PRECAST BOX CULVERTS

GENERAL

Concrete box culvert sections shall conform to the applicable requirements of ASTM C1433 for the design loading conditions. Approval to furnish wet or dry precast box culverts shall be on the basis of certification form an approved fabrication plant as listed in Appendix A of Office of Materials IM 445.02. Production plant approval shall be dependent on a recommendation by the District Materials Engineer responsible for the inspection of the plant and meeting requirements of IM 445.

The District Materials Engineer responsible for the inspection of the facility shall authorize approval to furnish special sections such as elbows and other related precast sections, on the basis of certification.

MATERIALS

All aggregates, cementitious materials, admixtures and reinforcing steel shall be from approved sources as listed in applicable Office of Materials IMs. Welded-wire fabric (WWF) reinforcement shall meet requirements of ASTM A185. Deformed WWF shall meet requirements of ASTM A497. Deformed billet-steel bars shall meet requirements of ASTM A615, Grade 60.

Coarse aggregate used in concrete mixtures shall be from approved sources meeting requirements of Section 4115, with a Class 2 or better durability rating. The coarse aggregate shall have 100% passing the 1-inch sieve and no more than 10% retained on the 3/4-inch sieve.

U-shaped tie rods shall meet the requirements of ASTM A36 steel. Nuts shall be hex or heavy hex meeting the requirements of ASTM A563. Washers shall be flat and shall meet the requirements of ASTM A436. Tie rods (U-shaped), nuts, and washers shall be galvanized per ASTM A153, Class C.

Engineering fabric for joint wrapping shall be from an approved source listed in IM 496.01, Appendix A.

Gaskets for joints shall be butyl rubber-based, rope gasket material, meeting the requirements of ASTM C443 or ASTM C443M.

Lifting cables shall be seven strands and shall meet the requirements of ASTM A416.

PLACEMENT OF REINFORCEMENT

The minimum concrete cover over the circumferential reinforcement shall be one inch.

The inside circumferential reinforcement shall extend into the tongue portion of the joint and the outside circumferential reinforcement shall extend into the groove portion of the joint. The clear distance of the end circumferential steel shall not be less than 1/2 inch or more than 2 inches from the ends of the box section. The maximum variation in the position of the reinforcement, as indicated by the approved shop drawing shall be ± 3/8 inch for slab or wall thickness of 5 inches or less and ± 1/2 inch for thickness over 5 inches.

Splices in the circumferential reinforcement shall be made by lapping. The overlap, measured between the outermost longitudinal sires of each fabric sheet, shall not be less than the spacing of the longitudinal wires plus two inches. The minimum lap distance is ten inches.

CONCRETE MIXTURE

The District Materials Engineer shall approve concrete mixtures used. The concrete mixture shall be proportioned and placed to provide a homogeneous concrete mix free of honeycomb and other defects meeting the design 28-day strength requirements. Wet cast concrete mixture shall have a maximum water-to-cementitious materials ratio of 0.50 by weight.

The concrete mixture shall have not less than 500 lbs./cy of cementitious material, or as approved by the District Materials Engineer.

CURING

One, or a combination of the following methods, shall be used to cure box sections: steam, water or use of an approved curing compound. The method used shall be so designed to provide and maintain a moist-cure environment at all times.

NOTE: When use of a curing compound is selected, the compound shall be sprayed on immediately after form removal and left intact until the concrete has achieved the specified 28-day compressive strength. The units must be protected from loss of moisture while still in the forms. Curing compound shall not be used when the ambient temperature is less than 32°F at the time of application.

The box sections shall be cured for a sufficient time to assure the concrete shall achieve the designed compressive strength within 28 days.

CONCRETE STRENGTH

Compression tests for determining concrete compressive strength may be made on standard rodded concrete cylinders or concrete cylinders compacted and cured in a like manner as the box sections, or on cores drilled from the box section.

A minimum average compressive concrete strength of 3500 psi shall be achieved before box sections may be moved and/or transferred to a storage site. At least three specimens shall be tested from each concrete mix used within a group (one day's production) to determine compressive strength.

Acceptance strength testing shall be based on a minimum of three specimens per lot (one calendar week per mix used). The average compressive strength of all cylinders tested shall be equal to or greater than the design concrete strength, and none of the specimens shall be less than 80% of design strength.

Unless otherwise specified, the minimum 28-day compressive concrete strength is 5000 psi for box sections.

DESIGN DIMENSION TOLERANCES

- Internal dimension – 1%
- Haunch (out-to-out) – 1/4 inch
- Slab and wall thickness – not less than 5%, maximum of 3/16 inch
- Length of opposite surfaces

  7 ft. internal span or less – 1/8 in./ft. of internal span, maximum of 5/8 inch
  Over 7 ft. internal span – 1/8 in./ft. of internal span, maximum of 3/4 inch

- Length of section – 1/8 in./ft. of length, maximum of 1/2 inch
- Area of reinforcement – areas of steel reinforcement shall be the design steel areas or greater. Minimum concrete coverage must be maintained.

MARKING

Each box section to be certified shall be legibly marked on the inside and the outside by indentation, waterproof paint or other approved method with the following:

- Span x Rise
- Date of Manufacture
- Name or Trademark of Manufacturer
- Maximum Design Earth Cover
- Certified Stamp

MONITOR INSPECTION CHECKLIST

The DOT developed an inspection checklist to assist the State Monitor/Inspector, which covers fabrication of the units. The checklist includes several items a monitor/inspector should cover for each project to assure compliance and uniformity statewide.

CHECKLIST – PRECAST BOX CULVERTS

Project Number _____ County _____

Size _____ Design Cover _____

Required Documentation:

- ❑ Approved Shop Drawing
- ❑ Steel Mill Certifications (Approved Source)
- ❑ Aggregate Certifications (Truck Tickets)
- ❑ Cement Certifications (Delivery Tickets)
- ❑ Cylinder Breaks
  (One day and shipping strength – 3 cylinders/calendar week for shipping – average equal to or greater than required strength – none less than 80% of required strength)

Required Steel Areas (Steel Designation Areas):

As1 _____ As2 _____ As3 _____ As4 _____

As5 _____ As6 _____ As7 _____ As8 _____

(**NOTE**: The steel areas for As5 and As6 are normally included in As7 and As8 by increasing steel area and modifying spacing. As5 and As6 mats are not normally installed.)

Steel Incorporated (Steel Used):

As1 _____ As2 _____ As3 _____ As4 _____

As5 _____ As6 _____ As7 _____ As8 _____

Verify:

- ❑ Joint Sealer (Butyl Rubber Base)
- ❑ Engineering Fabric (Approved Source)
- ❑ Joint Tie Rods (Galvanized, A36 Steel)
- ❑ Required Identification

Signed _____
District Materials Staff