

481-13-03

DATE: November 22, 2013

SUBJECT: Specification Implementation
Section 601

TO: District Executives

FROM: R. Scott Christie, PE /s/
Deputy Secretary Highway Administration

The FHWA recently approved a proposed specification change to Section 601 of Publication 408. This change will institute trench installation inspection requirements for pipe installations (including subsurface utilities) located under the roadway, sidewalk, or shoulder and will remove the explicit restriction on the use of excavator-mounted hydraulic plate compactors. The maximum backfill layer thickness will remain at 4 to 8 inches at this time. We are partnering with the industry to research whether these limits can be increased in the future.

For projects in design, with a PS&E submission after December 26, 2013, the special provision for changes to 408 will include modifications to Section 601. For projects currently advertised, with adequate time to issue an addendum or PS&E submission prior to December 26, 2013, incorporate Section 601 to include form CS-6 (11-13).

For projects in Construction or proceeding through Award Status, the District shall incorporate Section 601 upon request of the contractor or permittee (including HOPs). The Districts have the discretion to select the most effective contracting method to implement the modifications.

Note that an authorized inspector must be present for trench backfill work conducted in accordance with this Section 601.3(f) & (q). The attached inspection form, CS-6, must be submitted to the Department Representative promptly after installation.

If you have any questions, please contact Rebecca S. Burns, P.E., of the Innovation and Support Services Division at 787-787-6989.

Attachment

PIPE INSTALLATION INSPECTION FORM

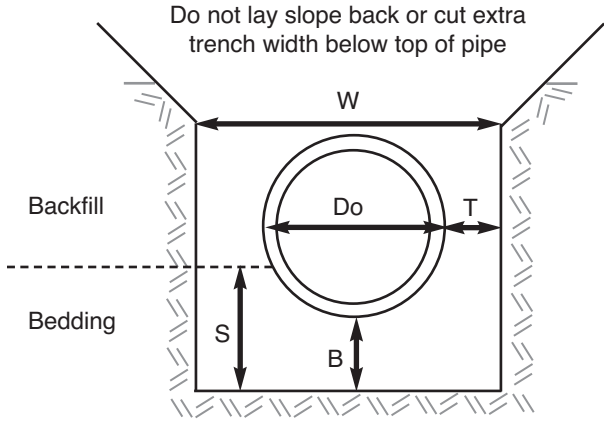
Project # _____ County, Route & Segment _____

Inspector _____ Installation Date _____

Item # _____ Ref. # _____ Producer Code _____ Contractor _____

Description _____

Station _____ Plan Page _____ Pipe Mat'l (RCP, Metal, HDPE, Iron, Other) _____



Pipe Size _____ inches
 W = Width of trench at Top of Pipe _____ feet
 Refer to RC - 30M
 Note: Trench or shoring walls to be vertical to Top of Pipe
 B = Thickness of bedding under pipe. _____ inches
 T = Outside diameter of pipe to trench wall. _____ inches
 S = Total Depth of bedding. _____ inches
 Do = Outside diameter of pipe _____ inches

Trench & Bedding Checks* (Actual Field Measurements)

| Check Stations & Location | T | W | B | S | Do | Initial | Date |
|---------------------------|---|---|---|---|----|---------|------|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

* Check every 50 feet, with a minimum of two checks per run.

| Field Measurements (Depth - ft) | Grade Check Method (Ruler, laser) | Backfill (Document density using TR-478A or TR 4276A) | | | | | | Inspector's Initials & Date |
|---------------------------------|-----------------------------------|---|------------------------|----------------------|-------------------------|--------------------------|-------------------------|-----------------------------|
| | | Compaction Method/ Equipment | Soil or Aggregate Type | % passing 3/4" sieve | Lift Thickness (inches) | Density required (% SPD) | # compactor passes/lift | |
| 0' - 3' | | | | | | 100% | | |
| 3' - | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Type of Joints (601.3d) _____ Joints Installed Satisfactorily? Yes No

Materials: Certified or Tested and approved prior to incorporation into the project? Yes No

All pavement undermining cut back and removed prior to compaction? Yes No

Remarks: Record problems, soft foundations, under cuts, rock, obstructions, utilities encountered, deviations, etc. Describe and note location of existing conduits encountered, whether connected, plugged and abandoned, reconnected, etc.

Sketch Area:

A large grid of dashed lines for sketching, consisting of 20 columns and 10 rows of squares.

Inspector's Signature _____

Date _____

By signing below, I certify that my company performed the work, the information on both pages of this form is accurate, the work complied with Publication 408, including Section 601 and references therein, and any deviations are noted on this form.

Name (print): _____ Title: _____

Company Name: _____

Signature: _____ Date: _____

SECTION 600 INCIDENTAL CONSTRUCTION

SECTION 601—PIPE CULVERTS

601.1 DESCRIPTION—This work is construction or reconstruction, inspection, and cleaning of pipe culverts; including subsurface utility facilities, sewers, and storm drains. This work also includes the direct design, manufacturing and testing of reinforced concrete pipes.

601.2 MATERIAL—

(a) **Pipes.** Comply with the following:

1. **Certification.** Section 106.03(b)3
2. **Size and Type of Pipe.** As indicated.
3. **Reinforced Concrete (RC) Pipe.**

3.a Round and Elliptical Reinforced Concrete Pipe. Publication 280. Provide RC pipe conforming to BD-636M, PennDOT Design Manual Part 4M, Appendix H, and the Pennsylvania Installation Direct Design (PAIDD) computer program. Manufacture and test according to Publication 280.

3.b Plant Acceptance.

3.b.1 General. Do not begin fabrication before the Structural Materials Engineer's inspection and acceptance of the plant. Provide a permanent building offered for the Department's acceptance.

Material, equipment, test procedures, methods of fabrication, handling, storage, and transportation are subject to inspection. Through wall lift holes are permitted only if formed during the manufacturing process or cored after the pipe is cured. Punch through methods are prohibited.

Register and certify the plant under either the American Concrete Pipe Association (ACPA) or National Precast Concrete Association (NPCA) plant certification program. Submit an annual endorsed copy to the Structural Materials Engineer for continued qualification.

3.c QC.

3.c.1 General. Establish a level of QC based on uniform production practices. Submit the plant's QC Plan and mix design(s) to the Structural Materials Engineer, BDTD, for review and approval. Include with the QC Plan a company organizational chart indicating a separate chain of command from the QC Manager to the Owner/Plant Manager independent of the Production Manager. Resubmit the QC Plan, mix design, and/or organizational chart, when required, due to changes in processes, materials, or personnel.

3.c.2 QC Manager. Provide a QC Manager who has the overall responsibility for the adequacy of production facilities, QC, sampling, and testing, and fabrication of the product, and who will ensure that items are fabricated as designed and specified.

3.d Testing and Inspection.

3.d.1 Testing. Publication 280.

3.d.2 Inspection. Publication 280. Provide the necessary pipe inspection equipment. Before installation, pipes may have non-through wall cracks of less than 0.003 inch in width. Any pipe having both an

unloaded surface crack width of 0.003 inch or greater and extending 12 inches or longer, will be rejected. To determine whether rejection or remediation is required, measure crack widths with leaf gages as described in AASHTO T 280. Use gages having a thickness of 0.003 inches to determine pipe acceptability before installation.

4. Metal Pipes.

4.a Ductile Iron Pipe. ASTM A 716

4.b Corrugated Steel Pipe, Metallic Coated. AASHTO M 36, Types I and IR; AASHTO M 218; AASHTO M 274; and AASHTO M 289

4.c Corrugated Aluminum Alloy Pipe. AASHTO M 196, Types I and IR

4.d Coated Corrugated Galvanized Steel Pipe. AASHTO M 245, Type I; AASHTO M 246; and AASHTO M 218. Fabricate pipes with coatings as follows:

- Grade 10/10 — 10 mil coating on all surfaces.

5. Half-Circle Pipe. Conforming to the requirements of the type indicated, except modified to meet the half-circle configuration.

6. Thermoplastic Pipes. Provide cell class of material (actual and minimum), minimum pipe stiffness, and the dimension ratio, when applicable, if not included in pipe markings.

6.a Group I. 15-foot maximum fill—1.5-foot minimum fill height.

6.a.1 Polyethylene.

- ASTM F 714, Type S, SDR
- ASTM F 714, Type S, SDR=26, cell class 335434C, 21-inch diameter—48-inch diameter only
- ASTM F 894, Type S, RSC=100, cell class 335434C, 36-inch maximum diameter
- ASTM F 894, Type S, RSC=160, cell class 335434C, 18-inch diameter—42-inch diameter only

6.a.2 Polyvinyl Chloride.

- ASTM F 794, Type S, PS=46, cell class 12454C or 12364C, 48-inch diameter maximum
- AASHTO M 304, Type S, cell class 12454C, 48-inch maximum diameter
- AASHTO M 304, Type S, cell class 12364C, 18-inch to 48-inch diameter
- ASTM F 679, Types S, T1, or T2, PS=46, cell class 12364C or 12454C, 36-inch maximum diameter
- AASHTO M 278, Type S, cell class 12454B, 12-inch diameter and 15-inch diameter only

6.b Group II. 12-foot maximum fill—1.5-foot minimum cover. Section 601.2(a)6.a and as follows:

6.b.1 Polyethylene. ASTM F 894, Type S, RSC=100, cell class 335434C, 42-inch diameter

6.c Group III. 8-foot maximum fill—2-foot minimum cover. Section 601.2(a)6.a and as follows:

6.c.1 Polyethylene.

- AASHTO M 294, Types D and S, cell class 335400C, 30-inch maximum diameter; and 2004 AASHTO LRFD Bridge Design Specifications (with 2001 interims) Chapter 12.

6.c.2 Polyvinyl Chloride.

- AASHTO M 304, cell class 12364C, 12-inch diameter and 15-inch diameter

6.d Group IV. 7-foot maximum fill—2.5-foot minimum cover.

6.d.1 Polyethylene.

- AASHTO M 294, Types D and S, cell class 335400C, 36-inch, 42-inch, 48-inch; and 2004 AASHTO LRFD Bridge Design Specifications (with 2001 interims) Chapter 12.
- AASHTO M 294, Type S, cell class 335400C, 54-inch and 60-inch diameters; and 2004 AASHTO LRFD Bridge Design Specification (with 2001 interims) Chapter 12.

6.e Group V. 7-foot maximum fill—2.5-foot minimum cover

6.e.1 Polyethylene.

- AASHTO M 294, Type C, cell class 335400C, 24-inch maximum diameter

6.f Group VI. 15-foot maximum fill—2.0-foot minimum cover

6.f.1 Polyethylene.

- AASHTO M 294, Types D and S, cell class 335400C; and 2004 AASHTO LRFD Bridge Design Specifications Chapter 12.

(b) Other Material.

- Premolded Expansion Joint Filler—Section 705.1
- Mortar—Section 705.7(a)
- Caulking Compound—Section 705.8(a)
- Preformed Pipe Joint Gaskets—Section 705.5(b)
- Cement Concrete for Miscellaneous Drainage—Section 704
- Reinforcement Steel—Section 709
- Coarse Aggregate—Type C or better, Section 703.2
- Curing Compound—Section 711.2

- Curing and Protecting Covers—Section 711.1
- Bituminous Paint—Federal Specification TT-V-51F. Certify as specified in Section 106.03(b)3.
- Zinc Chromate Primer—Federal Specification TT-P-645. Certify as specified in Section 106.03(b)3.
- Flowable Backfill—Section 220.1(a)
- Geotextile, Class 4, Type A—Section 735

(c) **Grout.** Mix one part cement and two parts fine aggregate with the minimum amount of water necessary to obtain grout of the required consistency containing 3% to 7% entrained air. Air entraining cement may be used in place of the plain cement and air entraining admixture. Use materials conforming to the following requirements:

- Cement—Section 701
- Fine Aggregate—Type A or C, Section 703.1
- Water—Section 720.1
- Admixtures—Section 711.3

601.3 CONSTRUCTION—As shown on the Standard Drawings and as follows:

(a) **General.** Provide 12-inch minimum cover from the bottom of base course to the top of pipe barrel. Construct the embankment to 4 feet above the top of pipe elevation or to subgrade, whichever is less, before excavating for the pipe. Do not haul over pipe with less than 4 feet of cover over the top of pipe barrel. Maintain a minimum pipe slope of 0.35% on drainage pipes unless otherwise specified.

If running water is encountered and cannot be diverted, provide an acceptable temporary pipe or other structure before placing embankment, or as otherwise directed.

In advance of installation, submit to the Representative a detailed list of lifting equipment and hardware, including their rated capacity from the manufacturers for each size of pipe being installed. In addition, perform a visual review of the lifting equipment and hardware each day before installation for signs of damage or wear. Replace damaged or worn lifting equipment and hardware before use.

(b) **Trench and Bedding.** Excavate trench and construct bedding as shown on the Standard Drawings. Compact the bottom of the trench before placement of bedding material. If flowable backfill material is used, provide support for pipe as specified in Section 220.3(b)2.

(c) **Laying Pipe.** Lay pipe as shown on the Standard Drawings before constructing base course or pavement. Lay pipe with bells or grooves up grade in shaped recesses when required, spigot ends fully entered into the hubs. Begin placement of the pipe at the outlet end with a full length of pipe and continue towards the inlet end, unless otherwise directed. Fill lift holes with a manufactured lift hole plug that is soil-tight

Control the pipe alignment and grade with suitable string lines, with an electronic laser beam system, or by other acceptable methods.

Camber the grade line to offset anticipated settlement due to the height of embankment and bedding used, if directed.

On straight-line pipe placements, join pipe sections within 1/4 inch per foot of inside diameter or 1 inch, whichever is less. Join pipes placed on a radius to within these tolerances as measured at a point halfway up the pipe, springline, along the interior of the curve. For pipe runs placed on curves with a radius less than 765 yards (greater than 2 degrees, 30 minutes) use shorter lengths of precast pipe to minimize the joint gap.

If pipes are protected by endwalls or connected with drainage structures, place exposed pipe end within cast-in-place wall or cut off flush with precast structure face and finish with mortar, as directed. Provide satisfactory connections to existing drainage structures.

Coat all aluminum surfaces that will be embedded into concrete with one coat of zinc chromate primer, or a coat of bituminous paint. Allow coating to dry completely before placement of concrete.

(d) Joints. Lay pipe, except interlocking style and pipe joined with bands, with pipe joint caulk or preformed pipe joint gaskets as follows:

1. Pipe Joint Caulk. Before placing succeeding pipe sections, place the caulk on the inside of the bell end of the pipe, such that a sufficient layer of material is placed around the entire circumference of the pipe. After the joint is assembled, remove excess caulk on the inside of the pipe, such that the flow of water is not obstructed and seal the outside circumference of the joint.

2. Preformed Pipe Joint Gaskets. Before placing succeeding pipe sections, place preformed pipe joint gaskets according to manufacturer's recommendation.

(e) Elongation of Metal Pipes. When indicated, elongate metal pipe vertically 5%, using acceptable shop methods. Elongate coated pipe by acceptable shop methods only. Satisfactorily repair coating damaged by elongation procedures.

(f) Backfilling Trench. After the pipe is laid, backfill the trench as shown on the Standard Drawings. Place material in 4-inch layers. However, 8-inch layers will be permitted if vibratory compaction equipment is used. Compact each layer of backfill uniformly to the density shown on the Standard Drawings to a height of 4 feet above the top of the pipe, for the full trench width. Use mechanical tampers or other acceptable compaction equipment with consistent application force that will not damage the pipe. Compact backfill material to the density shown on the Standard Drawing as determined by Standard Proctor Density (SPD). Compact top 3 feet of backfill material to 100% SPD. Test as specified in Section 206.3(b)1. Test the coarse aggregate backfill for reinforced concrete pipe before placing remaining backfill. If flowable backfill material is used, backfill the trench as shown in the Flowable Backfill Detail on the Standard Drawings, and as specified in Section 220.3.

(g) Shored or Trench Box Installation. Construct shored or trench box installation where indicated and as specified in Section 107.08. Construct shored or trench box installation as required for reinforced concrete pipe.

Construct shored or trench box installations for thermoplastic or metal pipe as follows:

- Leave trench sheeting in place to prevent loss of foundation support and backfill materials unless otherwise directed by the Chief Bridge Engineer. When the top of trench sheeting is to be cut off, make the cut 18 inches or more above the crown of the pipe. Leave rangers, walers, and braces in place as required to support the cut off sheeting and trench wall in the vicinity of the pipe zone. Leave timber sheeting in place. Treat timber sheeting against biological degradation and decay if placed above the ground water table.
- Do not disturb the installed pipe and its embedment when using movable trench boxes and shields. Do not use movable supports below the top of the pipe backfill pay limit zone unless methods for maintaining the integrity and level of compaction of the backfill material are submitted to and approved by the Chief Bridge Engineer. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. Finish placing and compacting the backfill material as supports are moved.
- If the use of sheeting or other trench wall supports is permitted below the pipe backfill pay limit zone, ensure that pipe, bedding, and backfill materials are not disturbed by support removal. Fill voids left upon removal of supports and compact all material to required densities.

(h) Jacked Pipe. Jack pipe by means of conventional tunneling or boring methods, when indicated. Before commencement of this work, submit a complete plan and schedule for pipe installation. Include complete details of sheeting, shoring, and bracing for the protection of facilities above the pipe, as well as materials and equipment pertinent to the jacking operation. Do not proceed with pipe installation until the plan and schedule are accepted.

Do not disturb facilities or cause settlement of the ground above the pipe. Provide free and unobstructed use of facilities above the pipe, without delay or danger to life, equipment, or property.

Install pipe immediately following the heading or tunneling excavation. After completion of the jacking operation, fill voids around the pipe with grout placed under pressure. Properly protect the grout for at least 3 days.

Place joint sealant material on concrete pipe in front of the jacking frame. Replace or repair pipe damaged during the jacking operations as directed. If steel casing pipe is used, butt-weld the joints as installation progresses. Make joints watertight.

If it is determined that the pipe installation is being conducted in an unsatisfactory manner, stop this work and place a bulkhead at the heading until an alternate procedure is proposed and accepted.

(i) Extension of Existing Pipe. If extensions of pipe culverts or drains are indicated or required, remove the existing endwalls as directed. Cut the existing pipe to a true edge, as required, to make a satisfactory joint. Join the new pipe to the existing pipe or endwalls, using acceptable collars constructed of Class A Concrete or acceptable metal connecting bands. Clean the existing pipe, as specified in Section 601.3(j). Repair or replace existing pipe damaged during construction.

As an alternate to removing the endwall, if permitted, extend the pipe using a concrete collar for pipe extension, as specified in Section 618.

(j) Cleaning Existing Pipes. Clean existing pipe culverts, as indicated and as directed, before the start of roadway paving operations. Clean inlets, bridge scuppers and piping, manholes, endwalls, and other drainage appurtenances connected to the pipes, as directed. Clean in an acceptable manner and repair damage resulting from the cleaning operation. Remove any material deposited in inlets during paving operations. Prevent material cleaned from the drainage system from entering streams or other bodies of water, and dispose of this material in a satisfactory manner.

(k) Relaid Pipe. Remove and clean existing pipes as indicated, and have them inspected by the Representative. Transport and relay accepted existing pipes at the indicated locations, in the same manner specified for new pipes.

(m) Removal and Replacement. Remove and replace pipe that is not true to alignment, shows settlement after installation, or is broken or damaged.

(n) Final Inspection of Pipes Except 100 Year Design Life Pipes. Before final acceptance, inspect all of the following types of installed pipe with total backfill/embankment load applied. Perform inspection on pipes at least 30 days after backfill/embankment is completed. The inspection may be performed before final paving is complete. Provide pipe inspection equipment and inspect all pipes over 30 inches in diameter from inside the pipe. Inspect 18-inch to 30-inch diameter pipes from access points. Provide written documentation on Form CS-600 of all inspections to the Representative within 72 hours following each inspection.

1. Concrete Pipes. Provide pipe gages, as specified in Section 601.2(a)3.d.2. and inspect concrete pipes for signs of damage including offset joints, bell/spigot shear failure, joint separation, cracks greater than 0.007 inch in width, spalls, damaged or cracked ends, and visible reinforcement. If signs of damage are identified during inspection, submit a plan for repair or replacement as specified in Section 601.3(p) for approval.

2. Metal Pipes. Inspect metal pipes for damage including rust, cracking of coatings, damaged galvanization or lining, joint separation, loose bolts, dents, and areas of buckling. Repair damaged coatings according to AASHTO M 36 and AASHTO M 245. Perform deflection testing using either electronic deflectometers, calibrated television or video cameras, properly sized, 9-leg (minimum) “go, no-go” mandrel, direct measurement by extension rulers or tape measures in pipes that allow safe entry, or other acceptable devices. At a minimum, perform deflection testing if pipe cannot be physically inspected. Develop and submit a remediation or replacement plan as specified in Section 601.3(p) if deflection is greater than 7.5% of a round pipe nominal diameter plus a manufacturing tolerance of 1% or 1/2-inch undersize, whichever is greater. For pipe arch, the deflection limits are a 7.5% decrease in rise and a 7.5% increase in span from the nominal dimension with no allowance for manufacturing tolerance.

3. Thermoplastic Pipes. Inspect thermoplastic pipes for damage including cracking, buckling, and joint separation, and perform deflection testing. If the pipe run is 40 feet or less in length, not under the roadway, and the initial visual inspection does not indicate any deflection or other deficiencies, additional testing will be waived. In all other cases, perform the deflection testing using either electronic deflectometers, calibrated television or video

cameras, properly sized “go, no-go” mandrel, direct measurement by extension rulers or tape measures in pipes that allow safe entry, or other acceptable devices. Perform deflection testing at a minimum if pipe cannot be physically inspected. Develop a remediation or replacement plan as specified in Section 601.3(p) if deflection is greater than 5% of the unloaded inside diameter of the pipe, or cracking, buckling, or joint separation is found. Provide the unloaded inside diameter pipe size from the manufacturer for each pipe type and size delivered to the project.

(o) Final Inspection of 100 Year Design Life Pipes. For 100 year design life pipe installations ≤ 20 feet in length at each location, perform final inspection as specified in Section 601.3(n). For all other 100 year design life pipe installations, perform final inspection as follows:

Before final acceptance, inspect the entire length of all installed pipe types listed in Table A with total backfill/embankment load applied. Perform inspection on pipes at least 30 days after backfill/embankment is completed. The inspection may be performed before final paving is complete. Provide the measurement equipment listed in Table A to document the required items. Provide the required documentation of all inspections directly from the inspection service provider and/or data processor to the Representative within 72 hours following each inspection.

| REQUIREMENTS FOR PIPE CULVERT INSPECTION BY TYPE OF PIPE | | |
|---|---|---|
| Pipe Type | Measurement Equipment | Items Required for Documentation |
| Ductile Iron Pipe | Crawler-Mounted Camera with Laser Profiler* | Joint Separation, Crack Widths and Lengths, Deflection, Evidence of Leakage or Soil Intrusion, Vertical Alignment (i.e. ponded water) |
| Reinforced Concrete Pipe | Crawler-Mounted Camera with Laser Profiler* | Joint Separation, Crack Widths and Lengths, Spalls, Offset Joints, Bell/Spigot Shear Failure, Dimensional Tolerance, Evidence of Leakage or Soil Intrusion, Vertical Alignment (i.e. ponded water) |
| Corrugated Aluminized Steel Pipe | Crawler-Mounted Camera with Laser Profiler* | Joint Separation, Crack/Gouge Widths and Lengths, Dents, Buckling, Seam Separations, Deflection and Ovality, Evidence of Leakage or Soil Intrusion, Loss of Aluminized Coating, Oxidation, Vertical Alignment (i.e. ponded water) |
| Corrugated Aluminum Alloy Pipe | Crawler-Mounted Camera with Laser Profiler* | Joint Separation, Crack/Gouge Widths and Lengths, Dents, Buckling, Seam Separations, Deflection and Ovality, Evidence of Leakage or Soil Intrusion, Oxidation, Vertical Alignment (i.e. ponded water) |
| Thermoplastic Pipe | Crawler-Mounted Camera with Laser Profiler* | Joint Separation, Crack Widths and Lengths, Buckling, Deflection and Ovality, Evidence of Leakage or Soil Intrusion, Vertical Alignment (i.e. ponded water) |

*Manual tools as measurement equipment for pipes with manual inspection procedures as specified in Section 601.3(o)2.

1. Remote Inspection. Perform a remote inspection according to PTM No. 450, Section 2, in the presence of the Representative for all 100 year design life pipe installations 48 inch in diameter and smaller. When defects or irregularities are observed with closed circuit television but cannot be measured within acceptable tolerances on pipes greater than 30-inch, inspect and report in accordance with manual inspection procedures including man-entry, as indicated in PTM No. 450, Section 3. Develop a remediation plan as specified in Section 601.3(p) to address all joint separation, cracks, deflections, and other irregularities exceeding the specification limits established in Section 601.3(c) and Sections 601.3(n)1, 2, or 3.

2. Manual Inspection. Perform a manual inspection according to PTM No. 450, Section 3, in the presence of the Representative for all 100 year design life pipe installations larger than 48 inch in diameter. Develop a remediation plan as specified in Section 601.3(p) to address all joint separation, cracks, deflections, and other irregularities exceeding the specification limited established in Section 601.3(c) and Sections 601.3(n)1, 2, or 3.

(p) Remediation. Remedial action may include but is not limited to removal and replacement or an accepted repair procedure. Submit all pipe remediation plans to the Representative for approval. All pipe remediation plans detailing either removal and replacement or repair must be prepared and sealed by a Professional Engineer registered in the State.

(q) Inspection During Installation. For pipe installations under the roadway, sidewalk, or shoulder, perform trench backfill work only in the presence of an authorized Inspector. The Inspector will complete Form CS-6 for each run of the conduit or pipe. Certify the work by signing the completed form and submit the signed form to the Representative.

601.4 MEASUREMENT AND PAYMENT—

(a) Pipe Culverts and Relaid Pipe Culverts. Linear Foot

Measured to the point of centerline intersection of “T,” “Y,” and other branches. The unit price includes the pipe, the bedding material, and the backfill as shown on the Standard Drawings. Furnishing personnel and equipment for dewatering operations, inspection of pipes, and all remedial measures are incidental to the pipe items.

If the pipe item for shore/trench box is indicated or required; the unit price includes placement and removal or keeping in place of shoring, supports, shield systems and trench boxes as specified in Section 601.3(g).

(b) Half-Circle Pipe. Linear Foot

(c) Cement Concrete for Miscellaneous Drainage. Cubic Yard

As indicated, for the class specified, for the item indicated.

The unit price includes reinforcement when required.

(d) Class 1 Excavation. Cubic Yard

Pay limits as shown on the Standard Drawings.

(e) Class 2 Excavation. Cubic Yard

For Half-Circle Pipe including bedding and anchors.

(f) Class 4 Excavation. Cubic Yard

Pay limits as shown on the Standard Drawing for pipe culverts and relaid pipe culverts. Where inlets are installed, measurement terminates 1 foot from the outside face of the inlet wall.

(g) Cleaning Existing Pipe Culverts. Linear Foot

Measured from inlets, manholes, endwalls, and other drainage appurtenances along the pipe centerline.

Pay items will establish a break point based on the sizes of pipes to be cleaned. The Department will pay for cleaning of pipe culverts having diameters up to and including 36 inches under one pay item, and cleaning of pipe culverts having diameters over 36 inches under a separate pay item.

(h) Jacked Pipe. Linear Foot

The unit price includes excavation.

(i) Flowable Backfill Material. As indicated, for all pipe installations, flowable backfill and geotextile are incidental to linear foot of pipe payment.