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AI Case Studies in Sewer Inspection and Pavement Assessment

Thursday, July 24, 2025

- 11:00 a.m. - 12:00 p.m. ET
- 10:00 a.m. - 11:00 p.m. CT
- 9:00 a.m. -10:00 a.m. MT
- 8:00 a.m. - 9:00 a.m. PT

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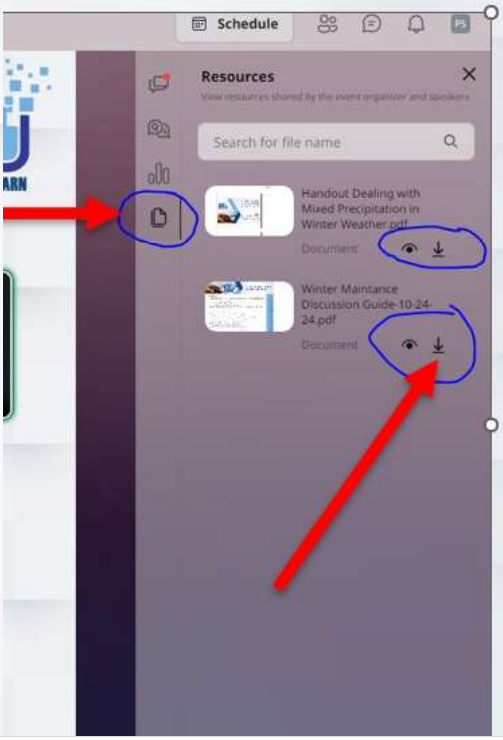
Handout for Today's Program can be download from the right-hand chat panel.



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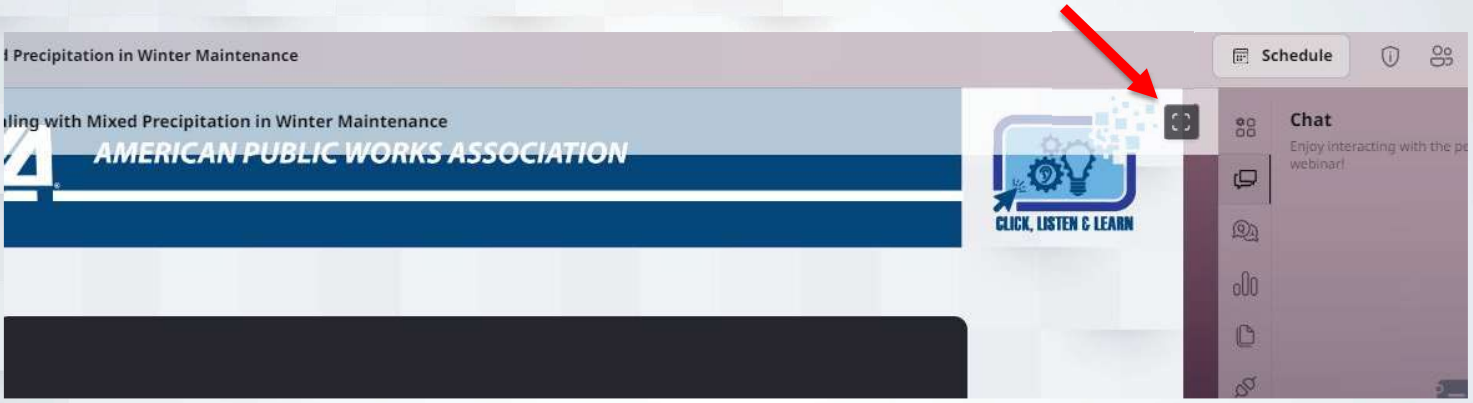
Viewing the Presentation



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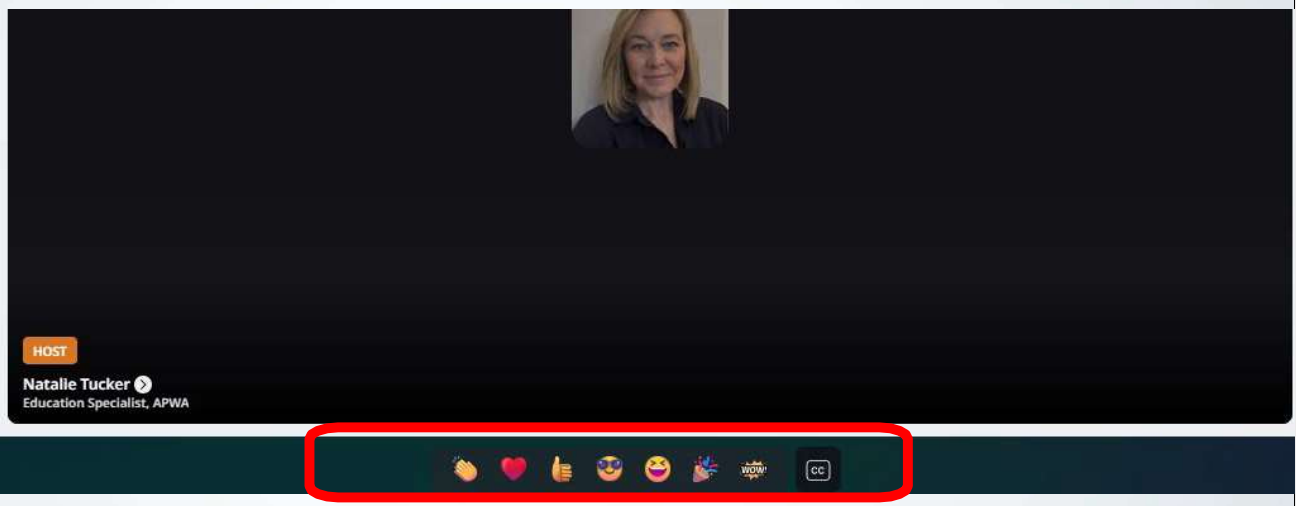
Communication & Engagement Opportunities

Reactions



Program Questions

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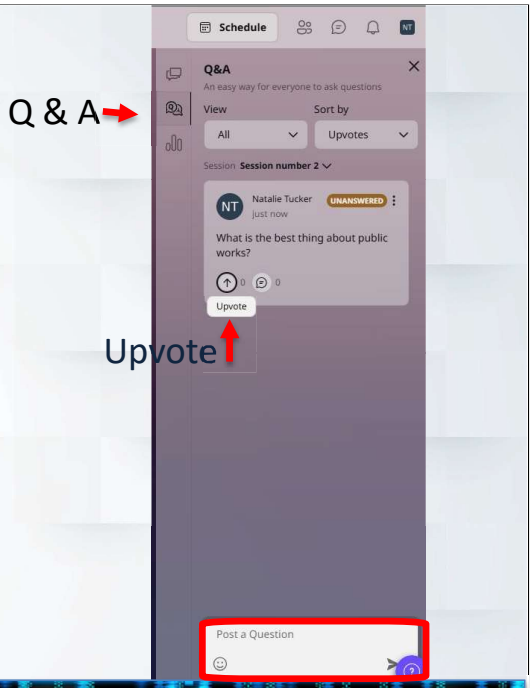
2. Choose to Upvote a question that is the same as your question.



Margaret Medellin

Associate Vice President

Hazen and Sawyer

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Get Involved with APWA

Nominations to join an APWA knowledge team or subcommittee are considered year-round. Share your interest via the QR code below.

Learning Objectives

After completing this course, participants will be better able to:

- *Identify resources needed to implement AI tools in the field, including budgets, training, and staffing.*
- *Apply AI tools across three key phases-implementation, assessment, and design.*
- *Determine the suitability of AI technologies for your project workplace.*

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Poll Questions

Tim Plath

Deputy Public Works Director

Egan, Minnesota

Ahmad Soufiani
Senior Engineering Manager
The City and County of Denver

Brian Zavarah
PhD Candidate
University of Colorado Denver

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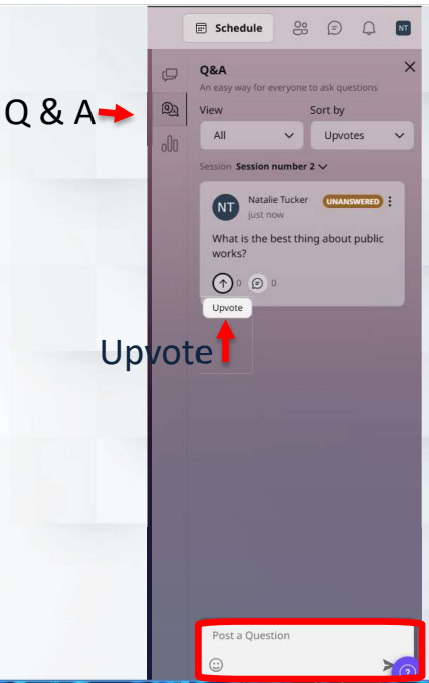


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Please join us in the virtual lounge for continued discussion
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AI in Pavement Assessment
APWA
EAGAN
Tim Plath, PE, PTOE
Eagan, Minnesota

Eagan at a Glance

- 2nd ring Twin Cities suburb
- Population: 68,500
- 36 square miles
- 244 centerline miles of streets
- 152 miles of trails and sidewalk

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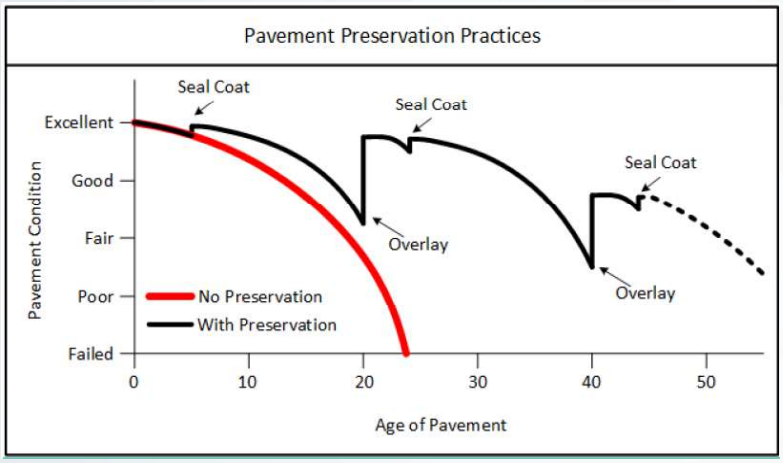
Pavement Management Plan



- Eagan has had a pavement management plan since 1989
- Goal: Citywide PCI (ASTM standard) of 75 (average)
- Valuable for financial and project planning ($103M completed since 1990)
- Develop resident support

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Pavement Data

- 2,398 City-owned pavement segments
  - 3-year PCI inspection cycle (1/3 of the City per year)
  - Bituminous trails are also inspected
  - Upcoming CIP project areas are inspected yearly

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Current Pavement Inspection Process

- Staff member walking/driving each road segment
- Measure and calssify distresses
- Enter data into AM System

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The Search for Streamlined Inspections

- First looked into AI PCI inspections in ~2021, but felt that the technology wasn't meeting our needs
- Looked at AI again in 2024

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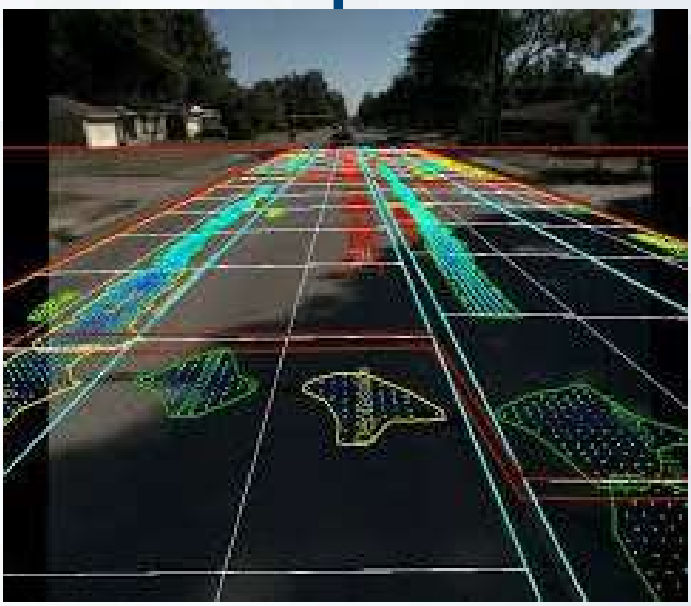
The Search for Streamlined Inspections

Three vendors contacted:

- Roadly and RoadAI are cell phone video-based programs
- Goodpointe partnered with a company that uses a rooftop-mounted LiDAR



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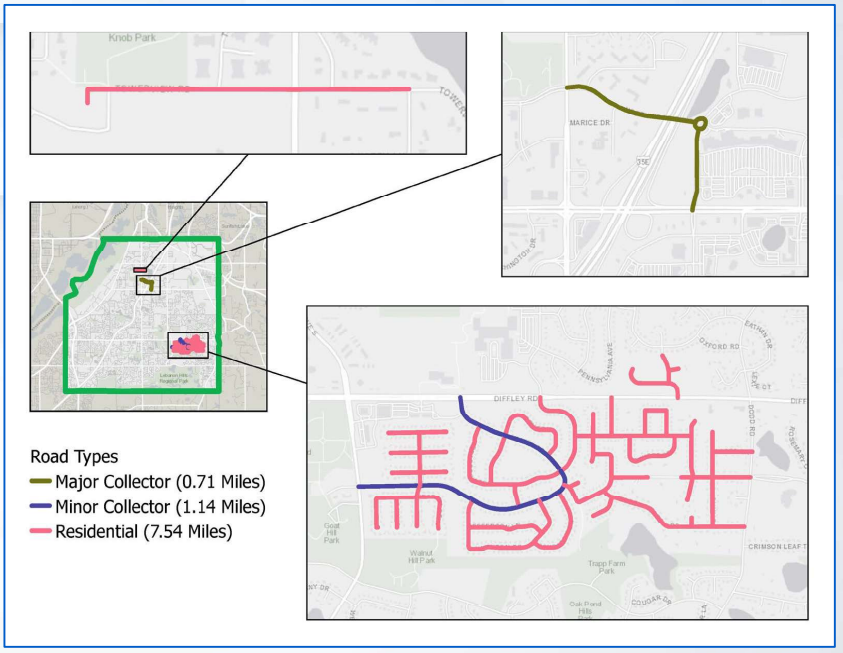
The Test Area

A mix of conditions and features like cul-de-sacs, a roundablout and roads with medians

An Eagan staff member manually inspected the test areas an assigned PCI scores as baseline.



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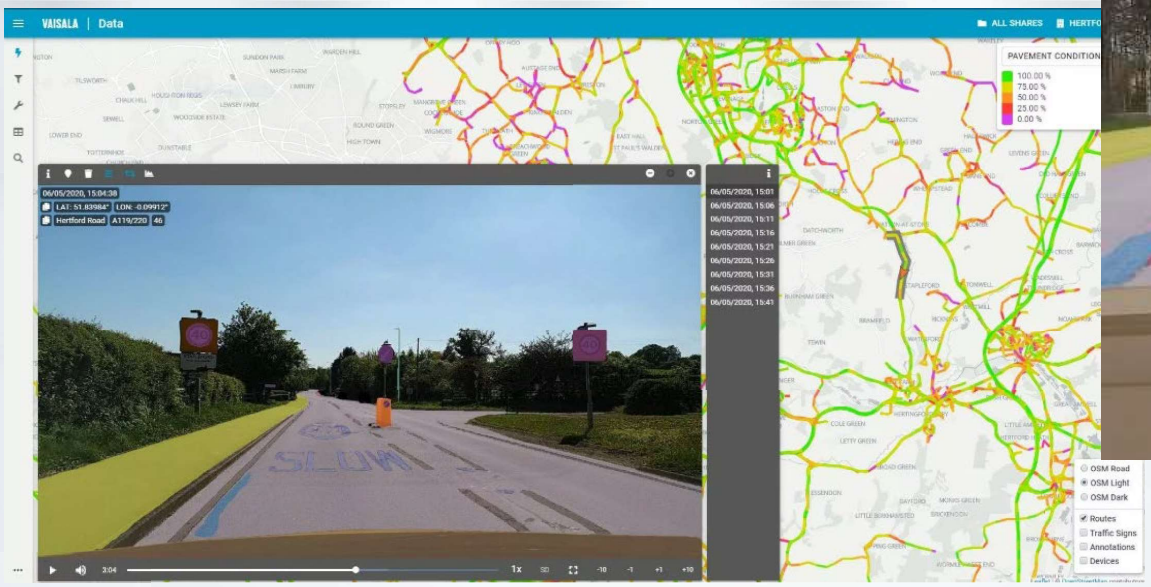
Cell-Phone Based Programs



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LiDAR Based Programs

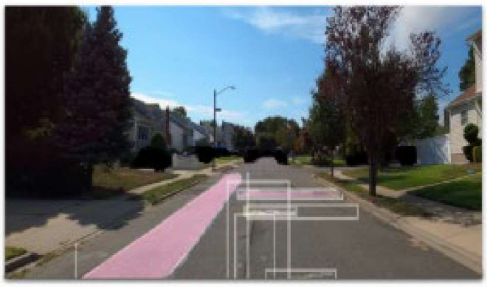

Image-based Distresses

- Alligator cracking
- L&T cracking
- Block cracking
- Edge cracking
- Patching, utility cuts

3D Surface-based Distresses

- Rutting
- Putoles
- Distortions
- Depressions
- Bumps & sags

Condition	
86 - 100	
71 - 85	
56 - 70	
41 - 55	
26 - 40	
25 - 11	
0 - 10	

The Cyvl.ai Pavement Condition Solution with LiDAR and Street View Imagery

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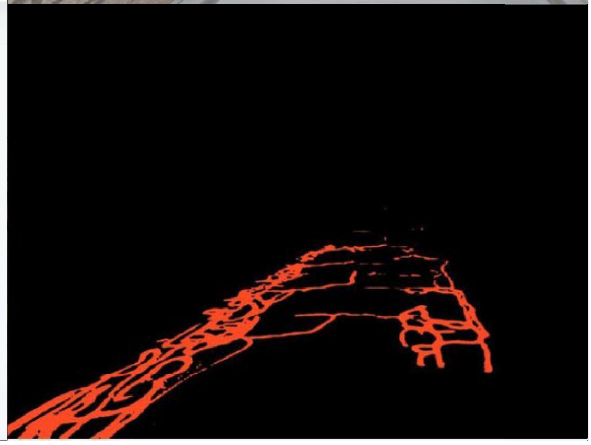
Goals of the AI Test

- Not expecting a perfect match to the scores in the human baseline
- Looking for a match in trends
- Accurate distress identification



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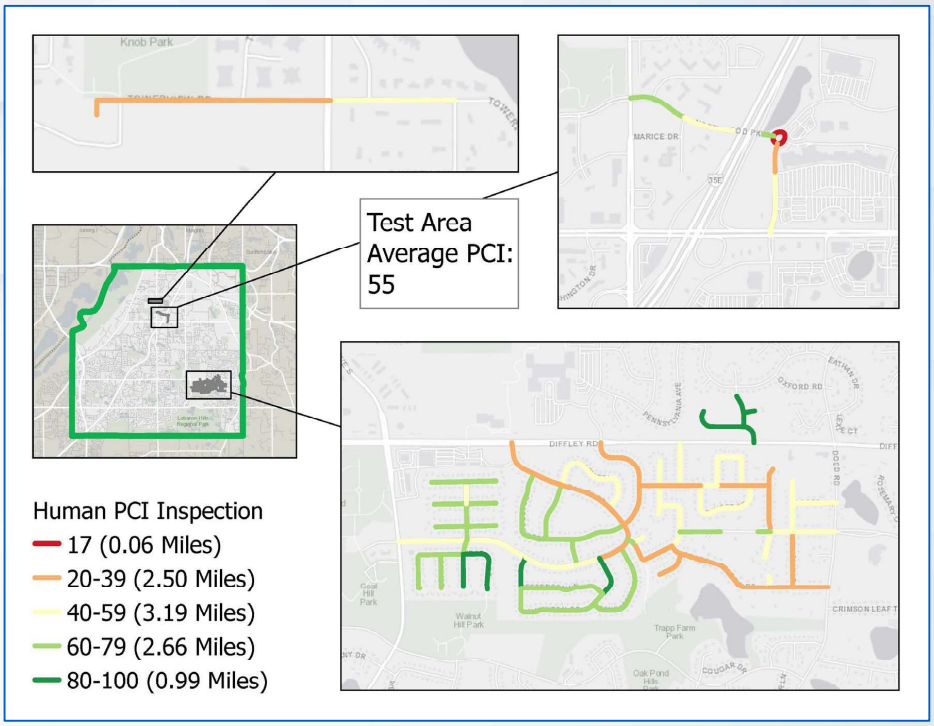
Results – Eagan Baseline

- 0-100 PCI score (100 being perfect condition)
- Eagan results generally had an overall lower PCI



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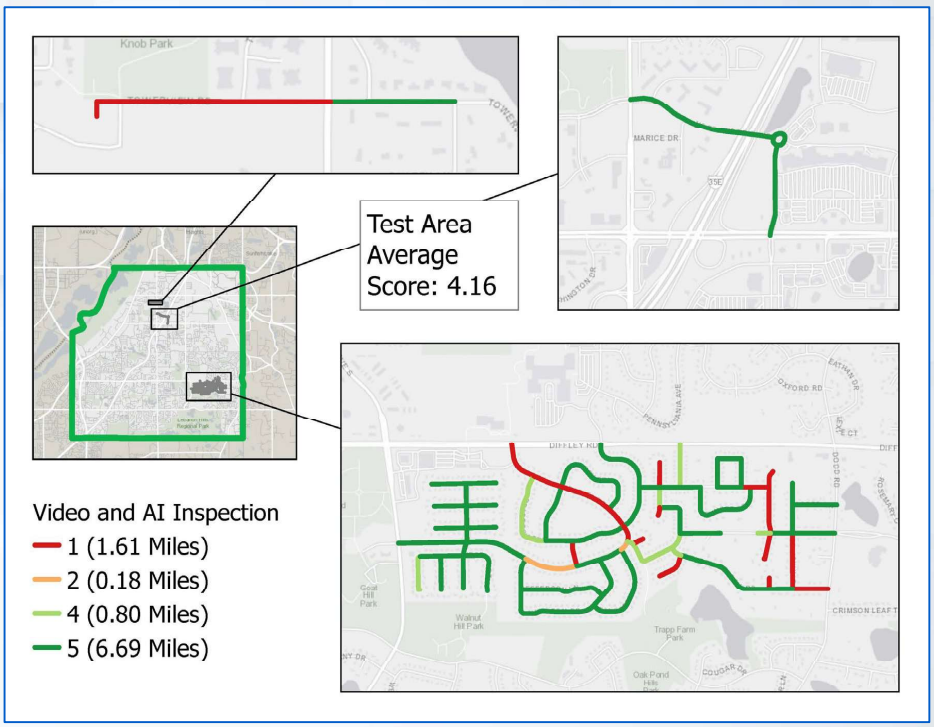
Results – RoadAI

- 1-5 score (5 being good condition), with report showing type and quantity of damages
- Results were ready in the dashboard just hours after collection
- Dashboard was user-friendly and provided video, scores, and data download options



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Results – Goodpointe

- 0-100 PCI score, (100 being perfect condition) with report showing type and quantity of damages
- Results took a few weeks to process and were provided in a spreadsheet
- Dashboard to view data is available, but wasn't part of this demo

Side by Side Results

LiDAR AI Inspection

20-39
40-59
60-79
80-100

Baseline (Human) Inspection

0-19
20-39
40-59
60-79
80-100

Video AI Inspection

1
2
4
5

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Eagan's Decision

- Eagan preferred the LiDAR and AI solution
  - Eagan has a longstanding pavement condition program and is comfortable with lots of detailed data and data synthesis
- The video option also provided good data, was easy to use, and was lower cost

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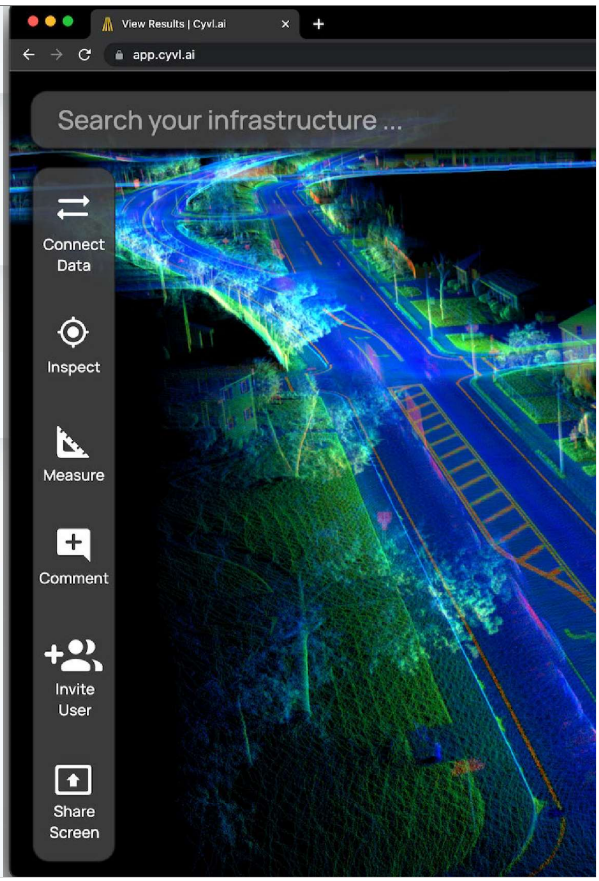

Thank you!

Tim Plath
City of Eagan, MN
651.675.5643
tim.plath@eaganmn.gov

AI-Sewer Pipe Inspections and Beyond

Denver Wastewater Management Division

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DENVER TRANSPORTATION & INFRASTRUCTURE

Welcome & Introduction

Introducing:

Ahmad Soufiani
Senior Engineering Manager

Zeke Zarco
Director of Operations

Brian Zavareh
PhD Candidate at BDLab, University of Colorado Denver

Farnoush Banaei-Kashani, PhD
Associate Professor of Computer Science and Engineering
Director of Big Data Laboratory (BDLab), University of Colorado Denver

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PLAN – DESIGN – BUILD – OWN – OPERATE – MAINTAIN – REGULATE - ENFORCE

CAPITAL
(60± FTEs)

- Plan
- Design
- Build/Deliver

OPERATIONS
(190± FTEs)

- Systems Maintenance
- Television
- Quality Control
- Laboratory
- Construction Operations
- Water Quality

ADMIN
(60± FTEs)

- Customer Service
- Accounting
- Support Services
- Safety

ROWS
(62± FTEs)

- Survey
- Inspection
- Development Services
- Engineering & Regulatory

320± FTEs

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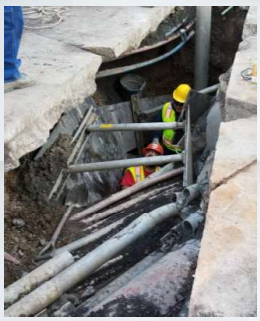
Inventory Management - Sanitary



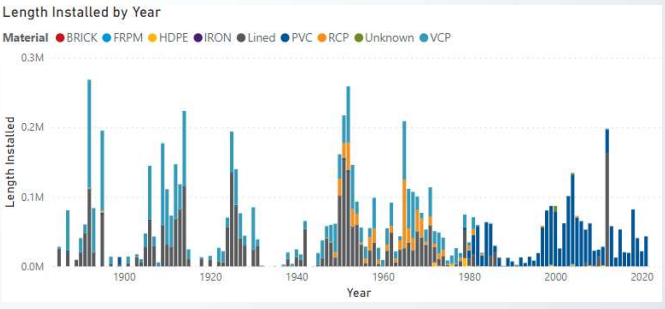
1,564 miles of sanitary pipe

36,188 Manholes

4,206 Pre-treatment facilities

7 Pumping stations

Treatment and some transmission is owned and maintained by Metro Water Recovery



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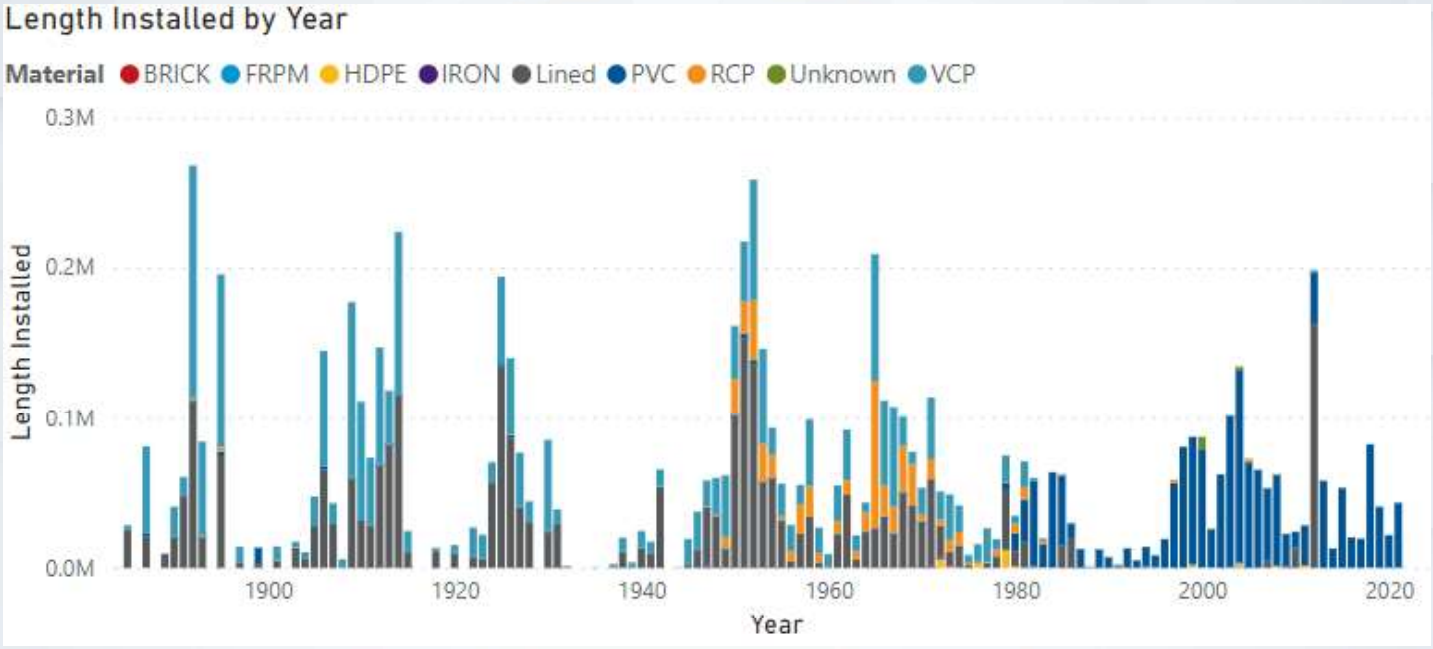

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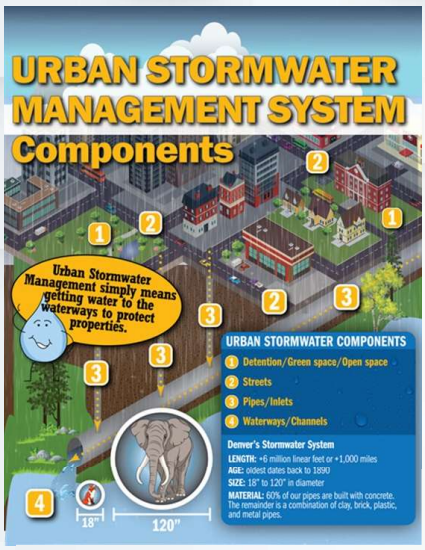
Inventory Management - Stormwater



- **864** Miles of storm pipe
- **24,043** Catch basins
- **16,819** Manholes
- **48** Miles of South Platte and tributaries
- **86** Miles of ditches and channels
- **32** Detention ponds
- **339** Siphons
- **199** Green Infrastructure Facilities
- **8** Pumping stations

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Condition Information

- National Association of Sewer Service Companies (NASSCO)
  - Condition assessment standards for pipes, manholes and laterals
  - Run Pipeline Assessment Certification Programs (PACP)
  - Scores individual structural and maintenance defects from 1 (Good)-5 (Bad)

1
Minor Defect

5
Major Defect

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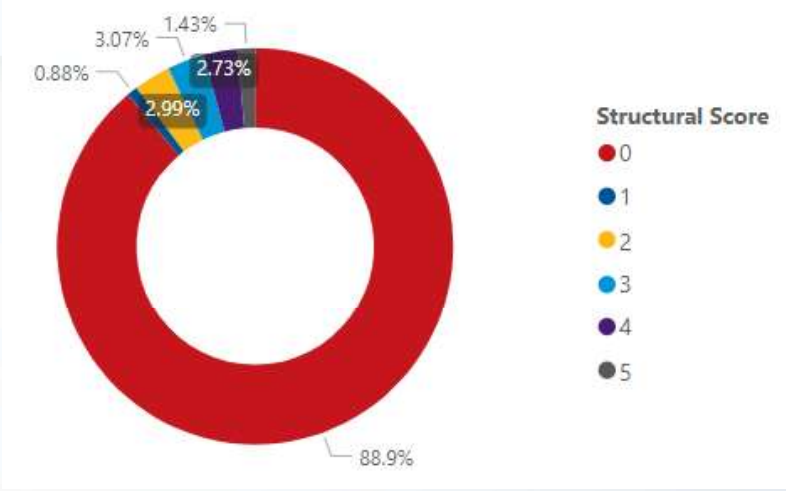
Current Condition Sanitary

- Pipes assessed approximately every 8 years
  - 58% with condition
  - Average age of sanitary system is 65 years.



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DOTI/CU Denver Collaboration on AI for Sewers

- SIPA Grant Awarded
- 3 Phases of Project
  - AI Pipe Defect Detection
  - Deterioration Forecasting
  - Work Order Optimization

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Data Insights and System Complexity

REC

26,223 Video Records (5.6 TB)

900 Miles Surveyed (2018-2024)

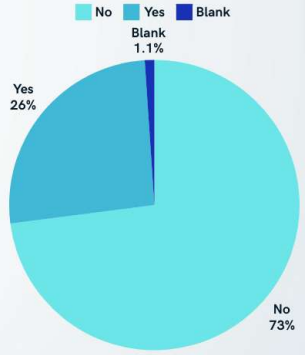
2,553 Complete Inspections/Year

Total Number of Condition Codes: **276,394**

Unique Condition Codes: **169** out of **249** possible

Condition Code	Description	Count	%
TF	Tap, Factory Made	53,187	21.07%
AMH	Access Point – Manhole	43,949	17.41%
TFC	Tap, Factory Made: Capped	36,356	14.40%
TS	Tap, Saddle	29,692	11.76%
MWL	Water Level	27,731	10.99%
TB	Tap, Break-in / Hammer	19,710	7.81%
MSA	Survey Abandoned	8,446	3.35%
MGO	General Observation	5,676	2.25%
MGP	General Photograph	3,630	1.44%
TFD	Tap, Factory Made: Defective	3,112	1.23%
FL	Fracture Longitudinal	3,002	1.19%

Maintenance Requirements



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Current Challenges in Sewer Maintenance

Manual Processes

Lengthy Inspections

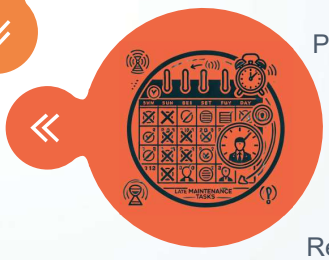
Labor-intensive Inspections

Inconsistent Defect Detection

Human Error

Inconsistent Expertise

Redundant Pre-scheduled Plans



Inefficient Scheduling

Excessive Reactive Maintenance

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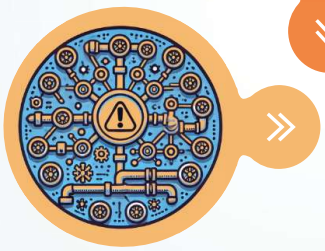
Inefficiencies in Today's Maintenance Practices

High Costs

Limited Scalability



Delayed Repairs and Reduced Lifetime

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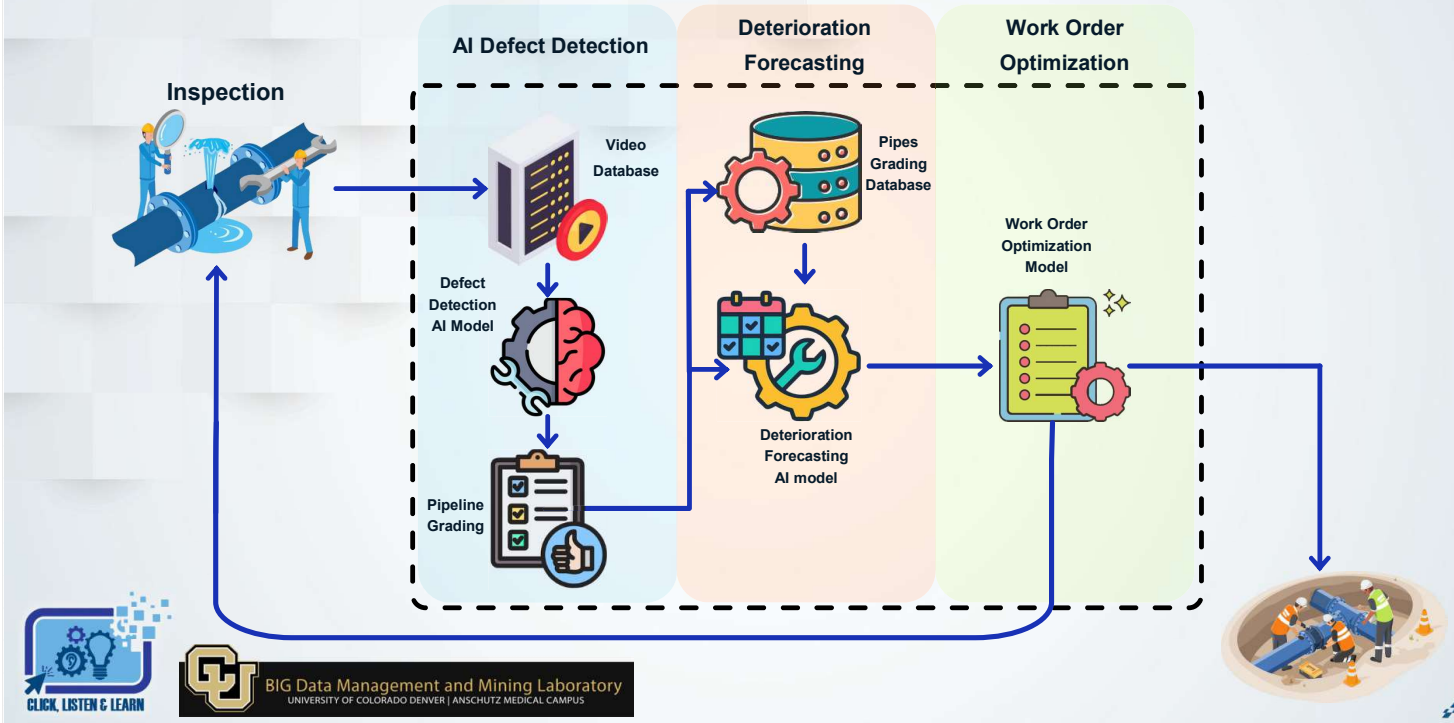
How Our Solution Works



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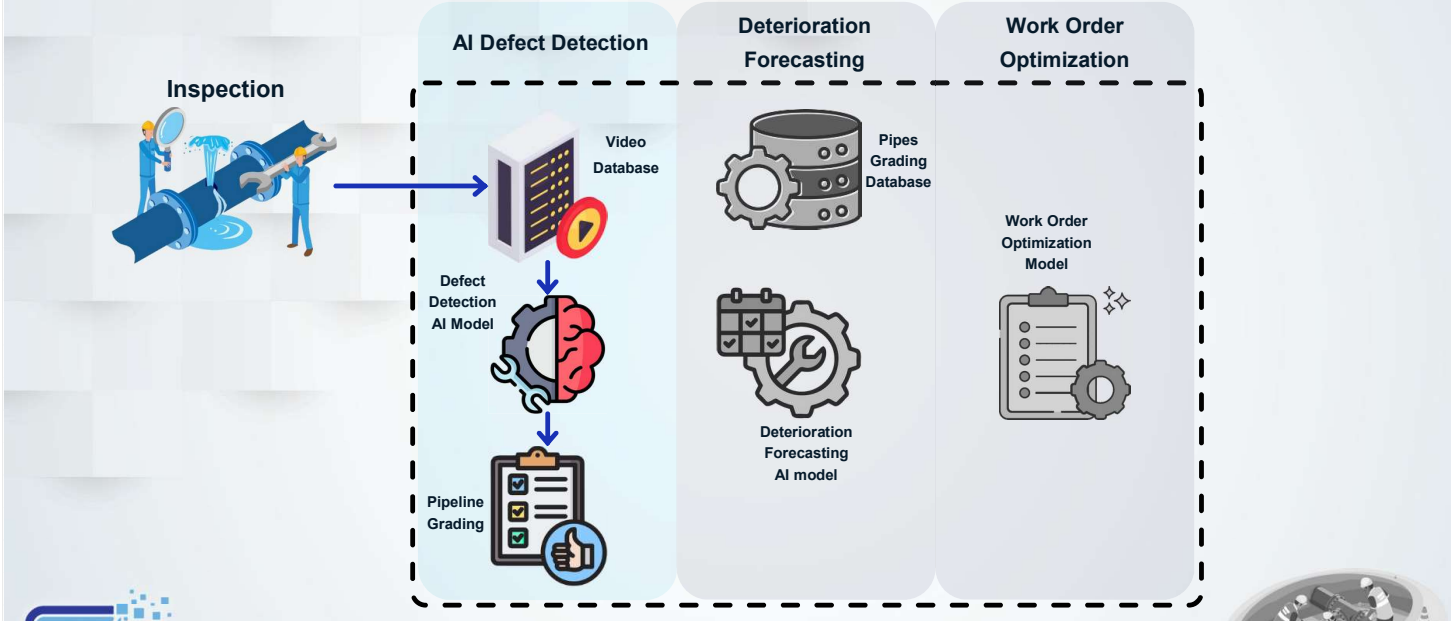
Current Development Status (SIPA Grant)



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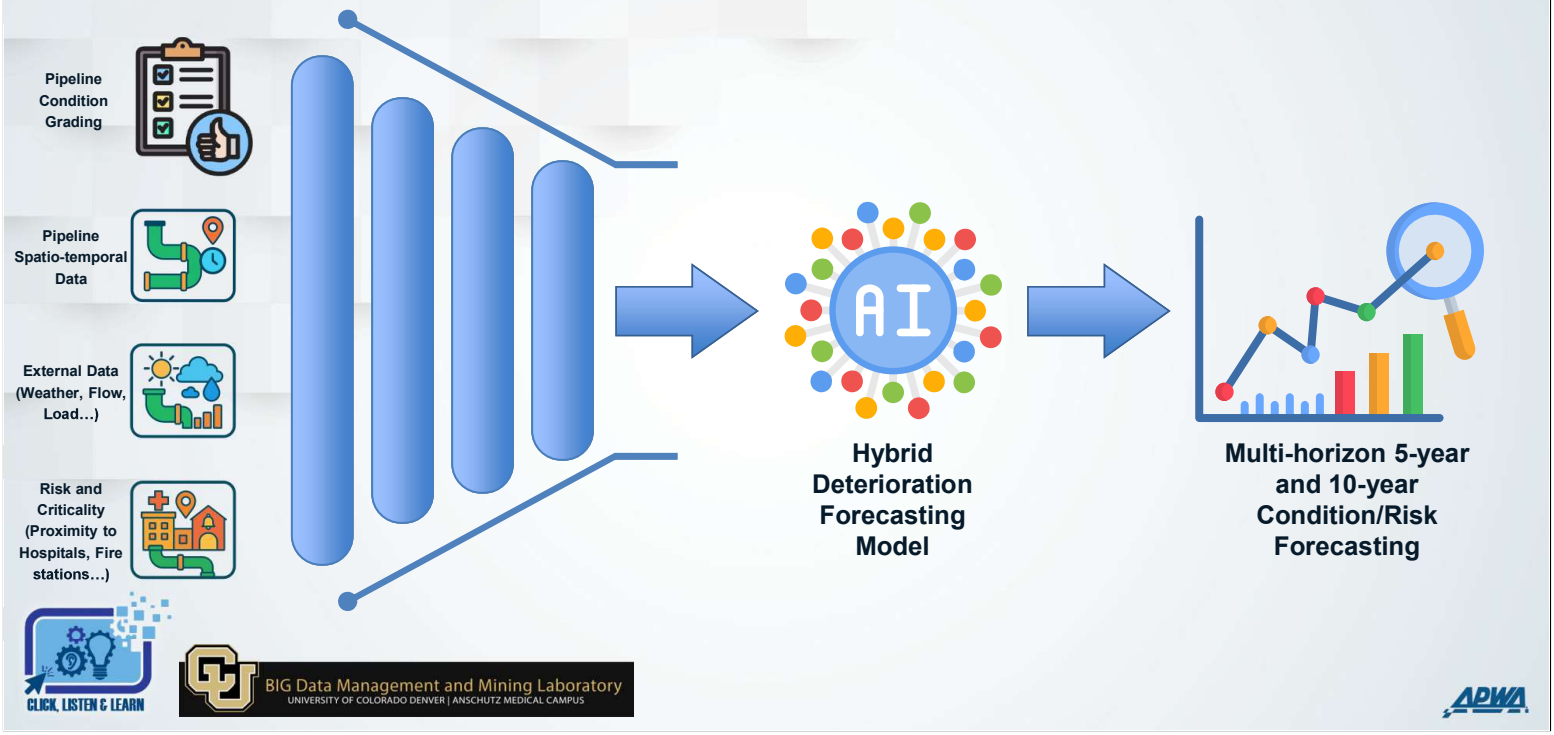
Deterioration Forecasting And Risk Assessment



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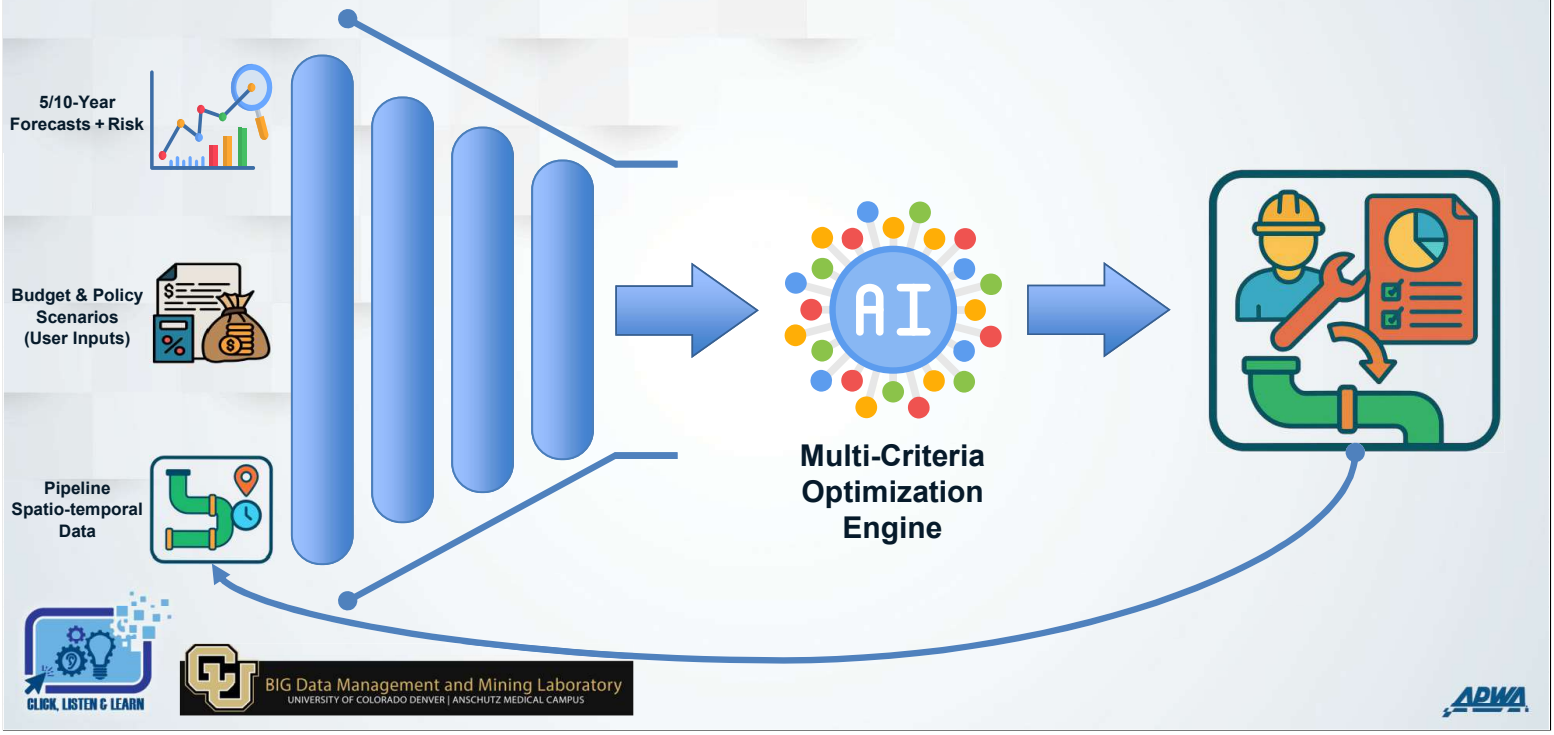
Dynamic Work Order Optimization



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"The art and science of asking questions is the source of all knowledge."

Thomas Berger

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