CHAPTER 8

TESTING INSTALLED LINES

Acceptance testing is the process of formalizing acceptance of a completed pipeline. Methods commonly used are, Low-Pressure Air Testing, CCTV Inspection and Hydrostatic Infiltration Testing. Common practice is to test each section from manhole to manhole after it is backfilled. NCPI recommends the low-pressure air test as the preferred method of acceptance testing because it is not a subjective test.

The first section of any sewer project should be tested immediately upon completion to ensure that the installation procedure will produce the results required by the specifications.

Experience demonstrates that continual testing as a job progresses improves adherence to good job site practices, increases contractor productivity and ensures compliance with engineering plans.

All acceptance tests must be performed by qualified personnel. These tests should be witnessed by the inspector or engineer's representative.

Low-Pressure Air Testing

This is the preferred and most commonly-used post-installation testing method because there is no room for interpretation. The low-pressure air test is unforgiving, it is not a subjective test.

When the measured water table is 5 ft. or less above the pipe barrel at the midpoint of the test section, a low-pressure air test is an accurate method of testing a sewer line for acceptance (for 5 ft. or greater see "Hydrostatic Infiltration Testing" on page 39).

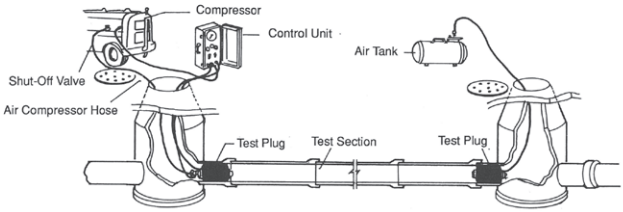

Figure 34: *Line Acceptance Testing*

Acceptance or failure of a line is determined by a specific drop in air pressure over a specified length of time (see *Low-Pressure Air Test for Sanitary Sewers* booklet, available online).

Test Procedure

Clean the sewer line by flushing before testing to wet the pipe surface and clean out any debris. Plug all pipe outlets to establish the required test pressure. All stoppers in laterals should be braced.

Figure 35: *Test Plug*

ASTM C828 *Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines* describes the procedure for air testing sewer lines. Air test tables found in the NCPI *Low-Pressure Air Test for Sanitary Sewers* are derived from ASTM C828.

The pressure-holding time is based on an average holding pressure of 3 psi gauge or a drop from 3.5 psi to 2.5 psi.

Add air until the internal air pressure of the sewer line is approximately 4.0 psi gauge. After an internal pressure of approximately 4.0 psi is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

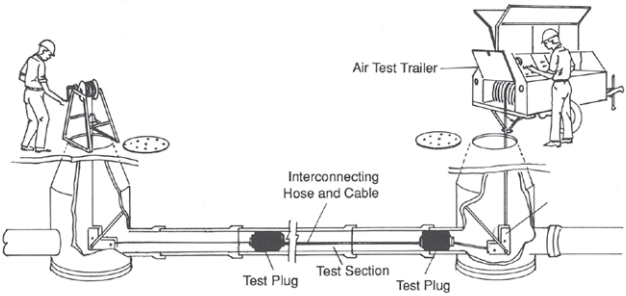

Figure 36: *Segmental Air Testing*

When the pressure has stabilized above the 3.5 psi gauge reading, reduce the pressure to 3.5 psi to start the test. Record the drop in pressure for the test time. If the pressure does not drop more than 1.0 psi during the test time, the line is presumed to have passed. It is not necessary to continue the test for the total time when it is clearly evident that the rate of air loss is less than the allowable.

This procedure can be used as a presumptive test, which enables the installer to determine the acceptability of the line before backfill and subsequent construction activities.

Safety During Testing

The air test can be dangerous if a line is improperly prepared due to improper training, a lack of understanding or carelessness.

Calculate the amount of back pressure the plug must withstand and be certain the plug being used is designed to withstand this pressure. Always use a pressure gauge and regulator when inflating a sewer plug. Under-inflated plugs will not be able to withstand the required back pressure. Over-inflated plugs can rupture causing possible damage and injury.

It is extremely important to install and brace the various plugs to prevent blowouts. A force of 250 Lbf is exerted on an 8-inch plug by an internal pipe pressure of 5 psi. The sudden expulsion of a poorly installed plug, or of a plug that is partially deflated before the pipe pressure is released, can be dangerous.

As a safety precaution, pressurizing equipment should include a regulator or relief valve set at 10 psi to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

CCTV Inspection

The high-quality video, images and reports CCTV camera systems produce have led to wide-spread adoption. As an investigative tool, these CCTV systems are unmatched in enabling operators to highlight concerns and more importantly the reports create a historical record of the condition of the pipe at the time of final acceptance. This visual record has become an important reason for many agencies to require CCTV inspection as part of the final acceptance testing on newly installed pipelines. This visual record has become a useful tool in the overall accessment of the collection system.

It is essential that CCTV operators receive ongoing training on the equipment, condition assessment methods and characteristics of the pipe material evaluated to minimize errors. Unintentional, incorrect observation(s) are not only unproductive but can also be quite expensive. There have been cases in which dig-ups were conducted only to discover the assessment did not match actual pipe conditions, or they were far less significant than originally indicated. For this reason, NCPI recommends the low-pressure air test as the preferred method of acceptance testing.

See the NCPI document *A Guide to Analyzing CCTV Inspection* (available online).

Hydrostatic Infiltration Testing

When the measured water table is 5 ft. or greater above the pipe barrel at the midpoint of the test section, infiltration testing is the preferred and least expensive method of acceptance testing. The infiltration test measures the ground water entering the pipeline. Manholes should be tested independent of the sewer line.

ASTM C1091 *Standard Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines* describes the procedure for Infiltration Testing and allowable rate of infiltration.

If water is present in the line, isolate the section of pipeline being tested from the upstream side. Discontinue pumping of ground water for a minimum of 24 hours prior to testing. Determine the infiltration flow rate in the sewer line at the furthest downstream point of the section being tested.

It is necessary to collect and measure the infiltration over a period of time. A convenient collection time is one hour. This measurement can be converted to gallons per hour and to gallons per inch diameter per mile, per day and compared to the specified standard.

Water infiltration may be collected by using a dam at the invert of the pipe, using a flow-through plug or other convenient method.

The set up in Figure 37 is recommended to achieve this result. After the infiltration for the pipe is determined, the lower plug in the upstream manhole can be removed and the combined infiltration from the pipeline and the manhole can be measured. The manhole infiltration is calculated by simply subtracting the pipeline infiltration from the combined pipeline and manhole infiltration. Other procedures for infiltration testing may be equally satisfactory.

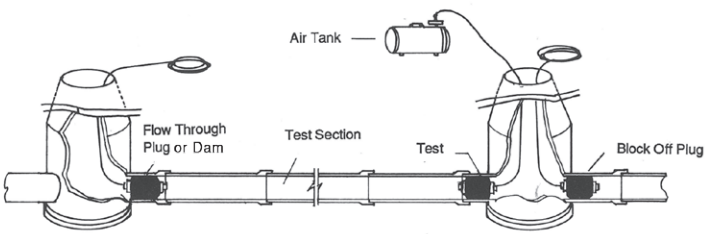

Figure 37: *Recommended set up for Infiltration Testing*