



Part 1



Agenda

- ▶ **Patching**

- ▶ Identification
- ▶ Corrective action

- ▶ **Concrete (PCC) Control Joints**

- ▶ Joint spacing
- ▶ Expansion joints

- ▶ **Drainage**

- ▶ Inlets
 - ▶ Flared end sections
-



Patching



Patching

- ▶ **Pavement defects/failures**
 - ▶ Fatigue (alligator) cracking causes
 - ▶ Excessive loading



Patching

- ▶ Fatigue (alligator) cracking causes, continued
 - ▶ Weak surface, base, or subgrade
 - ▶ Poor drainage/wet subgrade



Patching

- ▶ Fatigue (alligator) cracking causes, continued
 - ▶ Thin surface or base



Patching

- ▶ **Pavement defects/failures**
 - ▶ Block cracking causes
 - ▶ Old dried out mix



Patching

- ▶ Block cracking causes, continued
 - ▶ Low traffic volumes



Patching

- ▶ Block cracking causes, continued
 - ▶ Poor binder in mix



Patching

- ▶ Pavement defects/failures
 - ▶ Edge cracking causes
 - ▶ Weak base



Patching

- ▶ Edge cracking causes, continued
 - ▶ Poor drainage



Patching



Concrete (PCC) Control Joints

▶ **Curb**

- ▶ Contraction Joint Requirements
 - ▶ Placement
 - ▶ Spacing

▶ **Curb & Sidewalk**

- ▶ Expansion Joint Requirements
 - ▶ Placement
 - ▶ Spacing



Concrete (PCC) Control Joints



Concrete (PCC) Control Joints

- ▶ Curb



Concrete (PCC) Control Joints

- ▶ PCC Curb cracking, continued
 - ▶ Omission of contraction joints



Concrete (PCC) Control Joints

▶ When are contraction joints required for curb?

701.10 Joints. Expansion joints shall be formed using templates or saw cut at no greater than 160' (49 m) intervals. Joints must be cut or formed vertically to the full depth of the curb to allow full contact of the expansion material with the entire surface. Additional expansion joints shall be constructed at each end of radii and at both sides of all structures or obstructions.

Contraction joints shall be constructed at 10' (3m) intervals. If not templated, all surfaces, front, top and back shall be tooled or saw cut to a minimum depth of 1" (25 mm) and a minimum width of 1/8" (3 mm). Saw cutting shall be done as soon as the concrete has sufficiently set or no more than 16 hours from the time of placement of the concrete to avoid shrinkage cracking. Any curb showing shrinkage cracks shall be removed and replaced at no cost to the Department.

When constructed adjacent to concrete pavement, joints shall coincide with joints in the pavement. When sidewalk is behind the curb all joints shall be in alignment and the expansion joints in the curb shall coincide with expansion joints in the sidewalk.

When curb is placed adjacent to Portland Cement Concrete pavement the curb or pavement shall be formed or tooled to allow sealing as shown in the Standard Construction Details C-1 and P-2.

Concrete (PCC) Expansion Joints



Concrete (PCC) Expansion Joints

- ▶ Where are they required?



Concrete (PCC) Expansion Joints

- ▶ Curb
 - ▶ Expansion placement example



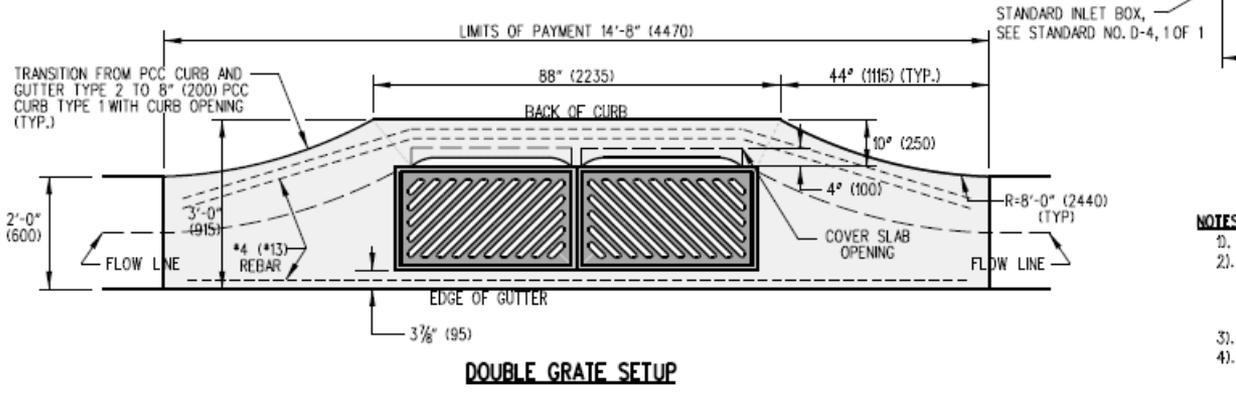
Drainage

- ▶ **Catch Basins/Inlets**
 - ▶ Grate orientation
 - ▶ Steps
 - ▶ Flow channels
- ▶ **Flared End Sections**
 - ▶ Personnel Safety Grates



Dr

► C



 DELAWARE DEPARTMENT OF TRANSPORTATION	DRAINAGE INLET TOP UNIT, TYPE S		
	STANDARD NO.	D-5 (2010)	SHT. 8 OF 9



Drainage

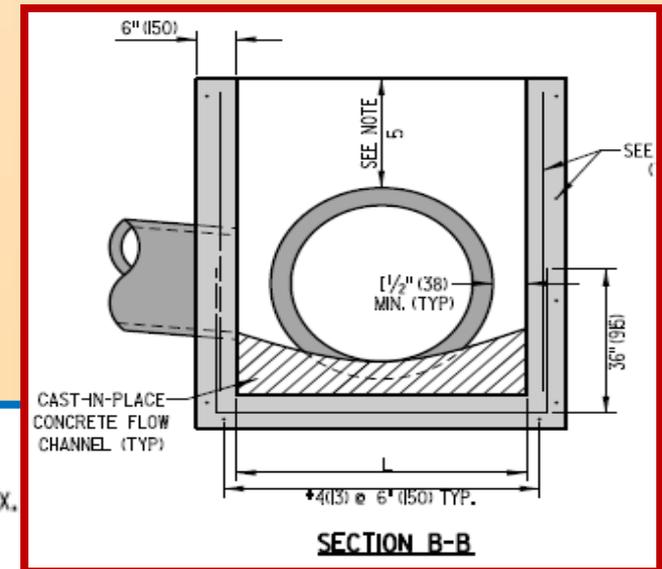
▶ Inlet step requirements

A. Adjusting and Repairing Drainage Inlet(s);

1. Remove covers of drainage inlets for inspection by Engineer.
2. Sawcut existing PCC or hot-mix pavement and dispose of excess materials in accordance with Subsection 106.09.
3. Excavate and remove existing castings.
 - a. Take care to not damage castings, clean and set aside for reuse;
 - b. Replace castings where specified.
4. If existing structure is in good condition, adjust the drainage inlet frame and grate to grade.
 - a. Set forms for adjusting frame such that frame is encased in Class B PCC.
 - b. Placing frame on bricks, blocks or other materials will not be permitted.
5. If existing structure is in poor condition, repair as directed.
 - a. Keep silt and debris away from structure until work is complete.
 - b. Set frame as directed in 4a.
6. Install steps on the back wall of drainage inlet(s) that are 4' (1.2m) in depth, measured from top of grate to the invert of the lowest pipe, or as directed on Plans.
 - a. Begin installation within 24" (600 mm) of the top of grate and end installation no more than 12" (300 mm) above the lowest invert, space at 12" (300 mm) intervals.
 - b. Embed steps a minimum of 3" (75 mm) in the wall and protrude 6" (150 mm) out from the wall.

Drainage

- ▶ Flow channel requirements
 - ▶ Installation/compliance required for new const. and adjustments
 - ▶ Images from Standard D-4

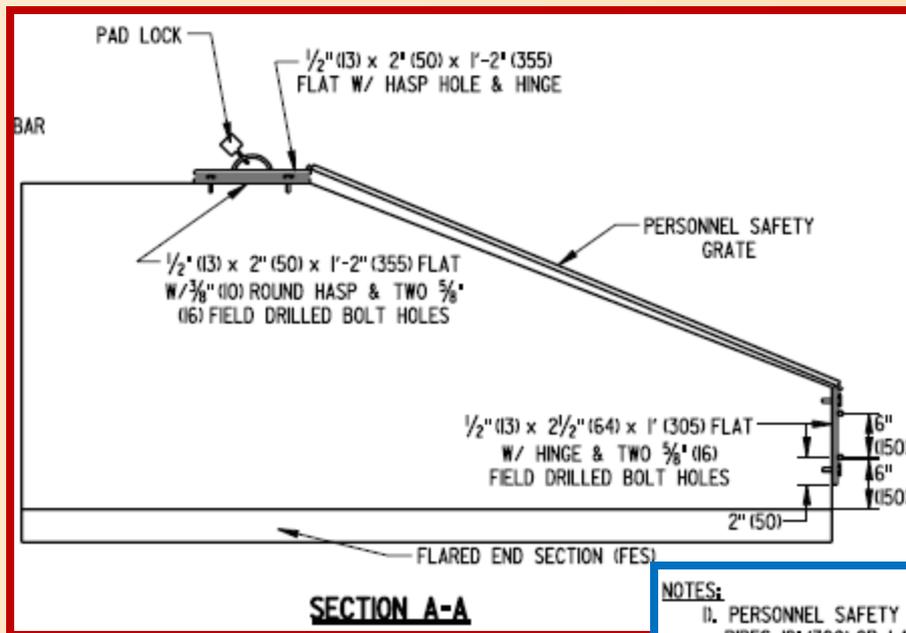


NOTES:

- 1). INLET BOXES SHALL BE PRECAST OR CAST-IN-PLACE.
- 2). PIPES SHALL NOT BE INSTALLED THROUGH ANY CORNER OF THE INLET BOX.
- 3). RISER SECTIONS MAY BE USED FOR DEEP INLET BOXES.
- 4). PIPES MAY BE INSTALLED NEAR OR THROUGH JOINTS FOR RISER SECTIONS.
- 5). WHEN THE COVER ABOVE THE PIPE IS LESS THAN 4" (100) TO THE COVER SLAB OR TOP UNIT OPENING, THE PORTION OF BOX WALL ABOVE THE PIPE MAY BE REMOVED AS SHOWN IN THE OPTIONAL PIPE OPENING DETAIL. THE AREA ABOVE THE PIPE SHALL THEN BE FORMED AND FILLED WITH HIGH-STRENGTH, NON-SHRINK GROUT MIXED WITH COARSE AGGREGATE IN A 1:1 RATIO BY WEIGHT.
- 6). CONCRETE FLOW CHANNEL SHALL BE WARPED FOR POSITIVE DRAINAGE.
- 7). WHEN INLET BOX IS PRECAST, PIPE OPENING SHALL BE BETWEEN 3" (75) AND 4" (100) LARGER THAN OUTSIDE DIAMETER OF PIPE AND SHALL NOT ENCROACH ON ADJACENT WALL.
- 8). REINFORCEMENT FOR LAWN INLET BOXES SHALL BE 4" (102) X 4" (102), W4 X W4 (W26 X W26) WELDED WIRE.

Drainage

- ▶ Personnel safety grate
- ▶ Images from Standard D-3



NOTES:

1. PERSONNEL SAFETY GRATES (PSG) SHALL ONLY BE INSTALLED ON THE INLETS OF STORM WATER PIPES 12" (300) OR LARGER IN DIAMETER THAT ARE NOT STRAIGHT FROM THE INLET TO THE OPEN OUTLET, REGARDLESS OF THE LENGTH.
2. THE GRATE SHALL BE MADE TO FIT THE OUTSIDE PERIMETER OF THE FLARED END SECTION (FES) $\pm \frac{1}{2}"$ (13).
3. ALL BOLT HOLES ARE TO BE DRILLED IN THE FIELD.
4. A STIFFENER IS TO BE INSTALLED WHERE TWO OR MORE BARS ARE USED.
5. BOTTOM BAR SHALL BE 6" (150) ABOVE INVERT OF FES.
6. ALL HARDWARE ATTACHED TO CONCRETE SHALL BE ATTACHED USING APPROVED TAMPER PROOF ANCHORS.

References

- ▶ <https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/ltpa/13092/001.cfm>
- ▶ <http://www.asphaltinstitute.org/asphalt-pavement-distress-summary/>



Questions

