

Specifiers Guide for Decorative Concrete in the Greater Kansas City Area

The Concrete Promotional Group
of Greater Kansas City



The Mid-West Concrete Industry Board



Provision:

The Concrete Promotional Group and The Mid-West Industry Board has prepared this document as a guide only. The information within the document is based on the best information and judgments available at the time of publication. The advancements in decorative concrete research and experiences continue to change how decorative concrete is placed and how mix designs are developed. In no event will the members of the trade association be liable for any direct, indirect, punitive, incidental, special or consequential damages. Any person or bodies of persons utilizing all or parts of the following information assumes all risks in connection therewith.

Specifiers Guide for Decorative Concrete in the Greater Kansas City Area

Forward

This guide has been assembled for specifiers who specify decorative concrete in their projects. It takes into consideration the local climate (freeze/thaw) and clay soils typical of the Kansas City Metro region for exterior concrete, as well as local resources/materials. The information found within this document is meant to facilitate the design and installation of decorative concrete. Decorative concrete has as many concrete mix designs as uses. The mix design will depend on its final application. Decorative concrete can be used in these venues, but not limited to these venues: exterior flatwork, pavements, patios, courtyards, retaining walls, columns, countertops, interior floors, walls, lobbies, back splash, mantles, etc. It is with exterior flatwork that extra care must be taken to withstand the freeze/thaw conditions in our market.

This guideline has an emphasis on 3 major categories

1. **Mock Up/Field Samples** to demonstrate workmanship, color, sound materials, and final appearance for approval process
2. **Pre Construction Conference** make sure communication is clear, accessibility, timing, final approval of mock ups
3. **Contractor Qualifications**

SECTION 1 – GENERAL

1.1 Scope

This guide addresses the equipment, materials, and processes necessary for decorative concrete construction in the Greater Kansas City Area. It includes preparation of subgrade and surface profiling where necessary. It is to be used in conformance with job specific plans, specifications and other contract documents in endless applications.

1.2 Technical Reports & References

- A. **American Concrete Institute (ACI)** (www.concrete.org)
 - ACI 301 Specification for Concrete
 - ACI 302 Construction of Concrete Floors
 - ACI 303 Architectural Cast-in-Place Concrete
 - ACI 305 Hot Weather Concreting
 - ACI 306 Cold Weather Concreting
 - ACI 308 Curing Concrete
 - ACI 310 Decorative Concrete
 - ACI 318 Structural Concrete Building Code
 - ACI 332 Residential Concrete
 - ACI 522.1-08 Specification for Pervious Concrete Pavement
 - ACI 610D Decorative Concrete Finisher Certification Committee
- B. **American Society for Testing & Materials (ASTM)** (www.ASTM.org)
 - ASTM C29 Test for Bulk Density (Unit Weight) & Voids in Aggregate
 - ASTM C33 Specification for Concrete Aggregates
 - ASTM C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - ASTM C94 Specification for Ready-Mixed Concrete
 - ASTM C138 Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
 - ASTM C150 Specifications for Portland Cement

ASTM C172	Practice for Sampling Freshly Mixed Concrete (air content, composite sample, slump, temperature, wet sieving, etc.)
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C1315	Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C979	Standard Specification for Pigments for Integrally Colored Concrete

- C. **Portland Cement Association (PCA)** (www.cement.org)
- | | |
|-----------|---|
| PCA PA124 | Finishing Concrete with Color and Texture |
| PCA SP021 | Color and Texture in Architectural Concrete |
| PCA EB217 | White Cement Concrete (Technical Manual) |
| PCA SP388 | Guide for Specifying White and Colored Concrete |
| PCA IS528 | Finishes: Creating Visual Appeal |
| PCA IS529 | Light Reflective Floors |
| PCA PL993 | White Cement Concrete and Colored Concrete Construction |
| PCA PA020 | Exploring Color and Texture |
| PCA DX039 | Plastic Forms for Architectural Concrete |
| PCA DX090 | Gap-Graded Mixes for Cast-in-Place Exposed Architectural Concrete |
| PCA CD028 | Exploring the Art of Concrete CD |
- D. **American Society of Concrete Contractors (ASCC)** (www.ASCCOnline.org)
Decorative Concrete Council's Problems & Practice Series #1-8
DCC Decorative Concrete Insights & Tips
- E. **American Association of State Highway and Transportation Officials (AASHTO)**
(www.transportation.org)
AASHTO M194 Chemical Admixtures

SECTION 2 - QUALIFICATIONS/MATERIALS/MOCK UPS/MIX DESIGNS/QUALITY/PRE CONSTRUCTION/CURING & SEALING

2.1 Contractor Qualifications

- Contractors shall be ACI Flatwork Finisher/Technician Certified (www.concrete.org)
- Decorative Concrete Certification is on the horizon, but not yet available. When it is available decorative contractors shall be decorative concrete certified.
- 2-3 years verifiable minimum experience in the concrete business

2.2 Mix Design

- Slump of concrete shall be consistent throughout Project at 4 inches or less. At no time shall slump exceed 5 inches (If super plasticizers are allowed, slump shall not exceed 8 inches).
- Aggregates should be carefully selected for durability, abrasion, soundness, cleanliness and minimize deleterious materials. It is suggested for concrete placed outside, exposed to the elements and the freeze/thaw conditions, to refer to one of these local market specifications for aggregate materials: a) Midwest Concrete Industries Board (MCIB) specification www.mcibconcrete.org, or b) Kansas City Metropolitan Materials Board (KCMMB) specification www.kcmmb.org. (It should be noted that the larger aggregates can limit stamping ability.)
- Air entrainment is mandatory in exterior flatwork exposed to the weather, 6% \pm 1.5% or to project specification.
- Do not add calcium chloride to mix as it causes mottling and surface discoloration, non-chloride accelerators can be used instead.

5. Supplemental cementitious materials can affect color and setting conditions, check manufacturer's recommendation. Supplemental cementitious materials are options for many mix designs that encourage green building/sustainable concepts.
6. Water slump, should maintain consistent throughout the project.
7. Add colored admixture to the mix according to manufacturer's written instructions per weight of cementitious content.

2.3 **Mock Up/Field Test**

1. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards and should always be in full cubic yard increments. Excess material should be discarded according to local regulations.
2. Construct a mock up on location at the jobsite, selected by the decision maker. Size of the mock up will be relevant to the scope of the project and showing all the different decorative colors/designs and patterns to be used in the final project.
2. Construct mockup using processes, materials and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the work for the project.
3. Written acceptance of mock up should be kept on record, NO VERBAL OK's.
4. Accepted mock ups provide visual reference for comparison during project.
6. Mockups shall remain through completion of the work for use as a quality standard for finished work.
7. Provide 2 mockups when possible. One to serve as the original point of reference, the other to conduct "repairs" on as needed to show how they will look when completed. Again, written acceptance of repairs to be kept in records.

2.4 **Quality Assurance**

1. The most important critical task for onsite QC is to maintain the W/C ratio for the given design mixture. Care should always be taken when adding water onsite that the W/C ratio is not exceeded. If water must be added onsite it should be added before the placement begins, no further addition of water should be allowed after placement starts. Water should never be used during the placement and finishing of the concrete as a finishing aide as surface discoloration will result. Care should also be exercised during finishing that the concrete receives even texture throughout the entire surface regardless of the finish. Variances in the texture will cause light refraction to occur giving the appearance of color inconsistencies.
2. On site testing when applicable should refer to ASTM 172. Testing could include:
 - a. Slump test ASTM C 143
 - b. Air content ASTM C 231 / C 173
 - c. Compressive strengths ASTM C 31 / C 39
 - d. Yield calculations ASTM C 138
3. Integral color shall meet ASTM C 979

2.5 **Pre Construction Conference**

1. To be conducted at least two weeks prior to the placement.
2. Attendance should be mandatory for the sub contractor, ready mixed producer, general contractor, architect, landscape architect, engineer, owner etc.
3. See the Checklist for a pre-construction meeting attached in the back of this document or refer to the pre construction checklist produced by the Midwest Industry Concrete Board (MCIB) www.mcibconcrete.org or the National Ready Mixed Concrete Association (NRMCA) www.nrmca.org .

2.6 Curing & Sealing

1. Curing is a critical factor for success when using integral pigments in concrete. When a curing method or product has been selected a representative jobsite sample or mock up panel should be prepared in advance to demonstrate the effects that the curing method may have on the color and finish.
2. The curing method selected will depend greatly on the type of finish applied to the surface and to the exposure the concrete is subjected to during placement and service. Example, interior floors may not require the same type of curing method as a slab exposed to continual freeze and thaw. Involved parties should agree on curing method prior to placement, during the mock-up stage.
3. Stamped concrete treated with a powdered release agent will require a different curing method due to the presence of the release agent on the surface.
4. Any curing method or product chosen must comply with ASTM C-309 and or ASTM C-1315. Apply curing to the manufacturer's instructions using manufacturer's recommended application techniques. Apply curing compound at a consistent time for each pour to maintain close color consistently.
5. Make sure the curing agent and the sealing agent are compatible with each other.
6. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 Plastic Shrinkage Cracking published by the National Ready Mix Concrete Association.
7. Do not cover decorative concrete with plastic sheeting.
8. Curing References: ACI 305, ACI 306, ACI 308
9. Typical methods:
 - a. Membrane forming cures – (use only when subsequent treatment interaction with concrete paste or concrete matrix penetration is not required)
 - i) Water based
 - ii) Solvent based
 - iii) Pigmented curing membranes
 - iv) Wax based
 - b. Dissipating curing membranes (water or wax based) - (use only when subsequent treatment interaction with concrete paste or concrete matrix penetration is not required or surface is to be mechanically abraded prior to subsequent treatments.)
 - c. Physical curing membranes or fabrics –Properly designed applied curing blankets can be effective but must be demonstrated not to have a deleterious effect on color. Curing method to be demonstrated on mock-up.
Cold weather blankets–Properly designed applied curing blankets can be effective but must be demonstrated not to have a deleterious effect on color. Curing method to be demonstrated on mock-up.
10. Curing considerations
 - a. Type of finish
 - b. Potential exposure to elements
 - c. Potential Exposure to freeze/thaw
 - d. Differential curing or slab discoloration
 - e. Potential for efflorescence
 - f. Release agent present
 - g. Subsequent treatments or methods or post placement finishing such as polishing or staining
11. Surface applied evaporation retarder or monomolecular films are often used during placement and finishing to help hold moisture from the mix in place and slow hydration. Although this helps reduce plastic shrinkage cracks and rapid hydration, it is not

considered a replacement for curing, but rather a supplemental treatment in hot weather conditions.

12. Sealing exterior flatwork is highly recommended to help protect the slab from freeze/thaw damage.

SECTION 3 - COLOR CONSISTENCY

3.1 Identifying What Can Effect Color Inconsistencies

1. Batch procedures / consistency
2. Use of supplementary cementitious materials (fly ash, slag etc.)
3. Changing suppliers midstream during a project
4. Curing methods
5. Efflorescence
6. Excess use of water
7. Finishing practices
8. Jobsite Addition of Water
9. Standing water / saturated subgrade
10. Subgrade preparation
11. Use of chloride containing admixtures
12. Variation in cement content
13. Variations in W/C ratios (Reread 2.4 Quality #1)

SECTION 4 - SUSTAINABILITY

1.12 Sustainability

1. Decorative concrete can be a green/sustainable building product, due to its durability and long lasting nature.
2. Because the color and texture of decorative concrete becomes an integral part of the concrete itself, it eliminates the waste associated with covering products such as carpet, tile and paints.
3. A wide variety of colors based on naturally occurring oxides that contain no VOC's or any off-gassing are available.
4. Lighter colors tend to be more reflective and thus reduce the urban heat island effect. Decorative concrete has many colors that can reach the minimum Solar Reflective Index (SRI) of 29 or higher, as required in some LEED® requirements.
5. Decorative concrete typically has reduced maintenance thus reduced life-cycle costs, typically associated with other coverings such as carpet, tile, wood etc.
6. Decorative concrete can help attain specific LEED® points and other Green Building Rating System points.

(Note for Decorative Pervious Concrete, refer to the Specifiers Guide to Pervious Concrete for Stormwater Mitigation in the Greater Kansas City Area available at www.concretepromotion.com, under the Pervious Tab.)

Decorative Concrete Pre-Construction Checklist

(This is modified from the Mid West Concrete Industry Board's Concrete Pre-Placement Agenda)

The following representatives shall attend the Pre-Construction Meeting, a minimum of two weeks prior to the decorative concrete construction:

- Owner
- Architect and/or Engineer
- General Contractor
- Sub Contractor
- Testing Firm
- Ready Mix Supplier

- 1) Concrete Mix Design Review
 - a) Concrete Mix
 - i) Review Location/Application
 - ii) Water/Cement Ratio
 - iii) Identify Slump \pm range with and w/o admixtures
 - iv) Air Content \pm range
 - v) Unit Weight \pm range
 - vi) Identify temperature \pm range (hot & cold weather)
 - vii) Identify transportation limits (discharge time, drum revolutions, load size, etc.)
 - viii) Unique admixtures and possible effects to mix
 - ix) Other
- 2) Mock Up Panels
 - a) Written acceptance in place?
 - b) Is communication clear as to color, intensity, pattern, texture, expectations?
- 3) Quality Control/Assurance
 - a) Lab accreditation requirements
 - b) Certification requirements for testing personnel
 - c) Advance notice for scheduling testing personnel
 - d) Concrete sampling and testing specification requirement
 - e) Test cylinder storage and transportation
 - f) Acceptance criteria for hardened concrete and report distribution
 - g) Testing of hardened in-place concrete
- 4) Job Specifics
 - a) Backup plant from primary supplier (verify availability of like materials and admixtures)
 - b) Back up supplier and approved mix designs
 - c) Identify transportation limits
- 5) On site Mix Modifications
 - a) Discuss limitations regarding the addition of water, including documentation.
 - b) Identify procedure for adding, mixing and re-testing when water or chemical admixtures are added.
 - c) The supplier shall perform addition of admixtures or water at the request of the designated responsible individuals.
 - d) The supplier shall document additional admixtures and/or water on the delivery ticket.

- 6) On Site Testing
 - a) Identify frequency of testing
 - i) Cylinders for compressive strength. (Identify type and number of cylinders)
 - ii) Air content
 - iii) Plastic Unit Weight
 - iv) Temperature
 - v) Transportation limits and methods of transportation of strength specimens from site to testing lab.
 - vi) Other
 - b) Strength of specimen initial curing procedure, (wet bath, insulated box, under tarp, temperature controlled environment, designated storage area, temperature record, etc.)

- 7) Rejection of Fresh Concrete
 - a) Identify individuals that will be on site that have the authority to accept and reject concrete based on plastic test properties.
 - b) Testing agency shall immediately notify one of the designated individuals regarding any fresh concrete results that are outside of the specified limits.
 - c) Concrete outside the specified parameters shall be grounds for rejection.

- 8) Ready Mix Supplier Job Requirements
 - a) Provide delivery tickets containing the following information:
 - i) Mix number corresponding to the approved submittal
 - ii) Batch time
 - iii) Arrival time
 - iv) Approved mix materials withheld at the plant, including water, will be identified on the delivery ticket. If nothing is withheld the ticket shall state "as designed".
 - v) Start and finish time associated with unloading
 - vi) Truck and ticket numbers shall be recorded by the testing firm with each cylinder test.

- 9) Job Requirements
 - a) The concrete placement contractor will provide the designated responsible individual(s) to receive all the delivery tickets, document the unload time, and reject out-of-spec material as identified by the testing agency.
 - b) Hot and/or Cold Weather procedures (ACI 305 and ACI 306)
 - c) Method of placement
 - i) Conveyance Method (conveyor belt, truck placement, pump truck, buggy, etc.?)
 - ii) Consolidation

- 10) Finishing Process
 - a) Curing
 - i) Method (water, membrane, chemical, etc.)
 - ii) Compatibility (with flooring finishes, treatments, sealers, etc.)
 - b) Weather Condition (ACI 308 Evaporation Chart)
 - c) Surface Finish (FF/FL, texture, pattern, etc.)

- 11) Other Job Specific Requirements

- 12) The General Contractor will provide a sign-up sheet and issue minutes of the meeting.

Glossary of Decorative Concrete Terms

(Technology and creativity advance decorative concrete methods and means constantly. This section will change. A good source for up to date terms can be found at www.concretenetwork.com)

Acid Etching: Application of muriatic or phosphoric acid to clean or profile a concrete surface. Used as an alternative to abrasive blasting for surface preparation.

Acid Stain: (or chemical stain) A stain containing inorganic salts dissolved in an acidic, water-based solution that reacts chemically with the minerals in hardened concrete to produce permanent, transparent color that will not peel or flake. Gives concrete an attractive variegated or marbled appearance. Colors tend to be earth tones, such as tans, browns, reddish browns, and greens. They should be applied over properly cured concrete.

Adhesive Stencils: Adhesive-backed masking patterns made of vinyl or plastic used for creating stenciled concrete effects. The adhesive keeps the patterns firmly in place on the concrete surface while the decorative treatment of choice is applied, such as acid stains, dyes, spray-down systems, etching gels, or sandblasting.

Admixture: An ingredient in concrete other than water, Portland cement, and aggregate used to modify the properties of concrete in its freshly mixed, setting, or hardened states. They may be added to concrete at the batch plant or on the job site. Prepackaged admixtures are available for convenient job site addition, giving contractors the ability to modify the concrete they receive when necessary, such as extending the amount of time available for decorative stamping.

Aggregate: A granular material such as sand, rock, crushed stone, gravel, or other particles added to concrete to improve its structural performance.

Air content: The amount of entrained or entrapped air in concrete, usually expressed as a percentage of total volume.

Air Entrainment: Adding an air-entraining admixture to fresh concrete to cause the development of microscopic air bubbles. Helps to improve the freeze-thaw resistance and durability of hardened concrete.

Alligatoring: Surface imperfections in a coating resulting in a wrinkled appearance. Usually caused by incompatibility of a newly applied coating with an existing surface coating or sealer. Also known as orange peel or fish eyeing.

Antiquing: A color layering technique for giving decorative concrete surfaces an aged or mottled appearance.

Broomed: Pull broom across freshly, floated, troweled, concrete to produce fine, medium, coarse texture in straight, wavy lines perpendicular to main line of traffic. Do not dampen brooms.

Bleed through: Color change caused by the diffusion of color from an underlying surface.

Bleed water (bleeding): Water that rises to the surface of freshly placed concrete due to segregation. Bleeding may interfere with finishing operations. If a dry-shake color hardener is being applied to the concrete surface, some bleed water is needed to wet out the hardener sufficiently so it can be floated into the surface.

Blistering: The formation of blisters in toppings or coatings and the loss of adhesion with the underlying substrate. On concrete surfaces, this is often caused by moisture or moisture vapor transmission problems.

Bond: The degree of adhesion or grip of a material (such as coatings, toppings, repair mortars, or sealers) to an existing surface.

Bonding agent: An adhesive agent used to increase the adherence of coatings or toppings to the existing surface. Also used to bond new concrete to old. Also known as a primer.

Bond breaker: A material that prevents adhesion of materials to a concrete substrate.

Broadcast: To hand toss a dry-shake color hardener, decorative aggregate, or other dry material in a uniform layer over fresh concrete, overlays, or coatings to add color or traction

Broom finish: Surface texture obtained by pushing a broom over freshly placed concrete.

Build: The wet or dry thickness of a coating or topping.

Bull float: A tool with a 3- to 4-foot rectangular blade made of wood, resin, aluminum, or magnesium. Used to eliminate high and low spots in freshly placed concrete slabs, embed large aggregate at the surface, bring a layer of paste to the surface needed during final finishing, and float in dry-shake color hardener. Long handles either clip on or screw into the float head so it can be pushed out onto the slab while the user stands at the perimeter.

Bush hammer: A percussive hammer with rows of pyramid-shaped points used to roughen or **profile** a concrete surface.

Calcium chloride vapor-emission test: ASTM D 1879 a test used to measure the volume of moisture vapor released from a concrete substrate over time (typically 24 hours). Too much moisture emitted from a slab can affect the performance and bonding of overlays, coatings, and sealers. Moisture vapor test kits are available that include small containers of pre-weighed, unhydrated calcium chloride. ASTM D 1879 only measures the top 1/8"-1/4" of the slab.

Cast in place: Concrete placed and finished in its final location.

Cement replacement (or supplementary cementitious material): A material used in concrete as a partial replacement for Portland cement. Includes pozzolans, fly ash, and granulated blast furnace slag. Can have positive effects on decorative concrete by improving finishability, reducing permeability, and reducing efflorescence.

Cementitious : A material containing Portland cement as one of its components or having cement-like properties.

Chalking: Loose, powdery substance caused by deterioration of a concrete surface or degradation of a coating or overlay.

Coating system: A complete system requiring a number of coats of material to be applied separately in a predetermined order and at prescribed intervals to allow for sufficient drying and curing. May include a primer, one or more intermediate coats, and a topcoat.

Compressive strength : The maximum compressive stress concrete or cementitious overlay materials are capable of sustaining, expressed as pounds per square inch (psi).

Color chips: Plastic chips, quartz or other material available in various colors and sizes, for broadcasting onto freshly placed epoxy resin flooring systems, such as epoxy terrazzo, to produce multicolored effects.

Color layering: Applying layers of color to achieve variegated or faux finish effects, such as antiquing or marbleizing. For example, a dry-shake color hardener may serve as the base color, accented by a pigmented powdered or liquid release agent, followed by additional accenting with acid stains, dyes, or tints.

Concrete countertops: A handcrafted alternative to manufactured countertop surfaces. Can be precast in a shop in molds built to the customer's specifications or cast onsite, by setting a mold on top of the base kitchen cabinets and then filling with concrete. The use of stains, pigments, decorative aggregates, and epoxy coatings can give concrete countertops the look, texture, and feel of quarried stone such as marble, granite, and limestone.

Concrete surface profile (CSP): The degree of roughness of a concrete surface achievable with various **surface preparation** methods. The International Concrete Repair Institute (ICRI) has identified nine distinct roughness profiles considered to be suitable for the application of sealers, coatings, and polymer-modified overlays.

Consistency: The ability of fresh concrete to flow. The usual measure of consistency is slump.

Control (or contraction) joint: Sawed or tooled groove in a concrete slab used to regulate the location of cracking.

Coverage rate : The area that a specified volume of coating will cover to a specified thickness upon drying.

Crack chasing: Routing out cracks in concrete with a saw or angle grinder before filling with a repair material.

Crack stitching: A method of repairing cracks that involves drilling holes on both sides of the crack and grouting in wire or U-shaped metal strips that span the crack.

Cracks, moving: Cracks in concrete that are still moving, or active. Often they are structural in nature and continue through the entire depth of the concrete.

Cracks, static: Random, non-moving hairline cracks that only affect the concrete.

Craze cracks: A series of fine, random cracks caused by shrinkage of the surface mortar.

Crusting: A condition that occurs when the surface of freshly placed concrete dries too quickly, often due to exposure to direct sun, wind, or high temperatures.

Curing: Action taken to maintain favorable moisture and temperature conditions of freshly placed concrete or cementitious materials during a defined period of time following placement. Helps to ensure adequate hydration and proper hardening.

Curing compound: A liquid that, when applied to the surface of newly placed concrete, forms a membrane on the concrete or penetrates the concrete to retard the evaporation of water.

Darby: A longer version of a hand float, ranging in length from 2 to 4 feet. Useful for leveling problem areas.

Decorative aggregate: Richly colored natural stones, such as basalts, granite, quartz, or limestone, used to enhance exposed-aggregate concrete or decorative toppings.

Decorative concrete: Concrete that has been enhanced by color, pattern, texture, or a combination of ornamental treatments.

Degreaser: A chemical solution for removing grease, oils, and other contaminants from concrete surfaces.

Delamination: A separation of a coating or topping from a substrate or the layers of a coating from each other due to poor adhesion. Or in the case of a concrete slab, a horizontal splitting or separation of the upper surface.

Densifier: A penetrating liquid chemical hardener applied to concrete to help solidify and densify the surface and provide extra protection from water penetration and staining. Often recommended for polished concrete, because hard concrete produces a better polish.

Diamond grinding: A multistep grinding procedure for producing polished concrete surfaces. Contractors use a floor polisher equipped with diamond-segmented abrasives, progressing from coarser to finer grits until the desired level of sheen is achieved.

Dry polishing: The method most commonly used for polished concrete. The floor polisher is hooked up to a dust-containment system that vacuums up the dust from diamond grinding of the surface.

Dry-shake color hardener: A mixture of coloring pigments, cement, aggregates, and surface conditioning agents. Applied as a dry shake to stamped concrete or stamped overlays to produce a colorful, wear-resistant surface.

Drying shrinkage: A decrease in the volume of concrete as it dries, due to loss of moisture. See also plastic shrinkage cracks

Dyes: Translucent color solutions containing very fine pigments that penetrate into the concrete surface. Will not chemically react with concrete (like acid stains will). Both water- and solvent-based dyes are available, with colors ranging from soft pastels to bolder hues such as red, blue, and orange

Edger: A tool used on the edges of fresh concrete to provide a clean, finished edge.

Engraving: The use of special tools and equipment to cut or route out patterns and designs in hardened concrete. Usually the concrete is stained first to give it color, so the routed areas look like grout lines.

Efflorescence: A crystalline deposit of salts (usually white in color) that forms on the concrete surface when soluble calcium hydroxides leach from the concrete and combine with carbon dioxide in the atmosphere. On colored concrete, especially darker tones, these white deposits can be particularly unsightly.

Epoxy injection: A method for sealing or repairing cracks in concrete by low-pressure injection of an epoxy adhesive.

Epoxy resins - Organic chemical bonding systems used in the preparation of protective and decorative coatings for concrete, adhesives for injection of cracked concrete, or as binders in epoxy mortars.

Epoxy terrazzo: A poured-in-place topping for concrete substrates that goes on at a thickness of 1/4 to 3/8 inch. The epoxy resin matrix can be pigmented to achieve an unlimited spectrum of colors and is often seeded while still wet with decorative aggregates or color chips.

Etching gel: A gentle etching medium often used with adhesive stencils to lightly etch designs in concrete surfaces. The material is thick enough to be applied by brush, permitting controlled application.

Evaporation retarder - A waterborne, spray-applied film that temporarily reduces moisture loss when applied to the surface of freshly placed concrete. This product should not be worked into the surface (not a finishing aid), as it will lower the water/cement ratio at the surface weakening the concrete.

Expanded metal lathe - A sturdy but flexible diamond mesh often used as a framework or support system for concrete sculptures, faux rock, **and** vertical stamped concrete.

Exposed aggregate: A decorative surface formed by removing the surface mortar from a concrete slab (either by scrubbing, pressure washing, chemical surface retarders or abrasive blasting) to expose the underlying aggregates.

Faux rock: An artificial rock formation sculpted or molded from concrete and then textured and colored to replicate the look and feel of natural rock. Popular applications include waterscapes, zoo exhibits, landscaping, and theme parks.

Feather edge: To smoothly, seamlessly blend the edge of a topping or repair material into the existing concrete.

Fibers: Tiny filaments made of polypropylene, polyolefin, nylon, polyethylene, polyester, or acrylic used alone or in conjunction with rebar or welded wire mesh to reinforce concrete.

Finishing: Leveling, smoothing, compacting, and otherwise treating the surface of newly placed concrete or concrete **overlays** to produce the desired appearance and service properties.

Film-forming sealer: A type of sealer that blocks the penetration of water and contaminants by forming a barrier on the concrete surface. May also impart a gloss or sheen, which enhances colored or exposed aggregate concrete.

Film thickness: The depth of the film when wet (wet film thickness) and the final depth when dry (dry film thickness).

Flashing (or flash broadcasting): A technique for applying accent colors of dry-shake hardener to concrete surfaces before stamping. Results in subtle, natural-looking color variations.

Flexural strength: The ability of hardened concrete or an overlay to resist failure in bending.

Float finish: Surface texture (usually rough) obtained by.

Floor polisher: A walk-behind machine used in the production of polished concrete. Most machines are equipped with a planetary drive system a large primary polishing head (from 17 to 36 inches in diameter) fitted with three or four smaller satellite heads that hold the diamond abrasives. When the machine is operating, the satellite heads rotate in the opposite direction of the primary head to eliminate linear grinding marks in the floor
Fly ash: A byproduct resulting from the combustion of ground or powdered coal; sometimes used as a cement replacement in concrete.

Form liner: Material used to line the interior face of formwork in order to impart a smooth or patterned architectural finish.

Fresno: A large trowel (about 2 to 4 feet in length) used for final finishing after bull floating. Long handles (like those used for bull floats) either clip on or screw into the blade.

Gauge rake: A tool with an adjustable depth gauge designed for application of high-build coatings or cementitious toppings at a preset, uniform thickness.

Glass-fiber reinforced concrete (GFRC): A Portland cement - based composite containing glass fibers for reinforcement. Substantially lower in weight than plain concrete, with higher flexural and compressive strengths. Often used in the production of faux rock formations and concrete countertops.

Granulated blast furnace slag: A glassy, granular material formed when molten blast furnace slag is rapidly chilled. Ground granulated slags are sometimes used in concrete mixtures as a cement replacement to help reduce permeability and improve durability. May also slow setting and extend the working time of the concrete.

Grinding: A mechanical surface preparation method using rotating abrasive stones or discs to remove thin coatings and mastics or slight flaws and protrusions.

Groover: A tool with a V-shaped bit used to create control joints in plastic concrete.

Grout: A mixture of cementitious materials and water, with or without aggregate, proportioned to produce a creamy consistency. Can be purchased pre-blended in a multitude of colors to define joints and saw cuts in decorative concrete slabs or walls, especially those with stone, brick, or tile patterns.

Hand float: A smaller handheld version of the bull float, ranging in length from 12 to 18 inches. Especially useful for floating along the perimeter of forms or to work in tight spots.

Hard-troweled finish: Surface finish obtained by using a trowel with a steel blade for final finishing of concrete. Often used where a smooth, hard, flat surface is desired.

High-build coating: A protective or decorative coating that produces a thick film (usually greater than 10 mils) in a single coat.

High-pressure water blasting: A process for cleaning or roughening concrete surfaces using a stream of water delivered at high pressure.

High-volume low-pressure (HVLP) sprayer: A spraying device that applies high-solids paints and coatings at low pressure and low velocity, to reduce overspray.

Hopper gun - A gravity-fed system for spray application of coatings or toppings. The material is placed in a hopper attached to a spray gun, which is powered by an air compressor. Often used to apply spray-down systems.

Hydration: The chemical reaction between cement and water that causes concrete or other cement-based materials to harden.

Integral color: A coloring agent premixed into fresh concrete or cementitious toppings before placement.

iron oxide - An inorganic pigment often used to color decorative coatings and toppings.

Joint (control, expansion, or isolation): Formed, sawed, or tooled groove in a concrete slab used to regulate the location of cracking (control joint) or to allow expansion or movement of adjoining structures. In decorative concrete, joints can also double as delineating design elements in a pattern.

Joint filler: A compressible material used to fill a joint to prevent the infiltration of debris.

Kerf : A cut in a concrete surface made by a saw or router.

Kneeboards: Boards used by concrete finishers to kneel on when hand floating or troweling concrete flatwork.

Knock-down finish: Achieved by applying a decorative topping with a hopper gun and then using a **trowel** to knock-down the material to produce a smooth or lightly textured surface.

Laitance: A thin layer of fine, loosely bonded particles on the surface of fresh concrete, caused by the upward movement of water. Laitance must be removed before application of a decorative coating or topping.

Marbleize: To give concrete surfaces the look and gloss of marble, through a combination of color layering and finishing techniques.

Margin trowel (also pointer or pointed masons trowel): A steel trowel with a small, rectangular flat blade about 5 to 8 inches in length and a short handle. It has multiple uses, including scraping off concrete from finishing tools and applying patching materials.

Masking: Covering select areas of a concrete surface with an adhesive stencil, tape, or other medium before applying a decorative treatment that will affect only the exposed areas.

Material safety data sheet (MSDS): Information sheets containing pertinent chemical ingredients, product handling and safety guidelines.

Membrane: Formed over a concrete surface to provide protection and enhance color. Typically clear plastic like acrylic, polyurethane or epoxy.

Microtopping: An ultra-thin polymer-based decorative topping, generally less than 1/4-inch total thickness. Typically applied by trowel or squeegee, and given a texture or smooth finish. Pigments can be incorporated into the mix or broadcast onto the surface for a marbled appearance.

Mil: A measurement equal to 1/1,000 (0.001) inch. Commonly used to denote coating thickness.

Mix design: Specific proportions of ingredients (cement, aggregates, water, and admixtures) used to produce concrete suited for a particular set of job conditions.

Mixing station: A designated work area outfitted with all the equipment and supplies needed to mix materials properly and efficiently.

Mock up: An architectural concrete sample made using the same materials and methods proposed for an actual project. Often required for quality assurance on large projects, to ensure that architectural requirements and industry tolerances are met. The size should be sufficient to adequately demonstrate all decorative treatments.

Moisture vapor transmission: The migration of moisture vapor to the surface of a concrete slab, caused by vapor pressure differentials in the concrete and the surrounding atmosphere. Can contribute to the failure of impermeable coatings or other floor toppings that do not permit moisture to escape.

Neutralize: To return concrete to the proper pH after acid etching, generally by washing the surface with a mixture of water and ammonia or sodium carbonate. Ideal pH is 7.0 (neutral), but a pH range of 6.0-9.0 is acceptable for most coatings. ASTM D 4262, "Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces" covers the procedure for determining the acidity or alkalinity of concrete surfaces prepared by chemical cleaning or etching prior to coating application.

Notched-squeegee: A rubber squeegee with notches or serrations on one or both edges. Used for smooth and consistent spreading of epoxy resin products or other low-viscosity coatings.

Opacity: The ability of a coating to hide the color of the underlying surface.

Overlay: A bonded layer of material, ranging from 1/4 to 1 inch or more in thickness, placed on existing concrete surfaces to beautify, level, or restore.

Patterned Concrete: See stamped concrete

Penetrating sealer: A **sealer** with the ability to penetrate into the concrete surface to increase water repellency and resist stains. Often used on decorative concrete to provide invisible protection without changing the surface appearance.

Permeability: The degree to which a membrane or coating will allow the passage or penetration of a liquid or gas.

pH Test: A test performed on the concrete surface to determine the level of acidity or alkalinity. Typically performed prior to applying sealers or coatings.

Pigment: A finely ground natural or synthetic particle adding color and opacity to a coating or topping.

Pinholing: A defect in a coating characterized by pinhead-sized holes that expose the underlying substrate.

Plastic: A condition of freshly mixed concrete indicating that it is workable and readily moldable.

Plastic shrinkage cracks: Irregular cracks that occur in the surface of fresh concrete soon after it is placed and while it is still plastic. Usually parallel to each other and less than 1/8" deep.

Plasticity: Property of freshly mixed concrete, cement paste, or mortar which determines its ease of molding or resistance to deformation.

Platform tools: Rigid stamps made of plastic or metal that leave deep grooves in freshly stamped concrete, which can later be grouted or left open.

Polished concrete: A high-gloss finish attained by using special floor polishers fitted with diamond-impregnated abrasive disks (similar to sandpaper) to grind down surfaces to the desired degree of shine and smoothness. The resulting surface is very low-maintenance and can be stained to replicate the look of polished stone.

Polyaspartic: An aliphatic polyurea coating that is very fast-curing and that can be applied to concrete over a wide range of temperatures. Seamless polyaspartic floors are typically applied in two or three coats with embedded vinyl or quartz chips to form a highly stain- and abrasion-resistant coating.

Polymer - modified overlay: A cement-based overlay with polymer resins added to improve performance, wear resistance, and aesthetic qualities. Overlay manufacturers use different types of polymer resins, often blending them to produce proprietary products with unique characteristics. Many of today's decorative overlays use acrylics or vinyl blends because these resins provide excellent bond strength and UV resistance.

Polymer stain: An acrylic-urethane based stain available in a broader palette of colors than acid stains. Very low in volatile organic compounds, with workability characteristics similar to latex paint. Can be applied to concrete surfaces by brush, roller, sponge, cloth, or commercial sprayer.

Popout: A pit or crater in the concrete surface, ranging in size from 1/4 inch to several inches in diameter, that results from the fracturing of unsound aggregate particles due to expansion pressure. Usually caused by porous aggregate having a high rate of absorption.

Pot life: The length of time a material is useful after its original package is opened or a catalyst is added.

Profile: The act of preparing a concrete surface to achieve the necessary degree of roughness.

Portland cement: A hydraulic product that sets and hardens when it chemically interacts with water. Made by burning a mixture of limestone and clay or similar materials.

Pozzolan: A siliceous and aluminous material that, in the presence of moisture, chemically reacts with calcium hydroxide to form compounds possessing cementitious properties.

Primer : The first coat of material applied to a concrete surface to improve bonding or adherence of subsequent coats.

Pump-up sprayer: An airless sprayer often used to apply sealers and liquid release agents.

Raveling: The dislodging of aggregate at the edges of joints or scored patterns in concrete, generally caused by saw cutting joints too soon after concrete placement.

Ready-mixed concrete: Concrete that is batched or mixed at a central plant before delivery to the job site for placement.

Rebar (or reinforcing bars): Ribbed steel bars installed in cast-in-place concrete to provide flexural strength. Rebar come in various diameters and strength grades.

Reentrant corner: An angle in a concrete slab that points inward. Often vulnerable to cracking, unless a control joint is installed.

Reflection cracking: The occurrence of cracks in overlays and toppings that coincide with the location of existing cracks in the substrate.

Reinforced concrete: Concrete construction that has steel rebar or welded wire mesh embedded in it to provide greater tolerance to tension and flexural stress.

Release agent: A powder or liquid parting agent applied to stamping mats or texturing skins before stamping to keep the mats from sticking to fresh overlay or concrete surfaces.

Rustication strip: A strip made of wood, polystyrene, or plastic that is fastened to forms or form liners to impart architectural details to wall surfaces.

Sacrificial coating: A final floor finish or wax designed to protect the sealer or topcoat from wear. Usually applied by mop or floor buffer in several coats to act as a shock absorber to scuffs, scratches, and grime.

Salt finish: A textured, decorative finish obtained by broadcasting rock salt onto fresh concrete and then using a roller or float to press the salt particles into the surface. After the concrete sets, the salt is washed away to reveal a speckled pattern of shallow indentations.

Sample (or sample board): A small (generally 2x2-foot) representation of a decorative concrete installation, used as a selling tool or to experiment with various decorative treatments and techniques for applying materials.

Sandblast stenciling: A technique for patterning existing concrete surfaces by applying resilient adhesive stencils followed by sandblasting to lightly remove concrete in only the exposed areas.

Sandblast: Allow concrete to cure to sufficient strength so that it will not be damaged by blasting but not less than seven days. Use light, medium, heavy sandblasting to remove cement mortar from surface and expose aggregate to match originally approved mockup, field sample. A method of abrading or profiling a surface with a stream of sand ejected from a nozzle at high speed by compressed air.

Saturated surface dry (SSD): Condition of concrete when the permeable voids are filled with water but no water is on the exposed surface.

Sawcutting: Using a concrete saw with abrasive blades or disks to cut joints or score patterns into hardened concrete.

Scaling: The flaking or breaking away of a hardened concrete surface, often due to exposure to freezing and thawing.

Scarifier: Milling equipment used to clean and profile concrete surfaces or to remove existing coatings. Uses rotary impact cutters held at a right angle to the surface.

Sealer: Solvent- or water-based material used to protect and enhance the appearance of decorative concrete.

Seeding: Broadcasting decorative aggregates on the surface of freshly placed concrete or toppings.

Segregation: The separation of the components of wet concrete caused by excessive handling or vibration. Concrete dropped too far away from final destination point and dragged to final destination can also cause segregation.

Self-leveling overlay: A flowable, polymer-modified cementitious topping with the ability to self level without troweling. Used to smooth and level existing concrete surfaces. Can also be enhanced by staining, dying, or sawcutting.

Set: The condition reached by concrete when plasticity is lost, usually measured in terms of resistance to penetration or deformation. Initial set refers to concrete that has reached first stiffening. Final set occurs when concrete attains full rigidity.

Setting: The chemical reaction that occurs after the addition of water to a cementitious mixture, resulting in a gradual development of rigidity.

Scratch coat: A base coat used to improve the rigidity and/or bonding of subsequent topcoats. A scratch coat is often required for vertical stamped concrete.

Screed box: A walk-behind applicator, similar in appearance to a lawn fertilizer spreader, designed to put down epoxy coating systems at a specific depth.

Shotblasting: An abrasive blasting method using round iron shot to clean and profile concrete surfaces.

Skim coat: An overlay layer applied very thinly with a squeegee or trowel.

Solvent: Liquid typically used as a carrier for sealers and curing compounds.

Spalling: A breaking away of concrete at joints in floors or slabs. Typically occurs at joints that are installed improperly or don't adequately support the loads applied to them.

Spray-down system: A decorative overlay applied as a splatter coat or a knock-down finish to a thickness of about 1/8 inch. Often used in conjunction with paper or adhesive stencils. Available precolored or can be integrally colored during mixing.

Slump: A measure of consistency of freshly mixed concrete, as determined by the distance the concrete slumps after a molded specimen is removed from an inverted funnel-shaped cone.

Spiked kneeboards: Kneeboards with spikes on the bottom that elevate finishers off floor surfaces to permit easier finishing of toppings and overlays.

Spiked roller: A cylindrical tool similar in appearance to a paint roller, but with rows of polypropylene spikes. Used to roll across the surface of freshly applied epoxy coatings to release trapped gas bubbles and to assist in leveling.

Splatter coat: A coating or topping applied by splattering it onto the surface, typically by dipping a brush into the material and then flicking it.

Stamped concrete: Concrete flatwork that is patterned with platform tools, stamping mats, or seamless texturing skins to resemble materials such as brick, slate, stone, tile, and wood planking.

Stamped/Imprinted: Apply pattern according to tool manufacturer's instructions. Touch-up pattern and finish edges with hand tools as necessary.

Stamped overlay: Similar to conventional stamped concrete, but can be applied to existing concrete. A cementitious topping is applied at a thickness of 1/4 to 3/4 inch and then stamped to mimic brick, slate, and natural stone. Color options include colored liquid or powdered release agents, acid stains, dyes, and tinted sealers.

Stamping mats: Rigid or semi-flexible polyurethane tools for imprinting stone, slate, brick, and other patterns in stamped concrete surfaces. Stamping mats usually imprint a shallower pattern than **platform tools**.

Static cracks: Random, non-moving hairline cracks that only affect the concrete surface.

Stenciled concrete: A decorative surface treatment using heavy-duty paper stencils with stone, tile, or brick patterns that are lightly pressed into fresh concrete, followed by the application of dry-shake color hardeners. When the stencils are removed, the uncolored concrete mimics mortar joints. Another technique, for use on existing concrete, is to apply adhesive stencils and then color, etch, or sandblast the surface straightedge - A rigid, straight piece of wood or metal used to strike off a concrete surface to proper grade before the floating operation.

Strike off: To level off freshly placed concrete to the correct elevation.

Substrate: An existing concrete surface that receives an overlay, decorative or protective coating, repair procedure, or other resurfacing treatment.

Surface preparation: Preparing concrete surfaces prior to resurfacing or application of a decorative coating to remove contaminants and minor defects or to obtain the necessary degree of roughness for adequate bonding.

Surface retarder: A chemical applied to the surface of newly placed concrete to delay setting of the cement paste so it can be removed easily later by scrubbing or power washing to produce an exposed aggregate finish.

Swirl: Float concrete. Work float flat on surface using pressure in swirling manner to produce series of uniform arcs and twists. Use aluminum or magnesium float to produce medium texture. Use wood float to provide coarse texture.

Tack: The stickiness or adhesiveness of a material.

Tamper (or pounder): A handheld impact tool used to firmly press stamping mats or texturing skins into fresh concrete to ensure a complete imprint.

Technical data sheet: Contains important specifications and manufacturer guidelines for product usage. Includes such data as coverage rates, recommended applications, product limitations, surface preparation guidelines, mix ratios and required mixing times, pot life, application procedures, cure times, performance data, and precautions.

Texture roller: A cylindrical tool similar in appearance to a paint roller used to impart a stonelike texture to stenciled concrete. It is rolled over the stencil and the fresh concrete to texture only the exposed surfaces.

Texturing: Giving concrete or overlay surfaces a texture without leaving deep pattern lines.

Texturing skins: Flexible skins for adding seamless textures to concrete surfaces. Generally thinner and more pliable than stamping mats. Often used to texture slab perimeters and vertical faces, such as stair risers. Can also be used to fix blemishes from non-uniform stamping.

Tint : A diluted color wash used to add hints of color to decorative concrete.

Trowel - A flat, broad-bladed steel hand tool used to compact the paste layer at the surface and provide a smooth, flat finish. Also useful for applying topping or repair materials. Available in different shapes (with rounded or square edges) and lengths (ranging from 8 to 24 inches). Smaller trowels are useful for borders, work in restricted areas, or to work in flashing accents of dry-shake color hardener.

Trowel finish: The smooth or lightly textured surface finish obtained by troweling.

Translucent: A type of finish where the coating has some level of transparency.

Vapor barrier/retarder: A moisture-impervious material, such as plastic sheeting, placed on the subbase under a concrete slab to help prevent moisture vapor transmission.

Vertical stamped concrete: A decorative finish for walls and other vertical surfaces using a lightweight **cementitious** overlay formulated to be applied at thicknesses of up to 3 inches without sagging. While the overlay is still plastic, it can be stamped or hand carved to produce deep-relief stone or masonry wall textures. After the material dries, acid stains or dyes can be sprayed or sponged onto the surface to give it the multi-toned look of natural stone.

Viscosity: A measure of the fluidity of a liquid material. The more viscosity a material such as a **sealer** or coating has, the less it flows.

Volatile organic compounds (VOCs): Organic chemicals that readily vaporize at normal room temperatures. Concrete coatings, sealers, or cleaning materials that are solvent-based generally have higher VOC contents than water-based materials. Some VOCs can be hazardous when inhaled.

Water-cement ratio: The ratio of the amount of water to the amount of cement in a concrete mixture. The key to producing high-quality decorative concrete is to keep the water-cement ratio as low as possible without sacrificing workability.

Water plug: A hydraulic cement used to fill cracks and to prevent the migration of moisture.

Water reducer: An admixture that either increases the slump of freshly mixed concrete without increasing water content or maintains workability with a reduced amount of water without affecting the strength.

Welded wire mesh: A woven mesh of wire strands, welded at each intersection, used to reinforce concrete slabs. Also called welded wire fabric.

Wet polishing: A method for polished concrete that uses water to cool the diamond abrasives and eliminate grinding dust. Not as commonly used as dry polishing, because the process creates a tremendous amount of slurry (a soupy mixture of water and cement dust) that must be collected and disposed of.

White cement: A Portland cement with a low iron content that hydrates to a white paste. Often used in integrally colored concrete to produce pure, bright color tones, especially pastels.

Workability: The ease with which concrete or other cementitious materials can be mixed, placed, and finished.

Working time: The amount of time available for placing and finishing a cement-based material before it begins to set. Often depends on the ambient temperature and substrate temperature.

Xylene: A common solvent. Used as a carrier for solvent based sealers. It is high in odor and flammability.