A Freight Emissions Monitoring Approach for Freeways in the GTHA

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SMART FREIGHT CENTRE™

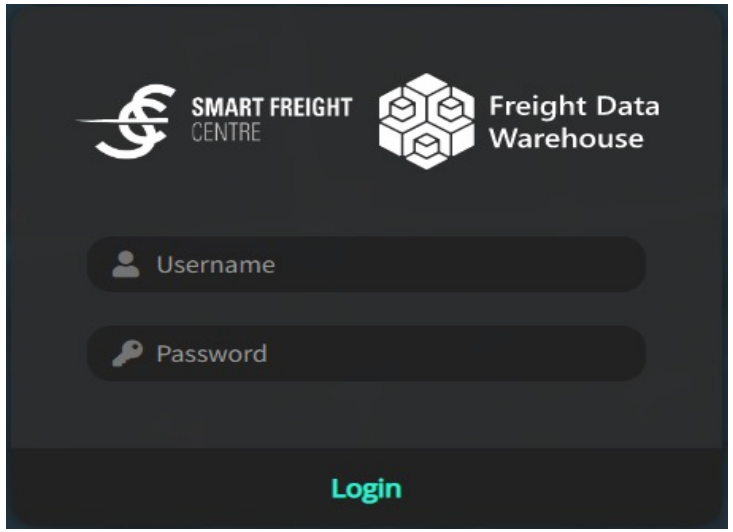
AGENDA

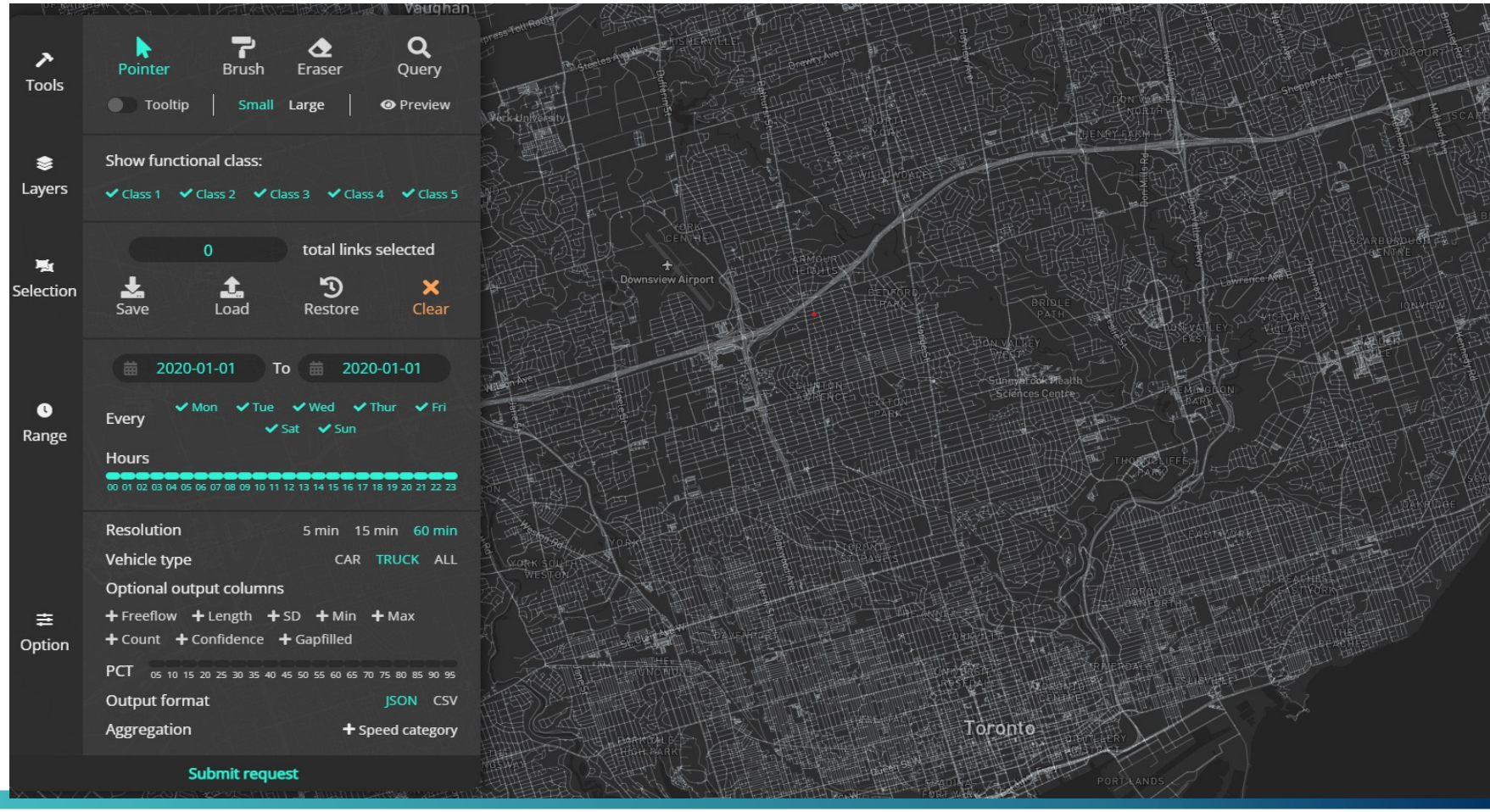
- Context
- Objective and Project Approach
- Data Sources
- Methodology
- Case Study: Highway 401
- Lessons learned and chief insights

Context

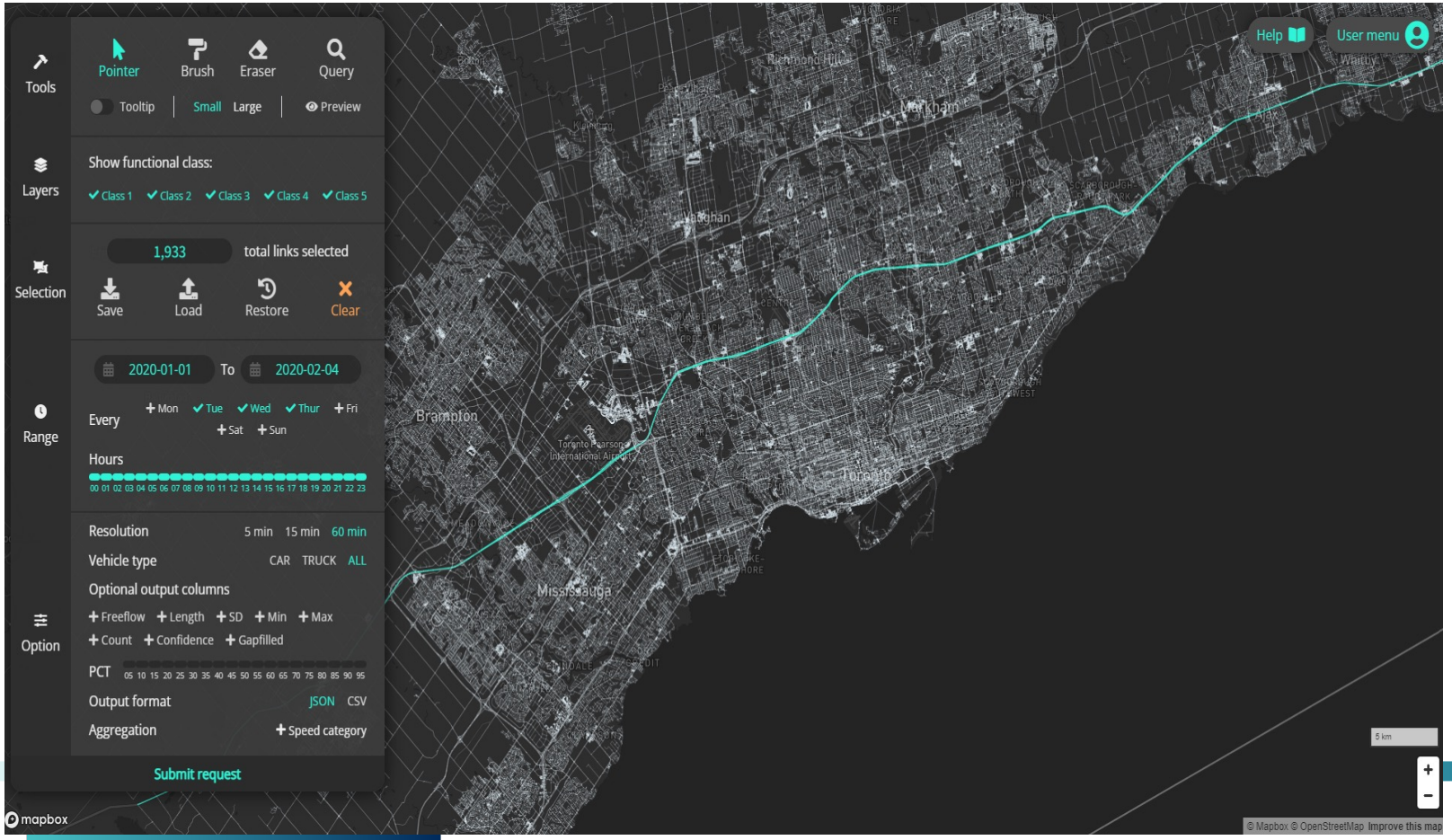
- Data has been an effective asset to assist passenger and freight vehicle operators in their transportation decisions (route choice, mode choice, etc.)
- The massive datasets collected are of interest to transportation agencies because they have the potential to characterize their networks using data-driven measures (Calabrese et al., 2013; Comi et al., 2014; Gonzalez-Feliu & Mercier, 2013)
- The Freight Data Warehouse (FDW), part of the Smart Freight Centre (SFC), focuses on enabling freight analytics, modeling, monitoring and research

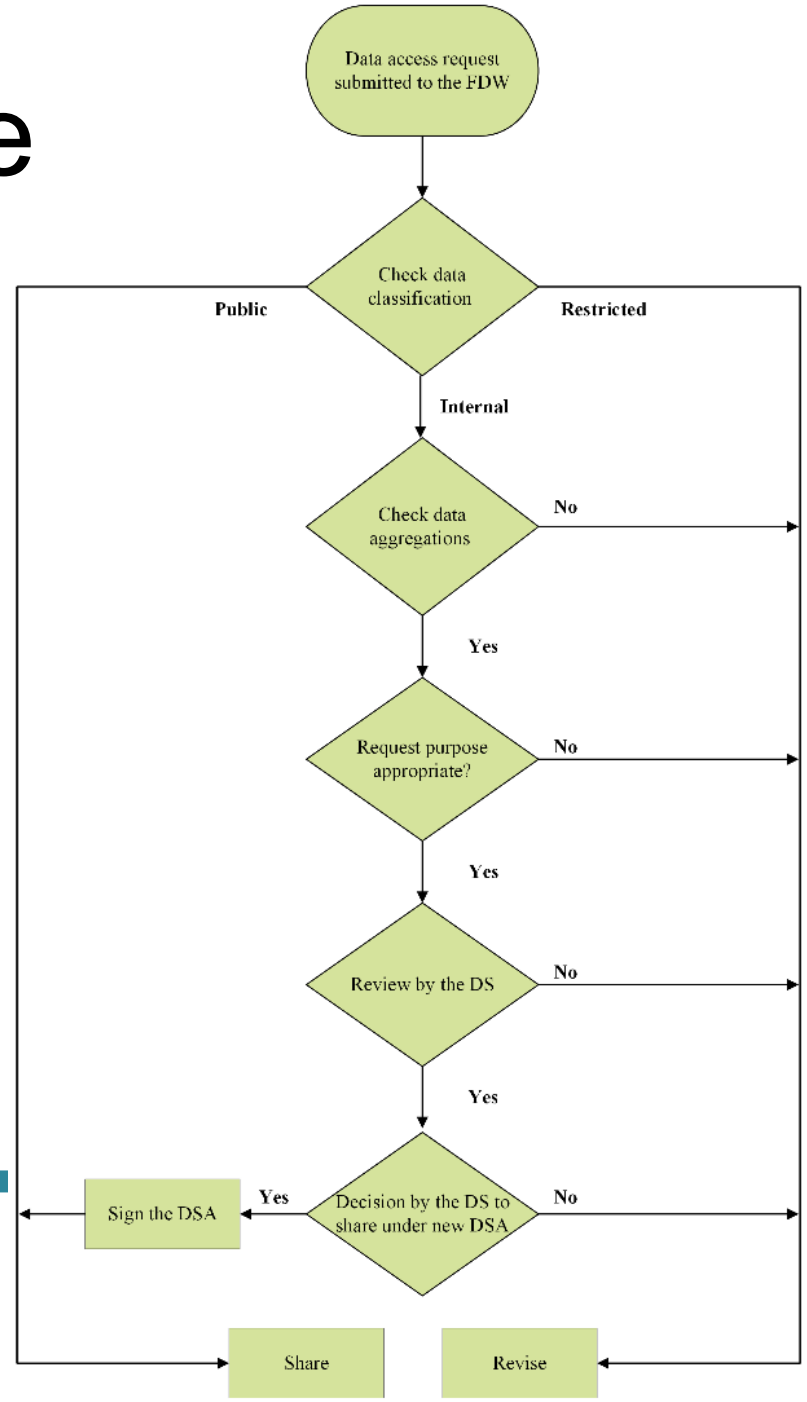
Context: FDW User Portal





Context: User Access Procedure



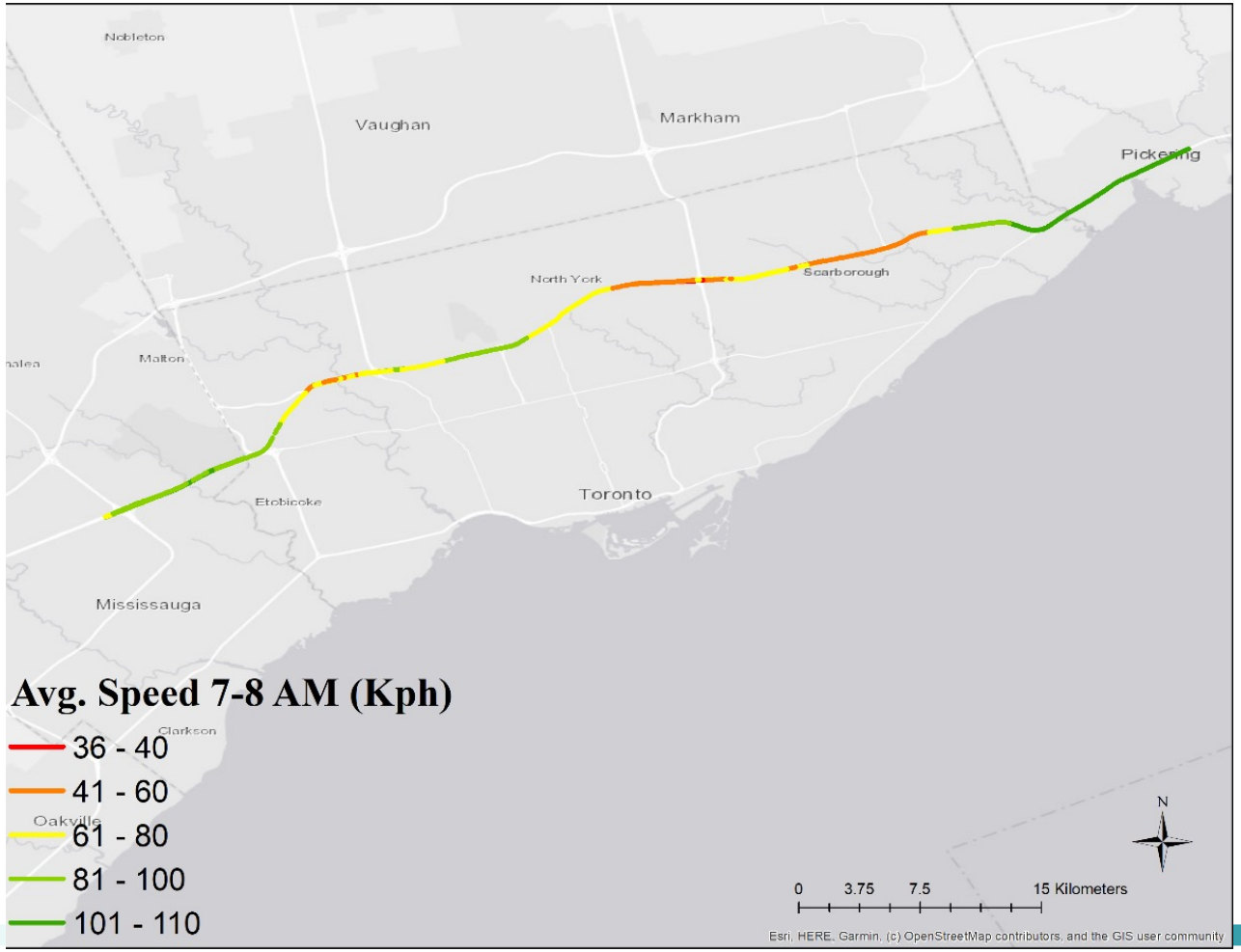


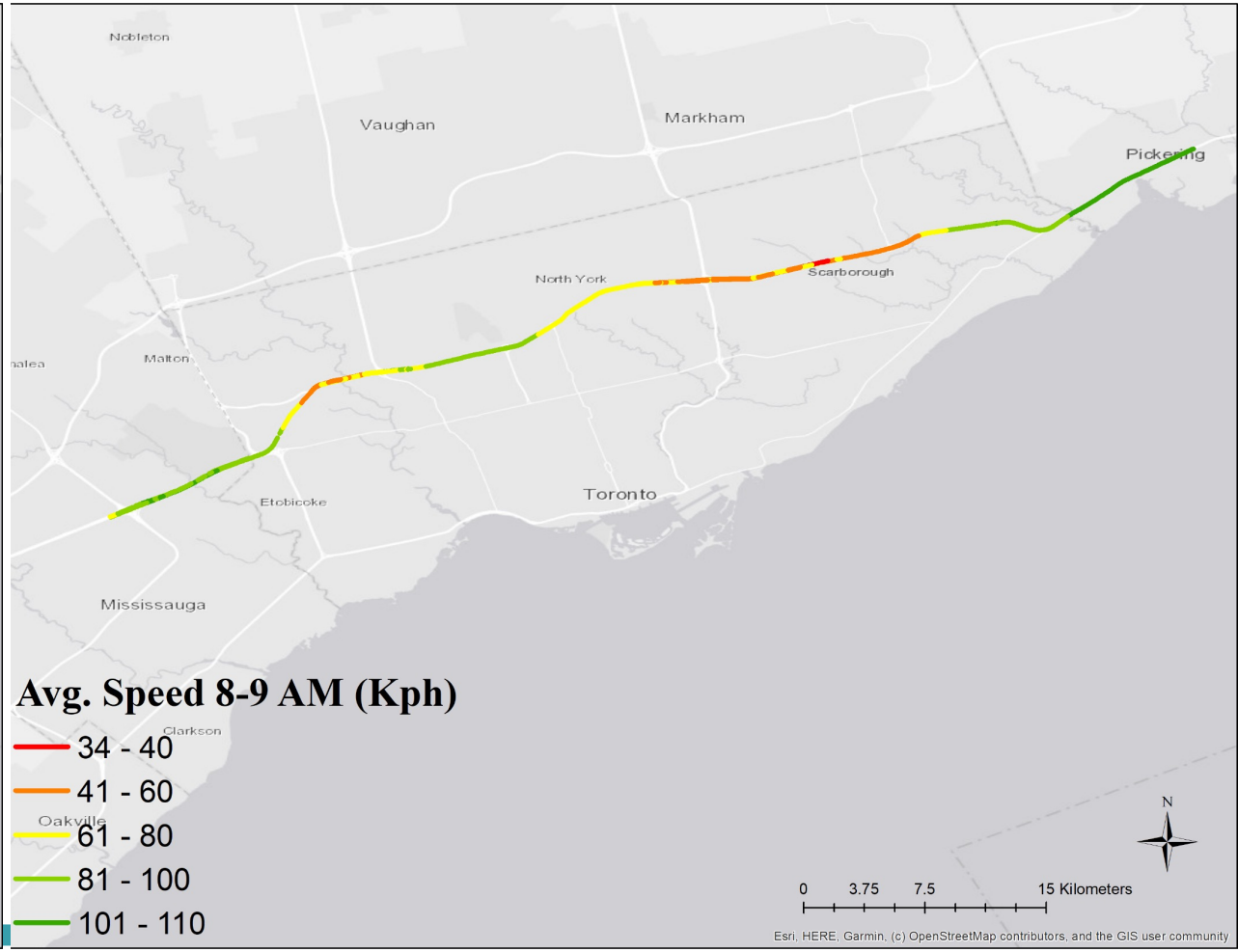
Objective and project approach

- **Objective:** Design a **methodology** for a **visualization service** so users can view up-to-date representations of commercial vehicle **greenhouse gas emissions** and air contaminants on freeways in the GTHA
  - by time of day, by roadway link, by vehicle class

- **Approach:** Data fusion project to combine different data sources.
  - Four main data sources:
    - Traffic speed data from Here
    - Traffic volume data: (sample) permanent counting stations
    - Emission factors
    - Vehicle classification data

Data Sources (I)

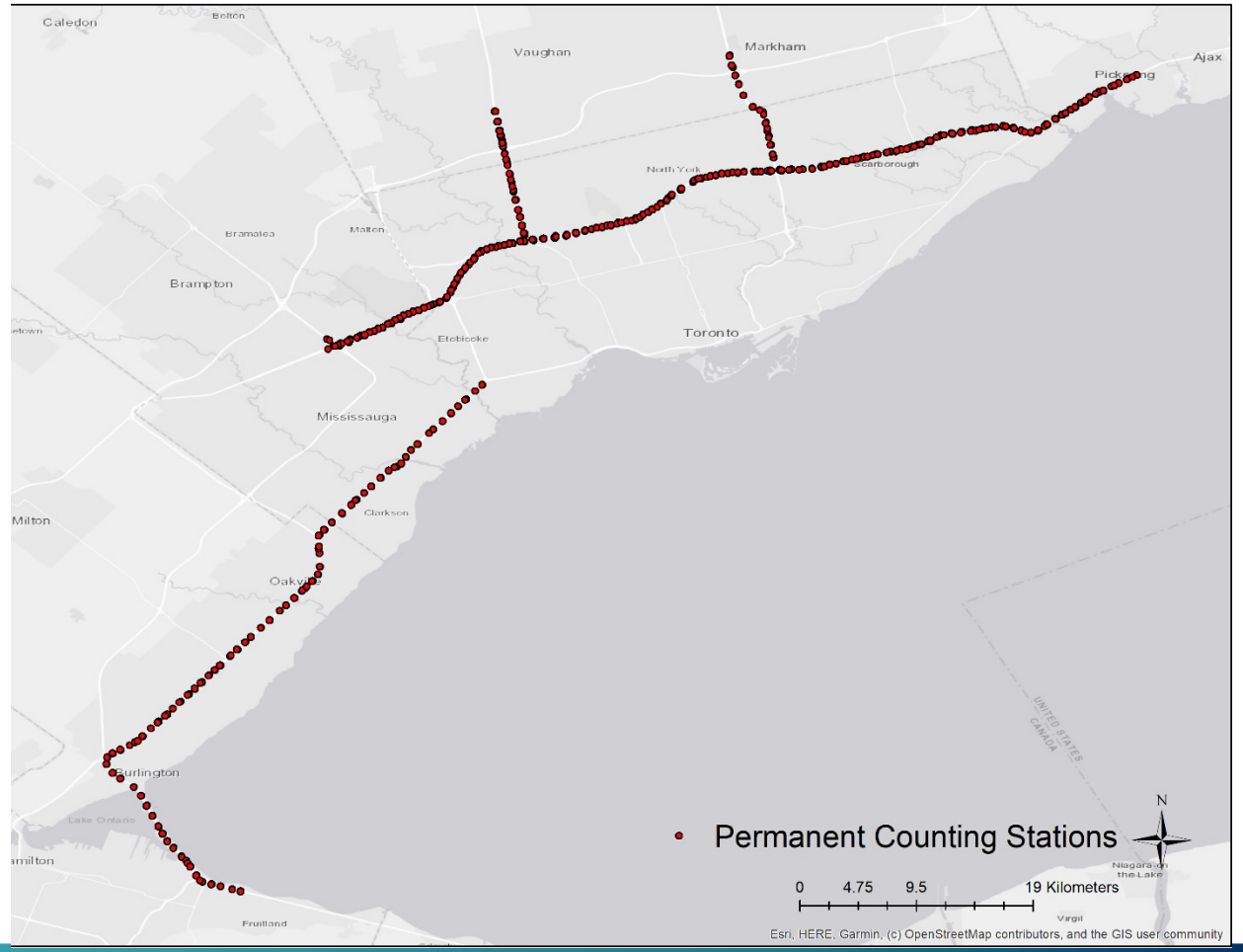




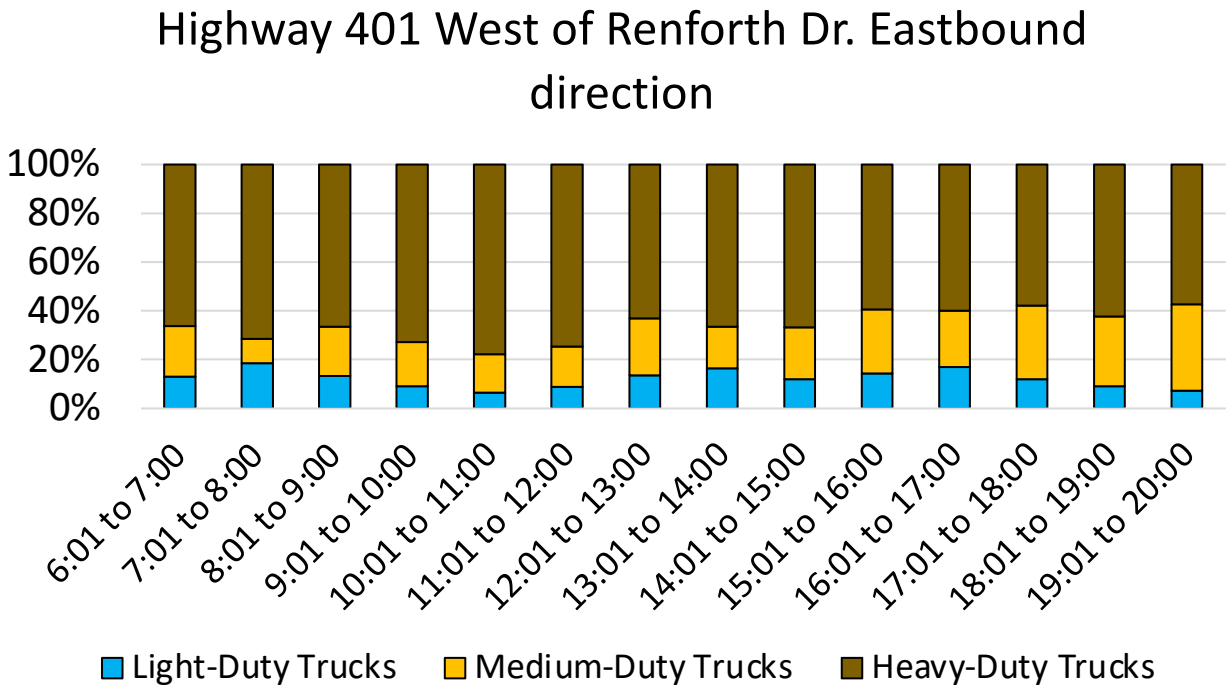
Data Sources (II)

- Sample of permanent counting stations
  - Highway 401 [Toronto]
  - Queen Elizabeth Highway [Mississauga, Hamilton]
  - Highway 400 [Toronto]
  - Highway 404 [Toronto]

- 644 in total; 335 along Highway 401

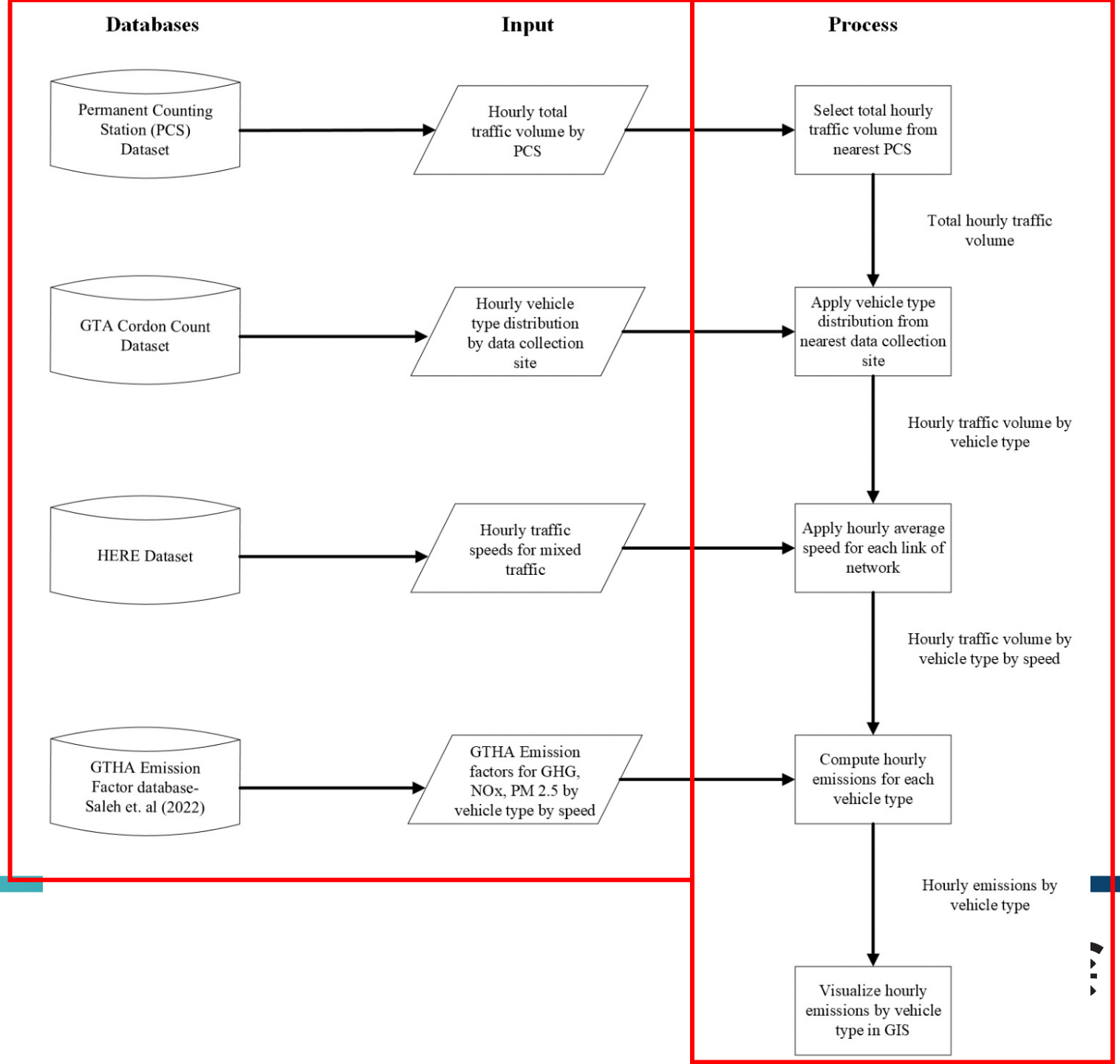


Data Sources (III)

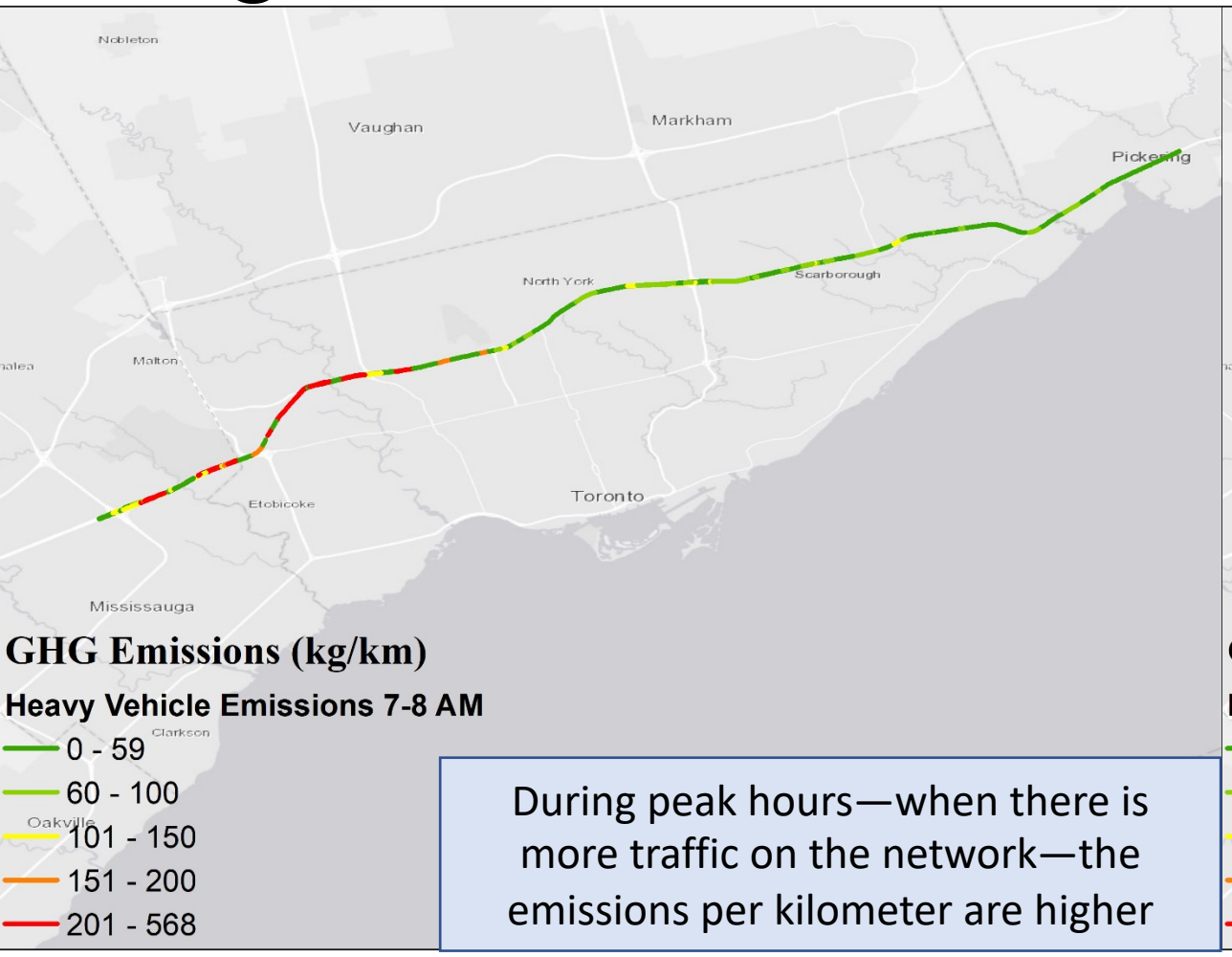


Speed (mph)	Rural Unrestricted (g/mile)	Urban Restricted (g/mile)	Urban Unrestricted (g/mile)
5	1052.52	1042.67	1052.52
10	647.74	634.50	647.74
15	512.82	501.40	512.82
20	443.48	416.77	443.48
25	398.10	373.24	398.10
30	355.53	345.33	355.53
35	337.94	335.80	337.94
40	327.82	329.67	327.82
45	320.12	324.89	320.12
50	314.27	317.94	314.27
55	312.26	311.41	312.26
60	313.90	308.71	313.90
65	318.92	316.57	318.92
70	332.46	332.43	332.46
75	352.58	352.58	352.58

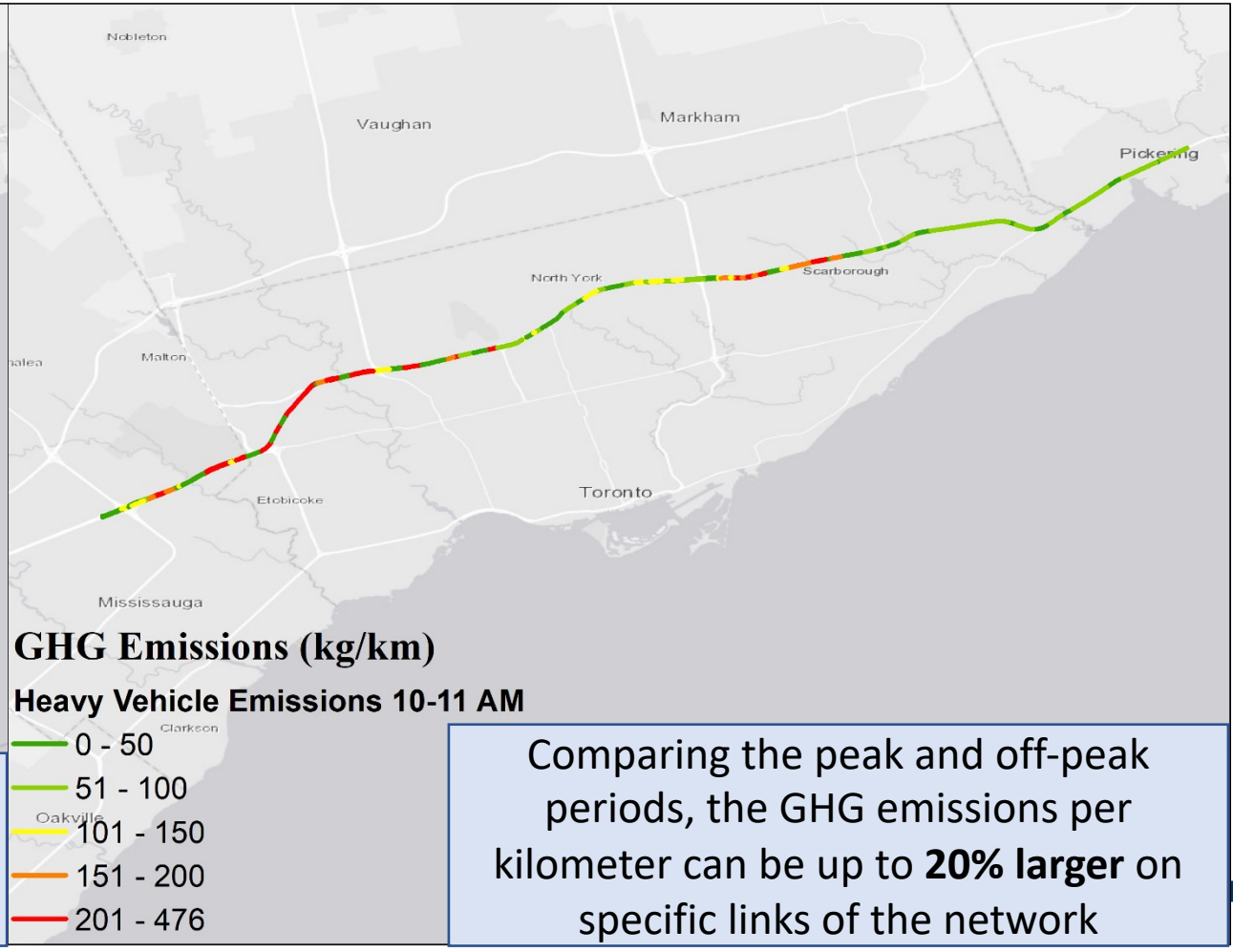
Methodology



Case Study: Greenhouse Gas Emissions of Freight Vehicles



During peak hours—when there is more traffic on the network—the emissions per kilometer are higher



Comparing the peak and off-peak periods, the GHG emissions per kilometer can be up to **20% larger** on specific links of the network

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Lessons learned and chief insights

- Developed a methodology that uses available data sources and data fusion techniques to visualize GHG and air contaminants on freeways
- The methodology was developed to rely on data that are broadly or commonly available in other jurisdictions, and can therefore be broadly transferable
  - Potential for implementation at an urban, regional, or nationwide scale
- The methodology can be used to have a regularly updated estimation of GHG and air contaminant emissions, if the speed and volume input databases are regularly updated

Lessons learned and chief insights

- Notable differences in emissions occur throughout the day, which are linked to the truck volume as well as the congestion in the GTHA network.
- Limitations of the proposed methodology are related to the quality and restrictions of the data.
- Potential next steps based on this research include the operationalization of a visualization service of GHG emissions and air pollutants using the methodology developed in this project.

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Thanks!!

QA?

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