Pre-CCTV Inspection Preparation

Inspectors and operators should be manufacturer-trained on the equipment and software of the CCTV system being used.

Knowledge of the Material Being Inspected

Of the various pipe materials found in sanitary sewers throughout the U.S., VCP will frequently be the oldest sewer pipe in a collection system. As a kiln-fired ceramic, VCP is a natural material with some dimensional and cosmetic variations being normal, such as the "lime pop" in the pictures on page 2. A small piece of lime may occasionally be close to the pipe surface after extrusion. During firing, this lime may "pop" and result in the marks seen in Figure 2 on page 2. These should not be regarded as a cause for rejection.

Dimensional tolerances and allowable cosmetic imperfections for VCP can be found in ASTM C700 (*Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated*) and ASTM C1208 (*Standard Specification for Vitrified Clay Pipe and Joints for Use in Microtunneling, Sliplining, Pipe Bursting, and Tunnels*).

Many municipalities in the U.S. still have pipe in-service that was installed in the 1800s. In the late nineteenth century there were hundreds of clay pipe manufacturers across the U.S. As a result, the pipe itself can vary in shades, glazing or various other cosmetic features. These variances should not be seen as areas of concern, especially in pipe installed prior to 1950.

As the joint cutaway photos on pages 5 and 6 (Figures 3, 4, 5 & 6) show, variations in color are still common, but no pipe currently manufactured in the U.S. is glazed.

Knowledge of the Jointing Systems

Probably the largest misconception about VCP surrounds the jointing system. Many people think of the early field-made tar joints from the 1800's and not the present day factory-made, flexible, compression joints that were first introduced in the late 1950s.

While cement mortar, oakum, and asphaltic joints are a thing of the past, there are many miles of pipelines with this type of joint system still in-service and conveying sewage on a daily basis.

The early versions of factory-applied, leak-free compression joints were put to the test in the San Fernando, CA earthquake of 1971. Following this earthquake, the City of Los Angeles and the ASCE (American Society of Civil Engineers) surveyed the pipe performance in the hardest-hit areas and noted that for all sizes of clay pipe, "...the flexible joint suffered significantly less percentage damage than the rigid joint pipe."

In the summary of their findings, the authors suggested: "The typical plastic compression joint could be modified to be more earthquake-resistant by placing a bead of the plastic material on the seat of the bell or on the spigot end to reduce damage due to hammering."

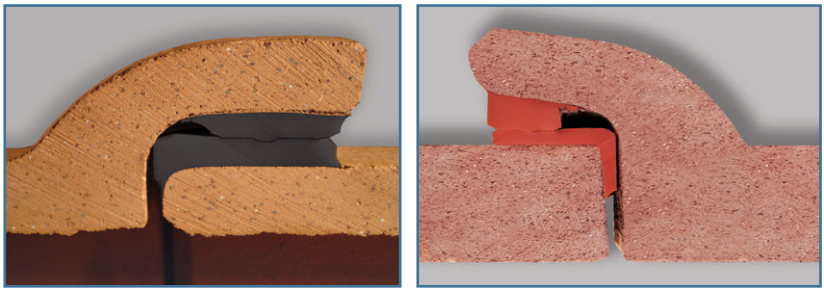

Figure 3: Vitrified Clay Pipe cross-sectional compression joint designs for Bell & Spigot pipe. Note the trim/ chamfer on the spigot and bell ends, as well as the "gap" on the fully homed joint.

Clay pipe manufacturers made a variety of adjustments to the original joints to address this recommendation, but the most important aspect of these was the "seismic cushion" as part of the spigot-end gasket. This design creates an intentional gap within the fully-homed joint assembly to allow for axial movement and prevent hammering. This flexible compression joint design encompasses a raised bead molded within the bell-end gasket to provide a connection that allows for angular deflection, shear load resistance, axial compression, and limited pullout (see Figure 3 on page 5). This became the first "seismic joint" design introduced to the industry.

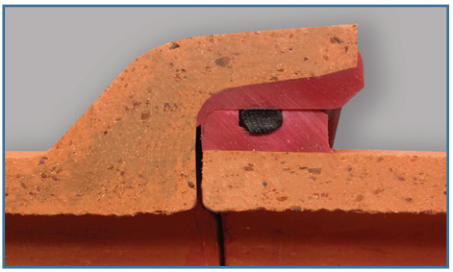

Figure 4: This joint design compresses a rubber O-ring between two dimensionally precise surfaces to achieve a water tight seal while allowing for normal amounts of angular deflection and shear load.

The flexibility designed into the joint allows for some angular deflection or offsets at the joint while the joint and the pipeline are functioning as intended. This flexibility at the joint is a design feature frequently used to create curvilinear sewer lines (For more information on Curvilinear sewers, see page 20).

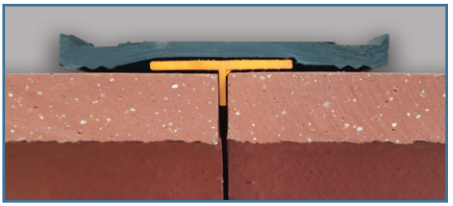

Figure 5: Plain-end pipe with rubber compression couplings, internal shear ring, and stainless steel tightening bands.

As is apparent in the joint designs pictured in Figures 3, 4, 5 and 6 it is impossible to "over-home" a VCP joint.

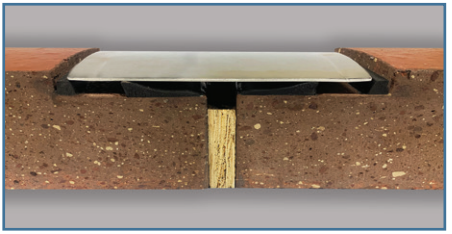

Figure 6: VCP jacking pipe joint.

Pipe and the jointing system are tested in the lab in accordance with ASTM C425 (*Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings*). These tests include angular deflection at the joint, an external load is applied and the pipe is filled with pressurized water. In order to pass this test there must be no leakage.

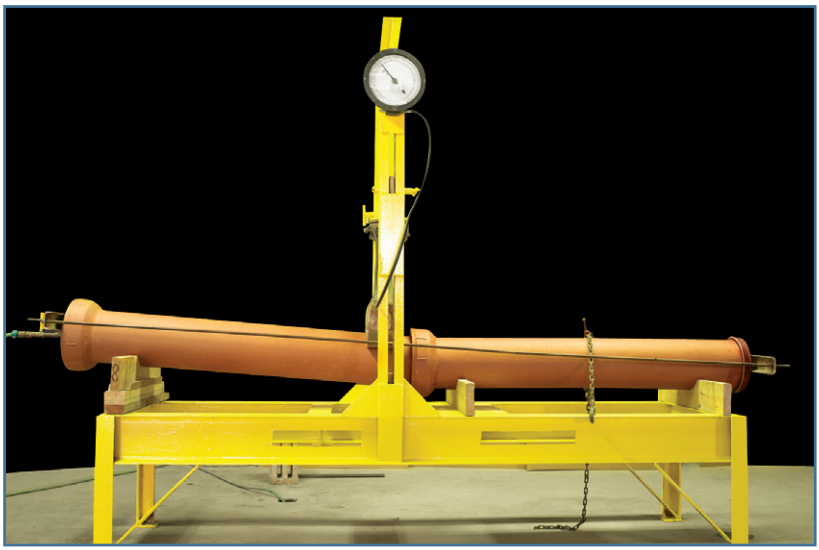

Figure 7: 8-inch Vitrified Clay Pipe laboratory testing with a vertical angular deflection at the joint of ½-inch per foot. VCP joints are required to pass this test with zero leakage.

Figure 8: 21-inch VCP Jacking pipe passing the same test.

Pipe Preparation

When a CCTV inspection is part of acceptance testing for a new installation, cleaning the line prior to inspection is strongly recommended to remove construction debris, cobwebs, bedding materials and other debris that can obscure defects.

When using CCTV for assessment of existing pipelines in service, it is necessary to clean the pipeline immediately prior to inspection. The National Clay Pipe Institute recommends following cleaning procedures outlined in ASTM C1920 *(Standard Practice for Cleaning of Vitrified Clay Sanitary Sewer Pipelines)* or the NCPI Operations & Maintenance Handbook. The handbook is available on the NCPI website at ncpi.org.

Figure 9: The best long-term value is realized when crews are trained to take full advantage of the cleaning options that are only available in VCP systems.

When cleaning any sewer line, it is important for the crew to know the type of pipe material(s) prior to cleaning method and tool selection. Flexible thermoplastic pipe materials will significantly limit the cleaning tool options if any sectional lengths are present within the line to be cleaned. Pipe wall damage and/or structural failure to thermoplastic pipe materials can occur when using tooling intended for abrasion resistant non-deflectable pipe materials. These pipe types will not stand up to the hydro jetting pressures and mechanical cleaning methods that are commonly used in VCP pipelines.

Following the cleaning, it is important for the CCTV operator, inspector, and/or reviewer to understand the differences between pipe materials being inspected.