Concrete Slabs Basics

Concrete Slabs Basics

Quick reminder of concrete basics:

- What is concrete?
    - Components: Basic and admixtures.
    - How is it manufactured.
    - What are concrete mixes.

Moisture content in concrete slabs:

- Causes of excess moisture.
- How moisture in slabs is measured.
- How it affects finishes.
- Remedies:
    - New construction.
    - Existing construction.

Concrete slab architectural finishes:

- Chemical finishes:
    - Acid staining.
    - Surface coloring.
    - Integral coloring.
- Mechanical finishes:
    - Polishing.
    - Exposing aggregate.

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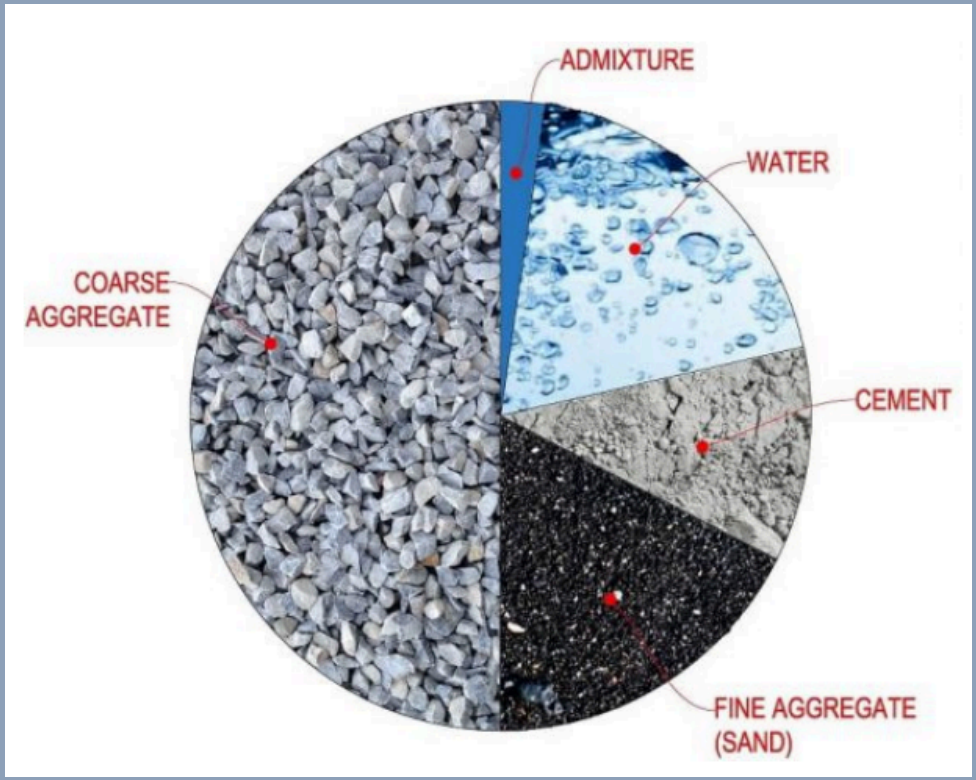

BASIC CONCRETE COMPONENTS

- Portland cement
- Aggregates - coarse and fine
- Water
- Admixtures

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Cement Plant in California (CEMEX)

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DESIGN MIX

The type of the components allowed and the characteristics of the concrete (strength, slump, air content, etc.) are determined by the structural engineer and the architect.

The “recipe” or quantities and type of the components that go in the mix to achieve the characteristics specified by the engineer are calculated and selected by the concrete mill, and are called the “DESIGN MIX”.

The DESIGN MIX is unique to each application.

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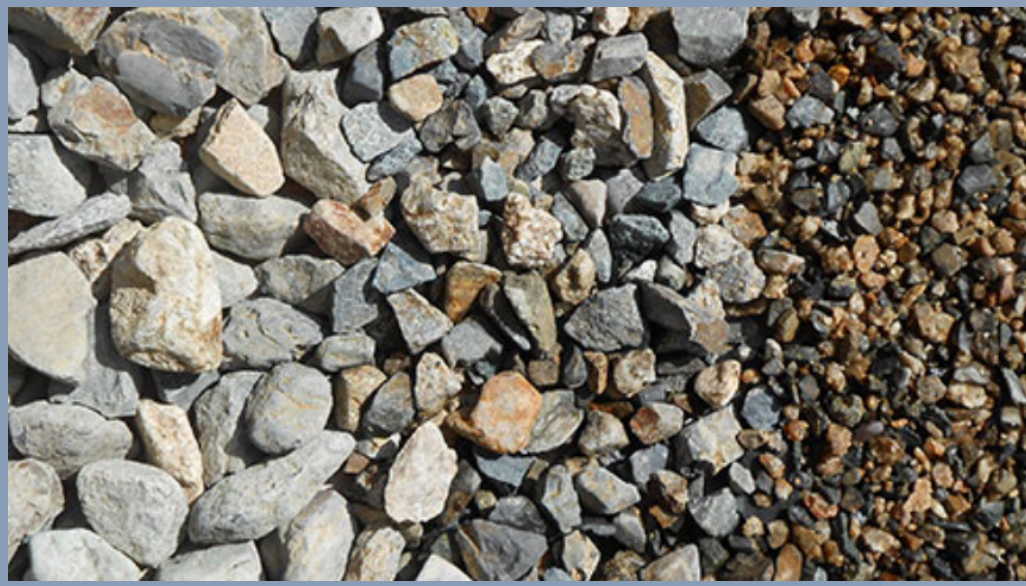
CONCRETE AGGREGATES

The workability, strength, durability, and performance of concrete is influenced greatly by the aggregate's characteristics. Although some variation in aggregate properties is expected, characteristics that are considered when selecting concrete aggregate include:

- grading or size classification
- durability
- particle shape and surface texture
- abrasion resistance
- unit weights and voids
- absorption and surface moisture

The combined aggregate gradation used in a concrete mix usually is obtained by blending two or more aggregate sizes.



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CONCRETE FLOOR MOISTURE CONTENT AND FLOOR FINISHES

Floor finishes installed over concrete or over separator membranes must be protected against failure. Failure may be caused either by water or by failure of the concrete slab such as cracking. Moisture problems in concrete slab finishes such as bubbling, blistering, and blushing of color are typically interior problems.

FAILURE BY WATER I Affects glue-down installations

- If precautions are not taken against water migrating upwards through the slab base and the slab, water will dilute the floor installation adhesives and damage the floor finishes.

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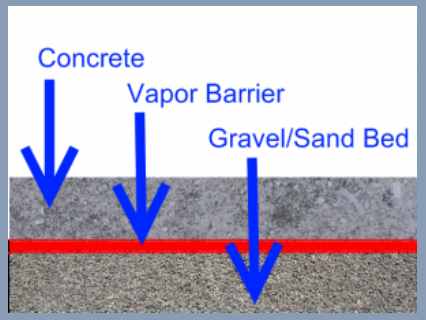
FAILURE BY WATER continued

How does the water enter concrete? Two ways:

- **MIGRATION** – Water migrates from the soil through the concrete into the surface of the slab.
- **VAPOR-TRANSMISSION** - Water in the concrete mix, evaporates during the curing process and after curing. This can happen in slabs on grade or in suspended slabs.

If the concrete slab over which a flooring finish is going to be installed has excessive moisture, it needs to be remediated before the flooring installation begins.



Typical installation of concrete slabs on grade.

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MOISTURE REMEDIATION - MEASURE THE MOISTURE

Before installation of floor finishes adhered or placed over concrete, it is good practice to investigate if there is a moisture problem. To do this, the MOISTURE ON THE CONCRETE SURFACE IS MEASURED to determine the level of water coming up through the floor assembly. There are two methods to do this:

Method 1: Follow the method described in ASTM F 1869 - Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride to weigh the water coming up to the surface of the slab.

- This test measures the vapor emission in the surface over a period of 24 hours. The level of vapor emission accepted by the flooring manufactures varies, but generally is up to 5 pounds of water for every 1000 sq. ft. of floor area. If the levels are higher, then the concrete needs remediation before the installation can take place.

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MOISTURE REMEDIATION - MEASURE THE MOISTURE continued

Method 2: Follow the method described in ASTM F 2170, Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes to measure the relative humidity in the slab.

This test measures the vapor emission in the surface over a period of 24 hours.

- The level of vapor emission accepted by the flooring manufactures varies, but generally is up to 5 pounds of water for every 1000 sq. ft. of floor area. If the levels are higher, then the concrete needs remediation before the installation can take place.
- ONCE the amount of moisture in the slab is measured it can be determined if it is more than what the flooring manufacturer recommends; if it is more, then remediation can begin.

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INSTALLATION PRACTICES TO REDUCE MOISTURE MIGRATION

NEW Construction:

- Install waterproofing or a vapor retarder under the slab that will reduce or stop water (vapor) from going through the slab.
  - Waterproofing stops water, vapor retarders stop most of the water. Ask before selecting a product.
- In addition to the waterproofing, installing a Drainage Base: Class “A” aggregate is the most commonly material used as base.
  - Class “A” aggregate consists of hard fragments of stone or gravel selected by size and type of stone.

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INSTALLATION PRACTICES TO REDUCE MOISTURE MIGRATION

NEW Construction:

PROPER CURING: Slabs cure from the top down; enough Water in the concrete evaporates at the slab surface. Time should be allowed for the slab to cure.

Curing serves two purposes: It retains moisture in the concrete so concrete continues to gain strength, and it delays shrinkage to reduce cracking. Curing methods are:

- **Water Curing**: The slab is flooded, ponded or mist sprayed.
- **Coverings:** The slab is covered with sand or canvas kept wet.
- **Waterproof Paper or Plastic**: The slab is covered with paper or plastic seals. These may alter the appearance of the concrete.
- **Chemical Membranes.**

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REMEDIES FOR EXCESIVE MOISTURE IN SLABS

NEW and EXISTING Construction:

These are typical remedies to use when there is EXCESS MOISTURE TRANSMISSION at on-grade and suspended slabs that may impair proper installation of glue-down finishes.

- Use a special water-resistant adhesive for installing the floor.
- Install an underlayment to stop the water from reaching the adhesives or pushing the floors upward.
    - The type of underlayment is selected according to the amount of water that is present in the slab.

Because the cost of remediation can be high, if remediation is suspected, it should be dealt with an **allowance**.

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FINISHES MECHANICAL FINISHES

SCRATCH FINISH

How is it Done: While concrete is still plastic, it is screeded, floated, and textured with brooms, brushes, or rakes.

Where is it done – At slabs scheduled to receive toppings or mortars.

FLOAT FINISH

How is it Done: While concrete is still plastic, float the surface with machines or by hand, then level, and float again until the surface is uniform and with a granular texture.

Where is it done – At slabs scheduled to receive trowel finish, waterproofing, or sand-bed terrazzo.

Floating

Scratching

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FINISHES MECHANICAL FINISHES continues

TROWEL FINISH

How is it Done: After floating, trowel concrete and consolidate by hand or machine. Repeat until surface is smooth and free of trowel marks and uniform in appearance. Grind smooth surface that could telegraph through floor finishes.

Where is it done – At slabs scheduled to receive resilient flooring, carpet, thin set tile over a membrane, and thin film finish floorings.

Trowel finish

Trowel finishing

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FINISHES MECHANICAL FINISHES continues

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Trowel finish

Trowel finishing

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FINISHES MECHANICAL FINISHES continues

TROWEL and FINE BROOM FINISH

How is it Done: Trowel finish the slab and while concrete is still plastic, lightly scarify surface with a fine broom.

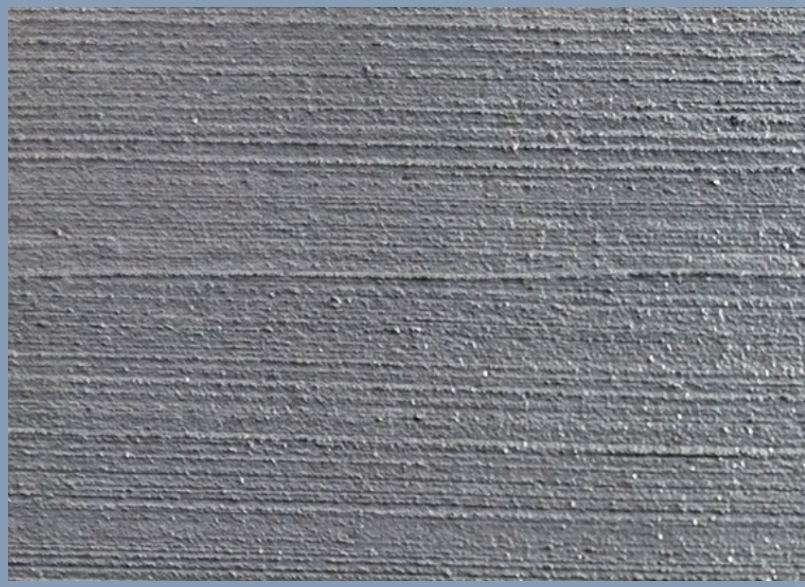
Where is it done – At slabs scheduled to receive thin set tile or thickset tile.

BROOM FINISH

How is it Done: After float finishing, roughen the surface with a fiber-bristle broom in a direction perpendicular to traffic.

Where is it done – Exterior concrete platforms, steps, ramps.

Broom finish



Broom finishing

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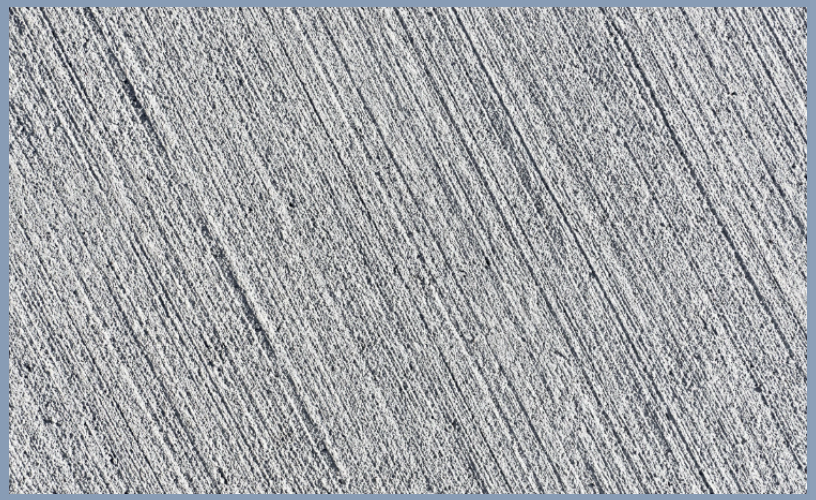
FINISHES MECHANICAL FINISHES continues

SLIP-RESISTANCE FINISH

How is it Done: Before final floating, broadcast aggregate or aluminum granules to concrete surface.

Where is it done – Concrete stair treads, platforms, and ramps.

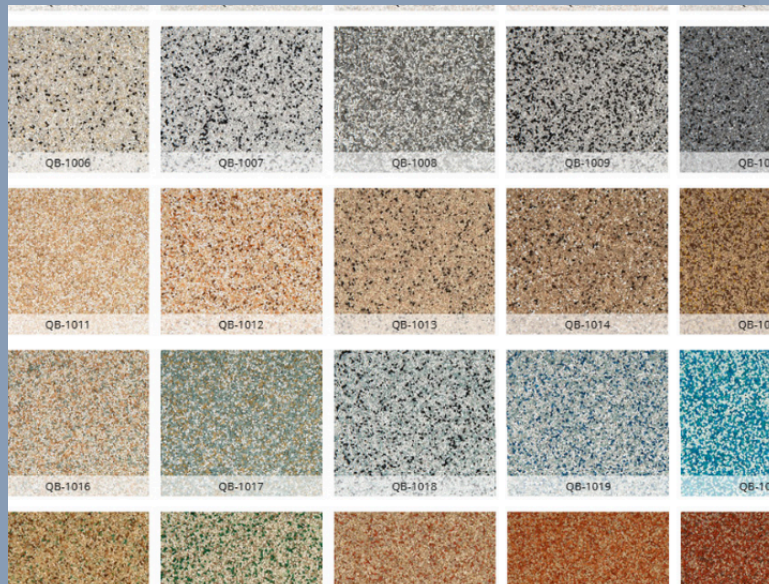
Slip-resistant finish



COATINGS and TOPPINGS for existing concrete

Anti Slip coatings for concrete are available and we have specified them in some projects. They have to be re-applied on a regular basis so they are effective.

Anti Slip concrete toppings are also available in different colors and textures.



Slip-resistant coatings

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FINISHES COLORING CONCRETE

PIGMENTED HARDENERS

How is it Done: These are applied to the surface of freshly placed concrete to improve wear resistance and occasionally to color concrete. They decrease concrete negative properties like dusting and liquid absorption by improving the abrasion resistance and reducing surface permeability.

Where is it done – In areas that require increased resistance of concrete floors to surface wear from truck tires, pallets, foot traffic and impact.

Application of colored hardener

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FINISHES COLORING CONCRETE continues

ACID STAINING

How is it Done: **Stains** for concrete are of two kinds: acid-based chemical stains and water-based acrylics. Both types can be applied to new or old and plain or integrally colored concrete..

Where is it done – Because stains penetrate the concrete surface, most stains have excellent UV stability and wear resistance, permitting their use on interior or exterior concrete.

EPOXY PAINT

Not recommended for areas with medium to high foot traffic. Always ask the paint manufacturer for a recommendation.

Acid staining

Epoxy paint

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FINISHES COLORING CONCRETE continues

ACID STAINING samples

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FINISHES COLORING CONCRETE continues

INTEGRAL COLOR ADMIXTURES

How is it Done: One method for coloring newly placed concrete is using integral coloring admixtures. These admixtures color concrete with rich, long-lasting, fade-resistant pigments in the concrete admixture. Stamped concrete contractors often use this coloring method to produce contrasting accent or antiquing colors. This method enables them replicate the appearance of natural stone.

Where is it done – In new concrete floors, interiors and exteriors.

Integral colored concrete
With embedded stainless steel

Integral colored concrete

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FINISHES POLISHING CONCRETE

POLISHED CONCRETE

How is it Done: Using polishing machines, the surface is polished by gradually removing top layers. The number of passes determines the degree of shine in the surface of the concrete.

- The concrete used can be uniform in appearance or aggregate may be used for decorative purposes.
- Colored concrete may be polished.

Where is it done – In new or existing concrete floors, interiors and exteriors.

Concrete polishing machines

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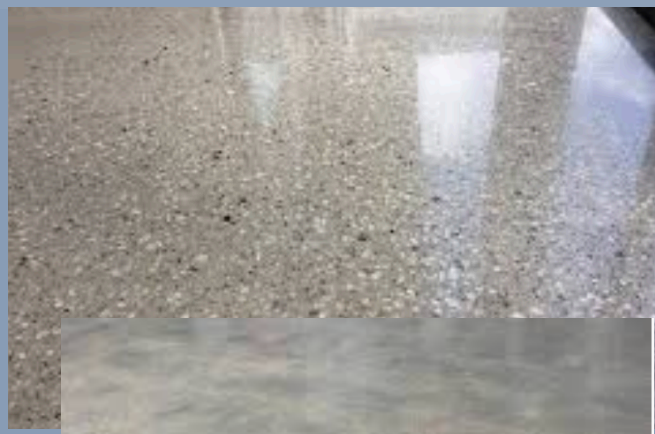

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FINISHES USING AGGREGATE TO CHANGE THE "LOOK"

EXPOSING THE AGGREGATE

How is it Done: The binder is removed from the top surface of the concrete mechanically to expose the aggregate which is harder.

- The depth to which the binder is removed determines the look of the concrete.

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The end

Fin

Finito

Das Ende

Slutet

La Fin

Slutten

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结束

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