

Post Installation Inspection Methods, Tools and Reports



American **Concrete Pipe** Association
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Pipe Installation Inspection

This document is written to provide the user with a detailed model specification for the Post Installation Inspection of newly installed storm drainage pipe or culverts. National Standards as well as excerpts from several state Departments of Transportation were utilized in developing this document. With the varying technology available for post installation inspection, it is important to provide some flexibility in the means and methods of carrying out PII as well as the PII report formats. This document aims to outline requirements that will give the owner the necessary information to verify proper pipe installation without confining the contractor to proprietary equipment.

The post-installation inspection shall be performed on 100% of all pipelines no sooner than 30 calendar days after completion of the pipe installation and final cover, which includes the embankment and all non-asphalt bases and/or subgrades. Post installation inspection may be completed by either the Remote Inspection Method or the Manual Inspection Method as allowed in XX Post Installation Methods, Tools, and Report. Conditions including joint gaps, tears, misalignment, cracks, and deformation shall be noted and reviewed by the Engineer. Engineer evaluation for the various conditions noted in PII report shall be evaluated as outlined in Guide for Drainage Pipe Evaluation and Repair.

In cases where paving operations will be conducted in less than 30 calendar days after pipe installation, a preliminary inspection of the pipe prior to paving shall be performed to ensure the pipe in areas to be paved meets all evaluation criteria prior to paving operations. Performing a preliminary inspection does not relieve the Contractor from the requirement of completing the post installation inspection for all pipe, including pipe that is inspected during preliminary inspection, after the prescribed 30 calendar day period.

A Post-Installation Inspection Report as described in XX Post Installation Methods, Tools, and Report shall be delivered to the Engineer and kept as a permanent record in the project documents. Payment for pipe installation and post installation inspection shall be measured and paid for at the contract unit price as provided by the contract specification and in conformance with this specification.

All necessary remediation or replacement of pipe as required in Guide for Drainage Pipe Evaluation and Repair or determined to be necessary by the Engineer in conformance with this specification shall be the responsibility of the contractor at no additional expense to the owner. All supplemental work items that are affected by the remediation or replacement

of pipe shall be the responsibility of the contractor at no additional expense to the owner. The Engineer shall approve all corrective actions before the work is performed and work shall be completed to the Engineers satisfaction. If any pipe requires remediation or replacement it shall be re-inspected after remediation or replacement has been completed. The Post Installation Inspection Report shall include all notes and data from the initial Post Installation Inspection and all subsequent Post Installation Inspections necessary to fulfill the requirements of this specification.

The Contractor is responsible for ensuring that all post installation requirements are performed in accordance with this specification and XX Post Installation Methods, Tools, and Report. It is the contractor's responsibility before post installation inspection to dewater and remove all debris and sediment from the installed pipe. The Engineer shall be provided an inspection schedule at least seven days in advance of beginning inspection.

Section XX: Post Installation Methods, Tools, and Report

The inspection equipment utilized for all post installation inspection of all pipe types shall be capable of delivering accurate, repeatable measurements of all items of interest as described in the Guide for Drainage Pipe Evaluation and Repair. All individuals performing the in-field inspections and those responsible for preparing the Post Installation Report shall be NASSCO-PACP Certified Technicians. The inspection company and/or its employees shall be an independent third party to the contractor and owner. The owner reserves the right to confirm any and all inspection data and defect measurement accuracy to insure the PII report and information included there in meets the requirements outlined in this specification. If the PII report and or data is found to be in non-conformance the owner shall require the inspections and the report to be corrected as needed. Any re-inspection required by owner or required due to remediation or replacement shall be the responsibility of and at the expense of the contractor.

Manual Inspection Method

Manual inspections are permitted for all pipe with a vertical rise of 48" and greater. Perform a manual inspection by entering the pipe to document defects and to record required measurements. The person performing the manual inspection shall use a high quality hand held video camera or a digital camera capable of clearly documenting any observed deficiencies. If the pipe is considered a confined space, provide entry for all project inspection personnel according to OSHA requirements.

Furnish pictures, still images, or video recording of areas of the pipe with noted deficiencies. All defects shall clearly identify the pipe being inspected. The identification shall include information necessary to locate the pipe and the noted deficiencies in the field at a future date. Such factors shall at a minimum include the project number, the station number, the structure number, size of pipe, the date and time of inspection, direction of travel from a given landmark, distance from given landmark for all noted deficiencies, and any other identifying data. The Contractor shall provide a source of light that allows all deficiencies to be readily observed on the camera or video recording. Furnish the still images or video recording in a digital, reproducible format approved by the Engineer.

The crack width or the width of any separation of the pipe wall, in all pipe types, shall be measured using a device or technology capable of measuring cracks from 0.01 inch to 0.10 inch on an accurate and repeatable basis. Cracks or tears greater than 0.10 inch, and joint gaps may be measured with either a metal or a fabric tape capable of measuring to the nearest 1/16 inch. Other measuring devices may be used if approved by the Engineer.

4.1 Flexible Pipe Inspection: Measure the deflection of all flexible pipe types using either a metal or a fabric tape and record to the nearest 1/16 inch. Deflection shall be determined by measuring the diameter of the pipe every 10 feet along the length of the pipe. Deflection shall also be measured at any location where deflection, bulging, buckling, or racking is evident. To determine the minimum deflected diameter, eight measurements shall be taken at each location at roughly 45-degree angles. All diameter measurements on corrugated pipe shall be from the top of corrugation to the top of corrugation. All measurements and the percent deflection for each location shall be recorded. Percent deflection shall be arrived at by the following formula.

$$(MMD - CMD)/CMD = \% \text{ deflection}$$

MMD = The minimum of the eight diameter measurements at each location every 10 feet along the length of the pipe or any location where deflection, bulging, buckling, or racking is evident.

CMD = Original certified mean diameter as provided by the pipe supplier

Remote Inspection:

Perform remote inspection for all pipe types with a vertical rise of less than 48 inches. Remote inspection shall be performed by using a crawler mounted camera and mea-

surement technology. The camera shall incorporate a lens with low barrel distortion and capable of recording video. The crack measurement technology shall have the capability to make measurements of crack widths and joint gaps on all pipe types. Remote inspections may also be accomplished with digital side scan technology equipment.

A check for deflection shall be performed on all flexible pipe types by either laser profiling or by use of a mandrel. Deflection testing is not required for rigid pipe.

Laser profiling and crack/joint measurement technology must be certified by the company performing the work to be in compliance with ASTM E 691 and ASTM E 177 which includes the following calibration criteria. The equipment and software used must be tested and approved by a recognized independent testing group and include a tested certified accuracy of 0.5% or better and a repeatability of 0.12% or better. Laser profiling technology may utilize actual pipe diameter as measured with this device to calculate percent deflection and ovality.

The camera technology utilized shall be able to deliver a high quality MPEG2 format video with a standard resolution of 720 X 480 or other format acceptable to the Engineer. A camera with lighting suitable to allow a clear picture of the entire periphery of the pipe shall be used. The camera shall be centered in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe and rotating 360 degrees. Digital 360 Degree side scanning data collection equipment that will allow an image of the entire pipe surface and joint circumferences to be clearly visualized and evaluated is also an approved inspection tool. Equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition shall be used. The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe.

Furnish a video recording of 100% of all pipe with information at the beginning of the video which clearly identifies the pipe being inspected. The identification shall include the project number, the structure number corresponding to the structure number from project documents, size of pipe, the date and time of inspection, direction of travel from a given landmark, distance from given landmark for all noted deficiencies, and any other identifying factors needed to locate the pipe in the field at a future date. Provide a source of light that allows all areas of concern to be readily observed on the video record-

ing. Furnish the video recording in a digital, reproducible format approved by the Engineer.

Move the camera through the pipe at a speed not greater than 30 feet per minute (If Digital 360 side scan technology is used the speed may be increased but should never exceed inspection equipment manufacturers recommendations). Mark the video with the distance down the pipe. The distance shall have an accuracy of one foot per 100 feet. Stop the camera and pan every joint. If digital scanner technology is used, every joint shall be evaluated.

If mandrels are used to check for deflection they shall be nine (or greater odd number) arm, non-adjustable, fixed arm mandrels, and shall be sized and inspected by the owner Engineer utilizing the appropriately sized proving rings prior to testing. The diameter of the mandrels and matching proving rings shall be based upon the actual certified mean diameter as provided by the pipe manufacturer (0.95 x certified mean diameter for 5% deflection or 0.925 x certified mean diameter for 7.5% deflection). The diameter of the mandrel at any point shall not be less than the allowable percent deflection of the actual certified mean diameter of the pipe being tested. The Fixed arm mandrels shall be fabricated of metal, fitted with pulling rings at each end, stamped or engraved on some segment other than a runner with the nominal pipe size and mandrel outside diameter. The mandrel shall be pulled through the pipe or culvert by hand with a rope or cable.

Post Installation Inspection (PII) Report Criteria:

A written PII Report shall be provided to the Engineer along with corresponding video, laser profiler data on a digital media storage device with pictures. The PII Report shall include a written description of any noted deficiency as outlined in Guide for Drainage Pipe Evaluation and Repair for each pipe. The report shall include a still image of these areas along with all field inspection information that indicates why this area is noted. Each still image and description of condition shall also have information that will allow the Engineer to locate and view this issue in the video recording if the inspection was a remote inspection.

If a condition continuously occurs along the pipe wall, the report should note the entire area where this condition was found, include at least one still image that best documents the condition and the information necessary to locate the entire condition in the video recording. If the Manual Inspection Method is utilized for flexible pipe products, the PII Report shall include the actual field measurements taken for the measurement of all deficiencies of note.

Payment will be made for a line of pipe and the Post Installation Inspection at the appropriate contract unit prices when the Post Installation Report indicates that all deficiencies have been corrected to the Engineers satisfaction in conformance with this specification.

The Report shall include type of equipment utilized for the inspection and clearly provides data to prove the equipment used meets this specification. The inspection contractor shall provide a statement of field accuracy achieved for all measurements including plus/minus tolerances. The report shall also include a narrative about required field/measurement calibration and provide proof that all calibration procedures were followed when collecting data within the report. The Post Installation Report shall include documentation that all individuals performing the in-field inspections and preparing the Post Installation Report are currently certified NASSCO-PACP technicians.

The PII Report and corresponding electronic media and data as discussed in this specification shall be made part of the permanent project public records.

In order to ensure proper installation of pipe, 100% of all pipelines should be inspected in a safe and effective method using tools that give accurate measurements to provide the Engineer with reports written by trained and competent professionals.

