

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Integrally colored Portland cement concrete paving with imprinted pattern, stain and cure/sealer.
- B. Integrally colored and color-hardened Portland cement concrete paving with imprinted pattern and stain/sealer treatments.

1.2 RELATED SECTIONS

- A. Section 02300 - Earthwork: Preparation of site for paving.
- B. Section 02740 - Asphaltic Concrete Paving: Asphaltic paving.
- C. Section 02765 - Pavement Marking: Pavement marking.
- D. Section 07920 - Joint Sealants: Sealant for joints.

REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 302 - Guide for Concrete Floor and Slab Construction.
- C. ACI 303 - Guide to Cast-in-Place Architectural Concrete Practice.
- D. ACI 305R - Hot Weather Concreting.
- E. ACI 306R - Cold Weather Concreting.
- F. ACI 308 - Standard Practice for Curing Concrete.
- G. ACI 309 - Standard Practice for Consolidation of Concrete.
- H. ACI 347 - Guide to Formwork for Concrete.
- I. ACI 503 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.
- J. ASTM C33 - Standard Specifications for Concrete Aggregates.
- K. ASTM C150 - Standard Specifications for Portland Cement.
- L. ASTM C260 - Standard Specifications for Air-Entraining Admixtures for Concrete.
- M. ASTM C309 - Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete.

- N. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.
- O. ASTM C618 - Standard Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- P. ASTM C881 - Standard Specifications for Epoxy-Resin-Base Bonding Systems for Concrete.
- Q. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- R. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- S. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- T. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
- U. ASTM C233 - Standard Test Method for Air-Entraining Admixtures for Concrete.
- V. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- W. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
- X. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
- Y. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- Z. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- AA. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- BB. ASTM E329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- CC. ASTM E548 - Standard Guide for General Criteria Used for Evaluating Laboratory Competence.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Testing:

1. Perform testing and analysis under provisions of Section 01400.
2. Submit proposed mix design for each class of concrete for review prior to commencement of work.
3. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
4. Four concrete test cylinders will be taken for each class of concrete placed each day.
5. One slump test will be taken for each set of test cylinders taken.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

B. Installer Qualifications:

1. The Installer shall provide a qualified foreman or supervisor who has a minimum of three years experience with imprinted and textured concrete, and who has successfully completed at least five Bomanite imprinted concrete installations of high quality and similar in scope to that required.
2. The concrete is cast in place, on the job site, by trained and experienced workmen who shall be employed by a firm that is a licensed and certified Bomanite Imprint Licensed Contractor:

Colorado Hardscapes
8085 E. Harvard Ave
Denver, CO 80231
Tel: (303) 750-8200
Fax: (303) 750-8886

3. Perform work in accordance with ACI 301, 302, 303.
4. Obtain materials from same source throughout.
5. Conform to applicable codes and regulations for paving work performed within the public right of way.

C. Ready-Mixed Supplier Qualifications: Supplier of ready-mixed concrete products shall comply with ASTM C 94 requirements for production facilities and equipment. Supplier shall be certified according to NCRMA's "Certification of Ready Mixed Concrete Production Facilities Quality Control Manuals."

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

E. Mock-Up: Provide field samples of surface colors textures and patterns specified for architect approval prior to beginning work, 48 inches by 48 inches (1219 mm by 1219 mm) in size illustrating paving finishes.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Do not place pavement when base surface or ambient temperature is less than 40 degrees F (4 degrees C) or if base surface is wet or frozen.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. All materials manufactured by The Bomanite Company are warranted to be of uniform quality within manufacturing tolerances.
- B. Since control is not exercised over their use, no warranty, expressed or implied, is made as to the effects of such use. The Bomanite Company's obligation under this warranty shall be limited to refunding the purchase price of that portion of the material proven to be defective.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
Colorado Hardscapes
8085 E. Harvard Ave
Denver, CO 80231
Tel: (303) 750-8200
Fax: (303) 750-8886
- B. Substitutions: Not permitted
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SYSTEM

- A. Supporting Structure:
 - 1. Mix Design:
 - a. Mix and deliver concrete in accordance with ASTM C94, Alternate
 - 2. Refer to Drawings for concrete strength requirements.
 - c. Use set retarding admixtures during hot weather only when approved by testing laboratory.



- d. Add air entraining agent to concrete mix for concrete work exposed to exterior, in amounts of 4 to 7 percent of total concrete volume or as otherwise recommended by testing laboratory.
- e. Add coloring admixture where scheduled in quantities recommended by coloring admixture manufacturer to achieve selected color.
- f. Add polypropylene fiber reinforcement at point of concrete batching at rate scheduled.
- g. Maintain water cement ratio to produce a minimum of 3 to maximum of 5 inch slump.
- h. Use of calcium chloride is strictly prohibited.
- 2. Subgrade:
 - a. Refer to Section 02300 for subgrade preparation.
 - b. Refer to drawings for scope of subgrade preparation.
- 3. Reinforcement:
 - b. Reinforcing Steel: ASTM A615; Grade 60; deformed billet steel bars, uncoated finish.
 - c. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in flat sheets; uncoated finish.

B. Color:

- 1. Integral Color:
 - a. Integral Coloring Admixture: Integral Color by The Bomanite Company, synthetic oxide pigment, meeting ASTM C979 and C494.
 - 1). Type A, cement dispersing/water reducing.
 - 2). Type D, set retarding/water reducing.
 - 3). Color to match Architect's sample.
- 2. Color Hardener:
 - a. Bomanite Color Hardener: The concrete shall be colored with Bomanite Color Hardener. Color(s) as scheduled. Refer to Drawings.

C. Tools Selection:

- 1. Imprinting Tools:
 - a. Mat type imprinting tools for texturing freshly placed concrete, in pattern/texture as selected by Architect or as scheduled.
 - b. Imprinting tools used in the execution of this project shall be manufactured by The Bomanite Company.
- 2. Bomanite Patterns: Design(s) as scheduled. Refer to Drawings.
- 3. Bomacron Textures and Patterns: Design(s) as scheduled. Refer to Drawings.

D. Release Agent Selection:

- 1. Powdered Release Agent. Color(s) as scheduled. Refer to Drawings.
 - a. Bomanite Release Agent.
- 2. Liquid Release Agent. Clear color.

- a. Bomanite Liquid Release.

E. Secondary Antique or Coloration:



1. Topical Stain: Color(s) as scheduled. Refer to Drawings.
 - a. Bomanite Topical Stain.
 2. Chemical Stain: Color(s) as scheduled. Refer to Drawings.
 - a. Bomanite Chemical Stain.
- F. Cure Agent:
1. Membrane Color Cure: Color(s) as scheduled. Refer to Drawings.
 - a. Curing Compound: Meeting ASTM C309, water based emulsion.
 - 1). BOMANITE Color Cure by The Bomanite Company.
 - 2). BOMANITE Clear Cure by The Bomanite Company.
 - 3). BOMANITE Clear Cure Matte Finish by The Bomanite Company.
 2. Silicate Cure & Densifier:
 - a. The concrete shall receive a cure treatment utilizing Bomanite Con Shield.
- G. Sealing and Finish Coatings:
1. Colorwax by The Bomanite Company.
 2. Hydrolock by The Bomanite Company
 3. VOC II by The Bomanite Company.

2.3 RELATED MATERIALS

- A. Cement: ASTM C150, type 1, Portland cement, gray color.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Form Material: Conform to ACI 301. If using metal, material shall be free from deformities. If using wood, use construction grade lumber, sound and free of warp, minimum 2 inches (51 mm) nominal thickness, except where short radii of curves require thinner forms.
- E. Contraction Joint Devices: Galvanized sheet metal, keyed profile, with knock-outs for reinforcing and dowel steel.
- F. Tie Wire: Annealed steel, minimum 16 gage (1.519 mm) size.
- G. Dowels: ASTM A615; Grade 40, plain steel, uncoated finish.
- H. Miscellaneous Reinforcing Accessories: Spacers, chairs, ties, and other devices necessary for properly placing, spacing, supporting, and fastening reinforcement in place.
- I. Form release agent: As acceptable to concrete colorant manufacturer, non-staining, dissipative type.
- J. Vapor Retarding Membrane: 10 mil (.2540 mm) reinforced polyethylene.
- K. Air-Entraining Admixture: ASTM C 206. Air Entrained Concrete shall be used wherever concrete is exposed to the freezing weather. Proportions of entrained air, as determined by ASTM C233, and C260, shall be as follows:

1. Aggregate: 3/8 inch (9.5 mm) maximum size aggregate 6-8 percent entrained air.
 2. Aggregate: 3/4 inch (19 mm) maximum size aggregate 5-7 percent entrained air.
- L. Joint Fillers:
1. Redwood Boards: Construction heart grade redwood, sound and free of checks, splits or other defects, 3/4 inch (19 mm) thick.
 2. Asphaltic Joint Filler: Asphalt impregnated fiberboard, ASTM D1751, 1/2 inch (12 mm) thick.
 3. Non-Asphaltic Joint Fillers: ASTM D1752, Type I.
- M. Sealants: Two part polyurethane sealants, of grade as required to suit application, meeting ASTM C920, in manufacturer's custom colors.
1. Urethane, SL grade, as specified in Section 07920.
 2. Urethane, SL-TB grade as specified in Section 07920.
- N. Bonding-Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene rubber.
- O. Epoxy-Bonding Adhesive: ASTM C 881, two component epoxy resin, capable of humid curing and bonding to damp surface, of class and grade to suit requirements if required, and as follows: Types I and II, non-load bearing, for bonding hardened of freshly mixed concrete to hardened concrete.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify compacted subgrade is ready to support paving and imposed loads, free of frost, smooth and properly compacted.
- B. Verify gradients and elevations of base are correct, and proper drainage has been provided so water does not stand in the area to receive paving.
- C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. If vapor retarding membrane is not used, moisten base to minimize absorption of water from fresh concrete.
- B. Notify Architect and testing laboratory, minimum 24 hours prior to commencement of concreting operations.

3.3 FORMING

- A. Construct and remove forms in accordance with ACI 347.
- B. Place and secure forms to correct location, dimension, and profile. Adequately brace to withstand loads applied during concrete placement.

- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- D. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 INSERTS AND ACCESSORIES

- A. Make provisions for installation of inserts, accessories, anchors, and sleeves.
- B. Place vapor retarder continuously over subgrade. Overlap joints a minimum of 12 inches (305 mm) and seal with a joint tape of same permeance as sheeting material.

3.5 REINFORCEMENT

- A. Accurately place reinforcement in middle of slabs-on-grade.
- B. Discontinue every other bar of reinforcement at control and expansion joints.
- C. Place reinforcement to achieve slab and curb alignment as detailed.
- D. Steel shall be free of rust, mill scale, dirt and oil.
- E. Provide doweled joints at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement. Provide support at both ends of dowels.
- F. Support reinforcing on bar chairs. Securely saddle tie at intersections. Rigidly secure in place to minimize displacement during concrete pour.

3.6 JOINTS

- A. Intentional stoppage of concrete placing shall be at planned location of either an expansion joint or contraction joint.
- B. When stoppage occurs at an expansion joint, install joint assembly with a bulkhead of sufficient section drilled to accommodate required dowels. Provide expansion joints at maximum 40 feet (12 m) o.c.e.w. in parking lots, 40 feet (12 m) o.c. for curbs and maximum 20 feet (6 m) o.c.e.w. at pedestrian paving.
- C. When stoppage occurs at a contraction joint, install sheet metal joint assembly of sufficient section to prevent deflection, shaped to concrete section. Drill bulkhead to permit continuation of longitudinal reinforcing steel through construction joint.
- D. Stoppage at Unintentional Location:

1. Immediately upon unintended stoppage of concrete placing, place available concrete to a line and install bulkhead perpendicular to surface of pavement and at required elevation. Place and finish concrete to this bulkhead. Remove and dispose of concrete remaining on subgrade ahead of bulkhead.

2. When placing of concrete is resumed before concrete has set to extent that concrete will stand on removal of bulkhead, new concrete shall be rodded with the first; otherwise, carefully preserve joint face.
 3. Provide a joint seal space at edges created by a construction joint of this type shall have a joint seal space as detailed on Drawings.
- E. Provide sawed contraction joints in vehicular paving and curbs spaced as detailed on Drawings, but in no case greater than 20 feet (6 m) o.c. spacing.
1. Saw joints after completion of finishing operations as soon as concrete has hardened to extent necessary to prevent revealing of joint or damage to adjacent concrete surfaces.
 2. Saw joints same day that concrete is placed except that sawing of joints in concrete placed late in day may be delayed until morning of following day.
 3. In any event, saw joints within 18 hours after placing concrete.
 4. Use a power-driven concrete saw made especially for sawing concrete and maintain in good operating condition.
 5. Saw cut shall be to a depth equal to 1/4 of slab thickness, minimum one inch (25 mm) depth.
 6. Align joints in vehicular paving with joints in adjacent pedestrian paving.
 7. Cut joints through curbs at right angles to back of curb.
- F. Place joint filler between paving components and building or other appurtenances.
- G. Provide scored joints in sidewalks and plazas to a depth of 1/4 the slab thickness, and at intervals as indicated, but in no case spaced greater than width of walk.

3.7 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301, 302, and 304. Deposit concrete so that specified slab thickness will be obtained after vibrating and finishing operations. Minimize handling to prevent segregation. Consolidate concrete by suitable means to prevent formation of voids or honeycombs. Exercise care to prevent disturbance of forms and reinforcing and damage to vapor retarder. Place concrete to lines and levels shown, properly sloped to drain as designed.
1. Hot Weather Placement: ACI 305.
 2. Cold Weather Placement: ACI 306.
 3. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
 4. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

- B. After consolidating and screeding, float concrete to gradients indicated. Use a straight edge to level and test surface in longitudinal direction to required grade. Finish edges to provide a smooth dense surface with 1/8 inch (3 mm) radius.

- C. Apply Bomanite Color Hardener prior to application of pattern. Apply at rate recommended by manufacturer, evenly to the surface of the fresh concrete by the dry-shake method. Applied in two or more shakes, floated after each shake and troweled only after the final floating.



- D. While concrete is still in its plastic state, apply the tool/texture pattern to the surface of the concrete. Properly tamp tools into the surface to achieve the required texture, with uniformity of pattern and depth of stamping. Utilize bond breaker to keep tools from sticking to fresh concrete. Release material shall be applied to the troweled surface prior to imprinting.
- E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
- F. Apply secondary stain treatment per approved mock-up or as scheduled to achieve design.
- G. Apply finish sealer per approved mock-up or as specified to achieve design required.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01400.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.9 PROTECTION

- A. Immediately after placement, protect concrete under provisions of Section 01500 from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION