Cross-Bores – Best Practices Outreach and Education

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Senior Program Manager, Intelligent Infrastructure Initiative

As a Senior Program Manager for GTI’s intelligent infrastructure initiative, Jim Marean leads efforts to assess and articulate natural gas’ role and value as part of the smart energy grid. In 2011 Jim co-authored a white paper (available on the GTI website) with Navigant Consulting titled Natural Gas in a Smart Energy Future which provides a compelling vision for the natural gas industry through 2030 and beyond.

Marean comes to GTI from New York State Electric and Gas (NYSEG), where he spent 30 years in positions of increasing responsibility. His background includes a variety of management and technical research responsibilities. He has wide-ranging experience with distribution engineering, natural gas and compressed air energy storage evaluation, alternative fuel and natural gas vehicles, environmental matters and manufactured gas plant investigation and remediation strategies.

Most recently at NYSEG he managed a large technical support services team, with significant focus on new innovations in technology and demonstration deployment. He has specific expertise in smart energy grid technology, geographic information systems and data mapping, bio-methane to pipeline quality, and exploration of new energy sources like wind and solar technologies.

He has held positions on the Board of Directors for Operations Technology Development (OTD) and Utilization Technology Development (UTD). Marean earned a B.S. degree in Wildlife Biology and an M.S. in Fisheries Biology from SUNY Environmental Science & Forestry, and an M.S. in Science Education from Syracuse University.
Cross Bore Program

> **Cross Bore Best Practices Guide** - single source of information for natural gas operators to investigate and remediate existing cross bores as well as prevent future cross bores

> **Outreach and Education Program** - information to effect positive changes in attitude, practices and operations.

> **Cross Bore Database** - A national database of damages and incidents to assist in identifying trends.

> **New Developments** – Acoustic Pipe Locator, Cross Bore Detection, Obstacle Detection
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Introduction to Cross Bores

> [http://www.youtube.com/watch?v=g_dUMLSLYtw&feature=email](http://www.youtube.com/watch?v=g_dUMLSLYtw&feature=email)
Cross Bores – What are They and Why is There Concern?

What is a sewer cross-bore?
A sewer cross-bore is the inadvertent placement of a gas main or service through a sewer line. Cross-bores typically occur during trenchless construction.

What can happen?
A blockage may occur.
Clearing the line may damage the gas line which could result in an explosion or fire.
Types of Cross Bores

Legacy Cross Bores

> Cross bore events that currently exist due to previous installations.

> Investigate using a risk-based approach that progresses from a review of records to a focused field investigation

Future Cross Bores

> Cross bores that do not currently exist but may occur as new gas mains and services are installed.
Potential Intersections
Regulatory Reactions

- First Incident – Kenosha, WI 1976
- Investigations
- Minnesota Department of Public Safety Alert
First Recorded Cross Bore Incident
Kenosha, WI  August 29, 1976

NTSB Recommendations

• **Complete inspection** of those locations along the construction route where gas mains and sewer laterals may be in proximity to one another and correct any deficiencies.

• **Examine records** to determine other locations where gas lines were installed near existing sewer facilities (including a review of sewer blockage complaints), then inspect these locations and take corrective action where necessary.

• **Revise construction standards** to require the underground facilities be located accurately before construction and to provide protection for these facilities near boring operations.

• **Inform inspectors and supervisory personnel** of the circumstances of this accident, **train** them to be alert for similar conditions, and **advise** them of preventive actions.
Cross Bore Investigative Results

- Minnesota Public Utilities Commission - 27 cross bores reported in a 6 month period
- Palo Alto, CA - 4 blocks inspected. 24 cross bores found
- City A - 2 cross bores per mile in 200 miles of sewer main, One cross bore at a school
- City B - 3 cross bores per mile of sewer main, One cross bore at a hospital
- City C - 2% cross bores out of 11,000 sewer laterals inspected
- Cross Safety Association – 2-3/mile of sewer main
May 10, 2010 - The Minnesota Office of Pipeline Safety (MNOPS) is now aware of at least 155 instances in Minnesota where gas pipelines were inadvertently installed through privately owned sewer service laterals due to trenchless construction techniques; MNOPS believes there are probably more. The majority of these “cross bores” were found by plumbers while cleaning sewer service laterals. Since 2000, six gas lines have been punctured by sewer cleaning contractors. On three occasions, the gas ignited, resulting in significant injuries and property damage.
Best Practices

> Tidbits and Observations
> Quick Guide
> Who to Involve
OTD Project

Cross Bore Best Practices


> Guide provides information that can be used to investigate and remediate existing cross bores as well as prevent future cross bores.
Tidbits and Observations (1)

> Interviewed 23 LDC’s

- Regional Differences in the Approach Used to Assess
  > Likelihood of a full basement or the need to construct the sewer at a depth to be below the level of frost penetration
  > Soil conditions
  > The influence of existing or proposed legislation
  > The use of the One-Call System or Call Before You Clear programs
  > The use of bi-lingual outreach materials
  > A "found" cross bore was the best indicator that there may be others in the immediate area
Tidbits and Observations (2)

> Legacy Program Status – of 23 Companies
  - 9 (~39%) have a legacy program in place
  - 4 (~17%) are developing a legacy program
  - 3 (~13%) do not have a legacy program but are exploring the option
  - 7 (~30%) do not have a legacy program

> Legacy Program - Change in Process
  - 4 of 23 companies made a process change that facilitates inspection or discovery of legacy cross bores
  - Most Beneficial Changes
    > Collaborative effort with the sewer operators
    > Separate department or an integrated team with a common goal, focus, and awareness
Best Practices – Quick Guide

Organizational Commitment
- Support From Highest Level
- Compliance with All Regulations
- Dedicated Resources
- Common Goals

Risk Based Approach
- Customer Type
- Lack of Natural Gas Service Does Not Excludes a Location
- Previous Claims or Incident Reports
- Attributes with Higher Probability

Auditable Record Keeping System
- Operating Procedures and Training Specific to Cross Bores
- Include in DIMP
- Coordinate With One Call Systems
- Use a GIS
<table>
<thead>
<tr>
<th>PRACTICE</th>
<th>INVESTIGATIVE APPROACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Type</td>
<td>Similar to public building inspections in a typical leak survey program. The type of customer can impact the magnitude of the potential outcome if an issue occurs.</td>
</tr>
<tr>
<td>Previous Claim Experience and/or Incident Reports</td>
<td>When a cross bore is reported it is probable that others may have occurred in the same area due to similar utility installation practices or field conditions.</td>
</tr>
<tr>
<td>Data Range</td>
<td>A determination of the date when trenchless technology was first used and/or the period when changes or improvements were made in the technique influenced the time period when a change in risk occurred.</td>
</tr>
<tr>
<td>Survey Completed Projects</td>
<td>Surveying completed trenchless technology projects on a random basis to identify patterns.</td>
</tr>
<tr>
<td>Service Path</td>
<td>Establishing the horizontal location of the sewer line and the crossing gas line through mapping and/or field locates to exclude the potential for the two facilities to intersect.</td>
</tr>
</tbody>
</table>
| Risk-based with Attributes     | Develop a list of attributes, which may be weighted, where each attribute would increase the probability of a cross bore occurrence. Risk attributes can be used in a matrix or added to prioritize investigations. The attributes would relate to the installation “environment” and would include but not be limited to:  

- Natural gas service depth  
- Sewer system depth  
- Service material type  
- Service installation type  
- Basement floor depth below surrounding grade  
- Building on slabs or with crawl spaces  
- Trailer parks  
- Sloped building lot |
Who Should Be Involved - Internal

> Executive Management
> Regulatory Affairs
> Finance and Accounting
> Public Relations
> Training
> Customer Service
> Call Center Reps
> Dispatch Operators
> Field Operations
> Engineering
> Construction
> General Utility Personnel
Who Should Be Involved - External

- Customers and Premise Owners
  - Bill Inserts
  - Direct Mailings
  - Door Hangers
  - Sewer Tags
  - Outgoing Calls
- Media
- Municipal Gov’t and Sewer Owner/Oper.
- One-Call System
- Other Utilities
- Contractors
- Plumbers
- Equipment Rental Owners
- First Responders
- Regulatory Agencies
Public Awareness
Cross Bore Public Awareness

- Increase awareness of the hazards associated with gas/sewer conflicts
  - Plumbing and sewer cleaning contractors
  - Equipment rental companies
  - Customers

- Safety DVD

- Bill inserts, advertisements, news media, online
PLANNING TO DO PLUMBING WORK?

IMPORTANT WARNING:
Natural gas pipelines may be present when clearing clogged sewer lines outside of the home.

SIGNIFICANT SAFETY TIPS:
When clearing a blockage in an exterior sewer line, remember to follow these important safety tips:

- Always use a clear outside of the structure to auger the sewer line, if one is available. Using an exterior auger will give you the chance of natural gas entering the structure in the unlikely event that a gas line is damaged while clearing the blockage.
- Exercise caution when using a power-driven tool to clear the blockage. Any spark-producing device may cause ignition if natural gas is present.

WHAT TO DO IF YOU SUSPECT A NATURAL GAS LEAK
If any signs of gas leak are present, immediately stop what you are doing and:
- Have everyone immediately evacuate the structure and move away from any area where gas is leaking.
- DON’T light a match, candle or cigarette.
- DON’T turn on electrical appliances or lights on or off (including any electric doors, light switches or appliances).
- Natural gas is a colorless, odorless, and invisible gas. If you smell natural gas, it is safe to return.
- At a safe location, call SoCalGas at 1-800-427-2500, day or night, seven days a week, or call 911.
- Do not go back into the building for any reason until a SoCalGas technician or a fire-marshal certified person has verified it is safe to return.

YOUR SAFETY IS IMPORTANT TO US.
SoCalGas has been working hard to provide safe and reliable service for more than 100 years. We have a strong safety record and work hard to maintain it throughout our natural gas transmission, pipelines, and distribution systems. We have been improving our program to conduct safety inspections of our entire pipeline system and comply with all federal and state regulations.

You have received this brochure because SoCalGas operates underground natural gas pipelines in areas where you or others may provide exterior plumbing services. Keep local customers, employees, the public and job locations safe by disseminating our information in this brochure.

* Some persons may not be able to smell the odor because they have a diminished sense of smell, or they have been exposed to prolonged exposure to the odor.
* People with a history of injury often have the most difficulty detecting the odor.
* People with insecticides or other substances in their system may be more sensitive to the odor.

About SoCalGas
SoCalGas is the nation’s largest natural gas distribution utility, serving more than 7.6 million customers throughout Southern California. We make the natural gas for you and the rest of the nation safe and reliable, whether it is used in homes, offices, or factories. We work hard to ensure that our customers are safely and reliably served. SoCalGas operates almost 4,000 miles of pipelines, and we employ more than 4,000 people to deliver safe, reliable service.
Public Awareness – Door Hanger Examples

Urgent Safety Notice
Possible Sewer & Gas Conflict

Address ____________________________ Date __________

To: Property Owner / Maintainer / Resident

National Grid, or its contractor, has installed gas piping on this property or across its frontage.

We used boring or drilling methods that reduced digging and trenching in the road and on your property. This required that we take several steps to avoid contacting buried sewer, water, telephone and electric lines.

We were not able to verify the location of your sewer line. Please contact the gas crew if they are still working in the vicinity, or call National Grid at the number below, so that we can arrange an inspection of the sewer line from inside your building – at our expense and at your convenience.

We believe we avoided your sewer line, but want to be sure. Damage may not become apparent for some time and can lead to a blockage. In the event we damaged the line, we will see to its proper repair.

We regret the inconvenience, but want to ensure your safety. We urge you to allow us to inspect the sewer line. If you refuse, please hang this tag next to your main sewer cleanout as an alert. If the line needs to be cleared in the future, determine the cause of the blockage by remote camera inspection before attempting to clear the line. Call National Grid if a gas line is found to be the cause of the blockage. Do not attempt to clear the line.

You may call the National Grid representative below to confirm this request.

Name ____________________________

Phone Number ____________________

Please Refer to this Project Number ____________________

This is an important notice. Please have it translated.

Urgent Safety Notice
Possible Sewer & Gas Conflict

LEAVE THIS TAG AT THE BUILDING’S MAIN SEWER CLEANOUT

Plumbers / Sewer Maintenance Personnel:
Please read the front of this card

If the sewer line here develops a blockage between the last inside cleanout and the main line, tank, or leach field, determine the cause by camera inspection before use of mechanical clearance methods.

Gas piping was installed on this property or across the frontage using trenchless methods. The clog could be caused by an unintended breakage of the sewer during the gas installation.

If the camera shows that a gas line is involved in the sewer blockage, call National Grid for immediate assistance.

Do not attempt to clear the line.

This tag should stay in place at the main cleanout. Once determined to be clear by camera inspection, check below:

☐ Camera Inspection Found Clear

Date ____________________________

WE’LL BE WORKING HERE SHORTLY

National Grid, or its contractor, will be installing gas piping on this property or across its frontage. You may have noticed stakes or markings on the ground above where buried utilities are located. Excavators use these marks to avoid damaging buried pipes, wires and cables.

Generally, private underground facilities, such as sewer pipes, are not subject to staking or marking.

What can you do to help? National Grid or contract employees, may ask to enter your premises to inspect the location of the underground utilities entering and leaving your property. After they properly identify themselves, brief access would be greatly appreciated. This will assist us in verification.

You may call the National Grid representative below to confirm this request. We regret any inconvenience, but want to work as safely as possible.

Name ____________________________

Phone Number ____________________

Please Refer to this Project Number ____________________

This is an important notice. Please have it translated.
Public Awareness – Sewer Tag Example

CAUTION

Avoid risk to yourself and others
Before clearing a blocked sewer line contact the natural gas utility serving your area before ANYONE attempts to clear the blockage.

Call before you clear.

UTILITY CONTACT INFORMATION LOCATED ON OTHER SIDE

NATURAL GAS UTILITY CONTACT INFORMATION

Xcel Energy
1-800-895-2999

CenterPoint Energy
1-888-944-4564

Minnesota Energy Resources
1-800-889-4970

Alliant Energy - Interstate Power
1-800-255-4268

Greater Minnesota Gas
1-888-931-3411
Gas Operations

- Awareness
- Tailgate Briefings
- Documentation
What is a sewer cross-bore?
The inadvertent placement of a gas main or service through a sewer line. Sewer cross-bores typically occur during trenchless construction.

What can happen as a result of a sewer cross-bore?
The sewer line may become blocked and need to be cleared with mechanical clearing tools. This may cause the gas line to be cut which could cause an explosion or fire.

How can I avoid causing a sewer cross-bore?
Excavating and locating sewer lines in advance of trenchless construction.

What do I do if I discover a sewer cross-bore?
Relocate the gas line and properly repair the sewer line. If you discover any other utility’s cross-bore, notify the building owner and the other utility.

What do I do if I damage a sewer line?
Ensure that it is repaired properly.
Tailgate Briefing – Existing/Legacy

Visual Tolerance/Safety Zone Around Sewer
- Minimum 2 Ft/0.6 m Horizontal
- 1 Ft/ 0.3 m Vertical

Do Not Assume Depth or Location of Any Facility
- Use Locating Tools to Pinpoint Sewer & Natural Gas Lines
- Use Sewer Camera to Verify No Cross Bores
- Hand Dig/Pothole Each Cross Point to Verify Location of Facilities

Repair All Cross Bores Before Leaving Site
- Schedule Repair of Intersected Facilities
- Schedule Property Restoration
**Tailgate Briefing – New/Replacement**

<table>
<thead>
<tr>
<th>Contact One Call or Sewer Operator</th>
<th>2 Foot/0.6 Meters Horizontal</th>
<th>1 Foot/0.3 Meters Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Tolerance/Safety Zone Around Sewer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do Not “Blind Bore” or Assume Location of Other Facilities</th>
<th>Use a Sonde or Camera – Pre and Post Installation</th>
<th>Hand Dig Pothole(s) at Each Crossing Point or Parallel Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure, Calculate, Locate and Expose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observe Bore Passing Cross Points and Reamer During Pull Back</th>
<th>Schedule Repairs of Damage Facilities</th>
<th>Schedule Property Restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report and Repair All Cross Bores Before Leaving Site</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
New/Replacement Documentation

> If trenchless methods are used records should be kept of the decisions made by the crew or supervisor

> Indicate the number of sewer laterals cleared of conflict

> Use a sewer crossing verification summary on an “as-built” drawing or an electronic job record

> Sign and date the document
Sewer Crossing Verification

Does the project involve crossing a sewer main or lateral?  YES__  NO__

If YES, how many sewer mains or laterals were cleared?  Mains____  Laterals____

What method(s) was used to verify the crossing did not result in a conflict?  Document what type of method was used (as approved by each utility):

__________Open Trench

__________Post Installation Camera Inspection

__________Locate and Expose by Excavation (Pothole)

__________Location and depth marked and verified prior to construction by ____method

__________Estimated Vertical Separation  ____________Estimated Horizontal Separation

__________Inserted into older steel facilities

__________Sewer in rear, gas in front

Were there any locations where a positive location could not be determined?  YES__  NO__

If YES, indicated the address, highlight the location on the “as built” and state the reason why. Indicate what method was used to perform due diligence and exclude the possibility of a cross bore if this were the case.
Customer Service Representative or Dispatcher Quick Reference
Sign of a Natural Gas Leak – Odor, Hissing Sound, Bubbles in Standing Water – Toilet?

Yes or Unknown

Instructions to Caller

Stop Work

Exit Building

DO NOT turn on/off any device, light a match or do anything that could cause a spark

Move 150 feet away, wait for utility Rep.

Collect Data Once Caller is in Safe Location

Issue order to Investigate – Class 1 Leak

No

Clog/Blockage Inside or Outside Building?

Inside – Not a Natural Gas Issue

Instructions to Caller

Outside

Issue Order to Investigate - Class 1 Leak


Collect Data From Caller

Stop Work
Acoustic Pipe Locator

Need/Benefits:

> Locate gas distribution pipes with emphasize on detecting plastic pipes
  
  ─ 300,000 miles of plastic pipes without tracer wires in US alone
  
  ─ 500,000 to one million miles of plastic pipes without tracer wires in the world
  
  ─ Tracer wires prone to damage/corrosion
    
    > Increases miles of plastic pipes to be detected
  
  ─ 60%+ damage by third party
  
  ─ Direct implications on operating cost and safety

> Water and sewer lines

Requirements:

- No special coupling liquids
- Use of same transducers for expected field conditions (dirt, grass, concrete, asphalt, etc.)
- Simple to operate and immediate results
- Pipe(s) display for locator/surveyor
- Cost-effective
OTD Project

Acoustic Pipe Locator

Ultra-Trac APL

> Technology licensed to Sensit Technologies
OTD Project

Mechanical Spring - Cross Bore Detection

> Goal - a tool that will detect a hit to sewer laterals during the HDD or mole installation of PE gas pipe.

> The tool uses a low-cost, easy to use mechanical spring system attached to the HDD/mole head during drilling or to the PE pipe during pullback.

> The spring system is activated inside the sewer pipe void; locating the lateral and providing a real-time alarm identifying a hit.
OTD Project

Mechanical Spring - Cross Bore Detection

> **Milestone Achieved:** Completed design of Prototype C (4-inch diameter unit)

> **Next Step:**
  - Address new design options for the smaller diameter units (Prototype D)
  - Complete IP-patent issue, contact HDD contractors
  - Coordinate with contractor, run test at GTI

> **Expected Deliverable/Format:**
  - Refine design with HDD contractors

> **Contact:**
  - Michael Adamo ……
OTD Project

Mechanical Spring - Schematic Design

Spring unit in soil
(spring arms are inside unit)

Sewer Pipe

Spring unit in void
(spring arms are open)
Prototype A
(no electronics)

Prototype B
(direct signal to surface)

Prototype C
(Signal stored in device)
OTD Project

Obstacle Detection During HDD

> Requirements:
  – Detect obstacles in advance of HDD operations
  – Sense both ahead of and adjacent to the drill bore
  – Data acquisition and display must be rapid
    > Simple display; Real time processing and display

> Projects:
  – Acoustic-based technology; Sensors on the ground
  – GPR-based technology; Sensors incorporated in the drill head

> Status:
  – Acoustic technology provided detection of pipes about 20 ft. in front of drill head; Applicable for most soils; Requires improved accuracy/repeatability
  – GPR technology detects pipes in close proximity; Good accuracy; Requires increase in pipe detection range; Issue on applicability in different soils
  – Both projects running in parallel; Potential to combine efforts into one system; Very challenging projects
Sources of Additional Information

ORGANIZATIONS
The following provides contact information for organizations that have information related to cross bores. This listing is not meant to be comprehensive but rather complimentary to this Guide and to serve as a starting point to obtain additional information:

American Gas Association (AGA)
400 North Capital Street, NW
Washington, DC 20001
Website: www.agag.org
Phone: 202.824.7000

Call Before You Clear
Sponsored by Several Utilities
Website: www.callbeforeyousee.com

Common Ground Alliance (CGA)
1421 Prince Street
Suite 410
Alexandria, VA 22314
Website: www.commongroundalliance.com
Phone: 703.836.1709

Cross Bore Safety Association (CBSA)
7424 Creektown Drive
Louisville, KY 40241
Email: info@crossboresafety.org
Website: www.crossboresafety.org
Phone: 812.719.4800

Distribution Contractors Association (DCA)
101 W. Renner Rd., Suite 460
Richardson, TX 75082–2024
Email: dca@dca-online.org
Website: www.dca-online.org
Phone: 972.680.0261

Gas Technology Institute (GTI)
1700 South Mount Prospect Road
Des Plaines, IL 60018
Website: www.gastech.org
Phone: 817.768.0500

Midwest ENERGY Association (MEA)
2119 Cliff Drive
Eagan, MN 55122
651-289-9600
Website: www.midwestenergy.org

National Underground Contractors Association (NUCA)
3925 Chain Bridge Road
Suite 300
Fairfax, VA 22030
Website: www.nuca.com
Phone: 703.358.9300

North American Society for Trenchless Technology (NASTT)
7445 Morgan Road
Liverpool, NY 13090
Website: www.nastt.org
Phone: 703.351.5252

Operations Technology Development, NFP (OTD)
1700 S Mount Prospect Rd
Des Plaines, IL 60018
Website – OTD: info@otd-co.org
Website – Cross Bore: http://www.otd-co.org/Pages/Cross-Bores---Best-Practice-and-Outreach-Program.aspx
Phone: 847-544-3400