Assessing the Underworld
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A Water Utility Perspective

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Assessing the Underworld  11\textsuperscript{th} December 2014
Buried pipe network inheritance challenge

post 1989 privatisation – utilities provide “stewardship of infrastructure”

circa 1million km of buried pipes - £500 billion to replace? -  **Asset or liability?**
UK water utility buried pipe & sewer asset inventory 2014

- circa 1 million km of pipes & sewers
- age <1 to > 200 yrs
- <3cm to >3m diameter
- construction material – metal, polymer, ceramic, brick, other?
- >0.5 billion? joints, fittings, valves, chambers and manholes
- buried depth <0.5m to >5m in soil, road fill, concrete, other?
- replacement cost £100 to >£1000m
Water utility buried pipe stewardship

- Operate affordable services to customers 24/7

- Provide efficient & sustainable resources to maintain asset function

- Detect unacceptable level of service & locate faults

- Find service level solutions and repair faults

- Plan investment to renew / replace assets & to meet new demands

- Interact with other agencies, buried asset owners, public

- Maintain records
Water utility needs from Assessing the Underworld technology & systems

**What** do we need to know? *(accuracy, confidence)*

**Why** do we want to know this? *(find, fix, renew)*

**When** do we need to know? *(real-time events / long-term plans)*

**Who** can provide & store this information? *(security)*
What do we need to know? *(ex- “STREETWISE” Workshop 1996)*

- Network asset & fault location, what else is buried nearby, condition?

"Exactly where am I?"
newish GPS

"Which customer?"
Post code but no data link to specific pipes

"Which pipe & valve?"
in-street GIS 2D errors
future "Tags" or remote sensing?

"Body Scanner in the Street?"

"Exactly where's the Fault?"

In-pipe "Smart pigs?"
(oil & gas sector)
What do we need to know?  

- 3D location *(10cm)* for buried infrastructure & other
- identification, utility type & owner *(cable, gas, electric..)*
- external size of pipe and material class
- joint, service connection, fitting location, size change, bends
- fault location *(<20cm)* & diagnosis *(small/large leak, collapse..)*
- condition assessment, cracks, int/external corrosion pits
- ground nature & presence of voids
- confidence level of historic or real time data *(risk assessment)*
- costs for the survey & data
Why do we want to know this?
*Find & fix, plan renewal, update GIS records*
*Mimimise space, cost & time of excavation, use low / no-dig solutions*

"Find & fix” asset failures, 
*install new connection, smart tag / sensor, inform customers*

Impact of Road Pricing?

Multi-utility

“No dig” in-pipe repair & renewal
*Changes in pipe size, vertical bends or side connections?*

Low dig & Quiet dig
“key hole surgery”

Can I use directional drilling?

Utilman
Body scanner & healthy body analogy

- Want a healthy body of network infrastructure under our streets
- Human body easier as we know where most of the pipes should be
- If we find the pipes can we find the failures?
- Can we diagnose “illness” and prevent failures?
Predicting Failure & Life Remaining
Understand interactions between natural & built environment?

True soil nature in built areas?

Predict corrosion & joint movement?

Impact of CC on ground & pipe movement?

Impact of traffic loading & other excavation?

Predict pipe failure from age, condition, soil, traffic & other factors?

Corrosive soils

London – Soil Map

Shrink / swell soils
“Body Scanner” v “Internet of the Underworld”?
Retro fit wifi sensors, smart tags – real time performance / condition

Sound?

Vibration?

Wet and leaking?

Tampering?
Condition assess large deep pipes?

In-pipe – Smart pigs & robotic sewer rovers?
Who / how will the research be implemented?

EPSRC funded research & papers progressing

Who funds the develop & implement phase?

Who will commercialise for UK Economic Growth in global markets?

Role for utilities, supply chain, Innovate UK, new UK Water Partnership?

How & when end user impact?