

Know

You Should



A Message from the American Concrete Pipe Association

Bulletin No. 136

Trend Toward Deflection Testing Plastic Pipe Installations

For years, HDPE pipe manufacturers have been telling the engineering community that “generally, no post construction inspection is necessary” ⁽¹⁾ or “mandrels should be considered a last resort to evaluating the installation.” ⁽²⁾ At the same time, ASTM D 2321, *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications* includes a deflection testing section that lists available deflection testing devices, including a properly sized “go, no-go” mandrel. The reality is that HDPE pipe requires a combination of high quality soil materials and proper compaction to function structurally. Since HDPE pipe is so highly dependent on proper installation techniques, more and more specifications are now making deflection testing mandatory and insisting that the test be performed no earlier than 30 days after completion of installation. Virtually all of these standards specify a maximum deflection limit of 5 percent.

The trend towards improved deflection testing specifications includes:

- **2005 AASHTO Bridge Committee - LRFD Bridge Construction Specifications: Section 30 has set these minimum requirements:**
 - “For locations **where pipe deflection exceeds 5 percent** of the inside diameter, an evaluation shall be conducted by the Contractor and submitted to the Engineer for review and approval considering the severity of the deflection, structural integrity, environmental conditions, and the design service life of the pipe. Pipe **remediation or replacement** shall be required for locations where the evaluation finds that the deflection could be problematic. For locations where pipe deflection exceeds 7.5 percent of the inside diameter, remediation or **replacement** of the pipe is required.”
 - “**Pipes shall be checked for deflection using a mandrel** or any other device approved by the Engineer” or “where direct measurements are made, a measurement shall be taken once every 10.0 ft. (3 m) for the length of the pipe.” “At least 10 percent of the total project footage on the project shall be randomly selected by the Engineer and inspected for deflection.”
 - “**Soil consolidation continues with time after installation of the pipe.** While 30 days will not encompass the time frame for complete consolidation of the soil surrounding the pipe, it is intended to give sufficient time to observe some of the effects that this consolidation will have.”

State DOT's and Provinces have already required deflection testing with specifications more restrictive than the recent AASHTO provisions. In the interest of brevity, all specifications requiring deflection testing cannot be listed. However, here are some selected cases.

- **Alabama Department of Transportation** requires the test to be conducted no fewer than 30 days after completion of all fill over the pipe. The mandrel shall have an effective diameter of 95% of the nominal inside diameter of the pipe. The pipe shall be replaced without extra compensation if the mandrel cannot be pulled through the pipe by hand without damaging the pipe.
- **Kentucky Department of Transportation** reduces contractor payment for pipe by up to 50 percent where incorrect installation causes the pipe to deflect beyond the 5 percent deflection limit.

- **North Carolina Department of Transportation** requires inspection after approximately 24 inches (600 mm) of backfill is in place, at 30 - 45 days, and 11 months after completion of the project. Maximum deflection must not exceed five percent of the nominal diameter as measured by a mandrel or by taking 4-point measurements. If any line shall fail to pass the deflection test, the pipe shall be removed and replaced with new pipe at no expense to the owner within the next 30 calendar days.
 - **Illinois Department of Transportation** requires mandrel testing after 30 days and that any pipe over 5 percent deflection (not meeting the specification requirements), be replaced.
 - **Nevada Department of Transportation** has a special provision that requires the pipe not exceed the 5 percent vertical deflection limit after 30 days and does not allow “rerounding” of pipe that does not pass the deflection test.
 - **Pennsylvania Department of Transportation** requires deflection testing at least 30 days after the embankment is completed as well as inspection for cracking and joint separation. If deflection exceeds 5%, or cracking or joint separation is found, then remediation or replacement is required.
- **Ontario (Canada) Provincial Standard Specification 410** - Construction Specification for Pipe Sewer Installation in Open Cut: Section 410.07.15.05
 - “Ring deflection testing shall be performed on **all** pipe sewers constructed using plastic pipe.”
 - “The device shall be pulled manually through the pipe **not sooner than 30 days** after the completion of backfilling and installation of service connections.”
 - “The suitably designed device shall be a mandrel, cylindrical in shape, and constructed with an odd number, minimum 9 in number, of evenly spaced arms or prongs.
 - “Any section of pipe that fails the deflection test shall be repaired and retested.”
 - **The Regional Municipality of Niagara, Ontario (Canada)** has implemented the Niagara Peninsula Standard Contract Document - SPC39 for deflection testing. Section C1 for flexible pipe states:
 - “A mandrel or pig, not less than 95% of the base inside diameter (as defined in the CSA or ASTM standard to which the pipe is manufactured), shall be successfully drawn through the flexible sewer pipe installed under this contract. **A total of two tests shall be completed; one upon substantial performance and the second at the end of the one year maintenance period.** All tests shall be carried out in the presence of the Engineer or his representative.”
 - **Bureau of normalization of Québec (BNQ) 1809-300** - Construction of sewer systems and water mains – General technical clauses. Article 11.5.
 - “Any deformation of the real inside diameter exceeding 5%, verified after the complete backfill stipulated in the contract documents and before the preliminary acceptance of the project must lead to the replacement of the pipes involved.”
 - “Any deformation of the real inside diameter exceeding 7.5%, verified between 60 and 30 days prior to the final acceptance of the project must lead to the **replacement** of the pipes involved.”
 - “**Manufacturing tolerances will not be taken into account in the calculations of the permissible deformation limit.**”
 - Equipment to correct over deflected pipes is forbidden.

The above referenced specifications are representative of the trend by DOT’s, Counties, Cities, and Provinces throughout North America in recognizing the critical effects of substandard installation on the performance of flexible pipe. Design and installation practices which fail to follow standard specifications can expose you to unnecessary liability and compromise the integrity of the project. How do your specifications measure up?

To assist contractors and inspection agencies, information on mandrels can be found through Cherne Industries at: <http://www.cherneind.com/products.asp> and at Hurco Technologies at: <http://www.hurcotech.com/gaugeTKO.html>

Concrete Pipe – the SAFE choice

(1) Advanced Drainage Systems - Product Note 3.115 - Installing N-12 Storm, Sanitary Sewer and Culvert Pipe – Section 12. Post Construction - November 5, 2003

(2) Hancor Technical Bulletin 6.10 – Deflection Testing

NOTE: Bold and underline per the author