Sustainability Assessment tools for Utility Streetworks

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Utility Infrastructure - streetworks

Utility streetworks and associated costs

- Streetworks operations (utility placement, renewal and maintenance) cost money, damage the environment and disrupt society.
- They also damage adjacent services, and the overlying road structure.
- More than 4 million holes in the UK's roads each year
- Utility streetworks cost the UK economy ~£7bn per annum

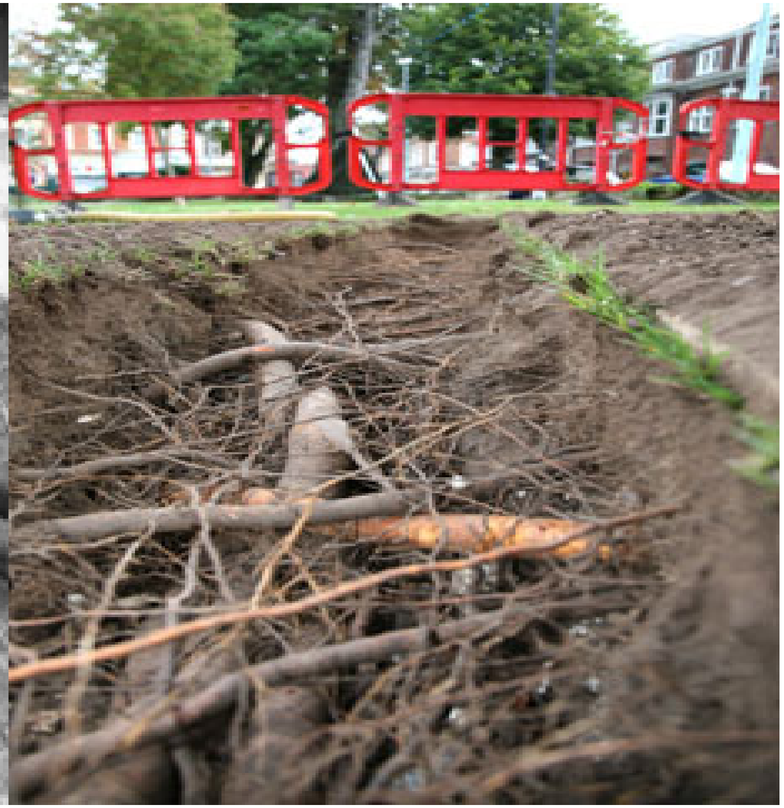
~£1.5bn direct construction costs
~£5.5bn indirect costs (social and environmental impacts)

(after McMahon et al., 2005)

ASSESSING THE UNDERWORLD

Utility streetworks and associated costs

- Damages to tree roots (from utilities) and vice versa
  (Environmental impact)

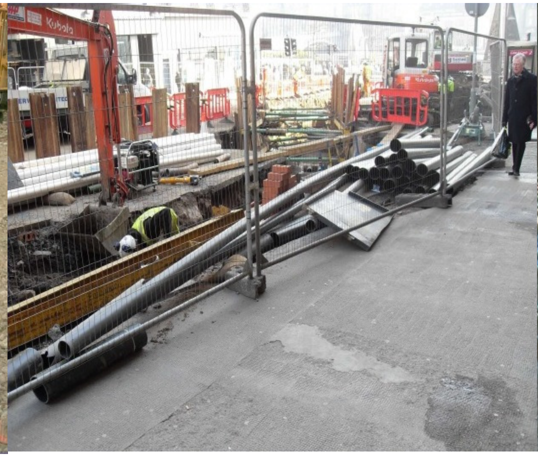
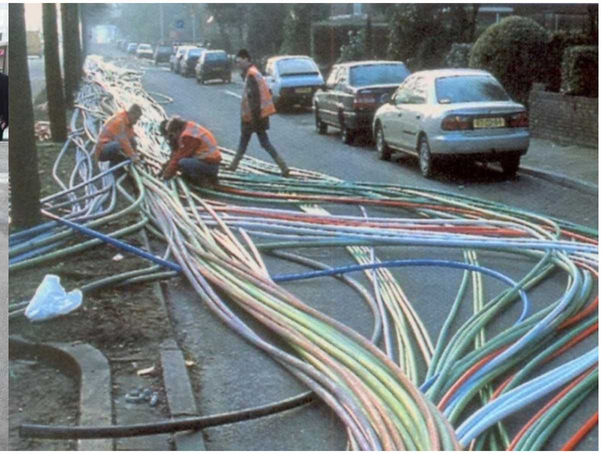


Reference: http://www.dartmoortreesurgeons.co.uk/

Utility streetworks and associated costs

- Loss of utility provision
- Traffic delays
- Losses to local businesses
- Reduced quality of open space

(Social impacts)

ASSESSING THE UNDERWORLD

Costing of utility streetworks

- Vision: to ensure sustainable implementation of streetworks, encompassing: Assessment and Evaluation Methodologies; Rehabilitation Scheduling; and Sustainability/Resilience

- True total cost of streetworks = Economic (direct and indirect) + Environmental + Social

- $C_{SUSTAINABILITY} = C_{ECONOMIC\ (DIRECT+\ INDIRECT)} + C_{SOCIAL} + C_{ENVIRONMENTAL}$

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Costing of utility streetworks

Methodology

- *Stage 1* – Assess costs within the context of benefits
- *Stage 2* – Establish method to determine true total cost of streetworks in short term
  - – Economic, Social and Environmental
- *Stage 3* – Define cost / impact in the long term to assess resilience

Costing of utility streetworks

- Sustainable and resilient engineering solutions for complex and interdependent infrastructures are essential, especially for streetworks with co-located utilities buried underneath our streets.

- This research is creating a sustainability costing model for streetworks to inform decision-making in an environment where competing private and public financial interests interact with peoples' daily lives.

ASSESSING THE UNDERWORLD

Costing of utility streetworks

- This research incorporates 'futures' scenarios to ensure our actions today deliver long-term benefits, and is establishing a method for assessing **'value' as well as 'cost'** across the full range of environmental, social and economic dimensions to move away from a 'single bottom line' approach to decision-making.

- Requirements
  - Streetworks sustainability assessment framework
  - Economic parameter inputs
  - Social and Environmental parameter inputs
  - Future proofing scenarios for infrastructure investments

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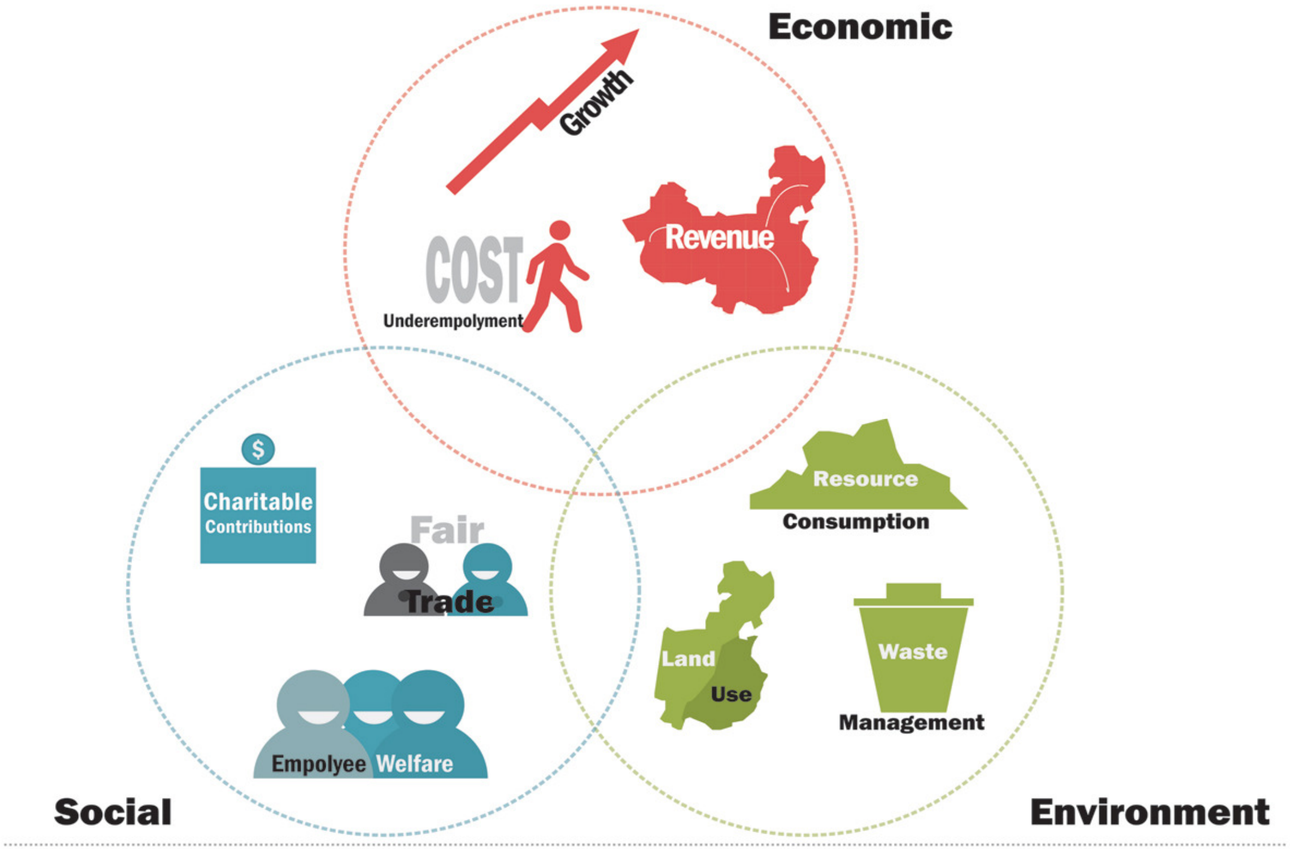
Sustainability

Triple bottom line (3 pillars of sustainability)



For underground space see Hunt et al (2009 a, b, c), For water see Hunt et al, (2010 a, b)

Sustainability assessment tools

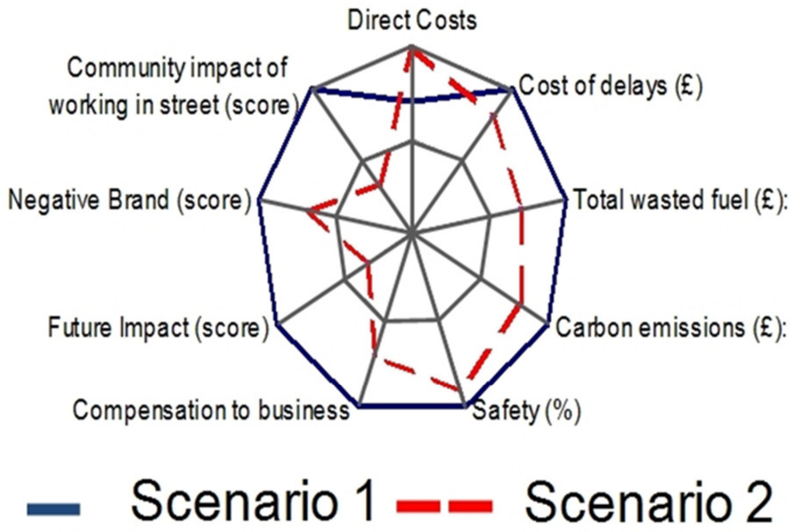
Existing infrastructure sustainability assessment tools and methods:

- ❑ Cost-Benefit Analysis (CBA)
- ❑ Life-Cycle Analysis (LCA)
- ❑ Multi-Criteria Decision Analysis (MCDA)
- ❑ Whole-Life Cost Accounting (WLC)
- ❑ Building Rating Systems (BRS)(e.g. BREEAM and LEED)
- ❑ Civil Engineering Awards Schemes (e.g. CEEQUAL)
- ❑ System Dynamics (e.g. HalSTAR)

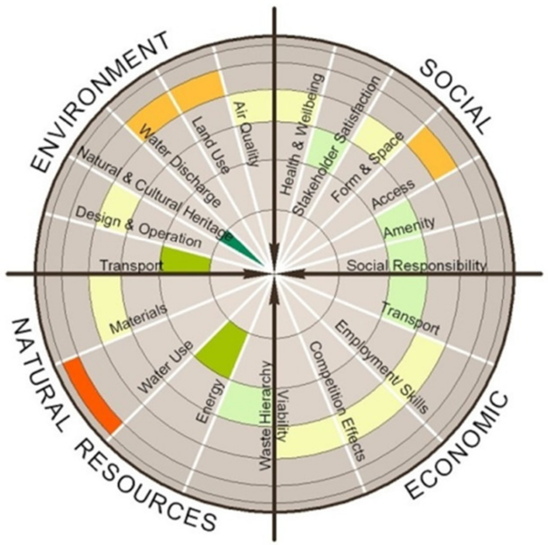
ASSESSING THE UNDERWORLD

Sustainability assessment tools

Halcrow Group Limited, 2008



Hayes, 2012



SPeAR® four quadrant model (Arup, 2007).

Sustainability assessment tools

Other tools and evaluation procedures:

- ❑ Sustainability checklists
- ❑ Surveys and public discussions
- ❑ Evaluation matrices
- ❑ Questionnaires and interviews
- ❑ Focus groups, peer groups and supported group discussions
- ❑ SWOT analysis (matrix)

PROGRESS TO DATE

Critical Review of Existing Sustainability Assessment Tools (Investigation of more than 40 tools and methods):

- SPeAR (Sustainability Appraisal, LCA based)
- CEEQUAL (Sustainability Rating, Environmentally focused)
- HalSTAR (Sustainability Toolkit, System thinking approach)

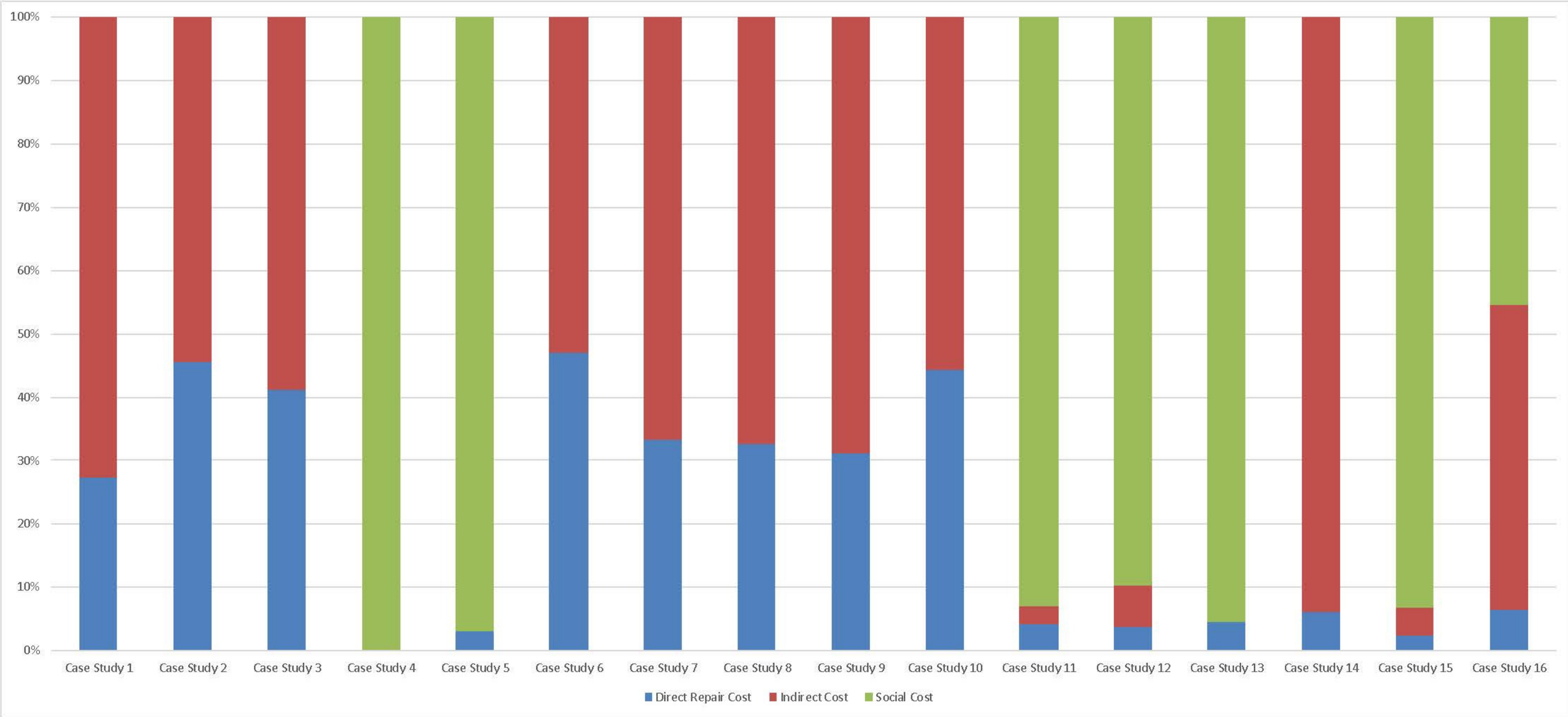
✓ Modifications are being made to SPeAR and CEEQUAL's indicator systems.

Preliminary Review of Sustainability Input Parameters (Cost Indicators specific to Utility Streetworks):

- A database for utility streetworks costs (impacts)
- Economic, Social and Environmental Impacts
- Long-term and short-term costs (impacts)

UPDATE

- Value Engineering approach is being proposed and reviewed as core of the Sustainability costing framework
- Definition of a Cost Ratio and ultimately a Value Index (VI) for different utility streetworks engineering alternatives
- Work is being undertaken to define a proxy for value within the context of utility streetworks
  - Cost ratio= Indirect cost+Social cost/Direct cost
  - Value Index= Function+Quality/Total cost
  - Value to Cost ratio for decision making



$$\text{Utility Strike (Case Studies 1-16) Cost Ratio} = \frac{\text{Indirect Cost + Social Cost}}{\text{Direct Repair Cost}} = \frac{1716086}{59804} = \approx 29$$

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.

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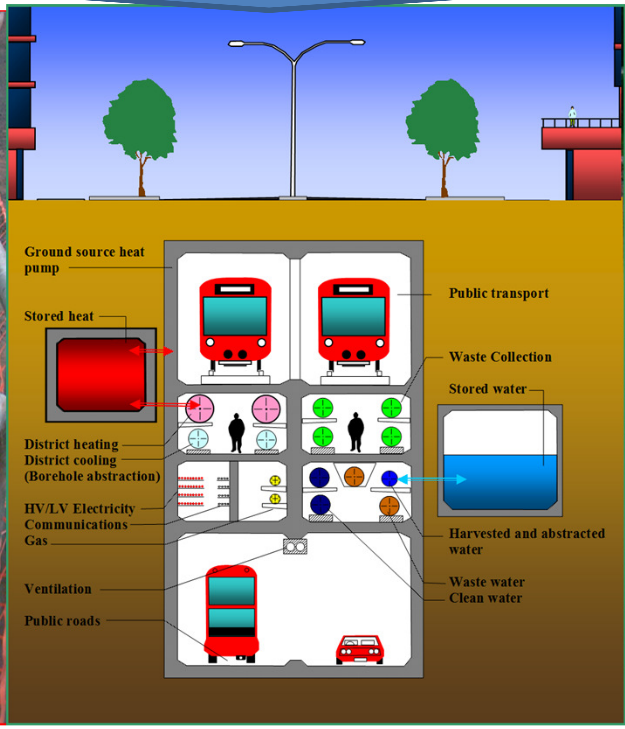
From confusion to management for ST and LT



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Thank you.

Any Questions?

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