



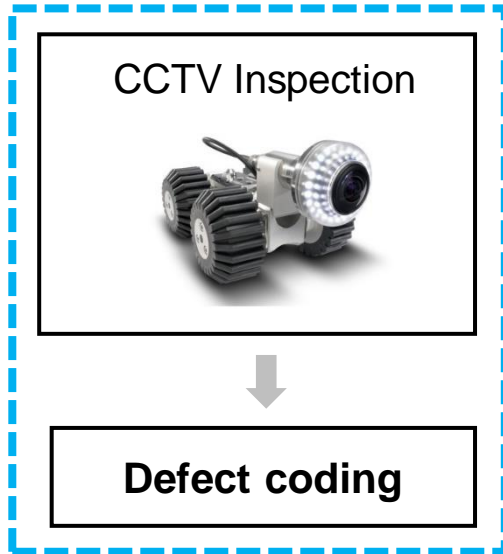
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From data to decisions: New tools and methods for sewer asset management

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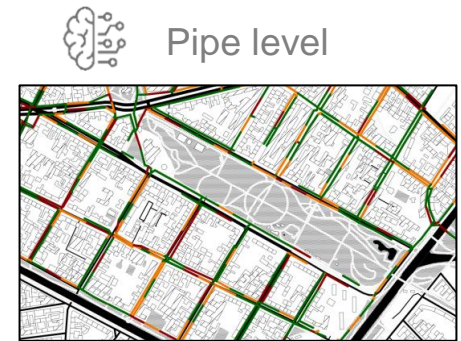
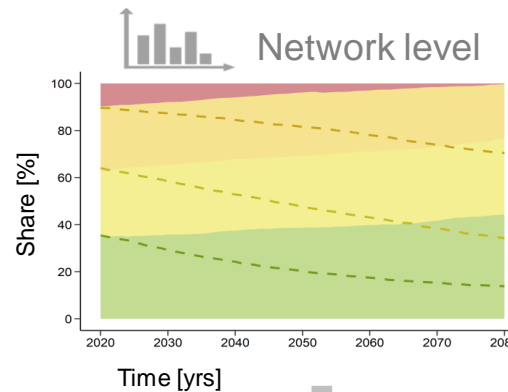
Pipe assessment

Condition	Need for action
Good	None / Long term
Fair	Mid term
Bad	Short term
Very Bad	Immediate

Deterioration factors

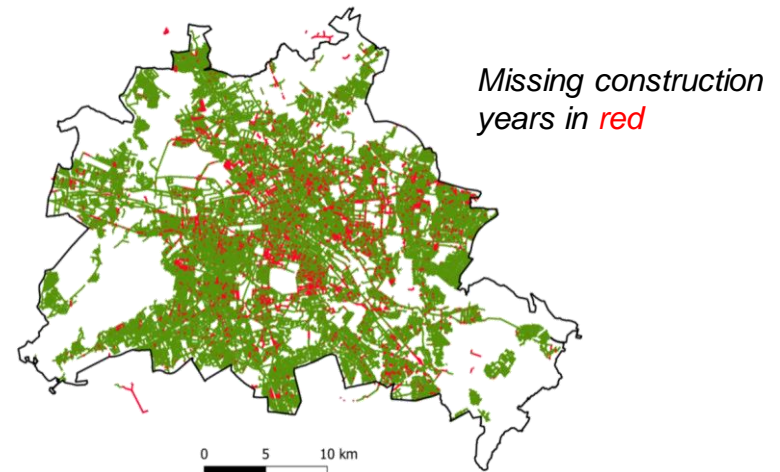
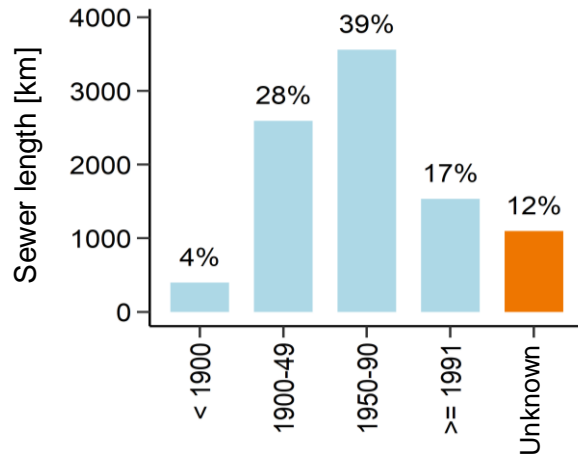
- Age
- Material
- Drainage type
- Shape
- Width
- Length
- Slope
- Soil type and coverage
- Groundwater coverage
- Trees
- District

Model predictions



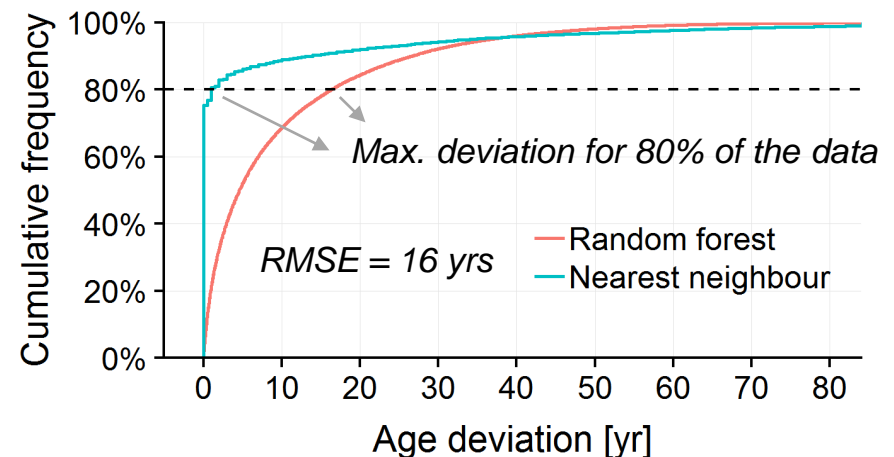
Filling gaps in sewer asset data

Construction year / age



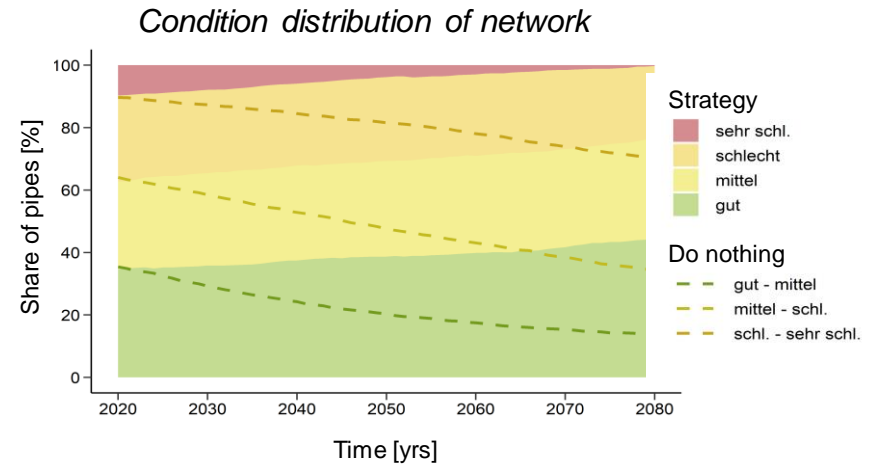
Method: Nearest neighbour model + Random Forest under consideration of sewer pipe characteristics and environmental factors

Results: Accurate prediction of age for majority of pipes; Symmetric error distribution; All gaps can be closed



I. Strategy simulator

Long-term predictions on the condition of the sewer **network** under consideration of different investment strategies



II. Pipe simulator

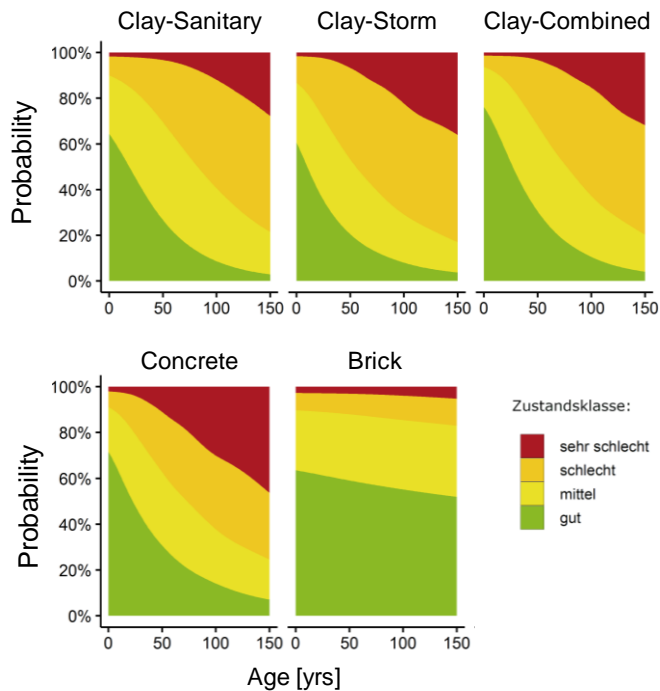
Identification of **defect pipes** to prioritise short-term inspections and rehabilitations



I. Strategy simulator

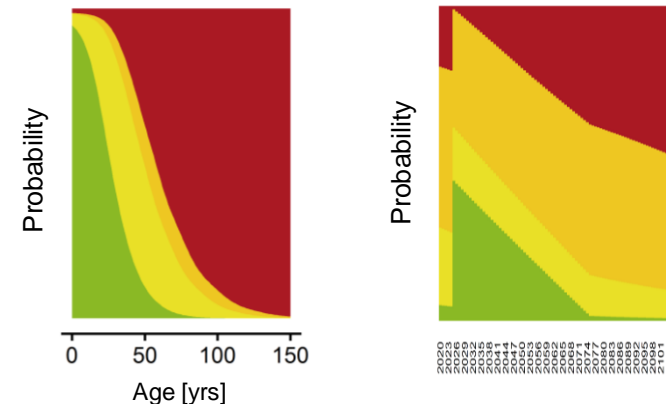
Goal: Long-term predictions for sewer network condition

Deterioration model



Rehabilitation components

+



Estimated survival curves for renovations

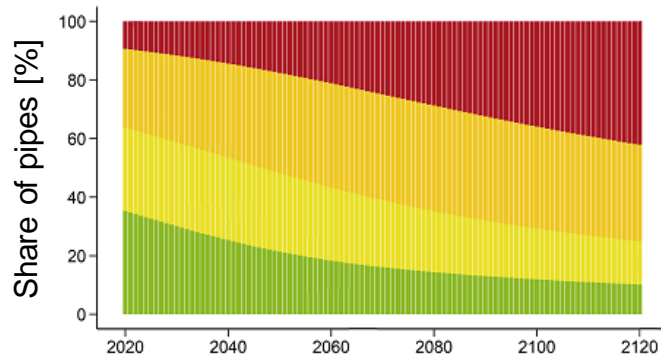
Offset model for repairs

Statistical regression model based on survival curves for different pipe cohorts

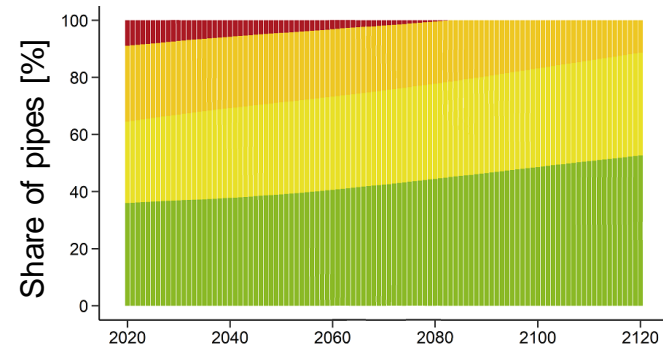
Variables:    

Condition distribution for different rehab strategies

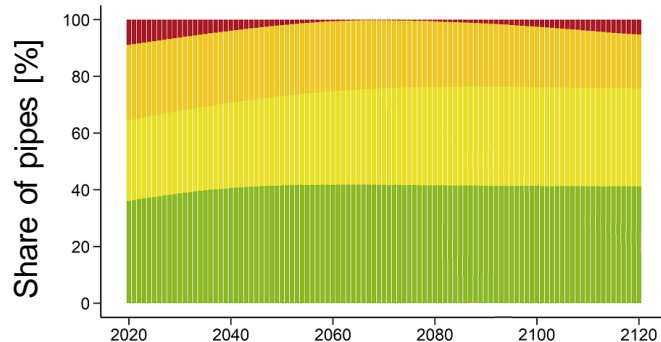
“Do nothing”



Renewal strategy (1%/a)



Mixed rehab strategy (1,1%/a,
renewal + renovation + repairs)



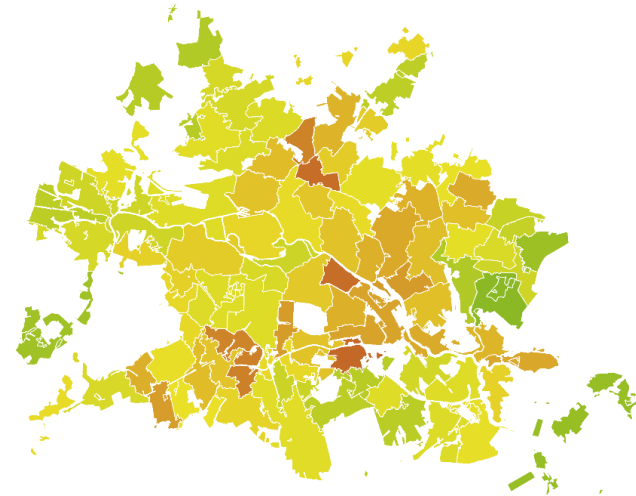
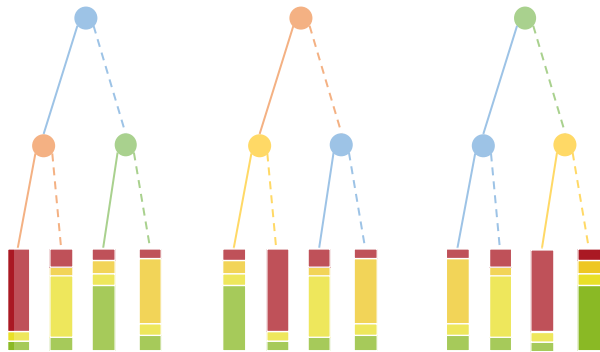
Other performance indicators:

- Rehabilitation costs
- Network age
- Value index

II. Pipe simulator

Goal: Prioritisation of pipes with high probability of severe defects

Random Forest



Hotspots
at pipe level

Area prioritisation

Variables:

Pipe characteristics



Environmental factors



- Model finds about 4 times more defect pipes than current strategic inspections
- Valuable information for efficient inspection programs

Summary and conclusions

- The **strategy simulator** can support utilities in long-term planning of efficient rehabilitation and investment strategies
- The **pipe simulator** prioritises pipes according to their defect probability, allowing for more efficient inspection programs
- Data gaps can be filled with reliable ML-based prediction models
- Both simulation tools are planned to be tested in other cities



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