Modelling Cycling in London
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TfL Planning
The work in this presentation sets out only one of a number of work streams underway at TfL, looking at ways to provide strong evidence on cycling demand and supply.

Other tools developed in parallel also consider an alternative, elasticity-based tool, currently in development.

Any views contained within this presentation are those of the authors and not necessarily TfL.
Modelling Cycling

► Background and Overview of the problem
► Highway Impacts Modelling Approach
► Conclusions and Next Steps
Cycling in London Now

- Cycle journeys in London hardly grew till 2001, but then grew by 79% from 2001 to 2011 → 2% of journeys now
- Equivalent to 20% of tube trips
- 30% of AM peak traffic on bridges
- Significant seasonal variation
- Target to deliver 400% increase from 2001 levels to 5% in 2026
- TfL is committed to achieving this growth
The vision for cycling in London
Potential for growth in cycling

Meeting this potential requires investment

- 80% of potential would take less than 20 minutes to cycle
- 300% growth potential in Central London, 220% in Inner London, 125% in Outer London
- 46% of cycling growth is expected shift from car
Investment in cycling

► To justify the investment we need convincing forecasts
The 10 challenges of modelling cycling

1. Observed changes in infrastructure over the last few years do not explain the demand trends
2. Route choice behaviour not fully understood
3. The factors that affect route choice aren’t coded in our models
4. Data about explanatory variables has not been collected traditionally
5. Mode choice behaviour contradicts travel time paradigm
6. Mode choice is based on a type of segmentation that our models do not include
The 10 challenges of modelling cycling

7. Cycling is a minority mode, hence prone to high forecasting error and low levels of confidence

8. Seasonal variation and weather impacts are significant (do we need to model the weather...?)

9. Cycle demand data collection only becomes standardised now, so there is insufficient historical data

10. A considerable proportion of new cycling trips are new leisure trips, making the total demand hard to predict

...A lot is being done to overcome these challenges – the following is just one example
Highway Impacts Modelling Approach
TfL Strategic Highway Models
Modelling Methodology

- Build Cycling Trip Matrix
- Add Network Detail
- Analyse Count / Survey Data

  - Initial Cycling Assignment
  - Calibrate / adjust parameters
  - Adjust Demand (ME)
  - Final Cycle Flow Estimate

Add flows to main model
Cycling Matrix Building (1)

- Build Cycling Trip Matrix
- Add Cycling Trip Matrix
- Analyse Count / Survey Data
- Initial Cycling Assignment
- Calibrate / adjust parameters
- Adjust Demand (ME)
- Final Cycle Flow Estimate
- Add flows to main model
Cycling Matrix Building (2)

- Borough level trips taken and expanded using planning data from London Travel Demand Survey (LTDS).
- Distributed zonally using planning data.
- Used a ‘gravity model’ to produce the matrix distribution and controlled to observed trip length distribution from LTDS.
Network Detail (1)

Build Cycling Trip Matrix

Add Network Detail

Analyse Count / Survey Data

Initial Cycling Assignment

Calibrate / adjust parameters

Adjust Demand (ME)

Final Cycle Flow Estimate

Add flows to main model
Network Detail (2)

- 168 New Nodes
- Links covering:
  - Cycle only
  - Missing count links
  - Minor roads
Data Analysis (1)

- Build Cycling Trip Matrix
- Add Network Detail
- Analyse Count / Survey Data
- Initial Cycling Assignment
- Calibrate / adjust parameters
- Adjust Demand (ME)
- Final Cycle Flow Estimate
- Add flows to main model
Data Analysis (2)

Cycling Congestion Impact Quantification
Figure 18: Selected counts for analysis
**Data Analysis (3)**

- Majority of growth taking place in peak periods.
- AM (7-10) period accounts of 30% of all day cycle trip with IP comprising of about less than a third of AM hourly volumes.

### All Day Growth in cycle trips crossing the Central London cordon

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound</td>
<td>17%</td>
<td>10%</td>
<td>11%</td>
<td>1%</td>
</tr>
<tr>
<td>Outbound</td>
<td>14%</td>
<td>19%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>15%</td>
<td>15%</td>
<td>7%</td>
<td>1%</td>
</tr>
</tbody>
</table>
Assignment Model (1)

- Build Cycling Trip Matrix
- Add Network Detail
- Analyse Count / Survey Data

1. Initial Cycling Assignment
2. Calibrate / adjust parameters
3. Adjust Demand (ME)
4. Final Cycle Flow Estimate

Add flows to main model
Objective: Load the highway network with fixed flows to represent cyclists.

Cycling assignment carried out on network with added detail to highway network.

Fixed speed of 20kph assumed for cyclists with only signal related delays. Attractiveness factors for different infrastructure based on stated preference, revealed preference and intuition. Also included turn penalties.

Cyclist flows calibrated/ validated against counts before/ after Matrix Estimation.

Cycle flows loaded to highway network before highway assignment.
Assignment Model: Parameters (1)

- Tagging to identify links as:
  - Cycle only
  - Cycle lane
  - Bus lane

- All major motorways, dual-carriageways and tunnels banned for cyclists
Cycle infrastructure benefits derived in several studies but large variation in specific values. Calibrated using counts.

Initial and final values used in CLoHAM for cycle infrastructure related benefits:

<table>
<thead>
<tr>
<th></th>
<th>Cycle with bus lanes</th>
<th>Cycle Lanes</th>
<th>Cycle only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>Final</td>
<td>10%</td>
<td>12.5%</td>
<td>30%</td>
</tr>
</tbody>
</table>

To calculate realistic background cycle flows for highway network cycle assignment penalties were also calculated based on TRL research.

<table>
<thead>
<tr>
<th>Junction/Turn Type</th>
<th>Left</th>
<th>Straight</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority</td>
<td>1 s</td>
<td>3 s</td>
<td>5 s</td>
</tr>
<tr>
<td>Signal</td>
<td>2 s</td>
<td>5 s</td>
<td>10 s</td>
</tr>
<tr>
<td>Roundabout</td>
<td>3 s</td>
<td>7 s</td>
<td>12 s</td>
</tr>
</tbody>
</table>
## Calibration Results

<table>
<thead>
<tr>
<th></th>
<th>Observed Flow</th>
<th>Modelled Flow</th>
<th>% Diff</th>
<th>GEH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central Cordon</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inbound</td>
<td>12,820</td>
<td>12,414</td>
<td>-3%</td>
<td>406</td>
</tr>
<tr>
<td>Outbound</td>
<td>2,427</td>
<td>1,900</td>
<td>-22%</td>
<td>527</td>
</tr>
<tr>
<td><strong>Thames Screenline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northbound</td>
<td>4,750</td>
<td>4,968</td>
<td>5%</td>
<td>-218</td>
</tr>
<tr>
<td>Southbound</td>
<td>1,458</td>
<td>1,499</td>
<td>3%</td>
<td>-41</td>
</tr>
<tr>
<td><strong>Central East-West</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northbound</td>
<td>2,616</td>
<td>2,678</td>
<td>2%</td>
<td>-62</td>
</tr>
<tr>
<td>Southbound</td>
<td>2,230</td>
<td>2,349</td>
<td>5%</td>
<td>-119</td>
</tr>
<tr>
<td><strong>Great North-South</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastbound</td>
<td>2,054</td>
<td>2,172</td>
<td>6%</td>
<td>-118</td>
</tr>
<tr>
<td>Westbound</td>
<td>2,162</td>
<td>1,846</td>
<td>-15%</td>
<td>316</td>
</tr>
<tr>
<td><strong>Radial Westminster</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastbound</td>
<td>2,211</td>
<td>1,506</td>
<td>-32%</td>
<td>705</td>
</tr>
<tr>
<td>Westbound</td>
<td>1,115</td>
<td>1,217</td>
<td>9%</td>
<td>-102</td>
</tr>
<tr>
<td></td>
<td>33,844</td>
<td>32,550</td>
<td>-4%</td>
<td>1294</td>
</tr>
</tbody>
</table>
Base Year Cycling Flows
Highway Impacts

- **Build Cycling Trip Matrix**
- **Add Network Detail**
- **Analyse Count / Survey Data**

**Flow Estimation Process**

1. **Initial Cycling Assignment**
2. **Calibrate / adjust parameters**
3. **Adjust Demand (ME)**
4. **Final Cycle Flow Estimate**
5. **Add flows to main model**

**Output:** 0.33 PCU
Conclusions and Next Steps

► Simple method implemented

► Lots of uncertainty – route choice, count data, demand patterns etc.

► Sensitivity tests underway

► Looking to build on method and gain better understanding of mechanisms