

	TRENCHLESS TECHNOLOGY RESOURCE CENTRE	
	TRENCHLESS TECHNOLOGY GUIDELINES	SECOND EDITION
	PIPE CLEANING AND PRE REHABILITATION INSPECTION	NEW VERSION MAY 2006

INTRODUCTON

The regular cleaning of sewers and water mains is an essential part of system maintenance, and can, in some circumstances, be a method of rehabilitation. In the USA, the cleaning of sewers is included in the CMOM (Capacity, Management, Operation, and Maintenance), programmes, which utilities must follow to receive funding. Similarly, the flushing of water mains may be used to temporarily solve water quality, and flow problems.

Cleaning is also used in conjunction with pre rehabilitation inspection to ensure that the pipe is in the correct condition for successful use of the chosen rehabilitation technology. The extent to which cleaning is required, at the time of rehabilitation, depends on the cleaning, and operational history of the line. The pre rehab inspection may also reveal the need for other forms of pipe preparation, such as removal of projecting lateral connections.

In some cases, cleaning will be undertaken before inspection, and may be repeated if further problems are revealed. This is most likely to be necessary in the case of pressure pipes, such as water mains, which are not normally inspected on a regular basis.

PRE REHABILITATION INSPECTION

Where the existing pipe is being utilised in the rehabilitation, it is essential to inspect it prior to commencement of the project. If the existing pipe is being used as a route for a replacement line, by, for example conventional slip lining, the inspection ensures that there are no obstructions to insertion of the liner. Where sewers are being renovated, using a close fit liner, the inspection checks the following.

- A That the structural condition of the sewer has not deteriorated significantly since the original assessment.
- B There is no debris surface deposits, roots, or other obstacles to liner insertion.
- C The exact position of each lateral connection is determined, to enable subsequent reinstatement.

In the case of pressure pipe rehabilitation, by lining, the inspection will verify the position, and severity of bends, and the location of connections, junctions, and in line plant, such as valves. The inspection also checks the quality of cleaning, and ensures that there are no other obstacles to liner insertion.

In man entry size pipes, the inspection can be achieved by walking, or crawling the line. In smaller pipes, CCTV survey is used. In the case of pressure pipe liners, the suitability of the pipe for liner insertion may also be assessed by pulling a proving pig through the line. It is common practice for the client to be given the results of the inspection prior to commencement of the work.

CLEANING

In gravity sewers, cleaning is aimed at removing accumulated materials, such as fats, oil, grease and sediments. In addition, structural defects, such as protruding taps, and root intrusion, may also cause blockages, and can be removed in conjunction with the cleaning operation.

In water mains, cleaning is designed to remove surface deposits, such as corrosion products, and scale, which can affect water quality, and flow/pressure performance.

In terms of preparation for rehabilitation, the main purposes of cleaning include

A Removal of loose debris or obstructions which might impede or damage the renovation system

B Removal of surface deposits, such as corrosion products, to maximise the existing free bore, and create a surface appropriate to the renovation method to be used This is particularly critical where a good bond is required between the liner and the pipe wall.

A range of cleaning techniques is available for both gravity and pressure pipes.

CLEANING TECHNIQUES FOR SEWERS

Sewers can be effectively cleaned by hydraulic or mechanical methods, or a combination of the two. In man-entry size sewers, manual cleaning using pressure hoses and scrubbing brushes is sometimes used to remove larger obstacles and debris. However, where man-entry is not possible or not desirable, the main technique used is hydraulic cleaning. The technique employs high-pressure water, which is passed through a specially designed jetting head attached to a pressure hose fed from a surface pump. The system allows the jetting head to be passed through a pipe at any speed desired. The pressure head is designed so that the water sprays out of it to hit the inner wall of the pipeline, dislodging any material stuck to it.

The debris created, is then pushed back through the pipe, either by the passage of the head as it is pulled through the pipe or by the flushing action of the used water as it flows out of the pipe. The cleaning equipment usually includes a vacuum and storage capability which allows the debris to be sucked from a manhole. All the necessary equipment is normally mounted on specialised cleaning vehicles or trailers.

These may be owned or leased by the rehab contractor or be provided as part of a complete cleaning service by a specialist subcontractor. Other devices such as balls, kites, bags, parachutes etc can be used to improve performance in for example large gravity sewers.

In some cases the pressure of the water in the jets can be sufficient to cut through some root intrusions. Where roots are a particular problem and standard jetting equipment is unable to remove the root mass there are specially designed remote controlled robots available that use very high pressure, low volume water jets or rotating cutter blades for the cutting process.

MECHANICAL CLEANING

Rodders

Mechanical cleaning means the use of some type of physical device that scrapes, cuts, or pulls material from the main line gravity sewer. The original method, called hand rodding, is the oldest and most labour-intensive method of mechanical cleaning. Small engine-powered rodding machines are now available. These machines are very inexpensive and provide a very effective method of cleaning in smaller systems and also in remote easements or right-of-way areas where large equipment cannot gain access.

Larger mechanical power Rodders are equipped with a reel to carry the steel rods and an engine to provide the force to rotate, push, and pull the steel rods. Power Rodders are available in both truck-mounted and trailer-mounted models and a variety of different engine sizes are available for each type of unit.

Power Rodders can clear most obstructions in a sewer main. The rodder is effective in cleaning roots and grease as well as cleaning or opening stoppages in the main line. The power rodder is not as effective when working with deposits of solids such as sand or gravel because the tools do not have the ability to move the material. The tools are designed to cut or scrape materials from the pipe walls and are most effective on hardened grease and roots.

Bucket Machines

Power bucket machines are another type of mechanical cleaning device; they are used to remove debris, roots, grease, or sediments from main line sewers. A bucket machine is equipped with a set of specialized winches that pull a special bucket through a pipe to collect debris. The captured materials are then physically removed from the pipe. These machines are very powerful and offer the best cleaning product with the least opportunity for operator error that could affect the results. Since a full-size cutter and brush can be pulled through the line, each cleaning should be thorough and no residual debris should be left in the sewer main.

CLEANING TECHNIQUES FOR PRESSURE PIPES

The cleaning of pressure pipes is usually more difficult than sewers because

- a) It often involves removal of thick/highly adherent surface layers

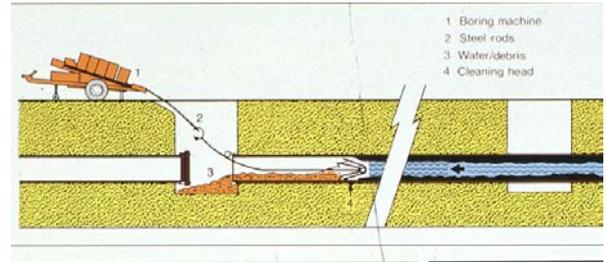
- b) Some lining technologies depend on adhesion to the pipe wall and require a very clean “bare metal” surface
- c) The line must usually be taken out of service during cleaning
- d) Some of the most aggressive methods can damage the pipe wall if not carefully controlled

Pressure Pipe Cleaning Systems

- Ultra High pressure Water jetting



Rack Feed Boring



Drag Scraping

Pig variants

Cleaning systems for Pressure Pipes are listed below

Method	Principle	Capability	Application
Flushing	Flushing action caused by rapid water flow from open valve or hydrant	Removal of lightly attached deposits from water mains	Maintenance technique for water mains



Air scouring	Flushing enhanced by injection of high pressure air to cause cavitation	More powerful than flushing	Maintenance technique for water mains
Jetting (normal)	Similar to hydraulic cleaning of sewers	Can remove loose deposits	
Jetting (very high pressure)	Ultra high pressure Water jet cleaning	Capable of removing even the most adherent surface deposits but also capable of damaging pipe wall	Used prior to epoxy/pu lining
Drag scraping	Special scraper tools winched through pipe to scrape off surface deposit	Creates suitable surface for cement lining and adhesive backed hose liners	Gas and water mains
Rack feed boring	Boring head attached to extendable rotating rods which are extended and pushed through pipe	Can be used where degree of tuberculation does not allow passage of winch cable	Used with epoxy/pu lining
Grit blasting	Air entrained abrasive particles directed against pipe wall		Mainly used for cleaning gas mains before use of adhesion dependant linings
Pigging	A close fit cylindrical polymer pig is propelled through the line by water pressure	A wide variety of pigs is available to suit different requirements	A low cost method which can clean long lengths of transmission mains

Pressure pipes are frequently severely scaled or suffer from tuberculation, as is the case with many water mains, the removal of this material normally requires more aggressive methods technique of a more aggressive nature is sometimes required. Scraping is a commonly used technique, which relies on a pipeline being open sufficiently, to pass a winch wire through it. Once in place a scraper head, normally a circular rubber or metal device, in the form of a wire brush or metal sheet or rubber shape that may or may not have some form of serration on the cutting edge, is attached to the wire and pulled through the pipe. The scraper dislodges any build-up of material and, as it normally designed to the internal diameter of the pipe, it pulls the debris to end of the pipeline into the winching access pit where necessary the static scraper head can be replaced by a flail attached to a rotating rod. The flail dislodges any unwanted material and it falls into the invert of the pipe. Jetting or flushing may then be used to remove the debris.

Where the pipe is heavily tuberculated it may not be possible to insert the winch wire and a system such as Rack Feed Boring must be used. This uses a boring head attached to a series of drive rods, which are used to rotate a boring head. The system is pushed into the pipe, and water flushed in the opposite direction, to clear the debris. In some cases, the utility will insist that the contaminated flushing water is disposed of by tanker.

When all else fails, the pipe can be cleaned by using water jets, operated at very high pressure, and this technique is generally used with renovation techniques which depend on a good bond. A major disadvantage of these aggressive cleaning techniques is the potential for damage to the host pipe under renovation. It has, at times, been known to cause so much damage that the non structural renovation technique originally selected is no longer appropriate

Pigging

Where the main cleaning work has been successful, sometimes a pipe requires a final inner wall surface clean. To achieve this, a pipe 'pig' can be employed. A pig is often a foam or plastic cylindrical plug that fit tightly, but not too tightly, in the internal diameter of a pipeline. The pig is pushed through the pipe, using compressed air or water pressure; to remove any remaining fine silts or particles that may interfere with a renovation process.

On some pipeline, 'pigging' can be used as the main cleaning technique, and is regularly used in the cleaning of plastic pipelines. Pigs used for the main cleaning action can have smooth outer skins or can be manufactured with a variety of external designs for removing debris from the pipe wall and transporting it out of the pipe.