JRA2 Evaluation of assets and deterioration impacts

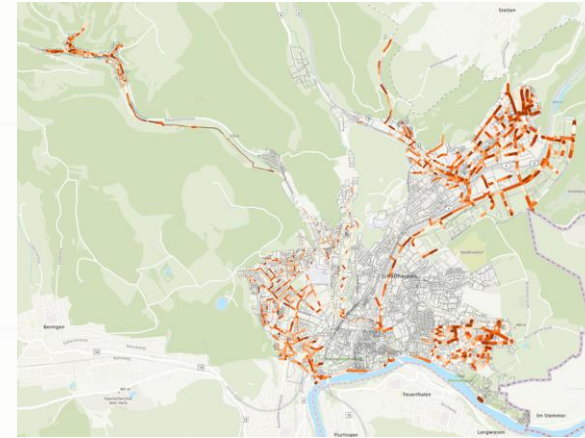Simon Tait, University of Sheffield

Co-UDlabs

Introduction

o Asset Inspection – evaluation of defect identification and condition classification

o Deterioration estimation and understanding of mechanisms

o System performance and impacted caused by asset deterioration

Japanese video much higher quality


European video much more variable quality

Network deteriorate and system performance

Automated Defect Identification

Label	Label Name	Map to classifications in Table 1.
Obstacle – Block	ObsPlc	Measure size of obstacle after DL detection
Obstacle – Tree Root	ObsRot	Measure size of obstacle after DL detection
Obstacle – Sediment Deposition	ObsDep	Measure size of obstacle after DL detection
Joint	Jnt	Measure thickness of joint after DL detection
Crack	Crk	After DL detection, count number of cracks in the image and measure size and position of them
Damage – Hole	DmgSev	Directly mapped
Damage – Severe (Broken, Collapsed)	DmgSev	Measure / compare cross-section of pipe after DL detection
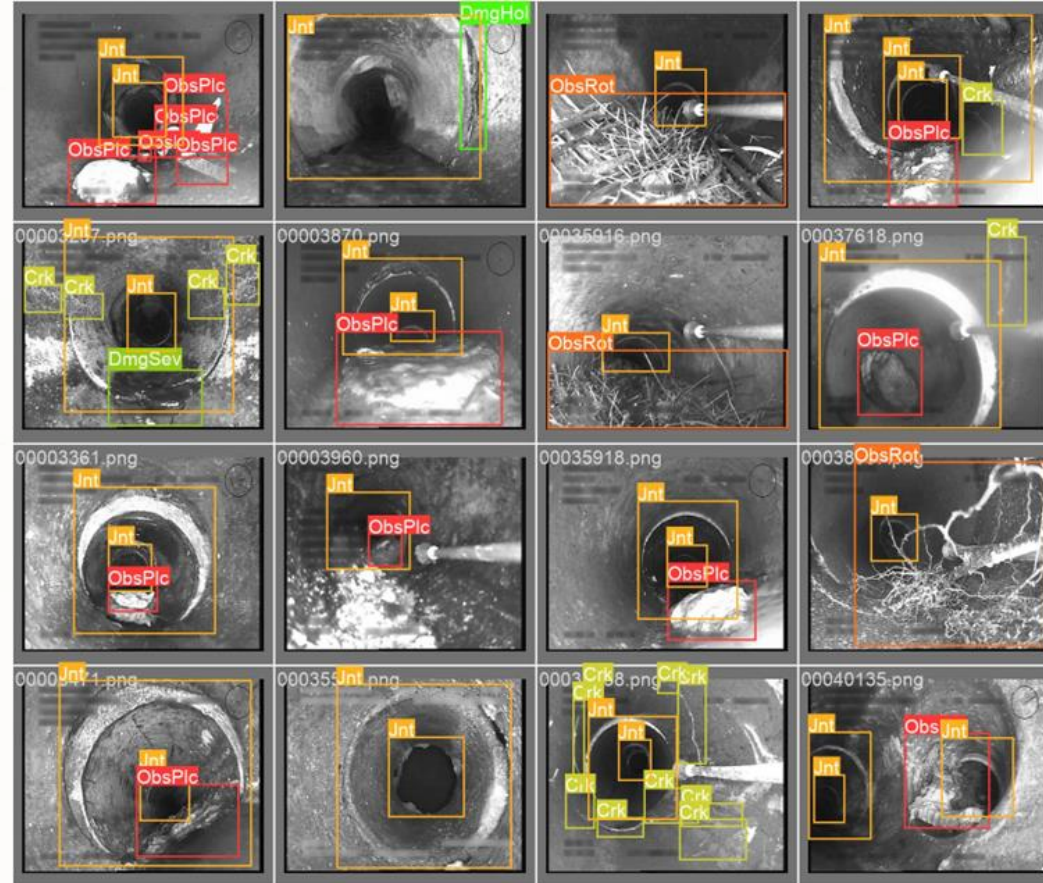
Open-source code and labelled images

Defects and System Performance

Data preparation
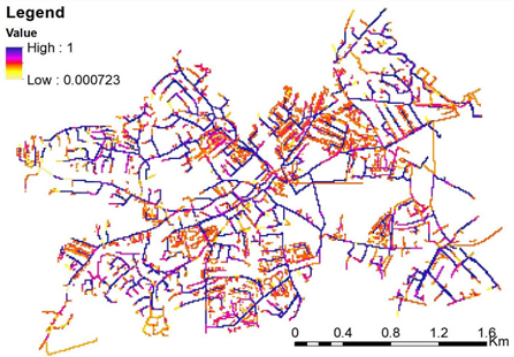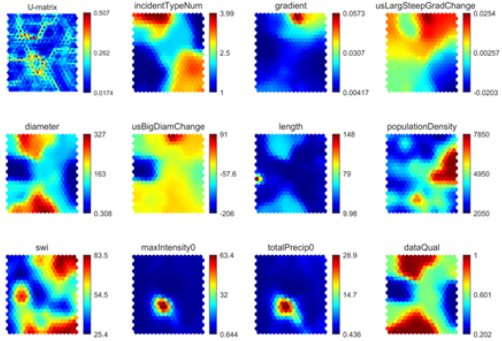
Identification of major relationships

Estimation of risk of pipe incidents

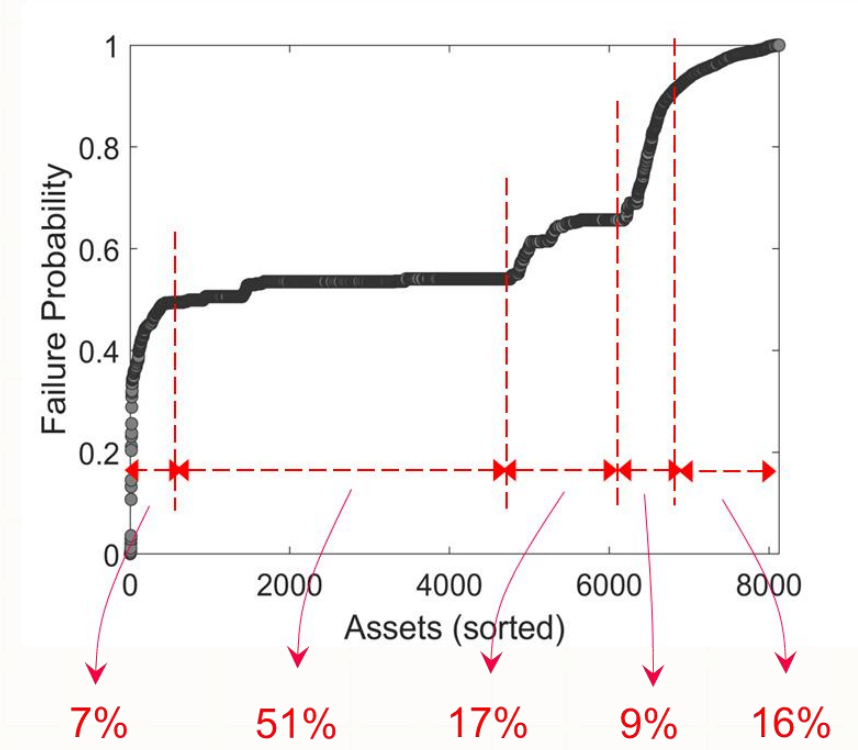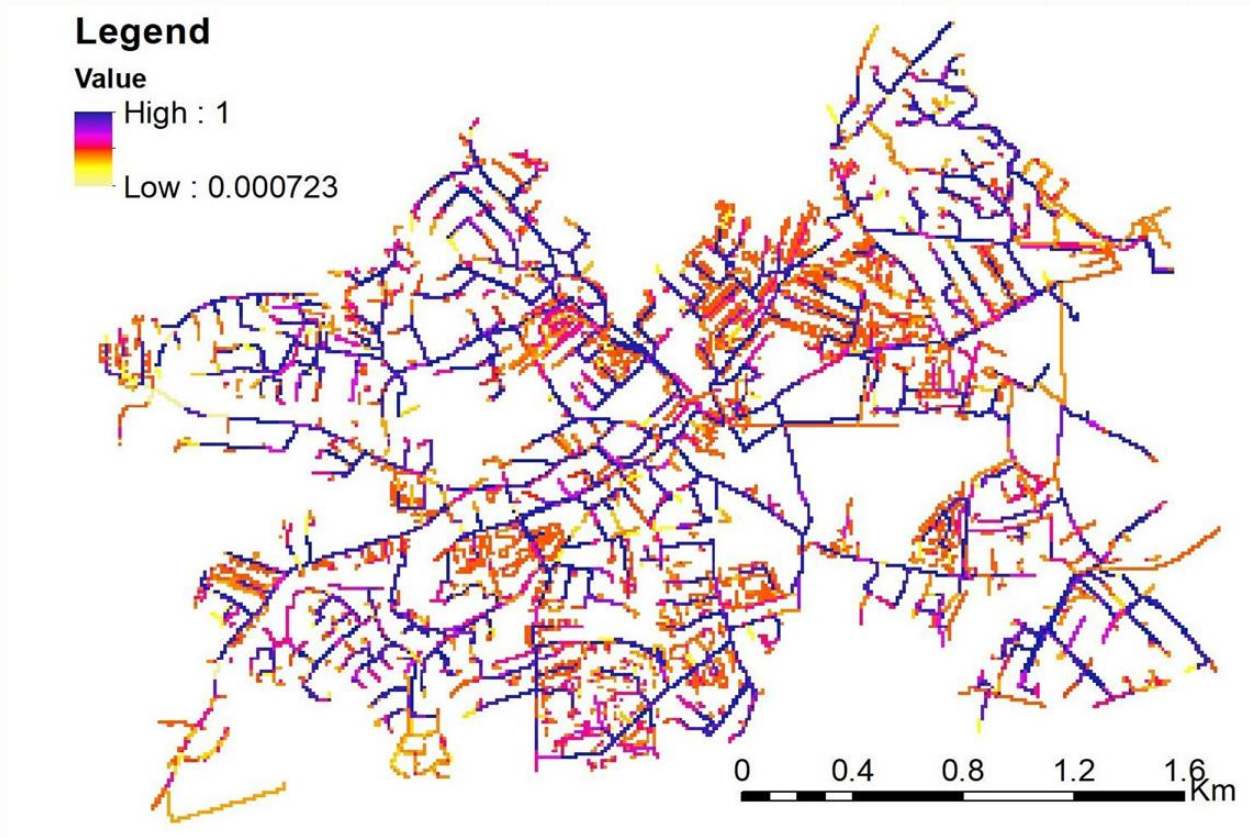Data from various sources

Self Organising Map

Supervised ML

- ✓ Asset inventory
- ✓ Pipe failures records
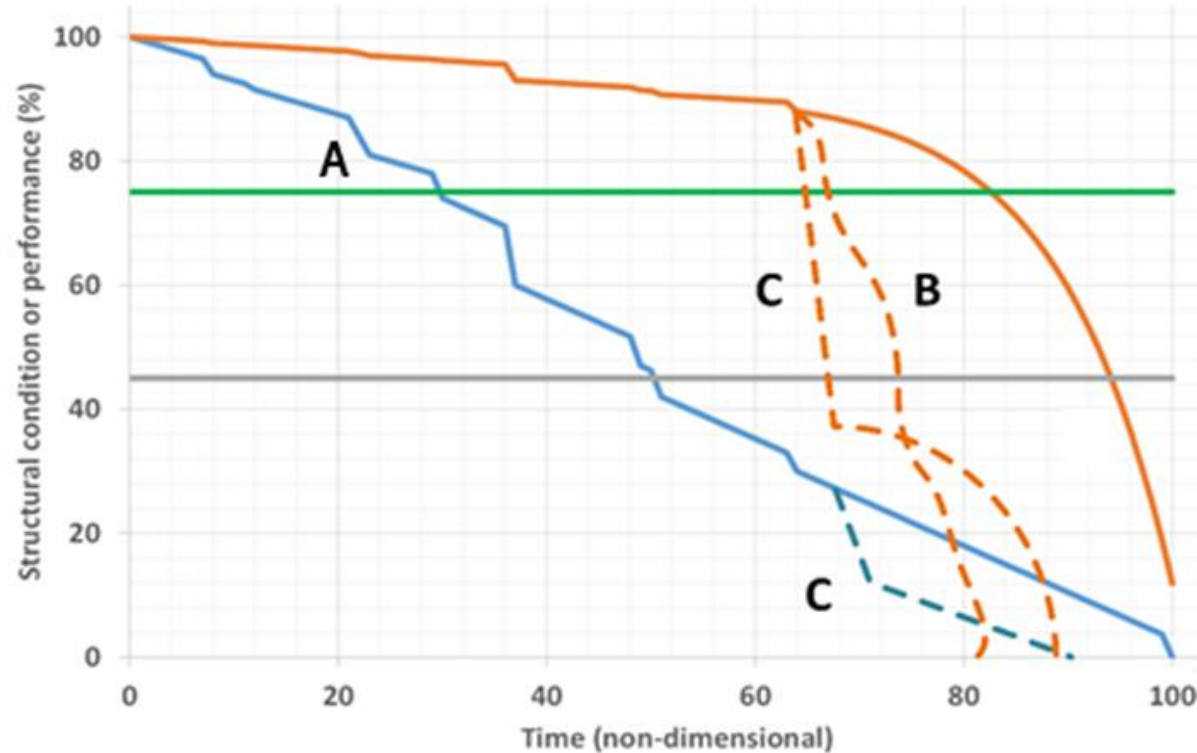- ✓ Met Office Rain Radar Data

The risk relationship can be used to plan pro-active inspection and ensure more focussed risk-based maintenance
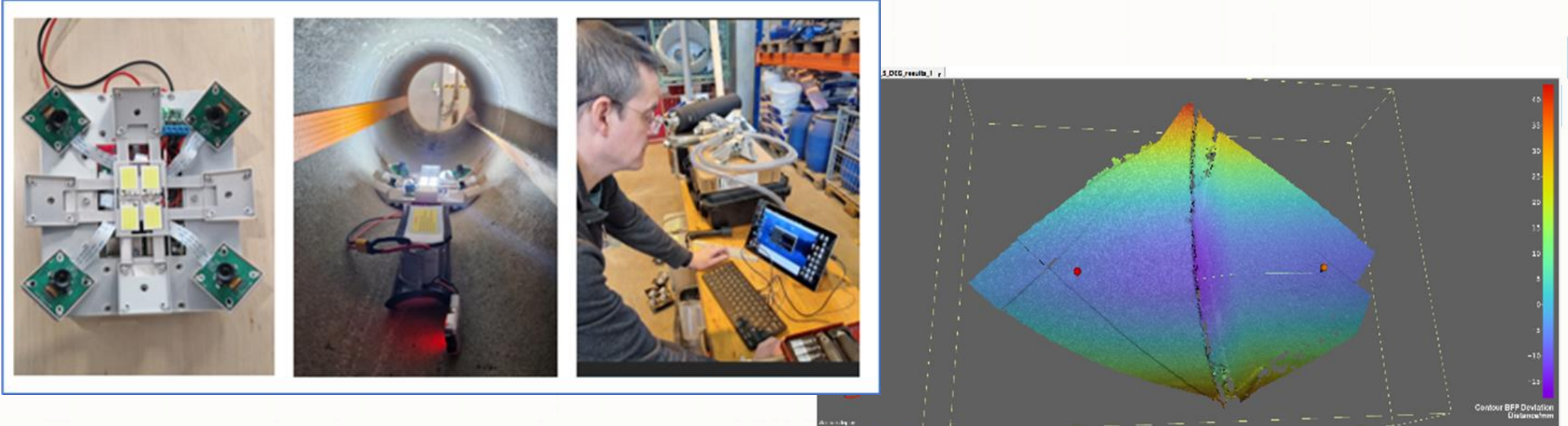
Defects and System Performance II

Data-driven, historical data required, identifies areas where defects are likely
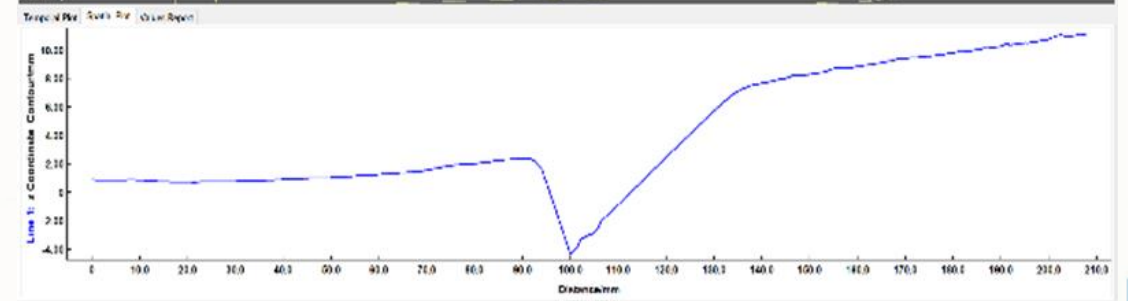
Deterioration Mechanisms

o How do asset deteriorate?

o What to understanding mechanisms in controlled environments

o How is system performance impacted by asset deterioration – digital twin

Measuring Deterioration in the Laboratory

o Enhancing measurement capabilities of in-pipe defects

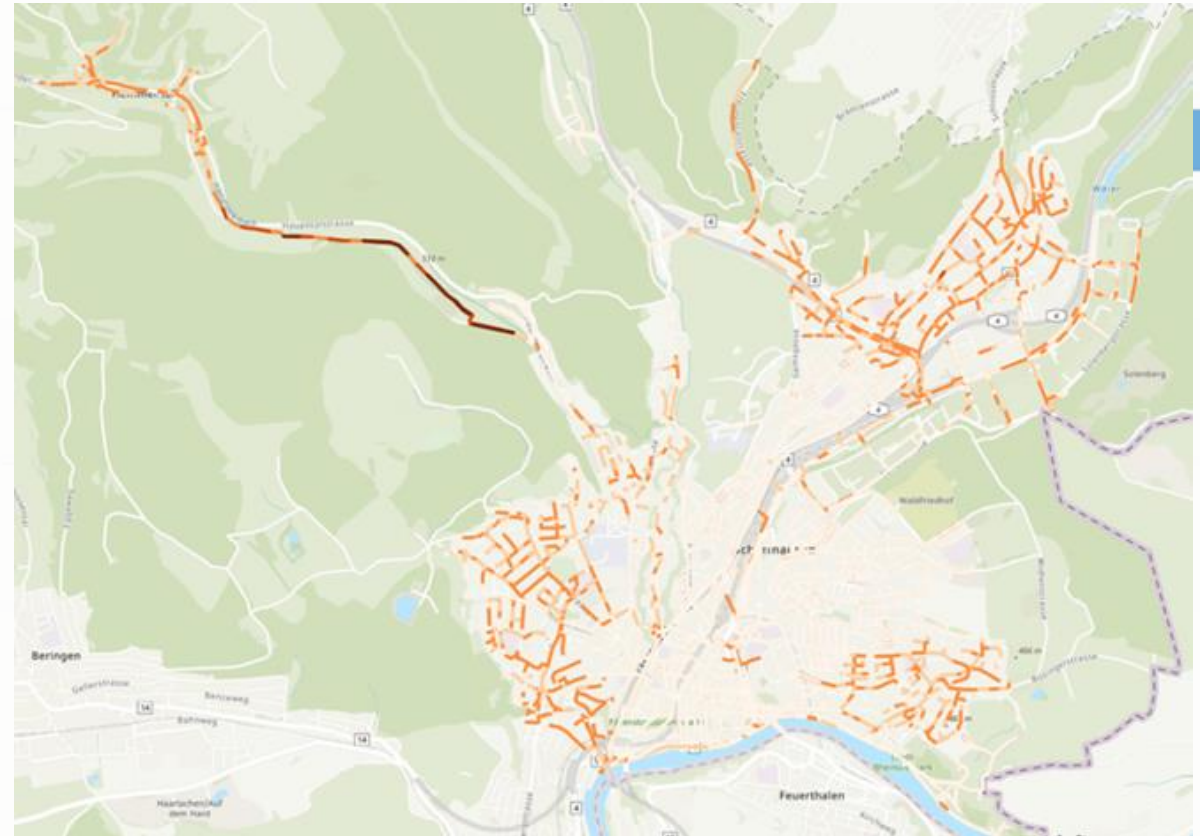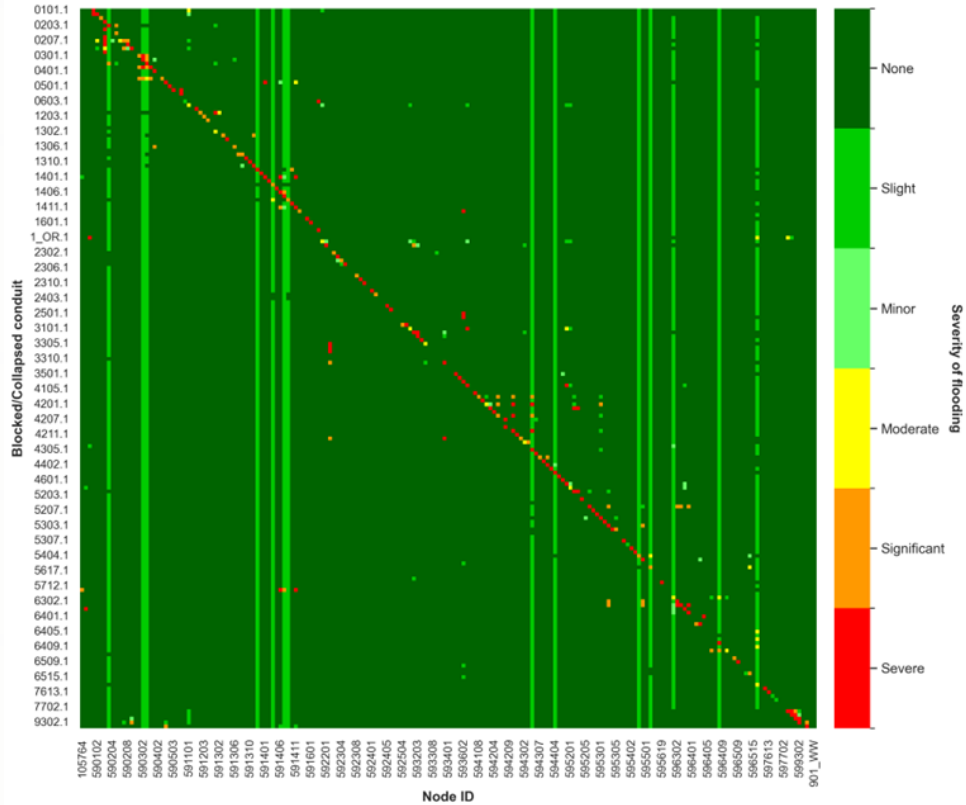o Testing in different laboratory environments

Measuring Deterioration in the Laboratory

o How is system performance impacted by asset deterioration?

o Common laboratory defects

o Comparable results

o Validate defect deterioration models – use in digital twins

Defect Impact on System Performance

Impact of Single Conduit Blockages on Flooding Severity Across Sewer Network Nodes – small network

Additional flooding caused by pipes with 20% siltation

JRA2 - Conclusions

- Examined more automated methods to process image-based data – questions existing defects coding. Identified a need more "physically relevant" measurements.

- Focus on improving techniques to examine deterioration mechanisms in the laboratory. New measurement techniques, common defect scenarios, preliminary study on infiltration/exfiltration.

- Developed modelling approaches that is able to simulate the impact of individual in-pipe defects on whole system performance (computationally intensive).
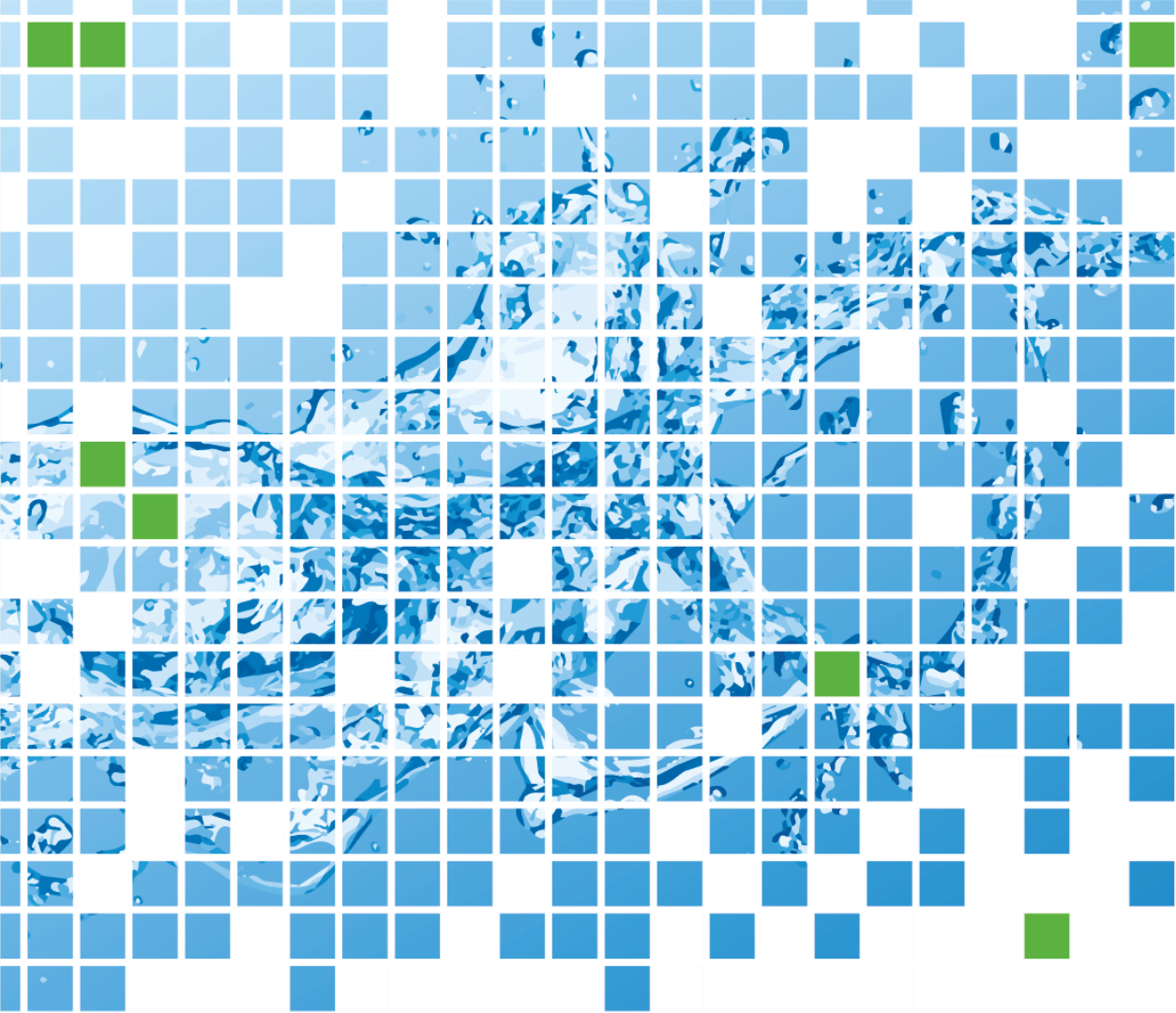
Co-UDlabs information sources

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