

SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-3 ABBREVIATIONS.

1-3.2 Common Usage.

<u>Abbreviations</u>	<u>Word or Words</u>
PAV.....	Pressure Aging Vessel
PCC.....	Portland Cement Concrete
PE.....	Polyethylene
PMB.....	Processed Miscellaneous Base
PRCB.....	Precast Reinforced Concrete Box

SECTION 216 – PRECAST REINFORCED CONCRETE BOX

216-1 GENERAL. These specifications cover materials for single-cell precast reinforced concrete box (PRCB) sections intended for the conveyance of storm water.

The span, rise, and design earth cover, shall be as shown on the Plans or specified in the Special Provisions.

Three sets of prints of the PRCB layout diagrams and 2 sets of shop drawings shall be submitted to the Engineer in accordance with 2-5.3, except one reproducible print of the layout diagrams will not be required. The layout diagrams will be used by the Engineer for reference only, and their use shall in no way relieve the Contractor for its responsibility for accuracy. The Engineer may waive the PRCB layout diagrams requirement.

216-2 MATERIALS.

216-2.1 Portland Cement Concrete (PCC). PCC for PRCB sections shall have a compressive strength of 5000 psi minimum and conform to 201-1.1.4 unless otherwise specified in the Special Provisions.

PCC shall conform to the following:

- a) Portland cement shall conform to 201-1.2.1.
- b) Aggregate shall conform to the reactivity requirements specified in 201-1.2.2.
- c) The combined aggregate gradation shall include aggregate of 3/4 inch (18mm) maximum diameter unless otherwise approved by the Engineer.
- d) Water shall conform to 201-6.2.3.
- e) Chemical admixtures shall conform to 201-1.2.4.
- f) Cementitious material(s) shall be Portland cement or Portland cement and fly ash.
- g) The water-cementitious material(s) ratio shall not exceed 0.53 by weight.
- h) Proportioning shall conform to 201-1.3.
- i) Mixing shall conform to 201-1.4.

216-2.2 Fly Ash. Fly ash shall be Class F conforming to 201-1.2.5 unless otherwise specified in the Special Provisions.

216-2.3 Reinforcement.

216-2.3.1 Deformed Welded Wire Reinforcement. The diameter of any deformed wire in finished deformed welded wire reinforcement shall conform to ASTM A496 or AASHTO M32 or M221. Deformed welded wire reinforcement shall conform to ASTM A497 or AASHTO M55 or M221.

216-2.3.2 Deformed Bars. Deformed bars shall be Grade 60, billet-steel bars conforming to 201-2.2.1.

216-2.4 Leveling Bed Material. Leveling bed material shall be sand, crushed aggregate or crushed miscellaneous base, native free-draining granular material having a sand equivalent of not less than 30, or the material specified in the Special Provisions.

216-3 FABRICATION.

216-3.1 General. PRCB sections shall be fabricated as shown on the Plans or Standard Plans. PRCB sections of greater strength than that specified may be furnished at the Contractor's option, and at its own expense. The interior surfaces of PRCB sections shall be smooth.

216-3.2 Joints. Joints for PRCB sections shall be fabricated with tongue and groove ends.

Outer cage transverse reinforcement shall be placed in the top and bottom slabs at the groove portion of the joint.

216-3.3 Reinforcement.

216-3.3.1 General. Reinforcement shall be deformed welded wire reinforcement conforming to 216-2.3.2 or deformed bars conforming to 216-2.3.3 unless otherwise specified in the Special Provisions. Other details shall be as shown on the Plans or Standard Plans.

Before reinforcement is placed it shall be free of mortar, oil, dirt, excessive mill scale and scabby rust, and any other coating of any nature that would destroy or reduce its ability to bond.

216-3.3.2 Area of Steel Reinforcement. The area of steel reinforcement shall be as shown on the Plans or Standard Plans. Steel areas greater than those shown on the Plans or Standard Plans shall not exceed 25 percent, unless the Engineer is provided with calculations verifying that the required ductile response is maintained. The calculations shall be prepared by a Registered Civil or Structural Engineer and submitted to the Engineer in accordance with 2-5.3.

If deformed steel bars are used, the steel area shall be increased to account for the difference in steel yield strength, steel spacing, concrete cover, and crack control between the welded wire reinforcement and steel bars.

216-3.3.3 Placement. Reinforcement placement shall conform to the details shown on the Plans or Standard Plans. Reinforcement shall be firmly and securely held in position by wiring at intersections and splices and by using plastic or ferrous metal chairs, spacers, metal hangers supporting wires, or other devices of sufficient strength to resist crushing under applied loads. Wooden or aluminum supports shall not be used. Placement on layers of fresh concrete as the work progresses will not be permitted. Tack welding of reinforcing bars will not be permitted.

Welded wire fabric shall be rolled flat before placing concrete, unless otherwise shown on the Plans or Standard Plans.

216-3.3.4 Splicing. Splices in reinforcing bars shall be constructed using lap splices.

Splicing of reinforcing bars will not be permitted at locations shown on the Plans or Standard Plans as a "No-Splice Zone." At the option of the Contractor, reinforcing bars may be continuous at locations where splices are shown on the Plans or Standard Plans. The locations of splices, except where shown on the Plans or Standard Plans, shall be determined by the Contractor.

Unless otherwise shown on the Plans or Standard Plans, splices in adjacent reinforcing bars at any particular section shall be staggered. The minimum distance between staggered lap splices or

mechanical lap splices shall be the same as the length required for a lap splice in the largest bar.

216-3.4 Curing.

216-3.4.1 General. Curing shall be for a length of time sufficient for the PCC to develop the specified compressive strength in 28 days or less. Any one of the following methods of curing or combinations thereof may be used:

a) Steam Curing.

Steam curing shall conform to ASTM C1433 (C1433M). PRCB sections shall be low pressure, steam-cured by a system capable of maintaining a moist atmosphere.

b) Water Curing.

Water curing shall conform to ASTM C1433 (C1433M). PRCB sections shall be kept moist continuously.

c) Membrane Curing.

A sealing membrane conforming to ASTM 309 shall be applied and left intact until the specified PCC compressive strength is attained. The temperature of the PCC at the time of application of the membrane shall be within $\pm 10^{\circ}\text{F}$ ($\pm 6^{\circ}\text{C}$) of the atmospheric temperature. All surfaces shall be kept moist prior to the application of the membranes and shall be damp when the membrane is applied.

216-3.5 Forms. Forms shall have sufficient rigidity to be capable of maintaining section dimensions within the permissible tolerances. Form surfaces which will come into contact with PCC shall be constructed of smooth non-porous material.

216-3.6 Lifting Holes or Devices. Lifting holes or devices may be cast into, or attached to, PRCB sections. Shop drawings shall be submitted in accordance with 2-5.3.3 if so specified in the Special Provisions.

216-4 TESTING REQUIREMENTS.

216-4.1 Test Specimens. Test specimens shall conform to 201-1.1.5 as modified to allow the use of Section 11 of ASTM C497 or AASHTO T280. The Engineer shall be notified before testing is started.

216-4.2 Compression Testing of Cylinders.

216-4.2.1 General. Compression testing of cylinders shall conform to 201-1.1.5. A minimum of 3 test cylinders shall be prepared from each PCC mix used for each lot of PRCB sections. A production lot for PRCB shall be the lesser of one day's production, 400 feet (120m) or 50 units.

216-4.2.2 Acceptance. When the average compressive strength of all cylinders tested is equal to or greater than the specified compressive strength of the PCC, and not more than 10 percent of the cylinders tested have a compressive strength less than the specified compressive strength, and no cylinder tested has a compressive strength less than 80 percent of the specified compressive strength, the lot will be accepted.

When the compressive strength of the cylinders tested does not conform to the aforementioned acceptance criteria, acceptance of the lot shall be determined in accordance with 216-4.3.

216-4.3 Compression Testing of Cores.

216-4.3.1 General. Cores shall be obtained and tested for compressive strength in accordance with 201-1.1.5.

216-4.3.2 Core Holes. Core holes shall be plugged and sealed using high-strength, non-shrink

grout. The compressive strength of the repaired core holes shall meet or exceed the compressive strength requirements of the PRCB section..

216-5 PERMISSIBLE VARIATIONS.

216-5.1 Internal Dimensions. Internal dimensions shall not vary more than 1 percent from the dimensions shown on the Plans or Standard Plans. The haunch dimensions shall not vary more than 1/4 inch (6mm) from the dimensions shown on the Plans or Standard Plans.

216-5.2 Slab and Wall Thickness. Slab and wall thicknesses shall not be less than that shown on the Plans or Standard Plans by more than 5 percent or 3/16 inch (5mm), whichever is greater. A thickness greater than that shown on the Plans or Standard Plans will not be a cause for rejection.

216-5.3 Length of Opposite Surfaces. The length of opposite surfaces shall not vary more than 1/8 inch/foot of internal span. The maximum variation shall not exceed 5/8 inch (15mm) for all sizes through an internal span of 7 feet (2100mm), and 3/4 inch (18mm) for an internal span greater than 7 feet (2100mm), except where beveled ends for laying of curves are specified.

216-5.4 Length of Section. The under-run in length shall not be more than 1/8 inch/foot of length with a maximum of 1/2 inch (12mm) in any PRCB section.

216-5.5 Position of Reinforcement. The maximum variation in the position of the reinforcement for slab and wall thicknesses of 5 inches (125mm) or less shall be $\pm 3/8$ inch (9 mm), and for thicknesses greater than 5 inches (125mm) shall be $\pm 1/2$ inch (12mm).

The cover over the reinforcement shall not be less than 5/8 inch (15mm), as measured to the internal surface or the external surface of the slab except as follows. The cover over the reinforcement for the external surface of the top slab for PRCB sections with less than 2 feet (600mm) of cover shall not be less than 1-5/8 inches (40mm). The aforementioned minimum cover limitations do not apply at the mating surfaces of a joint.

Hooks and bends shall conform to ACI 318.

216-6 MARKINGS. The following information shall be legibly marked on each PRCB section by indentation or waterproof paint:

- a) PRCB section span,
- b) rise,
- c) table number,
- d) maximum and minimum design earth cover,
- e) specification designation,
- f) interior invert cover,
- g) date of manufacture, and
- h) the word "top" lettered on the inside top surface.

216-7 CAUSES FOR REJECTION. Inspection of PRCB as may be deemed necessary by the Engineer will be made at the place of manufacture. Individual PRCB sections may be rejected due to any of the following unless repairs are made and approved by the Engineer:

- a) Fractures or cracks with widths exceeding 0.10 inch (3mm).
- b) Mixing and molding defects, honeycombed or open texture that would adversely affect the function of the PRCB section,
- c) Failure to meet the permissible variations specified in 216-5.
- d) Exposure of any reinforcement arising from misplacement thereof.

216-8 BASIS OF ACCEPTANCE. The basis of acceptance shall be by one of the following as specified in the Special Provisions:

- a) Compliance with these specifications, inspection of the manufacturing, and inspection of the completed PRCB sections.
- b) Acceptance of a Certificate of Compliance conforming to 4-1.5.

Such acceptance, however, shall be considered a tentative acceptance. Final acceptance will only be made when the Work is completed.

SECTION 306 – UNDERGROUND CONDUIT CONSTRUCTION

306-1.7 Precast Reinforced Concrete Box.

306-1.7.1 General. These specifications cover the construction of single-cell precast reinforced concrete box (PRCB) sections intended to be used for the conveyance of storm water. The PRCB sections shall conform to 216.

306-1.7.2 Repairs. PRCB sections damaged due to imperfections in fabrication or handling shall be repaired by a method approved by the Engineer.

306-1.7.3 Subgrade. Subgrade material shall be densified to 90 percent relative compaction. Unsuitable subgrade material shall be removed to the depth shown on the Plans or determined by the Engineer and replaced with leveling bed material. Voids below subgrade shall be filled with leveling bed material prior to densification.

306-1.7.4 Leveling Bed Material. Leveling bed material shall conform to 216-2.4 and be densified to 90 percent relative compaction.

306-1.7.5 Installation. PRCB shall be laid up-grade with the groove ends up-grade unless otherwise approved by the Engineer. Connections shall be made as shown on the Plans or Standard Plans or as specified in the Special Provisions.

At the close of work each day, or whenever the work ceases for any reason, each end shall be securely closed as approved by the Engineer.

306-1.7.5.1 Tongue-and-Groove Joints. Tongue and groove joints shall be constructed in accordance with 306-1.2.4 (b) modified as follows:

- a) Only one end shall be beveled for PRCB sections placed on curves.
- b) Concrete used to fill clear spaces more than 1 inch (25mm) and less than 3 inches (75mm) shall be 560-C-3250 (330-C-23) or Class C mortar conforming to 201-5 unless otherwise specified in the Special Provisions.

Preformed flexible joint sealant conforming to ASTM C990 or AASHTO M198 may be used. Preformed flexible joint sealant shall be installed in accordance with the manufacturer's specifications on the tongue and groove, in order to fill the joint annular space on the inside of the PRCB section. Flexible plastic gaskets shall not be used on PRCB pulled to provide a curve.

Preformed flexible joint sealant bands conforming to ASTM C877 may be used, in conjunction with mastic or mortar, when installed in accordance with the manufacturer's specifications.

306-1.7.5.2 Structure Backfill. Structure backfill shall conform to 300-3.5.1. Structure backfill material shall be placed 12 inches (300mm) from the top and 24 inches (600mm) from each side.

306-1.7.6 Measurement. PRCB will be measured for payment along the longitudinal axis between the ends laid for each size. The length shall include the actual length of the PRCB in place but it shall not include the inside dimensions of structures.

306-1.7.7 Payment. Payment shall conform to 306-1.6. Payment for additional leveling bed material shall conform to 3-3 unless otherwise specified in the Special Provisions.

Change No. 177NU(ESSApproved012010)

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