THE SOCIAL & ENVIRONMENTAL BENEFITS OF PIPELINE ROBOTICS

ENVIRONMENTAL | SOCIAL | COMMUNITY SAFETY
Pipeline Robotics: Enhancing The Energy Customer Experience Through Responsible Innovation

Rapid technological advancements over the past several years have empowered new innovations to evolve that provide enhanced means for inspecting and rehabilitating gas pipes. ULC Robotics Cast Iron Sealing Robot (CISBOT) which serves as an exemplary embodiment of such a technology.

CISBOT is used daily in the U.S. and U.K. to internally rehabilitate joints and prolong the life of large diameter cast iron distribution mains. By operating from inside the live main, the technology significantly reduces the amount of excavation requires by utilities to replace and repair their mains.

The Hidden Financial, Social & Environmental Cost

Utility companies incur “direct costs” associated with the work they perform daily. These costs are fairly easily quantifiable and include items of work such as labor, materials, fuel, permits, excavation, restoration, and a variety of operational and maintenance costs. While budgeting/decision making for projects are typically based solely on direct costs, there are other costs that play a role—these are referred to as indirect costs.

Social and environmental costs are “indirect costs”, which are not typically recognized or calculated during planning or post-project financial assessment. Social costs include carbon emissions and pollution, traffic delays created by lane closure and detours, time and business hours lost, inaccessibility to public places, businesses, and resources, and disturbance to the public. Without the inclusion of indirect costs in the total project cost, the energy/utility industry cannot calculate the full impact of routine work performed.

The U.S. and U.K.’s natural gas infrastructure is comprised of over two million miles of pipeline that transports gas to two hundred million consumers every single day. When traditional trenching methods are considered for pipeline rehabilitation, the amount of people, materials, and time needed to inspect, maintain, and repair this massive pipeline network is staggering.

Trenching or open-cut excavation is the traditional method used to access buried natural gas pipe and involves creating large excavations in the ground. Trenching is disruptive and expensive with tremendous social impact and environmental costs. This method requires the use of heavy construction equipment to open the trench, and to then backfill the work area once the work is completed. The exact location of the pipe is sometimes difficult to determine, so excessive excavation is carried out to pinpoint the correct location of the main. Traffic delays, business closures, excessive emissions from heavy construction vehicles, and excessive noise and dust are common disruptive issues neighborhoods are susceptible to.

CISBOT enters the main through a very small opening in the street, and travels 700 feet in either direction to remediate the leak prone joints.
The Average Amount of Carbon A Motor Vehicle Emits in Traffic Due To Construction

In 2017 NY Traffic Congestion

- Cost $2.54 BILLION In Vehicle Operation & Fuel
- $20 BILLION Lost in Revenue Yearly
- Over $100 BILLION Over Next Five Years

Wastes Emitting
247 LBS CO2e
Sitting in Traffic
42 HOURS Per Year

The Average Amount of Time People Wait in Traffic Yearly Due to Construction Delays

- 20% US National Highways Covered By Work Zones
- 6,400 ROADWORK SITES
- 482 MILLION HRS OF DELAYS

Indirect & Direct Costs
- $124 BILLION In 2013 Traffic Congestion
- $186 BILLION Projected Traffic Cost By 2030

Extensive Trucking Needed to Carry in Materials & Properly Dispose Waste
Multiple Trucks Release Excessive Pollution & Greenhouse Gases
Lane Closure & Excessive Traffic Resulting in Extensive Delays
Potential Increase of Third Party Damages Resulting in Costly Repairs
Longer Construction Time & Third Party Service Surges Project Budget

https://www.nrdc.org/onearth/speed-sweet-spot
https://ops.fhwa.dot.gov/congestion_report/chapter2.htm
Con Edison, partner and customer of ULC Robotics, distributes and transports gas to over 1.3 million customers in Manhattan, Bronx, and Queens every day. In 2017 began a key pipeline rehabilitation project at the West End Avenue of New York City. Con Edison is employing CISBOT to repair joints on the West End Avenue from 93rd to 104th street and 76th to 83rd street. The 20” diameter main was installed underground in 1912 and over the years the effective seal of the joints has deteriorated and developed a history of leakage. Con Edison had a choice to use traditional methods to repair or replace the pipe but instead chose to use CISBOT.

"The robot is also less expensive than the old methods of maintaining the mains," said John Ciallella, Con Edison’s section manager for gas engineering reliability. “Hiring ULC Robotics for the work with the robot on West End Avenue cost $400,000. To do the job the way such work used to be done would have cost $1.5 million to $1.8 million.”

**MINIMIZED EXCAVATION & TRENCHING**

A single 6’ x 10’ hole is excavated on West End Avenue and sheeting and shoring are performed to launch CISBOT into the main. With the ability to repair all joints along the 1300 section of main from a single excavation site, the amount of trenching work required is orders of magnitude less than traditional trenching. Trenching would require a 6-foot wide trench dug along the entire 1300 feet length of the pipe and the entire trench would need sheeting and shoring. This amounts to the removal of nearly 1852 cubic yards of dirt compared to only 14 cubic yards for CISBOT.
**SIGNIFICANTLY LESS NOISE**

Loud noises arising from excavation negatively impact communities. Pedestrians passing by the excavation site are exposed to the noise from heavy equipment. Damage to hearing is not noticeable on a day to day basis and typically no impact is felt. However, with traditional excavation taking many weeks, prolonged exposure to repeated noise may ultimately affect their health along with the increased stress attributable to high noise levels.

Road plates used to cover excavation can serve as tripping hazards and increase safety risks to pedestrians. These plates also tend to shift when repeated vehicular traffic passes over them during non-working hours. This causes large banging noises during the overnight hours when residents are trying to sleep, along with other fall-hazards that may also result. Residents complain about the noise generated from traffic moving over road plates. While CISBOT operations require removal of 1 or 2 road plates, trenching involves removal of many road plates along the entire site, and so the number of complaints from residents tend to be much more excessive when traditional excavation is employed.

**IMPROVED SAFETY**

Another important social benefit factor that is overlooked is safety. Although distribution companies take all necessary precautions to seal off the trenched areas, the chances of mishaps are still unavoidable. Since the site footprint of Con Edison’s West End Avenue CISBOT project was significantly smaller in scale, the work site contained fewer safety concerns where the public or utility workers could be injured.

Another safety consideration is third party damage. Damage to water or gas pipes or electrical cables, for example, could result in floods, fires, explosions, or electrocution, not to mention potentially significant supply disruption to utility customers and businesses. This is more common with traditional excavation and can be almost completely avoided when using a small excavation site footprint characteristic of CISBOT work.

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**In London Every Year**

- **300,000 Holes**
- **Causing 36%**
- **Of City Traffic Delays**
- **Costing $1.3B**

For London Businesses

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**Traditional Trenching: The Disruptive & Harmful Impact**

**Heavy Construction Trucks**

Traditional excavation would have required a box truck, backhoe, dump truck, and a material truck carrying new pipe. These trucks would need to be present at the site for many days.

**Exhaust Pollutants**

The amount of vehicle exhaust emitted from multiple trucks over numerous days in the traditional case causes a much bigger impact to the environment compared to CISBOT.

**Damaging Landfill**

Trucks need to transport the soil to the landfills and new trucks must come in with approved backfill materials. This amounts to more trucks, pollution, noise, and added costs. The use of CISBOT significantly reduces the amount of soil that needs to be transported.

**Excess Debris**

Traditional methods use large water trucks to water down the whirling dust and debris on the streets and sidewalks along the entire excavation creating more pollution.

**Traffic Congestion**

Chosen lanes would have to be closed along the entire excavation length resulting in slower traffic. Contributing to increased gas consumption and pollution. Slower traffic causes lots of frustration among city residents and businesses.

**Prolonged Noise**

With traditional excavation taking many days, pedestrians may suffer repeated noise exposure which may ultimately affect their health along with the increased stress due to high noise levels.

Utilities should consider quantifying and including social costs in their economic project planning so that trenchless or low-dig technologies can be rightfully selected over traditional trenching.

Con Edison estimates that what typically takes 45-50 days using traditional methods to complete excavation can instead take just 18 days using CISBOT. Once opening up the excavation, CISBOT can travel and repair joints at high speeds allowing the work to be completed in about 18 days. Traditional excavation would have required a box truck, a backhoe, a dump truck, and a material truck carrying new pipe. These trucks would need to be present at the site for many days during excavation and repairs. Additionally, once the job was completed a dump truck and paver would be needed to backfill and restore the entire road. With CISBOT, only a dump truck and backhoe is needed during the small excavation. During repairs, only the CISBOT truck is required to perform the pipe repairs and a lifting truck is needed for approximately a day to install the launch tube. Backfilling and re-pavement are minimal to restore just the small excavated site.

**REduced Vehicle Emissions**

The amount of vehicle exhaust emitted from multiple trucks over numerous days in the traditional case causes a much bigger impact on the environment when compared to CISBOT. Reducing methane emissions positively impacts climate change and in turn the public. Climate change has been proven to cause increased intensity of storms and longer droughts. Indirect impacts to the public include increased insurance premiums, food prices, and allergy seasons.

Traditional methods generate more pollution and release of greenhouse gases. Although the soil excavated in New York City at West End Avenue can typically be reused, at other excavation sites the soil must be sent to a landfill. Trucks need to transport the soil to the landfills and new trucks must come in with approved backfill materials. This again amounts to more trucks, more pollution, more noise, and additional social and environmental costs.

**Minimal Impact on Traffic**

The West End Avenue has two parking lanes and two opposing traffic lanes. Using the CISBOT method, there is only a small diversion at a single location on the block with negligible impact to traffic. In the case of traditional excavation, two or three out of four lanes would have to be closed along the entire excavation length and each active lane would be narrowed resulting in slower traffic.

Trucks and buses tend to move the slowest through these narrowed passageways. Slow moving traffic and bumper to bumper, stop and go movement is yet another contributor to increased gas consumption and pollution. City dwellers stuck in traffic get to work later than normal. This results in lower productivity and contributes to the overall social cost of traditional excavation. CISBOT rehabilitates are typically installed at deeper depths and along main traffic arteries. This would lend to more excavation times and soil replacement, as well as more critical traffic impact if traditional methods were used.

We aim to provide the safest job sites possible for our workers and the communities we work in by integrating safety into our daily work practices and through ongoing safety training.
Pipeline robotics are being increasingly used today and will continue to evolve as the preferred means for rehabilitating pipes. Customers can directly experience the positive benefits of pipeline robotics through the improved social and environmental benefits they perceive. Utility companies, like other businesses, constantly need to enhance the customer experience.

Moreover, pipeline robotics also provide us with the means for fulfilling our social and environmental obligations. We must promote advanced technologies so that our future generations can also benefit from reduced greenhouse gases, pollution, and landfills.

Pipeline robotics should be embraced as the primary solution for rehabilitation efforts.

As a world leader in the development of no dig, low dig and trenchless technology for over 15 years, ULC constantly works to provide the most innovative and technologically advanced products and services to the gas and electric utility market sector.
ULC Robotics In-House Project Teams
Increasing Safety & Reliability With Proper Research & Development

Manufacturing, Assembly & Quality Assurance
Electrical Engineers & Sensor Scientists
Software, Firmware & Application Developers
Robot Operators & Field Personnel
Project Managers
Mechanical Engineers

ULC Has Been A World Leader In The Development Of No Dig, Low Dig & Trenchless Technology For More Than 15 Years.

30+ Miles
Leak-prone Gas Mains In The US & UK Successfully Repaired

99% SUCCESS RATE

Gas Utilities Continue To Expand Deployment Of CISBOT To:

99%
Safely & Efficiently

Committed To Solving Maintenance & Operation Problems

Reduce Cost
Minimize Carbon Footprint
Improve Customer Experience

CREATING INDUSTRY SOLUTIONS FOR THE US & UK ENERGY MARKETS
Since 2010, our team has remediated more than 30 miles of large diameter cast iron—saving our customers millions of dollars in replacement and repair costs and reducing associated disruption to the public. We are working with Con Edison, National Grid and other utilities to remediate large diameter cast iron mains using a robotic system. Instead of digging up the roads, our technology remediates these mains at a fraction of the cost.

CISBOT VS Traditional Trenching
West End Avenue Rehabilitation Project

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<thead>
<tr>
<th></th>
<th>CISBLOT</th>
<th>TRENCHING</th>
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</thead>
<tbody>
<tr>
<td>EXCAVATION SIZE</td>
<td>6ft X 10 ft</td>
<td>6ft X 1,300 ft</td>
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<tr>
<td>PROJECT EFFICIENCY</td>
<td>18 Days</td>
<td>45-50 Days</td>
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<tr>
<td>EXCAVATION WASTE</td>
<td>8 Cubic Yards</td>
<td>1,155 Cubic Yards</td>
</tr>
<tr>
<td>TRAFFIC LANE CLOSURE</td>
<td>1 Lane</td>
<td>2-3 Lanes</td>
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Extending the Usable Life of Gas Mains With Deliverable Benefits

Our Customers Treat CISBLOT As a Capital Expenditure

Tremendous Cost Savings; CISBLOT Is Approximately 80 to 85% Less Costly Than Replacement or Traditional Methods
Bushwick Avenue Rehabilitation Project

Since 2012 ULC Robotics has worked with National Grid to remediate more than 5,600 joints across their U.S. business in New York, Massachusetts and Rhode Island using CISBOT. As a key project partner in the development of CISBOT, National Grid was the first to adopt CISBOT as a business-as-usual operation, fueling the full commercial roll-out of the technology in the US and UK. In 2017 National Grid identified a 20” large diameter cast iron gas main that runs along a 13-block span of Bushwick Avenue in Brooklyn, NY that had a history of leakage and was facing excessive repairs or replacement. Traditional excavation along the roadway would require either trenching along the entire length of the gas main for direct burial replacement. This massive amount of excavation would prove to be disruptive to the residents and businesses and costly to the utility. National Grid chose to remediate the joints using CISBOT.

From 8 Small Excavations, CISBOT Efficiently Completed The Bushwick Ave Project While Delivering Community & Environmental Benefits

CISBOT TRAVELED 13 City Blocks 4276 Feet

Successfully Sealing 300+ Joints

Businesses & Residents Can Expect To Go About Their Days Normally Using CISBOT

Blocking 2 Lanes Creating Traffic Disruption During Trenching

ONLY 8 SMALL EXCAVATIONS 6'X6' Each
With CISBOT

ENTIRE SITE TRENCHED AT 4276 Feet By 3 Feet
Bushwick Avenue is lined with residential apartments and busy commercial storefronts. National Grid’s efforts to reduce disruption through the deployment of CISBOT was successful with no interruption to their gas services, allowing them to go about their day as usual.

**MINIMIZING DISRUPTION TO LOCAL RESIDENTS**

“Having worked in this industry for 27 years, you realize that roadworks affect the public when you’re digging up several holes by their homes or places of business,” says Steve Sipp, Sub. Supervisor at National Grid. “With CISBOT we are able to avoid the complaints from the public as well as DOT by keeping our footprint to one excavation site instead of six or seven per block, or even trenching corner-to-corner. Furthermore, the excavation site only takes up one lane of traffic where the work is being carried out instead of blocking two lanes of traffic.”

Heavy construction operations for pipeline replacement put a considerable burden on utility resources and require multiple vehicles and crews on the job site. Trenchless technologies such as CISBOT work to reduce the number of vehicles on site. “CISBOT also helps us keep a smaller project team,” says Sipp, “We can mitigate the need for several crews, unit trucks, excessive paving, and other costly construction related services. Overall, it’s proven to be easier to utilize in the field, more cost effective, and less disruptive to the public.”

**No Disruption Of Gas Service To Customers**

Bushwick Avenue Rehabilitation Project

8 Pits / 4276 Ft / 300+ Joints Sealed
WORKING TO KEEP LOCAL BUSINESSES OPERATING AS USUAL

Traditional replacement methods would have resulted in larger excavations—potentially blocking pedestrian access to these businesses as well as parking spots in front of the businesses. Businesses who use natural gas for cooking and heat depend on continuous gas service to keep their businesses running. Replacement would also require temporary disconnection of gas service. By using CISBOT, the gas stays on the entire time and the need for utility workers to enter homes and businesses can be avoided. “I was walking by this morning and I saw the CISBOT truck and was curious what was going on. After learning about the process, it’s astonishing to see how far we have come with technology,” says local resident David Cordero. “Working and living in this area, I have firsthand experienced having providers coming into my home to turn the gas on and off.” “I never even noticed you were there until your truck was pointed out,” one business owner stated. Additionally, a bagel store and deli on the same block said the CISBOT jobsite did not affect their business.

Game Changer For The Gas Industry

CISBOT was able to efficiently complete the project with only 8 small excavations to minimize disruption to the community.