Multimodal Traffic Management 2

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Collaboration between LiU and KTH

Funded by Trafikverket through CTR

Aim

The Multimodal Traffic Management 2 (MMTL2) project aims to improve the efficiency of transportation systems through improved multimodal traffic management.

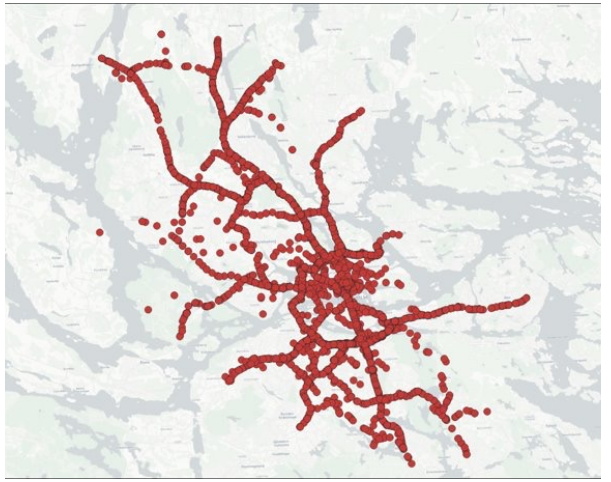
- The project will
  - develop new methods to estimating multimodal demand as well as transport mode and route choice during incidents
  - Evaluate effects of multimodal traffic management
- Interesting questions related to incidents in the network are
  - What is the effect of the incident?
  - Which travelers are most affected by the incident?
  - Which multimodal alternatives are there for these travelers?

Project goals

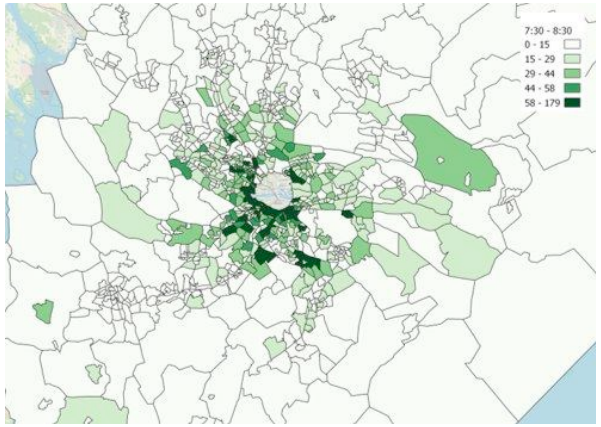
- Compile a **dataset of incidents** related to traffic management to enable analyses related to modeling and actions during incident management.
- Use **statistical models and machine learning** to combine and analyze data related to multimodal traffic management during incidents.
- Develop and evaluate **new models for route and mode choice** during incidents
- Combine the developed route and mode choice models with a **mesoscopic traffic model** to analyze the impact of different multimodal traffic management measures
- Gain **long-term knowledge** about methods and data sources for effective traffic management

Data sources for multimodal traffic management

Public transport tap-in data



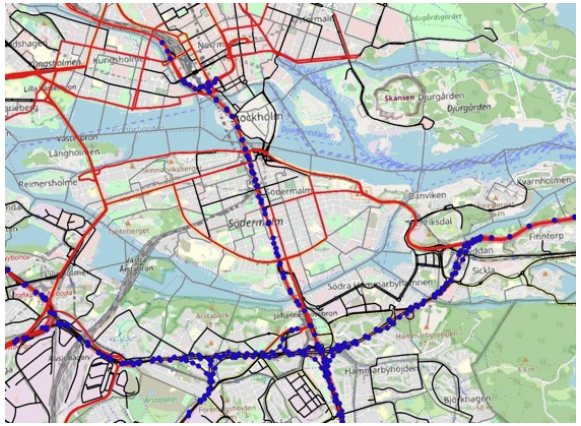
Incident data



Congestion charging portals

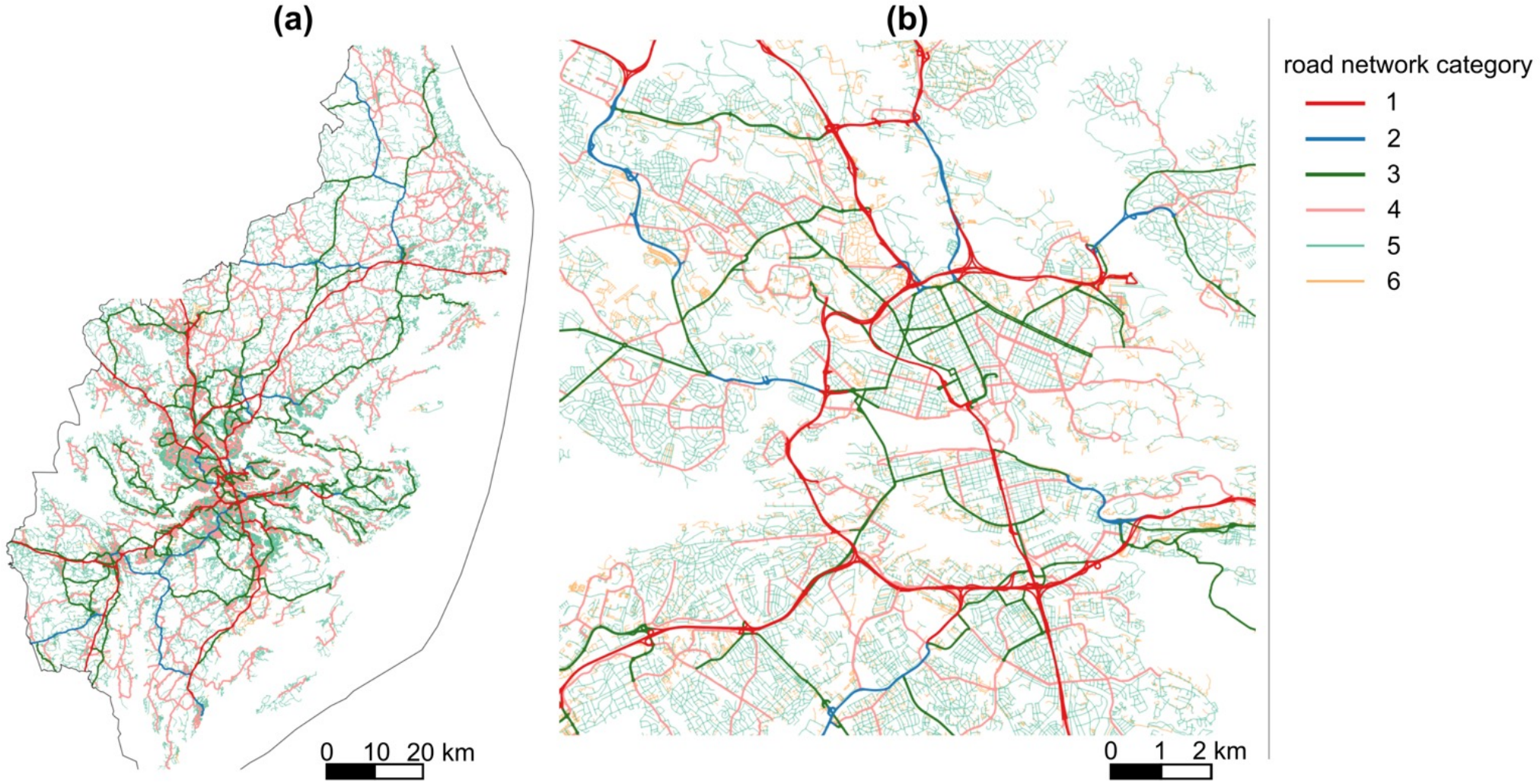
Inrix trips

Mobile network data

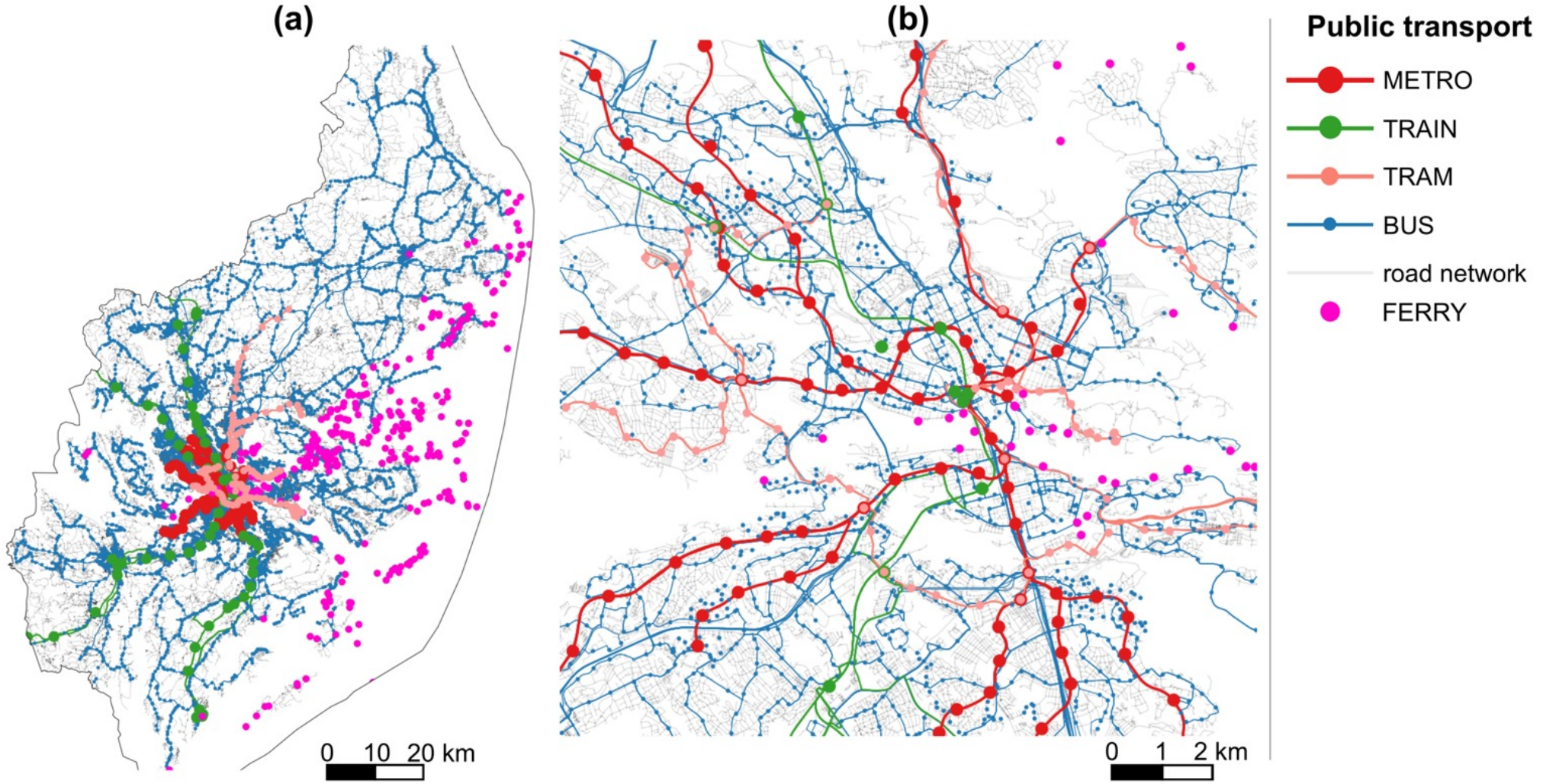


MCS

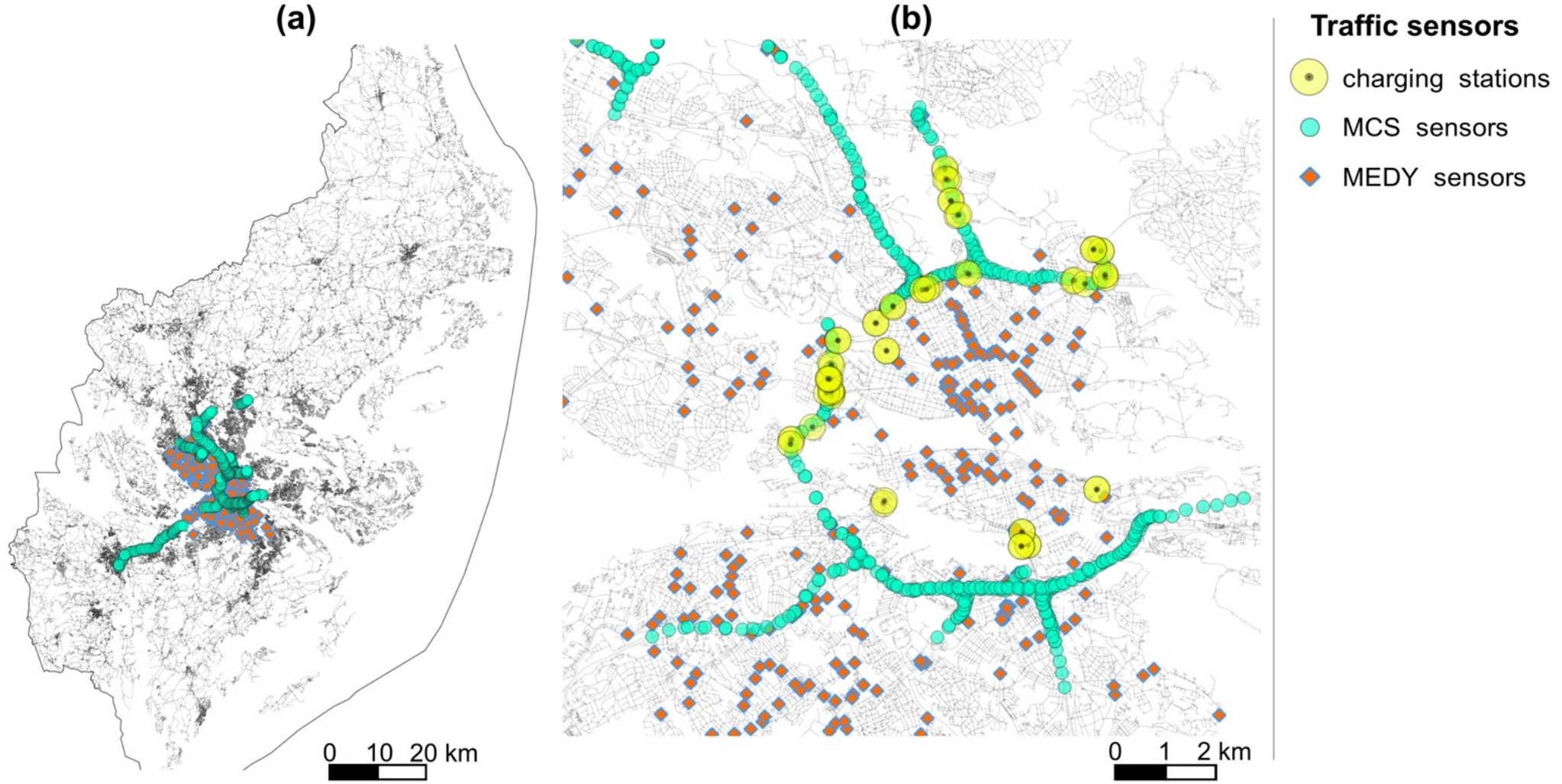
Exploratory analysis: multimodal network and sensors



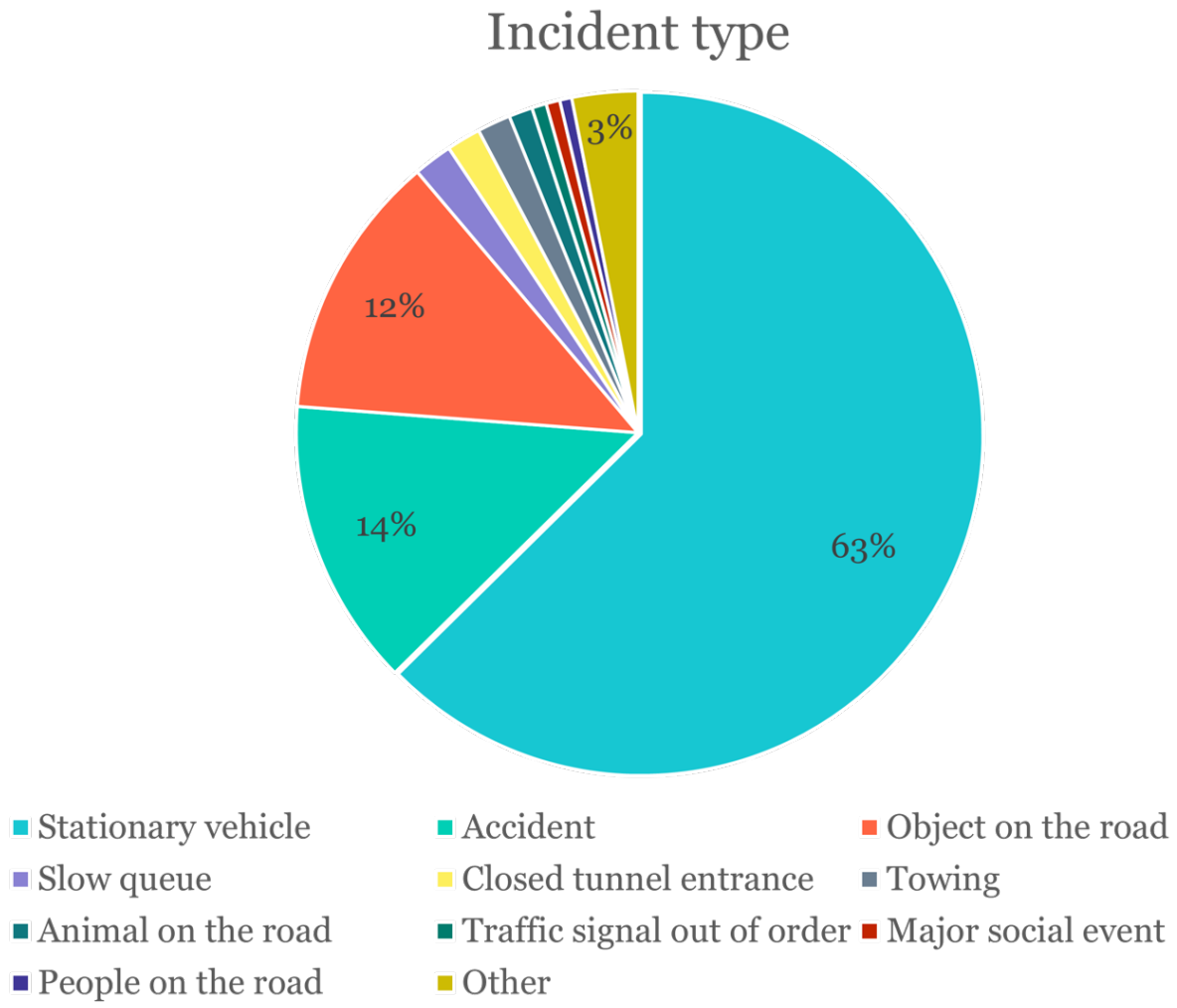
Exploratory analysis: multimodal network and sensors

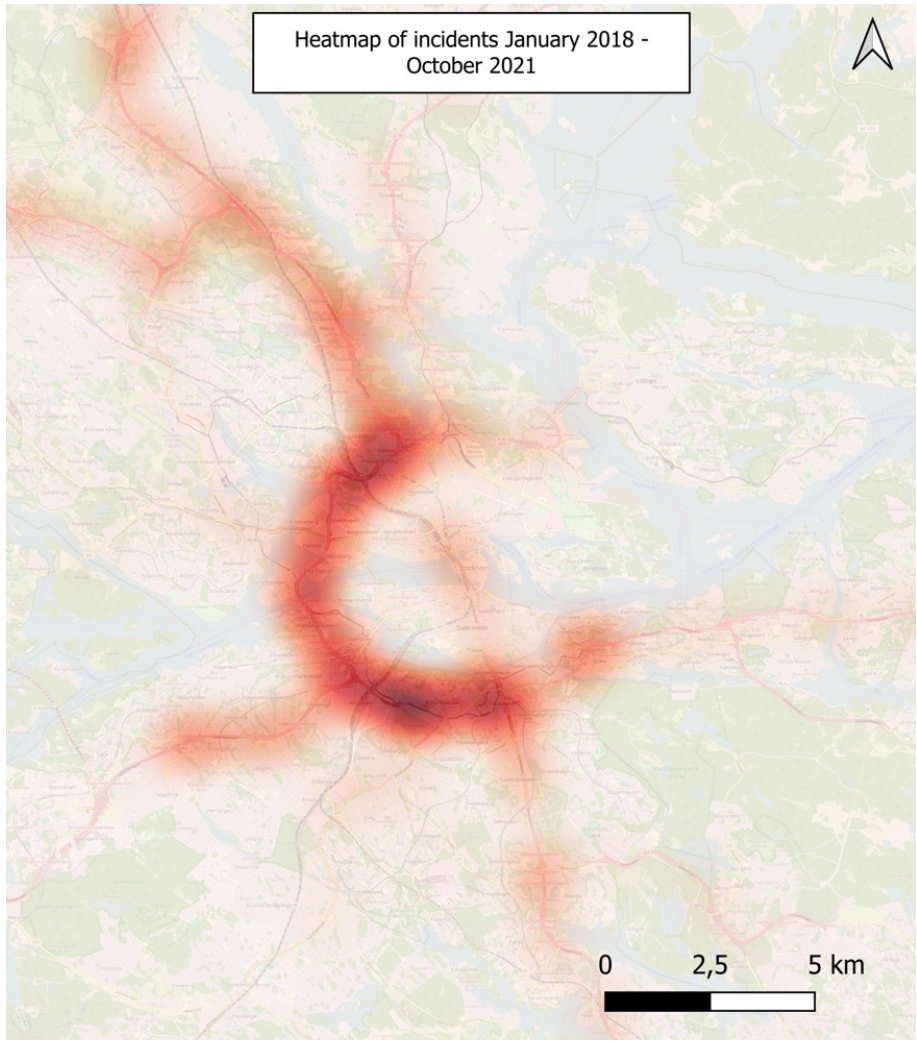


Exploratory analysis: multimodal network and sensors



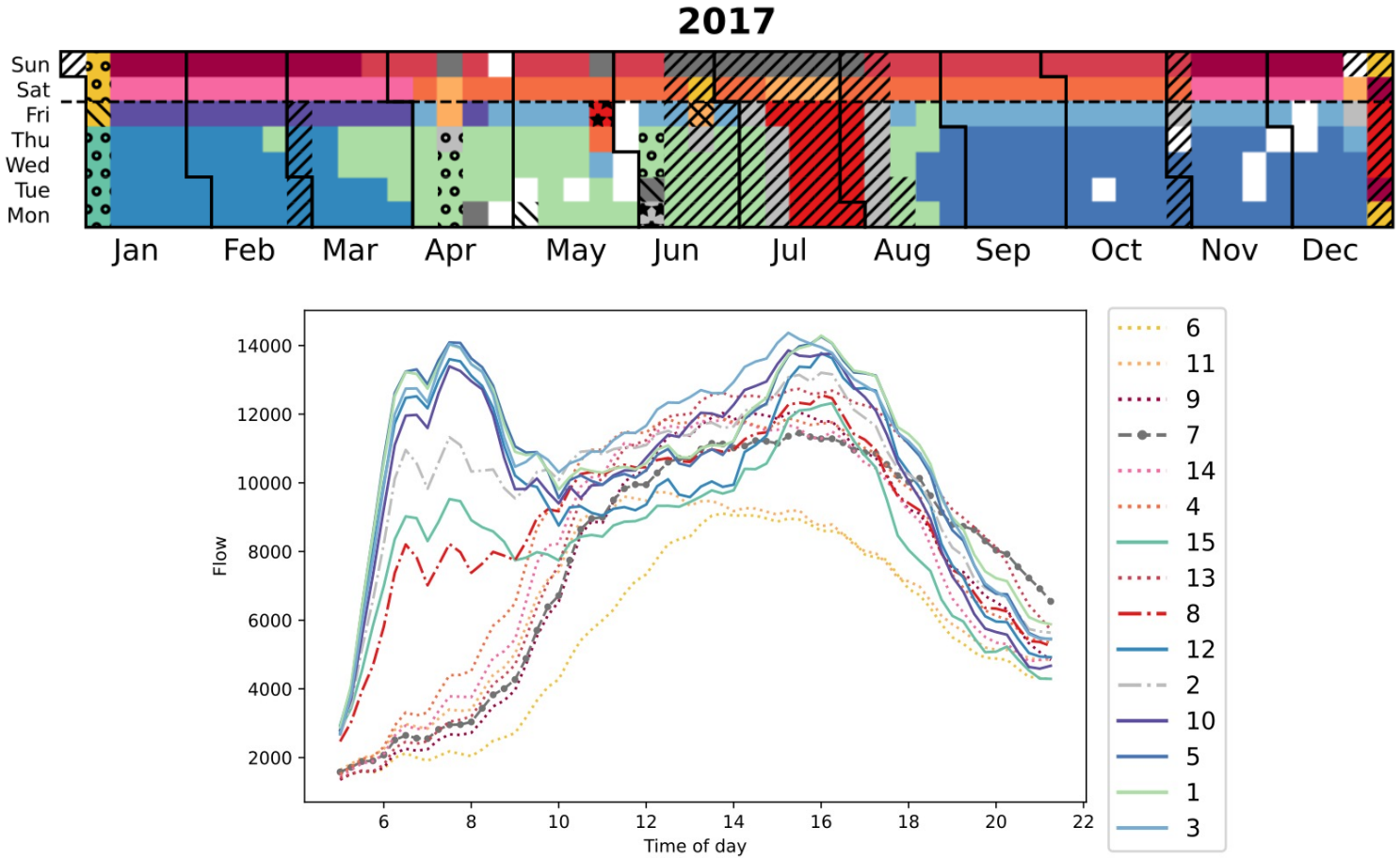
Exploratory analysis: incident data



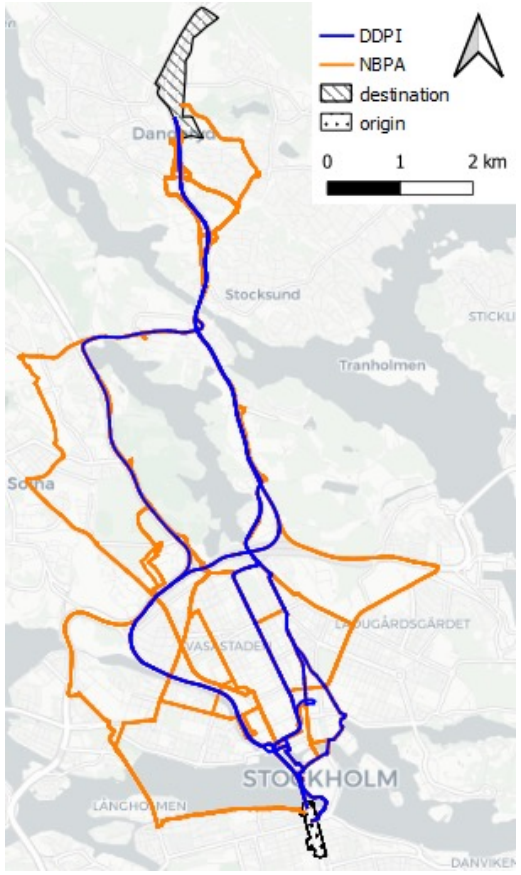


Results from MMTL 1

MCS flow day-types cluster analysis



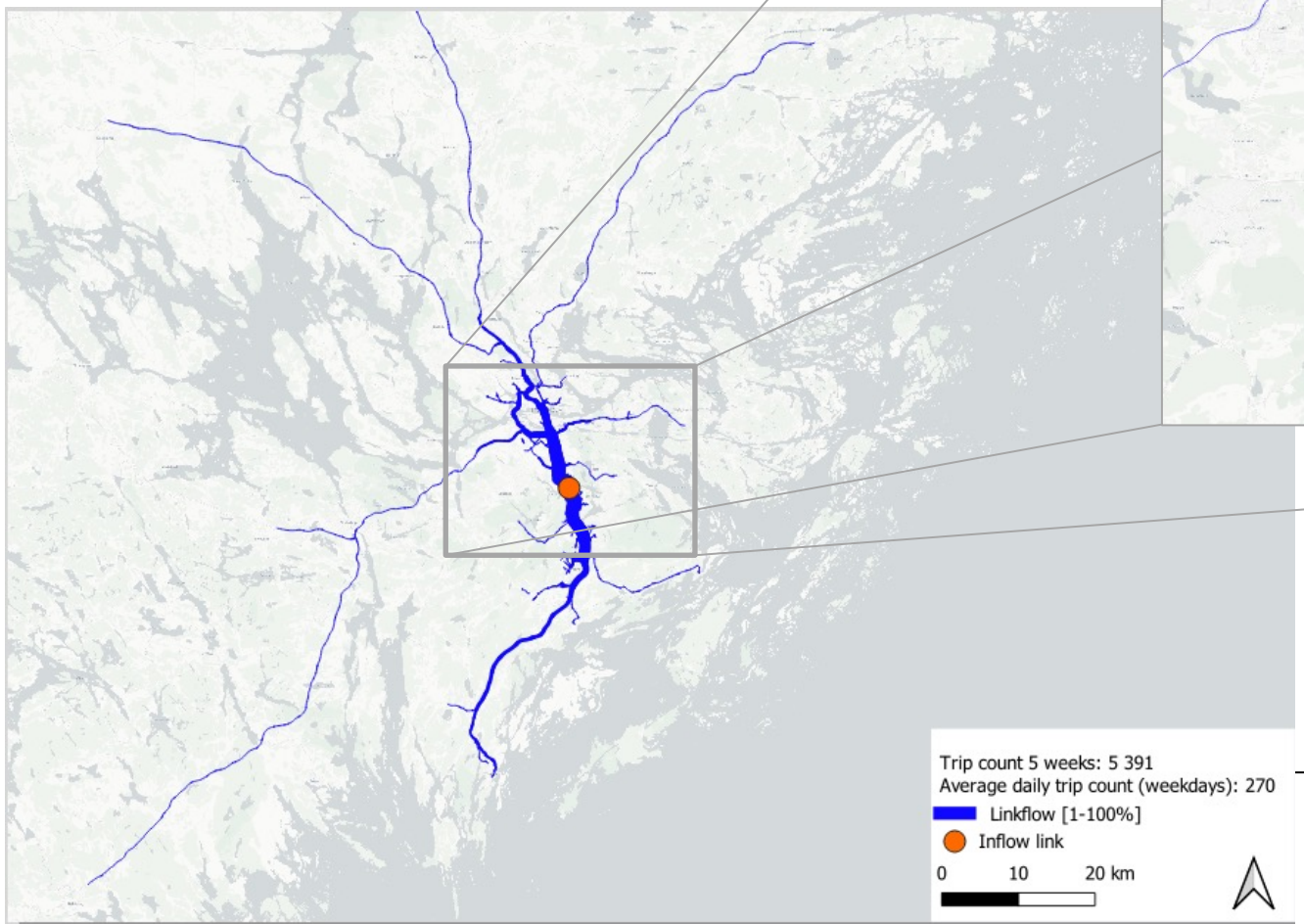
Route choice estimation for traffic management

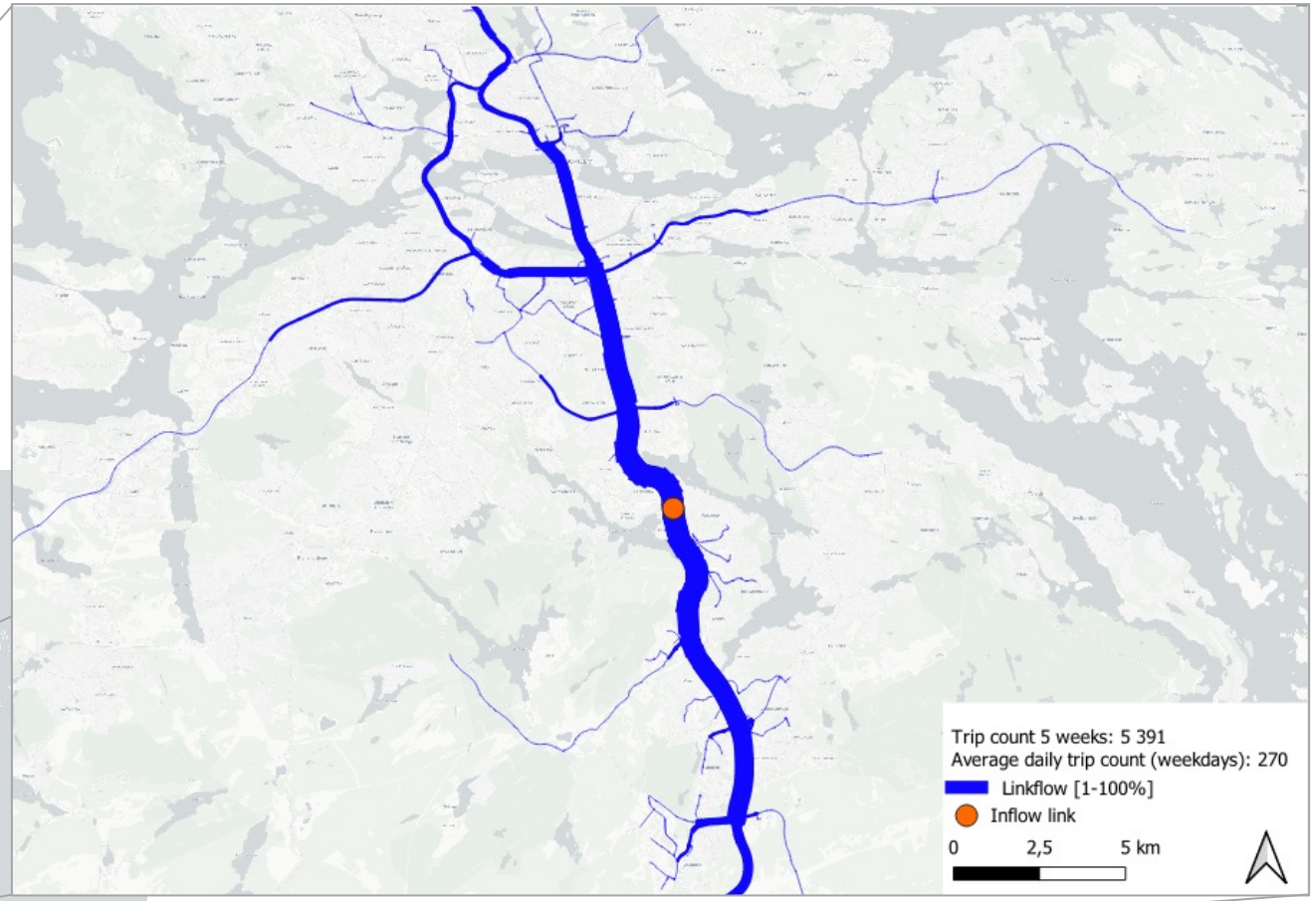


Route choice Stockholm

South to North

- Large proportion continues through the city center



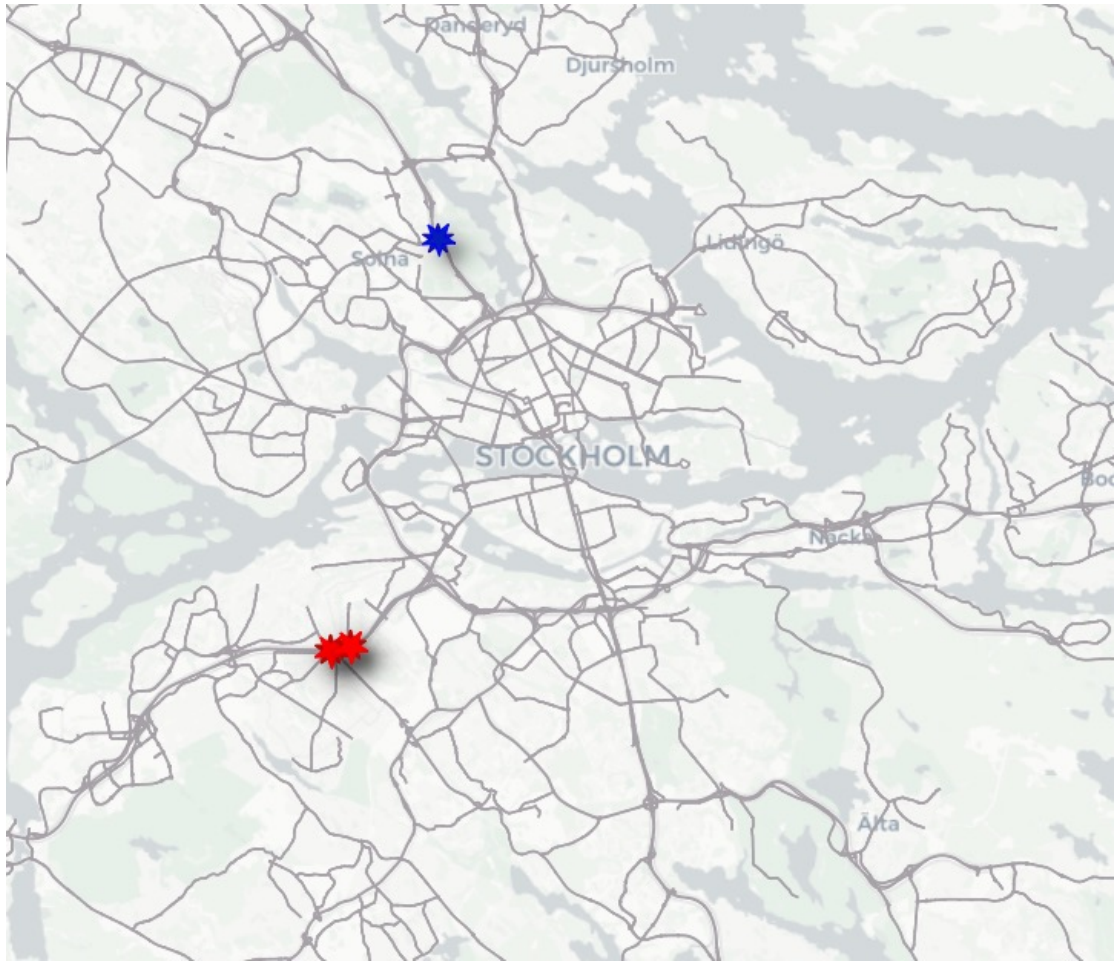


Multimodal analysis of travel patterns during incidents

Example incident

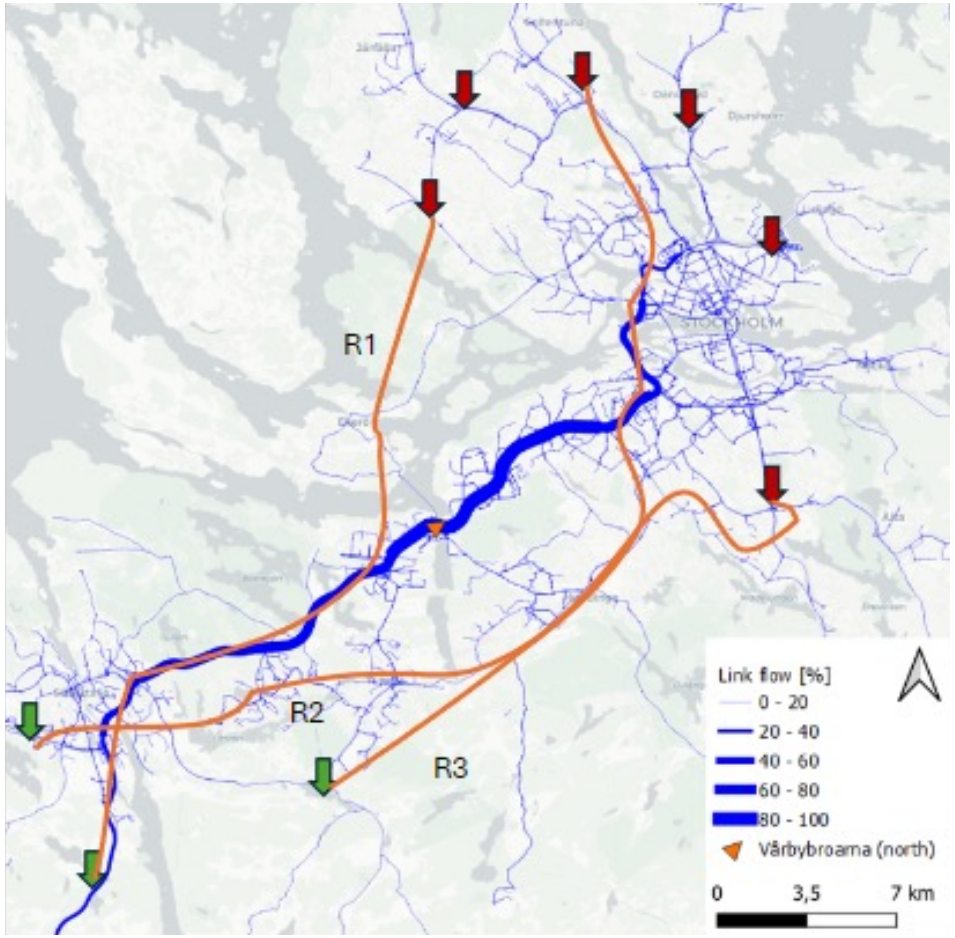
- Blue incident – Uppsalavägen
  - 2019-10-18 (Tuesday)
  - Private car standing still in right lane
  - Duration 49 min

- Red incidents – Essingeleden
  - 2019-10-01 (Tuesday)
  - Accident truck and private car 6:15
  - Truck in left lane 8.00
  - Stationary private car + assistance 8.30



Identification of alternative routes

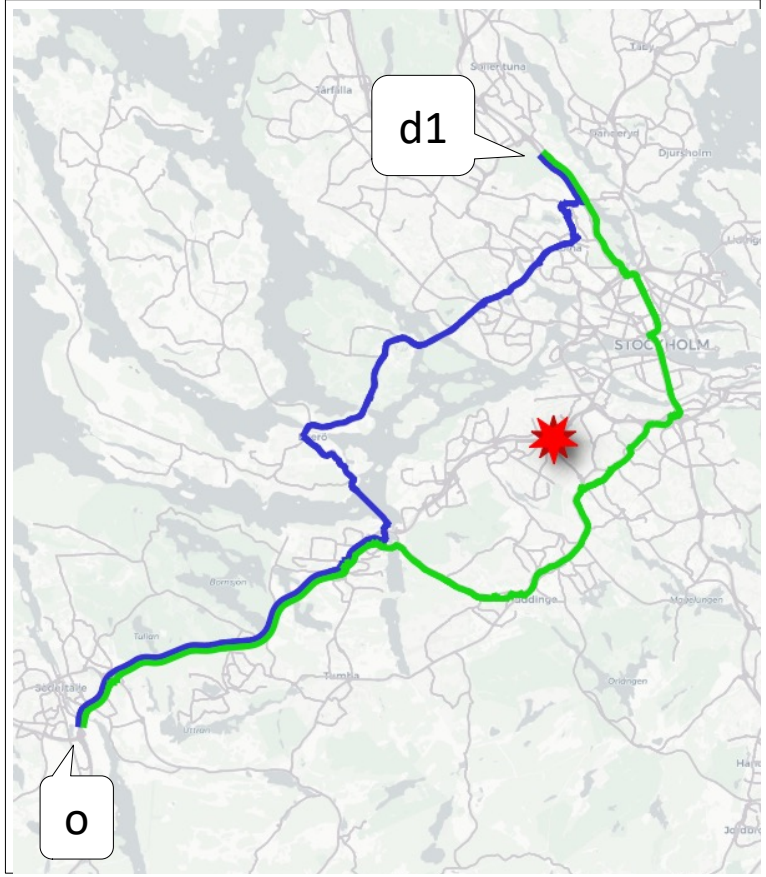
1. Start with spider plot/route flows for incident link
2. Traverse spider tree up- and downstream until threshold value of link flow
3. Calculate alternative routes for all nodes that are traversed
4. Add only routes that are not too similar and within travel time threshold



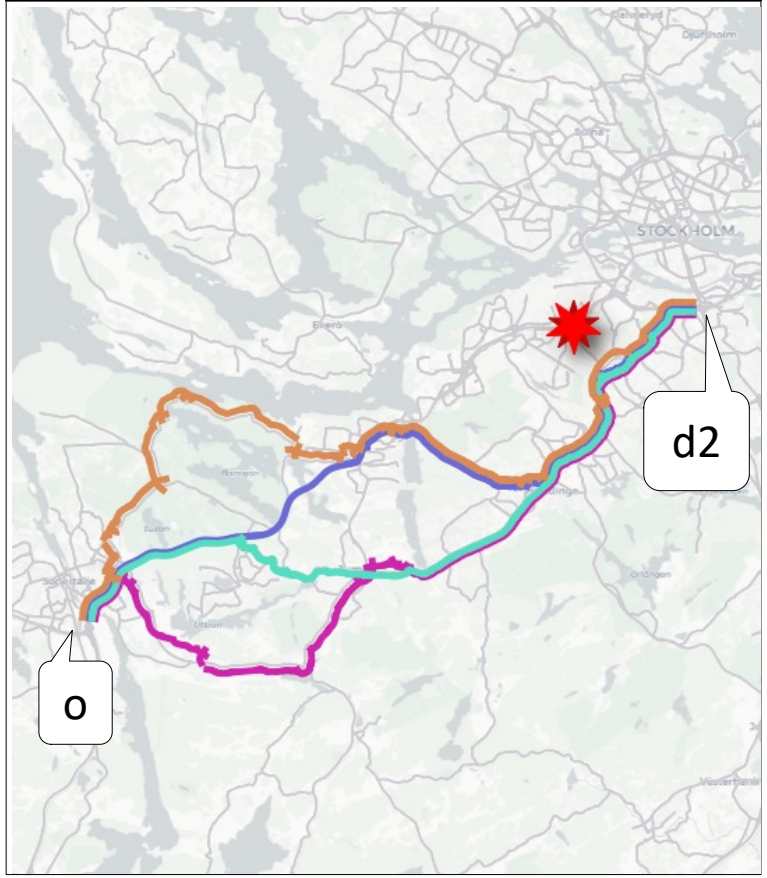
Route choice during incident on Essingleden

Spider plot

Alternative routes 1

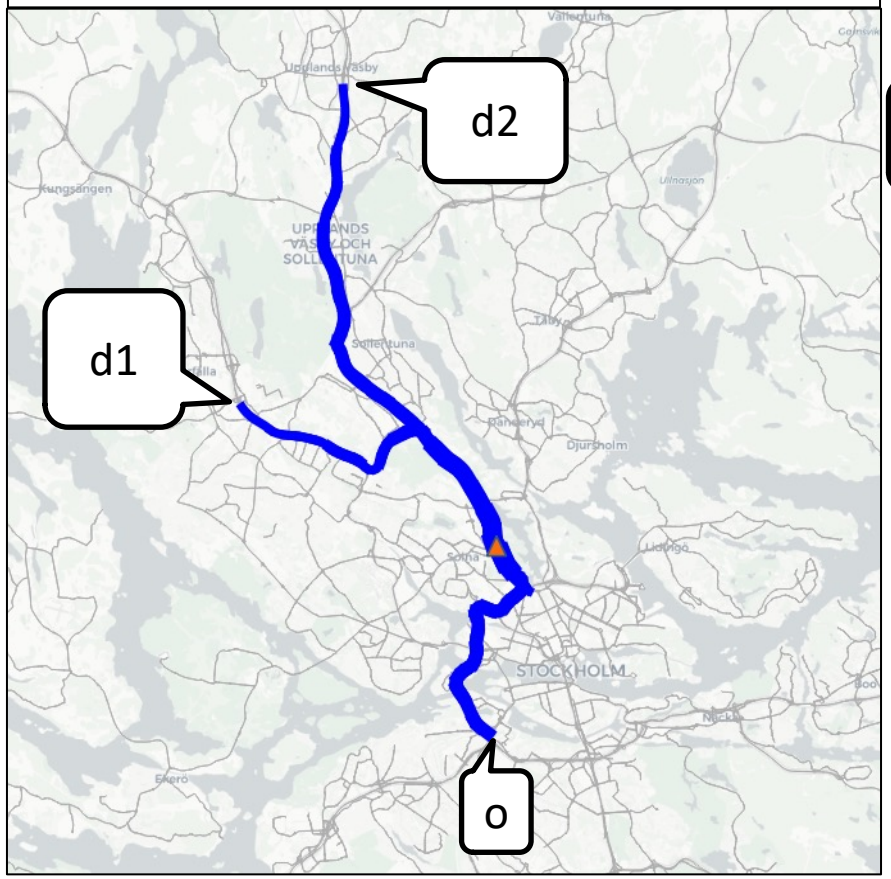


Alternative routes 2

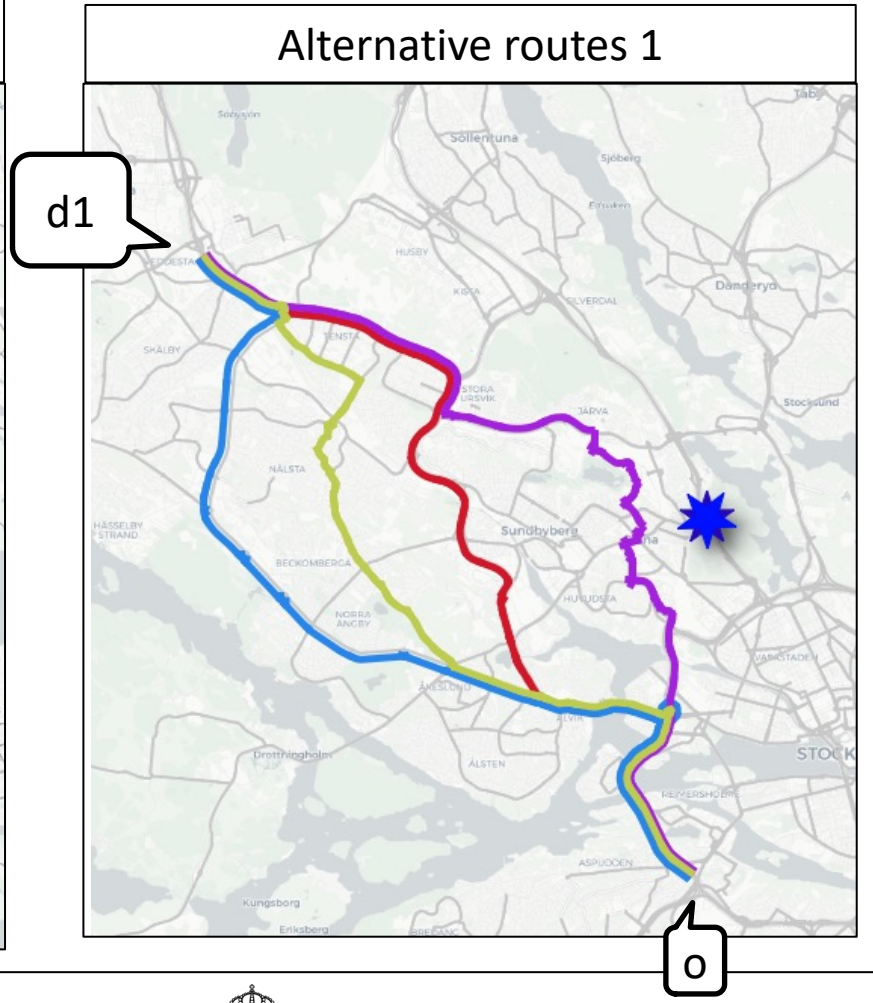


Route choice during incident on Uppsalavägen

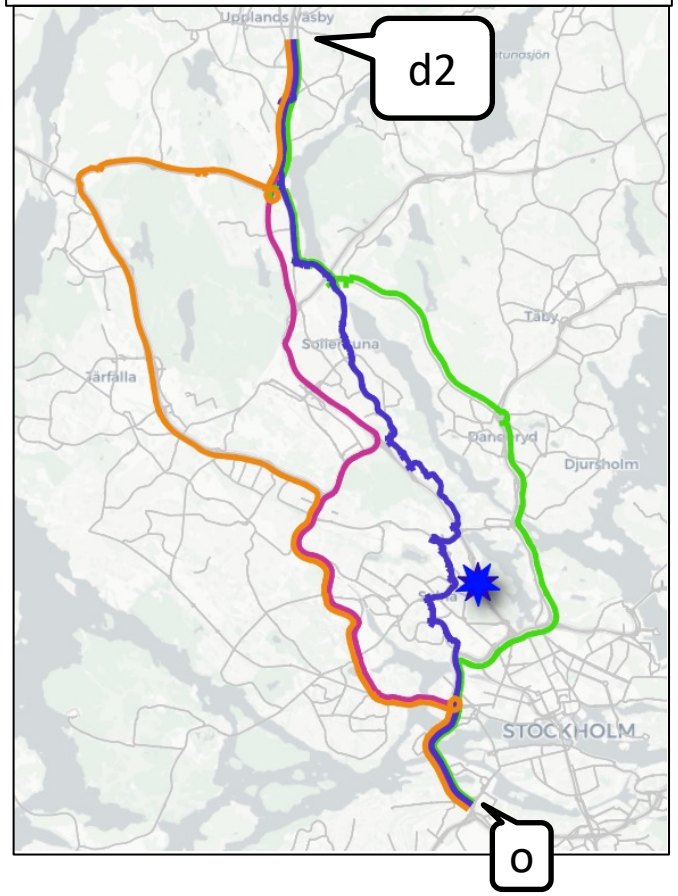
Spider



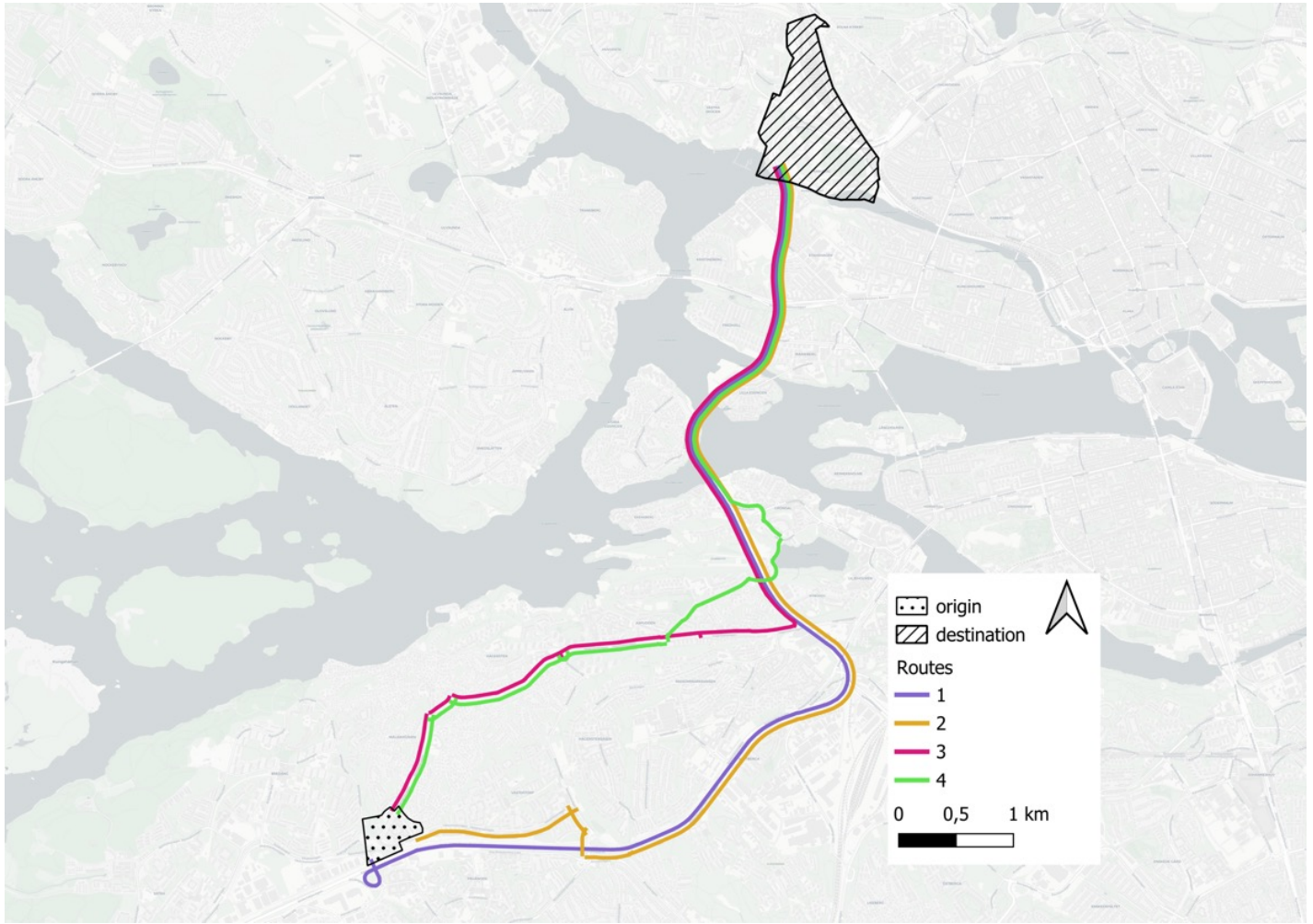
Alternative routes 1



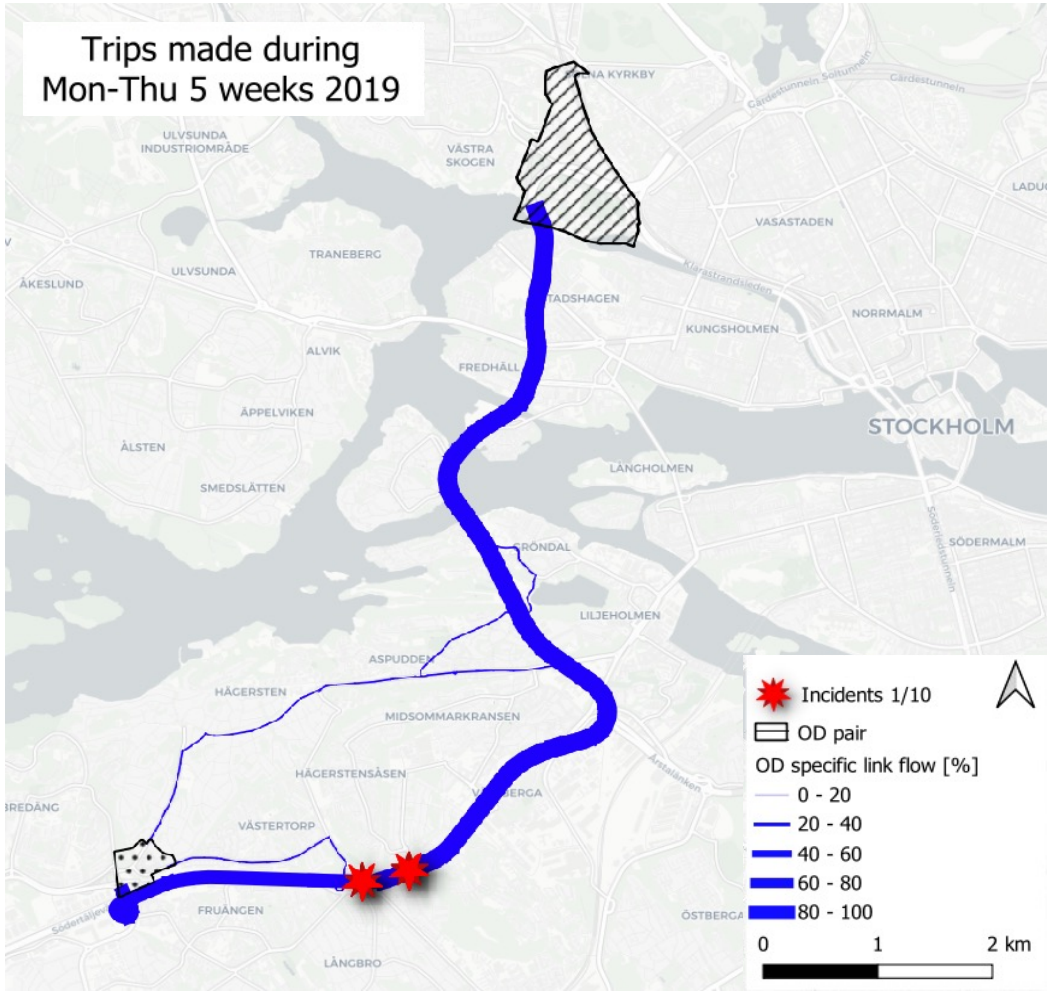
Alternative routes 2

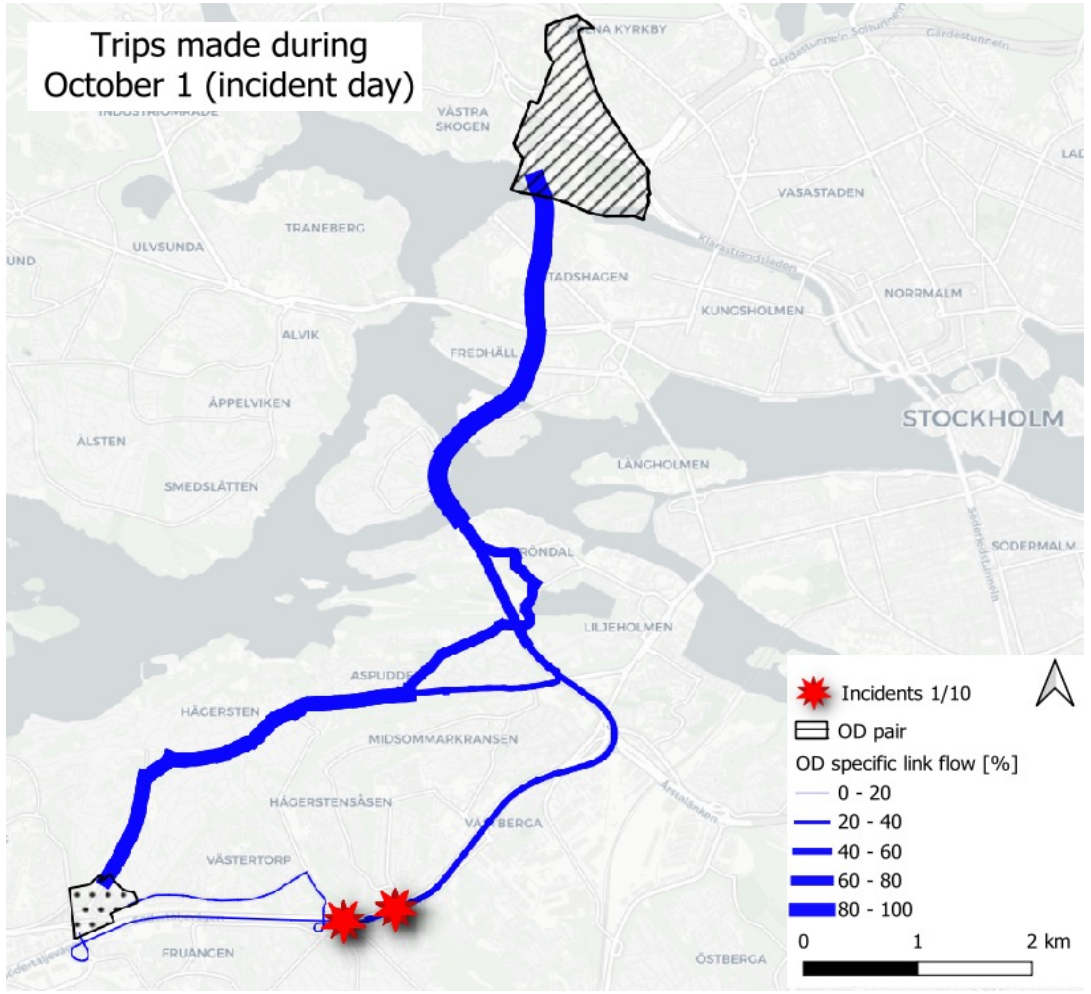


Example OD pair affected by incident on Essingeleden



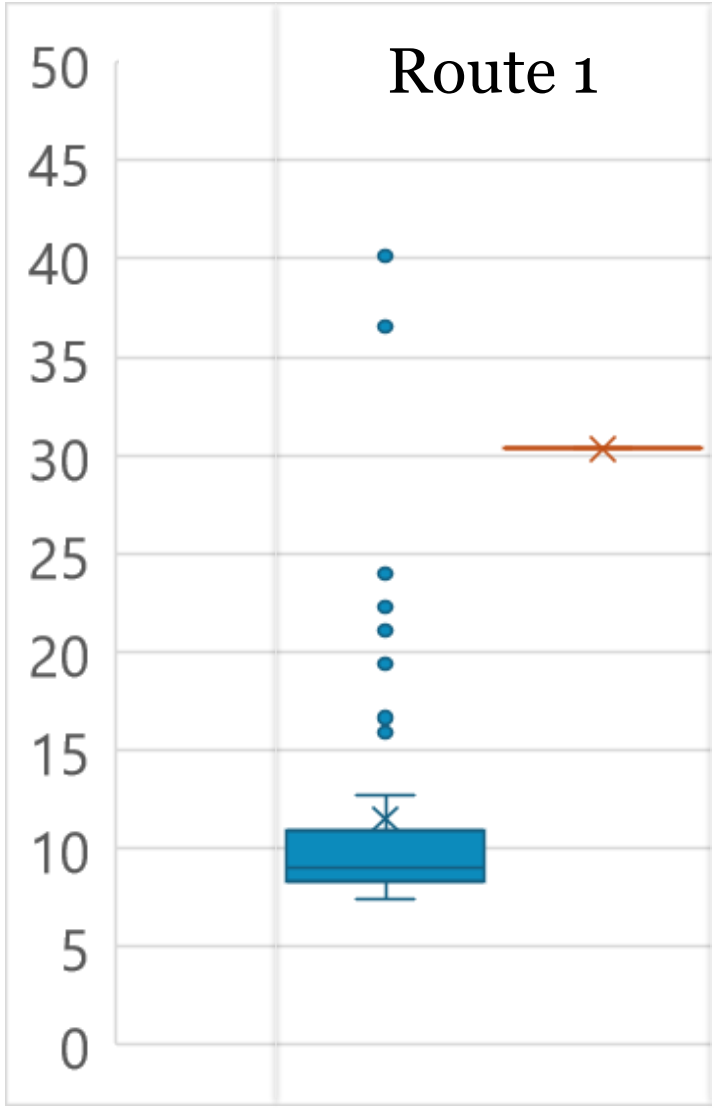
Routes example OD

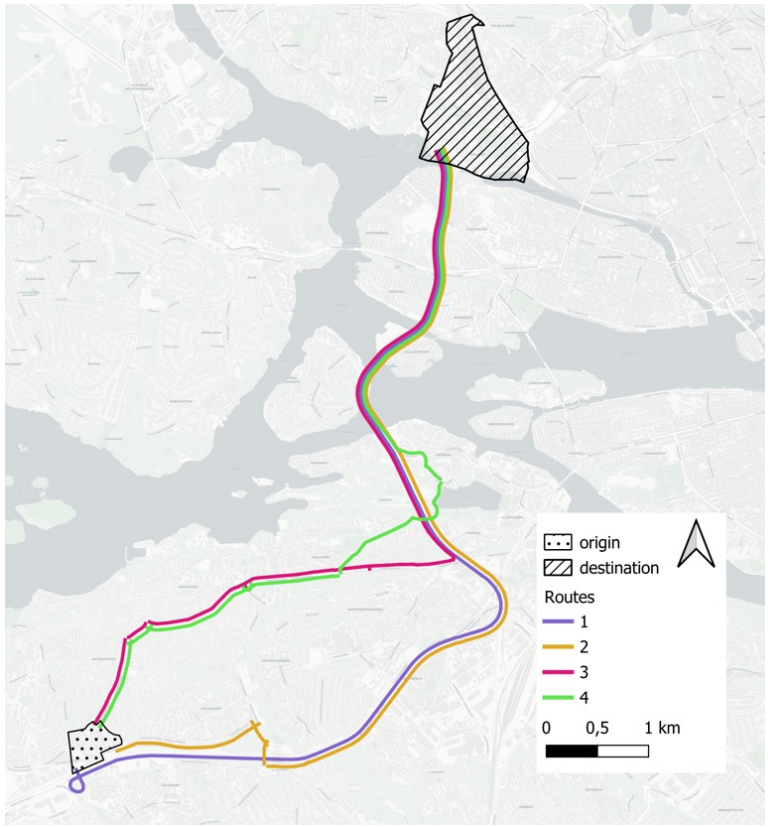




Number of routes used per day

Route traveltimes during red incident



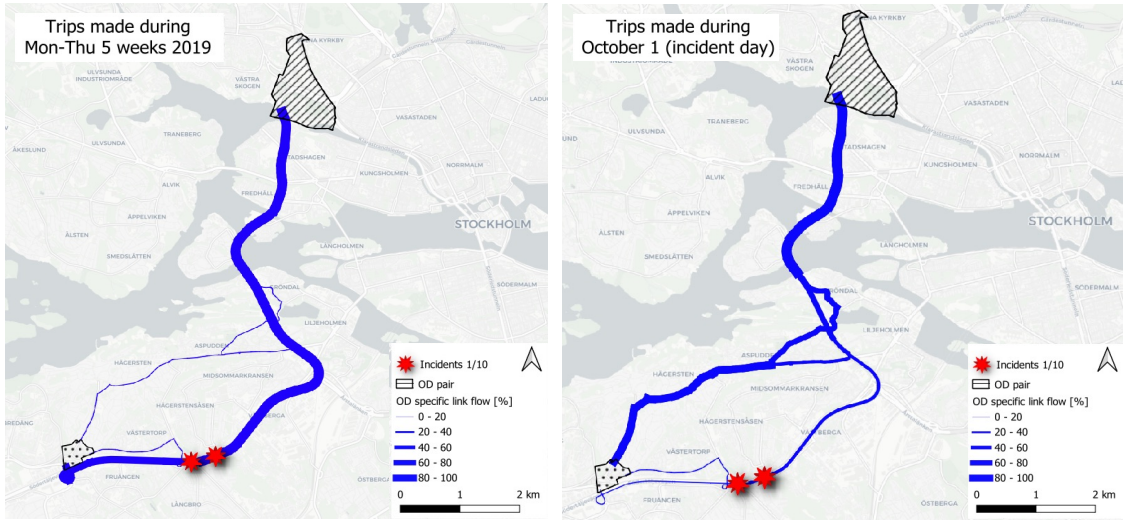


Blue = Normal traveltimes
Orange = Incident traveltimes

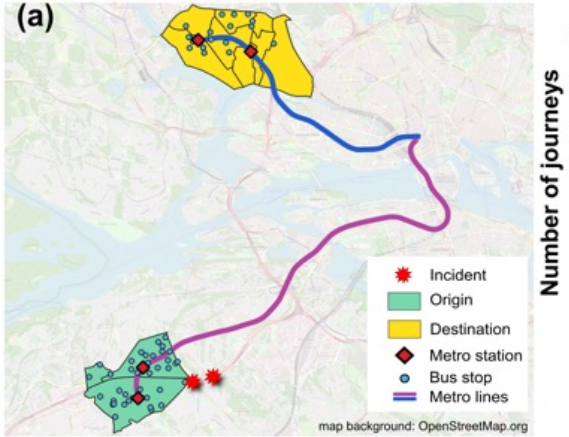
Multi-modal impact of road traffic incident

- Route choice in OD-pair changes
- Number of public transport journeys increases

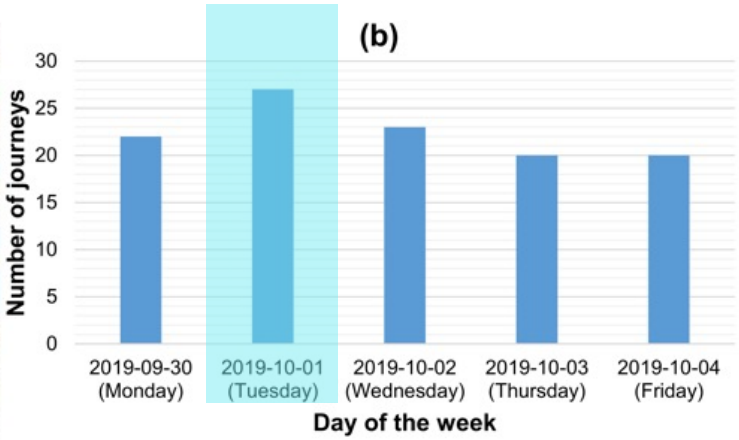
Road linkflow in affected OD-pair



Public transport journeys



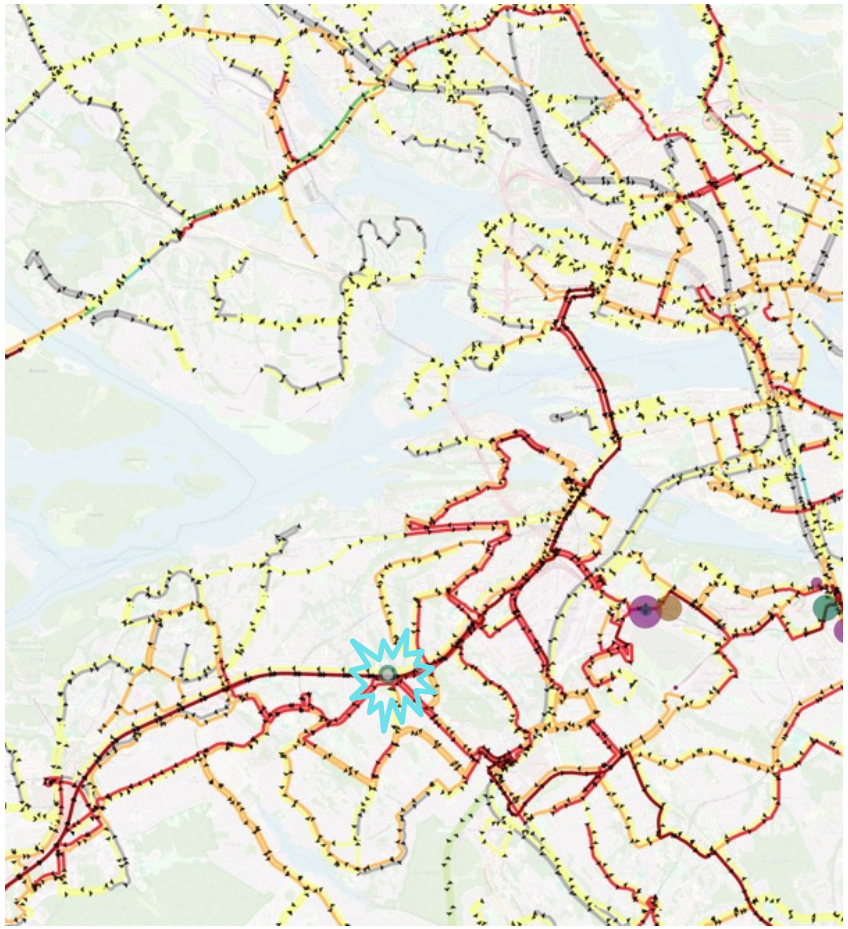
Incident day



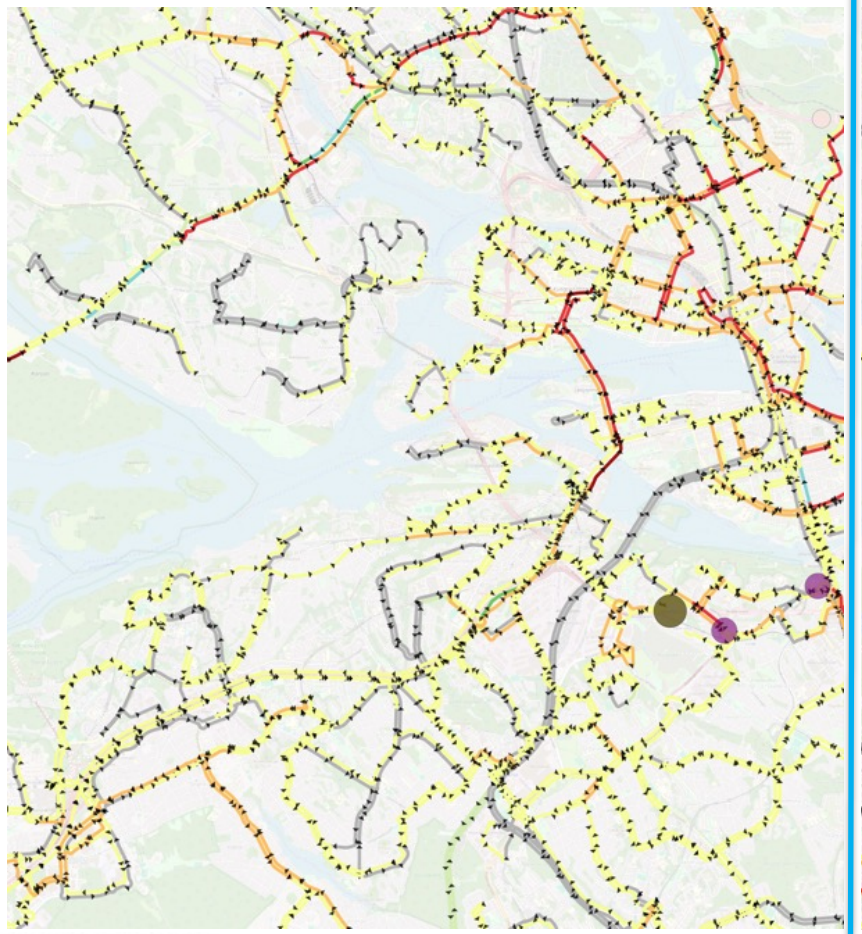
Difference between Incident and Normal day

Effects on bus delays

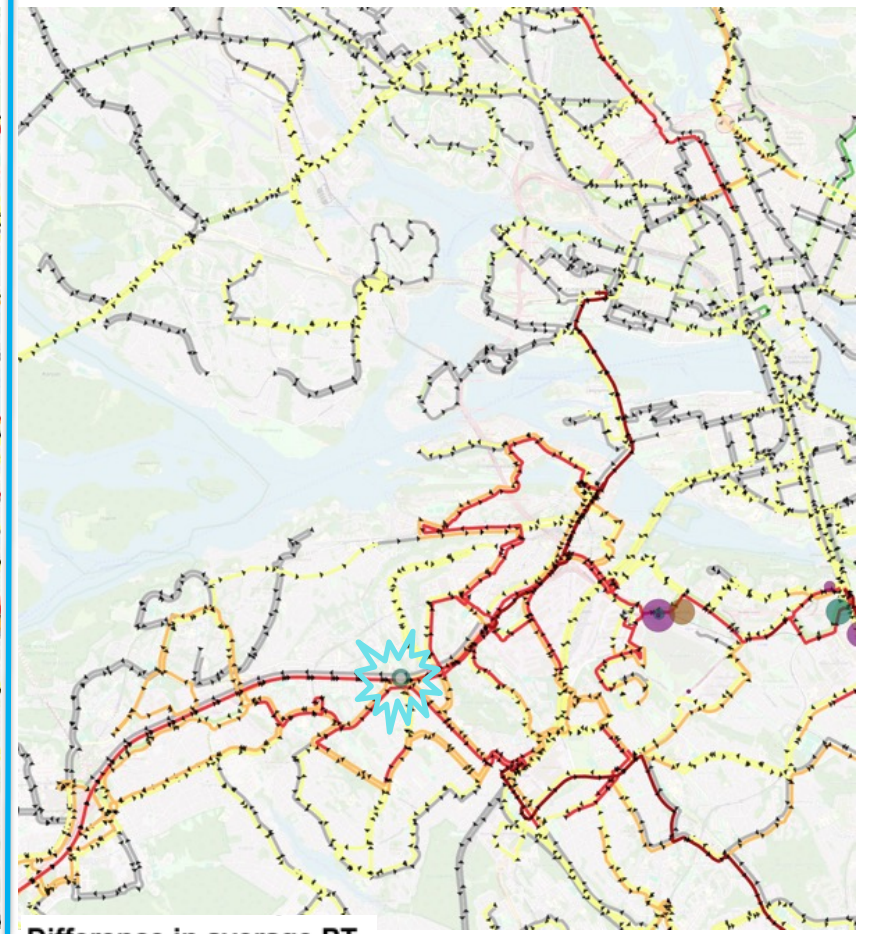
Incident day

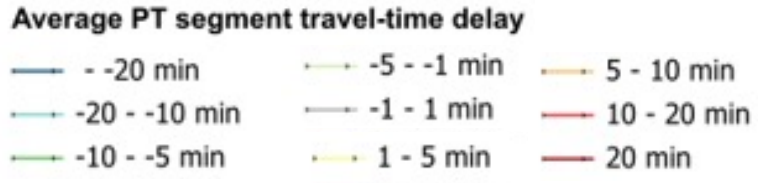


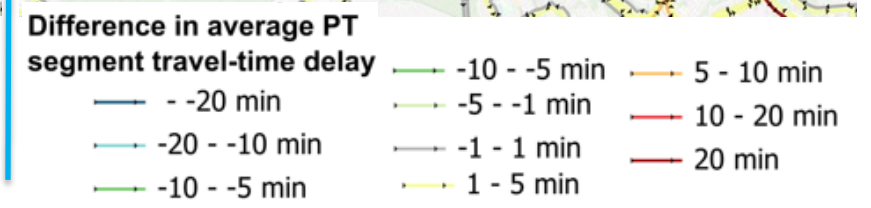
Normal day



Difference

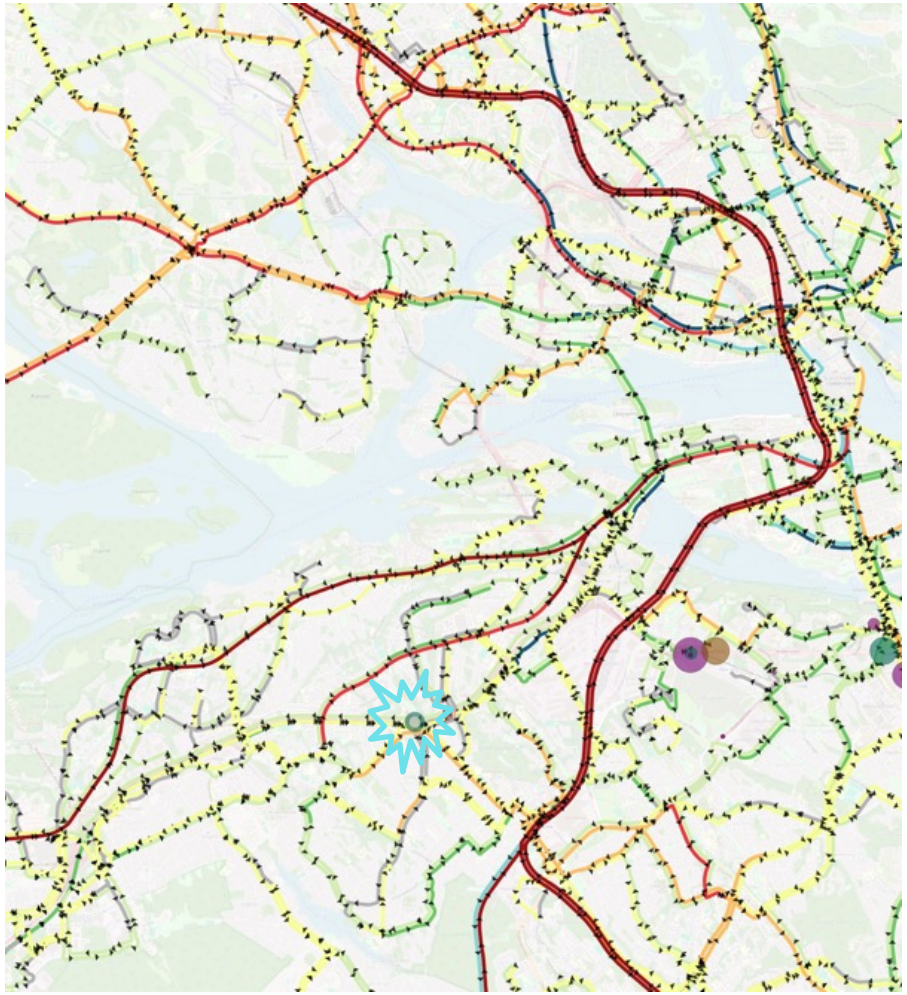






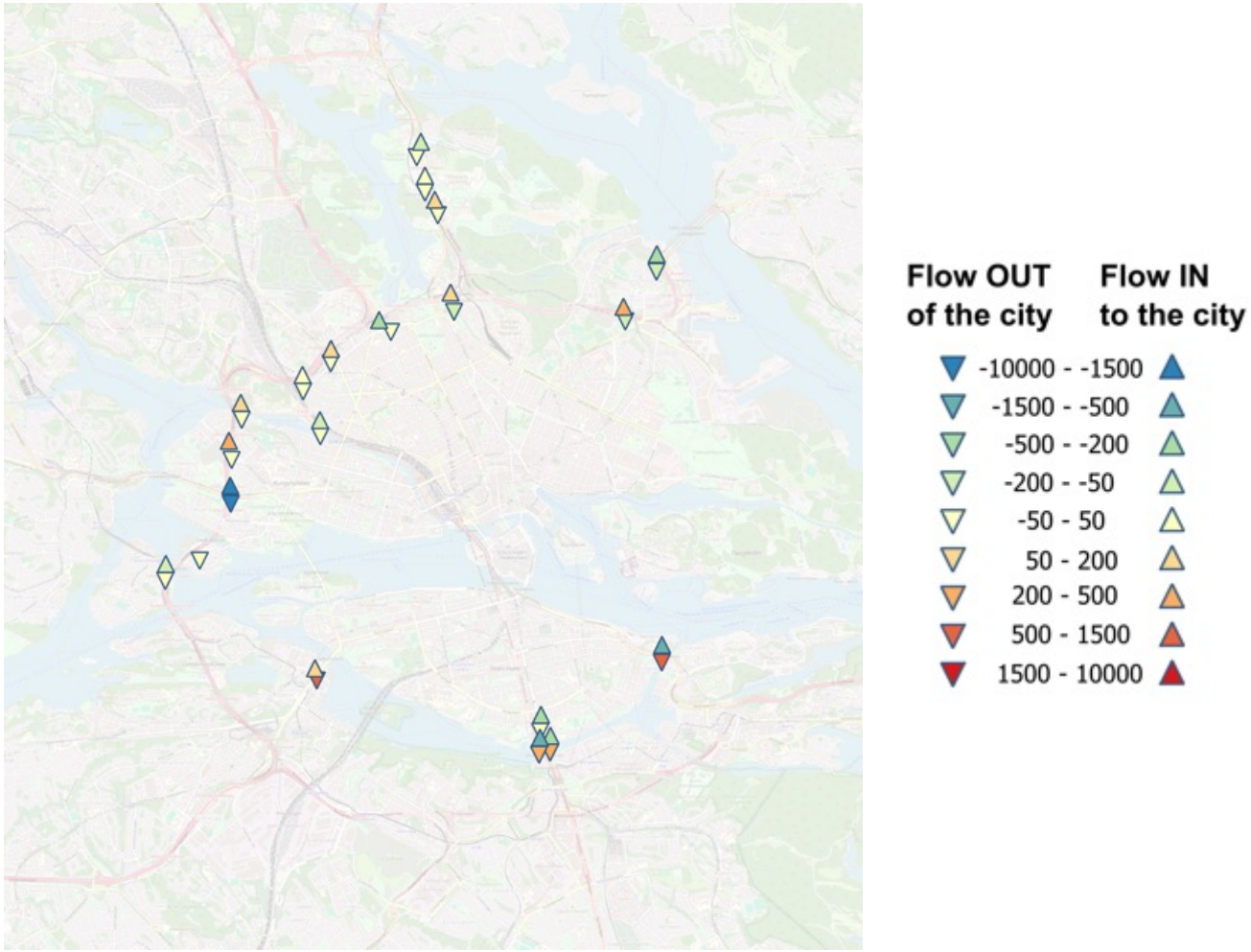
Difference between Incident and Normal day

Effect on public transport ridership



Difference between Incident and Normal day

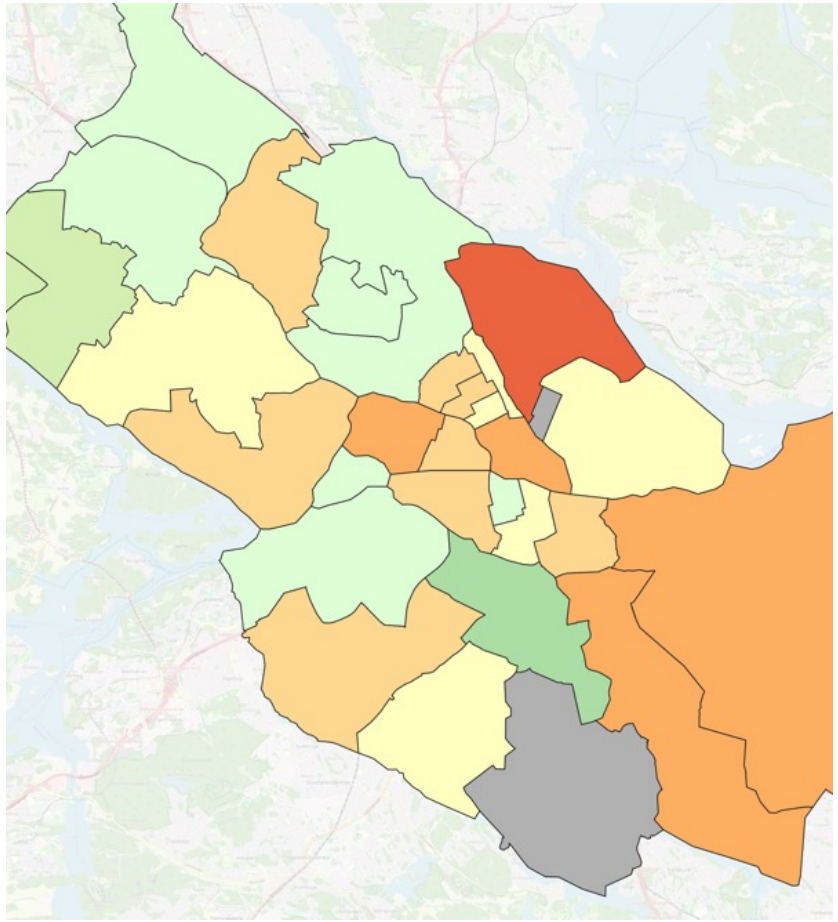
Effect on toll portals observations – flow IN and OUT of the city



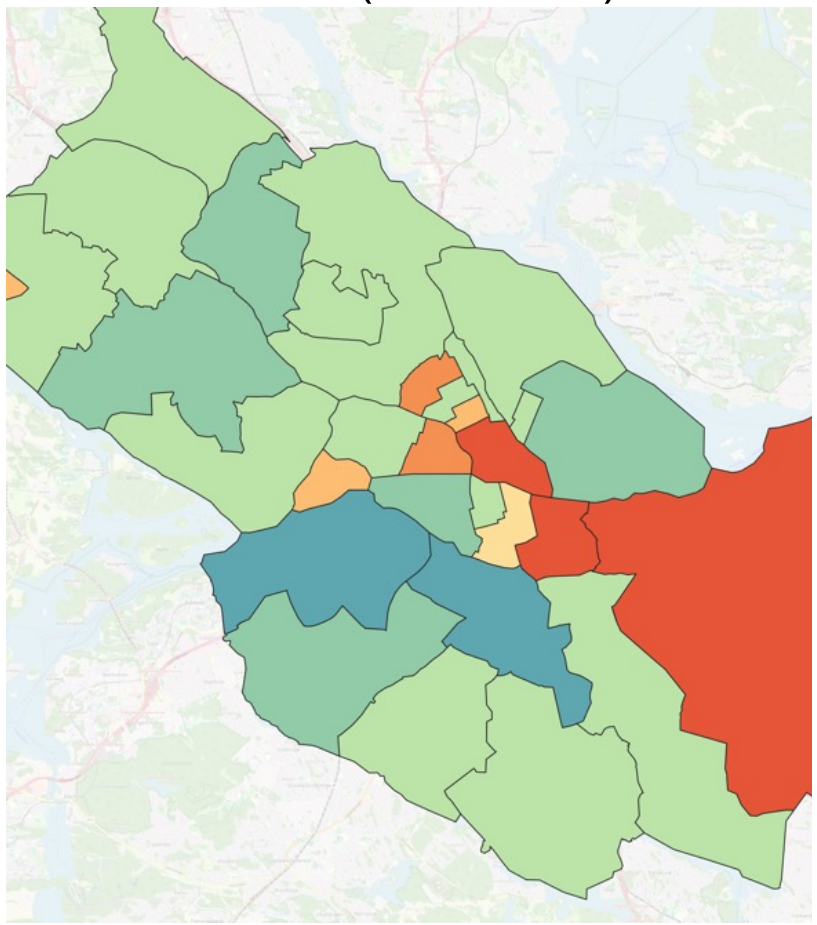
Difference between Incident and Normal day

Effect on total out-going zone flow

PT



TELIA (all modes)



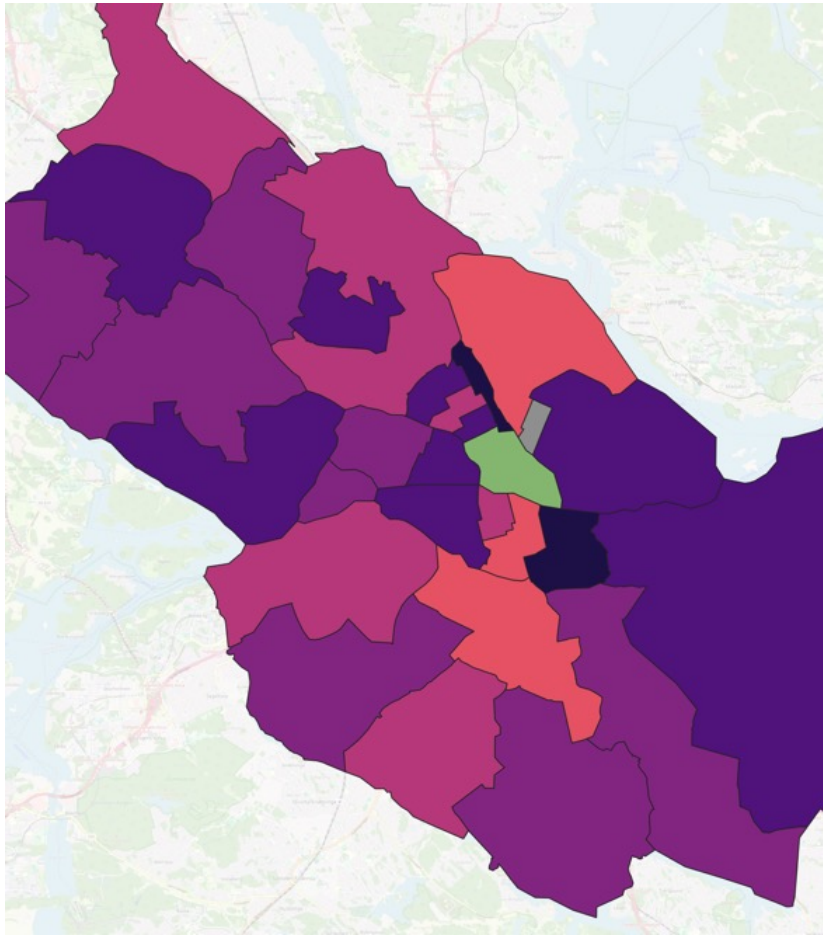
Absolute difference of originating flow

- -100000 - -3000
- -3000 - -1000
- -1000 - -500
- -500 - -100
- -100 - -10
- -10 - 10
- 10 - 100
- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000 - 1000000

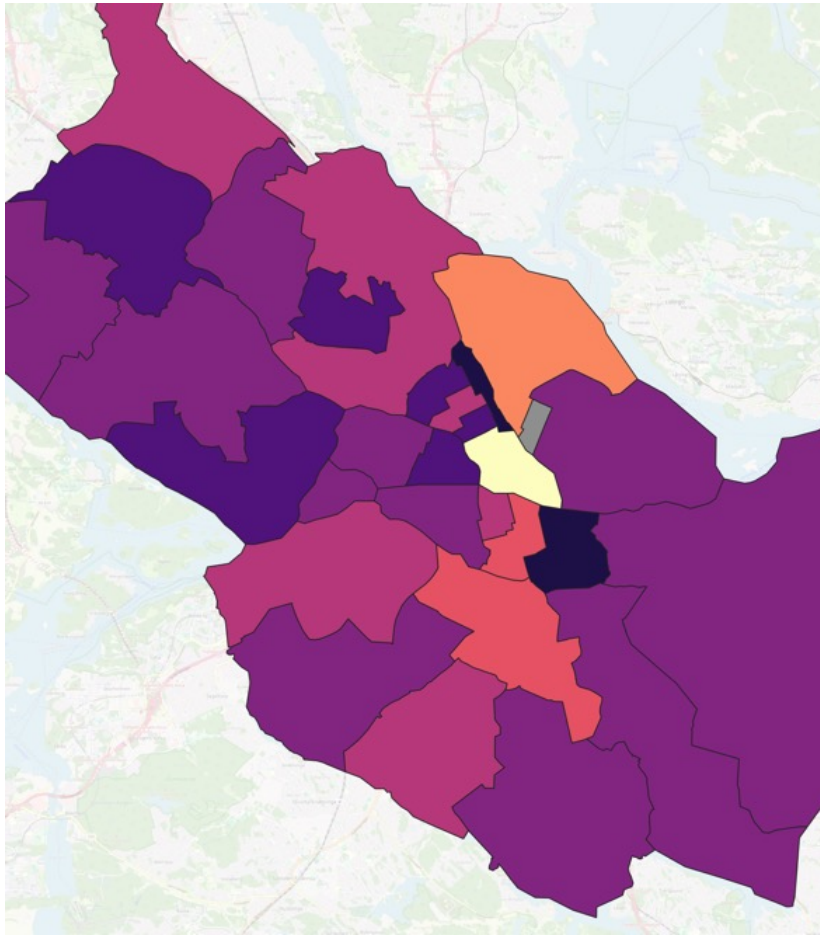
Difference between Incident and Normal day

PT mode share of out-going zone flow

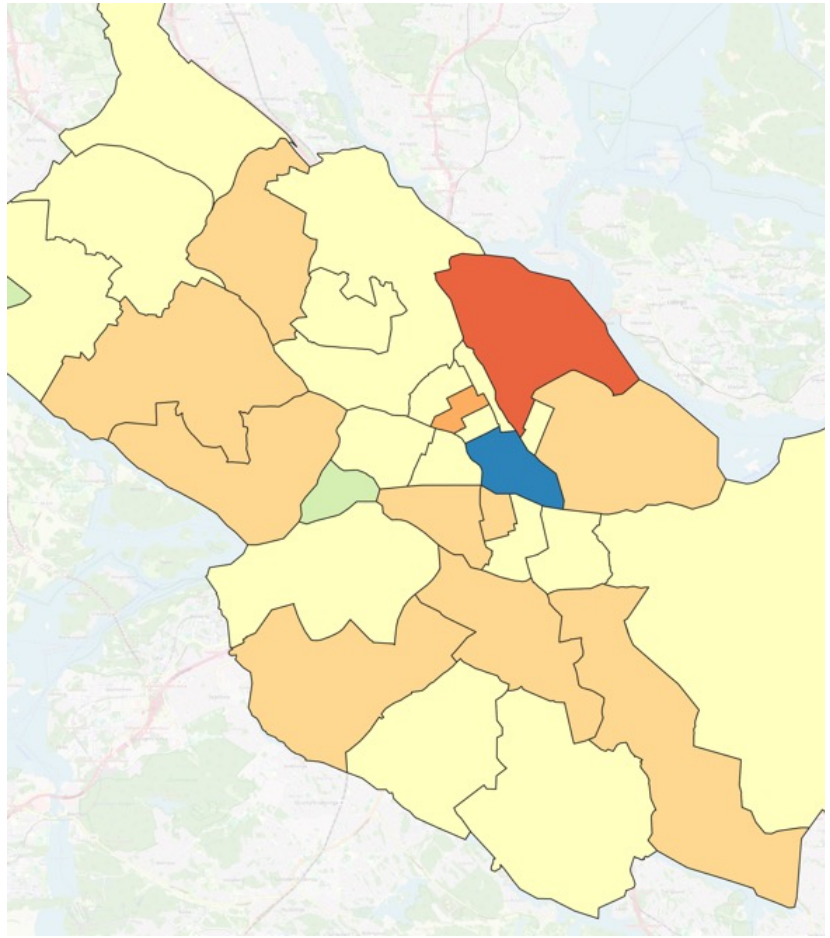
Incident day



Normal day



Difference



PT mode share of originating zone flow [%] = (PT / TELIA) * 100%

0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 -

PT share difference [%]

-10 - -6
-6 - -4
-4 - -2
-2 - -1
-1 - 1
1 - 2
2 - 4
4 - 6
6 - 10

Next steps

- Multimodal analysis of historic road incidents and PT disruptions
- Multimodal route sets (both for normal conditions and during incidents)
- Route and mode choice models adapted for incidents
- Multimodal anomaly detection
- Multimodal demand prediction with mode and route choices

Project web page:

Thank you!

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