



## KEYHOLE TECHNOLOGY

GTI is the industry's source for the development, testing, and introduction of innovative "keyhole" technologies for utility system repairs and renovations. With keyhole techniques,

maintenance activities are conducted through small pavement open-ings, resulting in significant cost savings, reduced public inconvenience, and more efficient repairs.

### WHY KEYHOLE TECHNOLOGY?

With excavation and restoration expenses costing U.S. natural gas companies more than \$1 billion annually, gas system operators are turning to keyhole methods as a way to reduce overall maintenance costs. Currently, excavation and pavement restoration costs are typically 50% less when keyhole technologies are used. Keyhole technology research at GTI is focused on further reducing maintenance costs and minimizing excavations.

Keyhole technology provides a cost-saving alternative to common repair methods, which often require large "open" excavations, followed by the removal and disposal of unwanted pavements and soils. These conventional practices – usually performed using several large pieces of equipment (backhoes, dump trucks, pavement breakers, etc.) – can account for 80% of the total cost of a repair job.

While utility operations can realize significant savings using keyhole technologies, consumers and the general public also benefit through less disruption and noise, quicker repair times, fewer and shorter service interruptions, and reduced traffic inconveniences.

### THE KEYHOLE PROCESS

#### 1. Locating

The first step in the keyhole process is pipe location. Precise location of facilities is important due to the reduced size of excavations through keyholes. GTI researchers are developing new, advanced technologies for locating plastic pipe, cast-iron joints, and pipe leaks.



#### 2. Coring

Common keyhole methods involve creating a pavement opening only 12 to 18 inches in diameter, usually made with a circular-drill core-hole cutter, allowing for remote access to the facilities. Restoration is accomplished by replacing the cut-pavement coupon after repairs are made.

#### 3. Vacuum Excavation



Once the core has been cut and removed, vacuum excavation is used to excavate down to the pipe. Debris removed from the hole is stored in a tank on the vacuum truck, and, ideally, the debris can be re-used to backfill the keyhole. GTI has conducted comprehensive research on safety aspects related to vacuum excavation.

#### 4. Construction & Maintenance Activities

With the help of specialized, long-handled tools, construction and maintenance can be conducted through a keyhole opening.



Activities currently performed through keyholes include: potholing/depth checks, valve box cleanouts, meter guard installations, plastic pipe squeeze-offs, service installation and abandonment, cathodic protection, and cast-iron joint sealing.

#### 5. Backfill & Pavement Restoration

Backfill and soil compaction are integral to the effective replacement of the cut core. Using the proper materials during backfill and core replacement will prolong the life of the pavement. To improve the process, GTI is conducting studies on measurement devices to assure proper soil compaction.