CASE STUDY COMPILATION

4 case studies.
1 industry-transforming solution.

SewerAI

PREVIOUSLY PRESENTED AT THE
NASTT 2023
NO-DIG SHOW

The Situation

America's sewers receive a failing grade.

The American Society of Civil Engineers has given the country's wastewater infrastructure a "D" grade and operators can't agree on what the problem is, with multiple studies finding:

⇆ **40% differed** CCTV image interpretations

↓ **15% underestimation** of severity of sewer defects

↑ **20% overestimation** of severity of sewer defects

See how SewerAI turned speculation into science in these four case studies, while raising America's "D" grade to an A+.

CASE STUDY #1

Unmatched speed. Unparalleled accuracy.

CASE STUDY #1

The Problem

1k+ videos, 60+ hrs of playback time = backed up workflows.

SewerAI conducted an analysis of a dataset of 1,040 lateral inspection videos selected to measure the efficacy of AutoCode™ in detecting cross-bore conflicts of gas distribution lines with side sewer laterals.

40 videos
with known cross-bores

1000 videos
not containing cross-bores

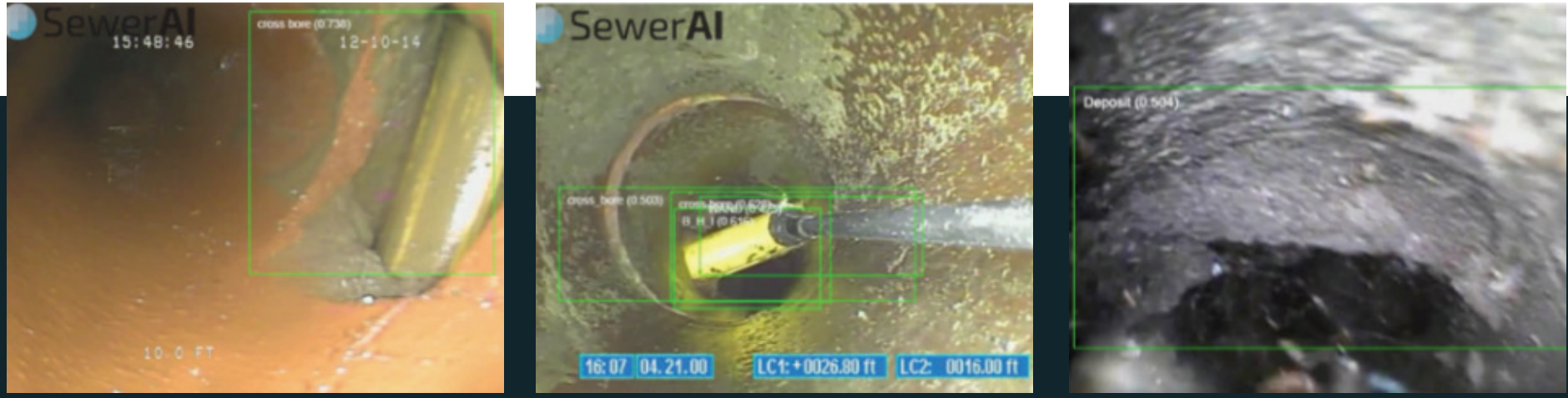
~64 hours
of combined playback time

~25k linear feet
of pipe data

The Solution

Automatic detection with AutoCode.™

AutoCode by SewerAI leverages artificial intelligence and machine learning algorithms to rapidly and accurately analyze sewer system data to detect specialized defects and conditions. In this case, AutoCode was specifically calibrated to identify cross-bores and any other regions of interest in the pipes that resemble or indicate evidence of cross-bores.



Images (left and middle) of cross-bores detected by AutoCode in CCTV sewer inspections, and on right an image overlayed with AI's prediction of a deposit defect (as opposed to "cross-bore" defect prediction).

The Results

70% less review time. 100% accurate.

39 out of 40
cross-bores were correctly identified

30% reduction
Out of the initial 64 hours of footage, the AI narrowed down the cross-bore search to 19 hours of footage (30% of the original)

70% reduction
Review time reduced by 70% from 108 to 32

97.5%
Level of accuracy before review

100%
Overall accuracy after review

AI that gets smarter with every use.

The single mis-identified cross-bore was an anomaly covered with deposits, resulting in the AI not recognizing it as a cross-bore, but instead as a “deposit” (see Figure 4).

By continuing to train the AI with additional images of defects and intervening to cross-check nuanced cases like this one, errors will not be repeated as the AI gets smarter with every use.

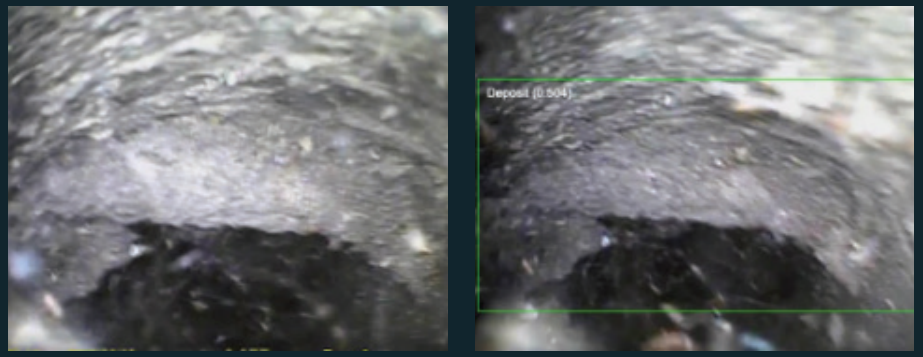


Figure 4: (left) Original image; (right) Image overlayed with AI’s prediction of a deposit defect (as opposed to “ cross-bore” defect prediction)

CASE STUDY #2

Critical tool for an essential need.

CASE STUDY #2

The Problem

A looming EPA Consent Decree pressured Houston to inspect its 6,200 mile sewer system and 129k+ manholes.

The City of Houston entered a Consent Decree with the EPA to avert the looming risk of overflow events. The City employed SewerAI's AutoCode™ to assess its accuracy against contractor submittals.

6,200-mile
sewer system

129,000+
manholes

1,500+
surveys coded by AutoCode

150
surveys coded by four different CCTV inspection contractors

CASE STUDY #2

The Solution

AI: a critical tool in repairing Houston's critical infrastructure.

To avert future sewer overflow events in the region, the City integrated AI into its assessment and capital planning workflow. The results of the citywide inspection will influence how $6 billion dollars will be spent over the next 15 years – demanding the efficiency and accuracy that only SewerAI can offer.

The Results

Houston finds AI to be 8x more accurate.

97%
avg. accuracy at properly coding identified defects

8x
greater accuracy compared to outputs from contractors

CASE STUDY #3

More detections. Less time.

CASE STUDY #3

The Problem

Water utility reports manual surveys as “highly inconsistent.”

A U.S. West Coast water utility crew assessed 200k+ linear feet of CCTV inspections using SewerAI and compared its findings with what a contractor assessed from the same pipe asset, using the same remote visual inspection data as a source.

252,302 linear feet of AI-inspected CCTV footage

192,473 linear feet of manually-inspected CCTV footage (same source)

1,278 total inspections

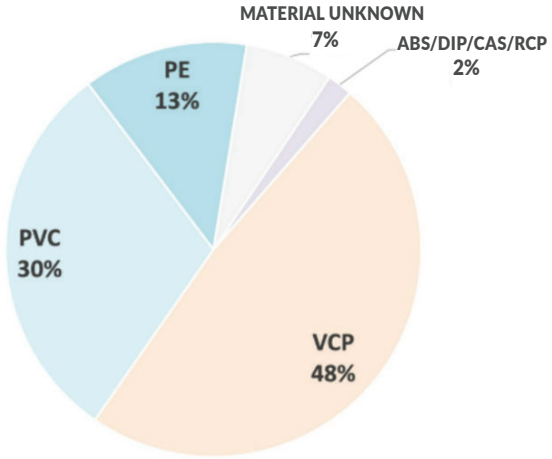
5,379 lateral (tap) connections

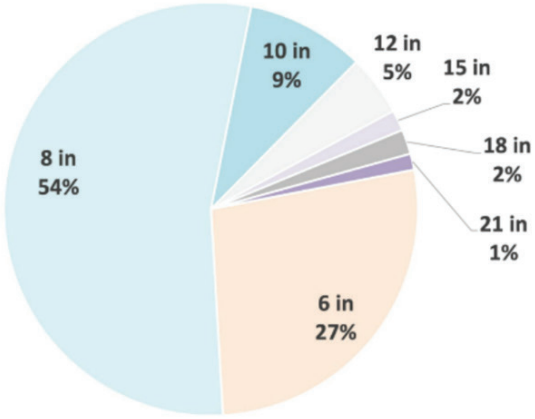
CASE STUDY #3

The Solution

AutoCode is deployed to serve and detect.

SewerAI deployed AutoCode to detect infiltration and structural defects. The Pipe Survey Comparison Index (PSCI) made it possible to quantify the consistency between the observations recorded under both methods. The dataset was comprised of a wide variety of pipe materials and diameters, shown below.





The Results

Compared to manually-coded surveys, AI-assisted surveys:

- Identified **75.6%** more groundwater infiltration defects
- Identified **42.4%** more structural defects
- Identified lateral connections missed by manual methods

CASE STUDY #4

Saving time, money, and infrastructure.

CASE STUDY #4

The Problem

Wasting more than time for wastewater professionals.

Mired in manual sewer assessments that required hours of CCTV review, a Pacific Northwest wastewater utility saw resources going down the drain. This waste in time was exacerbated by errors and misdiagnoses, which resulted in costly reactive measures. In an effort to increase efficiency and accuracy, the utility turned to SewerAI to compare its legacy efforts with SewerAI's revolutionary AutoCode assessment.

29,748
linear feet of CCTV inspections

132
total surveys conducted

CASE STUDY #4

The Solution

Establishing ground truth underground.

The assessment completed by AutoCode was also analyzed a second time by SewerAI QC staff to provide for a ground truth to compare with the manual assessments. This ensured that the result of the Pipe Survey Comparison Index (PSCI) would accurately reflect inconsistencies in findings between the two methods.

AutoCode assesses 29,000+ linear feet of CCTV inspections.

SewerAI QC staff cross-checks the findings against manual assessments.

A PSCI score is produced to signify inconsistencies between inspection methods.

The Results

AI identified 32.99% more conditions (defects and features)

AI displayed <10% margin of error, missing 90.13% FEWER conditions than manual survey

You've read the case study. Now become one.

By automating tedious, expensive, and error-prone tasks, SewerAI can help utilities, contractors, municipalities, and more achieve significant breakthroughs in CCTV inspection productivity and significant reductions in their overall inspection costs.

- 70% less review time
- <10% margin of error
- Lower chance of over/underestimating severity

- 97% avg. coding accuracy
- 32.99% more conditions found
- 42.4% more structural defects found

SewerAI also meets NASSCO, PACP™, and other industry standards and is already used around the country to serve more than 130 million people.

Work With The Leader In AI-Powered Sewer Infrastructure Management

SewerAI by the numbers:

125,775
hours of capacity unlocked (PIONEER)

$1,872,307
saved (in time saved through PIONEER)

33,000,000+ ft
of PACP (Mainline) AutoCoded (AutoCode)

23,000+ ft
of LACP (Lateral) AutoCoded (AutoCode)

31,000+
MACP (Manholes) AutoCoded (AutoCode)

**SewerAI data collected March 2024*

Inspect more pipe for less money.

Reach out to see how quickly and easily you can exponentially increase your productivity and lower your costs, while increasing the accuracy of your data.

Book a Call

SewerAI

References

- Read the original peer-reviewed paper, presented at the 2023 NASTT No-Dig Show here
- ASCE (American Society of Civil Engineers). (2017). 2017 Infrastructure Report Card, ASCE, Reston, VA. https://www.infrastructurereportcard.org/wp-content/uploads/2017/01/Wastewater-Final.pdf
- Bello, A. (2022). "Subject: Evaluation and Analysis of the use of SewerAI Pioneer Autocode system through March 4." Memorandum to: Bintuan Zhu, PE, City of Houston Public Works, Project Number: 191534.2, (March 4, 2022) https://sewerai.docsend.com/view/cbev3n7aakxxxup4
- Caradot, N., Rouault, P., Clemens, F., and Cherqui, F. (2018). "Evaluation of uncertainties in sewer condition assessment." Structure and Infrastructure Engineering, 14(2), 264-273.
- Cheng, J. C., and Wang, M. (2018). "Automated detection of sewer pipe defects in closed-circuit television images using deep learning techniques." Automat. in Constr., 95, 155-171.
- Dirksen, J., Clemens, F., Korving, H., Cherqui, F., Le Gauffre, P., Ertl, T., Plihal, H., Muller, K and Snaterse, C. (2013). "The consistency of visual sewer inspection data." Structure and Infrastructure Engineering, 9(3), 214-228. EPA (Environmental Protection Agency). (2015). Condition Assessment of Underground Pipes, < https://www3.epa.gov/region1/sso/pdfs/condition-assessment-underground-pipes.pdf> (December 1, 2020)
- Haurum, J. B., and Moeslund, T. B. (2020). "A Survey on Image-Based Automation of CCTV and SSET Sewer Inspections." Automation in Construction, 111
- Kumar, S. S., Abraham, D. M., Jahanshahi, M. R., Iseley, D. T., and Starr, J. (2018). "Automated Defect Detection in Sewer Closed Circuit Television Inspections using Deep Convolutional Neural Networks." Automation in Construction 91, 273 – 283.
- Kumar, S. S., Abraham, D. M., (2020). "Leveraging Big-Data and Deep Learning for Economic Condition Assessment of Wastewater Pipelines." The Water Research Foundation. https://www.waterrf.org/resource/leveraging-big-data-and-deeplearning-economical-condition-assessment-wastewater-pipelines
- Kumar, S. S., Sullivan, E., (2022), "Pipe Survey Comparison Index (PSCI)." (January 2022). https://sewerai.docsend.com/view/ne3um4v4dx9dkqpv
- Sullivan, E., (2022), "PSCI comparison of SewerAI vs Manual Coding for Pacific NW Sewer Utility in Single Drainage Basin." (June, 2022). https://sewerai.docsend.com/view/b8nussgtqur9cjb6
- Kumar, S. S., Sullivan, E., (2021). "SewerAI Anonymized AutoCode vs Contractor Comparison - West Coast Water Utility - 2021" (July 8, 2021). https://sewerai.docsend.com/view/tiek7yqdvwqzeu8f
- Kumar, S. S., Sullivan, E., (2021). "Time and Accuracy Analysis of AI-Assisted Utility Cross Bore Identification in Sewer Lateral CCTV Data." (January, 2021). https://sewerai.docsend.com/view/qjs62q6e33csem3t
- Kumar, S. S., Sullivan, E., (2020). "Case Study on Productivity Increases in CCTV Inspection Through an AI-Enabled Workflow." https://sewerai.docsend.com/view/np5e5irs3vqr6i8p
- NASSCO's Pipeline Assessment and Certification Program manual (2023), Reference Manual, Imperial Edition, v7.0.4
- Navab-Kashani, R., Gay, L., and Bayat, A. (2019). "Experimental and numerical study on production rate in sewer mainline video inspection." Journal of Pipeline Systems Engineering and Practice, 10.1061/(ASCE)PS.1949-1204.0000373.