# Keyhole Core Strategy Saves Millions Per Year in Construction & Maintenance Costs

# 2013 AGA Operations Conference

Orlando, FL Thursday, May 23rd, 2013

Marshall Pollock Utilicor Technologies



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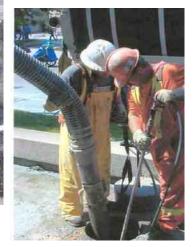
# What is Coring and Reinstatement?





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# **Pavement Restoration is Economic Driver**

• Average Savings: \$1,000 per excavation

### **Huge Pavement Restoration Cost Savings**

 Southwest Gas: Coring & reinstatement virtually eliminates paving restoration costs

Pavement Restoration Costs per mile of plastic pipe replacement:

- Open Trench: \$200,000 per linear mile
- Keyhole: \$26,400 per linear mile
- Savings (87%): \$173,600 per linear mile of replaced pipe
- National Grid: System-wide keyhole savings on Repair and Maintenance work:
  - 2011: 5,000 keyholes cored -- \$5 million restoration cost savings (avge. \$960)
- Washington Gas: rehabilitating 143,000 gas service lines and 1,900 miles of gas mains
  - Savings 50-80% in pavement restoration costs.

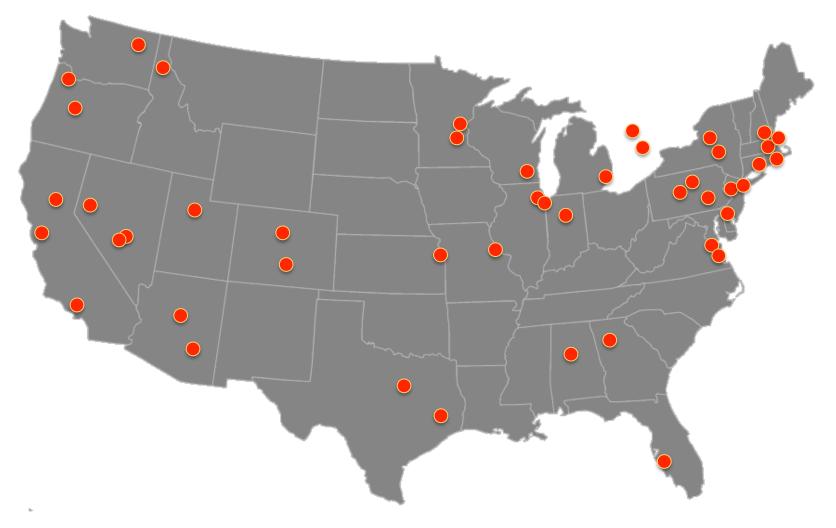
### **Pavement Restoration is Political Driver**

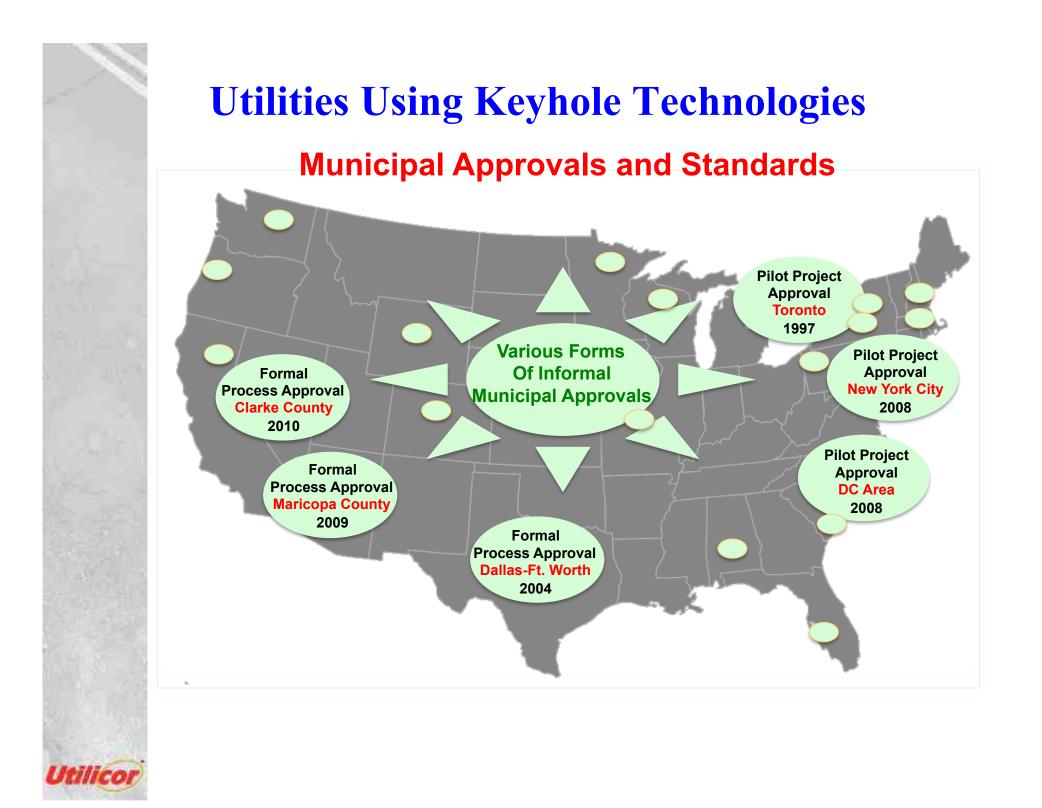
- Huge Political and Environmental Advantages
- Reduced Work Zone Delay and Disruption: no jackhammers noise and dust - 30 minutes to gain strength - no additional road closings - permanent repair - no repaying
- Reduced Pavement Damage: precise cut, no pavement breakers or backhoes to damage rest of pavement or crack the concrete -- no potholes - longer pavement life
- Reduced Impact on Environment: Reduce Reuse Recycle, saves resources, no disposal, reduced carbon footprint
- Aesthetically More Pleasing Result: Fewer citizen complaints

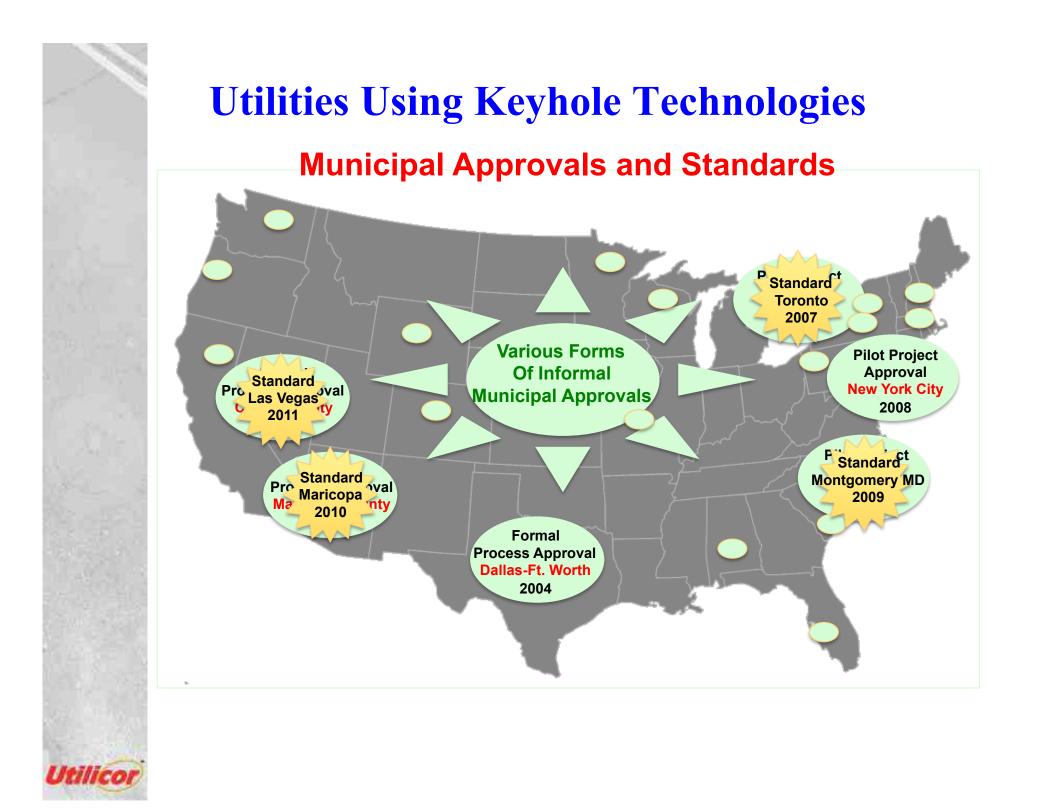
Municipalities have recognized Coring and Reinstatement as a Valuable Construction Standard.



# **Utilities Using Keyhole Technologies**







### Why a Cored Keyhole?

### Smaller is better and less intrusive.

### Laparoscopic Surgery

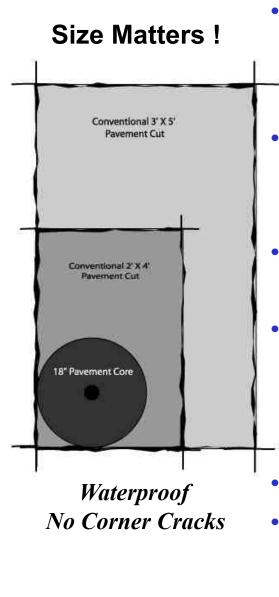
- Smaller Incision
- Short Recovery Period
- Faster Healing
- Smaller Scar
- Lower Cost

### **Keyhole Operation**

- Smaller Opening (keyhole)
- Faster Restoration
- Less Damage to Road System
- Smaller Repair Footprint
- Lower Cost

### and safer -- no men in the hole

# Why Coring and Reinstatement?



### Better Excavation Method

- No jack-hammers/Back hoes -- less disturbance for neighbors and to surrounding pavement
- Environmentally friendly, reuses materials, creates no spoils to truck away and dump, and no VOCs

### • Size and Shape

- Less than 1/10<sup>th</sup> size of conventional restoration
- **Reduced surface scarring** and peripheral damage
- Circular geometry with no corner cracks

### • Proven Strength -- NO Failures

- Reinstated core will support 50,000 lbs -- 5 times AASHTO standard

### • Greater Satisfaction -- Reduced Delay

- Reduced pavement deterioration -- no potholes
- **Reduced traffic delay** -- no additional road closing for repaving -- In and Out the same day.
- Aesthetically pleasing perfect surface match --almost invisible repair
- Reduces Pavement Restoration Cost by 87%
- Safer for Workers and Public

### **Keyhole Technology is a Process**



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# **Coring Process**







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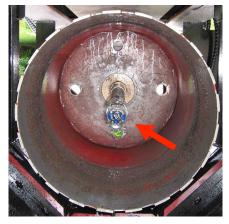
### **Rotary Coring Process (continued)**



# Perpendicular in both planes



- 18" 24" diameter hole up to 22" deep
- neat and accurate
- Time: 10-15 minutes depending on depth and composition
- Center pilot hole is cut simultaneously



*View: Inside coring drum showing center pilot bit* 

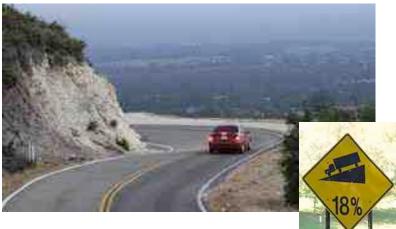
### A word about Pavement Geometry

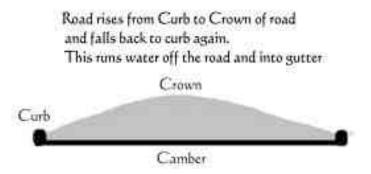
### Grade:

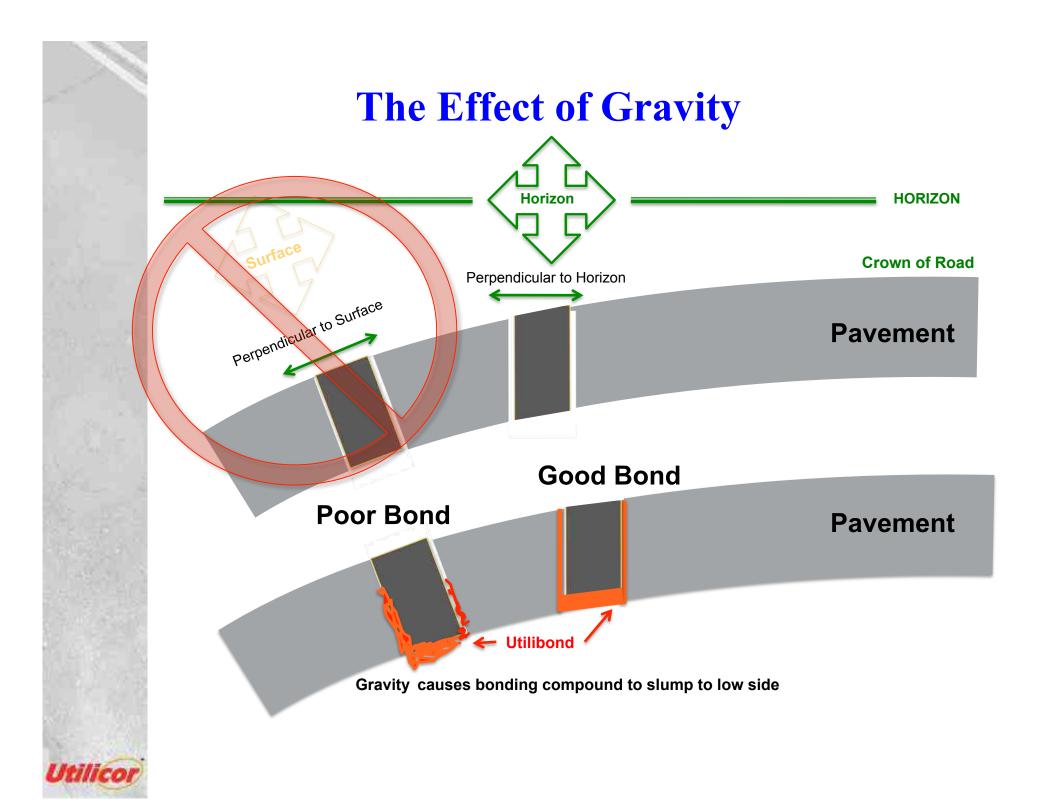
The Grade or Slope (incline or gradient or pitch or rise): the longitudinal inclination of the roadway surface compared to gravitational level. A larger number indicates higher or steeper degree of "tilt" or grade.

### Camber:

**Camber** or **Cross Slope:** the transverse curvature of the road surface that encourages surface water to flow freely from the roadway. On a normal two lane roads, the pavement cross-section usually has a roof-shaped doublesided cross slope, crowned in the centre and slanting down towards the shoulder or gutter.









**Rotary Coring Process (continued)** 

# Rotary Cutter cuts cores of different depths and compositions



**Thick Composite and Reinforced Concrete** 



### **Rotary Coring Process (continued)**



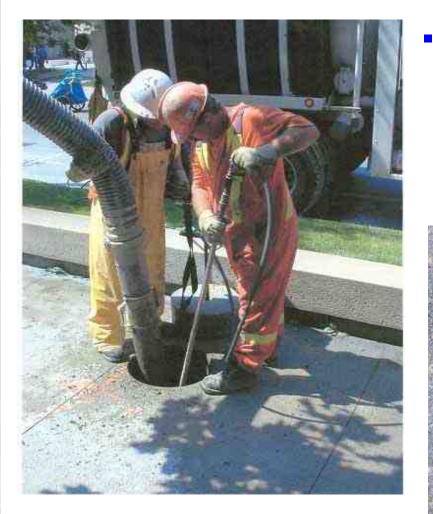


Once the core has been cut through ...

a core puller is used to remove the core;

The core is set aside (to be reinstated later).

### **Vacuum Excavation:**



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 the hole can then be vacuum excavated and the <u>exact</u> location of the potential conflict identified or the plant to be repaired exposed.



# **Keyhole Repairs**

Keyhole repairs are made from the surface using long-handled tools.



### **Typical Gas Applications**

- Cast iron joint repair
- Sacrificial anode installation
- Low pressure service cut off
- New service installation
- High pressure PE pipe repair
- Daylighting for directional drilling
- Pipeline integrity inspection

### **Typical Water Applications**

- Cathodic Protection
- Daylighting for directional drilling
- Service re-connection



# Backfilling



The hole is then back filled and compacted to the level of the base of the pavement so that the core or coupon of pavement can be reinstated.



**Soil Compaction Supervisor** 

- Accurate
- 8-12" lifts
- Auditable

# MALLEC

### **Reinstatement of the Core**

 A layer of pea gravel is used to level out the base and the Utilibond<sup>™</sup> is mixed with water and poured into the hole ...



... the core is reinserted into the hole and fitted to the level of the surface.





# **The Completed Repair**



- Utilibond<sup>™</sup> sets-up in 10-15 minutes
- Bond gains sufficient strength in **30 minutes** to support the single axel equivalent load equal to **five transit buses**
- 5 times the AASHTO standard or over 50,000 pounds.

The road can be safely reopened in 30 minutes!

... with no subsequent road closings or repaving required.

# **Connecting Service Laterals**







### **Excavated Service Lateral**

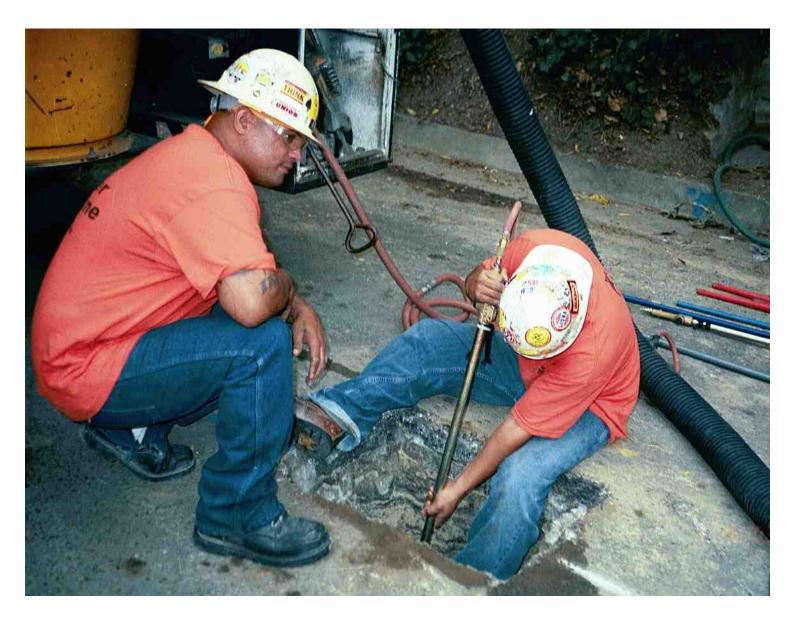




# **Keyhole Tools**



### **Connecting the Lateral using Keyhole Tools**





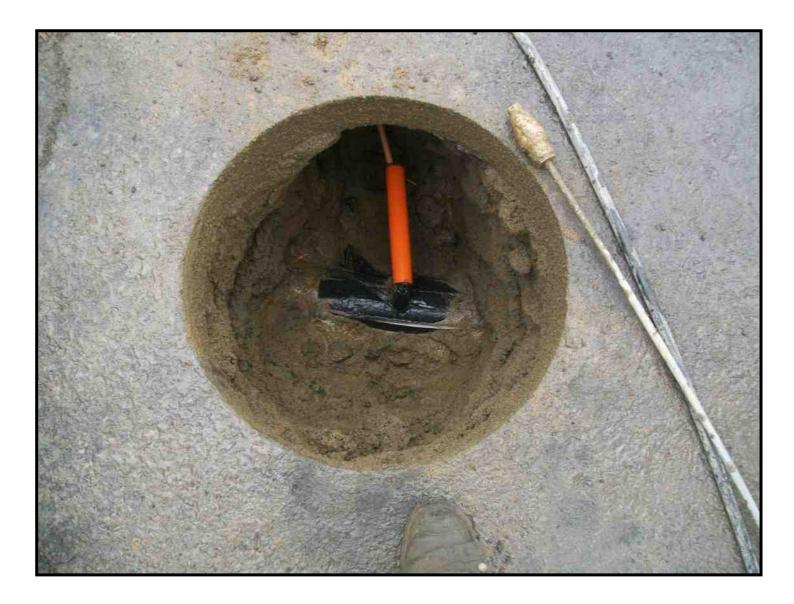


### **Final Connection**





# **Replacing Aldyl-A Tees**



# **Connecting New Tee**





### **Summary of Advantages**

It is Strong, Fast and Field Proven – Failure Free over 20 years

It works for Gas It works for Water

It reduces the impact of utility work on the public

It's a better pavement repair method – no potholes

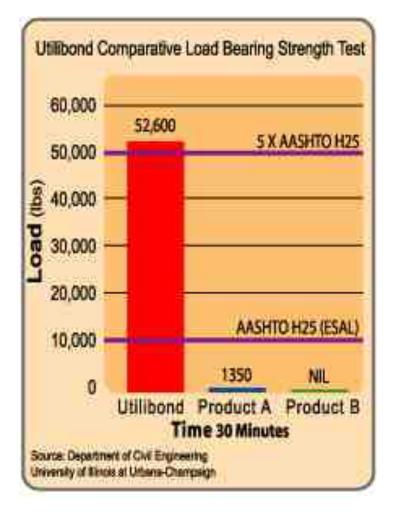
It works in hot and cold weather

It saves money

It is more environmentally friendly

It's a Process Technology: Large jobs can be scheduled for production line efficiencies

# **Bond Strength**

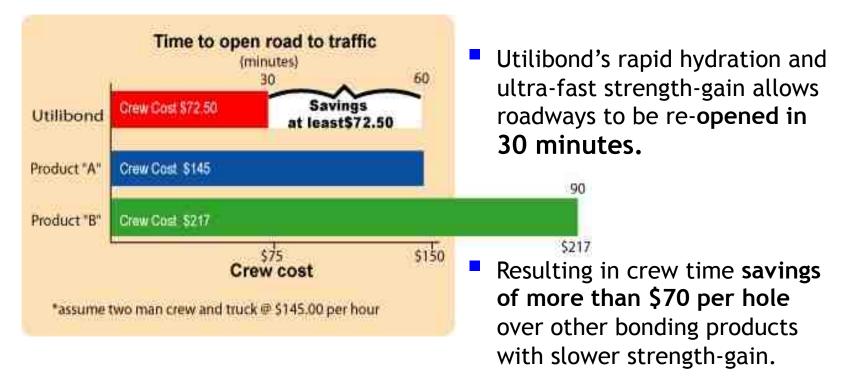


- Tests of 3 commercially available bonding compounds were conducted in July 2003 at the Department of Civil Engineering, University of Illinois at Urbana-Champaign.
- The Utilibond<sup>™</sup> bonded core gained sufficient strength within 30 minutes to support the combined weight of five transit buses -- over 52,000 lbs.
- Utilibond is the ONLY bonding compound that gains full strength in 30 minutes and is stronger than the pavement \*.

\* Construction Technology Laboratories An AASHTO Accredited Laboratory

# **Fast-Strength Gain**

### Time is money ... and Convenience !



Greater Public Convenience: road open to traffic again at least
1 hour sooner than conventional methods.

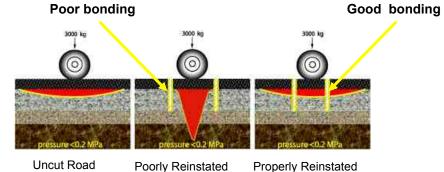


# **Proven Process: Golder Report**

Ten Year Longitudinal Engineering Study: 1992-2002



**Comprehensive Laboratory Testing** 



**Effective Load Transfer** 



Fast Setting, Rapid Strength Gain Convenient, Consistent,

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Long Term Performance through freeze-thaw cycles

Mechanical Bond No Voids

# **Restoration of Utility Cut Study**

- Joint project of North American cities, utility companies and U.S. state departments of transportation (2000-2005).
- **Objective:** to develop a guide for best restoration practice based on sound engineering principles.

### Toronto Field Experiment: Observations

### CONVENTIONAL TRENCH

- Noticeable failures in conventional cut.
- Conventionally repaired joint between road and the cut opened.
- Visible settlement in trench along wheel path.
- Material used to seal joint lost under action of traffic.
- Sand cover at base of trench exposed to higher than normal levels of moisture (compared with keyhole).

### **ROTARY CUT KEYHOLE**

- No defects in keyhole cut.
- Keyhole section established Oct. 2001 continued to perform well throughout life of project.
- Surface of restored keyhole remained level with the road profile.
- The bonding material surrounding the AC/ PCC core remained intact (no cracking or separation.
- Waterproof bond.

"Keyhole construction [is an] effective restoration technique that should be encouraged whenever feasible to minimize need for opening large trenches in the future."



US Army Corps of Engineers



National Research Council Canada

# **Utilities Using Keyhole Technology**

- Alagasco
- Atlanta Gas & Light
- Atmos Energy
- Avista Corp.
- Baltimore Gas & Electric
- Centerpoint Energy
- Colorado Springs Utilities
- Connecticut Natural Gas
- Consolidated Edison
- Enbridge Gas Distribution
- Energy East Corporation
- Equitable Gas
- Keyspan Energy Delivery
- Laclede Gas Company
- Las Vegas Valley Water District
- Michcon (DTE)
- National Grid
- Nicor Gas
- NIPSCO
- Northwest Natural
- NSTAR
- Pacific Gas & Electric

- Peoples Gas
- PECO
- Philadelphia Gas Works
- PSE&G
- Questar Gas
- Sempra Energy
- Southwest Gas
- Teco Peoples Gas
- UGI Utilities
- Washington Gas Light
- WE Energies

### **Under Review**

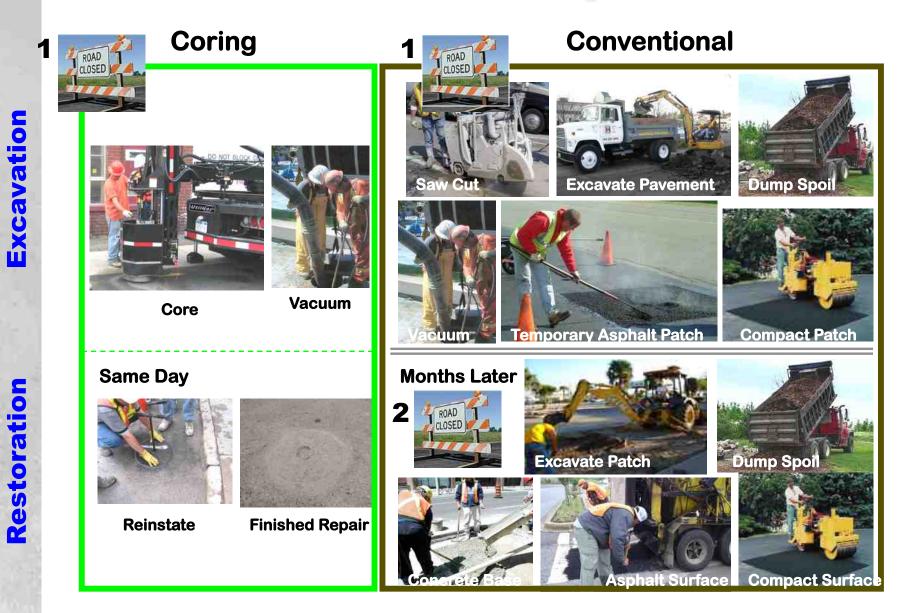
- Consumers Energy
- Cinergy
- Dominion East Ohio Gas
- Knoxville Utilities
- National Fuel Gas
- NiSource
- NYSEG
- Oklahoma Natural Gas
- Public Service of North Carolina
- South Jersey Gas
- Xcel Energies

# **Environmentally Friendly**



- No noisy and dusty pavement breaking machines.
- No spoil to be trucked and disposed of in dumps.
- No release of Volatile Organic Compounds (VOC's) from temporary patching material or cut asphalt.
- Re-uses existing materials -- *No new paving materials required*

### **Reduced Carbon Footprint**



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#### **Reduced Carbon Footprint**

- Coring and Reinstatement has a Carbon Footprint ONE-SIXTH the size of Conventional Methods
- EVEN IF YOU DON'T COUNT use of other pavement resources and the energy consumed in their production





# **3.6 million Utility Cut Permits** (issued by municipalities every year )



## 20-25% Utility Cut Permits for Small Holes

If 800,000 utility cuts were performed with keyhole coring and reinstatement, ANNUAL savings would be:

**Reduction** in asphalt used:

**Reduction** in spoil disposal:

**Reduction** in work zone delay:

#### 2 million tons

-- enough to resurface 650 miles of 4 lane highway

#### 27 million cu. ft.

-- enough to fill 200,000 dump trucks

- **2.8 million hours**
- **1.9 million gal fuel**
- **\$520 million cost**

**Restoration Cost Savings** to Utilities:

up to \$900 million

**Reduction** in GHG, VOCs and other emissions, energy consumption, noise, inconvenience, complaints:

**Priceless** !

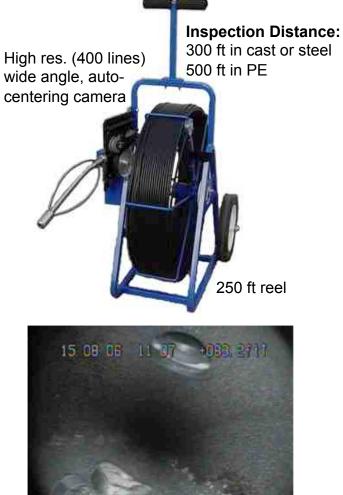
## **Pipeline Inspection Through a Keyhole**



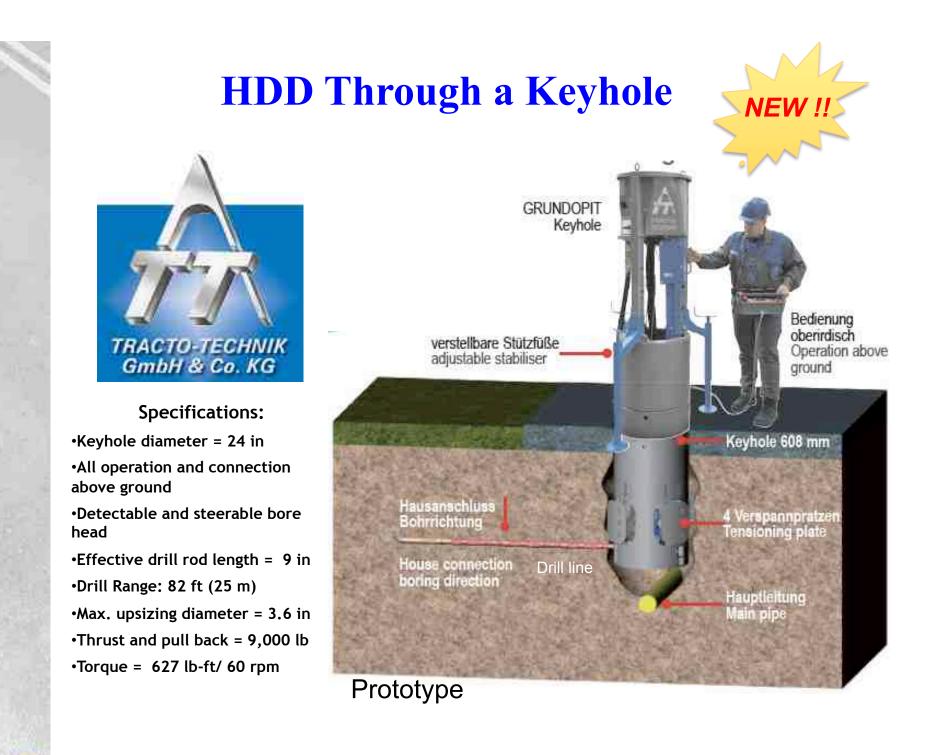
18-inch keyhole

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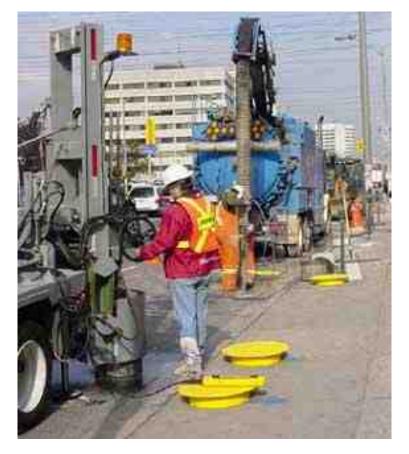


Up to 60 psi no-blow insertion



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## **Operationally Superior**



A coring, vacuuming process.

- Reduced pavement restoration cost.
- Improved Logistics: Single crew, onestop, same-day coring and pavement reinstatement means simplified scheduling, no temporary patching or repaving and no repeat visits.
- Special road plate lets you core and vacuum ahead of HDD -- no delays.
- Fewer complaints about traffic disruption, weakened or failed roads.
- Faster, safer and physically less demanding on work force -- no jack hammers and reduced potential for workplace injury
- Less damage to the road system



## **Aesthetically Pleasing**



## Creates favorable impression with the public

- Rotary cored and reinstated access hole almost invisible in the foreground. (Permanent)
- Conventionally repaired sidewalk cut in background. (Temporary)
- No unsightly utility cut "reminders" or potholes.
- No stress cracks or other failures.
- No "slip, trip and fall" litigation.



## **Functionally More Effective**



## Works better -- less damage to pavement

- Reinstated core exactly matches the original pavement profile because it is the original pavement !.
- No temporary "patch and fill" and then repave.
- The pavement system is restored to its original design specifications -- no deterioration in performance.
- No stress cracks, or ground water penetration or premature failure.
- Road re-opened to traffic much sooner -- less inconvenience to public.
- Year Round Restoration. Core restoration is independent of asphalt plant operation.

#### **Field-Proven Process**





#### **Core Reinstated 1995**

10/1CO

Same Core 2003

"Since the initial reinstatement, more than 145,000 transit buses and more than 13 million commercial and other vehicles have passed directly over the keyhole with no apparent weakening or other degradation of the reinstated core or the adjacent road system or paved surface."

Golder Associates April 21, 2003

#### ... and it works in the Winter



**Greater Convenience:** Timing of permanent pavement restoration is no longer dependant on schedule of HMA plants.







#### Winter Works





















## **Specific Advantages**

#### FOR THE UTILITY/CONTRACTOR

- > Saves Money: Dramatically reduced paving budgets.
- Positive Community Relations: Faster, less intrusive process. Fewer complaints from municipalities about traffic disruption, unsightly road cuts, sunken patches or weakened or failed roads.
- Improved Logistics: Single crew, one-stop, same-day coring and pavement reinstatement means simplified scheduling, no temporary patching or repaving and no repeat visits. Extends working season.
- Field-Proven Process: Zero reported failures in more than 15 years and over 100,000 successful corings in tough urban climates.

#### FOR THE CREW

- **Easy to Operate:** No extensive training required.
- Easy on the Back: Physically less demanding, no jack-hammers, shovels and backhoes. Reduces potential for workplace injury.
- Easy to Use: Utilibond packaged in easy-open, pre-measured polyethylene pails. Just add water, mix and pour. No awkward measuring from fragile paper bags.



#### **Specific Advantages (continued)**

#### FOR THE COMMUNITY

- Reduced Traffic Disruption: faster, one-step permanent pavement repair means reduced traffic congestion with fewer and shorter road closings and no repeat visits.
- Saves Tax Dollars: Less intrusive, more precise pavement coring and reinstatement process means *less structural damage to road system*, longer pavement life and reduced maintenance. Saves millions of tax dollars.
- Reduced Footprint: neat, almost invisible 18 inch diameter circular core (less than 1/4 the size of conventional road cut), means less scarring of the landscape and better pavement performance (no corner cracks).
- Environmentally Friendly: No road-cut spoil to be disposed of and no temporary patching compounds with volatile organic compounds (VOCs) to escape into the atmosphere, and no wasteful T-section cutbacks needed.
- Cleaner, Safer, Less Intrusive Worksite: No jack-hammers or large excavation equipment means less noise and mess during and after excavation and reduced disruption for neighbors.

## **Questions and Discussion**







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