



EMC<sup>2</sup>

# Projection of road sensors to the Dutch road network

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# Road sensors

- 60,000 road sensors in the Netherlands
- Vehicle counts every minute



**Aim: production of traffic statistics**

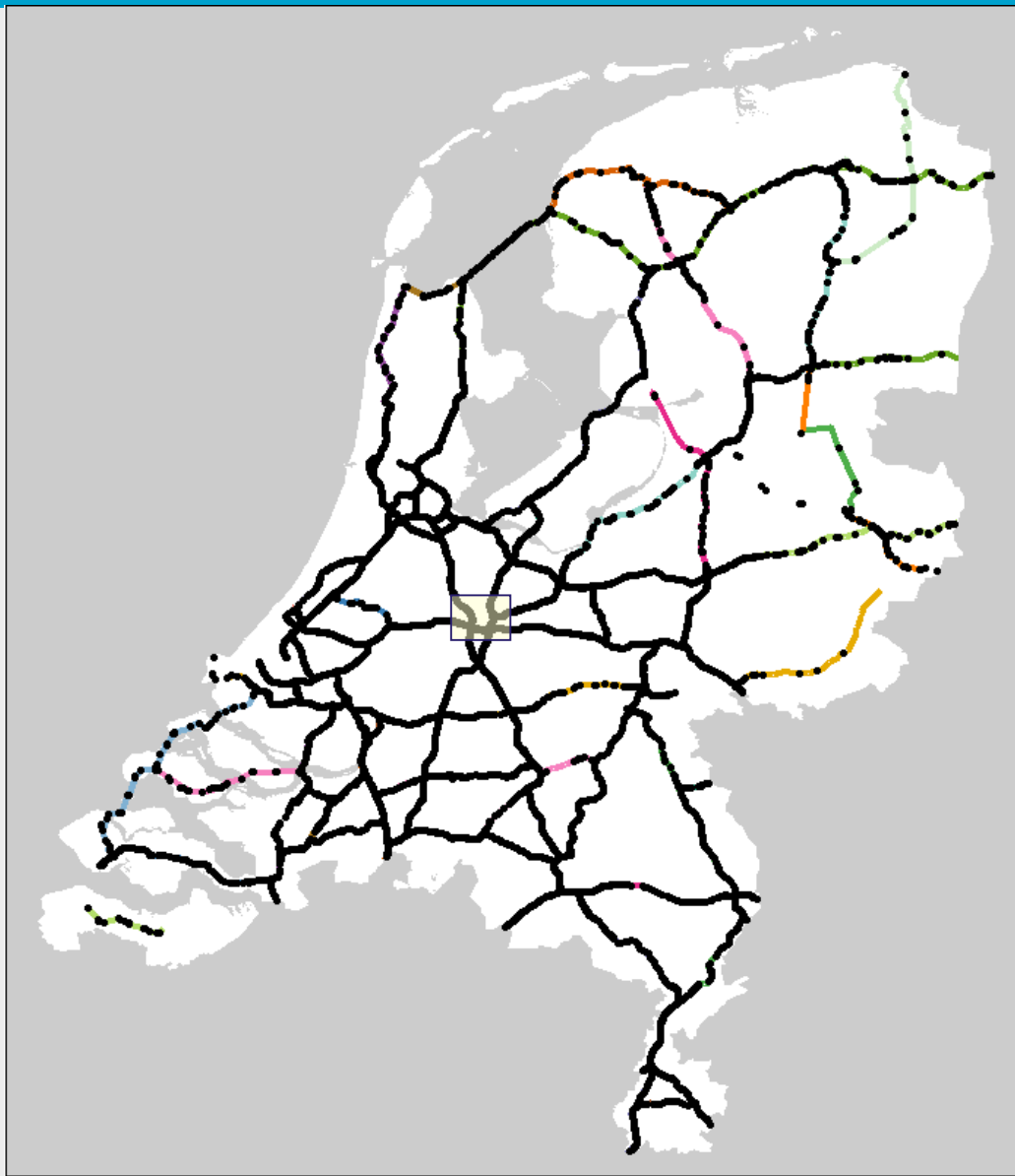


Output: **vehicle-kilometres** (= # passing vehicles \* trip length) per highway per direction per NUTS3 region.

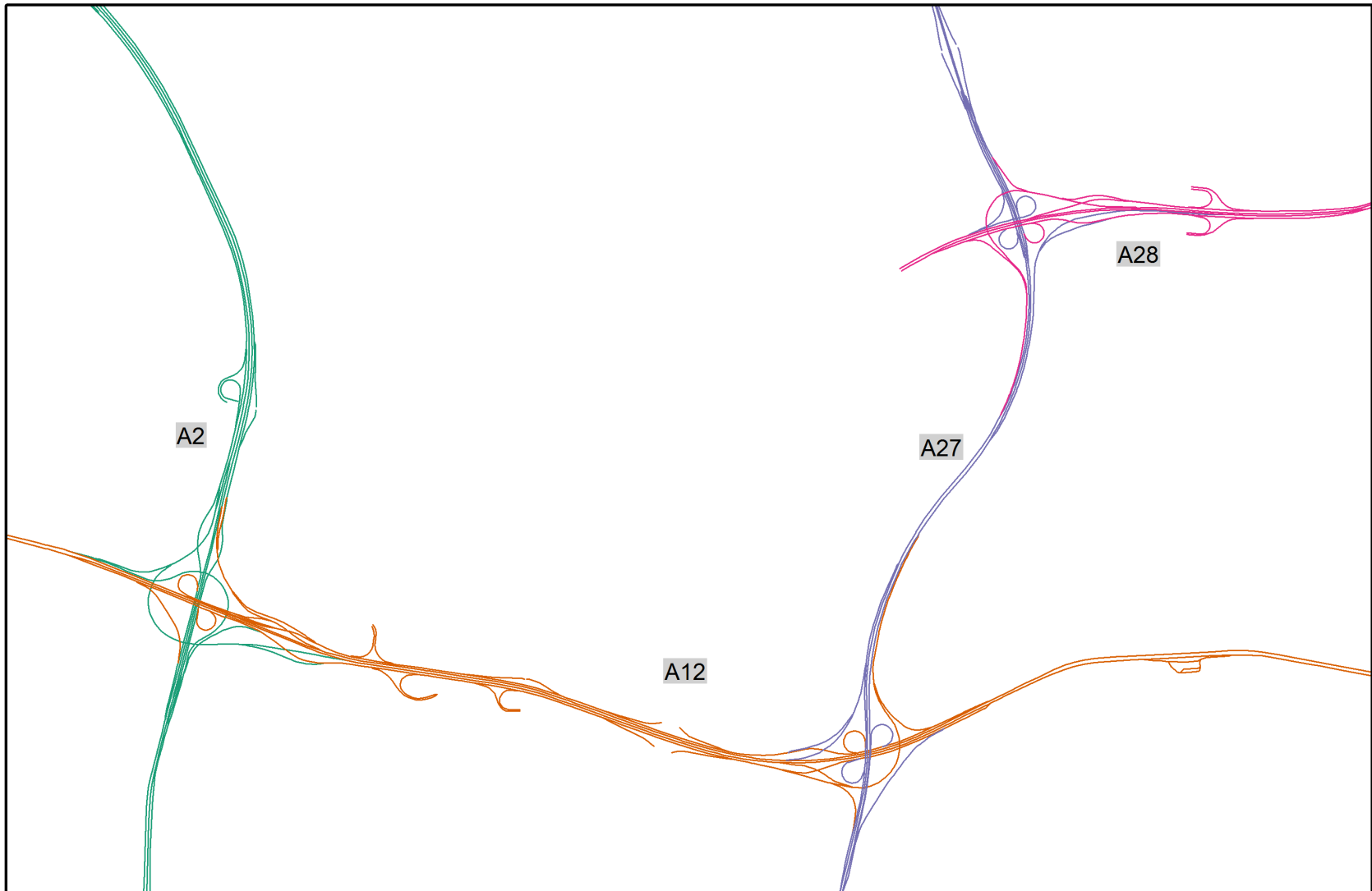
# Dutch highways



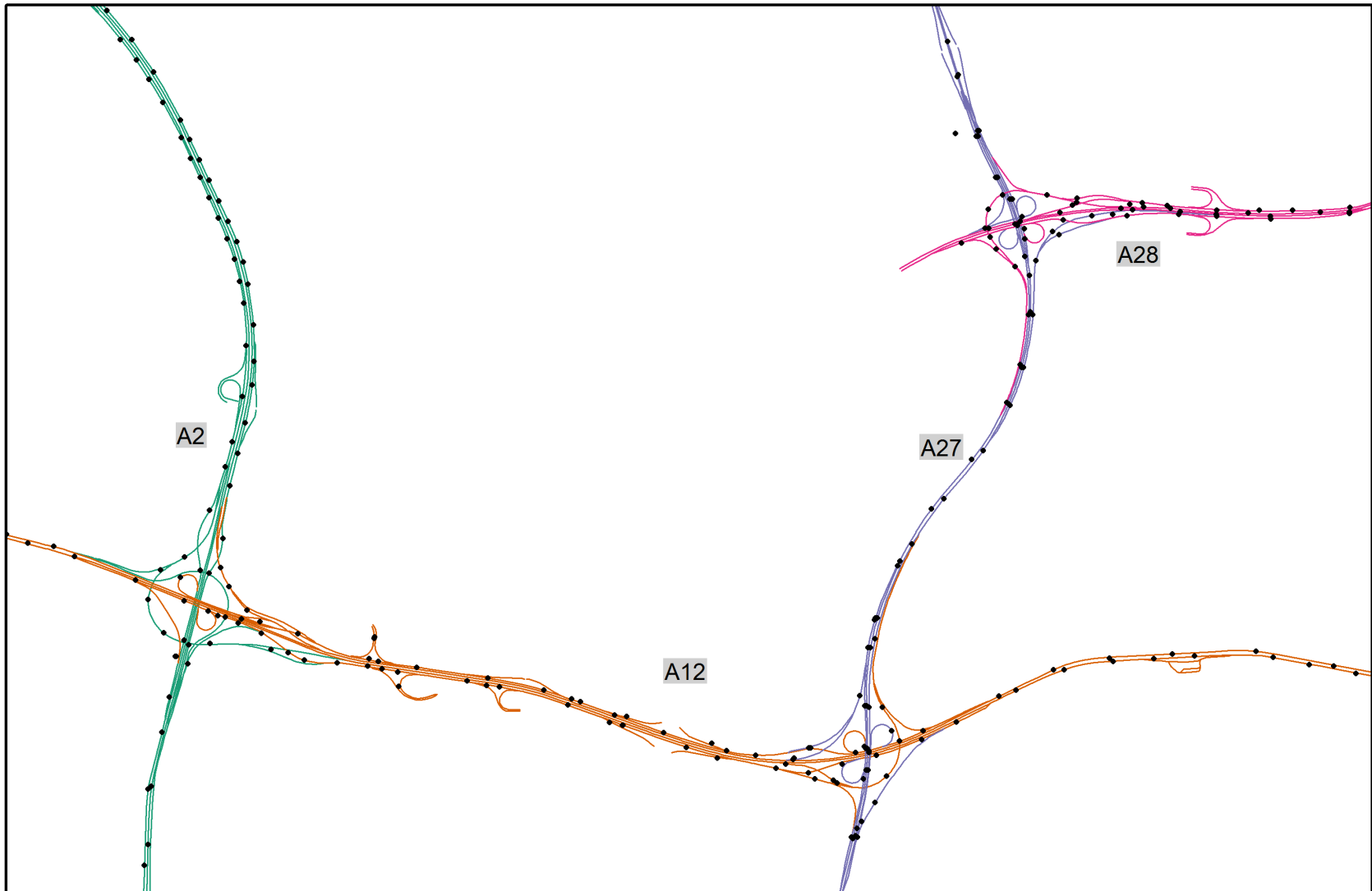
# Dutch highways with road sensors



# A closer look...

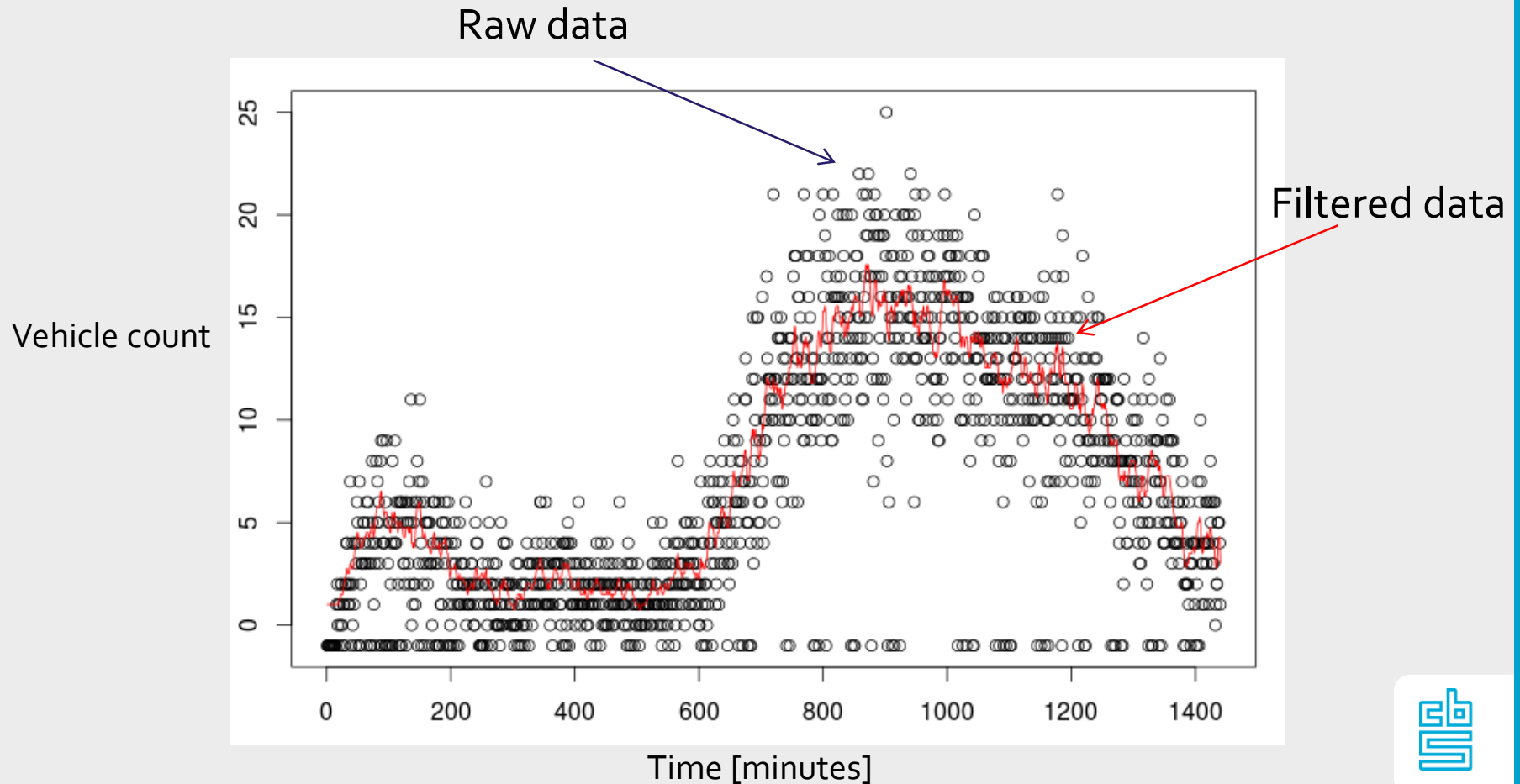


# A closer look...



# Sensor data

Data from a single sensor:



# Weighting method

## Survey statistics

## Traffic statistics

Frame

Target population (unit=person) Roads (unit=km)



Selection

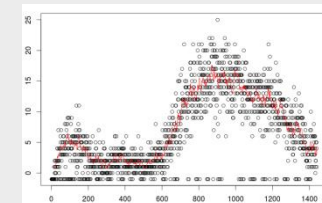
Sample of respondents

Road sensors



Measurements Questionnaire

Sensor data



Weights

Based on demographics

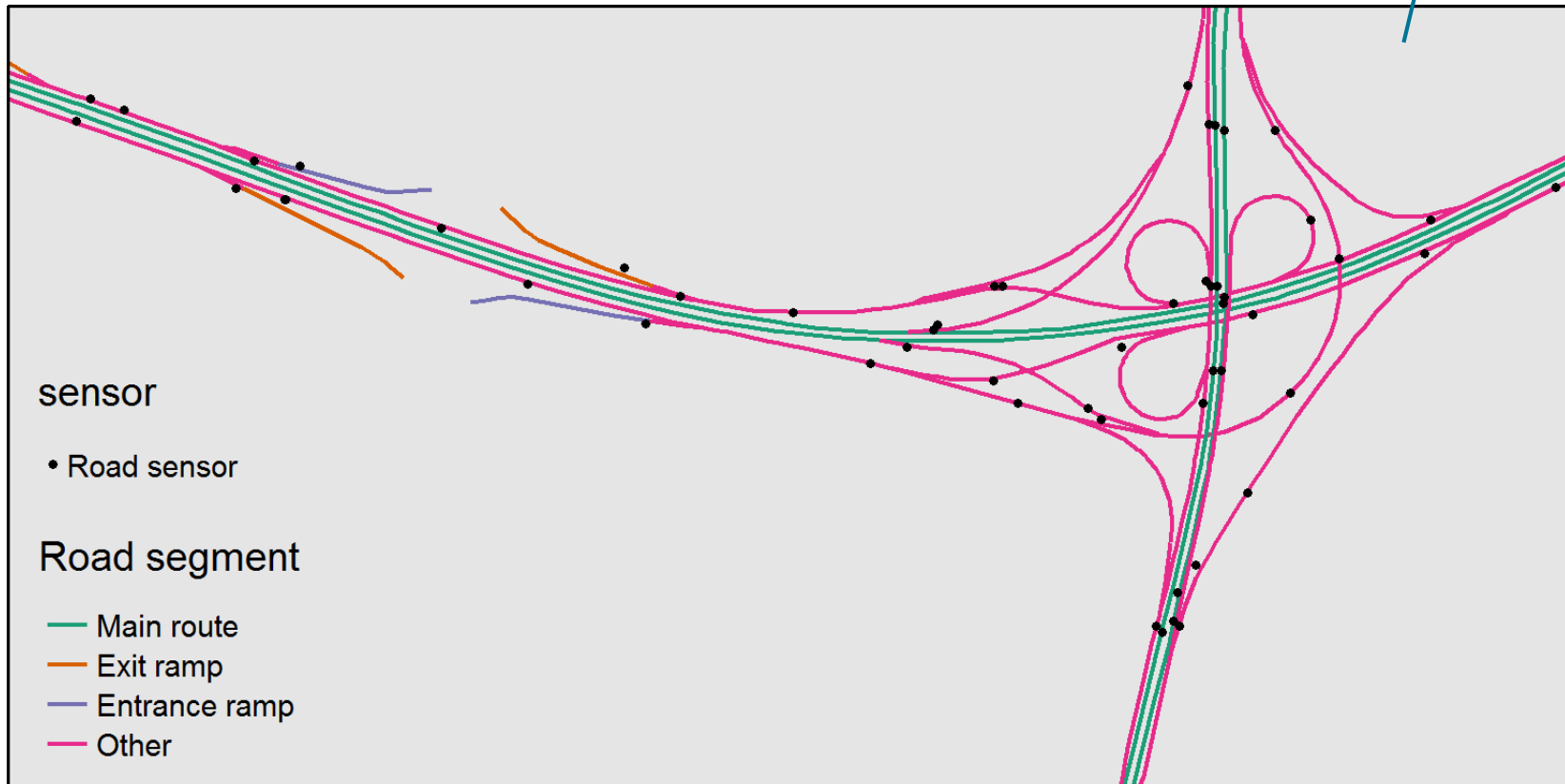
Based on location ...



# Road selection

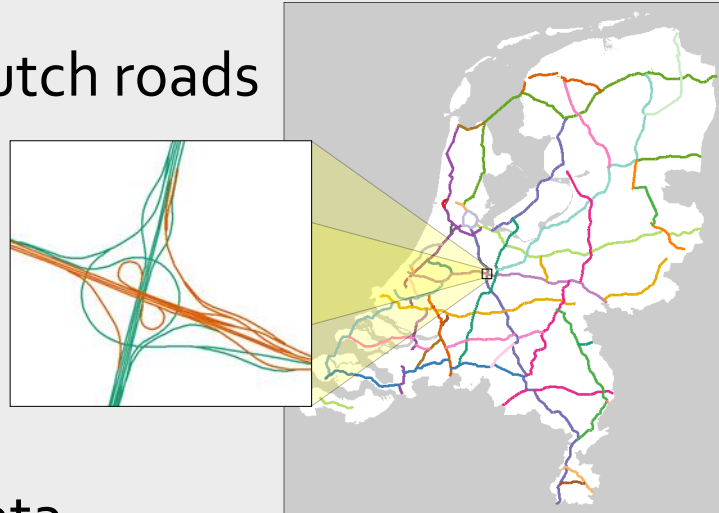
The plots were created with the R-package **tmap** (recently published on CRAN).

- Dutch Highways
- Main routes (no interchange, entrance and exit ramps)



# Metadata input

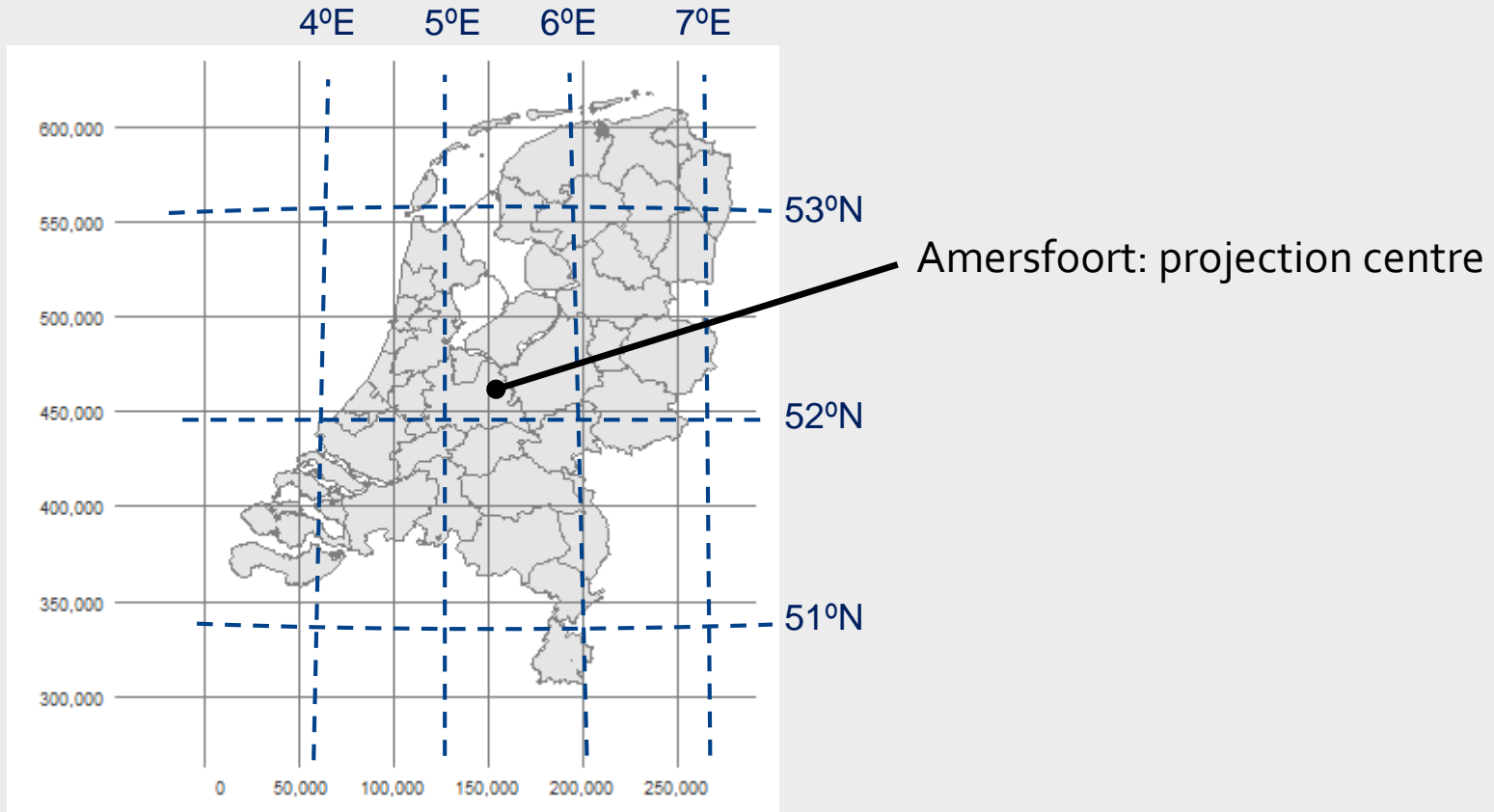
- ESRI shape file of Dutch roads



- Road sensor metadata

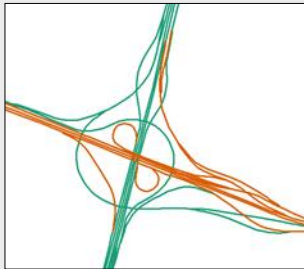
Road	Direction	Type	Lat	Long
A79	West	Main	50.8779	5.7502
A79	West	Main	50.8772	5.7625
A79	West	Main	50.8768	5.7737
A79	West	Main	50.8747	5.8082
A79	West	Main	50.8828	5.8650
...	...	...	...	...

# Map projection



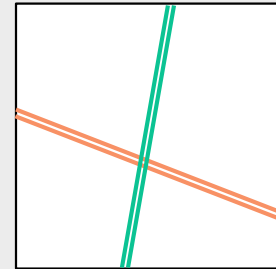
- Dutch National Grid (Rijksdriehoekstelsel)
- Preserves real-world distances

# Main routes



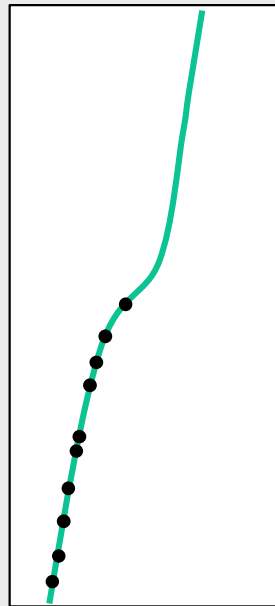
Raw shape

Simplify

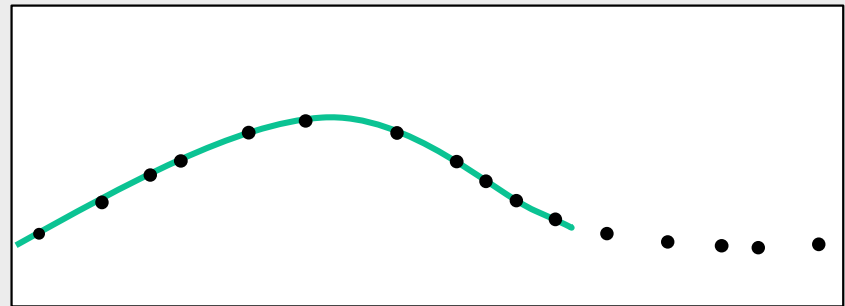


Main routes

# Metadata inconsistencies



No road sensors?



Where is the road?

Possible causes:

- Errors in metadata
- Different time references
- Different definitions

Solutions:

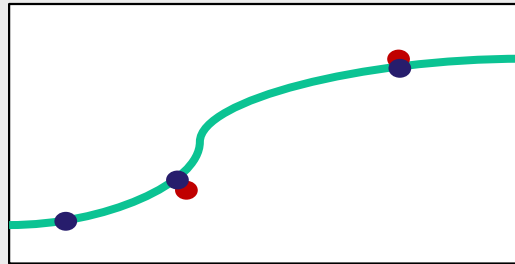
- Shape is leading: Impute empty part
- Sensors are leading: Cut off empty part

- Remove loose road sensors
- Extrapolate main route

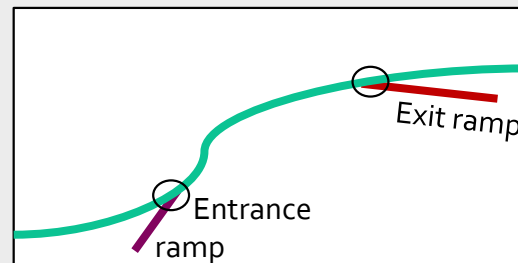


# Projections

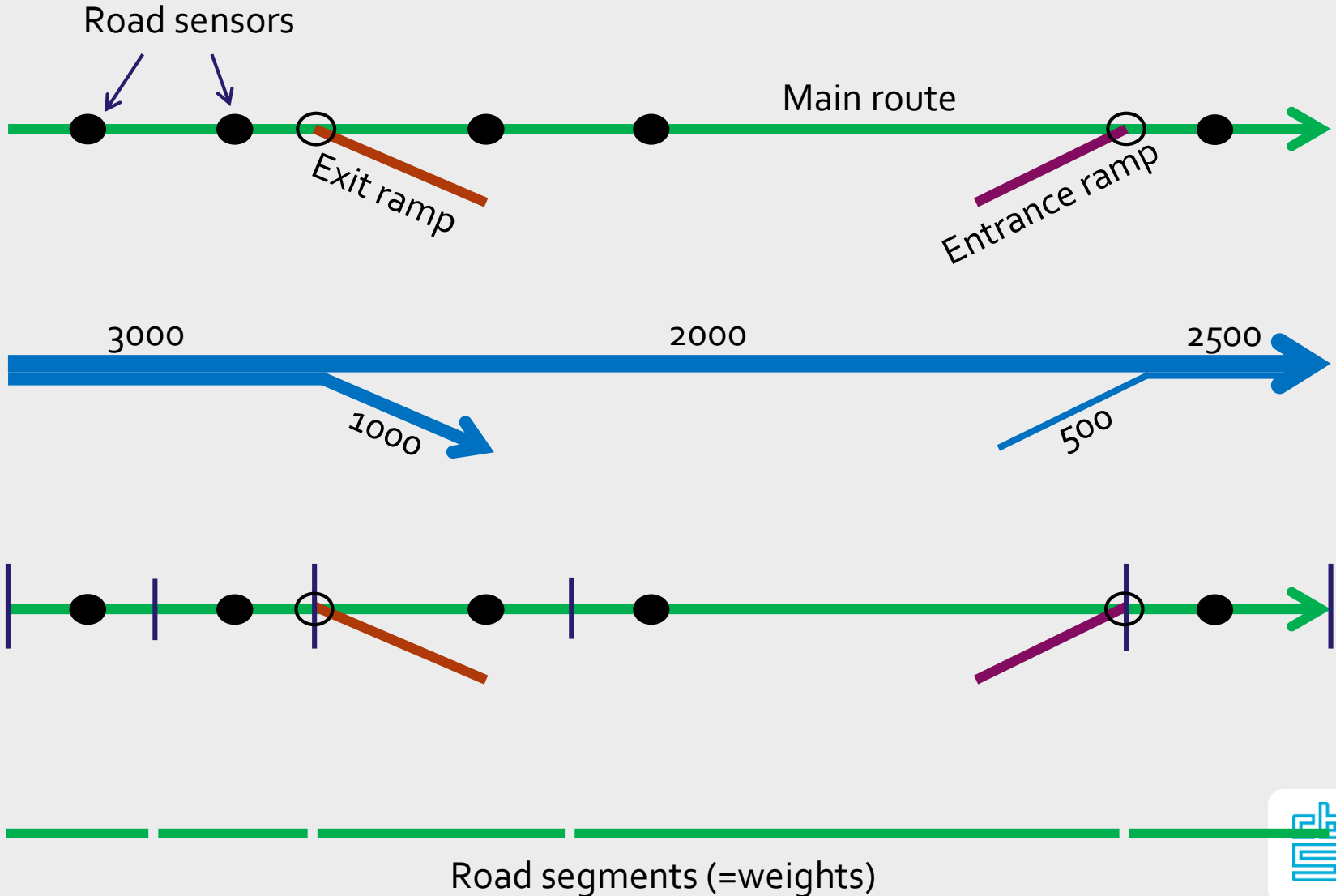
- Project road sensors on main routes



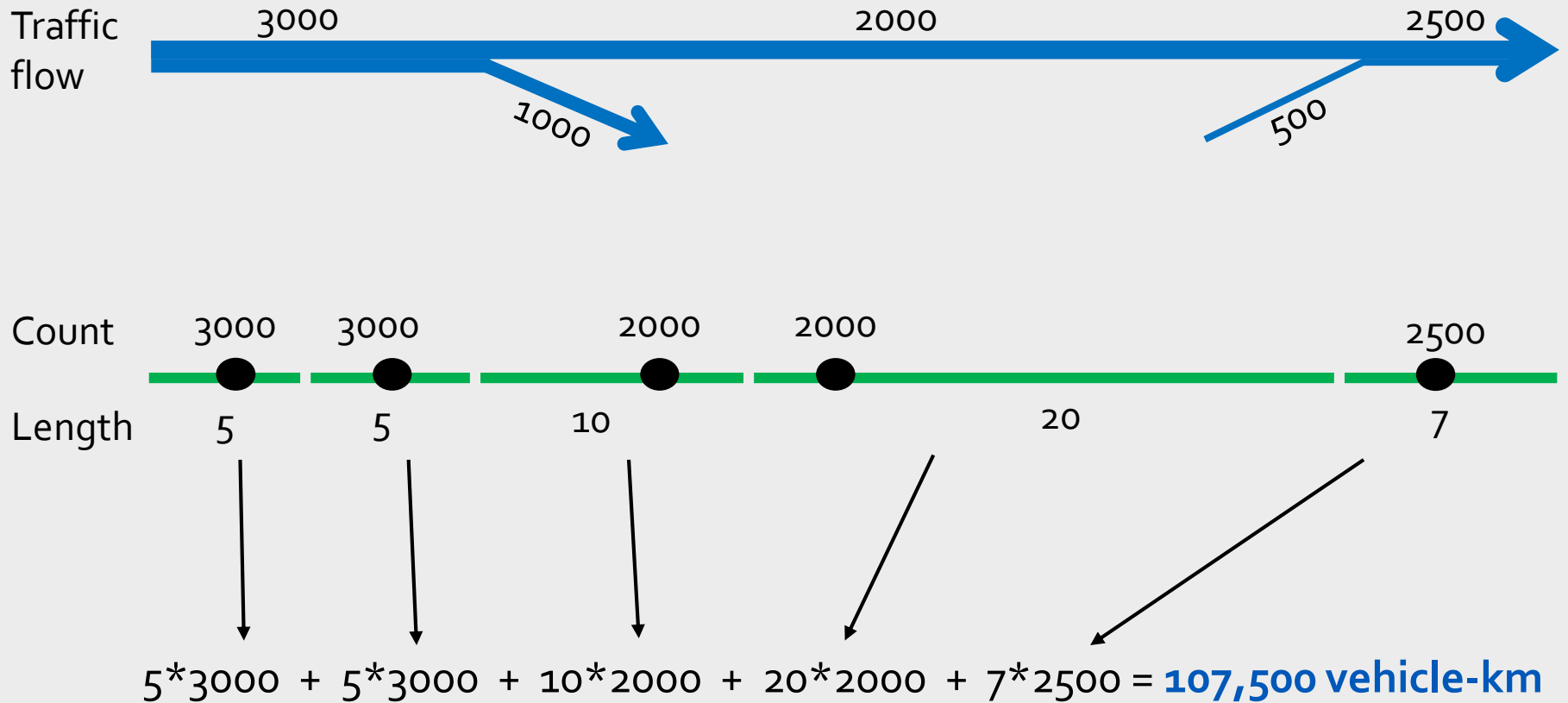
- Determine points of bifurcation for all entrance and exit ramps



# Road segments



# Weighting





# Conclusion remarks

- A **proper frame** is often required for big data driven statistics.
- For traffic statistics, the **road segment lengths** are used as **weights**; vehicle counts are weighted to the road network.
- Further development at Statistics Netherlands:
  - Embedding into **regular production**
  - Extension with **provincial roads**.

**The end.**

