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Midwest

DAMAGE PREVENTION TRAINING CONFERENCE



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The Beginning of the End of Crossbores

Damage Prevention Gold to be Mined from Crossbore Data

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THE ANALOG HISTORY OF CROSSBORE QA/QC

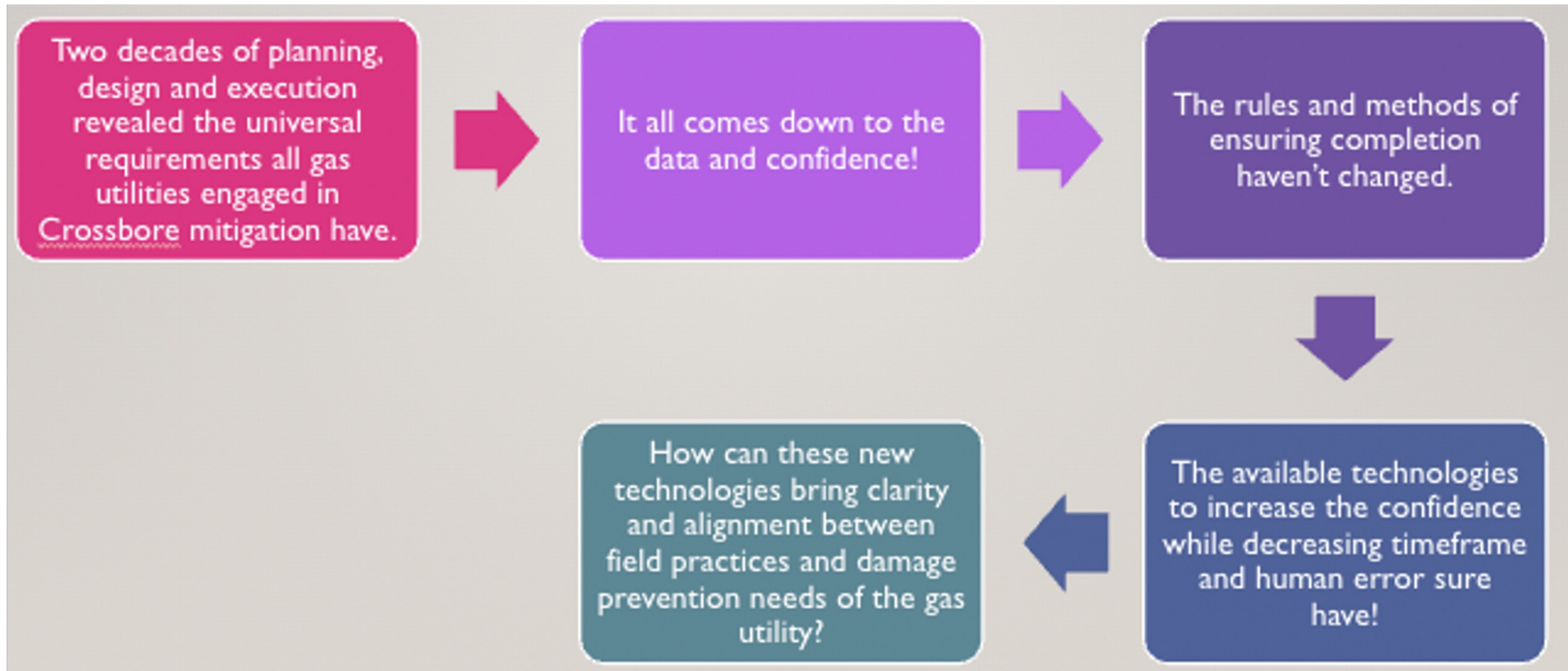
- Early Crossbore data consisted of VHS and paper spreadsheets.
- Quickly converted to digital hard copy deliverables and electronic logs.
- Earliest Legacy and New Construction quality control via retiree reviews by gas utilities internally.
- Practice abandoned early on due to lack of internal resources.
- Industry standard evolved to allow Crossbore experts to perform varying degrees of self inspection via back-office review.
- Traditionally only the largest contractors offered 100 percent review of all collected videos with varying methods of validating and database techniques.



CROSSBORE IMAGES



IN PURSUIT OF CLARITY AND ALIGNMENT



WHAT HAVE WE LEARNED?



VALIDATED, MAPPING BASED, WEB ACCESSIBLE TRACKING BY ADDRESS, PARCEL AND METER NUMBERS WORKS BEST.



CAN YOU PUT YOUR FINGER ON ADDRESS SPECIFIC INFORMATION QUICKLY AND EASILY?



DID THE SEWER INSPECTIONS CONTRACTOR UNDERSTAND THE TRENCHLESS INSTALLATION PROCESS TO THE DEGREE THAT ALL POTENTIALLY AFFECTED DRAINAGE SYSTEMS WERE IDENTIFIED AND INSPECTED POST CONSTRUCTION TO THE NECESSARY LIMITS?



DID THE INSPECTOR OR UTILITY REPRESENTATIVE UNDERSTAND WASTEWATER SYSTEMS INSPECTIONS REQUIREMENTS PERTAINING TO PROPOSED BORE PATHS IN THE EVENT THE SEWER INSPECTION CREW TECHNICIANS ARE NOT EDUCATED IN GAS DISTRIBUTION SYSTEMS?



THESE DECISIONS SHOULD NOT BE APPROVED UNTIL BACK-OFFICE, POST-PROCESSING OF COLLECTED FIELD DATA HAS BEEN COMPLETED BY ANALYSTS COMPETENT IN BOTH WASTEWATER SYSTEMS AND TRENCHLESS INSTALLED GAS DISTRIBUTION SYSTEMS TYPICALLY OVERSEEN BY A SYSTEMS MODELER AND A PROFESSIONAL ENGINEER.



THIS CUMBERSOME BACK OFFICE IS COSTLY AND ONLY THE LARGEST NATIONAL CONTRACTORS CAN ACCOMMODATE THESE BEST PRACTICES LIMITING COMPETITION AND DRIVING UP INSPECTION COSTS.



THE ELEPHANT IN THE ROOM

Not all sewer inspection contractors understand the liability associated with delivering an “all clear” status on a Crossbore project.

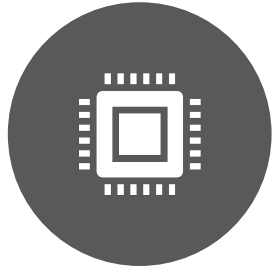
Sewer contractors are often paid by and managed by the installation contractor not the utility thus encouraging damage prevention to be overshadowed by productivity.

No entity should be both the capturing party and the safety net simultaneously.

Smaller more localized contractors typically don't possess the I.T. infrastructure or funding to post process data to the current industry standards.



NECESSITY AND INNOVATION



The advent of open-sourced machine learning and object detection software drove internal dialogue as to how this tech could increase accuracy in Crossbore data while decreasing staffing and time requirements



2016 Hixon Consultants begins coding the first-generation algorithm to identify breaches and tailor software to determine completion status of each step in legacy or new construction projects.



2017 Upon completion of legacy pilot inspections DEO staff reviews Hixon Consultants AI driven back-office QA/QC process and poses the question could this system bring higher levels of accuracy in identifying Crossbores in older legacy data.



2018 DEO staff decide to beta test using the process to track and manage all inbound Crossbore data



Process developed in 2004 in order to validate inspection data as accurate and complete

Grew organically as we designed, planned and executed the earliest Crossbore projects nationally

Designed to bring transparency and real protection to the utility through time-stamped, mapping-based, and web-accessible deliverables in real time as the installation process unfolds

Upon serving as expert witness in Crossbore-related court cases, it became apparent that the quality and airtight validation of collected data is paramount to protecting the utility and their contractors from potential punitive situations

In this particular market, human error or a single missed live Crossbore could be catastrophic

Everything comes down to the data and the ability to quickly access address-specific information to absolve the gas utility of risk





Historically, Hixon Consultants required a large back office with many analysts and systems modelers, and was managed by a professional engineer with huge costs in mirrored SQL servers, in order to perform the industry standard of 100% review of all pre and post-construction videos



Machine learning technology reached and then grossly exceeded the capabilities of the camera crews and analysts to safely and accurately arrive at an “all clear” status for every LF of potentially affected sewers within proximity of trenchless installations of gas distribution assets



Further modeling and training of the algorithm allowed object and color detection of any foreign body not typically found in gravity-fed wastewater systems, making breaches or intrusions identifiable even in poor visibility or low-lighting situations



Any frame of video the software deems less than 97% confidence factor is automatically loaded in cue for analysts to make a decision based on post review. These results are then communicated to the software, thereby further increasing its ability to differentiate between safe versus compromised pipes



The software and 4-5 staff members can now handle the entirety of most gas utility's data load, versus the 15-20 employees historically required with a nearly 78% reduction in time spent processing data



The Potential

We understood the importance and significance of this pioneering opportunity to implement our technology via Dominion and chose to work exclusively as such to ensure the process was further developed to its maximum capabilities before considering expansion

This process was designed with the mindset of easily handling the lion's share of all Crossbore data captured nationally, with minimal additions in personnel or infrastructure, to keep inspection costs low as the typical national average per lateral inspected by CCTV system is reaching \$250

This process makes the capturing party's pipeline inspection software irrelevant, as we simply need to know what should have been inspected to ensure not one Crossbore goes undetected and repaired

We are presently not working anywhere near capacity, as current staff can safely process 3-4 additional multi-state distribution companies



AI CAPABILITIES

- Currently 3rd Generation Model



Fast scanning ability -
Able to scan over 100
frames per second while
congruently scanning five
other videos



Accurate model - Over
97% accuracy



Efficient scanning with
built in Static Frame
Filtering



Capacity per GPU per
day ~ 180 videos with
1.5hr length



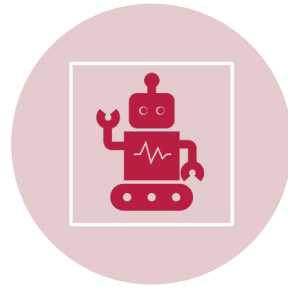
The model improves
itself over time



DID YOU SEE IT?



THIS CROSSBORE WAS ONLY VISIBLE FOR LESS THAN ONE SECOND, WHICH COULD BE EASY MISSED ON SITE.



AI REVIEW WAS ABLE TO ACCURATELY DETECT AND CAPTURE ALL FRAMES FOR THIS QUICK CROSSBORE.



MULTI-CLASS TRAINED

- Our AI model has been trained on most common objects found in sanitary lines to prevent false positives



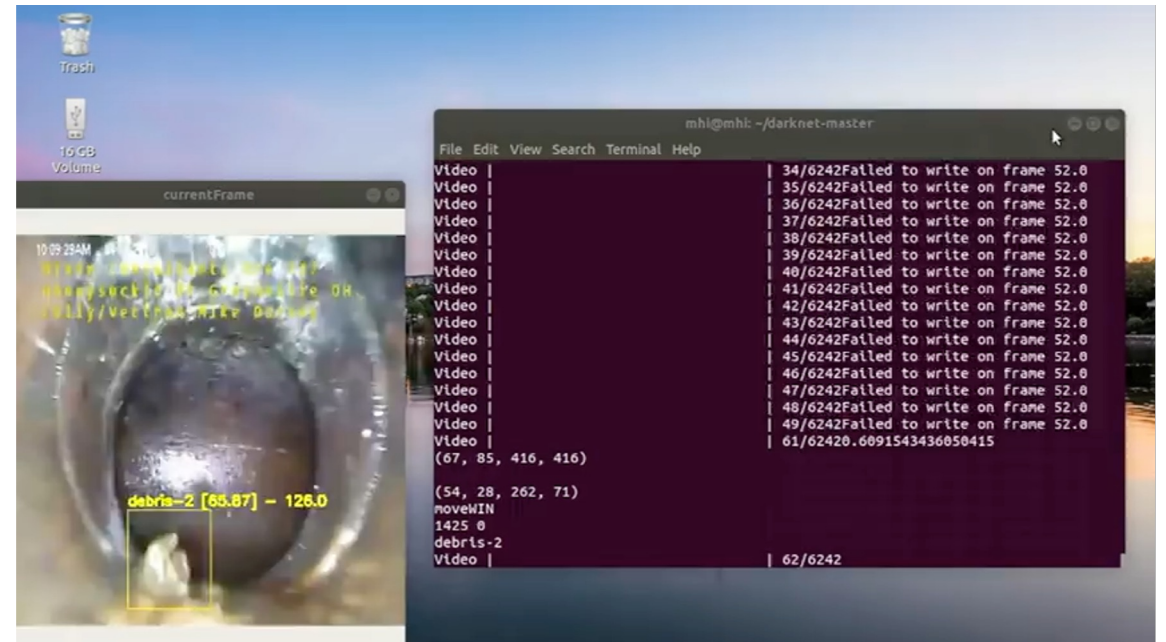
CURRENT MODEL RUNNING LIVE DETECTION



This is an output of our detection model. The lower left current frame shows what the AI model is detecting on the input video.



As the model detects objects the most recent are displayed at the top.



Video



PARTIAL BREAK CROSSBORE



IN CLOSING

It is our belief that the next logical step to solidifying Dominion Energy as the industry leader with the most state of the art damage prevention and risk mitigation technologies and practices, should include gaining control of the front end data capture processes. This can be accomplished by placing simple forms on every capturing device to ensure that the algorithm is receiving all pertinent information necessary to validate all potentially affected underground drain systems have been inspected to the proper limitations of trench less installation or upgrade activity. This system is only as complete as the information captured and entered. The next level would be aiming the superhuman capabilities of machine learning to ensure what needed to be inspected was properly assessed at the moment the camera crews are on site real time. This would also lend itself to an even higher level of mapping based AI driven deliverables the likes not achieved by any gas distribution company in the Crossbore detection and avoidance industry to date.



•Thank you!

•Questions? Comments?

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