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 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.

Sustainability Assessment of Streetworks
To achieve the work stream’s aim and deliver the objectives, a methodology has been developed and scheduled for three stages of deployment:
- Stage 1 will define each ‘cost’ within the context of the overall sustainability benefits or dis-benefits that each (streetworks) option provides.
- Stage 2 will establish methods to determine ‘true cost’ across the three core areas (economic, social and environmental) for the short term.
- Stage 3 will define cost / impact in the long-term future, to assess the resilience of today’s actions tomorrow.

Links to Other Work Streams
- Close links with WS6 & WS7, which are researching data integration and the development of a Decision Support System (DSS), respectively.
- Outcomes of the DSS will be tested for their sustainability credentials and require an iterative process between WS7 & WS8.

SSAF Methodological Development
- Conceptualising the SSAF framework (2 phases): Decision making tool (SPeAR-based methodology) – Social and environmental accounting
- SPeAR® was adapted as SSAF-SPeAR at the University of Birmingham to assess sustainability in Utility Streetworks projects
- Based on the three pillars of sustainability with an additional focus on indirect economic costs (see table and the rose diagram to the right)
- Four sets of indicators were developed based on four headline indicators (Direct Economic, Indirect Economic, Social and Environmental)
- Each headline indicator was categorised into Construction and Maintenance phases, all with sets of indicators and associated sub-indicators allocated
- Aim is to minimise the cost / impact on all 4 categories
- SPeAR® for Utility Streetworks is based on the adaptation of the SPeAR® framework and development of new sets of sustainability indicators specifically for streetworks
- The developed SSAF framework is being applied to a number of case studies, including the University campus and Queen Elizabeth Hospital in Birmingham, for testing and validation

Connection to Affiliated Research
This research will build on previous resilience and sustainability projects, including the ‘Designing Resilient Cities’ research, and link closely with ongoing affiliated research including:
- 1-BUILD: Infrastructure Business models, valuation and Innovation for Local Delivery – www.research.ncl.ac.uk/build
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.

<table>
<thead>
<tr>
<th>Headline Indicator</th>
<th>Economic Category</th>
<th>Indicator Category</th>
<th>Indicator Name</th>
<th>Indicator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Direct Economic Impact</td>
<td>Direct Cost</td>
<td>Total Cost</td>
<td>Road Damage</td>
<td>Total Repair Cost</td>
</tr>
<tr>
<td>Maintenance Direct Economic Impact</td>
<td>Indirect Cost</td>
<td>Material Cost</td>
<td>Labour Cost</td>
<td>Machinery Cost</td>
</tr>
<tr>
<td>Construction Indirect Economic Impact</td>
<td>Cost of Indirect Economic Costs</td>
<td>Environmental Impact</td>
<td>Carbon Footprint</td>
<td>Water Consumption</td>
</tr>
<tr>
<td>Maintenance Indirect Economic Impact</td>
<td>Opportunity Cost</td>
<td>Social Impact</td>
<td>Employment Impact</td>
<td>Earnings Impact</td>
</tr>
<tr>
<td>Construction Environmental Impact</td>
<td>Environmental Impact</td>
<td>Environmental Impact</td>
<td>Environmental Impact</td>
<td>Environmental Impact</td>
</tr>
<tr>
<td>Maintenance Environmental Impact</td>
<td>Environmental Impact</td>
<td>Environmental Impact</td>
<td>Environmental Impact</td>
<td>Environmental Impact</td>
</tr>
</tbody>
</table>

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

\[ \text{TSC} = \text{Direct (economic)} + \text{Indirect (economic)} + \text{Social} + \text{Environmental} \]