

Gas Industry R&D
New Technology Transfer Process @

PECO Energy

Underground Utility Verification

COMBINING INNOVATIVE

TECHNOLOGIES

Government & Industry Pipeline

Research & Development Forum

February 7, 2007

New Orleans, LA

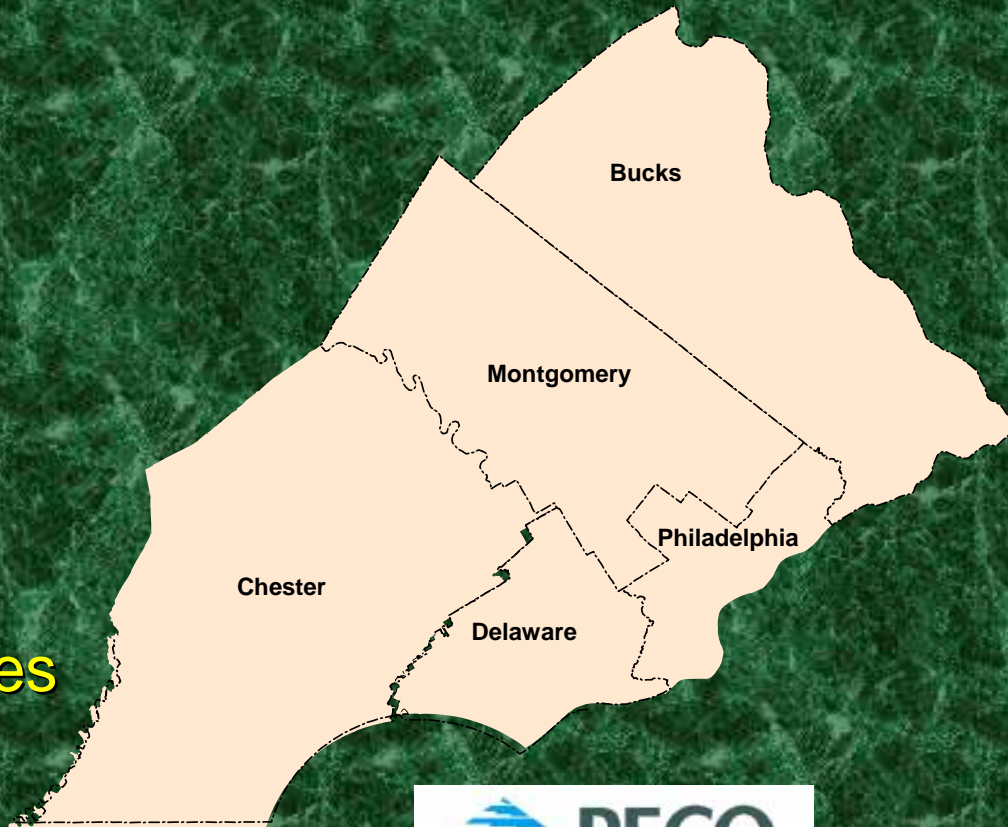
Mark Andraka, Sr. Engineer, PECO Energy Company

Philadelphia, PA



PECO Operations & Territory

- ✓ 1.5 million electric customers / 450,000 gas customers
- ✓ 6100 miles of gas distribution pipe
- ✓ 229 municipalities & boroughs
- ✓ PADOT and 5 counties
- ✓ Relocations are not reimbursed by state or local municipalities



Gas New Technology Development



NYSEARCH

gti

American Gas Association

American Public Works Association

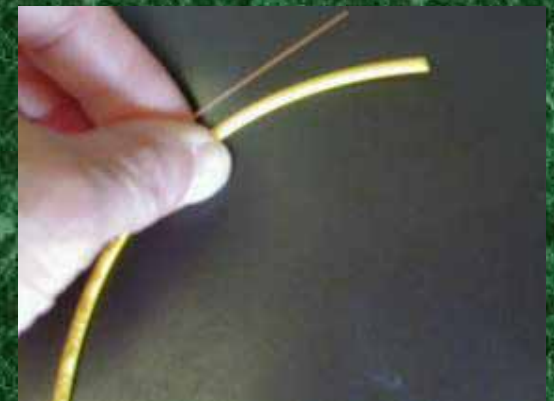


NYSEARCH's Strategy for Damage Prevention

* Program with Multiple Projects; both Transmission and Distribution

✓ *Initially targeting proactive warning before encroachment*

* Expanding search for prevention by warning both in ground and at sources of damage



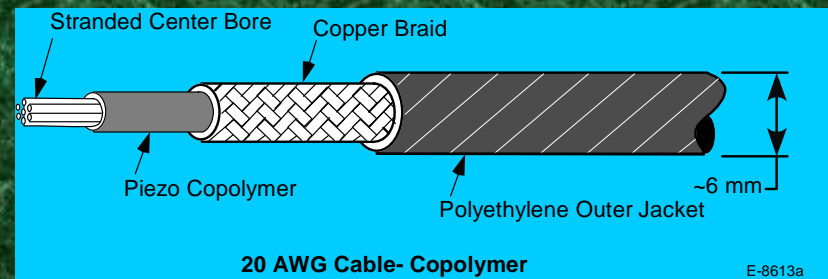
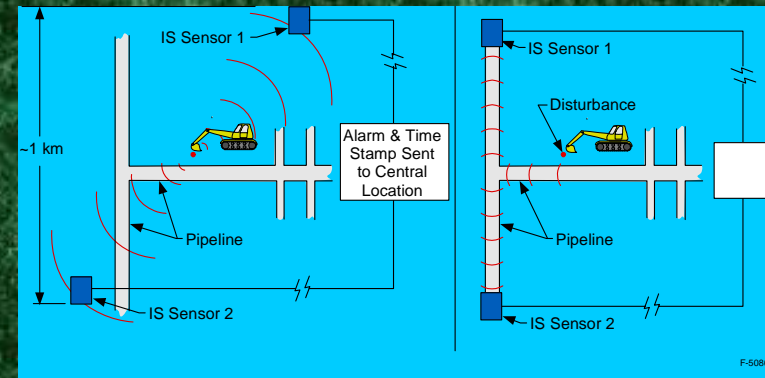
PIGPEN – ProActive Damage Prevention

✦ Low Frequency Seismic Sensor

✦ Objective:

✓ *Develop an infrasonic sensor system that will*

- Detect potential third party threats
- Pinpoint threat location
- Identify type of equipment involved
- Provide a warning in time for permit termination of excavation prior to pipe disturbance



PIGPEN – ProActive Damage Prevention (cont.)

✦ Status

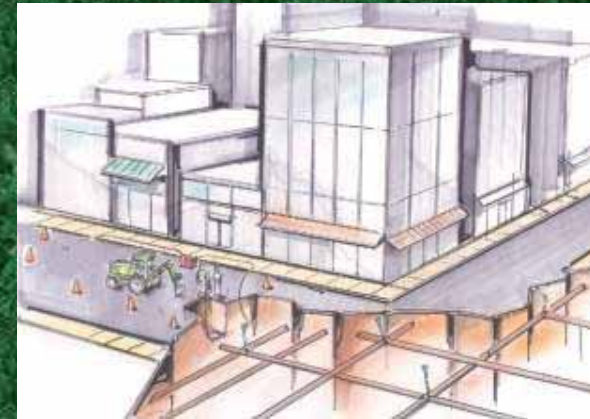
- ✓ *Proof-of-Concept achieved*
- ✓ *Alpha System prototypes tested*
- ✓ *Beta sensors and algorithms tested*
- ✓ *Currently addressing concerns about location accuracy for distribution applications*
- ✓ *More testing needed particularly in complex soils*
- ✓ *Additional work funded thru SBIR*
- ✓ *DOT/OPS & NYSEARCH jointly addressing commercial potential*



GASNET Distributed Sensor Network

✦ **Objective:** Develop a wireless, real-time distribution network monitoring system using a multitude of sensors

✦ **Workscope:** Design prototype system; prove concept in lab and field; develop pre-commercial system



GASNET Distributed Sensor Network

- ✦ **Results:** Proved concept of wireless in-pipe network of sensors in the lab and in the field
- ✦ **Status:** Alpha-prototype system proven viable; Design, construction and testing of pre-commercial system completed; Beta field tests underway at (4) member companies



Third Party Damage Monitoring Evaluation of Commercial Fiber Optic Approach

✦ **Developer: FFT – Secure Pipe™
Monitoring System**

✦ **Operation**

- ✓ *System uses standard fiber optic cable buried above pipe (approx 12" below surface)*
- ✓ *Light travels along fiber & is altered by vibration, compression, acoustics, strain-stress*
- ✓ *Alteration is evident in change in signal*
 - Amplitude, phase, wavelength, time-of-flight

PSEG Field Test

- * **Fiber optic cable direct buried 18" deep**
- * **Pipe is 12" wrapped steel operating at 475 psi with depths ranging 3' – 5'**
- * **Site diversity**
 - ✓ *Waterway & marsh land*
 - ✓ *Adjacent to and under RR*
 - ✓ *Under two paved roadways*
 - ✓ *Residential areas*
 - ✓ *Some hilly and rough terrains*



Questar Field Test

- ✦ Salt Lake City area
Mostly sandy, rocky,
 - ✓ *hilly terrain*
 - ✓ *Extensive*
 - ✓ *construction in area*
 - ✓ *(sewer, water,*
 - ✓ *roadways, curbs)*
- ✦ Pipeline
 - ✓ *20" wrapped steel*
 - ✓ *MAOP 600 psi*
 - ✓ *Burial depth is 3 to 6*
 - ✓ *feet*
 - ✓ *Length – 3.2 miles*
- ✦ Install cost - \$1.50/ft



Resistant Materials

Technology/Economic Assessment of RTP

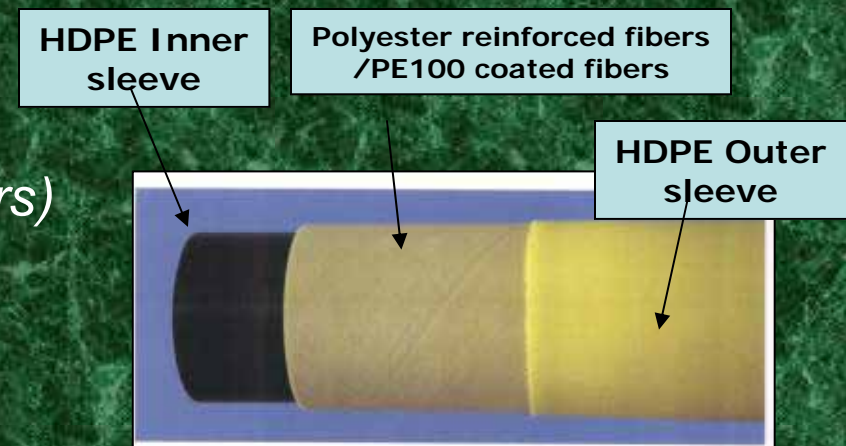
✦ RTP – Reinforced Thermoplastic Pipe

✦ Objective: To determine resistance to Third Party Damage & technical/economic feasibility



✦ Product Features:

- ✓ Pressure Rating: 600 psi (42 Bars)
- ✓ Size Availability: 4" & 5"
- ✓ Length Coils: 200' to 400'



Other Resistant Pipe Materials

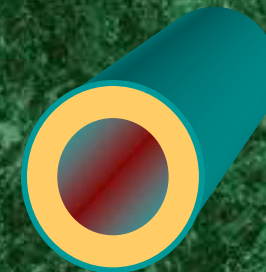
✦ Profuse/Peelable Pipe



✦ PE/PEX Composite Pipe

✦ Edgeplast - PE100 pipe with Toughened PE covering

✓ *Tested/marketed in Europe – resistant to scratches, gouges, rock impingement*



Two layer pipe
ELTEX® TUX100 /
PE100

**THE BEGINNING
OF BELL AND
SPIGOT JOINTS**

No Picture

Clip180

The R&D Challenge

Enhancement and Introduction of New Technologies into Operations

- ✓ *Technologies accepted into work force*
- ✓ *The right technology for the right circumstance*



The Project

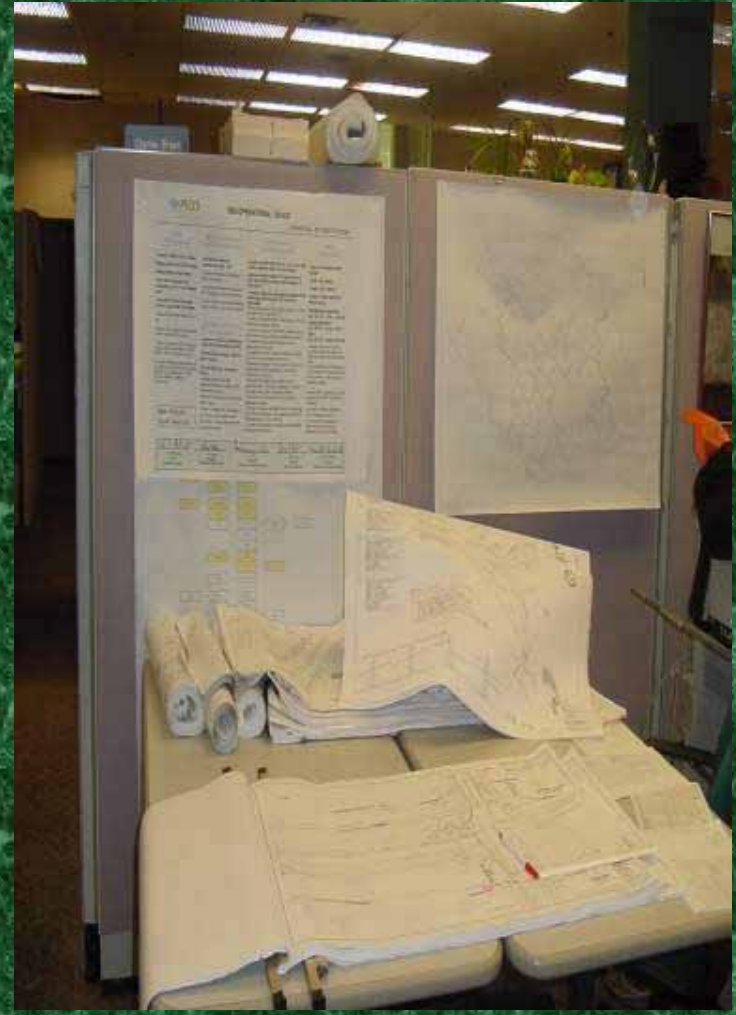
✦ One Year GTI / PECO Energy Pilot Project

- ✓ *Underground Utility Verification through Combining New Technologies (GPR-Vacuum) Project*
- ✓ *Combine tools into one toolbox*



Fragments of Technology

- ✦ **Tools were dispersed throughout the company.**
 - ✓ *Large VAC Truck Used for Directional Drill and Anaerobic Sealant Couldn't Support an Engineering Function*
 - ✓ *PipeHawk - GPR*
 - ✓ *Reactive approach to facility relocation*

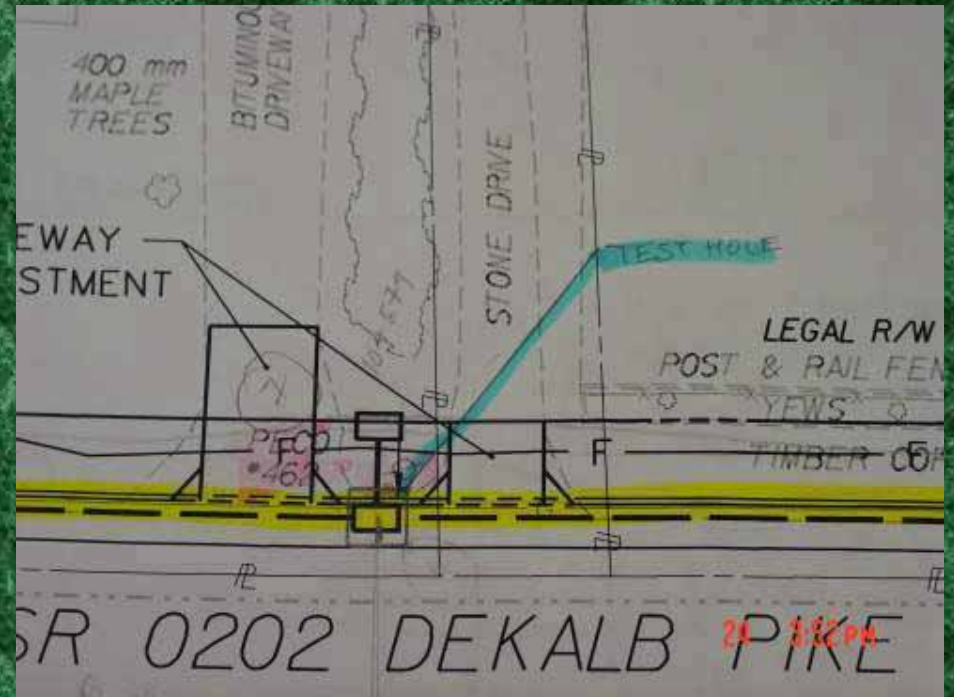


Case Study – Dresher Rd

- ✦ **20” Steel Gas Main**
- ✦ **Conflicts with proposed storm drain system**
- ✦ **Involvement during design phase enabled the elimination of conflicts**
- ✦ **Township re-designed storm drain layout to cross facilities in one location only**
- ✦ **Four 20” steel offsets were eliminated**
- ✦ **Avoided \$200,000 expense**

Utility Coordination

- ✦ **Goal: Conflict Avoidance through pre-design**
 - ✓ *Build relationships*
 - ✓ *Obtain timely and accurate horizontal and vertical measurements*
 - ✓ *Reduce relocation costs*
 - ✓ *Prevent last minute relocations*
 - ✓ *Customer Satisfaction*



Pipeline & Gas Journal

✦ “New Technologies, Close Coordination Save PECO Energy \$1M”


✦ August, 2002

- ✓ *Mark Andraka*
- ✓ *Brian Camfield*
- ✓ *Bill Hutton*
- ✓ *Allen Spivey*

Permission To Copy
Order A Reprint

Locating Underground Pipes & Facilities


New Technologies, Close Coordination Save PECO Energy \$1M



by T. Mark Andraka,
Product Engineer,
PECO Energy.



Brian Camfield,
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William Hutton,
Foreman,
Omega Tools, Inc.,



and Allen Spivey,
Manager,
Mechanical Engineering
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Gas Technology Institute

In May 2001, PECO Energy, with the assistance of Gas Technology Institute (GTI), initiated a year-long pilot program involving the use of advanced technology to develop improved methods for locating, identifying, and accurately verifying the location of underground facilities.

The combined use of new technologies and conventional techniques has enabled PECO to improve both the precision of locating facility locations and the quality of the information needed for critical construction planning. By accurately identifying underground facilities (based on size, PECC product, facility mission, related construction drawings, and related the job of that pipe), PECO estimates that the company can save \$1 million a year by improving the process for resolving utility location, budget reduction, infrastructure management, and technology enhancement were the drivers of PECO Energy Company's Facility Verification Program. The program was designed to enhance the existing capability of locating underground utilities using conventional metal-detecting equipment by also employing conventional

techniques, ground-penetrating radar (GPR), and satellite navigation.

This pilot program has not only helped PECO improve how it manages its locating activities, but also helped to enhance some of the tools that are increasingly being used throughout the world for locating subsurface facilities.

PECO Energy's operations department was familiar with various excavation and in-use in such operations as cutting and setting, service streets, video flow cleaning, trench repair, and other trenching/drain work. The company had also researched a local supplier of locating devices, including the Pipeline GPR system from EarthLink gas and RailRobinson's Portable Pipe Locator.

With the potential application of both of these technologies identified, company management knew that they could use these tools to judge buried pipes that were not properly shown on existing drawings. The company expects that facility verification facilities could be significantly reduced as company designers coordinate activities with state and local municipalities during the planning stage of construction. If municipalities could leverage their confidence in the accuracy of facility information given to them, potential conflicts could be identified and resolved ahead of time.

Compromising the need for approved locating technologies was the fact that designers were having difficulty obtaining needed facility verification (i.e., drilling or digging test holes). General contractors were previously more hesitant to coordinate with municipal engineering departments to approve, because engineers proposed a program to increase the capability to perform roadwork, but two separate to use various excavators and locating tools, and suitable devices to improve benefits of the effort.

Pilot Program

At the outset of the program, it was necessary to organize the activities. Special teams were created to require all relevant data and coordinate all subsequent flow work. As the program developed, it was found that the effective location of underground utilities relies on a complete and

✦ A two-person team consisting of John Kaapp (PECO) right and Brian Schaefer (Omega) left, dug a test hole which helped locate a storm drain conflict. Kaapp utilizes the attached probe while Schaefer restores out the debris into the trench during work.



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THE PROCESS



Process



*Environment
dictates action
plan*



*Keep tools
utilized*



Forms



Database for Tracking and Reporting

The screenshot shows a Microsoft Word document with the following table:

Category	Project Name	Region	Sum of Savings
Municipal Conflict	363 & 629 (Summerville)	BuxMont	\$0
	E. Hancock St & Spruce St	BuxMont	\$15,666
	Hog Island Rd	DelChester	\$21,500
	Lansdale Project	BuxMont	\$39,831
	Meetinghouse & Easton Rds	BuxMont	\$20,000
	Morris Rd & Pennlyn Blue Bell Pi	BuxMont	\$20,000
	Mt. Vernon & Line St	BuxMont	\$15,666
	Old Lincoln Hw	BuxMont	\$15,838
	Pine St - Darby	DelChester	\$35,000
	Richlieu & Galloway	BuxMont	\$81,000
	Rubicam Road Project	BuxMont	\$21,000
	Summary for Municipal Conflict (12 detail records)		
		Sum	\$305,501
		% of Total	30.4%
Operations	Brookside Rd	BuxMont	\$1,200
	Old Eagle School Rd	DelChester	\$4,800
	Rt 29	BuxMont	\$5,000
	Rte 30 Project	DelChester	\$5,000
Summary for Operations (4 detail records)			
		Sum	\$16,000
		% of Total	1.6%
Pre-design			

Enhancements to Vac Unit Resulting from Pilot

- ✦ **Worked with Servac/Omega**
 - ✓ *Trailer Vac Unit with Mobile Dump Valve*
 - ✓ *Hose Assisted Unit – One Man Soil Breakup and Vacuum*
 - ✓ *Storage area for Pipehawk*
 - ✓ *Air-Water Knife*





NYSEARCH

Handheld Pipe Locator



Handheld Pipe Locator

✦ **Objective:** To develop a low-end construction crew check tool that is portable and used strictly for on-site mark-out of facilities

✦ **Product Features:**

- ✓ *Low end construction crew check tool*
- ✓ *Air-coupled antenna, shoulder mounted battery pack and display*
- ✓ *Optional Ground-coupled antenna that can integrate with same display and control unit*
- ✓ *Plan and cross section views to be provided on site; no off-site processing*



Harris Technologies Ultra-Long-Wavelength Ground Imaging System (ULW/GIS) Objectives of NYSEARCH Project

- ✓ *Develop a unit that has the functional capabilities of a commercial unit*
- ✓ *Develop a prototype to demonstrate*
 - Ability to detect and locate plastic pipes
 - Ability to detect and locate cast iron joints
 - Ability to detect at locations where there are multiple substructures
 - Ability to function in confined spaces
 - Improved horizontal position location capability
 - Improved measurement and display rate
 - Ability to Address FCC Cert Reqts



HT Ultra-Low Frequency Pipe and Joint Imaging System

✦ **Objective: To develop and commercialize a combination pipe/joint locator**

✦ **Product features:**

- ✓ *Light-weight cart-based system; future vision of handheld system*
- ✓ *Unique approach works in all soils*
- ✓ *Unique approach for automatic calculation of dielectric constant yielding accurate depth predictions*



Results

✦ Savings / Avoided Cost / Projects

- ✓ *\$1,117,910 Yearly Cost Avoidance*
 - Electric and Gas
- ✓ *Improved utility coordination with municipalities for 97 projects*
- ✓ *Updated 13.4 miles of Gas Main on Quads*
 - Road widening, grade changes, etc.
- ✓ *Customer Satisfaction – Smaller Holes Mean Less Road Disturbance*
- ✓ *Safe Digging Technology – Will Not Tear Through Cable or Pipe*

1st Company in the **WORLD** to Combine Radar and Vacuum Excavation

Development of KEYHOLE TECHNOLOGY



gti



Gas O&M from above excavation



✦ Standard Cut

- ✓ 3'X4" Excavation
- ✓ Excavate +/- pipe
- ✓ In-hole repair process
- ✓ Temporary black-top

Cut-backs

Separate Re-pave Contractor

Dumping & Transportation Fees

- ✓ Up to 6 week time frame start to finish

✦ Keyhole

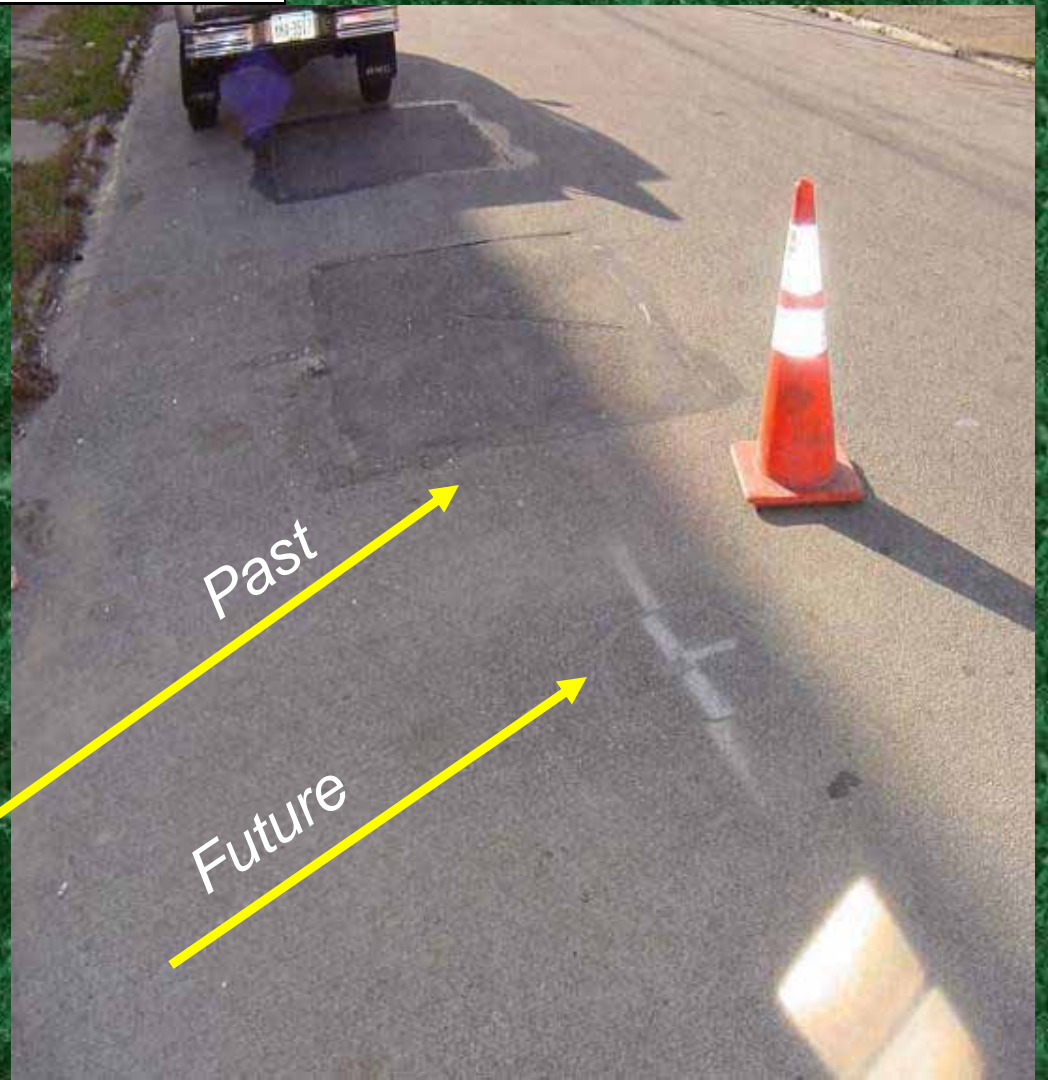
- ✓ 10"—18" Excavation
- ✓ No need to excavate below pipe
- ✓ Above ground repair process
- ✓ Core reinstated-- No cut backs
- ✓ Homogeneous materials
- ✓ Can be performed year-round
- ✓ Minimal Impact to Traffic Flow and Public
- ✓ Job Complete prior to crew leaving site



A Solution

A New Way to Undertake Our Infrastructure O&M Processes

✓ *Inactive Gas Service Cut-offs*



Q&A

Thank you for attending!

✦ Contact Information:

- ✓ *Mark Andraka*
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