

**SECTION 32 05 23  
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS**

SPEC WRITER NOTE: Use this section only for NCA projects. Delete text between // \_\_\_\_\_ // not applicable to project. Edit remaining text to suit project.

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Site work concrete.

SPEC WRITER NOTE: Delete items not required by project or include any special items.

2. // Integrally Colored Concrete: // List locations //.
3. // Curb, // gutter, // and combination curb and gutter //.
4. Pedestrian Pavement: // Walks // flower/water stations // mow strips // wheelchair curb ramps // plaza areas // and // steps //.
5. Vehicular Pavement: // Maintenance yards // driveways //.
6. Equipment Pads: // Transformers // propane tanks // irrigation field satellites //.

SPEC WRITER NOTES: If Section CONCRETE is not a portion of specification, cover items cross referenced thereto within this section, and delete all references to Section 03 30 53, SHORT FORM CAST-IN-PLACE CONCRETE throughout this section.

**1.2 RELATED REQUIREMENTS**

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: // Section 31 20 00, EARTH MOVING // Section 31 20 11, EARTH MOVING-SHORT FORM //.
- C. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 53, SHORT FORM CAST-IN-PLACE CONCRETE.
- D. Metal Components of Steps (Nosing and Railing): Section 05 50 00, METAL FABRICATIONS.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.

- B. American Association of State Highway and Transportation Officials (AASHTO):
1. M31M/M31-15 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  2. M55M/M55-09 - Steel Welded Wire Reinforcement, Plain, for Concrete, Single User.
  3. M147-65 (2004) - Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.
  4. M148-05 - Liquid Membrane-Forming Compounds for Curing Concrete.
  5. M171-05 - Sheet Materials for Curing Concrete.
  6. M182-05(2012) - Burlap Cloth Made from Jute or Kenaf and Cotton Mats.
  7. M213-01(2010) - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  8. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
  9. T99-15 - Moisture-Density Relations of Soils Using a 2.5-kg. (5.5-lb) Rammer and a 305-mm (12-in.) Drop.
  10. T180-15 - Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- C. American National Standards Institute (ANSI):
1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).
- D. ASTM International (ASTM):
1. A775/A775M-16 - Epoxy-Coated Steel Reinforcing Bars.
  2. C94/C94M-16 - Ready-Mixed Concrete.
  3. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
  4. // C979/C979M-16 - Pigments for Integrally Colored Concrete. //
  5. C1116/C1116M-10a(2015) - Fiber-Reinforced Concrete.
  6. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
  7. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

#### 1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

SPEC WRITER NOTE: Edit participant list to ensure entities influencing outcome attend.

1. Required Participants:
  - a. Contracting Officer's Representative (COR).
  - b. // Architect/Engineer. //
  - c. // Inspection and Testing Agency. //
  - d. Contractor.
  - e. Installer.
  - f. // Manufacturer's field representative. //
  - g. Other installers responsible for adjacent and intersecting work, including excavation, plantings, traffic markings, and  
// \_\_\_\_\_ //.

SPEC WRITER NOTE: Edit meeting agenda to incorporate project specific topics.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
  - a. Installation schedule.
  - b. Installation sequence.
  - c. Preparatory work.
  - d. Protection before, during, and after installation.
  - e. Installation.
  - f. Terminations.
  - g. Transitions and connections to other work.
  - h. Inspecting and testing.
  - i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

#### 1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  1. Show size, configuration, and fabrication and installation details.
  2. Show reinforcing.
  3. Include jointing plan for concrete pavements, curbs and gutters.
- C. Manufacturer's Literature and Data:
  1. Description of each product.

- a. Expansion joint filler.
  - b. Hot poured sealing compound.
  - c. Reinforcement.
  - d. Curing materials.
2. Installation instructions.

SPEC WRITER NOTES: Delete sample paragraphs below for items not included in project.

D. Samples:

1. Submit pigment manufacturer's color chart or chip set for color selection and approval; indicate pigment number and required dosage rate.
2. Colored Concrete Panel: As specified in Section 09 06 00, SCHEDULE FOR FINISHES, with mix data.
3. Construct 2.4 m by 2.4 m by 100 mm (8 feet by 8 feet by 4 inch) sample panel of integrally colored concrete pavement on project site, demonstrating materials, workmanship, scoring, stamping and curing methods to be used throughout project. Accepted sample panel provides visual standard for work of this section. Remove sample panel when no longer required for comparison with finished work.
4. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.

E. Test Reports: Certify products comply with specifications.

1. Job-mix formula.
2. Select subbase materials.

F. Certificates: Certify products comply with specifications.

1. Expansion joint filler.
2. Reinforcement.
3. Curing materials.
4. Concrete protective coating.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Installer with project experience list.
2. Land surveyor.

H. Concrete mix design.

SPEC WRITER NOTES: The State Highway Spec is acceptable to specify subbase materials as well as concrete materials. The Highway spec must contain quality

standards, percentage of compaction, and tests for quality and field and laboratory compaction. The Contractor must retain and reimburse a laboratory to perform testing required; or to obtain a certification from the authorized representative of the State; or to obtain certification from the aggregate producer or concrete ready-mix plant if the State Highway spec is also used for site concrete. Certificate of compliance shall cover quality and gradation of aggregate subbase, quality and grades of concrete materials, and that the job-mixture meets or exceeds the State requirements.

- I. Select subbase job-mix design: Report the following:
  - 1. Material sources.
  - 2. Gradation.
  - 3. Plasticity index.
  - 4. Liquid limit.
  - 5. Laboratory compaction curves indicating maximum density at optimum moisture content.

#### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications:
  - 1. Regularly installs specified products.
  - 2. Installed specified products with satisfactory service on five similar installations.
    - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.
- C. Preconstruction Testing:
  - 1. Engage independent testing laboratory to perform tests and submit reports.
    - a. Deliver samples to laboratory in number and quantity required for testing.
  - 2. Concrete mix design.

#### **1.7 DELIVERY**

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, // color, // and manufacture date.
- C. Deliver steel reinforcement to prevent damage.

- D. Before installation, return or dispose of products with damaged or opened packaging and distorted or damaged steel reinforcement.
- E. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

**1.8 STORAGE AND HANDLING**

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

SPEC WRITER NOTES: If select subbase material is required due to unstable conditions or frost action, include the following Article and edit all other applicable paragraphs of this section.

**1.9 FIELD CONDITIONS**

- A. Place concrete as specified under Article 3.4 E., for Cold Weather Placement and Article 3.4 D., for Hot Weather Placement of Section 03 30 53, SHORT FORM CAST-IN-PLACE CONCRETE.

**1.10 WARRANTY**

SPEC WRITER NOTE: Always retain construction warranty. FAR includes Contractor's one year labor and material warranty.

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

**PART 2 - PRODUCTS**

**2.1 CONCRETE**

- A. Concrete: Type C, air-entrained as specified in Section 03 30 53, SHORT FORM CAST-IN-PLACE CONCRETE, except as follows:

| TYPE                | MAXIMUM SLUMP*                      |
|---------------------|-------------------------------------|
| Curb & Gutter       | 75 mm (3 inches)                    |
| Pedestrian Pavement | 75 mm (3 inches)                    |
| Vehicular Pavement  | 50 mm (2 inches) (Machine Finished) |
|                     | 100 mm (4 inches) (Hand Finished)   |

| TYPE                                                                                                               | MAXIMUM SLUMP*               |
|--------------------------------------------------------------------------------------------------------------------|------------------------------|
| Equipment Pad                                                                                                      | 75 to 100 mm (3 to 4 inches) |
| * For concrete to be vibrated: Slump as determined by ASTM C143/C143M. Tolerances as established by ASTM C94/C94M. |                              |

SPEC WRITER NOTE: Specify epoxy-coated reinforcing bars in northern climates.

## 2.2 REINFORCEMENT

- A. Steel Reinforcement: Type, amount, and locations as shown on drawings and as specified.
- B. // Epoxy-Coated Steel Reinforcement: ASTM A775/A775M. //
- C. Welded Wire-Fabric: AASHTO M55M/M55.
- D. Dowels: Plain steel bars complying with AASHTO M31M/M31.
- E. Tie Bars: Deformed steel bars complying with AASHTO M31M/M31.
- F. Fiber Reinforcement: Polypropylene fibers designed for use in concrete pavement, complying with ASTM C1116/C116M, Type III, 13 to 38 mm (1/2 to 1 1/2 inches) long. Include 2.27 kg (5 lbs.) per .76 cu. m (1 cu. yd.) of concrete in batch.

SPEC WRITER NOTES: Confirm need for special subbase material and thickness required. If subbase is selected, delete the phrase (where required). If using State Highway Spec., adjust gradations to comply.

## 2.3 SELECT SUBBASE (WHERE REQUIRED)

- A. Subbase: Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, Grading E or F.
  - 1. Materials meeting other gradations than that noted will be acceptable whenever gradations are within tolerance of three to five percent, plus or minus, of single gradation established by job-mix formula.
- B. Subbase Material: Compacted, dense-graded course, meeting specified density requirement.

**2.4 FORMS**

- A. Forms: Metal or wood, straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating of concrete.
- B. Tolerance: 3 mm (1/8 inch) maximum variation from straight line in any 3000 mm (10 foot) long section, in either a horizontal or vertical direction.
- C. Wood Forms: Minimum 50 mm (2 inches) thick (nominal), free from warp, twist, loose knots, splits, or other defects. Provide approved flexible or curved forms for forming radii.

**2.5 CONCRETE CURING MATERIALS**

- A. Concrete Curing Materials: Comply with one of the following:
  - 1. Burlap: AASHTO M182, weighing 233 g/sq. m (7 oz./sq. yd.) dry.
  - 2. Impervious Sheeting: AASHTO M171.
    - a. Polyethylene: Minimum 0.1 mm (4 mils) thick.

SPEC WRITER NOTE: Type 1 is clear or translucent and Type 2 contains white pigmented additive.

- 3. Liquid Membrane Curing Compound: AASHTO M148 // Type 1 // Type 2 //, without paraffin or petroleum // and approved by pigment manufacturer for use with colored concrete //.

**2.6 EXPANSION JOINT FILLERS**

- A. Expansion Joint Filler: AASHTO M213.

**2.7 ACCESSORIES**

- A. Equipment and Tools: Obtain COR's approval of equipment and tools for handling materials and performing work before work begins. Maintain equipment and tools in satisfactory working condition at all times.
- B. Sealants:
  - 1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
  - 2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.
- C. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

SPEC WRITER NOTES:  
1. Two methods of producing colored concrete finishes are available: integral color and dry-shake. For durability,



uniformity of color and lower cost, VA prefers the integral color method. The amount of pigment used to achieve integral colored concrete should be the minimum amount necessary to produce the desired color, but never more than 10 percent by weight of the cement. The use of white Portland cement produces cleaner, brighter colors and is preferred to normal gray Portland cement, except for black or dark gray colors.  
 2. Delete three following Articles below if project does not contain colored concrete.

## 2.8 PIGMENTS

- A. Pigments: Pure, concentrated mineral pigments especially processed for mixing into concrete and complying with ASTM C979/C979M.
- B. Packaging: Provide pigments in pre-measured Mix-Ready disintegrating bags for project site mixing.

## 2.9 CEMENT, SAND, AGGREGATES AND OTHER ADDITIVES

- A. Cement, Sand and Aggregate Color: As required to match paver colors.
- B. Provide silicon carbide or aluminum oxide grains as required to match paver colors.

## 2.10 PATTERN STAMPING TOOLS AND MATERIALS

- A. Tools: Mat-type stamping tools. Pattern to be // Describe-Pattern Name-Number //.
- B. Release Agent: As recommended by pattern tool manufacturer and compatible with integral pigments.
- C. Release Film: 0.05 mm (2 mil) polyethylene sheet.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Prepare, construct, and finish subgrade as specified in // Section 31 20 00, EARTH MOVING // Section 31 20 11, EARTH MOVING-SHORT FORM //.
- D. Maintain subgrade in smooth, compacted condition, complying with required section and established grade until succeeding operation has been accomplished.

SPEC WRITER NOTES: Use following Article only if SELECT SUBBASE is specified. If

Subbase is selected, delete the phrase  
(where required).

### 3.2 SELECT SUBBASE (WHERE REQUIRED)

- A. Mixing: Proportion select subbase by weight or by volume in quantities so final approved job-mixed formula gradation, liquid limit, and plasticity index requirements will be met after subbase course has been placed and compacted. Add water in approved quantities, measured by weight or volume, to produce uniform blend.
- B. Placing:
1. Place mixed material on prepared subgrade in uniform layer to required contour and grades, to maximum 200 mm (8 inches) loose depth that, when compacted, will produce layer of required thickness.
  2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers. Remove unsatisfactory areas and replace with satisfactory mixture, or mix material in placement area.
  3. Adding thin layers of material to top layer in order to meet grade will not be permitted.
  4. When subbase elevation is 13 mm (1/2 inch) or more below grade, excavate top layer and replace with new material to minimum 75 mm (3 inches) compacted thickness.
- C. Compaction:
1. Perform compaction with approved hand or mechanical equipment well suited to material being compacted.
  2. Moisten or aerate material as required to provide moisture content that will readily facilitate obtaining specified compaction with equipment used.
  3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified by AASHTO T180 or AASHTO T99, respectively.
- D. Tolerances:
1. Test completed subbase for grade and cross section with straight edge.
  2. Surface Variation: Maximum 10 mm (3/8 inch) each layer.
  3. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).
- E. Protection:

1. Maintain finished subbase in smooth and compacted condition until concrete is placed.
2. When subsequent construction operations or adverse weather disturb approved compacted subbase, excavate and reconstruct subbase with new material meeting specified requirements, at no additional cost to Government.

### 3.3 SETTING FORMS

#### A. Form Substrate:

1. Compact form substrate to uniformly support forms along entire length at grade as shown on drawings.
2. Correct substrate imperfections or variations by cutting or filling and compacting.

#### B. Form Setting:

1. Set forms sufficiently in advance of concrete placement to permit performance and approval of operations required with and adjacent to form lines.
2. Set forms to indicated line and grade and use stakes, clamps, spreaders, and braces to prevent movement in any direction.
3. Tolerances: Conform to line and grade with 3 mm (1/8 inch) tolerance when checked with straightedge, with maximum 6 mm (1/4 inch) deviation from true line at any point.
4. Remove forms when removal will not damage concrete and when required for finishing.
5. Clean and oil forms before each use.

SPEC WRITER NOTE: Include slipforming  
machine option if applicable.

#### C. Land Surveyor: Establish and control alignment and form grade elevations // or concrete slipforming machine operations //.

1. Make necessary corrections to forms immediately before placing concrete.
2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck form before placing concrete.

### 3.4 PLACING REINFORCEMENT

- A. Keep reinforcement free of dirt, oil, rust, scale or other substances preventing concrete bond.
- B. Install reinforcement as shown on drawings.

- C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.
- D. Obtain COR's approval of reinforcement placement before placing concrete.
- E. Synthetic Fiber in Flatwork: Uniformly disperse in concrete mixture at 3 kg/cu. m (5 lbs./cu. yd.) minimum rate.

SPEC WRITER NOTE: Delete Article below if project does not include colored concrete.

### 3.5 MIXING PIGMENTS

- A. Mix pigments according to manufacturer's instructions. Mix until pigments are uniformly dispersed throughout mixture and bags disintegrated.

### 3.6 PLACING CONCRETE - GENERAL

- A. Preparation:
  - 1. Obtain COR's approval.
  - 2. Remove debris and other foreign material from between forms.
  - 3. Uniformly moisten subgrade, base, or subbase without standing water.
- B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.
- C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.
  - 1. Vibrate concrete against forms and along joints.
  - 2. Avoid excess vibration and handling causing segregation.
- D. Place concrete continuously between joints without bulkheads.
- E. Install construction joint whenever concrete placement is suspended for more than 30 minutes and at end of each day's work.
- F. Workmen or construction equipment coated with foreign material will not be permitted to walk or operate in concrete during placement and finishing operations.

### 3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENTS, AND EQUIPMENT PADS

- A. Place concrete in one layer conforming to cross section shown on drawings after consolidating and finishing.
- B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

- C. After concrete has been placed in forms, use a strike-off guided by side forms to bring surface to proper section to be compacted.
- D. Consolidate concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish concrete surface to grade with wood or metal float.
- F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

### **3.8 PLACING CONCRETE FOR VEHICULAR PAVEMENT**

- A. Deposit concrete into forms as close as possible to its final position.
- B. Place concrete rapidly and continuously between construction joints.
- C. Strike off concrete and thoroughly consolidate with finishing machine, vibrating screed, or by hand-finishing.
- D. Finish surface to elevation and crown as shown on drawings.
- E. Deposit concrete near joints without disturbing joints. Do not place directly onto joint assemblies. Do not place adjacent lanes/areas without COR's approval.

SPEC WRITER NOTE: In some cases, it may be practical and economical to build concrete vehicular pavement with an integral curb section. The integral curb being constructed simultaneously with the pavement slab in a one-step operation avoids a longitudinal joint between the curb and gutter, and pavement. The curb is easily formed with a template and straightedge. The only joints generally required in the integral curbs are continuations of the transverse joints in the pavement slab. Another option for concrete curb or curb and gutter not required to be constructed integral with or tied to a concrete pavement, is the use of a self-propelled machine (slip forming machine) to place the concrete. This type of construction is most advantageous when the drawing details indicate a "mountable" (rolled) type curb and gutter. However, use of these machines on small jobs is generally not cost effective. Include the following paragraph and additional requirements for the integral curb template, extrusion equipment, and self-propelled machine when an integral curb is indicated on the drawings or the use of a curb-forming machine is justified.

- F. Curb-Forming Machines: Curb-forming machines for constructing // integral curbs // curbs // and gutter // will be approved based on trial use on project. If equipment produces unsatisfactory results, discontinue use and accomplish work by hand method construction as specified. Remove unsatisfactory work and reconstruct full length between regularly scheduled joints. Legally dispose of removed portions off project site.

### 3.9 CONCRETE FINISHING - GENERAL

- A. Follow operation sequence below, unless otherwise indicated on drawings:
1. Consolidating, floating, straight-edging, troweling, texturing, and joint edging.
  2. Maintain finishing equipment and tools in clean and approved condition.

SPEC WRITER NOTE: Broom and exposed aggregate finishes are also possible to be specified.

### 3.10 CONCRETE FINISHING - CURB AND GUTTER

- A. Gutter and Curb Top:
1. Round edges of gutter and curb top with edging tool to 6mm (1/4 inch) radius or as otherwise shown on drawings.
  2. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform texture.
  3. Finish surfaces longitudinally, while still wet, with bristle type brush.
- B. Curb Face:
1. Remove curb form and immediately rub curb face with wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed.
  2. Brush curb face, while still wet, to match gutter and curb top.
- C. Tolerances: Except at grade changes or curves, when tested with 3000 mm (10 foot) straightedge.
1. Variation from Indicated Plane and Grade:
    - a. Gutter: Maximum 3 mm (1/8 inch).
    - b. Curb Top and Face: Maximum 6 mm (1/4 inch).
- D. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.
- E. Correct depressions causing standing water.
- F. Visible surfaces and edges of finished // curb, // gutter, // and combination curb and gutter // to be free of blemishes, form marks, and tool marks, and uniform in color, shape, and appearance.

### 3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

- A. // Walks // Flower Water Stations // Mow Strips // Wheelchair Curb Ramps // Plaza Areas // Steps //:
1. Finish concrete surfaces to grade and cross section with metal float, troweled smooth and finished with a broom moistened with clear water.
  2. Broom surfaces transverse to traffic direction.
  3. Carefully finish slab edges, including at formed joints, with edger with radius as shown on drawings.

4. Unless otherwise indicated, edge transverse joints before brooming. Use brooming to eliminate flat surface produced by edger. Produce uniform corrugations, maximum 2 mm (1/16 inch) deep.
5. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
6. Paving Tolerances:
  - a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
  - b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
7. Replace paving within joint boundary when paving exceeds specified tolerances.

SPEC WRITER NOTES: Site steps are those exterior steps not attached to a building or structure. Specify all other steps in Section 03 30 53, SHORT FORM CAST-IN-PLACE CONCRETE. Edit subparagraphs to include metal components (nosing and railing) specified in Section 05 50 00, METAL FABRICATIONS, when required.

- B. Step Treads, Risers, and Sidewalls: Finish as specified for pedestrian pavement, except as follows:
  1. Remove riser forms sequentially, starting with top riser.
  2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round tread corner; use inside edger to finish corner at bottom of riser.

SPEC WRITER NOTE: Broom and exposed aggregate finishes are also possible to be specified.

3. Apply neat, uniform finish to treads, risers and sidewall.
  - a. Risers and Sidewall: Brush finish.
4. Treads: Stiff brush finish to provide slip-resistant surface complying with ANSI B101.3.
5. Step Tolerance:
  - a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

### 3.12 CONCRETE FINISHING - VEHICULAR PAVEMENT

- A. Longitudinally float pavement surface with float minimum 3000 mm (10 feet) long and 150 mm (6 inches) wide, properly stiffened to



prevent flexing and warping. Operate float from foot bridges in sawing motion parallel to direction in which pavement is being laid from one side of pavement to the other, and advancing maximum half float length.

- B. After longitudinal floating, but while concrete is still plastic, eliminate minor irregularities in pavement surfaces by metal floats, 1500 mm (5 feet) long, and straightedges, 3000 mm (10 feet) long. Make the final finish and float entire pavement surface with straightedges.
- C. Test surface trueness with 3000 mm (10 foot) straightedge successively held parallel and at right angles to direction in which pavement is being laid and entire area, as required, to detect variations. Advance straightedge along pavement in successive stages of maximum one half straightedge length. Correct irregularities and refinish surface.
- D. Pavement Tolerances:
  - 1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
  - 2. Variation from Indicted Thickness: Maximum 6 mm (1/4 inch).
- E. Finish pavement edges and joints with edging tool.
- F. Broom finish concrete surface after bleed water dissipates and before concrete hardens with approved fiber broom, minimum 450 mm (18 inches) wide.
  - 1. Gently broom surface transverse to traffic direction from edge to edge.
    - a. Use brooming to eliminate flat surface produced by edger.
    - b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep.
- G. Align finish surfaces where new and existing pavements abut.

### 3.13 CONCRETE FINISHING - EQUIPMENT PADS

- A. Strike pad surface to elevation shown on drawings.
- B. Provide smooth, dense float finish, free from depressions or irregularities.
- C. Carefully finish pad edges with edger having radius as shown on drawings.
- D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.
- E. Pad Tolerances:
  - 1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

F. Correct irregularities when pads exceed specified tolerances.

**SPEC WRITER NOTES:**

1. When aesthetics are of prime importance and certain areas are shown to have a special finish and texture, such as an exposed aggregate surface or to have colored concrete, contact the Portland Cement Association district office in the area of the project for advice in specifying and detailing the finish and texture desired.

2. Exposed Aggregate Concrete: For use by the physically handicapped, the texture of an exposed aggregate surface must be smooth with the aggregate size not producing a rough finish.

**3.14 SPECIAL FINISHES**

A. Exposed Aggregate Finish:

1. Prepare concrete base 10 to 13 mm (3/8 to 1/2 inch) lower than the finish grade.
2. Evenly spread aggregate over concrete base surface and embed by use of hand float, straight edge, or darby.
3. Apply concrete mix and mark off surface as indicated with surface joints at least 10 mm (3/8 inch) deep. Level off finish to a true surface and compact with wood float, working as little as possible so that coarse material will remain at the top. Before finish has set, treat top surface with cement retarding material. When body of concrete finish has set, remove retarded surface film by wire brushes and fine water spray to remove the mortar from the top of the colored aggregate. Continue washing and brushing until flush water runs clear and there is no noticeable cement film left on the aggregate.

**SPEC WRITER NOTES:** Some coloring materials affect air entrainment while others do not. Ensure that the color and mixtures used do not produce a concrete having less than the desired air content specified. Edit the following paragraph and drawing details as required to cover mixing, placing, preparation, equipment, finish, and any special construction.

B. Colored Concrete: Add integral color pigment to the pedestrian concrete paving mix at the batch plant. Introduce sufficient quantities of

// carbon black // mineral oxide pigment // to produce the color specified in Section 09 06 00, SCHEDULE FOR FINISHES.

SPEC WRITER NOTE: Edit joint requirements for pedestrian and vehicular pavement and curb and gutter. Delete text not applicable to project.

### 3.15 JOINTS - GENERAL

- A. Place joints, where shown on drawings.
  - 1. Conform to details shown.
  - 2. Install joints perpendicular to finished concrete surface.
- B. Make joints straight and continuous from edge to edge of pavement.

### 3.16 CONTRACTION JOINTS

- A. Cut joints to depth as shown with grooving tool or jointer of radius as shown on drawings or by sawing with blade to produce required width and depth.
- B. Construct joints in // curbs // and gutters // by inserting 3 mm (1/8 inch) steel plates conforming to // curb // and gutter // cross sections.
  - 1. Keep plates in place until concrete can hold its shape.
- C. Finish joint edges with edging tool having radius as shown on drawings.
- D. Score pedestrian pavement with standard grooving tool or jointer.

### 3.17 EXPANSION JOINTS

- A. Form expansion joints with preformed expansion joint filler material of thickness shown on drawings.
  - 1. Without dowels, locate joints around perimeter of structures and features abutting site work concrete.
  - 2. Create complete, uniform separation between structure and site work concrete.
- B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on drawings.
- C. Cut and shape material matching cross section.
- D. Anchor with approved devices to prevent displacing during placing and finishing operations.
- E. Round the edges of joints with an edging tool.

**3.18 CONSTRUCTION JOINTS**

- A. Locate // longitudinal // and // transverse // construction joints between slabs of vehicular pavement as shown on drawings.

SPEC WRITER NOTE: Adjust time for ambient conditions at project location.

- B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.
- C. Provide butt-type joint with dowels in // curb // and // gutter // if joint occurs at planned joint location.
- D. Provide keyed joints with tiebars if joint occurs in middle third of typical // curb // and // gutter // joint interval.

**3.19 FORM REMOVAL**

- A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.
- B. Do not use bars or heavy tools against concrete to remove forms. Promptly repair damaged concrete found after form removal.

**3.20 CONCRETE**

- A. Concrete Protection:
  - 1. Protect unhardened concrete from rain and flowing water.
  - 2. Ensure sufficient curing and protection materials are available and ready for use before concrete placement begins.
  - 3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
    - a. Replace pavement damaged by curing method allowing concrete cracking.
    - b. Employ another curing method as directed by COR.
- B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:
  - 1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap mats minimum 150 mm (6 inches).
  - 2. Impervious Sheeting: Provide waterproof paper, polyethylene-coated burlap, or polyethylene sheeting.
    - a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
    - b. Overlap sheets minimum 300 mm (12 inches).
    - c. Securely anchor sheet materials preventing displacement.

C. Liquid Membrane Curing Compound:

1. Protect joints indicated to receive sealants preventing contamination from curing compound.
2. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.
3. Apply curing compound before concrete dries.
4. Apply curing compound in two coats at right angles to each other.
5. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gal.), both coats.
6. Immediately reapply curing compound to surfaces damaged during curing period.

SPEC WRITER NOTE: When the project is located in an area where winter damage from deicing chemicals and freeze-thaw cycles pose a serious problem, check the need for a special protective coating of linseed oil mixture. The coating protects only against the action of urea, sodium chloride, and calcium chloride used for deicing purposes. Protection against these chemicals is not required for concrete that will be in place for a cumulative time of six weeks at a continuous minimum temperature of 5 °C (40 °F), excluding the curing time. Otherwise, give concrete protective coating.

**3.21 CONCRETE PROTECTIVE COATING**

- A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.
- B. Complete backfilling and curing operation before applying protective coating.
- C. Dry and thoroughly clean concrete before each application.
- D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.) for first coat, and maximum 16 sq. m/L (70 sq. yds./gal.) for second coat, except apply commercially prepared mixture according to manufacturer's instructions.
- E. Protect coated surfaces from vehicular and pedestrian traffic until dry.
- F. Do not heat protective coating, and do not expose the protective coating to open flame, sparks, or fire adjacent to open containers or

applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

### 3.22 FIELD QUALITY CONTROL

SPEC WRITER NOTE: Section 01 45 29, TESTING LABORATORY SERVICES includes NCA provided testing for large projects and contractor provided testing for small projects. Coordinate testing responsibility.

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
  - 1. Concrete: Testing specified in Section 03 30 53 SHORT FORM CAST-IN-PLACE CONCRETE.
    - a. Delivery samples.
    - b. Field samples.
  - 2. Slip Resistance: Steps and pedestrian paving.

### 3.23 CLEANING

- A. After completing curing:
  - 1. Remove curing material, except liquid membrane.
  - 2. Sweep the concrete clean.
  - 3. Seal all joints after removing foreign matter from joint.
  - 4. Clean concrete of debris and construction equipment as soon as curing and joint sealing have been completed.
- B. Remove and legally dispose of debris, rubbish, and excess material from project site.

### 3.24 PROTECTION

- A. Protect exterior improvements from traffic and construction operations.
  - 1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by COR.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.
  - 1. When directed by COR, replace concrete containing cracking, fractures, spalling, and other defects within joint boundary, at no additional cost to Government.

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