EMERGING APPROACHES FOR TRAVEL DEMAND MODELLING

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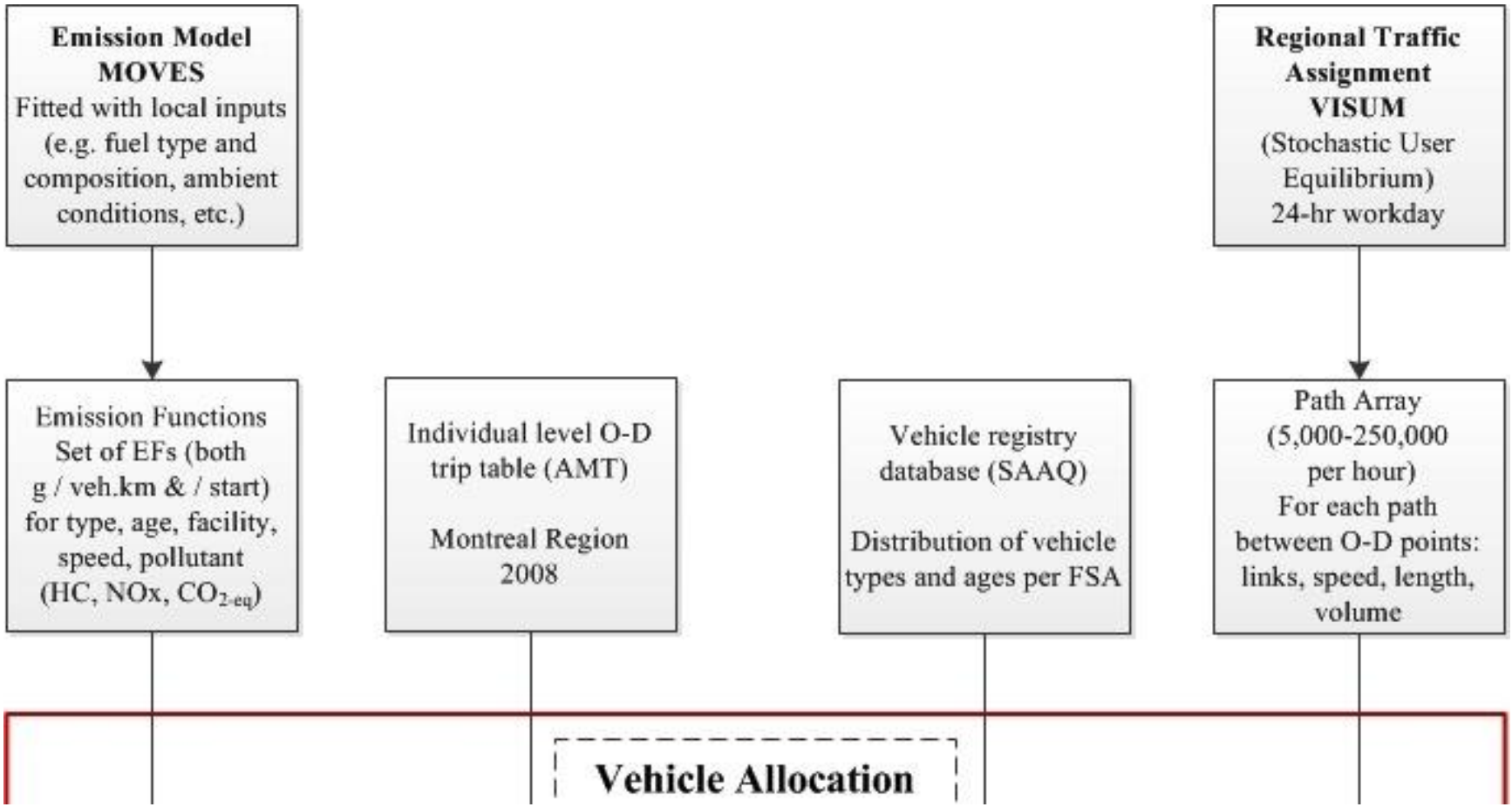
A NEW TRANSPORTATION MODELING PARADIGM: INTEGRATING LAND USE, ENVIRONMENT AND HEALTH

Urban travel modeling

- Considerable evidence linking exposure to traffic-related air pollution:
  - Birth outcomes
  - Children's health
  - Respiratory and cardiovascular diseases

- Grand vision to develop an integrated framework to connect travel patterns with emissions
  - Can provide powerful tools to evaluate social justice and equity issues
  - Information for epidemiologists to undertake health causation studies

Montreal Framework I



Base Data Sources

2008 AMT Origin-Destination Survey

- Approx. 162,000 individual driving trips
- Each trip associated with origin, destination, departure time, and household attributes

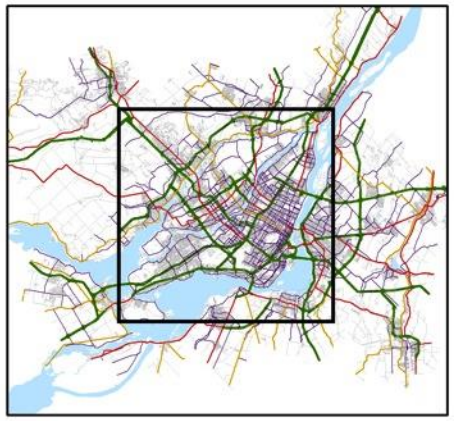
Vehicle Ownership Registry from the Société de l'Assurance Automobile du Québec (SAAQ)

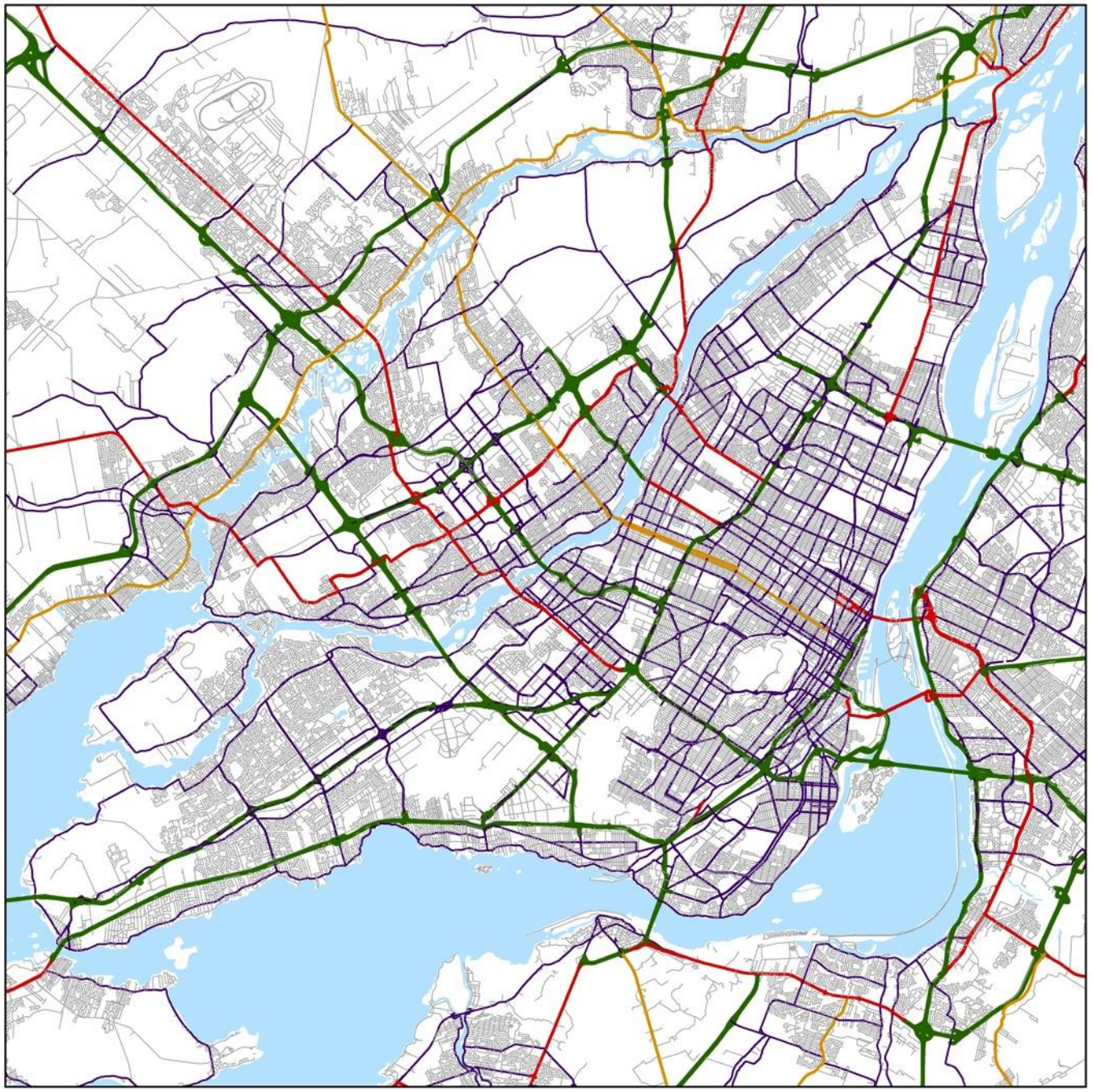
- Total # of vehicles by type and model year at the FSA-level
- 12 vehicle types collapsed into 2 (Passenger Cars and Passenger Trucks)

Traffic Assignment

Regional traffic assignment model:

- Built using the PTV VISUM platform
- Approx. 125,000 links and 1552 traffic analysis zones
- Hourly OD matrices from the 2008 OD survey
- Assigned to the network using a stochastic user equilibrium assignment
- Output hourly trip-level paths with congestion-related link speeds





Road Type

- Expressways
- Primary Highways
- Secondary Highways
- Main Roads
- Local Roads

0 2 4 8 Km

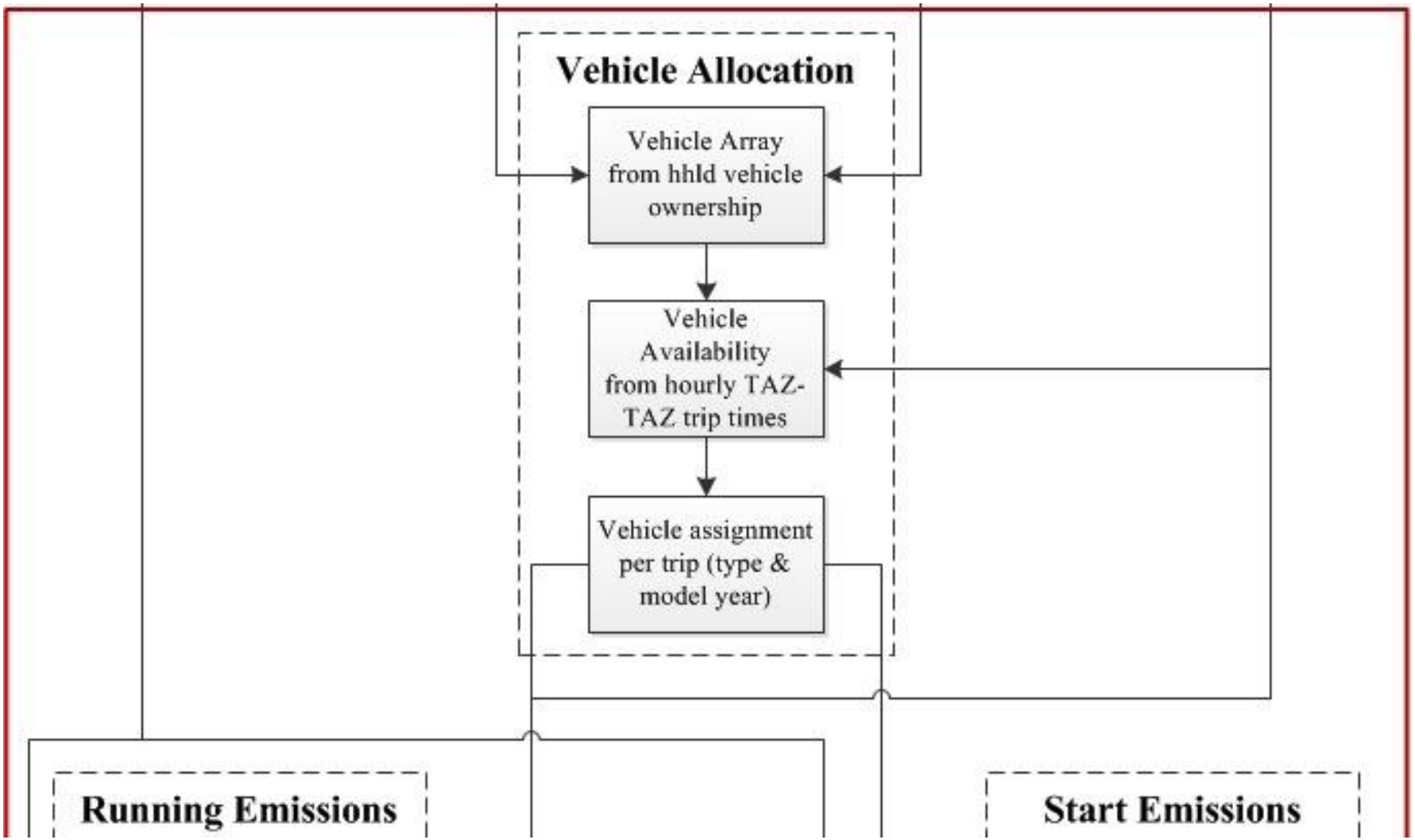
0 1.75 3.5 7 Miles

N

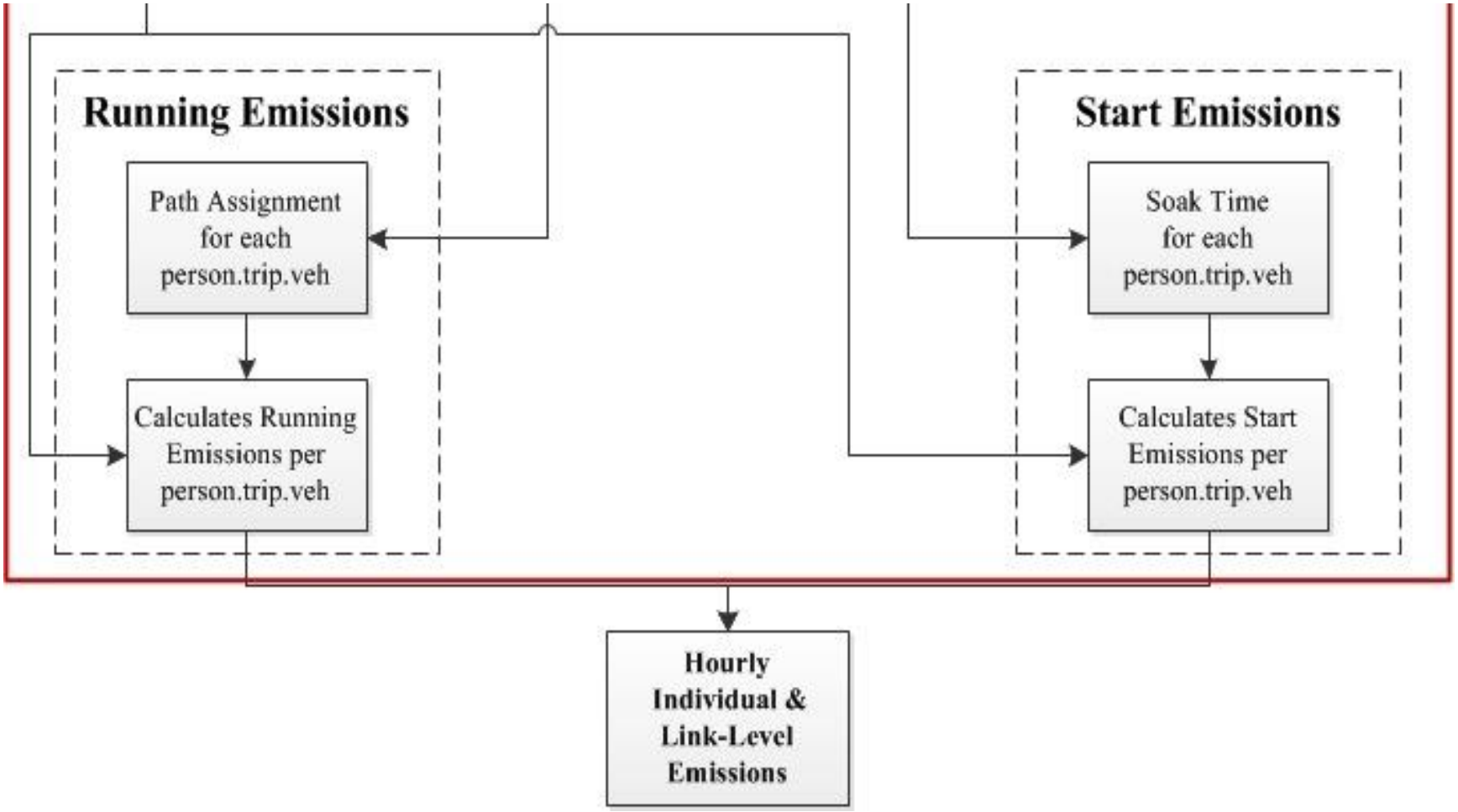
Source: TRAM 2009

Projection: NAD 1983 MTM 8

Detailed Framework II

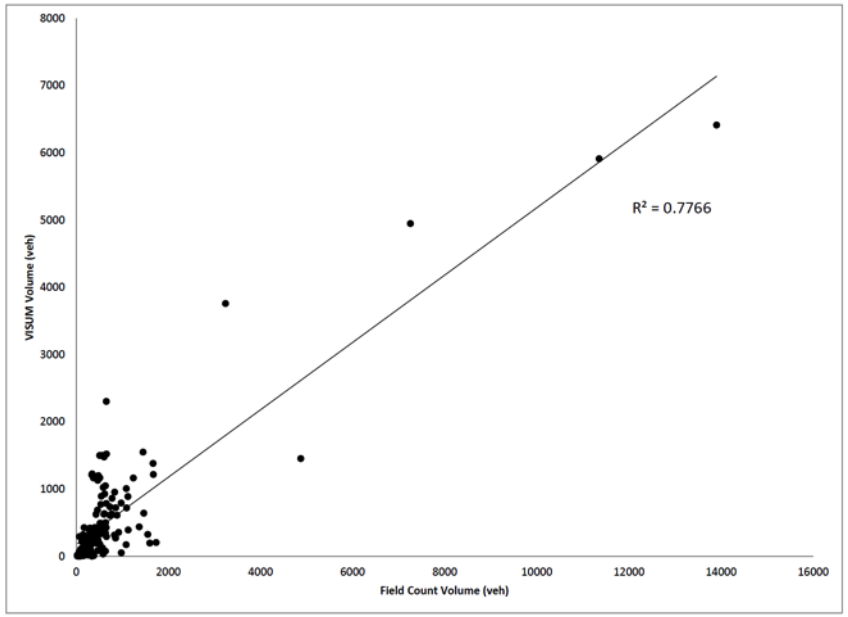


Detailed Framework III

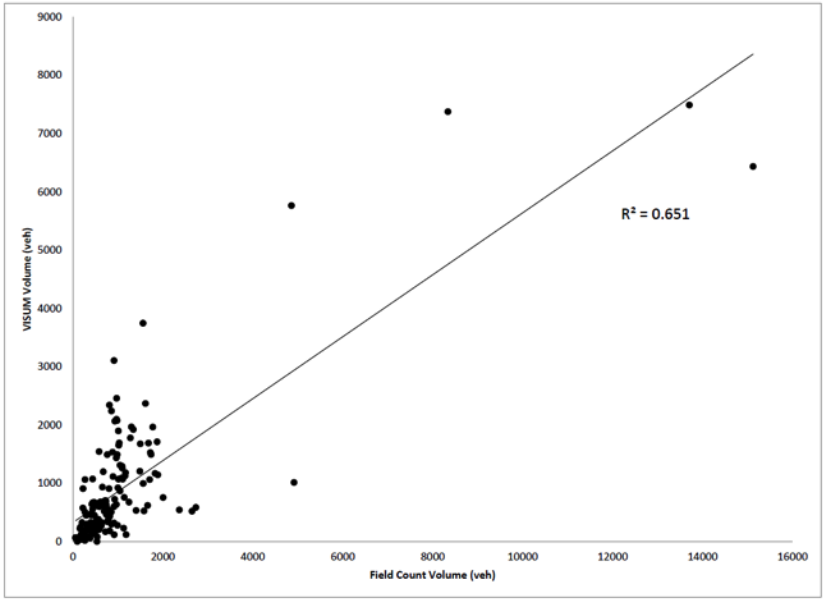


Validation: Traffic Volumes

6 – 7 am



7 – 8 am



Hourly correlations over the entire 24-hour period range from 0.62 to 0.86

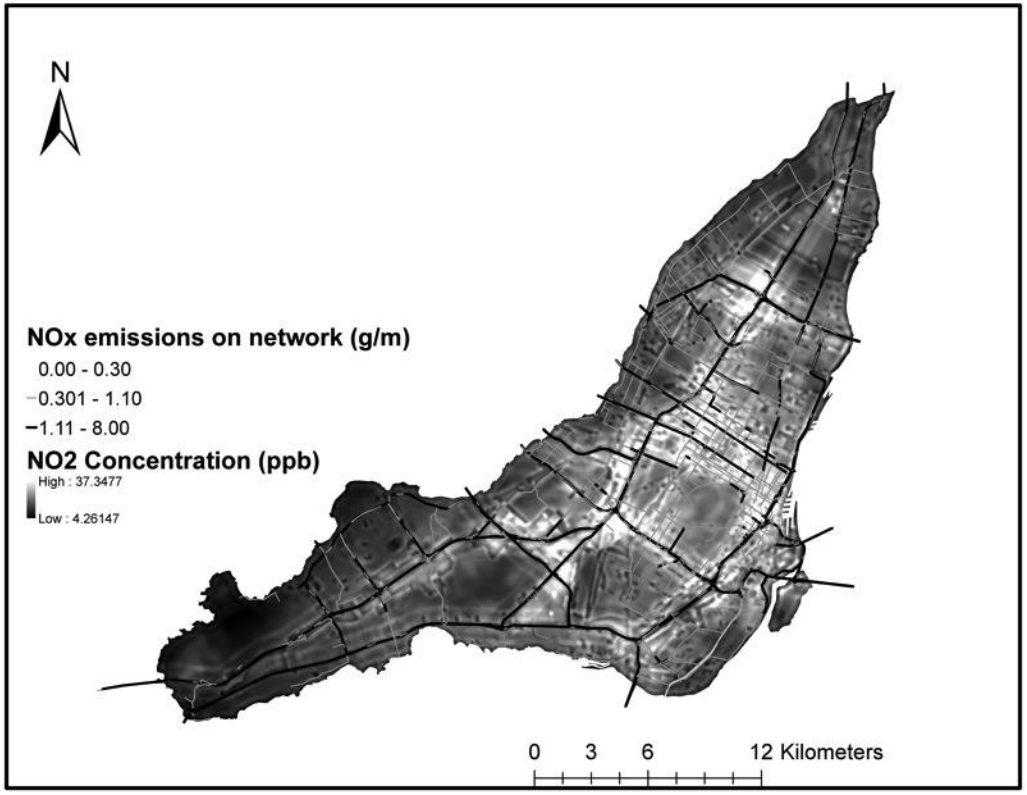
Validation: GHGs

Comparison of Daily GHG Emission Inventories from Private Vehicle Operation

Region	Source	Year of Estimate	GHG Estimate (tons per day)
MMR	Integrated transport and emission model	2008	11,920
Montreal CMA	Statistics Canada (2012)	2007	11,900 – 14,500 [a]
Island of Montreal	Logé (2006)	2003	10,070 – 12,790 [a]
City of Toronto	ICF International (2007)	2004	17,040 – 20,690 [a]
Greater Toronto & Hamilton Area	Hao et al. (2007)	2001	24,120 – 25,810
Metro Vancouver	BC MoE (2013)	2010	10,600 – 12,872 [a]

[a] Calculated from a yearly estimate by assuming 261 workdays per year and that 70-85% of traffic occurs during the week

Validation: NO_x



133 near-roadway NO_2 measurement points (Crouse et al, 2009)

Correlation along roadways is around 0.8

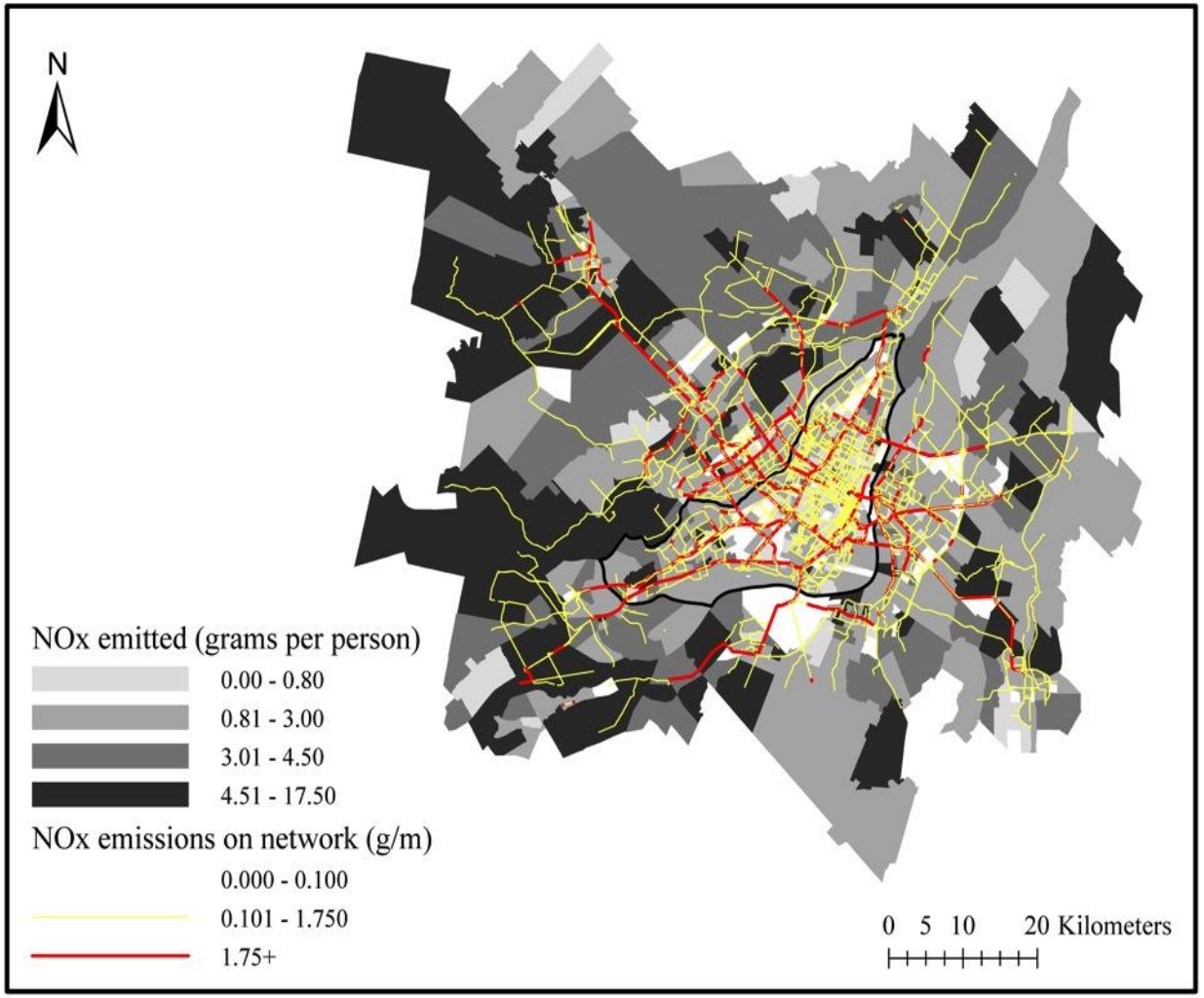
Indicators of Traffic-related Air Pollution

Two indicators are estimated:

I. Average level of emissions generated per person for each TAZ → ‘Polluting Power’

II. Average level of emissions occurring in each TAZ → Proxy for air pollution exposure

Household vs. Link-level NO_x



Revisiting public transportation

- *Traditional* public transportation systems - bus, metro and rail systems
- *Innovative* public transportation systems - bike-share and car-share systems

- Growing role of econometric models in handling "Big Data"
  - Bicycle sharing systems can be accessed online through crawling scripts to save the number of bicycle available at each bicycle station – minute by minute arrivals/departures (720 records per day) for about 6-12 months (365*720*number of stations)

Transportation Safety

- According to the World Health Organization (WHO), the death toll of road traffic crashes is expected to become the fifth (currently eighth) leading cause of death by the year 2030 (WHO, 2013)
- Two major streams of research
  - Frequency analysis – number and likelihood of accidents
  - Severity analysis – injury sustained in the event of crash
- Different groups
  - Vehicle occupants
  - Pedestrians and bicyclists
- My research team has been exploring these two streams and the different groups

Acknowledgments

- My current and former students at McGill and UCF
- My collaborators including Dr. Abdul Pinjari, and Dr. Marianne Hatzopoulou
- My Advisor Dr. Chandra Bhat

Links to Research

- Research Webpage
- https://people.cecs.ucf.edu/neluru/publications/

Questions