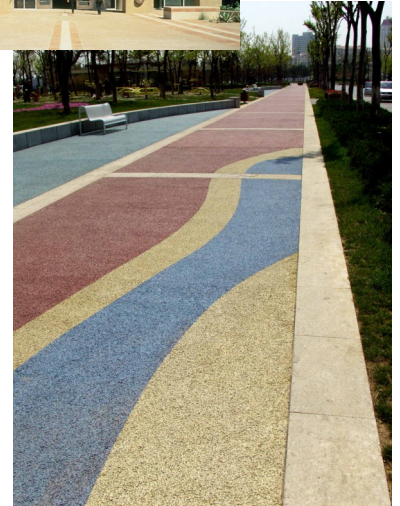

Guideline to Successful Architectural & Decorative Concrete Paving



6 Key Tips to Success

This guide provides basic principles & tips towards specifying and producing quality architectural & decorative paving outcomes with new concrete.

Achieving a desirable and acceptable architectural/decorative concrete experience takes the combined efforts of everyone involved in the project: the designer, concrete contractor, concrete mix engineer and the concrete supply batch plant; all adhering to and utilizing good concreting best practices.

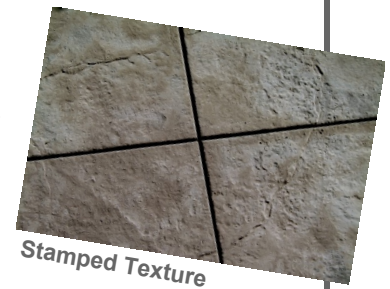
**Southern
California
Concrete
Producers**

Guideline 1 - Set Expectations at the Beginning:

Concrete is made from naturally occurring materials. As with stone, decorative concrete or even uncolored concrete has natural variation. It is important to plan for this variation from the beginning. Decorative texture finish patterns from stamping, brooming or exposed aggregate can diffuse light and minimize variations in the final product. Educate your customer about textures by visiting similar jobs and/or showing project photographs, preferably ones you've already finished.

The responsibilities of the various parties involved with the project should be addressed at a "pre-construction meeting" for any large or critical project – towards reviewing and agreeing upon expectations. Personnel for this meeting should include: owner's authorized representative, the designer/architect, general contractor, and concrete contractor.

On large or complex jobs always create a mock-up for customer approval before beginning production. Utilize the same approaches, materials and finishes in the mockup as to be utilized in the project.



Stamped Texture

Guideline 2 - Mix Design:

An important aspect of planning for an architectural concrete paving installation is the project's mix design document, sometimes referred to in the industry as the "statement of mix design." This document, developed and finalized by the lead project team members, defines the concrete and the ingredients to be within each cubic yard of concrete, and includes:

- Ready-mix producer's batch plant
- Mix design number & date
- Project owner; Project address
- Compressive strength @ 28 days
- Fine aggregate source
- Coarse aggregate source
- Aggregates gradation chart
- Portland cement Type (II, III, IV, V) and supplier
- Cement content per CY of concrete
- Water/Cementitious ratio
- Concrete slump & acceptable variance range (typically 4" to 5" +/- 1")
- Admixtures used (synthetic fibers, retarders, accelerators, water reducers, air entrainment, color pigments, shrinkage reducing admixtures)
- Batch weights per 1 CY of concrete for each of: cementitious materials, fine & coarse aggregates, water, and admixtures
- Paving finish or texture type (per architect's drawing)
- Signed stamp and date of appropriate design professional
- Method for concrete testing
- Typical strength results per local building code
- Mock-up specification (if used) for pre-approval
- Concrete lab's authorization signature
- Designated project representative authorization signature (architect, landscape architect, general contractor)

Guideline 3 - Concrete Materials & Sourcing:

Concrete Materials: To maintain project consistency, specify "sole-sourcing" (i.e., consistent or non-altered sourcing) of materials over the project. Concrete is a mixture of cement, water, fine & coarse aggregates, air and performance admixtures. The cement and water combine to form a paste which binds the aggregates together. As the paste hardens via chemical "hydration," the aggregates turn into a rock-like mass resulting in "concrete." Freshly mixed concrete has "rich" or "lean" mixes comprised of the following ingredients & proportions:

- Portland Cement (Type II, III, IV, or V) – 7% to 15% of the total volume (up to approx. 600-660 lbs./CY). Fly ash – a typical supplementary replacement to cement (up to 30% of cement volume; approx. 190-198 lbs./CY) - aids in pumpability, finishing, and reduces alkali-silica reaction. Maintain a consistent supply and quality of cement and fly ash throughout the project.
- Fine Aggregate (washed sand) – 24% to 30% of total volume (up to approx. 1,650-2,050 lbs./CY)
- Coarse Aggregate (3/8" pea-gravel or 3/4"-1" gravel) – 31% to 51% of total volume (up to approx. 800-1,000 lbs./CY)
- Water – 14% to 21% of total volume (up to approx. 400 lbs./CY)
- Air – 1% to 8% of total volume



Stone Stamp with Color

• Admixtures - Typically used today within all concrete mix designs to affect desired enhancements in concrete property areas of: workability, finishability, strength (early or long-term), durability, permeability, wear resistance, and/or coloring.

Concrete Sourcing: For specific suggested concrete ordering guidelines, refer to NRMCA's Concrete in Practice (CIP) #31 "Ordering Ready Mixed Concrete".

Guideline 4 - Job Preparation:

Basic job-site preparation steps are essential towards constructing a quality concrete installation. The sub-grade, proper formwork, and reinforcing must be appropriately specified. Key factors are:



Smooth Troweled Colored

1. The sub-grade should consist of semi-permeable, non-expansive soils. It should be well graded and compact, with no standing water at time of placement.
2. Place concrete over a minimum of 2" of damp, screeded washed concrete sand. Sand creates a proper slip plane, retains moisture, and provides an avenue for migration of bleed water – all of which reduces surface cracking, prevents soil-to-concrete surface contamination, and controls bleed water.
3. Utilization of industry standard recommended formwork practices creates quality edges, smooth grades and even transitions.
4. Utilize slab reinforcement that compliments the desired architectural concrete outcome for desired strengths and loadings, and minimize potential slab displacement due to possible settling. Typical slab reinforcement types for architectural concrete are: Synthetic fibers, reinforcing steel (rebar), and/or steel dowels.

Review and determine the surface finish's jointing plan. Concrete jointing serves to control the location of anticipated random slab cracking as well as to aid in the overall aesthetic appearance. The three basic paving joint types recognized by ACI are:

1. Contraction Joint (often called control joint, hand-tooled joint, crack control joint) - This is a decorative saw cut or tooled joint used to avoid random cracks or provide an aesthetic score line pattern.
2. Construction Joint (often called cold joint or doweled construction joint) - This is the most commonly used method for alternate placements or checker-boarding of alternate placements.
3. Isolation Joint (often called expansion joint) – These are used to permit movement between vertical and horizontal surfaces, e.g. horizontal slabs against walls, columns, foundations, footings or points of restraint such as drains, manholes, utility covers, and steps.

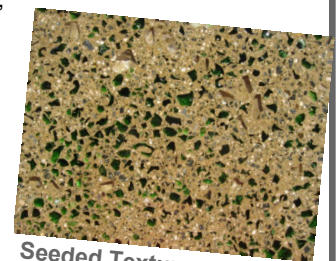
Surface Finish Texture & Color: Determine the agreed upon architectural surface finish texture and color scheme. Utilize mock-up panels and/or preliminary samples whenever possible. Establish a production review expectation ("hold point") to confirm the project's actual surface finishes match understood expectations. Refer to the photos throughout this Guideline for an initial selection of architectural finish types.

Weather Conditions: Changes in weather conditions can affect the appearance of concrete. Temperature affects the amount of water required to make the concrete mix workable. Variations in the water-to-cement ratio can have an effect on final concrete color. Maintain a consistent water/cement ratio throughout the project and follow ACI guidelines for hot and cold weather concreting where applicable.

Guideline 5 - Concrete Delivery, Placement & Finishing:

Before any concrete is delivered to the jobsite, coordination & project review efforts should have taken place between the essential parties (see "pre-construction meeting" above). Concrete related topics at this point should include mix design, finish elevations, utility coordination, concrete placement sequencing and scheduling, joint layout, plus the surface finish color and texture type.

Upon delivery of the concrete, verify that the delivery tickets match the project's certified Statement of Mix Design. A slump test should be taken at the point of discharge on site to confirm the specified slump. Acceptable water reducing admixtures should be utilized to achieve required slump performance at delivery, versus any site addition of water – which could alter strength performance and final color outcome.



Seeded Texture

Placement:

1. Transport the concrete from the mixer to its place of deposit as close to its final location as possible to minimize segregation of aggregates or loss of material. Deposit at the bottom of any slope and work uphill as applicable.
2. As necessary for the mix design, use a concrete vibrator to consolidate the placed mix. Don't move concrete horizontally with a vibrator, as it will cause segregation.
3. Strike-off concrete immediately after placing with a straight edge to level concrete to the top of the forms. Screeding must be performed before bleed water rises to the surface.

Guideline 5 - (Continued):

Finishing:

1. Bull-floating the surface immediately after screeding will reduce surface bleeding and eliminates surface high and low spots.
2. Wait for bleed water to disappear before continuing finishing. Finishing the concrete surface with bleed water present can lower the concrete's surface strength and lead to blistering, dusting and scaling.
3. Never spray water on the surface during the finishing process, as it will discolor the concrete by increasing the surface's water/cement ratio.
4. Depending on finish, float the surface with wood floats or darbies. Floating imbeds large aggregates beneath the surface, produces a level surface and consolidates the surface in preparation for troweling.
5. Trowel the surface only after floating to produce a hard, smooth surface that will be easy to clean and maintain.
6. Perform jointing in accordance to the project's pre-determined jointing plan.
7. Saw cut contraction joints if jointing was not performed during plastic stage.



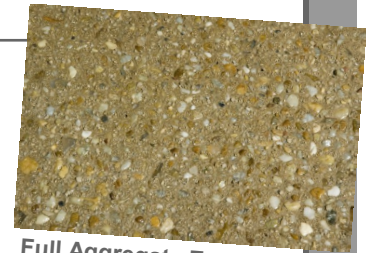
Stamped & Stained



Sand Exposed Texture

Guideline 6 - Curing & Sealing:

To achieve a long lasting outcome, complete architectural and decorative concrete finishing with a membrane-forming cure and seal formulated specifically for decorative concrete. A properly applied curing compound will assist in achieving **consistent** drying (to achieve desired strength properties) and a **consistent** final color. Lack of proper curing can lead to shrinkage cracks, dusting and surface deterioration.



Full Aggregate Exposed

- Any saw cutting, either decorative or structural, should take place before sealing materials are applied. Thoroughly clean all cutting residue before applying sealing products.
- Curing with water sprinkler, membranes, paper, sodium or fluoro silicate-type hardeners and non-approved compounds can cause discoloration. If water is used to cure, a lighter color will likely occur.

Always use curing, sealing (non-yellowing), and cure-and-seal products suitable for decorative (or colored) concrete and follow the manufacturer's recommendations for application.



Integrally Colored Pervious

This Guide explains the basics of producing high quality, decorative concrete and the how-to's for maximizing surface appearance. This Guide shares "Tips of the Trade" that are specific to decorative concrete, but does not provide a complete guide to decorative concreting as specific needs may vary.

For more information on creating finishes, see *Finishing Concrete Slabs with Color and Texture* by the Portland Cement Association, or contact us for suggestions & guidance.

Further information on specifying concrete can be found in ACI 360R-06, *Design of Slabs-on-Ground*, published by American Concrete Institute, www.concrete.org.

Observe applicable building codes, project specifications, appropriate safety procedures and follow good industry practices for concrete construction.

Visit our web site at: www.concreteresources.net Additional decorative concrete resource information may be found at:

www.cement.org/decorative
www.cement.org/decorative/floors.asp
www.concretenetwork.com



Wood Planked

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