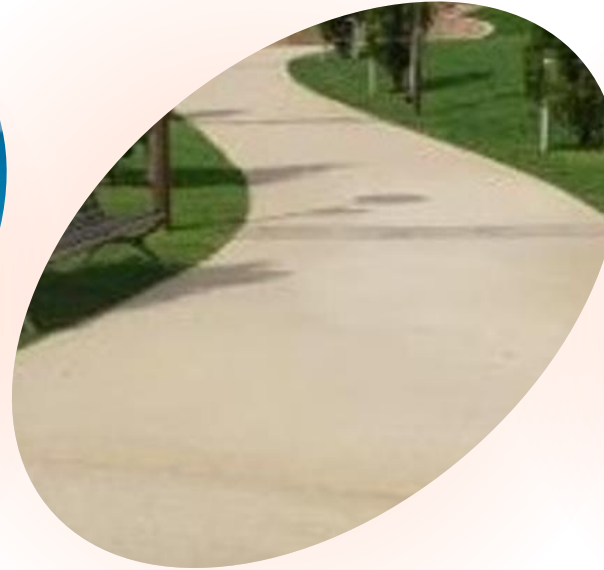
Chryso is a global leader in construction chemicals, developing innovative solutions and services for sustainable construction



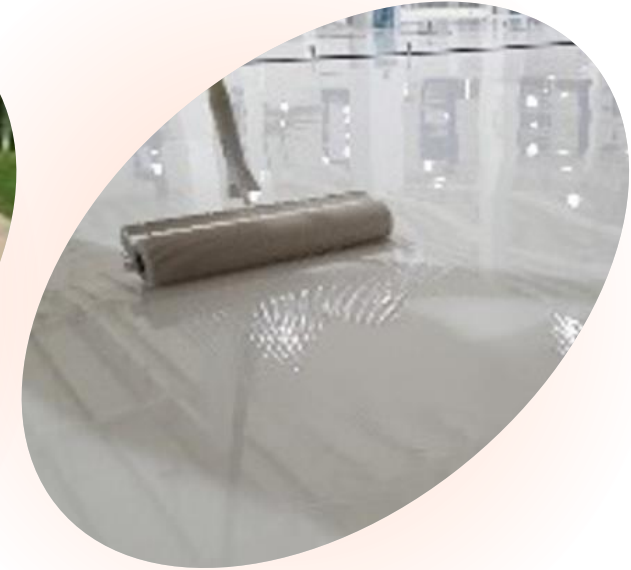
**Concrete Admixtures,
Fibers, and Releasing
Agents**



Cement Additives



Decorative Concrete



**Flooring Screed and
Slab**



**8 Applicative Labs and
2 Innovation Centers**



**200+ Years of Experience
in Tech Services**

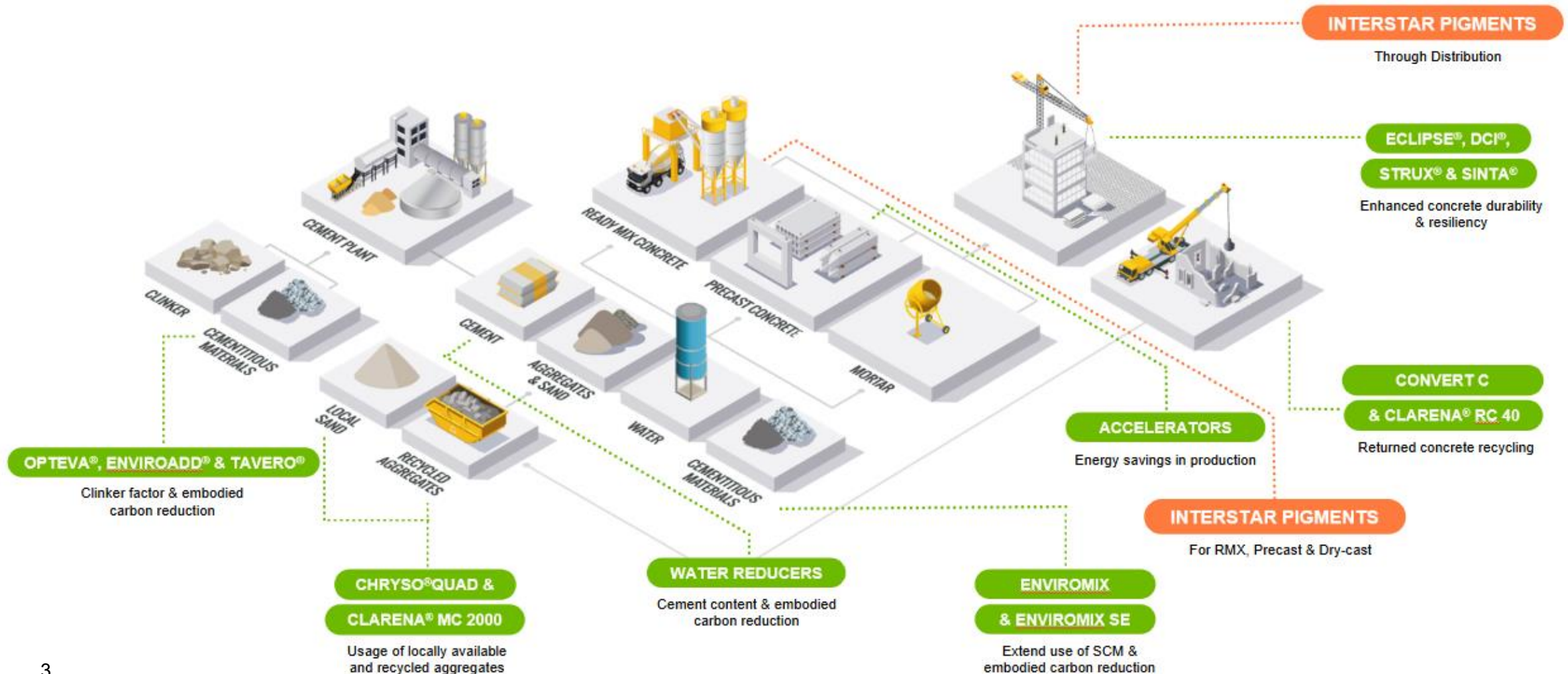


**Over 500 Employees in
North America**

**Part of Saint-Gobain,
born from the merger of
GCP and Chryso**

Strong & Differentiating Solution Offer

Cement Production – Concrete Production – Construction/demolition



Interstar is a leading North American manufacturer in high-performance pigments



INTERSTAR

Pioneered Granular Color for ready mix, MCP and precast applications with proprietary granulation and binder process



30+ years as a global player in decorative concrete, recognized for outstanding customer service and premium offerings

Automated dispensing: creator of Granastar, the first truly automated, reliable granular dispenser



Quality: Industry leaders in quality control standards

Sustainability

Zero-discharge facility: no by-products from the manufacturing processes released into the atmosphere

Utilizes **air filtration systems** that collect dust created from the manufacturing of pigment

100% of our iron oxide pigment waste is **recycled**



Part of Saint-Gobain Construction Chemicals since August 2025

Agenda

01 Basic of Color
Pigments and types

02 L, a, b
Its Importance

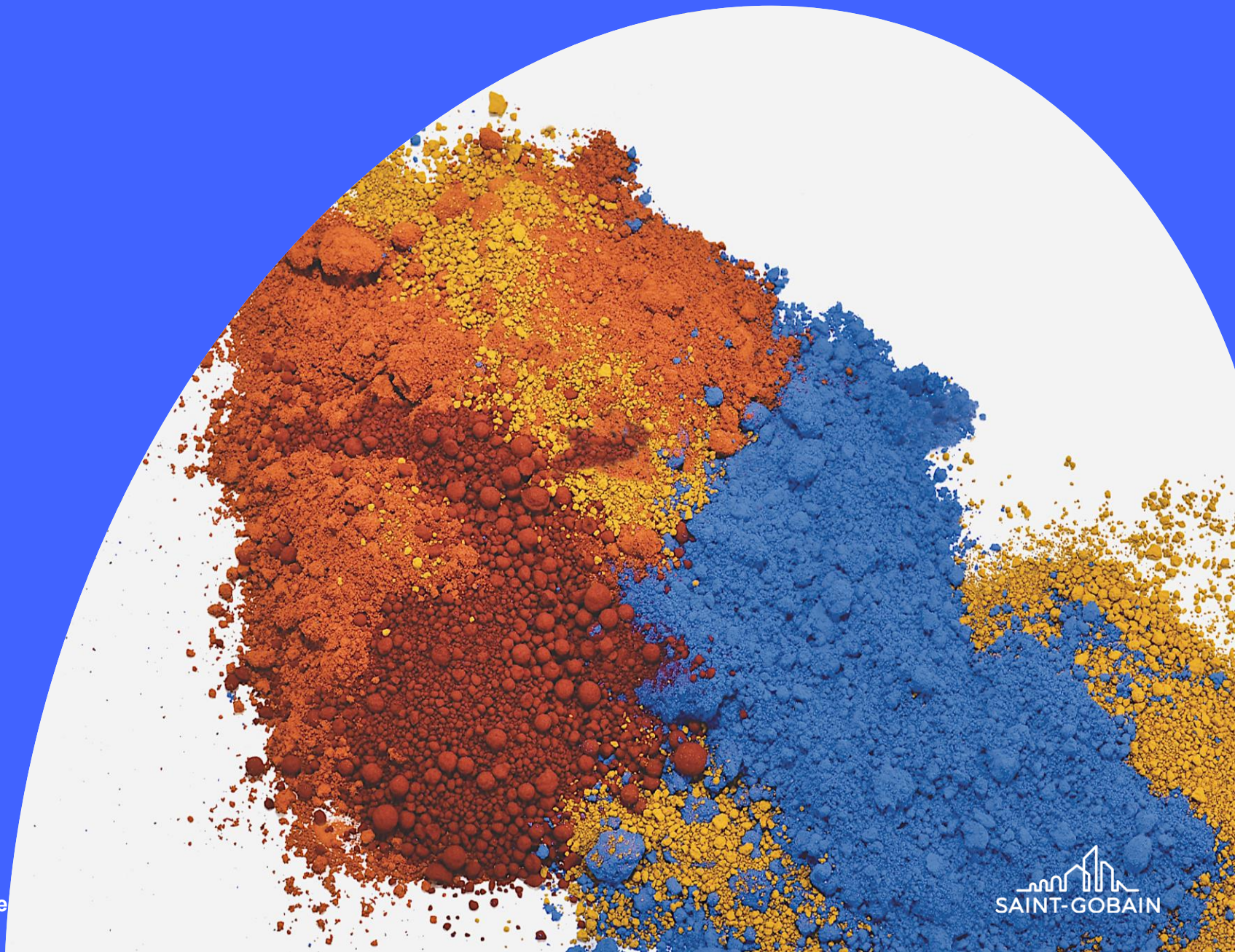
03 What Affects Color
One guess!

04 Troubleshooting
And Best Practices

05 Conclusions
Where to use

01

Basics of Color



Integrally Colored Concrete

Introduction

Common Uses

- Decorative & Architectural Designs
- Safety & Utility Designation
- Paving (drive throughs, ingress & egress, parking spaces)

Why the rise in integrally colored concrete?

- Offers the same durability and functionality as concrete but gives aesthetically pleasing characteristics
- Uniform color throughout gives more uniformity and versatility
- Cost effective and more durable than alternatives
- Decorative finishers are more confident in their ability and the process

DEFINITION

Integral color in concrete is the addition of pigments to create a uniform color throughout

Iron Oxides

Overview



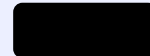
VAST MAJORITY OF COLOR IN THE CONCRETE INDUSTRY IS MADE WITH IRON OXIDES

- Natural Iron Oxides are mined
- Synthetic IOs are produced through chemical reactions and the most common iron oxide you will find in the market
 - They offer higher tinting capabilities than natural iron oxides



4 PRIMARY COLORS THAT CAN BE BLENDED TO CREATE COUNTLESS VARIATIONS IN "EARTHTONE COLORS"

Black



Yellow



Blue-Red



Yellow-Red



- Synthetic Iron Oxides are resistant to UV rays (color fast) so when properly maintained the color can last for the same duration as the concrete.
- There are also a variety of other synthetically produced pigments that can color concrete integrally, such as titanium dioxide (white), chromium oxides (green), and cobalts (blue).
- The combination, alongside the base colors, make up the full color spectrum.

When reviewing color manufacturers make sure their product conform to ASTM C979, *Standard Specification for Pigments for Integrally Colored Concrete*

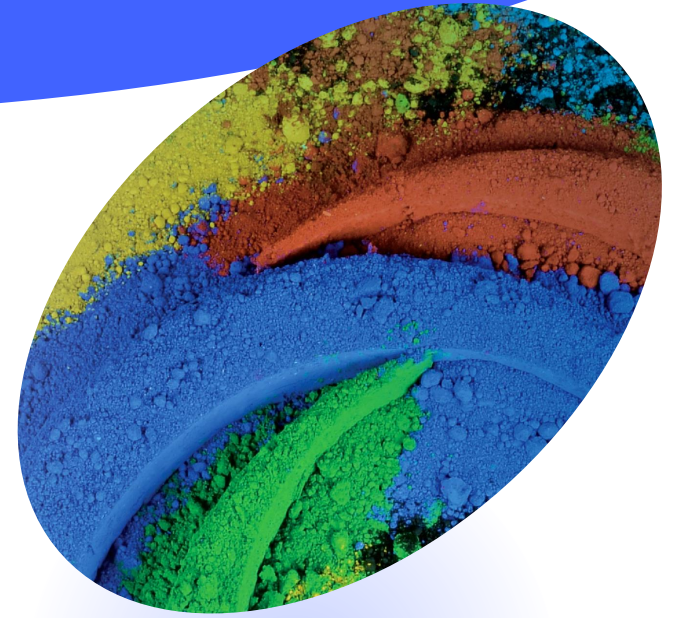
Pigment Options



Powder



Liquid



Granular

Powder Color

Pros

- Mobile, good for small quantity
- No Dispensers
- Specialty colors (blues/greens/purples/white etc.)

Cons

- Costly (material & labor)
- Safety (climbing onto trucks)
- Excess Inventory
- Little Flexibility
- Long Lead Times
- Messy & Dusty



Liquid Color

Pros

- Flowable
- Adjustable to Total Cementitious Material
- Easily integrates into truck
- Just in Time Color Inventory

Cons

- IO's can settle in water over time
- Concrete mix adjustment to compensate for additional water
- Messy
- Can freeze in cold conditions
- Dispensers require continuous maintenance
- Spill response VERY intense
- Dispenser unit uses plant resources while not in use



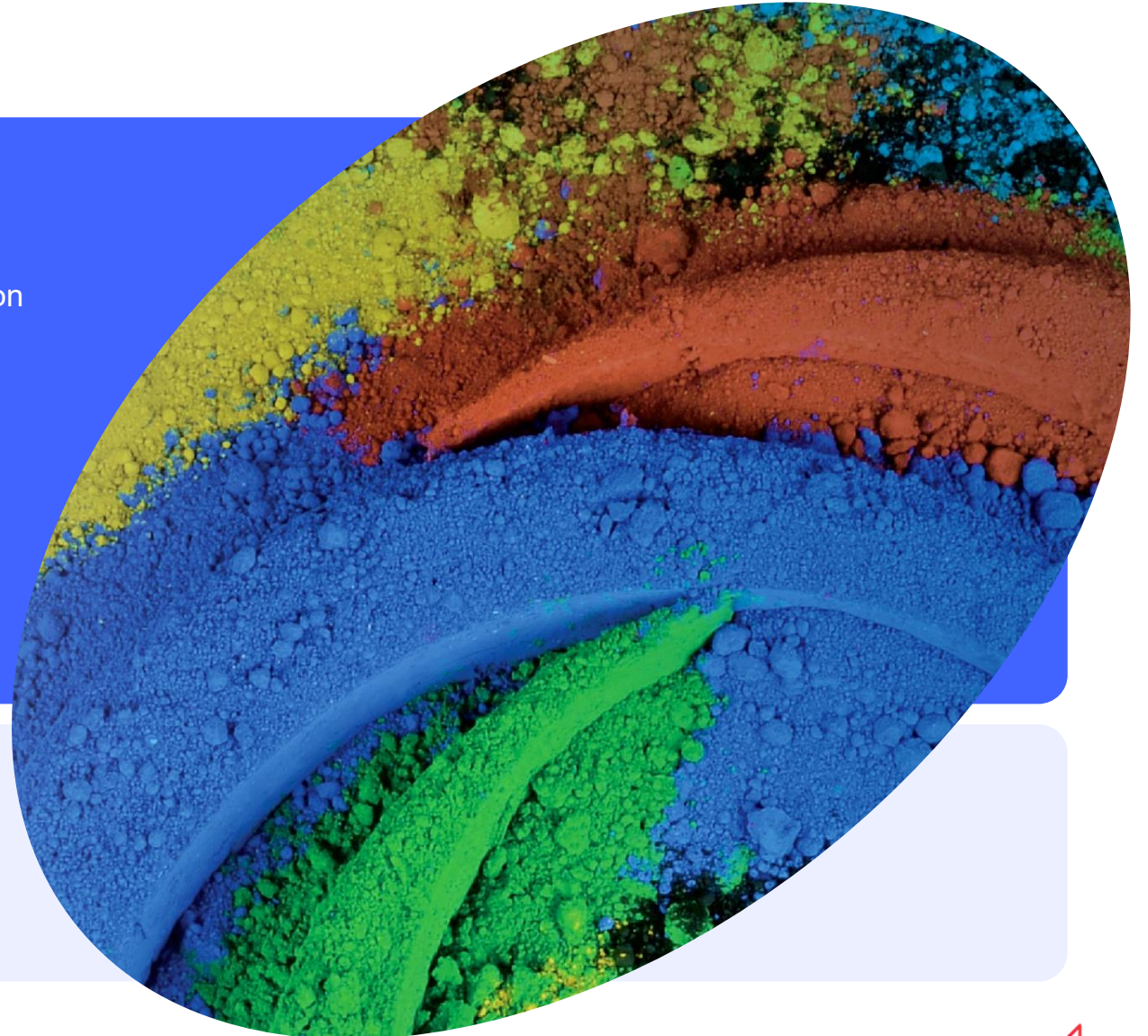
Granular Color

Pros

- Free flowing, reliable
- Doesn't freeze
- Dispensers used for multiple plants in region
- Non-toxic
- No totes sitting around the yard
- Easy clean up
- Dispenser ready to go at any time
– even winter
- No water! Freight advantage
vs. liquid color

Cons

- No exotic colors (blue, green, white,
etc.) available in granular form
(powder only)



02

L, a, b: What it Means



Explanation of the L, a, b Color Scale

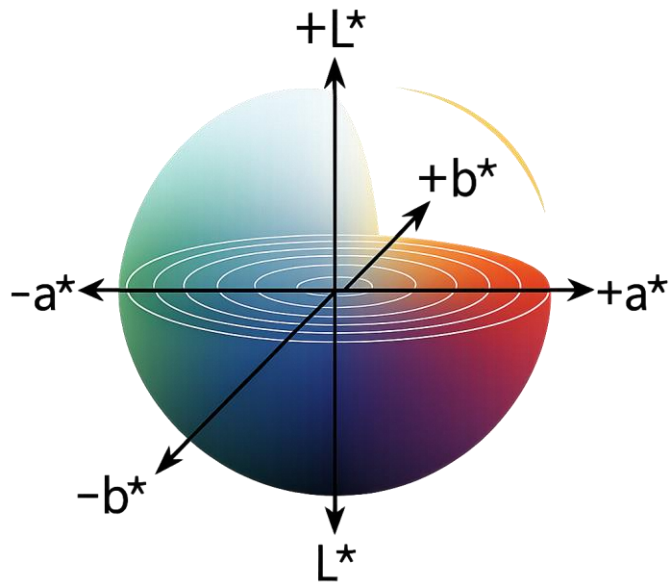


Image Credit: <https://www.hunterlab.com/en/blog/what-is-cielab-color-space/>

A color's location is its position in a three-dimensional coordinate system where:

- **L*** determines whether a sample is bright (high L*) or dark (low L*).
- **a*** and **b*** indicates the sample's chromaticity (hue and chroma).
 - **a*** = red to green (+a = redder, -a = greener).
 - **b*** = yellow to blue (+b = yellower, -b = bluer).
- The intersection of the three "color" axes yields neutral gray
- ΔE = difference between the reference L, a, b

Role of L, a, B in Color Specification for Concrete



Purpose of L, a, b System

L, a, b color space enables precise color specification for concrete, improving communication between manufacturers and clients.



Ensuring Color Uniformity

Using L, a, b helps maintain consistent color across different concrete batches, enhancing product quality and customer satisfaction.

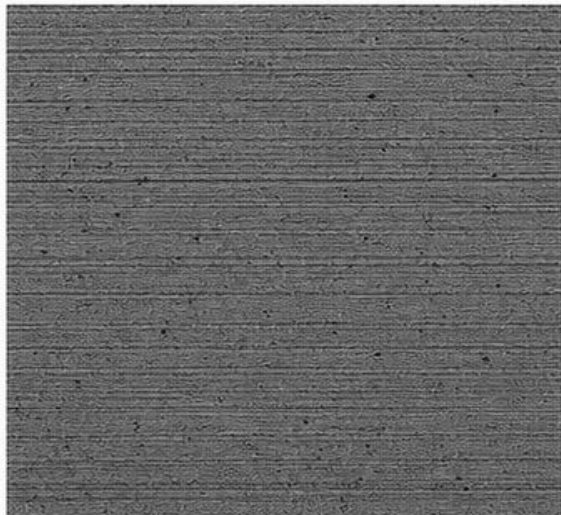
Delta E Comparison – Concrete Color Swatches

Same base concrete color with controlled color differences

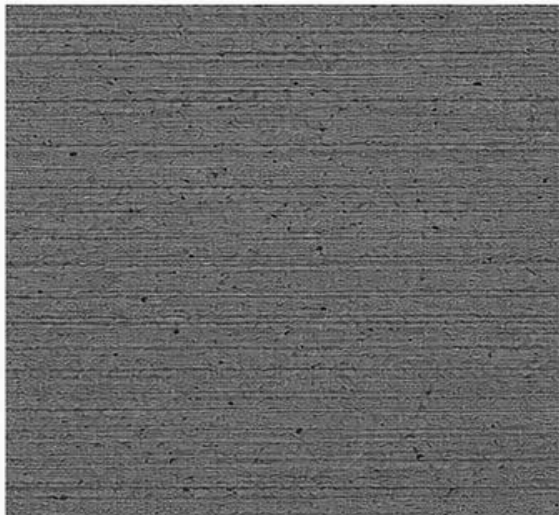
ΔE 0.5

Very small difference

Barely perceptible



Base Color



ΔE 0.5

L*, a*, b*:
42.35, 0.20, 0.10

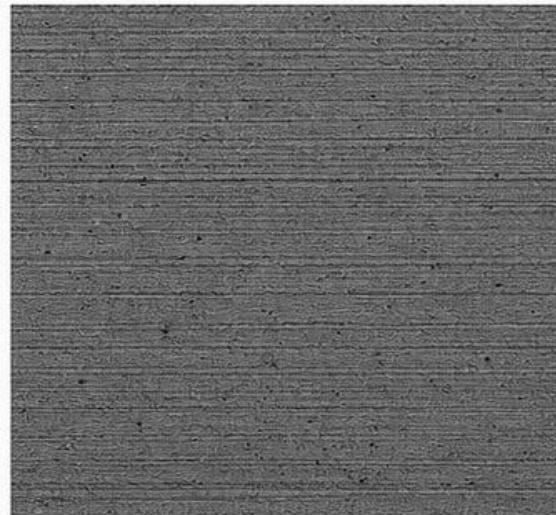
L*, a*, b*:
42.61, 0.53, 0.41

$\Delta E = 0.50$

ΔE 2.0

Noticeable difference

Easily visible



Base Color



ΔE 2.0

L*, a*, b*:
42.35, 0.20, 0.10

L*, a*, b*:
43.59, 1.97, -1.10

$\Delta E = 2.00$

ΔE (Delta E) quantifies the perceived color difference between two colors.

As a general guide: $\Delta E \leq 0.5$ = imperceptible | $\Delta E 1.0-2.0$ = slight difference | $\Delta E \geq 2.0$ = noticeable

Benefits of Using the L, a, b Scale for Color Consistency

Objective Color Evaluation

The L, a, b scale enables precise and *objective* measurement of colors, minimizing *subjective* interpretation.

Reduced Color Variability

Using the scale reduces color inconsistencies, ensuring uniformity across different batches and applications.

Improved Customer Satisfaction

Consistent integral color results lead to higher customer satisfaction and trust in product quality.

03

What Affects Color?



ambient temperatures **water content**
finishing techniques **pigment**
scms coarse aggregates
coarse aggregates **fine aggregates**
aggregates **cement**
curing sealing **pigment loading**
placement techniques pigment type
admixtures



Key Terms in Concrete



Essential Ingredients

Cement, aggregate, and water content are the fundamental components of concrete, determining its basic properties and performance.



Pigments and SCMs

Pigment type, pigment loading, and SCMs influence concrete color, texture, and sustainability, playing a vital role in technology advancements.



Mixing, Placement, and Curing

Proper mixing and placement methods, along with correct curing, are crucial for achieving durability and optimal strength in concrete.

Material Variables: Cement Type, Aggregates, Water/Cement Ratio

Cement Type Effects



Different cement types influence the final color and strength characteristics of concrete mixes.

Aggregate Composition



The type and color of aggregates affect the texture and hue intensity of integral concrete color.

Water-to-Cement Ratio



Adjusting the water-to-cement ratio changes the concrete's color depth and uniformity.

Mixing Process and Pigment Dispersion



Uniform Pigment Distribution

Achieving even pigment dispersion during mixing is essential for consistent color in concrete.



Importance of Proper Mixing

Proper mixing techniques prevent color variations and ensure homogeneity throughout the concrete mass.

What happens when you don't follow proper/enough mixing

Curing, Finishing, and Environmental Influences

Curing Methods Impact



Different curing methods influence the strength and color consistency of colored concrete surfaces.

Finishing Techniques



Finishing techniques determine the texture and visual appeal of the colored concrete surface.

Environmental Conditions



Temperature and humidity during curing affect the durability and color of concrete.

04

Troubleshooting/ Best Practices

Guidelines for Mix Design and Batching



Mix Formulation Best Practices

Careful selection and proportioning of ingredients ensure consistent color and quality in the final mix.



Batching Process Control

Precise control of batching processes maintains uniformity and desired color performance in production.



Effect of Materials and Finish

Target Selection



Broom



Sandblast



Troweled

Cementitious Color



White

Light Gray

Dark Gray

Aggregate Color



White

Light

Dark

Aggregate Size



Small

Medium

Large

Water



Correct

Excess

General Recommendations for Colored Concrete

01 | Set Expectations

- Concrete in-place will not match the color chart/chip
 - Place sample panels!
- Meet call with owner contractor to discuss expectations
- Are specifications consistent with decorative finish

02

02 | Plan and Prepare

- Avoid extreme temperatures
- Properly prepare substrate
- Prevent delays by ensuring proper curing conditions
- Plan joints and consider visual appearance

This sample was prepared under laboratory conditions by our company personnel and is intended to be an approximation of the color and/or finish expected for initial selection purposes. It is not intended to represent the actual, field-cast concrete and will vary from it based on a variety of environmental, material and production factors including, but not limited to: temperature; precipitation; natural variation in constituent material colors, sizes and distribution; contractor handling, placement, finishing and curing practices.

We recommend an actual, on-site placement arranged by your contractor to confirm the final selection. Concrete is composed of natural materials;

stone, sand cement etc. which all have the potential for variation over time and exact duplication of any product is not guaranteed. Local aggregate sources frequently contain some ferrous minerals which could result in some surface staining under certain conditions.

05 | Cure and Seal

- Don't add water to the surface
 - Do not cure with plastic sheeting
- Curing & sealing products for colored concrete
Follow manufacturer's recommendations

03 | Finish

- Use consistent with colored concrete
- Use brooms
- To dissipate
- Finish
- Deposit concrete close to final position

Finish Concerns



No Wet Brooms

Brooms can be dampened but excess water and concrete must be removed before the next pass.



No Plastic in Contact

Plastic sheeting will leave permanent marks on the surface. Plastic tenting can also result in condensation and dripping water from above.



Visual Break

Consider a visual break between loads if possible. This can lessen the perception of color variation.



No Calcium Chloride

Calcium Chloride accelerators change the reaction of cement compounds and it can be difficult to properly disperse. This may result in dark splotches that are particularly offensive in colored concrete.

Onsite Practices and Aftercare Recommendations

Onsite Handling Procedures

Careful onsite handling ensures materials maintain their color quality and structural integrity during application.

Curing Process Importance

Proper curing techniques are crucial for enhancing durability and preserving the original color of materials.

Maintenance Protocols

Regular maintenance protects color vibrancy and extends the lifespan of applied materials.

05

Conclusions



Architectural and Decorative Uses



Enhancing Architectural Design

Integral color adds vibrant hues that enrich and complement architectural concrete features.



Durable Decorative Surfaces

Integral color ensures long-lasting color retention for concrete elements exposed to wear and weather.



Infrastructure and Urban Design

Use of Colored Concrete

Colored concrete enhances the visual appeal and design of urban infrastructure projects.

Urban Aesthetics Improvement

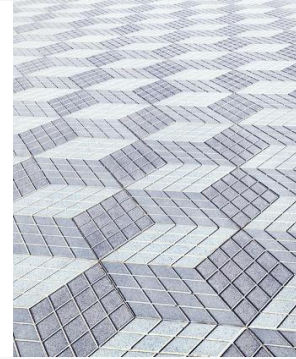
Applying colored concrete improves the look and feel of pavements and public spaces, contributing to urban beauty.

Functional Benefits

Colored concrete also contributes to durability and functionality in urban infrastructure applications.

Residential, Commercial, and Industrial Applications

Residential Uses



Integrally colored concrete enhance residential patios with durability and attractive visual appeal, improving outdoor living spaces.

Commercial Flooring



Integrally colored concrete provide vibrant and long-lasting commercial flooring solutions that withstand heavy foot traffic.

Industrial Walkways



Integrally colored concrete are used in industrial walkways for enhanced durability and safety with visually clear surfaces.

Final Thoughts

- Integral color gives architectural aesthetics at a minor cost, throughout the entire concrete body
- Color opportunities are everywhere within the RMC landscape
- Multiple factors affect final concrete color
- **Curing integrally colored concrete is necessary!**
- **Mock-ups are required**
- Manage expectations
- Reach out for any questions



Thank You

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