

SECTION 4200 - CONCRETE STRUCTURES

PART 1 - GENERAL

- 1.01 SCOPE:** This Section covers installation of header curb, retaining walls, energy dissipation structures for drainage channels, reinforced concrete box (RCB) culverts, headwalls, and wing walls. Topics covered are formwork, weep holes, reinforcement placing, concrete placing, joints, finishing, curing, timing of form removal, dampproofing, and tolerances.
- 1.02 RELATED WORK:** Refer to the following sections for related work:
- | | |
|-----------------------------------|---|
| Concrete Mixes and Weather Limits | Section 4000-Concrete Materials and Methods |
| Porous Fill Material | Section 2000-Earthwork |
- 1.03 SHOP DRAWING:** Unless drawings give a complete tabulation of reinforcing, submit reinforcing shop drawings for review by Engineer prior to fabrication. This requirement applies to retaining walls, headwalls, wingwalls, and RCB's only.
- 1.04 PRECAST STRUCTURES:** Minimum material and construction requirements and dimensional tolerances for precast structures shall be the same as for cast-in-place concrete structures. Precast structures shall be designed for HS-20 vertical load an equivalent fluid pressure of 60 psf/ft horizontal.

PART 2 - PRODUCTS

- 2.01 CASTINGS:** Castings for inlet grates and catch basin access covers shall conform to ASTM A48, Class 35B. Castings for manhole covers and rings shall conform to ASTM 48, class 35B and shall be of the weight, dimension, and design shown on the detail drawings.
- 2.02 WEEP HOLES:** Weep holes shall be formed with 3-inch diameter, schedule 40 PVC pipe. Material for granular pocket shall be porous fill material as referenced in Part 1. Alternate to granular pocket material shall be drainage mat equal to Miradrain 6000 by Mirafi Inc. or Enkadrain by BASF Corporation.
- 2.03 DAMPPROOFING:** Dampproofing shall be asphalt based, fibrillated semi-mastic, of a consistency for cold brush application and conforming to ASTM D2823. Surface preparation and primer shall be as recommended by dampproofing manufacturer. Apply at a rate to achieve a 1/16-inch wet film thickness.
- 2.04 CONCRETE MIXES:** Mix designs are specified elsewhere; see Related Work in Part 1 of this Section.
- 2.05 GRANULAR BEDDING MATERIAL:** KDOT Standard Specifications Subsection 1102, CA-5 or Subsection 1108, BD-1, crushed stone or gravel, meeting the following gradation.

| CA-5 | | BD-1 | |
|-------------------|-------------------------|-------------------|-------------------------|
| <u>Sieve Size</u> | <u>Percent Retained</u> | <u>Sieve Size</u> | <u>Percent Retained</u> |
| 1-inch | 0 | 1-1/2-inch | 0 |
| 3/4-inch | 0 - 5 | 1-inch | 0 - 10 |
| 3/8-inch | 40 - 60 | 3/4-inch | 10 - 40 |
| No. 8 | 95 - 100 | No. 4 | 80 - 100 |
| | | No. 16 | 90 - 100 |
| | | No. 50 | 93 - 100 |
| | | No. 100 | 98 - 100 |

PART 3 - EXECUTION

- 3.01 GENERAL:** General placing and curing requirements and weather limitations are specified elsewhere; see Related Work in Part 1 of this Section. The following requirements are in addition to the referenced section.
- 3.02 FORMS:** Forms shall be designed and constructed in accordance to ACI 301 and ACI 347. Forms shall be placed and braced so the finished surfaces are within tolerances. Clean out and inspection holes shall be left in the bottom of otherwise inaccessible areas until after form inspection. A 3/4-inch chamfer shall be placed on all edges exposed to view, except slabs of catch basins adjacent to sidewalks shall be radiused to match the adjacent walk. Forms for surfaces visible after backfill shall be free from defects that would affect the texture of the concrete surface; the number of seams in exposed work shall be minimized and arranged in an orderly manner. Use forms for all concrete except where otherwise indicated or specified. Concrete for encasements and manhole and inlet bases may be earth formed.
- 3.03 REINFORCING AND EMBEDMENTS:** Reinforcing bars shall be protected by the thickness of concrete indicated on the drawings. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

| <u>Location of Reinforcement</u> | <u>Cover in Inches</u> |
|---|------------------------|
| Concrete cast against and permanently exposed to the earth | 3 |
| Formed surfaces exposed to the earth, or water, or weathering | 2 |

Provide all spacers, bolsters, chairs, ties, and other devices necessary to properly space, place, support, and fasten reinforcing in place during the concrete placement. Bolsters, chairs, and accessories shall conform to ACI SP-66 and the CRSI Manual of Standard Practice. Metal accessories shall be galvanized or plastic-coated where legs will be exposed in finished concrete surfaces.

Placement of reinforcement and embedded items shall be in accordance with ACI 17, ACI 301, and the CRSI Manual of Standard Practice. Embedments shall be secured with templates.

When it becomes necessary to splice reinforcing steel at points other than those shown on the drawings, the location and length of splice shall be approved by Engineer. Welding or tack welding of reinforcement will not be permitted.

Weepholes shall be installed where shown on the drawings or, if not shown, at 10-foot centers on all retaining walls, headwalls and wingwalls, and culvert sidewalls.

3.04 EXPANSION JOINTS: Expansion joints shall be placed where indicated or specified and between the cast-in-place structure and existing structures.

- A. Expansion joint filler shall cover the entire face of the joint except as required to place backer rod and joint sealant. Joint filler shall be secured so that it will not move during placement and consolidation of the concrete.
- B. If dowels are required, they shall be supported in a dowel basket. Dowels shall lie perpendicular to face of joint.
- C. After removal of forms but before backfilling, expansion joints shall be sealed. Both faces shall be sealed. Joint preparation and placement shall follow the sealant manufacturer's recommendations.

3.05 CONTRACTION JOINTS: Unless shown otherwise on the drawings, vertical contraction joints shall be placed on retaining walls and header curb not more than 30 feet apart nor more than 15 feet from a corner, but not within 5 feet of a corner. Other structures shall receive contraction joints where shown on the drawings. Joints in header curb shall align with score pattern in sidewalk. Joints in retaining wall shall align with vertical rustication or other vertical architectural elements.

Control joints shall be formed with recesses on both sides and top of section; reduction in width of 20 percent shall be achieved. Form strip may stay in place on faces to receive backfill. One half of horizontal temperature steel shall be interrupted at joint.

3.06 CONSTRUCTION JOINTS: Locate construction joints where indicated or specified. Where Contractor's procedures call for additional construction joints, they shall be reviewed by Engineer prior to placement. Construction joints shall have a 1-1/2" x 3-1/2" key beveled 15° for removal. Reinforcing steel shall continue across construction joints.

3.07 OBSERVATION: Reinforcing, embeddings, joints, and formwork shall be observed by Engineer prior to ordering concrete. One day response time to request observation, not counting weekends or holidays, shall be allowed. Contractor's job foreman shall accompany Engineer on this observation.

3.08 PLACING AND CONSOLIDATING: Rate of placing shall be adjusted to avoid both the creation of cold joints in the wall and blowout or deformation of the forms. Maximum free fall of concrete shall be 5 feet. Concrete shall be placed as close to final position as practicable. Concrete shall be vibrated or, in areas inaccessible to vibrators, shall be rodded to produce a solid mass.

- 3.09 CURING AND FORM REMOVAL:** Concrete shall be cured for four days, including the time the forms remain in place. The tops of slabs or wall sections and surfaces where forms are removed before four days shall be cured by application of waterproof sheeting or curing membrane, according to the curing requirements for concrete pavement and flatwork.

Removal of forms shall not damage the concrete. Forms and falsework shall not be removed prior to the times set in the table below. Times are valid for Type I or II cement without set adjusting admixtures and for air temperatures above 50°F. Required times may be adjusted by Engineer to reflect actual conditions.

| | |
|--------------------------|----------|
| Walls and Sides of Slabs | 16 hours |
|--------------------------|----------|

| | |
|--|--------|
| Top Slabs less than 10 Feet Clear Span | 4 days |
|--|--------|

| | |
|------------------------------------|--------|
| Top Slabs 10 to 20 Feet Clear Span | 7 days |
|------------------------------------|--------|

No backfill shall be placed until 80 percent of 28-day design strength is reached.

- 3.10 FINISHING:** Unless otherwise indicated or specified, concrete surfaces shall be finished as follows:

- A. Unformed surfaces: Tops of walls and shaped inverts shall receive a troweled finish to produce a uniformly smooth surface. Tops of inlet boxes shall receive a finish similar to adjacent sidewalk or, if no sidewalk exists, as specified for new sidewalk.
- B. Surfaces not visible after backfill shall have defects and tie holes patched and fins larger than 1/4-inch removed.
- C. Surfaces exposed to view in the finished work shall have defects and tie holes patched and all fins removed. The color of the patching grout shall be adjusted to match the formed surface by use of white portland cement. If patching is extensive or if the patches do not match the color of the formed surface, the surface shall receive a hand rubbed finish after patching is completed.

- 3.11 MOISTURE PROTECTION:** Dampproofing shall be installed on the backfill side of retaining walls and header curb. Follow manufacturer's recommendations. Dampproofing shall be held back 6 inches from top of wall. A minimum 2-cubic-foot pocket of granular material shall be installed behind weepholes. As an alternate, a continuous 4-foot tall section of drainage mat may be installed over the weepholes.

- 3.12 BEDDING FOR PRECAST STRUCTURES:** Unless a cast-in-place base or invert is required, a 6-inch layer of consolidated granular bedding material shall be placed under precast structures.

- 3.13 TOLERANCES:** Formed surfaces shall be within the tolerances specified below or ACI 301, whichever is the most restrictive:

- A. Vertical lines, edges, and surfaces shall be plumb to 1/4-inch in 10 feet, and 1/2-inch in the entire length.

- B. Horizontal lines and edges shall be level to within 1/4-inch in 20 feet, and 1/2-inch in the entire length.
- C. Linear elements shall be at position shown on drawings to within 1/2-inch. Embedments shall be at position shown on drawings to within 1/4-inch.
- D. All members except inverts and footings shall be no more than 1/4-inch thinner nor 1/2-inch wider than shown on the drawings. Thickness of footings shall be no more than 5 percent thinner than shown on drawings.

END OF SECTION 4200