ITEM 427
SURFACE FINISHES FOR CONCRETE

427.1. Description. Finish concrete surface as specified.

427.2. Materials. Furnish materials in accordance with this Article for the type of surface finish specified.

A. Coatings.
   1. Adhesive Grout and Concrete Paint. Provide coatings in accordance with DMS-8110, “Coatings for Concrete.” Match color of coating with Federal Standard 595B color 35630, concrete gray, unless otherwise shown on the plans.
   2. Opaque Sealer. Provide penetrating-type sealer in accordance with DMS-8110, “Coatings for Concrete.” Match color of coating with Federal Standard 595B color 35630, concrete gray, unless otherwise shown on the plans.
   3. 742 Appearance Coating. Provide #742 gray appearance coating (Federal Standard 595B color 35630) in accordance with DMS-8100, “Structural Steel Paints-Formula.”
   4. Epoxy Paint. Provide Type X epoxy coating in accordance with DMS-6100, “Epoxies and Adhesives.”

B. Exposed Aggregate Finish. Provide approved aggregates meeting the grading requirements shown on the plans. Unless otherwise shown on the plans, provide gravel consisting of predominantly rounded particles. When a bush-hammered finish is desired, use crushed stone. Provide a concrete surface retardant. Provide clear acrylic resin sealer in accordance with DMS-8110, “Coatings for Concrete,” or clear Type II permanent anti-graffiti coating in accordance with DMS-8111, “Anti-Graffiti Coatings.”

427.3. Equipment. The Engineer may require demonstration of the equipment’s capabilities.

A. Low-Pressure Water Blasting. Use equipment capable of supplying a minimum pressure at the nozzle end of 3,000 psi at a minimum flow rate of 3 gpm. Use a 0° rotary, vibratory, or wobble-type nozzle. Use equipment capable of including abrasives in the water stream when specified on the plans.

B. Abrasive Blasting. Use equipment equipped with filters to produce oil-free air and also water-free air when dry air is required.

C. Slurry Blasting. Use equipment capable of combining air and abrasives with water to form a wet blast media capable of cleaning and preparing surface without creating dust.

D. Spraying. For spray applications, use equipment with fluid and air pressure regulators and gauges to allow for adjustment to produce a uniform spray pattern.

E. Off-the-Form Finish Forms. Use nonstaining, nonporous, high-quality forming materials (e.g., steel or medium-density and high-density overlaid plywood forms). Use steel or high-density overlaid plywood forms when the same form will be used more than twice.

F. Form Liners. Provide form liners capable of producing a patterned finish as shown on the plans. Use form liners that provide a clean release from the concrete surface without pulling or breaking the textured concrete.

427.4. Construction. Provide the finish specified on the plans for the specific surface areas.

A. Surface Areas of Finish. “Surface area of finish” designates the areas where the specified surface is to be applied.

1. Surface Area I. Surface Area I includes:
   - surfaces of railing;
   - exterior vertical faces of fascia beams, slabs, slab spans, arches, and box girders;
   - the outside bottom surface of fascia beams and girders;
   - the underside of overhanging slabs to the point of juncture of the supporting beam;
   - the entire underside of slab spans when shown on the plans;
• vertical and underside surfaces of bents and piers;
• all surfaces of tie beams, abutments, bridge wingwalls, culvert headwalls and wingwalls and retaining walls exposed to view after all backfill and embankment is placed; and
• all other exposed surfaces shown in the plans to require surface treatment.

2. **Surface Area II.** Surface Area II includes surfaces of railing, all wingwalls, and the exterior vertical faces of slabs.

3. **Surface Area III.** Surface Area III includes only the top and roadway faces of all concrete railing and bridge wingwalls.

4. **Surface Area IV.** Surface Area IV includes areas designated on the plans.

**B. Surface Finishes.** Apply the coating or special finish from Table 1 as specified on the plans.

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<th>Coatings</th>
<th>Special Surface Finishes</th>
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<td>Concrete paint</td>
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<td>742 appearance coating</td>
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1. **Application of Coatings.**

   a. **Preparation.** Before applying a coating, thoroughly clean the surface by chemical cleaning, if required, and by blast cleaning.

   (1) **Chemical Cleaning.** Clean surfaces contaminated with oil, grease, or other contaminants by scrubbing the area with an approved detergent or other concrete cleaning material before blast cleaning. Do not use a solvent that will stain the surface or inhibit coating adhesion. Perform the following test to check for surface contamination of oil type materials:
   - Spray the surface with a fine mist of potable water.
   - Examine the area to see if water beads up.
   - If beading is found, clean the surface.

   (2) **Blast Cleaning.** Before applying a specified coating, blast-clean the designated surface to remove weak surface material, curing compound, and other contaminants, leaving a lightly etched uniformly textured surface. Use an approved abrasive propelled by oil-free air with or without the addition of potable water, or blast with potable water with or without the addition of an approved abrasive at sufficient pressure to effectively clean and prepare the surface. When water-blasting, maintain the stand-off-distance of the nozzle to a maximum of 12 in. from the surface being cleaned.

   Do not damage concrete surface by gouging, spalling, or exposing coarse aggregate by the blasting operation.

   Immediately before application of any coating, blow clean oil- and moisture-free air on all surfaces with sufficient pressure to remove loose particles. Perform the following test to check for surface cleanliness as directed:
   - Press a 10 in. long strip of 2 in. wide clear packing tape on the surface by rubbing with moderate pressure times.
   - Grasp the free end of the tape, and remove the tape from the surface with a sharp jerk.
   - Examine the surface of the tape for clinging particles.

   Continue cleaning the concrete surface until there are no particles clinging to the tape surface for subsequent tests. An additional test that can be used to check the surface for dust is to wipe the surface with a dark cloth and then examine the cloth for discoloration.
b. **Application.** Mix coating materials thoroughly with a mechanical mixer at a speed that causes the mixture to rotate entirely in the container. Ensure complete mixing by probing the container with a stirring device searching for non-dispersed or settled material. Do not apply coatings before the new concrete aging a minimum of 28 days unless approved otherwise. Do not apply coatings when weather conditions will be detrimental to the final surface finish as determined by the Engineer. Do not apply coatings when surface temperature of the concrete exceeds 110°F. Apply coatings to obtain a consistent color and texture.

1. **Adhesive Grout.** Apply coating on a moistened surface to a uniform minimum thickness of 1/16 in. Do not apply when ambient temperature is less than 50°F.

2. **Concrete Paint.** Apply the coating on a dry surface in 2 coats for a total maximum application rate of 150 sq. ft. per gallon. Match the color of the applied coating with the color standard shown on the plans. Do not thin material unless approved. Apply when ambient temperature is between 50°F and 100°F.

3. **Opaque Sealer.** Apply the coating to a dry surface in 2 coats for a total maximum application rate of 200 sq. ft. per gallon. Match the color of the applied coating with the approved color standard shown on the plans. Do not thin the material unless approved. Apply when ambient temperature is between 40°F and 95°F.

4. **742 Appearance Coating.** Apply the coating on a dry surface at a rate of at most 400 sq. ft. per gallon. Apply when ambient temperature is above 40°F.

5. **Epoxy Paint.** Apply the coating on a dry surface at a maximum application rate of 100 sq. ft. per gallon. Apply when ambient temperature is above 50°F.

Repair surface finish where coating has been applied that exhibits peeling, flaking, or discoloration or that has been damaged during construction. Remove defective or damaged coating. Clean and recoat repair area in accordance with the requirements of this Item.

2. **Special Surface Finishes.** Submit a work plan to the Engineer for any special finish shown on the plans. Include in the work plan the type of aggregates, materials, variation of panel or pattern arrangement, dimensions, construction methods, and other features affecting the work as is necessary for the “Special Surface Finish” specified.

a. **Blast Finish.** Provide surface profile as shown in the plans, or meet the minimum requirements of Section 427.4.B.1.a, “Preparation.” Construct a 4-ft. by 4-ft. sample panel using the same concrete used in construction of the member to receive the blast finish. Prepare the surface of the sample panel to meet the specified finish, and obtain approval of the sample finish. Use the approved sample panel finish as the standard for surfaces requiring a blast finish.

b. **Rub Finish.** Provide a finish to the surface by rubbing the surface with a carborundum stone or other approved material. Begin rubbing the surface immediately after forms have been removed. If rubbing surface is delayed to the point where the surface is dry and unable to be rubbed to produce an acceptable finish, provide blast finish or other finish as directed at no additional cost to the Department. Perform the requirements to obtain the ordinary surface finish specified in Section 420.4.M, “Ordinary Surface Finish,” concurrently with rubbing the surface. Where concrete patching is performed, rub these areas after the patch material has thoroughly set and blend the patch in with the surrounding area to produce a surface with uniform color and texture. After form removal, keep the surface continuously wet until the rubbing is complete. Rub the surface sufficiently to bring the wetted concrete surface to a paste producing a smooth dense surface without pits, form marks, or other irregularities. Do not use cement grout to form the paste on the surface. Stripe the surface with a brush to conceal the rubbing pattern and allow the paste to reset. Wash the concrete with potable water after the paste has sufficiently set to leave it with a neat and uniform appearance and texture. If required, apply membrane curing in accordance with Item 420, “Concrete Structures,” after rubbing is complete.
c. **Off-the-Form Finish.** Provide a finish with minimal surface defects and uniform color and texture by using non-staining, non-porous, high-quality forming materials. Use the same type of forming materials for like elements for the entire structure.

Use mortar-tight forms to prevent leakage and discoloration. If necessary, seal joints with compressible gasket material, caulk, tape or by other suitable means that are not detrimental to the concrete finish. Use one brand and type of form release agents for all surfaces unless another product produces a similar concrete surface appearance. Do not use barrier-type (wax, fuel oil, carrier oil, etc.) release agents. Use form release agents containing a rust inhibitor on steel forms. Clean rust off steel forms before use. Do not use plywood that will cause discoloration of the concrete surface.

Direct special attention to consolidation and vibration of the concrete around the form surfaces to minimize bug holes. Modify concrete placement and vibration techniques if surface contains an excessive amount of bug holes. Remove all forms without interruption once form removal begins to prevent discoloration due to differing form curing times.

Do not use membrane curing on surfaces with off-the-form finish.

Repair honeycombed and spall areas with least dimension larger than 2 in. in accordance with the concrete surface repair procedures outlined in Item 420, “Concrete Structures,” to obtain an ordinary surface finish as defined in Section 420.4.M, “Ordinary Surface Finish.” For honeycombed and spall areas with least dimension greater than 3/4 in. but smaller than 2 in., patch by filling defect with repair material omitting the chipping operation. Do not patch honeycombed and spall areas with least dimension smaller than 3/4 in. Perform required repairs as soon as forms are removed. Match repair material color and texture with surrounding concrete surfaces. Minimize the area of repair by not smearing the repair material over acceptable concrete surfaces in an attempt to blend the repair with the surrounding concrete. Cut out form ties at least 1/2 in. below the surface, and patch accordingly. Perform repair work as soon as possible after removing forms so that concrete and repair material have similar ages. Replace or refurbish the forms when the Engineer determines that defective formwork is causing an excessive amount of repair work.

d. **Form Liner Finish.** Provide patterned finish as shown on the plans. Do not splice form liner panels in a way that causes a noticeable transition or line between pieces. Wash and clean form liners after each use when the forms can be re-used. Replace form liners that have become damaged or worn.

Construct a sample panel for each form liner finish. Approval is required to verify that the sample panel meets the requirements of the plans and specifications before beginning work. Upon approval, the sample panel becomes the model panel that all other work will be compared against. Deviation in color, grade, or depth from the model panel is grounds for rejection of the form liner finish. Removal of defective work may be necessary as determined by the Engineer and in accordance with the surface finish requirements outlined in Item 420, “Concrete Structures,” to obtain an ordinary surface finish as defined in Section 420.4.M, “Ordinary Surface Finish.”

Seal all form liner joints in a manner acceptable to the Engineer to prevent leakage at the surface.

e. **Exposed Aggregate Finish.** Provide exposed aggregate finish as indicated on the plans. Provide a depth of finish between 3/8 in. and 1/2 in. unless directed otherwise.

Apply a concrete surface retarder that penetrates approximately 1/4 in. into the forms or concrete surface to help achieve the desired finish. Apply 2 or 3 coats to wood forms to account for absorption if necessary. Tape or caulk form joints to prevent escape of the retarder during the placing operations. Protect the form surfaces from sun and rain while exposed to the atmosphere. Re-treat form surfaces with retarder if disturbed. Protect adjacent areas of concrete not requiring exposed aggregate finish from the retarder.

Remove forms 12 to 15 hr. after concrete placement but not before concrete has gained sufficient strength to support the self-weight of the member unless directed otherwise. Expose
the aggregate for the finish immediately after form removal. Remove the grout paste covering the aggregate to be exposed by an approved method. Do not loosen the aggregate by the grout removal operation. Maintain required curing on all surfaces except for the time while the aggregate is being exposed. Cure using wet mats or membrane after the aggregate is exposed. Repair defective areas as determined by the Engineer.

Re-clean exposed aggregate surfaces by an approved method. Apply a coat of acrylic resin sealer or clear Type II permanent anti-graffiti coating to cleaned exposed aggregate surface. Apply a single coat or multiple coats for a total maximum application rate of 250 sq. ft. per gallon.

427.5. Measurement. When surface finishes for concrete is shown on the plans to be a pay item, measurement will be by the square foot of the type of surface finish specified.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2, “Plans Quantity Measurement.” Additional measurement or calculations will be made if adjustments of quantities are required.

427.6. Payment. Unless otherwise specified on the plans, the work performed, materials furnished, equipment, labor, tools, and incidentals will not be paid for directly, but will be considered subsidiary to pertinent Items.

When a surface finish for concrete is specified as a pay item, the work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Adhesive Grout Finish,” “Concrete Paint Finish,” “Opaque Sealer Finish,” “742 Appearance Coating Finish,” “Epoxy Paint Finish,” “Blast Finish,” or “Rub Finish.” This price is full compensation for materials; cleaning and preparing surfaces; application of materials; and equipment, labor, tools, and incidentals.

Off-the-form, form liner, or exposed aggregate finishes (including anti-graffiti coating) will not be paid for under this Item but are subsidiary to other pertinent Items.