DAVIS COLORS

1. Product Name

Davis Colors™ - Color Pigment Additives for Concrete and Concrete Products

2. Manufacturer

Davis Colors
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3. Product Description

Davis Colors are made with pure, concentrated pigments specially processed for mixing into concrete or any other building material made of cement. They are lightfast, alkali resistant, weather resistant and formulated to give long-lasting appeal to concrete. Davis Colors have been giving concrete the added design dimension of color since 1952. Davis Colors meet or exceed ASTM C979, which establishes the criteria for the alkali resistance, stability and lightfastness of pigments and their compatibility with concrete.

BASIC USE

Use Davis Colors to beautify cast-in-place concrete buildings, structures and pavement. Davis Colors are also used in precast and tilt-up concrete, concrete masonry units and unit pavers, masonry mortar, shotcrete, plaster and other Portland cement based products. Concrete suppliers and product manufacturers normally add Davis Colors into the mix at the factory; therefore, the following information regarding packaging and mix instructions may not be necessary for architectural specifications.

COMPOSITION & MATERIALS

Davis Colors are color admixtures made from metal or mineral oxides either recycled from iron or refined from the earth. Most Davis Colors are made from iron oxide, an inert and environmentally safe material. Davis Colors 807 and 8084 are concentrated carbon black, treated in a proprietary process for extra tint strength and dispersibility. They are economical alternatives where concrete is not air entrained and is sealed against water damage.

Davis Colors are manufactured to exact quality control standards to maintain uniformity of color from shipment-to-shipment and year-to-year. They are mechanically milled to microscopic particle size to obtain high tinting strength, particularly in concrete applications.

COLORS

Davis Colors are available in a wide spectrum of standard colors and can be custom blended to meet special design requirements. Concrete ready mix producers equipped with the Chameleon™ automatic color dosing system by Davis Colors can supply pre-colored concrete in nearly all available shades and intensity. Plus, they can create custom colors or adjust colors at their factory with little or no lead time. For further information on colored concrete finishes and textures, see the publications listed in Part 4 Technical Data.

PACKAGING

Davis Colors are available in powder, liquid and low-dust granular form, packaged in small bags, bulk bags, liquid bins or large bulk transporters. Concrete suppliers add Davis Colors to the mix using the Chameleon automatic dosing system or Mix-Ready® disintegrating bags. Mix-Ready bags are tossed into the mix without opening or pouring. They disintegrate under mixing action, leaving no bags to throw away in the environment. The Chameleon is a computer-controlled automatic dosing system that improves color accuracy, availability and handling efficiency.

LIMITATIONS

- Do not use with admixtures containing calcium chloride
- Davis Colors are for mix-in use only; do not sprinkle or dust onto concrete surfaces

4. Technical Data

APPLICABLE STANDARDS

ASTM International - ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete

REFERENCE INFORMATION

ACI International (American Concrete Institute)

- ACI 301 Specifications for Structural Concrete for Buildings
- ACI 302.1 Guide for Concrete Floor and Slab Construction
- ACI 303 Guide to Cast-In-Place Architectural Concrete Practice

Integral color adds a design dimension to otherwise ordinary concrete.

- ACI 305 Hot Weather Concreting
- ACI 306 Cold Weather Concreting
- ACI 306.1 Standard Specification for Cold Weather Concreting
- ACI 325.9 Recommendations for Construction of Concrete Pavements & Bases
- ACI 347 Guide to Formwork for Concrete

Portland Cement Association (PCA)

- PA124 Finishing Concrete Slabs with Color and Texture
- SP021 Color and Texture in Architectural Concrete

5. Installation

The keys to successful concrete, whether colored or not, include consistency in materials and craftsmanship and careful planning and detailing of the project. Follow industry standards for high quality concrete work, comply with current editions of the applicable ACI publications unless otherwise specified, and observe the following recommendations.

CONCRETE MIX DESIGN

- Choose color from the Davis color card and specify it by color name and number
- Custom shades are made by varying the amount of color added to the mix. Typical dose rates range from 1 - 5 lb (0.45 - 2 kg) of Davis Colors per 94 lb (43 kg) sack of cement contained in the mix (liquid color dose rates range from 1 - 8 lb (0.45 - 4 kg) per 94 lb (43 kg) of cement)

- Maximum dosage rate of dry color should not exceed 10% of weight of cement content
- Cement content for dosage determination includes Portland cement, fly ash, silica fume, lime and other cementitious materials but not aggregate or sand
- Use the same pigment-to-cement ratio for each mix design
- For consistent color throughout a job, each component of the concrete should be from a single consistent source, uniform in color, and consistently proportioned
- Maintain 5" (127 mm) maximum slump unless otherwise specified
- If greater workability is required, use water reducing or plasticizing admixtures instead of added water
- A low water-cement ratio minimizes shrinkage and cracking, maximizes hardness and promotes a richer, darker concrete color. Adding water causes concrete to pale or wash out
- Specify the largest size of coarse aggregate usable to keep water content low. In locations subject to freeze/thaw conditions, specify entrained air content range of 5 - 7% for improved workability and durability
- Clean mixer thoroughly before batching colored concrete and after pour to prevent color carry-over
- Mix-Ready bags are compatible with vinsol resin-type air entraining agents, water reducing or plasticizing admixtures and reinforcing fibers. They have a track record of compatibility with other commercially available admixtures but have not been tested with all admixtures and mix designs

Note - The pure pigments in Davis Colors are not blended with the fillers, additives or admixtures used in some other brands of concrete colors. Preblended admixtures, sometimes called color-conditioning admixtures, add unnecessary expense and can be incompatible with the concrete mix specified for a particular project. Instead of preblended admixtures, Davis Colors recommends using admixtures which have a proven performance record with concrete producers near the project location.

Davis Colors in Mix-Ready disintegrating bags can be added to the concrete mix without opening. Read label on bags. Make sure pigment number and amount added to mixer match batch ticket or mix design.

EXAMPLE OF FINISHES

Broomed - Made by pulling special brooms across stiff, freshly floated or troweled surface. For variety, broom texture can be heavy or light, or in straight or wavy lines.

Exposed Aggregate - Aggregate is exposed by seeding the fresh concrete with aggregate, or spraying a surface set-retarding compound and then scrubbing off cement paste from the surface of the concrete. If retarders are used, exercise caution and follow manufacturer's instructions explicitly.

Mechanically Abraded - Aggregate can also be exposed by removing the surface cement paste by using a high-pressure water wash, sand blasting, grinding, or bushhammering. Exposure level can vary from barely revealing fine aggregate ("brush") or up to 1/3 the diameter of coarse aggregate ("heavy").

Salt Pocked - Rock salt is pressed into the surface after finishing. After 24 hours, the salt is washed away with water and a brush. Remove all traces of salt. Allow surface and pockets to dry before applying curing compound. This finish is not recommended in cold areas where water could collect and freeze in pockets.

Stamped - A powder release agent or plastic sheet is placed on the colored concrete surface after floating. Special stamping tools are pressed into the concrete to create a pattern and then removed. Follow recommendations of stamping tool manufacturer.

Form Liners - Form liners allow endless design possibilities for texture, pattern and relief. They are available in a wide range of standard patterns as well as custom designs.

Davis Colors

BAG MIXING METHOD (STANDARD)

1. Batch mixer truck with at least 3 yd³ (2.3 m³) of concrete.
2. Toss in Mix-Ready bags and mix at charging speed for at least 5 minutes (7 minutes for pea-gravel mixes).

BAG MIXING METHOD (ALTERNATE)

Use the following method if satisfactory results are not obtained:

1. Wet mixer drum with approximately 1/2 - 2/3 of total batch water and some of the aggregate.
2. Toss in Mix-Ready bags and mix at charging speed for 1 - 2 minutes to break bags and disperse pigment.
3. Add cement and remaining aggregate and batch water. Continue mixing at charging speed for 5 minutes (7 minutes for pea-gravel mixes).

Note - In mixes with small aggregate, dry low-slump mixes, or batches with short mixing duration, bags may not completely disintegrate. With sandblasted or exposed aggregate finishes, use smaller bag sizes, 15 lb (7 kg) maximum, to reduce possibility that small pieces of bag could be exposed.

MOCK-UP

- Provide mock-up to establish that proposed materials and construction techniques provide acceptable visual effect. Construct at least 1 month before start of concrete work to allow concrete to cure before final inspection. Materials used for mock-up should be those proposed for actual construction; retain samples of cement and aggregates used. Use the same placement and finishing techniques that will be used in project
- Provide mock-up sections of building and structures which typify the most difficult areas to build. Include full allocation of reinforcing steel to be used in project. Erect forming to simulate all formed conditions in project. Include repaired areas to demonstrate the color and texture of patching materials to be used

Note - While mock-ups are not generally required on paving projects, they should be considered on large or complex projects and to demonstrate special finishes.

PREPARATION - FLATWORK

- Subgrade must be uniformly graded, compacted and dampened
- Do not place concrete if subgrade has standing water, hard or soft spots, ice, frost or muddy areas
- Add a 2" - 3" (51 - 76 mm) layer of sand, gravel or crushed stone and compact with vibrating equipment
- Grading should be sloped so that water drains away from the slab
- If a vapor barrier is used, overlap sheets and tape holes in barrier. Then place a 3" (76 mm) layer of granular self-draining compactible fill over barrier to reduce shrinkage cracking
- Fill should be uniformly compacted and free of self-draining water at time of placement.
- Forms should be positioned to achieve uniform slab thickness

Note - ACI standards for reinforcement and joint placement should be followed to control cracking.

PREPARATION - FORMED CONCRETE

- Comply with ACI 347
- Design forms to prevent pillowing and deflection of forms
- Avoid porous form materials; steel and high density overlaid plywood forms and plastic form liners are recommended. Lumber forms can affect color of concrete surface through variation in absorption of different portions of the board unless sealed with a nonporous coating
- Specify tight joints; surface blemishes occur when water containing cement is allowed to leak from forms
- Seal joints with tape or foam rubber to avoid leakage. Multiple horizontal pours should have tight-fitting forms and should be sealed against previous pours. Rustication strips are recommended at construction joints or between pours
- Use a nonstaining, chemically active release agent to ensure forms can be removed without damaging colored concrete. In general, a very thin application of release agent will result in a higher quality concrete surface and reduce the size and number of bugholes

SCHEDULING

- Schedule deliveries for consistent mixing times for each load so trucks arrive just before concrete is required
- Schedule placement and finishing of paving and exterior slabs to minimize exposure to hot sun before curing materials can be applied
- Postpone concreting until windy conditions pass. Do not concrete if rain, snow or frost is in forecast

Pattern stamping and colored release agents are applied to integrally colored concrete for unique effects.

PLACING CONCRETE

- Place in accordance with ACI 301
- Protect finished surfaces, landscaping and adjacent structures from splatters with plastic sheets
- Keep concrete temperature consistent. Temperatures between 65 - 85 degrees F (18 - 29 degrees C) will normally produce more uniform color
- Prevent segregation of mix ingredients
- Flatwork - Place concrete near its final location and move it with shovels; do not move with vibrators
- Formed concrete - Deposit concrete in lifts 12" - 18" (305 - 457 mm) thick. Layers should be fairly level so that vibrator does not need to move the concrete laterally. Insert vibrator at about 18" (457 mm) on center depending on concrete mix and vibrator used. Vibrator should penetrate at least 6" (152 mm) into preceding layer. Do not overvibrate

FORM REMOVAL

Remove forms in accordance with ACI 347. Different color hues can be expected between surfaces where adjacent formwork is stripped at different ages.

FINISHING

Textured surfaces produce more uniform looking concrete than smooth troweled or formed surfaces because the roughness of the surface scatters light reflecting off the concrete.

Textured surfaces are also more slip resistant when wet than smooth troweled floors and paving.

Flatwork

Concrete paving and slabs can be finished with a variety of attractive finishes, including broomed, swirled, troweled, rock salt pocked, exposed aggregate, sandblasted, acid-washed or pattern stamped.

- Wood bull-floats and darbies cause less surface discoloration than magnesium tools
- Wait for bleed water to disappear before starting floating and troweling. Over-troweling or starting troweling late can lead to trowel burns and dark spots
- Do not sprinkle the surface with cement or with Davis Colors or other pigments meant for integral coloring
- Do not fog the colored concrete with water or add water to tools or brooms; adding water causes the surface to pale or discolor

Note - For more information, see PCA Publication PA124.

Formed Surfaces

Sandblasting, high pressure water jet, bushhammering and surface retarders can be used to texture the surface and expose the fine or coarse aggregate. Sandblasted finishes can be brush, light, medium or heavy depending on texture desired. For more information, see PCA Publication SP021.

PATCHING COLORED CONCRETE

- Fill holes and defects in formed concrete surface within a few days after form removal. This allows patches and surrounding concrete to age together and reduces the possibility of color variations
- Use the same patching materials and techniques that were approved on mock-up. Make patches with materials from the same sources as the concrete. Because the stiff mortar used for patching typically has a lower water/cement ratio than the rest of the concrete, it will normally dry darker. To overcome this, white cement should be added to the mortar patch mix
- Determine mix proportions by trial and error; a good starting mix is 3 parts sand, 1 part gray cement, and 1 part white cement. Add enough color to create the same color/cement mix rate used on the job, but the white cement used to lighten the patch should not be included when figuring the color/cement mix rate for patching. If necessary, add aggregate to mortar mix so patches will have the same texture and appearance as adjacent concrete

CURING

- Uneven curing = uneven drying = uneven color. Use only curing compounds specifically recommended for colored concrete. Davis Colors W-1000 Clear Cure & Seal™ allows the natural appearance of concrete to show through. Davis Colors Color Seal covers concrete with a thin colored coating, creating a more uniform appearance. Curing with water, membranes or nonapproved compounds can discolor concrete
- Maintain concrete temperature between 65 - 85 degrees F (18 - 29 degrees C) in most applications during the crucial first days after placing. Dark or black-colored concrete will absorb additional heat during sunny conditions and requires extra protection during curing
- Flatwork - Apply curing compound as soon as the surface will not be damaged by walking on the concrete. If saw-cut control joints are required, make cuts before application of curing materials; thoroughly rinse cutting residue off slab to prevent stains
- Formed surfaces - Apply curing compound if forms are removed before concrete is adequately cured

WATER REPELLENTS

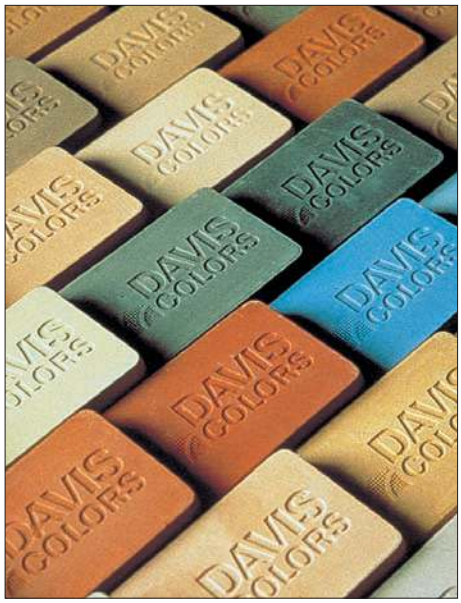
The use of a high quality sealer or water repellent treatment can help preserve the beauty of colored concrete by reducing efflorescence and staining. Follow manufacturer's instructions for use on colored concrete.

JOINT SEALANTS

Joint sealants used at construction and control joints in concrete are available in colors to match concrete colors.

PRECAUTIONS

- Color of cured concrete can vary from color cards or samples due to differences in mix water content; forming, finishing and curing methods; weather conditions; and variations in base color of cement or other concrete materials. As with all natural materials, minor variations in appearance are an accepted feature of concrete, both colored and uncolored
- Observe industry practices for quality concrete. Check a test batch to determine if it meets specifications before finalizing mix design. Sample concrete throughout pour to ensure it meets specifications



Davis Colors can transform concrete into a wide range of shades.

- Efflorescence, a salt deposit that forms a white stain on concrete, can be particularly objectionable on colored concrete. Reduce efflorescence by using a low water-cement ratio, using curing compound, and designing concrete mix for less permeability. Seal concrete against water penetration and leaks. Keep de-icing salts away from paving which is not fully cured. Remove efflorescence as soon as possible. If removal is delayed, deposits convert to calcium carbonate; it can be removed with a dilute acid wash but the removal process will affect the surface appearance
- Davis Colors are not hazardous and are nontoxic if accidentally ingested. Protect against breathing dust and contact with eyes, skin or clothing. Wash thoroughly after use. See label on package and Material Safety Data Sheet (MSDS)
- Store containers in a dry, cool place away from sources of heat or open flame

6. Availability & Cost

AVAILABILITY

Davis Colors can be mixed into concrete and delivered directly to the jobsite by concrete producers. Davis Colors are also available from building material dealers for mixing at the jobsite. Contact Davis Colors or visit www.daviscolors.com for the nearest suppliers.

COST
Compared to surface applied coatings and dust-on colors, Davis Colors are economical to color concrete. Integral colors are part of the concrete and eliminate extra costs such as surface preparation, scaffolding and labor associated with coatings. Because Davis Colors are permanent, the life-cycle costs of maintaining and reapplying surface applied materials are reduced. Integral color adds between 5 - 50% to the material cost of concrete. Contact Davis Colors, the local Davis Colors dealer or visit www.daviscolors.com/tech/usage for additional pricing information.

7. Warranty
Davis Colors guarantees its integral color products comply with ASTM C979 standards, with the exception of Davis Colors 8084 and 807 due to their effect on air entraining admixtures. If any Davis Colors products are found to be defective, buyer's sole remedy shall be refund of color purchase price from point of purchase. Davis Colors does not guarantee the concrete materials, jobsite, installation or resulting colored concrete.

8. Maintenance
- Cleanup - Cured concrete can be cleaned using power washing or commercially available cleaning solutions; contact the cleaner manufacturer for instructions. Strong acids can cause discoloration. Test the cleaning method in an inconspicuous location before application and rinse thoroughly with clean water
- Paving and slabs - When desired, Davis Colors' curing compounds can be reapplied periodically to reseal the concrete surface to reduce staining and wear

9. Technical Services
A complete concrete color laboratory is available to provide technical assistance and match custom colors. Davis Colors sales representatives are available nationwide.

10. Filing System
- Reed First Source
- ARCAT®
- Concrete Sourcebook
- Landscape Architecture's OneSource Directory
- Sweet's Catalog Files
- SweetSource
- Additional product information is available from the manufacturer, including:
  Video Presentation
  Material Safety Data Sheets
  Samples and Color Cards
  Guide Specifications
  CD-ROM