Nawkaw®

ARCHITECTURAL FINISHES INSPIRED BY **ART & SCIENCE**

(AIA CES COURSE #NAW2020)

The Transformational Power of Concrete Stain

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Coloring Concrete with Stain

Learning Objectives

I. The Science of Stain: Understanding Advantages Over Traditional Coatings

II. Color Theory: Understanding Tolerances and Color Spaces

III. Staining Preparation and Process

IV. Color Equalization: Concrete Correction

V. Stain in Action: Architectural Finishes & Concrete Stain At Work

Paint vs. Stain

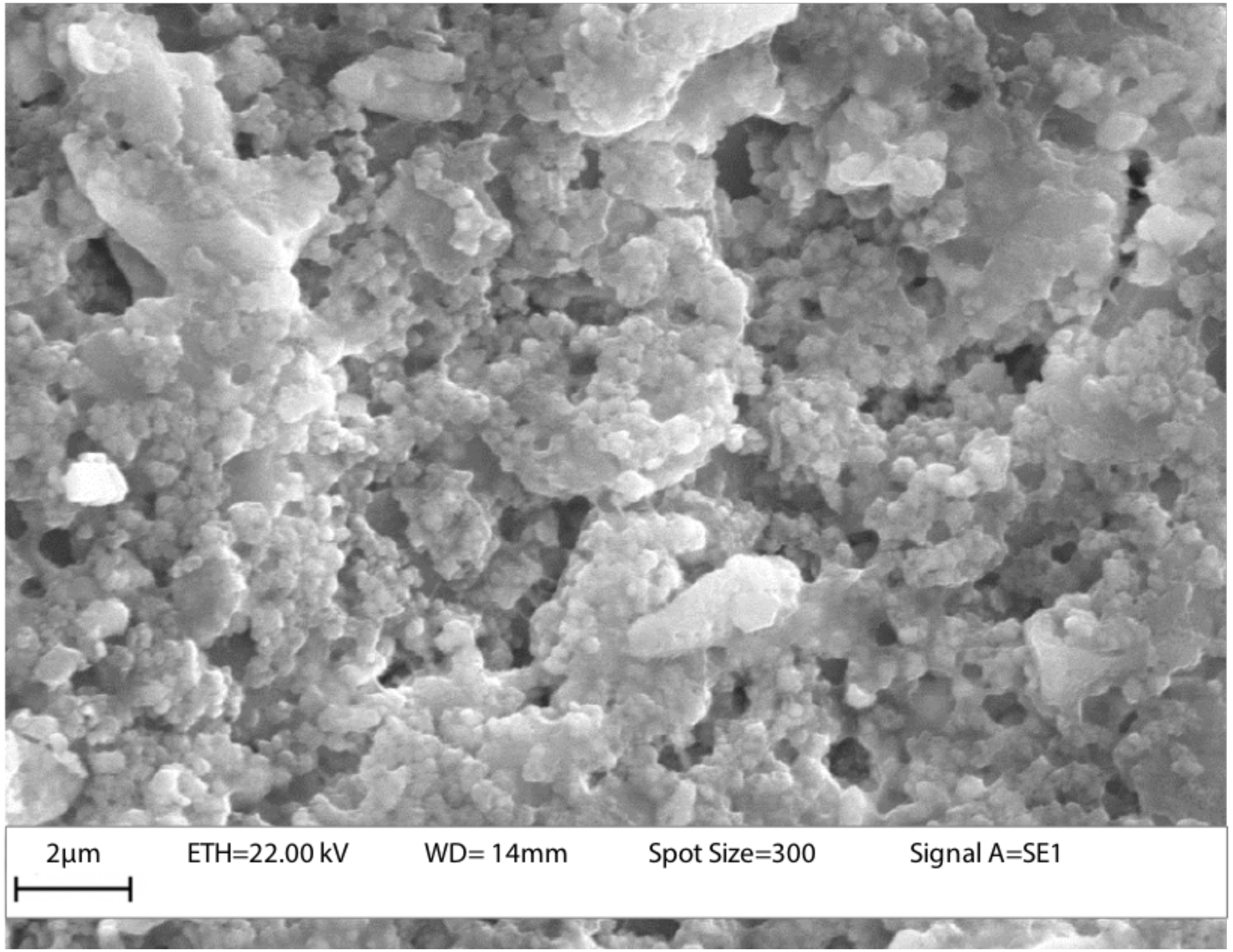
Paint

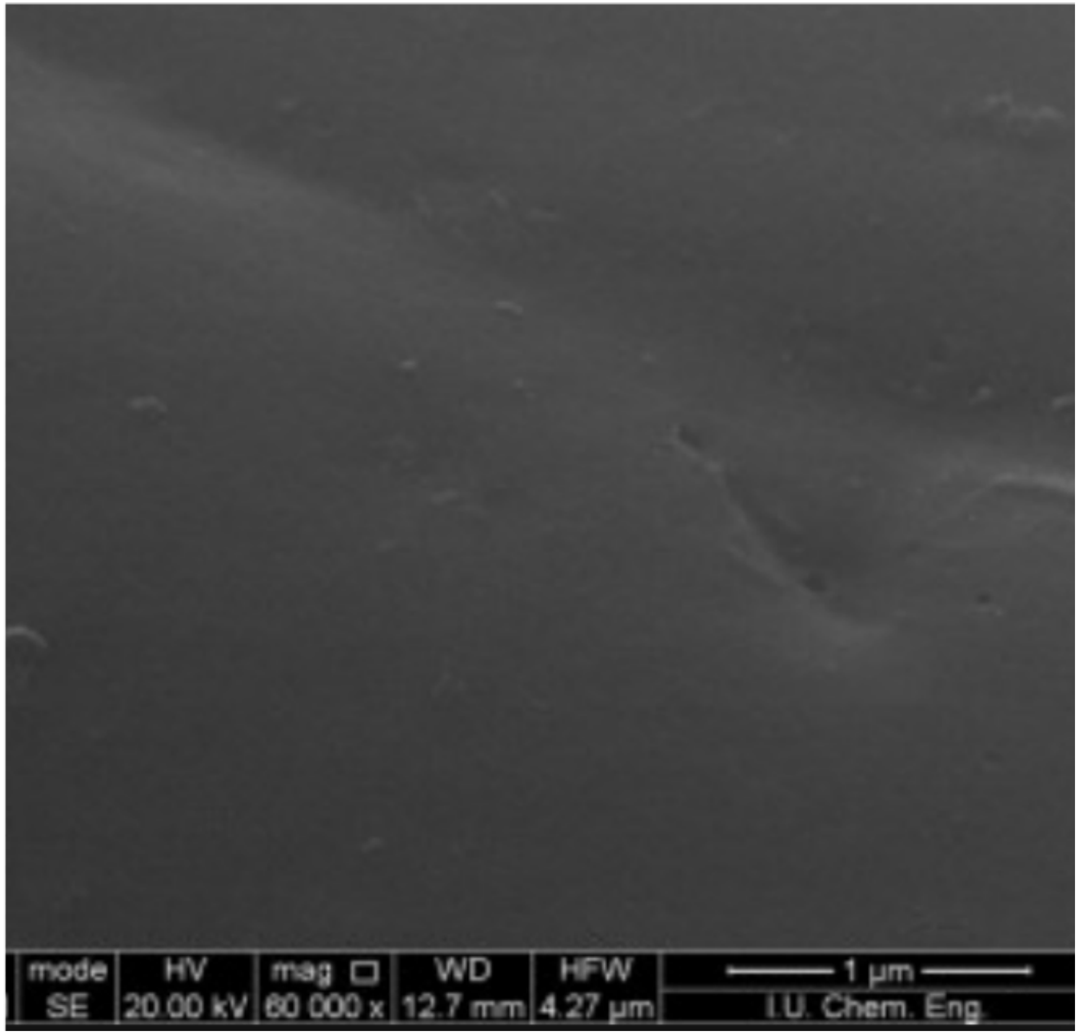
Paint sits **on top of** the porous concrete surface--trapping air, dirt, water, and other debris between the surface of the concrete and the paint itself. These imperfections expand over time, often resulting in chipped or cracked paint. Simultaneously, exposure to the elements often fades the color painted to the building. Both inherent disadvantages of paint mean that concrete must be repainted several times; often exacerbating the problem.

Stain

Many stains **bond with** the underlying concrete and form strong bonds with the porous material. This bond may also be chemical, resulting in no functional distinction between the stain and the underlying concrete. With no entrapment of air, dirt, water, or other debris, properly applied mineral stain will not crack or peel. The quality of stain pigments also enable stain to retain colors far longer than paint, as well as provide UV resistance.

Cured Mineral Coating vs. Latex Coating





Permeability

Coating Breathability

WHY IS PERMEANCE IMPORTANT?

Permeance is critical when it comes to the prevention of water entering concrete surfaces. The table to the right shows the absorption and diffusion characteristics of both a high-quality latex coating and mineral stain.

With 490 grams per square meter per day absorbed by the latex coating system and 440 grams per square meter per day absorbed by the mineral stain.

However, at 21°C/69.8°F, the mineral stain allows 2100 grams of water to evaporate per square meter per day. The latex coating system allows just 95 grams of water per square meter per day to evaporate.

Drop the temperature down to to 11°C/51.8°F, and 90% of the moisture in the wall will remain at the end of the day.

ABSORPTION AND DIFFUSION CHARACTERISTICS

High-Quality Latex Coating vs. Mineral Stain

LATEX	MINERAL
Absorption W= 490 g /(m^2d)	Absorption W= 440 g /(m^2d)
Diffusion T=21 °C V= 95g /(m^2d)	Diffusion T=21 °C V=2100 g /(m^2d)
T=11 °C V= 50g /(m^2d)	T=11 °C V= 1100g /(m^2d)

*At the same temperature, mineral stain enables **4x more water to evaporate than was absorbed**!*

The Science Behind Staining

Components: High-Quality Stains

MINERAL PIGMENT

QUARTZ SAND

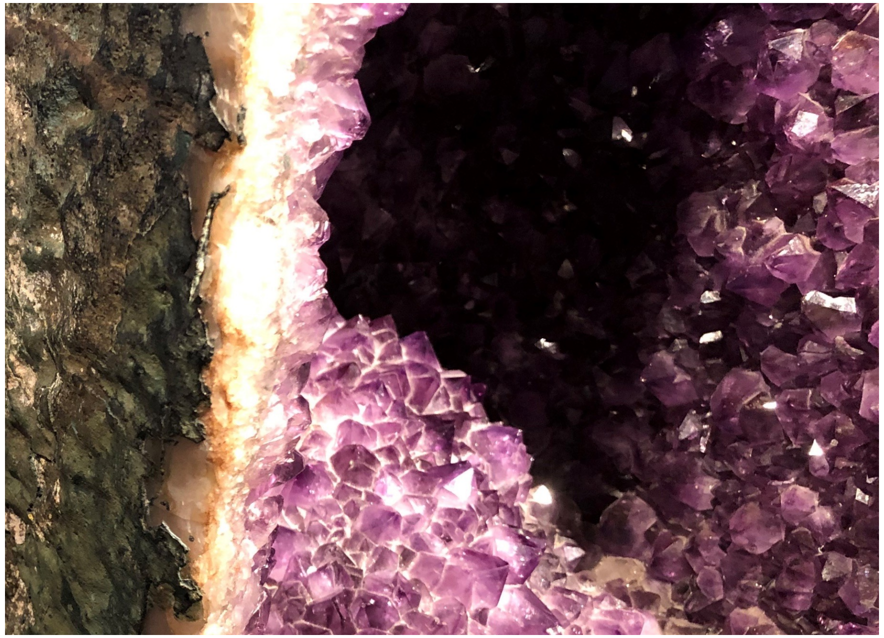
SILICATE BINDER

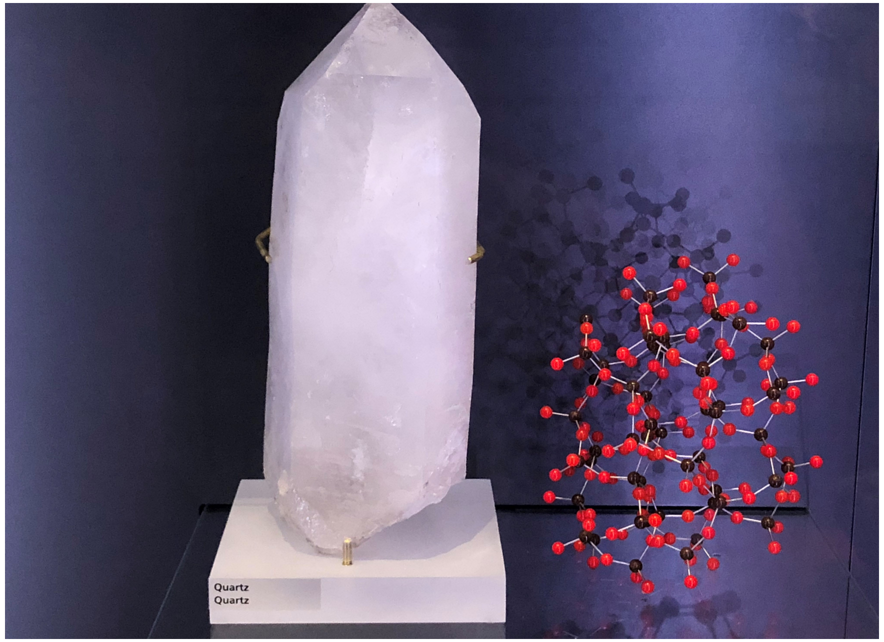
WATER

FILLERS

ADDITIVES

Quartz





Quartz Sand

Quartz sand, which can also be referred to as silicon dioxide, can be melted and combined with a silicate binder and other additives to form the basis of a crucial ingredient in mineral concrete stain: **Potassium Silicate.**

Effective mineral stains form chemical bonds with the surface, or substrate, that they are applied to. These stains then become a part of the substrate on a molecular level!

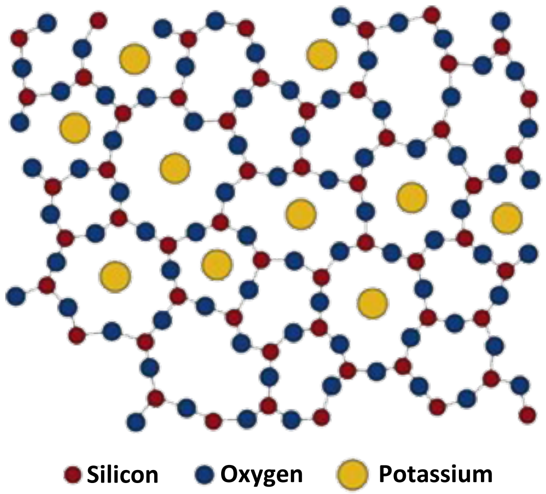
  

Potassium Silicate

Potassium Silicate

$K_2O(SiO_2)_4$

- Also called "water glass"
- Basis of silicate coatings
- Principal component of silicate stains and paints
- First used in 1879 for murals
- Produced from quartz sand, potassium carbonate and water



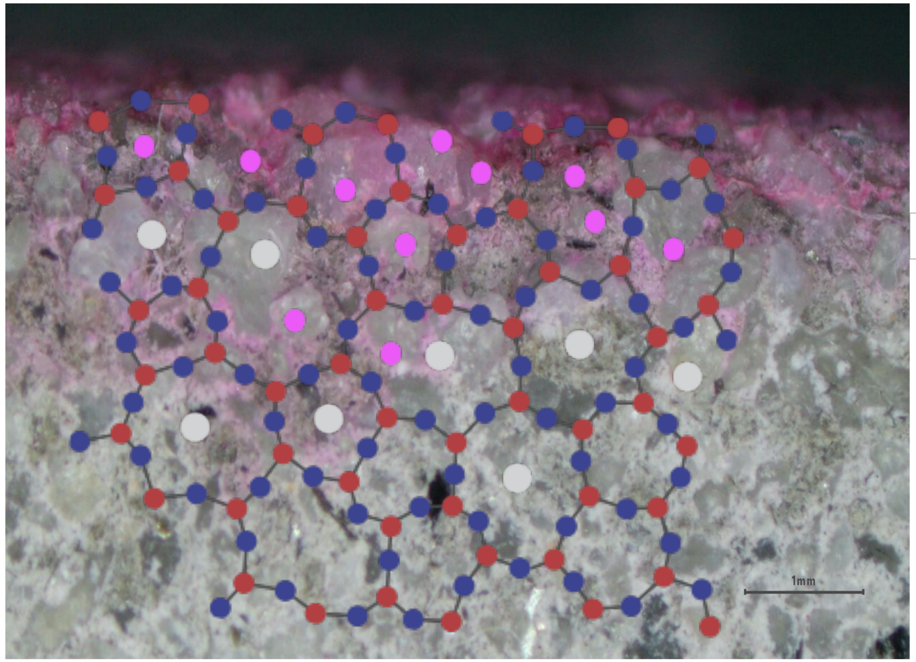
HOW WATERGLASS GETS ITS LOOK:

Silicon and oxygen atoms are covalently bonded and form ionic bonds with potassium cations. Those cations are irregularly positioned within the silicate network. Such chemical structure is responsible for the amorphic appearance of water glass.

Silicification

$$K_2O \times nSiO_2 + Ca(OH)_2 \longrightarrow CaO \times SiO_2 + (n-1)SiO_2 + 2KOH$$

$$2KOH \xrightarrow{+CO_2} K_2CO_3$$



CROSS SECTION VIEW – BINDER WITH DYE

PERFECT, UNSOLUBLE BONDING:

The silicification of the binder with a substrate results in unparalleled durability. Stains based on potassium silicate technology have **hundreds of years** of real-world applications that showcase and exemplify their durability, structural soundness, and imperviousness to pollution, acid rain, and severe weather patterns.

Water permeability of the coating also reduces damage from freezing temperatures. While standard coatings trap moisture and erode the substrate beneath, stain allows the underlying concrete to breathe.

Mineral Pigments

Natural Inorganic Pigments

- **Red Earths:** Mostly iron oxides (hematite, lepidocrocite, maghemite, and others)
- **Yellow Earths:** Silica, clay, iron oxides (limonite, goethite), and others
- **Green Earths:** Silica as well as glauconite and celadonite
- **Lapis Lazuli:** A complex mixture of deep blue lazurite with calcite or calcspar and iron pyrite
- **Azurite:** Greenish-blue crystals of copper carbonate
- **Malachite:** Green hydrous copper often found in surface deposits

INORGANIC VS. ORGANIC: WHAT'S THE DIFFERENCE?

The fundamental difference between an organic pigment and an inorganic pigment lies in the **presence of carbon.**

Carbon can be found in organic pigments, while inorganic pigments lack carbon in their chemical makeup.

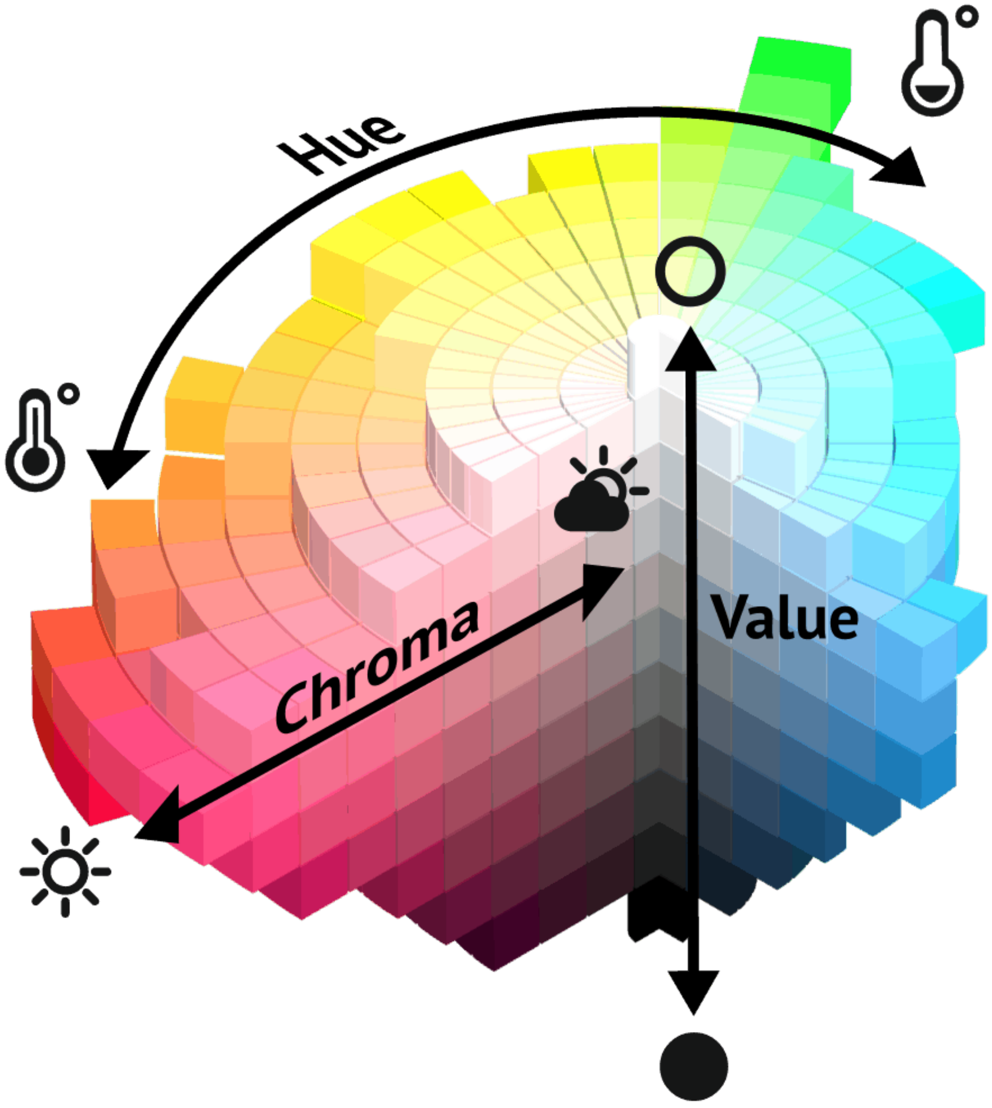
Color Theory

Color Theory

- Color Theory (also known as Color Science or Colorimetry) quantifies all visible shades of color into a color space.

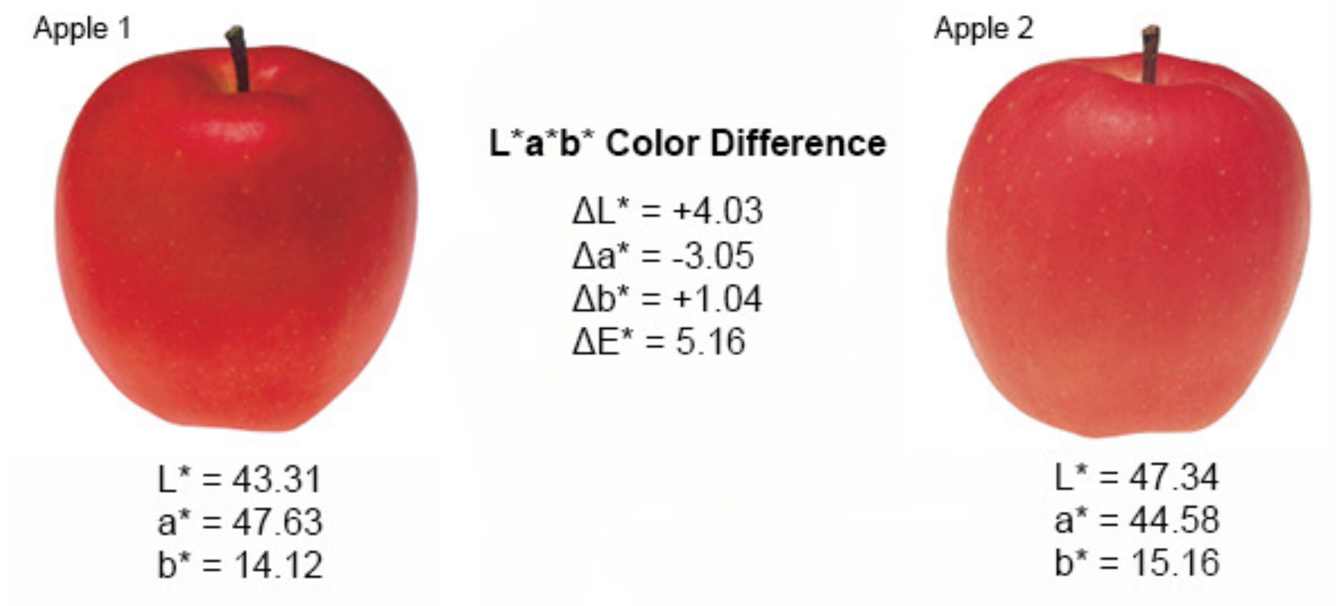
- One of the most popular color spaces is the Munsell color system, which assigns and specifies numbers for each color.

- In order to assign numbers, each color is broken down into 3 factors:
    - **Hue:** How an object's color is perceived (purple, red, orange, etc.)
    - **Chroma:** object's saturation (the intensity of the color)
    - **Value:** an object's lightness (how much black or white is in a color)



CIELAB Tolerancing

- The CIELAB tolerancing standard is expressed as a ΔE of 1. Anything below a ΔE of 1 is indiscernible to the human eye!
- Using the color scale and CIEL*a*b we can get the ratio of the 3 factors needed to recreate the color.

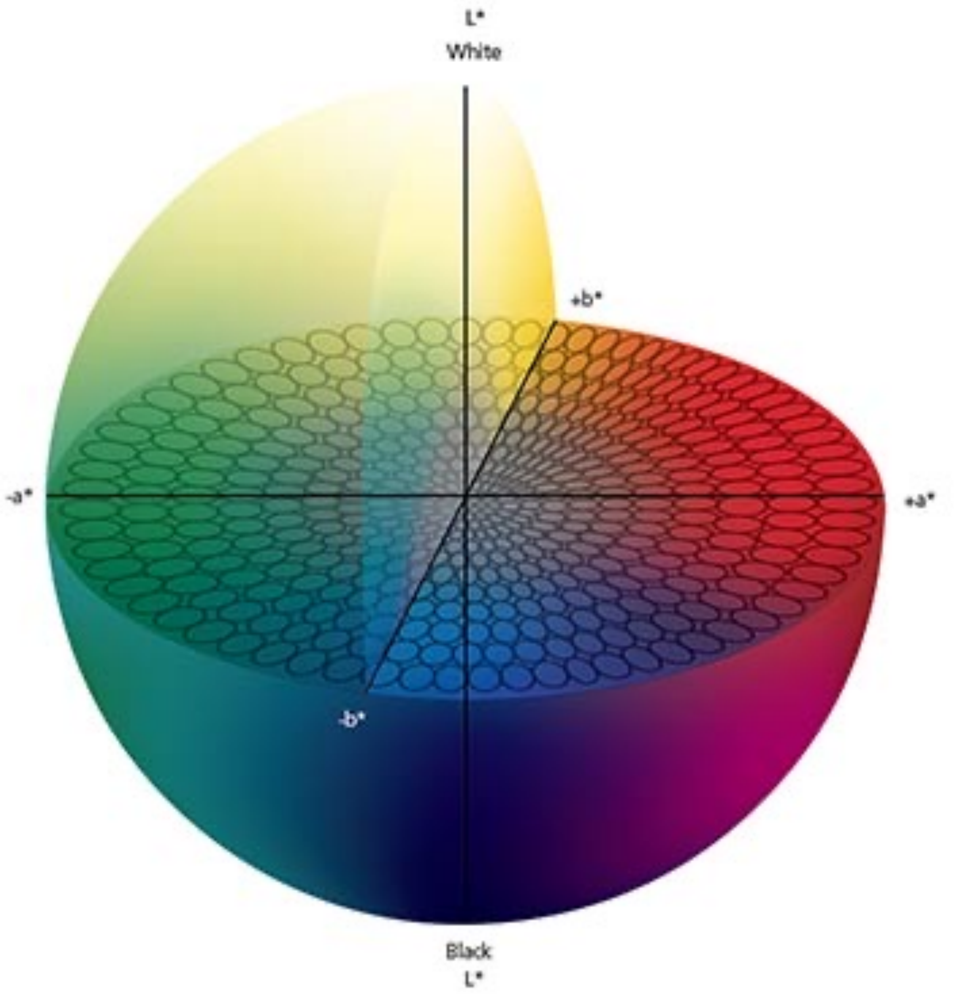


CMC Tolerancing

- A separate tolerance system used is **CMC tolerancing**, which combines lightness (value), chroma, and hue to represent tolerance through a single value: ΔE

- CMC calculations define an ellipsoid around a color; with that ellipsoid itself defining acceptable color variation. This ellipsoid's shape varies dependent upon its location in a color space.

- The CMC standard for the acceptable difference in color formulated and color needed is a ΔE of 2.



Surface Preparation

Preparing Concrete

- A hot water rinse is often the first step and is necessary to clear off all debris prior to stain application.
- Detergents and/or cleaning agents may be required for certain substrates.
- Precast concrete may require a light sandblasting or acid wash as well as the removal of wax and release agents.
- Tilt-up concrete must have wax and release agents removed prior to staining.

Staining Process

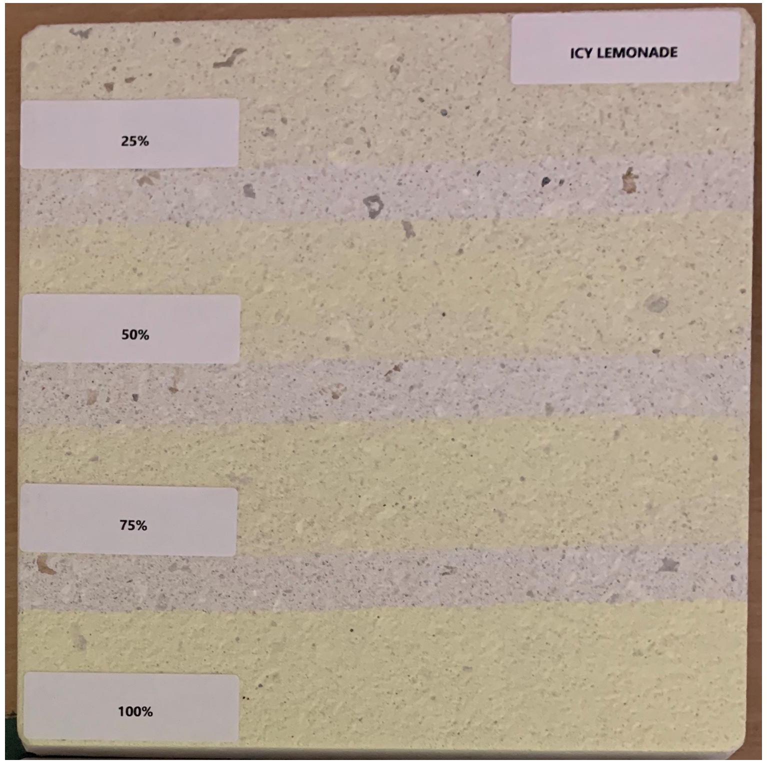
Tools of the Trade

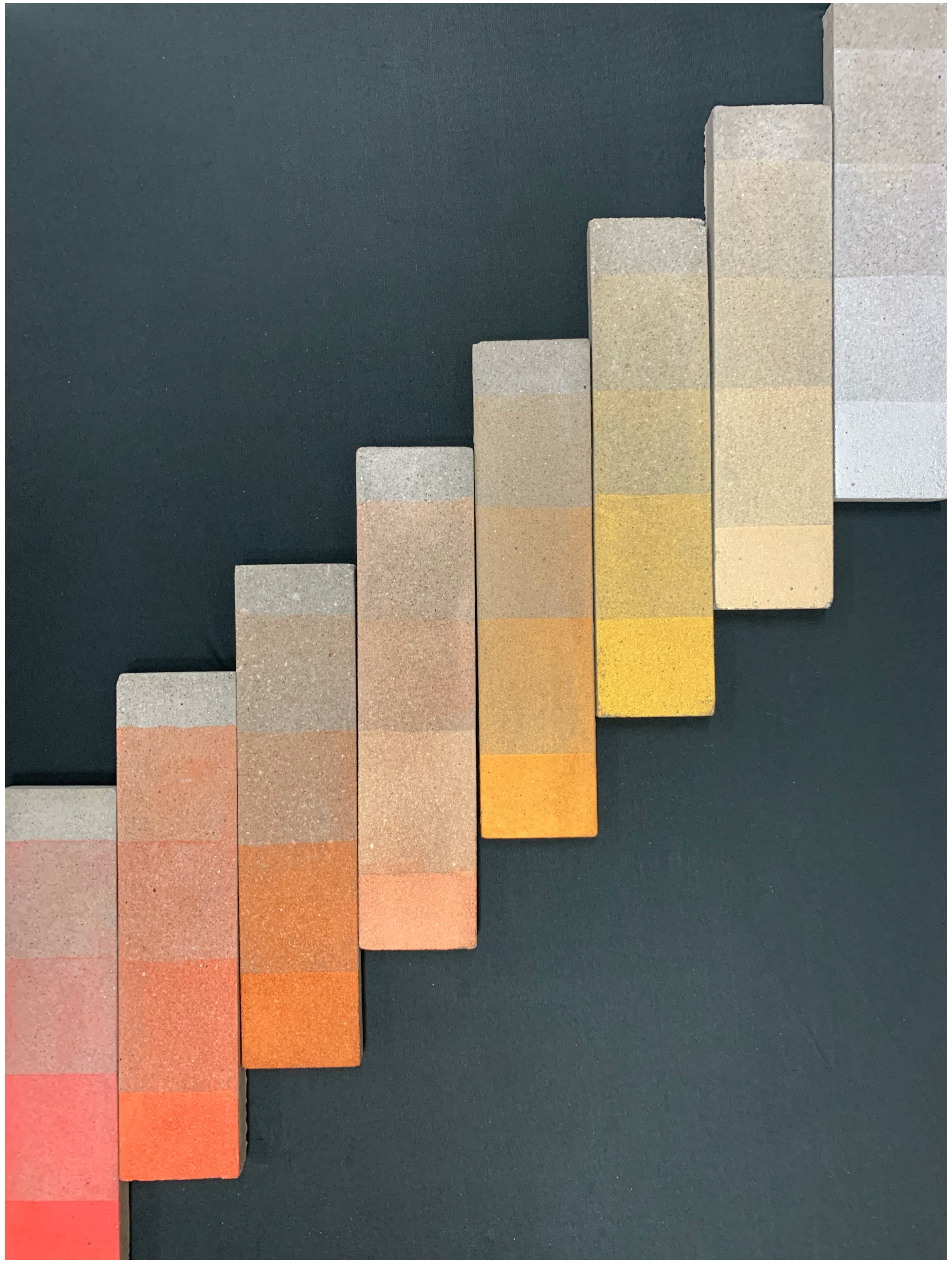
- Brushes
- Sponges
- Rollers
- Rags
- Splatter Techniques
- Sprayers

Coloring Techniques

Concrete stain may be diluted with thinning agents that do not disturb the chemical bond stain forms with the substrate, but adjust the opacity of the final color.

Varying levels of opacity enable applicators to reveal more or less of the substrate; **giving greater control over the final texture.**



Color Equalization

Correcting Concrete

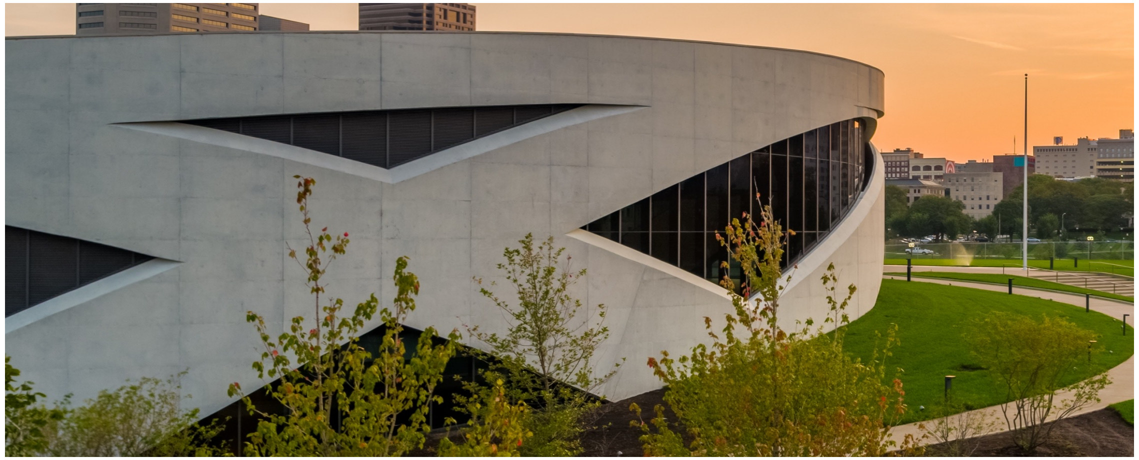
Inconsistencies in the color of concrete occur due to variations in curing times, construction equipment, and variations in the pouring procedure during long-term projects.

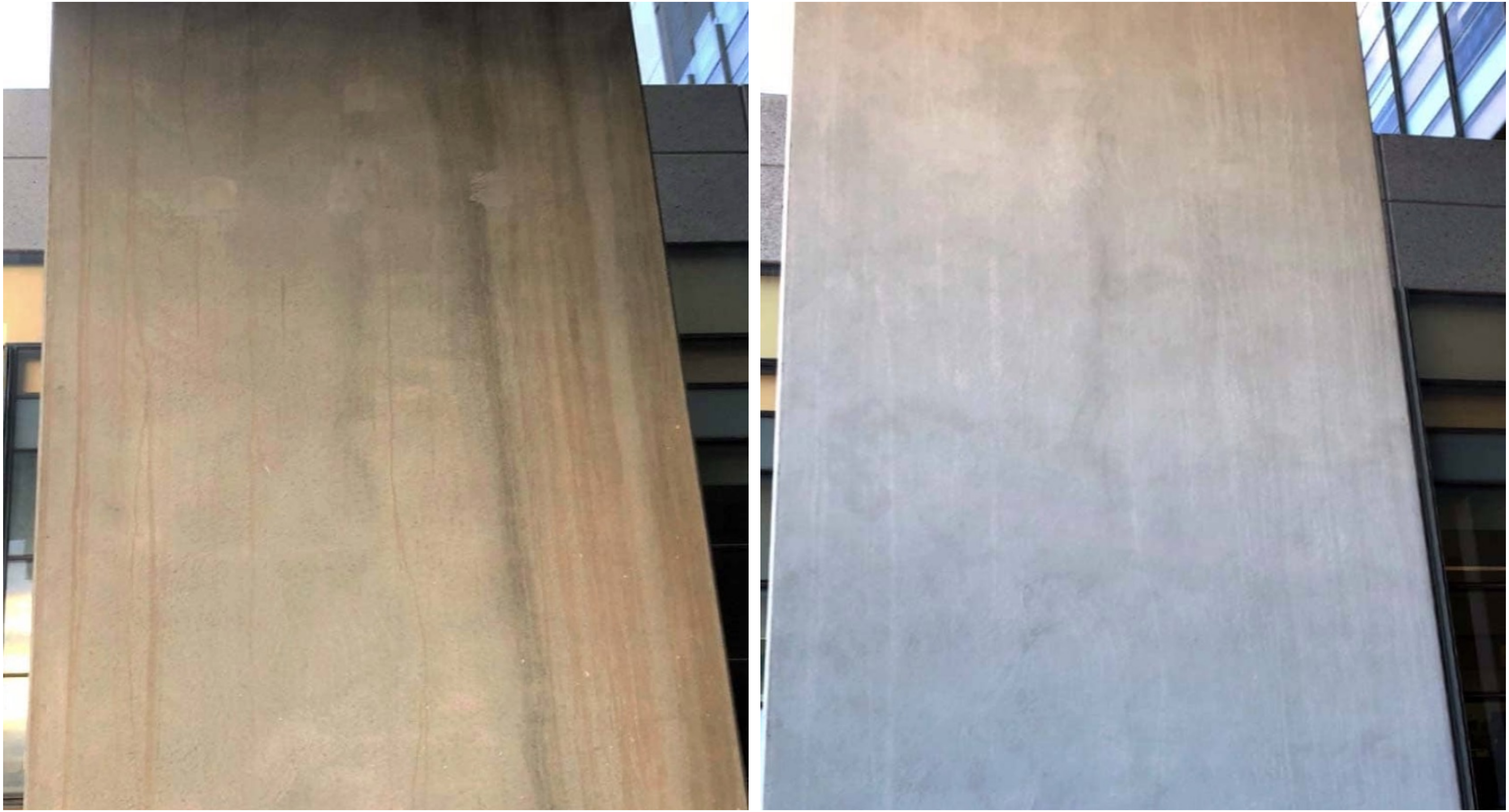
Concrete stain can be utilized to even out inconsistencies caused during construction to create a clean grey hue throughout.

This procedure can radically impact the appearance and aesthetic appeal of a final product or project.


Gravity
AFTER

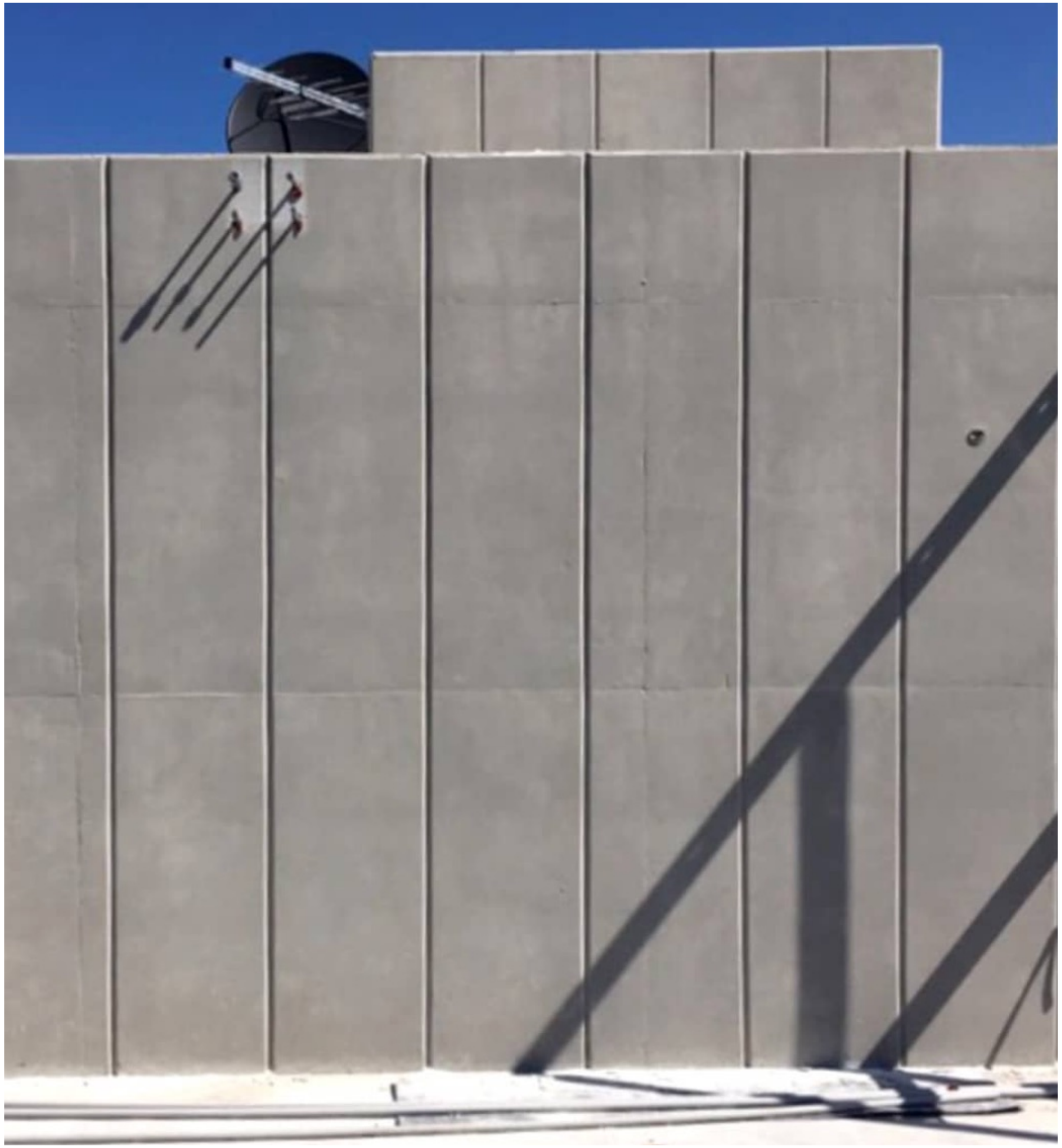

BEFORE






BEFORE


AFTER

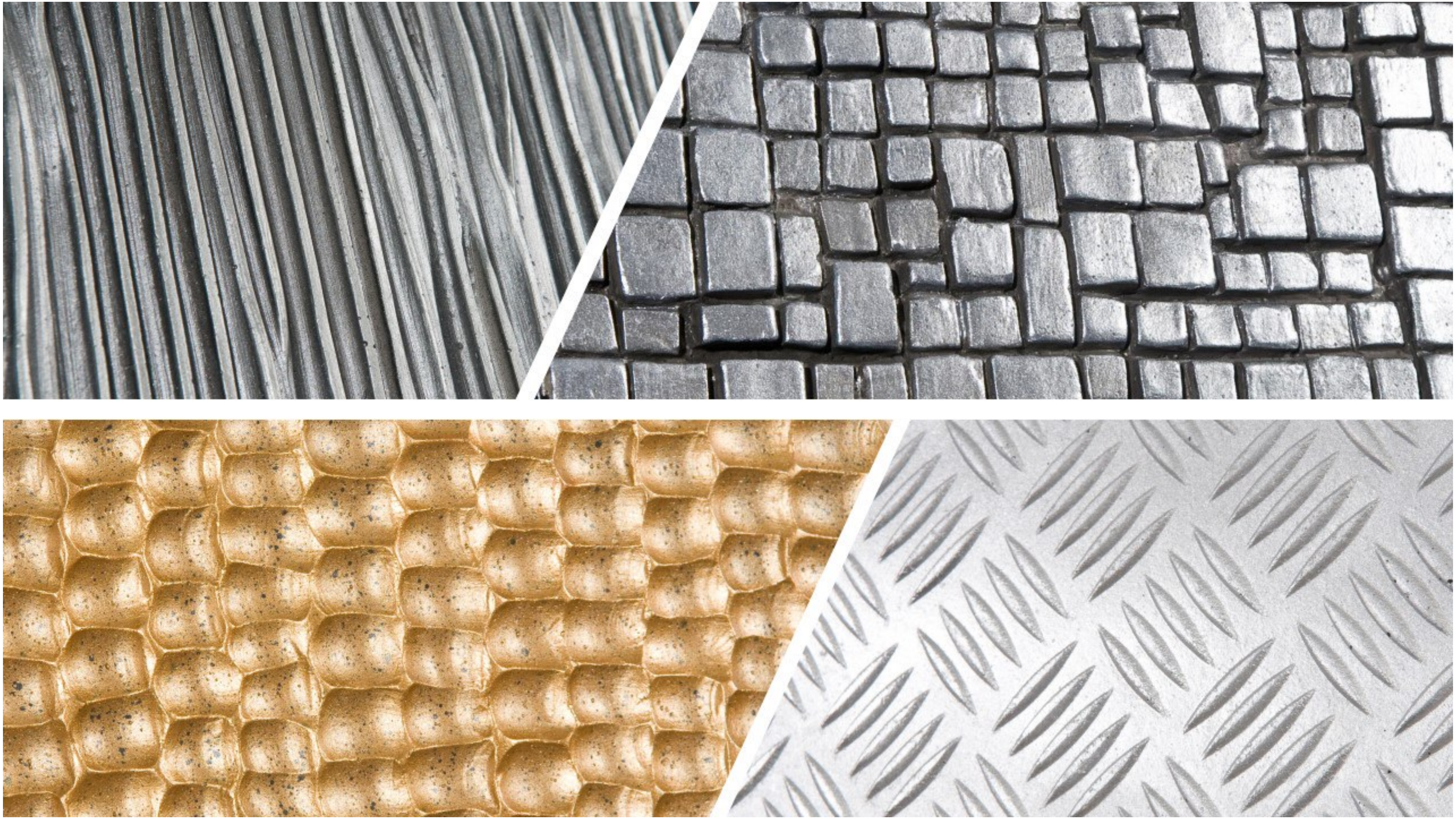





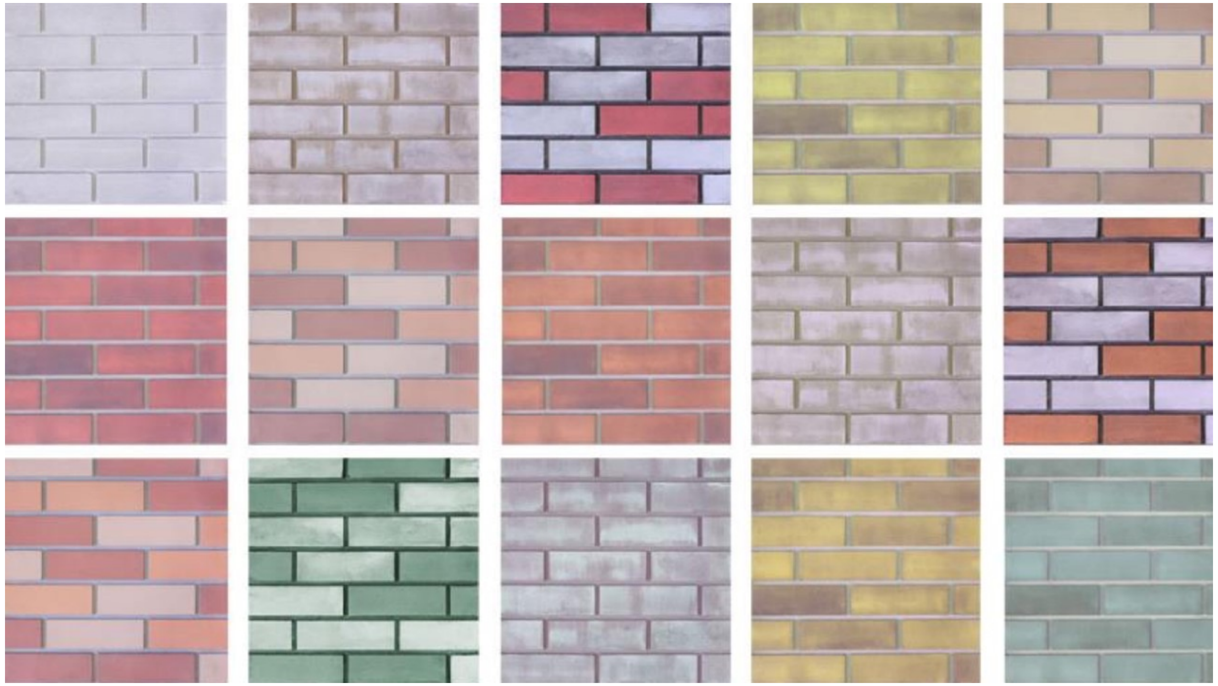


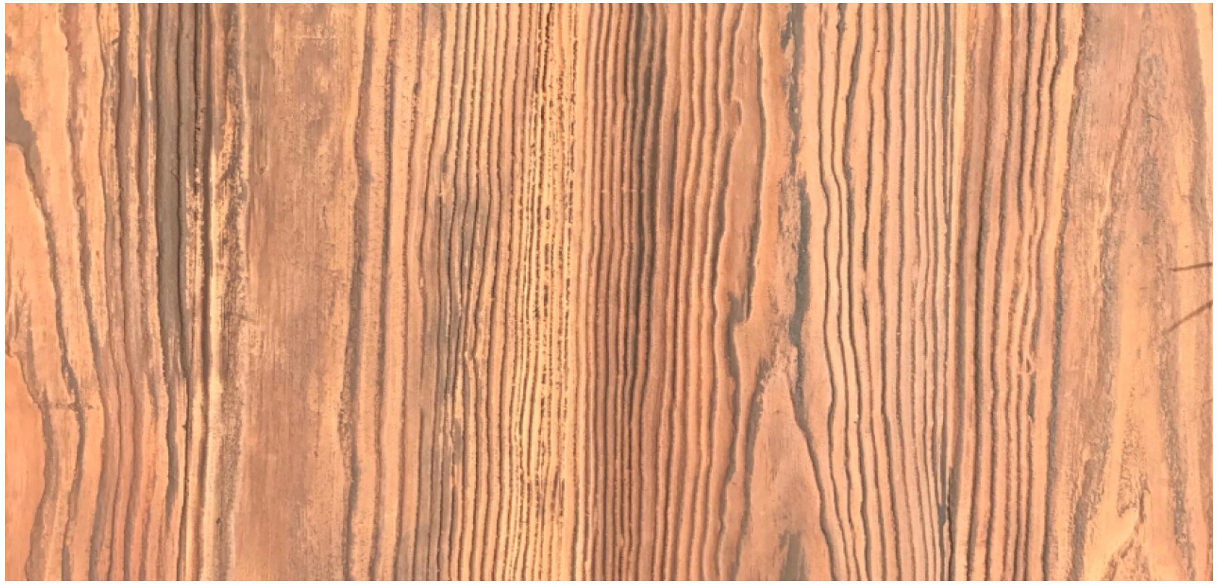


Stain in Action



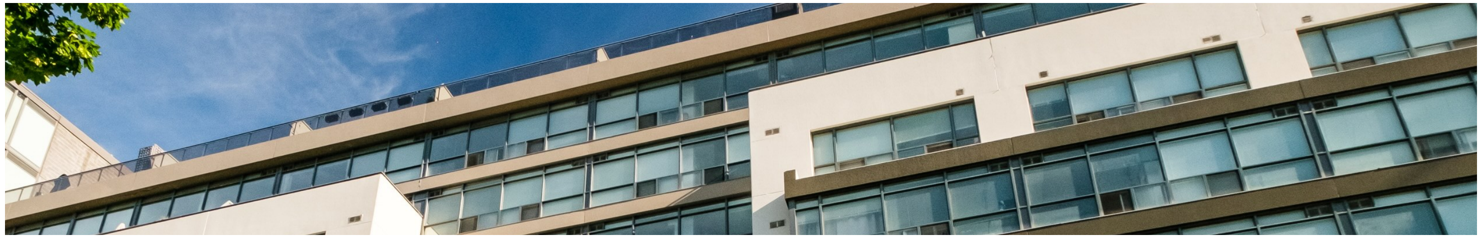




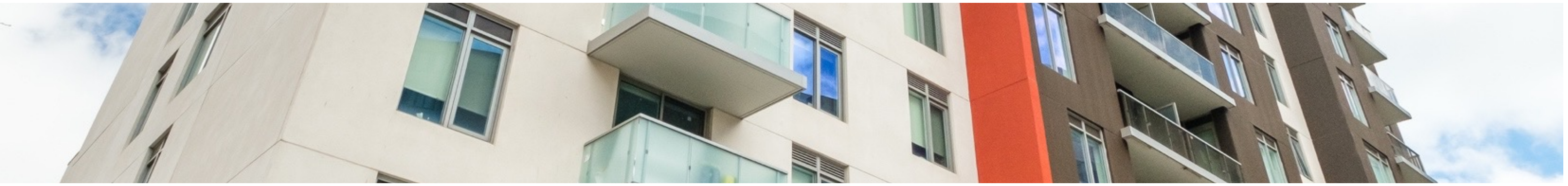

BEFORE
Exceptional
Apartment
Living


AFTER
PUBLIC
PARKING
STOP

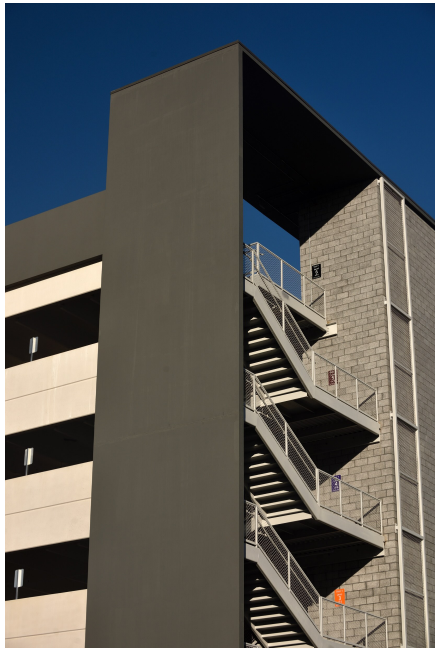
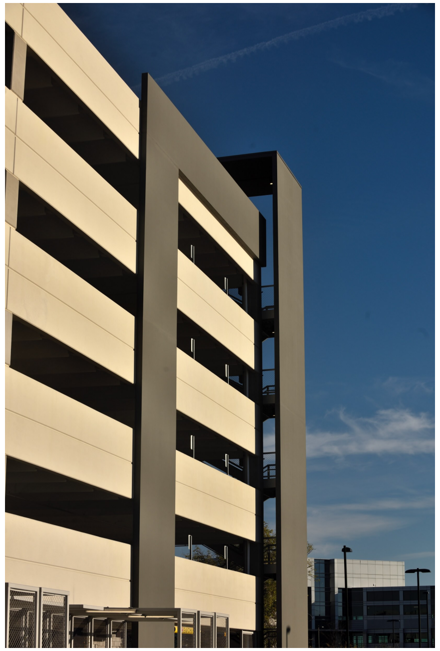



AFTER


BEFORE



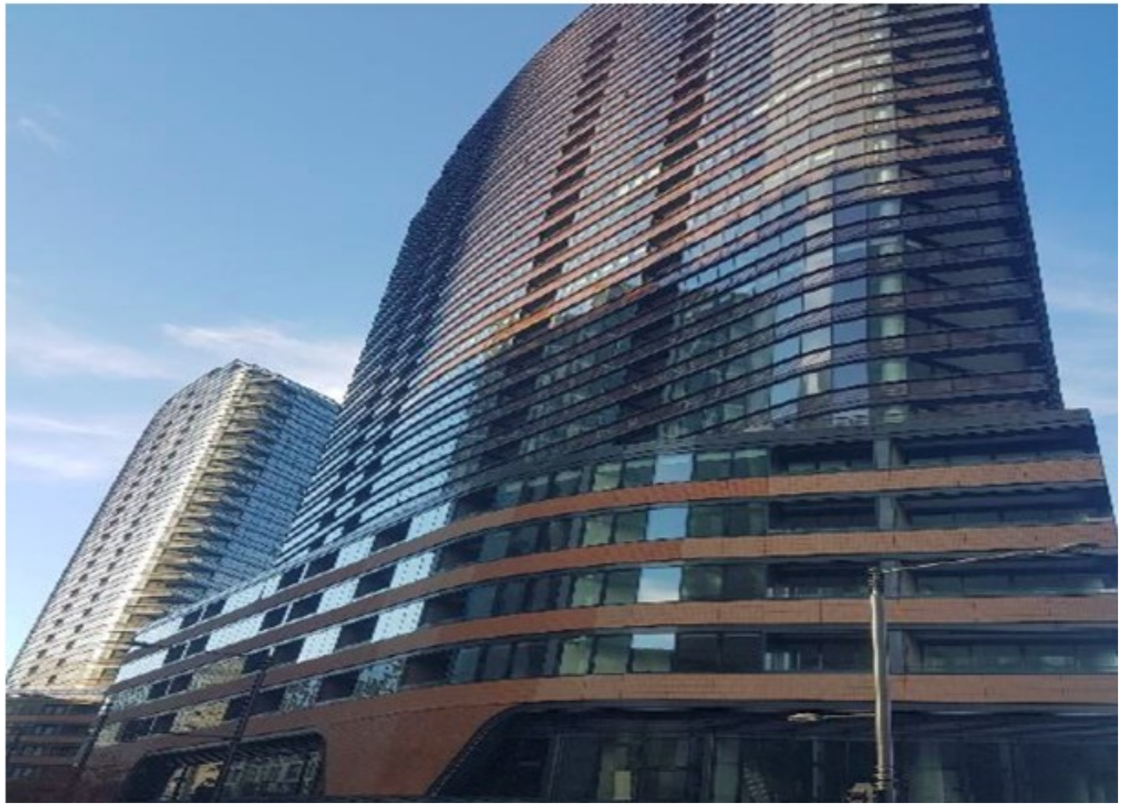






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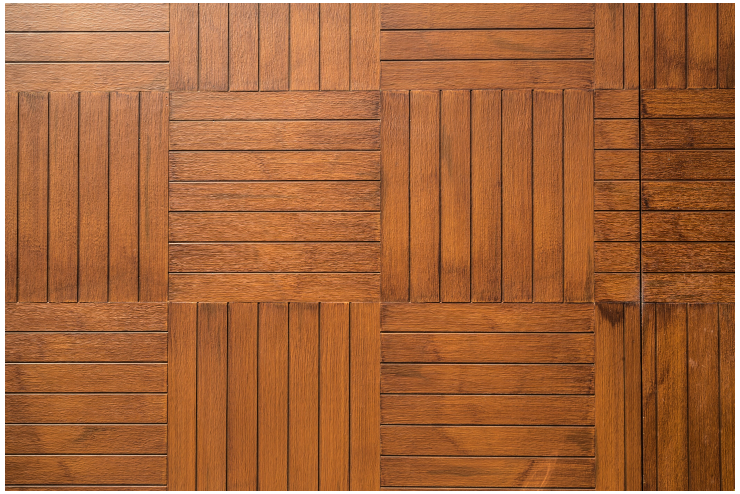
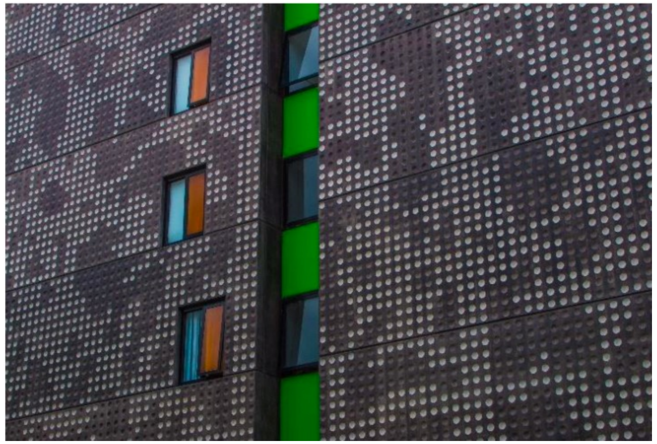
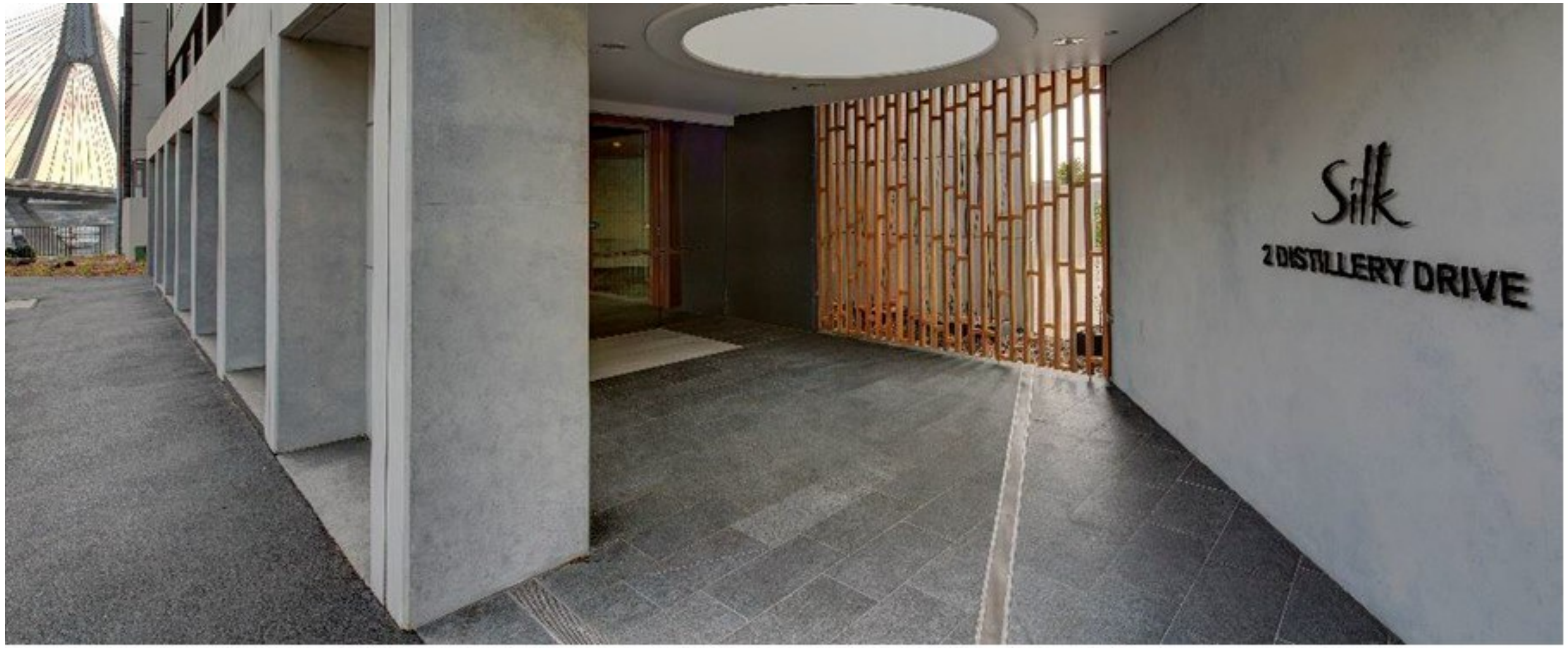





PRIVATE
PARKING
AREA
CUSTOMER PARKING
ONLY
24 HOURS 7 DAYS


Medical Clinic
Dental Clinic
Denture Clinic
Entry




Silk
2 DISTILLERY DRIVE



McDonald's
2965


LA|FITNE


THE HOME DEPOT


STARBUCKS
DRIVE THRU


Tim Hortons


Walmart
Supercentre


BEFORE


AFTER


TOTAL CRANE
313

CHOOSING COLORS AND FINISHES

SAMPLE COLOR

DURING

AFTER

BEFORE

COMPLETE COLOR CHANGES

STAIN OFFERS A LONG LASTING, NATURAL LOOK

AFTER

BEFORE

AFTER

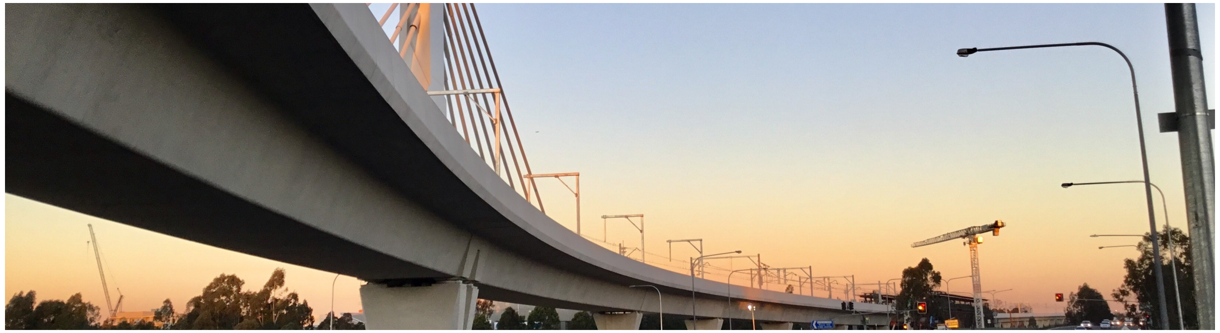
THE NEW LOOK WILL INCREASE THE VALUE OF YOUR BUILDING

Photocatalytic Systems

Coatings for Virus Protection & Self-Cleaning Surfaces

Concrete surfaces, including concrete coated with a mineral or acrylic stain, can be coated with a photocatalytic layer which yields air purifying and self-cleaning properties to surfaces.

Photocatalytically active systems utilize light to activate chemical reactions, that decompose pollutants, bacteria, viruses, and other harmful substances and release oxygen alongside other harmless byproducts.



Photocatalysis

The Power of The Sun:

Photocatalysis a chemical reaction that's accelerated by light. When light from the sun or artificial sources strikes the titanium dioxide in photocatalytic coatings, the titanium dioxide pulls water molecules towards itself.

That pull is called **superhydrophilicity**, and ensures that two essential processes can occur.

The first is that water molecules are so drawn to titanium dioxide, they slide underneath dirt, debris, graffiti, and other contaminants on the surface. On exterior surfaces when it rains, the water runs off of the surface, carrying along the contaminants, and the surface will clean itself.

The other essential process is that water molecules are oxidized and reactive oxygen species are created. This process releases oxygen into the air and destroys bacteria, viruses, and fungi in contact with the process as well.

Questions?

Common Questions

Can previously painted or stained surfaces be stained?

What is the price per square foot?

Does staining take longer than painting?

This Concludes The Educational Portion of Our Presentation

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