Last-Mile Logistics in Urban Areas

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Freight Traffic Control 2050: Transforming Last-Mile Logistics
(ran from Jan 2016 to July 2019)
Last mile parcel logistics

- Final stages of delivery logistics networks
- Small van traffic growing in urban areas
- Less-than-van loads increasing with ‘same-day’ delivery
- Competitive industry
- Lots of small players
- Lots of inefficiencies
- Pressure to reduce emissions
- Land use planning not accounting for new e-commerce trends
Evidence

Total number of deliveries around Oxford Street:
Carrier 1: 1st October 2016 – 7th February 2017 (129 days)
Carrier 2: 28th August 2016 – 5th November 2016 (69 days)
## Evidence

### Number of deliveries - All 836 postcodes (Top 8 Postcodes)

<table>
<thead>
<tr>
<th>Activity (days)</th>
<th>Total</th>
<th>Average per postcode</th>
<th>Standard Deviation</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier 1 (129)</td>
<td>14009 (2348)</td>
<td>16.8 (293.5)</td>
<td>40 (56)</td>
<td>379</td>
</tr>
<tr>
<td>Carrier 2 (69)</td>
<td>19218 (8637)</td>
<td>23 (197.5)</td>
<td>158 (140)</td>
<td>4041</td>
</tr>
<tr>
<td>All Deliveries</td>
<td>33227 (9684)</td>
<td>39.8 (491)</td>
<td>169 (163)</td>
<td>4041</td>
</tr>
</tbody>
</table>
Data Collection

W1 – Mayfair, Soho, Oxford St., Fitzrovia, Marylebone

WC1 – British Museum, UCL, St. Pancras, Gray’s Inn, High Holborn

WC2 – Covent Garden, Leicester Square, Somerset House, Charing Cross
Data collection

• Three days: Tue 25/10/16 to Thu 27/10/16

• A total of 25 rounds over the three days

• GPS tracks from driver and the vehicle:
  • RouteTracker2 App (surveyor)
  • Qstarz trackers (driver + van)
Round distance: 14.8 kms
Round duration: 7.82 hrs
Total driving time: 1.77 hrs
Total parking time: 6.05 hrs
Average speed: 1.89 km/hr
#parking stops: 35
#items delivered: 119
Efficiency: 0.06 hr/item
Round distance: 18.5 kms
Round duration: 7.3 hrs
Total driving time: 1.7 hrs
Total parking time: 5.6 hrs
Average vehicle speed: 2.53 km/hr
Number of parking stops: 46
Number of items delivered: 131
Efficiency: 0.05 hr/item
**Time sensitivity?**

Data from a major carrier (4–9 June 2018)

<table>
<thead>
<tr>
<th>Delivery by</th>
<th>#</th>
<th>From Depot 1</th>
<th>%</th>
<th>#</th>
<th>From Depot 2</th>
<th>%</th>
<th>#</th>
<th>From Depot 3</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>178</td>
<td>2.1%</td>
<td></td>
<td>25</td>
<td>4.9%</td>
<td></td>
<td>213</td>
<td>1.6%</td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td>253</td>
<td>3.0%</td>
<td></td>
<td>22</td>
<td>4.3%</td>
<td></td>
<td>296</td>
<td>2.3%</td>
<td></td>
</tr>
<tr>
<td>12:00</td>
<td>663</td>
<td>7.8%</td>
<td></td>
<td>42</td>
<td>8.3%</td>
<td></td>
<td>933</td>
<td>7.2%</td>
<td></td>
</tr>
<tr>
<td>18:00</td>
<td>7352</td>
<td>87.0%</td>
<td></td>
<td>417</td>
<td>82.4%</td>
<td></td>
<td>11584</td>
<td>88.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>8446</td>
<td>100.0%</td>
<td></td>
<td>506</td>
<td>100.0%</td>
<td></td>
<td>13026</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>
Clustered routing strategies

- Initial modelling focuses on one driver on a given patch

- A two level-distribution model:
  - Clusters of delivery points
  - Routing across the clusters

- The routing strategy within clusters may vary
Case study

Round on 27 October 2016:
• 57 delivery locations
• Suggesting 48 clusters
• Four hours of driving and an hour of walking in total
Alternative clusters

Optimisation using 34 clusters:
- About 60% reduction in total driving time compared to original
- Parking times reduced
- Overall delivery time reduced by about 2.5 hours to original
Change in workload (weight)
Portering solutions
Portering

• Scenario 1: Drop-and-drive
  • No porter facilities required
  • Carriage provision needed
  • Synchronisation may be needed

• Scenario 2: Reception points
  • Temporary (mobile?) depots
  • Greater coverage of catchment area
Simple analysis

Scenario 1

• Van covered 16.8km over 7.3 hours

• Partition into nine approx. equal size patches

• Shortest path assumed in each patch
Simple analysis

Potential benefits:

• Reduction of 14.6km in distance (86%)

• Reduction of about six hours (5.3h + 1h – 20min)

• But…

<table>
<thead>
<tr>
<th>Delivery patch (no. consignees)</th>
<th>Parcels</th>
<th>Walking time (seconds)</th>
<th>Walking distance (m (yards))</th>
<th>Handover Time for driver to porter (seconds)</th>
<th>Collections (no. consignors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (6)</td>
<td>54</td>
<td>602</td>
<td>849 (928)</td>
<td>586</td>
<td>0</td>
</tr>
<tr>
<td>2 (8)</td>
<td>10</td>
<td>527</td>
<td>741 (810)</td>
<td>133</td>
<td>0</td>
</tr>
<tr>
<td>3 (6)</td>
<td>15</td>
<td>559</td>
<td>790 (864)</td>
<td>185</td>
<td>0</td>
</tr>
<tr>
<td>4 (4)</td>
<td>4</td>
<td>475</td>
<td>662 (724)</td>
<td>71</td>
<td>3</td>
</tr>
<tr>
<td>5 (9)</td>
<td>15</td>
<td>792</td>
<td>1107 (1211)</td>
<td>185</td>
<td>2</td>
</tr>
<tr>
<td>6 (3)</td>
<td>6</td>
<td>445</td>
<td>627 (686)</td>
<td>92</td>
<td>0</td>
</tr>
<tr>
<td>7 (5)</td>
<td>13</td>
<td>458</td>
<td>647 (708)</td>
<td>164</td>
<td>0</td>
</tr>
<tr>
<td>8 (9)</td>
<td>11</td>
<td>565</td>
<td>791 (865)</td>
<td>143</td>
<td>1</td>
</tr>
<tr>
<td>9 (2)</td>
<td>3</td>
<td>31</td>
<td>44 (48)</td>
<td>61</td>
<td>0</td>
</tr>
<tr>
<td>Total (52)</td>
<td>131</td>
<td>4454</td>
<td>6.26km (3.89 miles)</td>
<td>1620</td>
<td>6</td>
</tr>
</tbody>
</table>
Optimisation challenges

- Clusters
  - Fixed vs unknown
  - Capacity limitations (two-dimensional)

- Porter routes
  - Open vs closed
  - Rendezvous points
  - Infrastructure
Portering solution
Portering solution
Working with Transport for London and with several universities as part of the FTC2050 research project, Gnewt has been trialing urban portering services to measure the impact of this new approach as a model for reducing the number of vans needed to fulfil deliveries and cut emissions.***

Issues in portering systems

• Geographical Coverage

• Location and Type of Portering Infrastructure

• Financing and Operating the Portering Service
Thank you!

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Thanks to my co-authors within the FTC2050 consortium.