Modelling multi-modal transport and service accessibility within the UK

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Aim

Develop a tool that uses open-source transport data to analyse multi-modal travel in the UK to better understand whether, and how, people can access services.
Background

Initially developed for Welsh Government to allow for more frequent and up-to-date calculations of access to services domain of the Welsh Index of Multiple Deprivation.
Access to Services

- Pharmacy
- Food shop
- GP
- Post office
- Broadband
- Primary school
- Public library
- Sports facility
- Secondary school
- Petrol station
Why?

For policy makers to:

• Introduce transparency
• Create reproducibility – query other use cases
• Use an open service
How?
Creating transport data feeds

- Transport data:
  - UK nationwide bus schedules
    - TransXChange files updated weekly (*DfT*)
  - Train
    - CIF files updates weekly (*Network Rail*)
  - Car, bicycle, and foot travel - *OpenStreetMap*
Different transport, different sources, different formats

- **Solution:** General Transit Feed Specification (GTFS)
- GTFS are a popular type of transport data to draw directions and calculate travel times.
- They also work well with open source network builders, e.g. OpenTripPlanner.
Point to point

Isochrone
How many people in Wales can reach a sports venue, with a capacity greater than 10,000 within 90 minutes using public transport?
A map of Wales showing the location of the sports stadiums (black circles) and the Medium Super Output Area (MSOA) locations (coloured circles)
Travel between Cardiff 008A and Cardiff City Stadium on 1st October 2018 between 15:00 and 19:00 at 20 minute intervals, using public transport.
Maximum travel distance (within 90 minutes) from an area in Cardiff on 18th August 2018 between 08:00 and 22:00 at 20 minute intervals, using public transport.
<table>
<thead>
<tr>
<th>MSOA</th>
<th>Cardiff Park</th>
<th>Cardiff City Stadium</th>
<th>Cwmbran Stadium</th>
<th>Liberty Stadium</th>
<th>Parc y Scarlets</th>
<th>Penydarren Park</th>
<th>Principality Stadium</th>
<th>Racecourse Ground</th>
<th>Rodney Parade</th>
<th>SWALEC Stadium</th>
<th>Stadium Count</th>
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</thead>
<tbody>
<tr>
<td>Blaenau Gwent</td>
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<td></td>
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<td>72</td>
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<td>1</td>
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<tr>
<td>Bridgend</td>
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<td>72</td>
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<td>54</td>
<td>72</td>
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<tr>
<td>Cardiff</td>
<td>36</td>
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<td>36</td>
<td>90</td>
<td>36</td>
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<td>Denbighshire</td>
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<td>Pembrokeshire</td>
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<td>Rhondda Cynon Taf</td>
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<td>Swansea</td>
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<td>Wrexham</td>
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<tr>
<td>MSOA Count</td>
<td>183</td>
<td>133</td>
<td>63</td>
<td>60</td>
<td>49</td>
<td>75</td>
<td>193</td>
<td>37</td>
<td>104</td>
<td>157</td>
<td>406</td>
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<tr>
<td>Total (Persons)</td>
<td>1,408,983</td>
<td>1,013,372</td>
<td>471,432</td>
<td>461,167</td>
<td>373,73</td>
<td>591,317</td>
<td>1,488,604</td>
<td>280,458</td>
<td>791,888</td>
<td>1,205,478</td>
<td>2,201,328</td>
</tr>
</tbody>
</table>
2,201,322

70% of the Welsh population using MSOA population centroids

10,000+ capacity sports stadium
What is the most optimal Job Centre location (using Public Transport, by distance and cost) for those who are unemployed in Wales?
<table>
<thead>
<tr>
<th>Output Area</th>
<th>Location</th>
<th>Assigned Job Centre</th>
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</thead>
<tbody>
<tr>
<td>W000000001</td>
<td>Isle of Anglesey</td>
<td>Llangefni</td>
</tr>
<tr>
<td>W060000003</td>
<td>Conwy</td>
<td>Rhyl</td>
</tr>
<tr>
<td>W060000009</td>
<td>Pembrokeshire</td>
<td>Pembroke Dock</td>
</tr>
<tr>
<td>Output Areas</td>
<td>Out</td>
<td>Return</td>
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<td>-------------</td>
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<tr>
<td>10.047</td>
<td>8.684</td>
<td>8.834</td>
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</tbody>
</table>
Service Optimisation

*Example: What is the nearest (and most appropriate) Job Centre per household?*

- **278** Job Centres
- **33** Average travel time
- **£3.66** Average cost per journey
- **174** Longest travel time
- **£54.89** Most expensive journey
- **25** Average travel time
- **£2.49** Average cost per journey
- **151** Longest travel time
- **£30.22** Most expensive journey
Official Statistics
e.g. Welsh Government to use for calculating WIMD (Welsh Index of Multiple Deprivation) statistics

Strategic Planning
e.g. Valleys Taskforce, where to locate hubs to help improve prosperity in the South Wales valleys

Service Optimisation
e.g. What is the nearest (and most appropriate) Job Centre per household?

Transport Infrastructure
e.g. South Wales Metro, where should public transport stops be placed, and what should the new timetable be?

Econometric Analysis
e.g. Can we measure night-time economy of regions such as Greater Manchester?

Disability Access
e.g. Can we improve the way we calculate and measure UN Sustainable Development Goals?
What’s next?

• UK built network
  • Currently only available for Wales, Scotland, and England
• Google Cloud Platform