

## **Post-Installation Inspection and Repair of Storm Drainage Pipes and Culverts**

The City of Charlotte (City) is requiring a post installation inspection of storm drainage pipes and culverts installed through the Land Development process. This inspection, performed at the expense of the developer shall assess the internal condition of the pipes using Closed Circuit Television Inspection (CCTV) and/or confined space entry (CSE) to verify compliance with the installation standards referenced in the current version of the Charlotte Land Development Standards Manual.

The conditions and requirements of this document apply to any system, regardless of constructed material, subject to the subdivision ordinance, Unified Development Ordinance (UDO) and/or any system installed and/or modified by a developer that conveys runoff from a public right of way.

Prior to requesting acceptance of a street(s) or associated map phase(s) developer will submit to the City a complete post installation inspection report of the associated storm drainage system. Defects including but not limited to joint gaps, tears, misalignment, cracks/fractures, and deformation shall be noted and reviewed by the engineer. Defects, if observed shall be assessed for severity and if necessary repaired in accordance with appropriate repair methods specified within this document. Reinspection's of the asset may be required to verify that repairs have been properly completed. Upon satisfactory completion of repairs (if any) the City will provide written notice of acceptance.

The following guidelines are a compilation of best practices from the City of Charlotte, NCDOT, ACPA, NAASCO and AASHTO.

### **General Guidelines for Post Installation Inspections:**

- Post installation inspections are to be completed before placing the final lift of pavement (where applicable), but no sooner than 30 days after backfill placement.
- Pipes must be clean of all debris and obstructions at the time of inspection to allow for a continuous complete inspection, partial inspections are not allowed.
- For flexible pipes (HDPE, Polypropylene, CAASP, CAAP), deflection testing must be performed in accordance with the City of Charlotte *Third-Party Inspection for Pipe Installation* Document.

### **Post Installation Inspection Report:**

A Post Installation Inspection Report (Report) summarizing the inspection results shall be submitted to the City for review. The report shall include the following:

- Project Name – Example: The Reserve at Charlotte
- Accela Number – Example: SDRSF-2023-00001
- Pipe Installation Contractor – Example: John Doe Development
- Plat, map or drawing identifying each pipe segment assessed/proposed for acceptance with all structure nodes labeled consistent with the approved development plans.
- Inspection Results – per pipe run
  - For pipes inspected by CCTV, standard software reporting is acceptable.
  - For pipes inspected by CSE, pipe inspection logs are required.
- Where defects are observed, engineer shall provide a repair recommendation in accordance with this document.

The City reserves the right to randomly or at its discretion monitor, evaluate, and review videos and reports submitted by the owner or certified consultants as a quality assurance/quality control (QA/QC) practice. Any discrepancies between the report and the City review may constitute non-acceptance of the approval.

If staff determine that additional repairs are needed outside of engineer's recommendations, additional video and reporting will be required.

Proposed repair activities will be reviewed and approved by the City before work is performed. Any pipe requiring repair or replacement shall be reinspected after work is completed.

### **Closed Circuit Television Inspection Requirements (CCTV):**

Applies to all pipes up to 48" in diameter or a vertical rise of 48" in non-circular applications.

- All pipe inspections must be completed by a National Association of Sewer Service Companies (NAASCO) Pipeline Assessment Certification Program (PACP) certified professional.
  - All defects must be coded in accordance with the most recent version of the PACP.
  - Each pipe run must have a separate video and report.
- Video and associated report and infrastructure map shall identify and include the following:
  - Project and/or Street Name
  - Upstream and Downstream structures, labeled consistently with approved development plans.
  - Direction of Video
  - Pipe size and material, both to be field verified by operator.
- Camera shall be centered within the pipe, both vertically and horizontally and shall have a full unobstructed view of the entire pipe.
- Lighting shall be sufficient to produce a clear image of the entire periphery of the pipe interior.
- Video image shall be clear, focused and relatively free of distortion that would prevent the reviewer from evaluating the condition of the pipe.
- Operator shall not exceed a speed of 30 ft/min.
- Operator shall stop and complete a 360-degree assessment of each pipe joint.

### **Confined Space Entry Inspection Requirements (CSE):**

Applies to all pipes 54" in diameter or greater or pipes with a vertical rise of 54" or greater in non-circular applications.

- Entrants/Inspection staff must conduct inspections according to OSHA requirements for confined space entry where applicable.
- Camera, Video and Lighting shall be sufficient to produce a clear image of the entire periphery of the pipe interior.
- For Flexible pipes (HDPE, Polypropylene, CAASP, CAAP),, provide deflection testing at 10' intervals along pipe alignment. Provide measurements at each location in both t horizontal and vertical directions.
- Provide images and/or video of all defects. Use an appropriate measuring tool to document size and extents of defect.

- All defects and observations shall be reported in a pipe inspection log prepared by the engineer. The following minimum information shall be required:
  - Project and/or Street Name
  - Upstream and Downstream structures, labeled consistently with approved development plans.
  - Direction of observation
  - Pipe size and material, verified by entrant/inspection staff.
  - Location and type of defect measured respective to upstream or downstream structure.

### **Evaluation and Repair Guide:**

The following criteria applies to all pipe materials and will be utilized to determine the course of action, if any, to be taken when defects are observed during the post installation inspection. Defects include but are not limited to cracks/fractures, holes, deflection, offsets, tears, spalls, and slabbing. The final decision on proposed repairs and acceptability will be determined by the City. Any repairs made to the installed pipe must be certified by the contractor and the repair contractor. This certification will state that all repairs will have the same service life as newly installed pipe. Proposed repairs will be classified as follows:

- Minor Repair – Can be addressed with approved materials and/or methods and do not require a site-specific analysis and design. Suggestions for typical minor repair types are specified for each type of defect.
- Site Specific Major Repair – Requires a design prepared sealed by a North Carolina Professional Engineer and submitted to the City for review and approval.

### **Alignment**

Check for vertical and horizontal alignment deviations that would prevent proper function of the system. If any issues are noted, the engineer shall evaluate the impact on the performance of the pipe joints and determine if corrective actions are needed.

### **Broken (Rigid Pipes)**

Broken describes a defect to a pipe where pieces are noticeably displaced and have moved from their original position. Engineer shall consider a site-specific major repair or replacement of the affected pipes.

### **Cracks and/or Fractures (Rigid Pipes)**

A crack is defined as a visible break line on the surface of the pipe wall but is not visibly open with a gap. If a gap is observed or there is vertical offset present, the defect will be considered a fracture.

- Cracks < 0.01" typically do not require repair. Individual cracks > 0.01" and < 0.05" are acceptable. However, multiple cracks within this range in any 8' section may require minor repair. Typical minor repairs may include sectional CIPP liners, CIPP liners and pipe collars.
- Cracks/Fractures > 0.05" but < 0.10" are acceptable unless vertical offsets existing along the crack. When vertical offset is less than .10" a minor repair will be required. Typical minor repairs may include sectional CIPP liners, CIPP liners and pipe collars. When vertical offset is greater than .10" a site-specific major repair or pipe replacement will be required.

- Cracks/Fractures > 0.10" will be given consideration by the City to replace the pipe or allow a site-specific major repair.

**Cracks and/or Tears (Flexible Pipes)**

- Consideration will be given by the City to replace the pipe or allow a site-specific major repair for any through wall tear of a flexible pipe.

**Deflection/Deformation (Flexible Pipes)**

This condition relates to a noticeable change in the cross-sectional geometry of the pipe. All deflection measurements shall be recorded as a comparison (%) of the inside pipe diameter as supplied by the manufacturer vs. the actual measurements obtained during the post installation inspection.

- Polypropylene Pipe has allowable deflection of 3%. Any deflections exceeding 3% will require removal and replacement.
- HDPE Pipe has allowable deflection of 5%. Any deflections exceeding 5% will require removal and replacement.
- Aluminum/Aluminized Corrugated Pipe has allowable deflection of 5%. Any deflections exceeding 5% will require removal and replacement.

**Joint Performance (All Pipe Types)**

Any observed defect that impacts the performance of the pipe joint. Defects can include but are not limited to broken, fracture, holes, infiltration, improper gasket placement, separations, and offsets.

- Engineer shall evaluate the joint type that was specified (silt tight, leak resistant, etc.) and determine if a minor repair is suitable or a site specific major repair or pipe replacement will be required. Typical minor repairs are pipe collars, sectional CIPP liners and/or chemical injection grouting.

**Spalling (Rigid Pipe)**

Spalling is defined as localized delamination of concrete along the pipe wall or along edges of cracks/fractures.

- For pipe with spalling that does not have exposed reinforcement, evaluate to determine if a Portland cement or epoxy patch is an effective minor repair.
- For pipe with spalling that has exposed reinforcement, evaluate to determine if site specific major repair will be appropriate. If not, replace the pipe.

**Slabbing (Rigid Pipe)**

Slabbing is defined as large slabs of concrete delaminating from the pipe wall accompanied by straightening of the reinforcing steel.

- For newly installed pipe where slabbing is observed, replacement will be required.

**References:**

- NCDOT Guidelines for Post Installation Evaluation and Repair of Newly-Installed Drainage Pipe
- AASHTO Post Installation Inspection Guideline – Pipe Culvert Inspection for New Construction.
- NAASCO Pipeline Assessment and Certification Program
- ACPA Evaluation of Newly Installed Culvert and Storm Drainage Pipe