Assessing The Underworld
An Integrated Performance Model of City Infrastructures
Sustainability Costing Model for Streetworks in Urban Environments

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ASSESSING THE UNDERWORLD

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An old problem, still in place!

- Global population predicted to be > 9 billion by 2050.
- More than 70% of the world population predicted to live in cities by 2050.
- A projected 43% increase in traffic for the UK from 2010 to 2040.
- Utility services are essential to the quality of life in modern urban living.
- More than 4 million holes are excavated in the UK's roads each year.

Issue	Impact
~ £7 billion per annum: cost of utility streetworks to the UK economy	78% of which is indirect costs including social and environmental impacts
Road occupation due to utility streetworks	Accounted for equivalent of ~ 6.16 million days of work in the UK in 2014-2015
An estimated 1.37 million streetworks undertaken by utility companies alone	This equates to 2.4 million road openings in the UK in 2014-2015

- In 2014-2015 alone, 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.

Open-cut remains the most widely adopted solution for utility placement by practitioners and yet various alternative solutions exist, such as Trenchless Technologies (TT) and Multi-Utility Tunnels (MUTs).

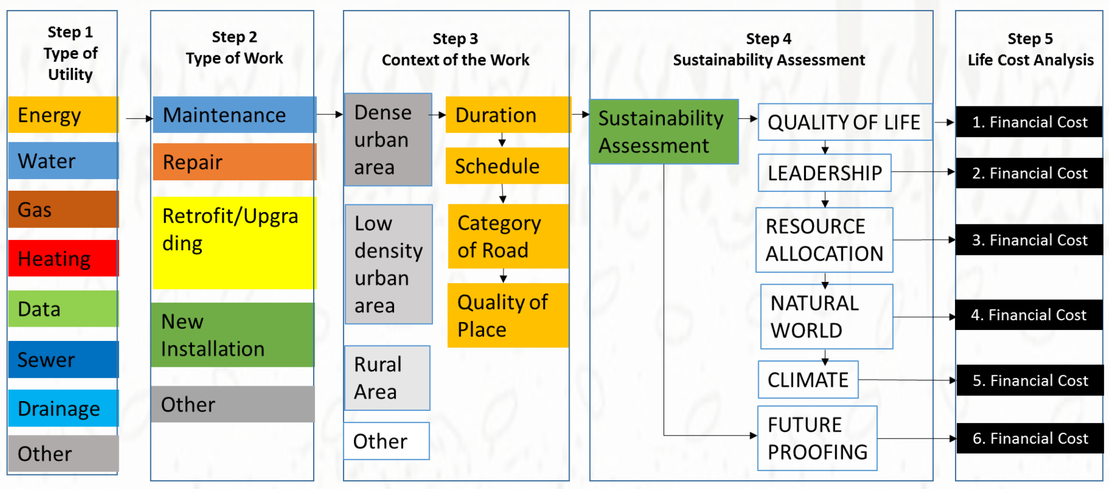
Main aim

To develop a sustainability costing model alongside an evaluation framework and methodology for utility streetworks to allow the assessment of interventions, based on the true total costs and impacts (economic [direct and indirect] + environmental + social) balanced against the full range of benefits to support investment decisions.

Objectives

- Development of a Streetworks Sustainability Assessment Framework (SSAF).
- Development of a balanced approach for deriving economic, social and environmental indicators / input parameters for streetworks.
- Establish suitable methods for assessing sustainability in terms of 'Value vs Cost' of streetworks.
- Creation of Future Scenarios using the 'Designing Resilient Cities' methodology for future proofing investments for streetworks.
- Creation of a clear and concise platform for visualisation of sustainability outcomes to be incorporated in the ATU Decision Support System (DSS).
- Testing and evaluation of the methodology on test sites in collaboration with ATU project partners to establish an evidence base of case histories.

FRAMEWORK FOR UTILITIES SUSTAINABILITY IMPACT MODELLING



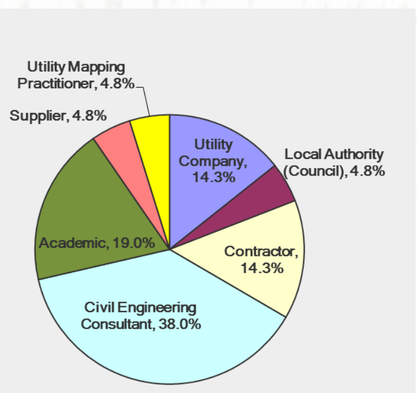
SSAF Methodological Development

- Conceptualising the SSAF framework (2 phases):
  - Decision making tool (SPeAR-based methodology)
  - Social and environmental accounting
- SPeAR® for Utility Streetworks is based on the adaptation of the SPeAR® framework and development of new sets of sustainability indicators specifically for streetworks
- Four sets of indicators were developed based on four headline indicators (Direct Economic, Indirect Economic, Social and Environmental)
- Aim is to minimise the cost / impact on all 4 categories

Total Sustainability Cost (TSC) of streetworks is defined as:

$$TSC = Direct_{[economic]} + Indirect_{[economic]} + Social + Environmental$$

Questionnaire – to validate the developed indicator sets and to capture expert opinion on their importance and applicability – distributed to a wide group of industry experts (20 participants):

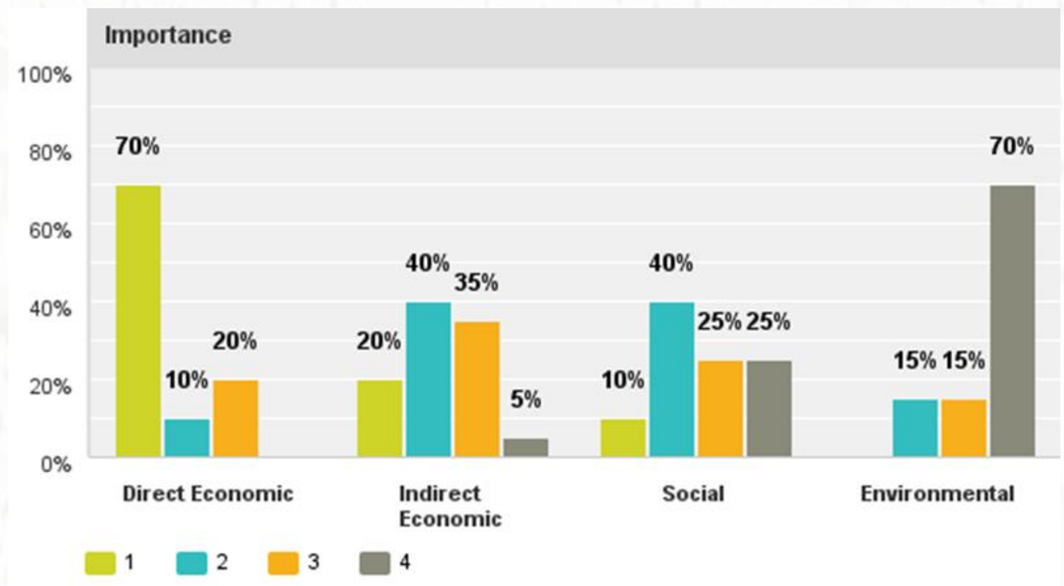


Example set of indicators for Indirect Economic Costs

Construction Indirect Economic Impact	Third Party utility damage
	Compensation to businesses for loss of profit
	Compensation to customers for interruptions to services
	Loss of income to asset owners or utilities
	Compensation to local authorities for damage to their assets
Maintenance Indirect Economic Impact	Goodwill
	Required Training (upskill)
	Insurance
	Loss of business to competitors
	Lost Opportunity Cost

Example question in the questionnaire:

With regard to utility streetworks projects, specify the importance of the following headline cost / impact categories, where 1 is the most important and 4 is the least important:



Testing and Evaluation

The developed SSAF framework and Sustainability Assessment Model is being applied to a number of case studies, including:

- The University of Birmingham campus utility services network
- Utility services of the Queen Elizabeth Hospital in Birmingham
- Pipe Subways in London
- Various Trenching and Trenchless utilities projects in different areas of the Netherlands, including:
  - Amsterdam
  - Rotterdam
  - Utrecht

Connection to Affiliated Research

This research will build on previous resilience and sustainability projects, including the EPSRC-funded *Designing Resilient Cities* research, and link closely with ongoing affiliated research including:

- *Liveable Cities*: Transforming the Engineering of Cities for Societal and Planetary Wellbeing – www.liveablecities.org.uk
- *iBUILD*: Infrastructure BUsiness models, valuation and Innovation for Local Delivery – www.research.ncl.ac.uk/ibuild

The main purpose is to advance sustainable streetworks and infrastructure resilience and to use the outcomes of the work in conjunction with the ATU Decision Support System to support intelligent and sustainable streetworks.

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