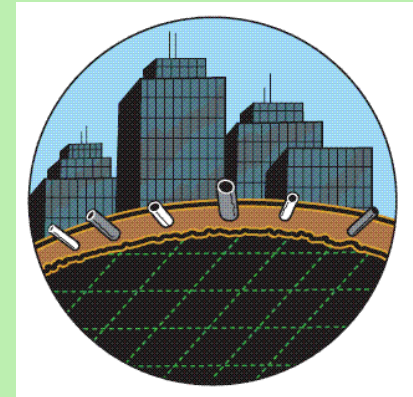


Assessing The Underworld

Achieving Sustainable Streetworks

Professor Chris Rogers
University of Birmingham
27th March 2013



Street works disrupts society, damages the environment ... and adjacent services, and the overlying road structure



VISTA

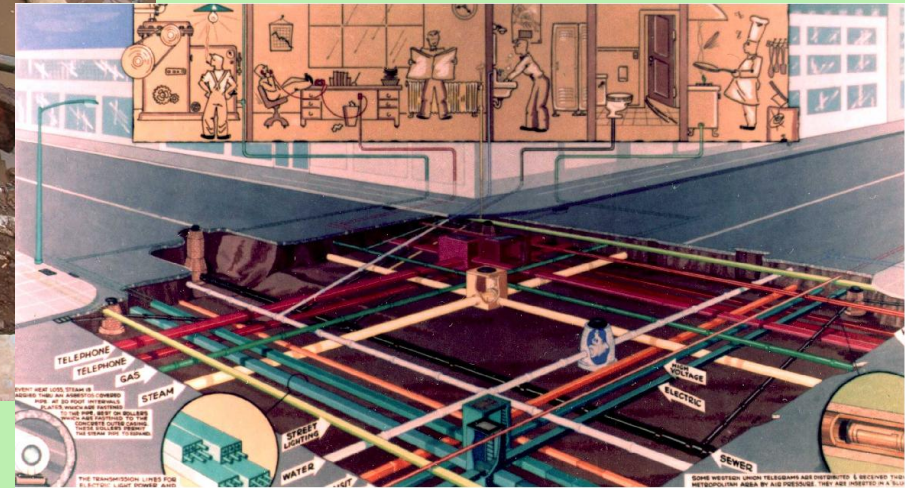
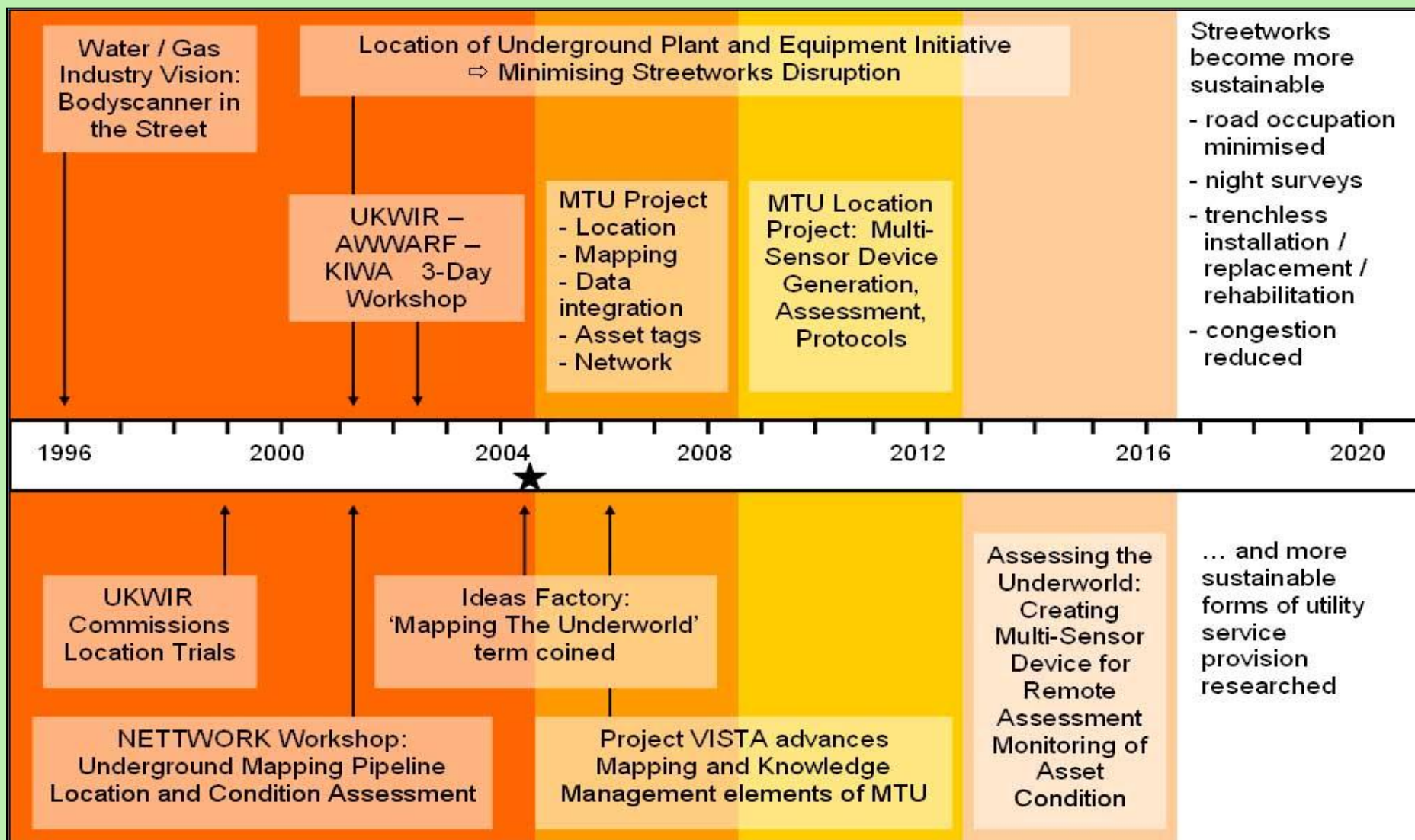


Image from
www.seattle.gov/transportation/stuse_utilpermits.htm

We dig some 4 million holes in the UK's roads each year



Some 4 million road structures are damaged each year



Assessing the Underworld

We contend that what is buried in, and on, the ground is to some degree controlled by the ground

... if the ground properties change, or the ground moves, the adjacent / overlying infrastructure responds accordingly

We seek to create a system able to manage, coherently, what we do to the buried infrastructure (add new services, repair or renovate existing services, leave it alone for now), and for this

... we need to be informed by the ground conditions and how the ground might react to any new activity or intervention

The same argument holds true for the transport infrastructure

Assessing the Underworld

This new research proposes to use MTU's multi-sensor platform, with amendments and additions, and robotic in-pipe pigs to

- ... assess the condition of buried pipelines and cables,*
- ... and of the ground in which they are buried,*
- ... and of the surface infrastructure that overlies it*

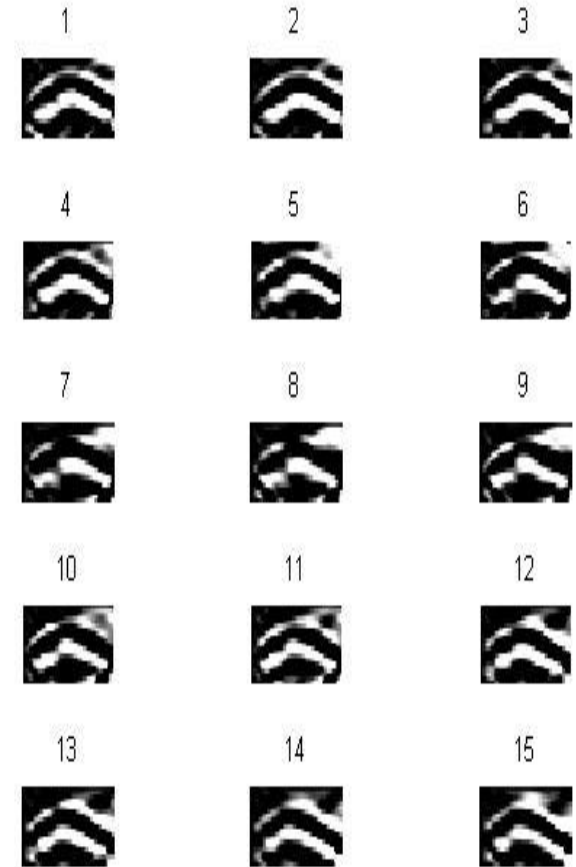
For example, a deteriorated water pipeline gives a different response than a pristine pipeline



Assessing the Underworld

One full dataset, with the caveats:

- These were ideal conditions
 - ... dry, uniformly placed sand
 - ... new plastic pipe
 - ... carefully manufactured defect
- Tests under laboratory conditions
- There was no clutter



Assessing the Underworld

This new research proposes to use the multi-sensor platform to

*... assess the condition of buried pipelines and cables,
and of the ground in which they are buried*

For example, a deteriorated water pipeline gives a different response than a pristine pipeline

*... while wetting of the adjacent soil or voids created by
local erosion due to leakage will result in a different
ground response to unaltered natural soil*

The influence of time is accounted for by a sequence of surveys

*... analysed alongside variations in climate, local conditions
and pipeline condition (via deterioration models)*

Assessing the Underworld

The project vision is to prove the concept of the creation of a single, integrated (virtual?) national ‘model’ for the UK’s infrastructure

... and explore the role of the remote assessment technologies in providing buried utility service infrastructure condition attributes alongside positional information

... and the condition of the surrounding ground

Adding the same information for roads (and later rail and other transport infrastructure) into the ‘model’ – and incorporating deterioration models – any civil engineering intervention in this system can be undertaken intelligently

... being informed by a level of integrated and coherent information heretofore unavailable

Assessing the Underworld

The only sensible base into which to add details of the utility service and transport infrastructures, and their condition, is the 3D geological 'map'(or 'model') held by the British Geological Survey

... which has solid geology, parent soils, surface soils and fill materials mapped to a fine scale in urban areas

... along with geotechnical attributes, groundwater levels, pore water chemistry measurements and suchlike

If the UK's physical infrastructures and their condition were added to this 3D 'map', then we could explore the full implications

on adjacent services, the road structure and the surrounds

of excavating a trench in a particular road at a particular location to carry out work on a particular pipeline or cable.

Assessing the Underworld

WS1 – **Impact Delivery** (*Bham, Leeds*)

WS2 – **Vibro-acoustics** (*Southampton ISVR*)

WS3 – **Broadband Electromagnetics** (*Bath, Bham, Soton – all Elec Eng*)

WS4a – **Geotechnical Infrastructure** (*Bham, Newcastle, BGS*)

WS4b – **Road Infrastructure** (*Bham, URS Scott Wilson*)

WS5 – **Buried Utility Infrastructure** (*Sheffield Civil Eng, Robotics*)

WS6 – **Technology and Data Integration** (*Bham, Leeds*)

WS7 – **Intelligent Decision Support System** (*Leeds, Bham, BGS*)

WS8 – **Sustainability Costing Model** (*Bham, Newcastle*)

Announced value = £5.8 million Dates = June 2013 – May 2017

Supported by 57 project partners committing ~£16 million in-kind

Conclusions

Mapping the Underworld is a research initiative that aims to revolutionize how street works are undertaken in the UK

... and the US, and elsewhere (much international interest)

MTU Phase 1 was hailed as a big success

... it got us going, and sparked this wide interest

MTU Phase 2 Location Project seeks to develop a multi-sensor device capable of detecting all buried assets in all ground conditions without the need for proving excavations

... and it has led to major advances and delivery of impact

... with 34 original project partners committing £1.36 million

... more have joined, with an additional £2+ million

Mapping The Underworld Centre of Excellence

JK Guest took up the challenge ...

- discussions took place at No Dig Live
- the need for the training / accreditation centre was recognised
- provide greater confidence in geophysical surveys
- a safe environment for training and researching

*A variety of pipes and cables, and
complexity of arrangements, and
ground conditions, and degrees of sub-
surface congestion, and weathers ...
... the site is near Wigan*





Assessing the Underworld

- *An integrated, 3D ground – infrastructure model*
- *Links utility service and transport infrastructures*
- *Is based around condition assessment*
- *Acknowledges that the ground, and its condition, greatly influences the performance of the infrastructures*
 - ... *and should influence engineering decisions*
- *Builds on MTU and the multi-sensor device*
- *Allows for future (climate, other) changes*
- *Ensures the UK continues to lead the world in this area*

We would value your participation to help drive it forwards

