The AccraMobile Initiative
Understanding Paratransit through Digital Data
Going beyond a descriptive approach

- Mapping gives a good picture of the network
- But very static and descriptive approach
- Need to better understand the performance of the transport system

We decided to analyze it from two different angles:
  - From the user’s perspective, looking at service reliability (subset of 60 routes, over 1'200 trips recorded)
  - From the operator’s perspective, looking at operational performance (case study on a terminal with detailed analysis on 6 routes)
Digital applications used to date

DataMobile/Itinerum

TapLog

Main limitations:

- A lot of manual manipulation required (retrieving data from server, cleaning up...)
- Data from two different sources has to be merged
- OSM Tracker more integrated but does not allow passenger counts
Headway variability

- Peak hour headway between 5-15 minutes
- **Very frequent departures during peak hours**
- Complementary patterns across routes
- Reflect distribution of demand (load-and-go)
Vehicle load factor analysis

- No seats available on first part of outbound trip
- Passengers have to walk to terminal!
- Passengers alight before last stop to avoid congestion close to terminal
- Lower load factors on return trip, since vehicles are not allowed to wait at last stop
### Rotations and driving time

#### Results

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td><strong>Mean rotations by vehicle</strong></td>
<td>38</td>
<td>5.6</td>
<td>5.5</td>
<td>5.5</td>
<td>5.7</td>
<td>5.1</td>
<td>6.2</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>Max. rotations by vehicle</strong></td>
<td>87</td>
<td>12</td>
<td>15</td>
<td>12</td>
<td>13</td>
<td>11</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td><strong>Estimated driving time / veh.</strong></td>
<td>23h</td>
<td>3h30</td>
<td>3h25</td>
<td>3h25</td>
<td>3h25</td>
<td>3h</td>
<td>3h55</td>
<td>3h55</td>
</tr>
<tr>
<td><strong>Total number of rotations</strong></td>
<td>2'667</td>
<td>389</td>
<td>385</td>
<td>384</td>
<td>397</td>
<td>355</td>
<td>436</td>
<td>321</td>
</tr>
<tr>
<td><strong>Number of vehicles operating</strong></td>
<td>70</td>
<td>67</td>
<td>68</td>
<td>68</td>
<td>70</td>
<td>70</td>
<td>67</td>
<td>63</td>
</tr>
</tbody>
</table>

#### Revenue analysis (in Ghana cedis)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Total collected revenue</strong></td>
<td>129'700</td>
<td>19'000</td>
<td>18'800</td>
<td>18'800</td>
<td>19'300</td>
<td>17'200</td>
<td>21'200</td>
<td>15'400</td>
</tr>
<tr>
<td><strong>Max. revenue by vehicle</strong></td>
<td>GHS 3'740</td>
<td>GHS 610</td>
<td>GHS 680</td>
<td>GHS 560</td>
<td>GHS 620</td>
<td>GHS 560</td>
<td>GHS 680</td>
<td>GHS 660</td>
</tr>
<tr>
<td><strong>Mean revenue by vehicle</strong></td>
<td>GHS 1'860</td>
<td>GHS 280</td>
<td>GHS 280</td>
<td>GHS 280</td>
<td>GHS 280</td>
<td>GHS 250</td>
<td>GHS 320</td>
<td>GHS 250</td>
</tr>
<tr>
<td><strong>Median revenue by vehicle</strong></td>
<td>GHS 1'780</td>
<td>GHS 290</td>
<td>GHS 270</td>
<td>GHS 270</td>
<td>GHS 260</td>
<td>GHS 250</td>
<td>GHS 320</td>
<td>GHS 270</td>
</tr>
<tr>
<td><strong>Standard deviation in revenue</strong></td>
<td>GHS 490</td>
<td>GHS 110</td>
<td>GHS 110</td>
<td>GHS 100</td>
<td>GHS 100</td>
<td>GHS 90</td>
<td>GHS 100</td>
<td>GHS 110</td>
</tr>
</tbody>
</table>

- Vehicles do 5 or 6 rotations per day on average
- Drivers spend less than 30% of their time driving...
- **And 70% of their time waiting in line at terminals!**
  - Oversupply of vehicles causing inefficiencies and congestion
- Average daily revenue is approximately 50 EUR
### Passenger volumes by section

#### Daily passenger volumes (both directions)

<table>
<thead>
<tr>
<th>Route</th>
<th>Route Length</th>
<th>Travel Time</th>
<th>Commercial Speed</th>
<th>Passengers</th>
<th>Passengers / Travel Time</th>
<th>Number of Departures</th>
<th>Vehicle.km Traveled</th>
<th>Passengers (both directions)</th>
<th>Morning Peak Hour Headway</th>
<th>Evening Peak Hour Headway</th>
<th>Number of Vehicles Operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mortuary Rd</td>
<td>12 km</td>
<td>34 min</td>
<td>21 km/h</td>
<td>26.6</td>
<td>48</td>
<td>105</td>
<td>1,265 km</td>
<td>2'810</td>
<td>5 min</td>
<td>11 min</td>
<td>31</td>
</tr>
<tr>
<td>2. Korle Bu</td>
<td>9 km</td>
<td>33 min</td>
<td>16 km/h</td>
<td>30.0</td>
<td>55</td>
<td>76</td>
<td>680 km</td>
<td>2'270</td>
<td>8 min</td>
<td>14 min</td>
<td>38</td>
</tr>
<tr>
<td>3. Chorkor</td>
<td>11 km</td>
<td>42 min</td>
<td>16 km/h</td>
<td>31.6</td>
<td>45</td>
<td>138</td>
<td>1,516 km</td>
<td>4'350</td>
<td>12 min</td>
<td>3 min</td>
<td>61</td>
</tr>
<tr>
<td>4. Shallom</td>
<td>10 km</td>
<td>36 min</td>
<td>17 km/h</td>
<td>27.9</td>
<td>47</td>
<td>67</td>
<td>668 km</td>
<td>1'860</td>
<td>11 min</td>
<td>8 min</td>
<td>36</td>
</tr>
<tr>
<td>5. Soko</td>
<td>9 km</td>
<td>29 min</td>
<td>19 km/h</td>
<td>25.8</td>
<td>53</td>
<td>61</td>
<td>547 km</td>
<td>1'570</td>
<td>43 min</td>
<td>11 min</td>
<td>35</td>
</tr>
<tr>
<td>6. Alhaji</td>
<td>10 km</td>
<td>40 min</td>
<td>15 km/h</td>
<td>26.5</td>
<td>40</td>
<td>24</td>
<td>244 km</td>
<td>N/A</td>
<td>43 min</td>
<td>7 min</td>
<td>13 min</td>
</tr>
</tbody>
</table>

#### Results are rounded

- Over 50% of passenger traffic concentrated on two routes
- Most travelled route has 4,350 passengers/day
- Number of km travelled can be used to calculate CO2 emission
- Passenger volumes by road segment can be used to direct investments on infrastructure
## Perspectives

### Current limitations

<table>
<thead>
<tr>
<th>Non-dedicated data collection apps require heavy manual treatment of data</th>
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<tbody>
<tr>
<td>Lack of automatic integration between data collection and analysis stages</td>
</tr>
<tr>
<td>Data quickly becomes obsolete (need for regular updates)</td>
</tr>
</tbody>
</table>

### Desired solution

- OSM-compatible data collection app compatible with the specificities of paratransit
- Web-based interface w/ analysis and rendering capabilities directly using data from data collection campaigns against OSM backdrop
- Real-time data on location of vehicles through embarked GPS sensors

### Future developments

- Jungle Bus future release to include GPS tracking functionality
- ???
- ???
Conclusion

Avoid the “data-for-the-sake-of-data” syndrome and consider applications:

For authorities
- Target investments on transport infrastructure
- Tie license delivery to service level agreements
- Focus enforcement on black spots to encourage compliance
- …

For operators
- Develop business cases to access financing towards fleet renewal
- Better match the transport demand (in time and space)
- Rationalize/reorganize supply at the branch or metropolitan level

For passengers
- Obtain information on existing services (maps, journey planning…)
- Have access to on-demand transport in areas or at times of low service
- …

⇒ Digital technologies and data can be a powerful driver towards a transformation of the paratransit sector!
Thank you for your attention

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