Cycling Data for Active Traffic Management in CPH

Innovative ways of collecting cycling data in Copenhagen
A GREEN, SMART AND CARBON NEUTRAL CITY

CPH 2025
CLIMATE PLAN
Service goals

• Reduce travel time for cyclists by 10% on specific corridors
• Reduce number of stops for cyclists by 10% on specific corridors
• .. as well as goals for busses, pedestrians and cars
Active Traffic Management

• Ability to monitor and manage traffic as it happens
• Data within minutes, not days/weeks/months
• Many data sources are fine for analysis, but not fit for operational use
• Yes, data and active traffic management should also be for bicycle traffic
Key Metrics

- Volume
- Travel time
- Number of stops
Volume?

- Loops
  - often destroyed
- Radars
  - can’t count groups
- Apps
  - no absolute counts
ViSense

- Camera sensors mounted in traffic light poles
- Images analysed on the device, only simple counts are transmitted
- Need to improve performance in some low-light situations

<table>
<thead>
<tr>
<th>Hour</th>
<th>Detected</th>
<th>Truth</th>
<th>Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>445</td>
<td>434</td>
<td>2.3%</td>
</tr>
<tr>
<td>16:00</td>
<td>359</td>
<td>352</td>
<td>2.0%</td>
</tr>
<tr>
<td>23:00</td>
<td>47</td>
<td>46</td>
<td>2.2%</td>
</tr>
</tbody>
</table>
ViSense installations

City of Copenhagen

Cycling Data for Active Traffic Management in CPH

8

Notifications: 0  New alarms: 6,345  Seen alarms: 4
Automatic traffic optimization

• Scenarios are configured in MobiMaestro, and can use volumes, e.g:
  – IF service goals is met on the corridor
  – AND more than 300 cyclist / min for at least 15 minutes on side street
  – THEN change signal programs to prioritize side street
• Not just local traffic control – can consider the big picture
ViSense data

Cycling Data for Active Traffic Management in CPH
Travel time / number of stops?

• Hard to find existing solutions that deliver operational travel times or number of stops for cyclists
• Need to track individual cyclists?
• Need to install a lot of equipment?
Shared City Bikes?

• All bikes have GPS
• 1.5 million trips per year

• But not operational data
• Ex: Bredgade/Grønningen
  – 440 trips / day
  – Only 15 travel times / day

Measured travel times
11-08-2016

Seconds
600
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 Time
Apps?

• It’s the future! But still hard because:
  – Single apps provide too little data
  – User group too narrow, leading to biased data
  – Uncertainty about quality of data

• A few big players probably have enough data, but don’t (yet) have a business model for selling it
BikeSim

- Smart reuse of existing equipment and systems
- We can already fetch real-time data from all traffic lights!
- Part of our MobiMaestro traffic management system

- BikeSim computes estimated travel times and number of stops based on:
  - Actual signal state of traffic lights
  - Distance between intersections

- Monte Carlo simulation of cyclist moving along a corridor
- Optionally use of volume sensors for estimating the effect of crowding
- Data fetched from traffic lights using the open RSMP protocol
BikeSim example: Vesterbrogade

VisSim: Vesterbrogade / Trommesalen 02.06
- Cyclists/min: 240

VisSim: Vesterbrogade / Værnedamsvej 25.06
- Cyclists/min: 480

BikeSim: Rådhuspladsen --> Rahbek's Alle
- Rejsetid (mål 8.1): 7.12
- Antal stop: 4.28

BikeSim: Rahbek's Alle --> Rådhuspladsen
- Rejsetid (mål 8.1): 6.64
- Antal stop: 6.35
BikeSim concept

Simulator configuration

- Average speed: 20 km/h
- Standard deviation speed: 0 km/h
- Iteration time: 60 sec
- Averaging period: 240 sec
- Min. stop time: 10000 ms

Time difference between actual time and signal timestamps used in the simulation

Initial time difference simulation: 30000 ms
Traffic Lights: our travel time sensor network
Automatic selection of VMS content based on travel times
BikeSim data
BikeSim data

City of Copenhagen
BikeSim data
Cycling Data for Active Traffic Management in CPH

Dashboard / BikeSim servicemål
Search... (e.g. status:200 AND extension:PHP)
Add a filter

BikeSim: Rejsetid, alle korridorer, som tabel

<table>
<thead>
<tr>
<th>Filters</th>
<th>Rejsetid (minutter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tuborgvej - Kongens Nytorv</td>
<td>19.92</td>
</tr>
<tr>
<td>2 Emdrup Sø - Sølvtorvet</td>
<td>14.612</td>
</tr>
<tr>
<td>3 Tomsgårdsvej - Nørreport</td>
<td>15.571</td>
</tr>
<tr>
<td>4 Rahbekø Allé - Rådhuspladsen</td>
<td>8.307</td>
</tr>
<tr>
<td>5 Øresund Station - Rysenstensgade</td>
<td>15.528</td>
</tr>
<tr>
<td>6 Sundbyvester Plads - Kongens Nytorv</td>
<td>16.865</td>
</tr>
<tr>
<td>7 Lille Triangel - Hovedbanegården</td>
<td>12.371</td>
</tr>
</tbody>
</table>

BikeSim: Antal stop, alle korridorer, som tabel

<table>
<thead>
<tr>
<th>Filters</th>
<th>Antal stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tuborgvej - Kongens Nytorv</td>
<td>8.491</td>
</tr>
<tr>
<td>2 Emdrup Sø - Sølvtorvet</td>
<td>7.454</td>
</tr>
<tr>
<td>3 Tomsgårdsvej - Nørreport</td>
<td>8.831</td>
</tr>
<tr>
<td>4 Rahbekø Allé - Rådhuspladsen</td>
<td>5.132</td>
</tr>
<tr>
<td>5 Øresund Station - Rysenstensgade</td>
<td>3.596</td>
</tr>
<tr>
<td>6 Sundbyvester Plads - Kongens Nytorv</td>
<td>8.113</td>
</tr>
<tr>
<td>7 Lille Triangel - Hovedbanegården</td>
<td>6.29</td>
</tr>
</tbody>
</table>
Challenges

• Maintaining a stable system involving multiple suppliers
• Validating data quality and establishing ground truth
• Privacy and GDPR
• Cost of equipment and maintenance
Why can’t we just buy this bicycle data?

• We would rather just buy the data
• Most people already bike around with a powerful computer packed with sensors
• For cars, we can buy operational data from e.g. INRIX or TomTom – they collect from multiple sources and merge into a single uniform data set
• When will somebody grab this business opportunity?
Thank you

Emil Tin
Project Manager
ITS Program
City of Copenhagen
zf0f@kk.dk