Assessing The Underworld
An Integrated Performance Model of City Infrastructures

A Sustainability Assessment Framework for Utility Streetworks in Urban Environments
...In urban areas ‘more of the same’ is becoming increasingly untenable and in the 21st Century traffic congestion due to repeated street works is becoming politically, as well as socially and environmentally, unacceptable.
Streetworks in a Time of Austerity

The challenge faced by those responsible for providing our infrastructure systems, and their essential services:

- Budgets (£) are stretched, we must provide services at minimum cost (£) to our water / gas / travelling customer

- Streetworks have (often very considerable) social and environmental impacts – collateral damage, I'm afraid

- Only direct costs are (truly) considered when planning the engineering works… indeed in some case the Regulator insists on it

- Several Sustainability Assessment Frameworks exist… however, none is designed specifically with utility streetworks in mind

- ATU has addressed this shortfall – focussing on overall value and recognising there is ‘one customer’ – with the help of iBUILD
Utility Streetworks and Associated Costs

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<th>Issue</th>
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<td>~ £7 billion per annum: this is the cost of utility streetworks to the UK economy</td>
<td>... 78% of which is indirect costs including social and environmental impacts</td>
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<td>Road occupation due to utility streetworks causing traffic delays</td>
<td>Accounted for equivalent of ~ 6.16 million days of work in the UK in 2014-2015</td>
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<td>An estimated 1.37 million streetworks are undertaken by utility companies alone</td>
<td>This equated to ~2.4 million road openings in the UK in 2014-2015</td>
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In 2014-2015, utility streetworks in England and Wales have incurred costs of more than £1.5bn.

The projected cumulative total cost of utility streetworks in the UK from 2013 to 2030 is £319bn.

We dig some 4 million holes in UK’s roads each year trying to locate services ... all incurring disruption and safety issues
Utility Streetworks and Associated Costs

Direct Repair Cost – Indirect Costs – Social Costs

Utility Strike (Case Studies 1-16) Cost Ratio

\[
\text{Utility Strike Cost Ratio} = \frac{\text{Indirect Cost + Social Cost}}{\text{Direct Repair Cost}} = \frac{1716086}{59804} = \approx 29
\]

UTILITY STRIKE COST RATIO = 29:1

Example: Assuming you have a strike incident with a direct cost of £1000, that would mean as a rule of thumb that the true cost (direct + indirect + social) is £29000, based on the case study findings.

Generated as part of the iBuild project sponsored by EPSRC
ATU has developed a new utility streetworks sustainability framework

- Direct & indirect economic, social, environmental costs
- For both Construction & Maintenance phases

Case Studies showed trenchless technologies performed better when considering the three pillars of sustainability.

Open-cut Trenching

Pipe Jacking
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We have also developed a methodology to integrate sustainability into BIM (level 6D)

- Extending the Envision tool and integrating it into BIM allows full integration of sustainability assessment
- Adoption and deployment of BIM best practices could result in annual global cost savings of
  ... 10-25 % during engineering and construction
  ... 8-13 % during operations
... and its Inclusion in BIM

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Case studies showed trenchless technologies performed better when considering the three pillars of sustainability.

We have also developed a methodology to integrate sustainability into BIM (level 6). This includes:

- Extending the Envision tool and integrating it into BIM allows full integration of sustainability assessment.
- Adoption and deployment of BIM best practices could result in annual global cost savings of...
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... overcomes barriers to adopting alternative utility engineering options.

Full benefits of more sustainable, resilient, and liveable cities of the future could be achieved.
Reshaping Utilities Business with BIM

To what extent will the adoption of BIM that embeds sustainability assessment in utility projects affect your organisation’s offerings today and five years from today?

- **Owner Engagement and Understanding**
  - Increased Owners’ Ability to Actively Participate in Design Process
  - Increased Owners’ Understanding of Proposed Design Solutions

- **Design**
  - Increased Ability to Manage Project Scope
  - Improved Quality/Function of Final Design

- **Documentation and Constructability**
  - Generated Better Construction Documents
  - Improved Constructability of Final Design

- **Estimating and Bidding**
  - Improved Process and Accuracy of Estimating Construction Costs
  - Improved Accuracy and Completeness of Bids

- **Construction Phasing and Logistics**
  - Improved Ability to Plan Construction Phasing and Logistics
  - Improved Owners’ Understanding of Construction Phasing and Logistics

- **Contractors’ Understanding of Design**
  - Increased Contractors’ Understanding of Proposed Design Solutions
  - Reduced Number of Requests for Informations (RFIs)

- **Cost Control and Reduction**
  - Improved Process of Controlling Construction Costs
  - Reduced Final Construction Cost of Projects

- **Schedule and Project Duration**
  - Improved Achievement of Planned Schedule Milestone Dates
  - Compressed Schedule Results in Accelerated Project Completion

- **Unplanned Changes, Rework and Out-of-Sequence Work**
  - Increased Predictability/Fewer Unplanned Changes
  - Reduced Rework
  - Reduced Amount of Out-of-Sequence Work Due to Earlier Problems

- **Labour, Safety and Material Waste**
  - Improved Labour Productivity
  - Reduced Site Labour Due to Increased Offsite Fabrication
  - Reduced Portable Safety Incidents
  - Reduced Material Waste

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Percentage of respondents who expect a large ("a lot" or "great") effect on a five-point scale
Reshaping Utilities Business with BIM

BIM Utilities APIs

Sensor information  Map information  What if? model component

Ubiquitous Connectivity
Moving Towards MTUs and ATU’s Vision

From confusion and inefficiency to ST & LT effective asset management