Using Bikeshare Data to Understand Bicycle Traffic in Kelowna

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Who We Are

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Agenda

- Introduction
  - Project Goal
  - Data and Challenges

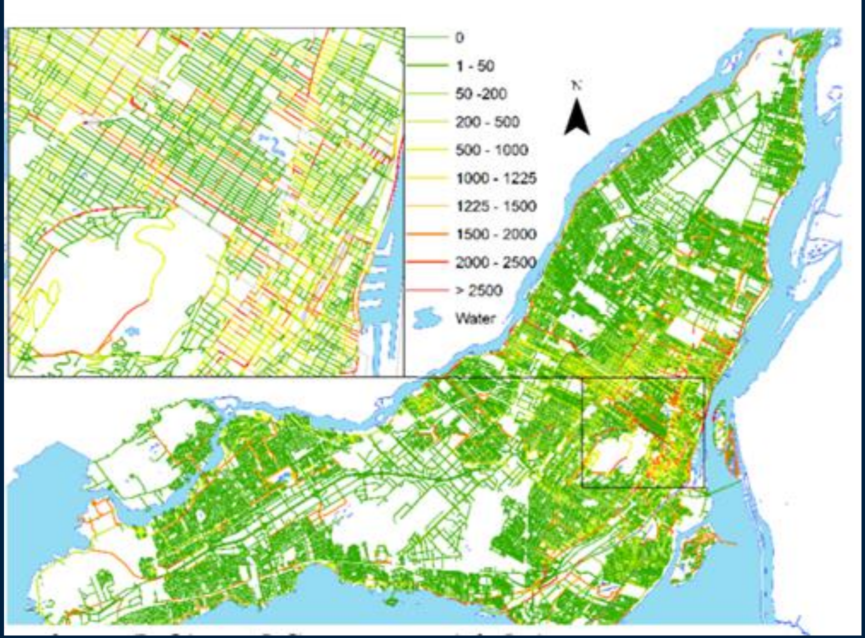
- Analysis
  - Tools
  - Finding Routes
  - Counting Bikeshare Trips
  - Evaluation of Path-Finding Models
  - Estimation of Average Daily Bicycle traffic

- Final Visualization

- Conclusion

Project Goal

Using the bikeshare and Eco-Counter data, estimate and visualize the Average Daily Bicycling (ADB) volumes for downtown Kelowna.



ADB by segment produced by combining GPS and counter data, Montreal

Data and Challenges

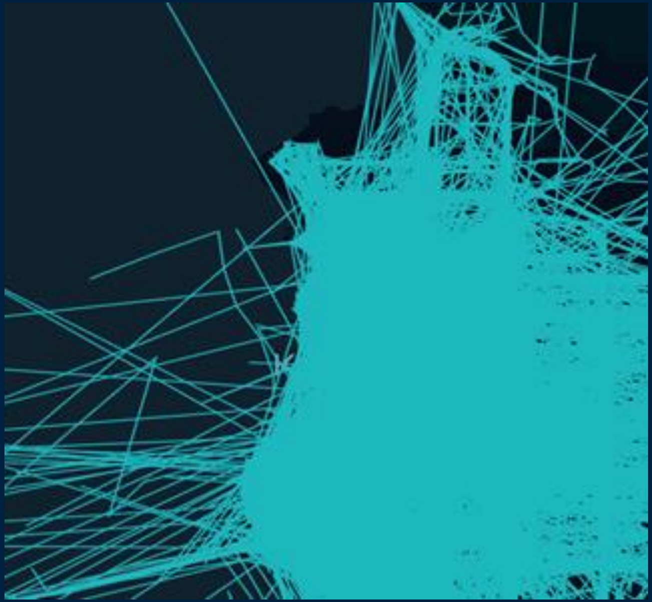
- 2018 Dropbike Bikeshare Pilot
  - Dockless bikeshare - 3 months
  - Latitude, Longitude, Timestamp for each trip
  - Cleaned data: 8,853 trips

  Challenge: GPS Low Resolution, Low Accuracy

- Eco-Counters

  Challenge: Low bikeshare count compared to counters

Data and Challenges



Analysis Tools

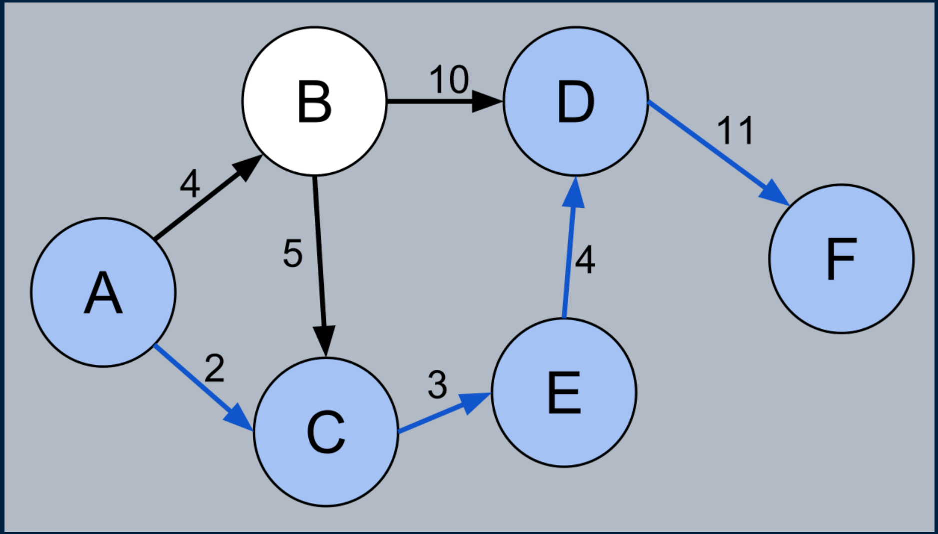
- QGIS
  - Visualization
- R
  - Statistical Analysis
- OSMnx Python Library
  - OpenStreetMap and Networkx
  - Turns the map into a graph
    - Each street is an edge
    - Each intersection is a node
  - Algorithms to calculate distances and paths

Finding Routes: Snap GPS Points To Graph

- Found nearest node in the graph for each GPS point
- Removed GPS points that are at least 150m far away of the calculated nearest node
- Removed any trips with less than three points

This left us with 8815 trips and 95905 GPS points.

Finding Routes: Connect The Points



Source: Wikipedia

- **OSMnx calculates shortest path between nodes based on given numerical weights for each edge**
- **Tried 8 different path-finding models based on:**
  - **Distance**
  - **Route Type Preference**
  - **Road configuration**

Counting Bikeshare Trips

Evaluation of Path-Finding Models

Criteria:

- Visual
- Speed
- Percentage split
  Eco-Counter loc
- Linear regressio
  Counter data vs
  data at City Par

Winner:

- Shortest distanc

Estimation of ADB: Differences In Traffic

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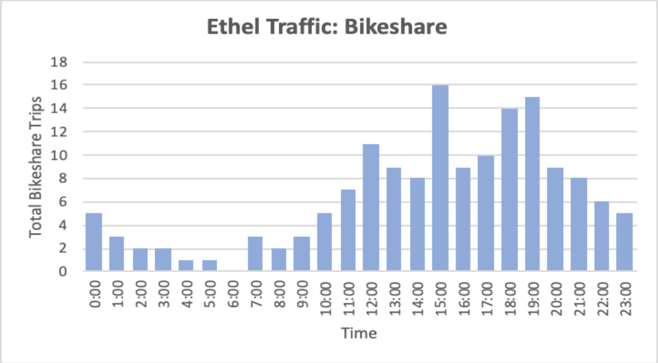
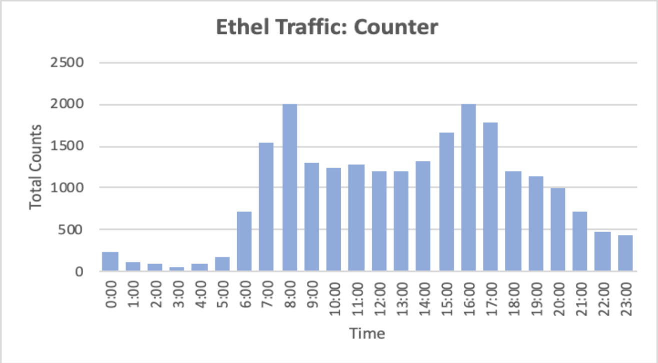
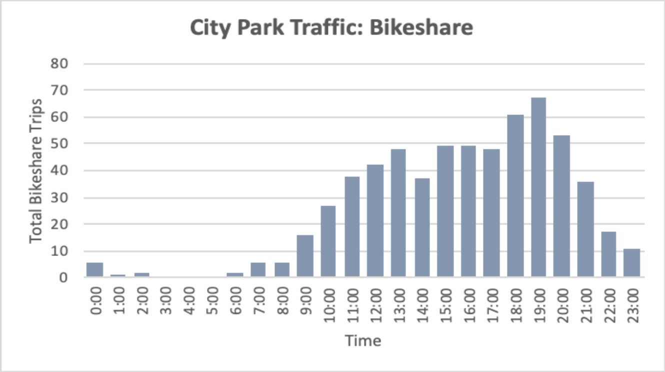
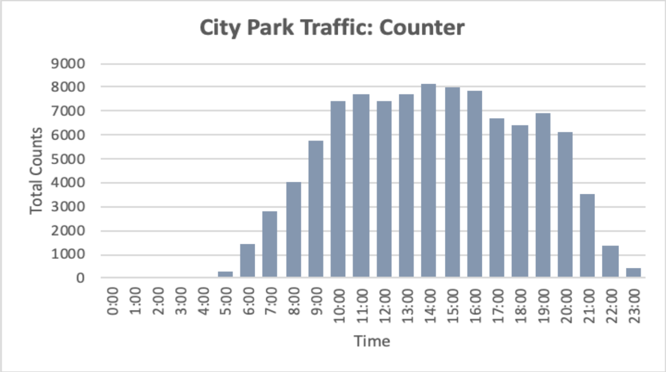








Estimation of ADB: Approach

Least Squares Optimization

- Find a single multiplier (***m***) such that:

  $m \times bikeshare = counter$

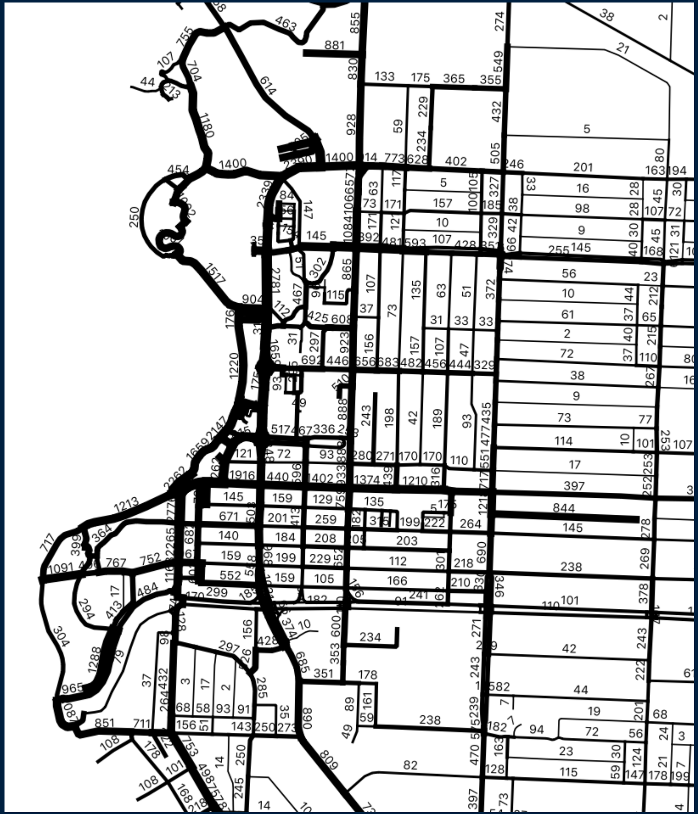
- Minimize the following equation across counters:

  $$f(x) = \Sigma\left((m \times bikeshare - counter)^2 \times split\right)$$

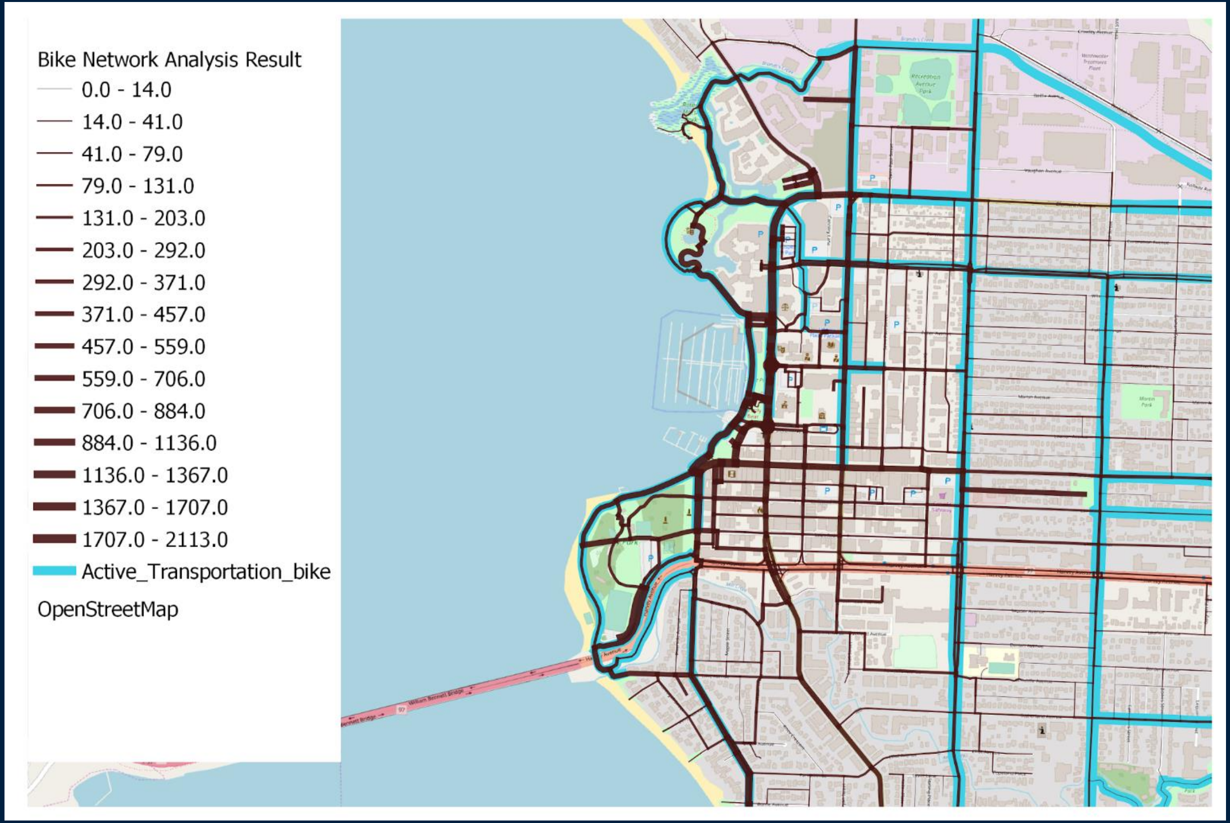
  $m = 159$

- Calculate ADB for each segment:

  $ADB = (m \times bikeshare)/91$



Final Visualization



Conclusions

- Using OSMnx to apply graph theory gave us the mapping and path-finding tools needed.
- The best path-finding model was shortest distance between points.
- Traffic patterns are different at each counter.
    - Bikeshare traffic is different from overall traffic recorded by the counters.
- Least squares optimization gave us an estimate of ADB.
- Total count of bikeshare trips used for understanding how bikeshare users cycled through the network.

Thank You!

Questions?

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