CLUE: City Logistics for the Urban Economy

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City Logistics for the Urban Economy
CLUE

SMART FREIGHT CENTRE

CLUE Motivations

- Shortage of accessible data that quantify freight, and resulting impacts on society, environment competitiveness.
- Lack of knowledge about the impacts of e-commerce, home delivery and the sharing economy on freight transportation
- Little research in Canada on the benefits and impacts of new technologies and business processes
- Little focus on pilot studies
- Imperative to improve transportation safety and sustainability in urban areas.

Partnership

3 Universities: 10 faculty investigators

Partnership: 13 industry / government partners

4 year research project (2020-2024)

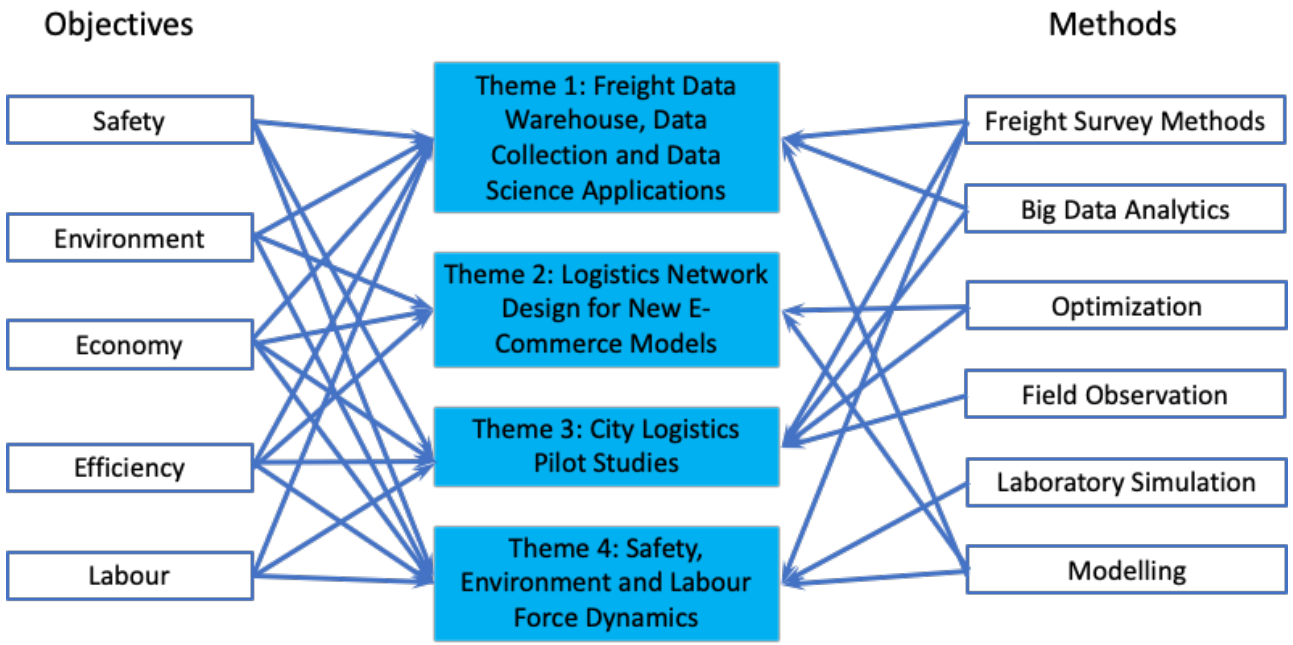
Three Goals

Research: 4 themes, 24 projects

Training: 28+ graduate students with skills in logistics, transportation engineering, data science and sustainability.

Knowledge transfer: working with public & private sector partners

Themes, objectives and methods



CLUE research/management team

Partners


Region
of Peel
working with you


Transport
Canada
Canada


TORONTO


York Region


GEOTAB
management by measurement


esri Canada


CHET
EST. 1997


PEMBINA
institute


TAF
The
Atmospheric
Fund


BOSCH


LCBO


Loblaws


Walmart


CLUE

Theme 1) Freight Data Warehouse, Data Collection and Data Science Applications

1. Freight Data Warehouse
2. Shipper and Truck Driver Surveys

Data Science Applications

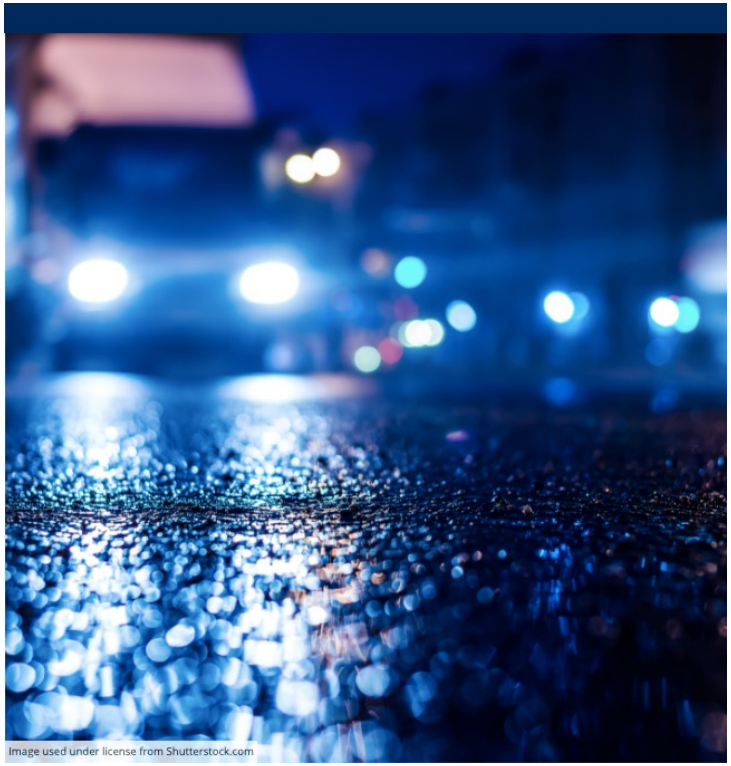
3. Supply Chain Analytics & Visualization
4. Freight Bottleneck Analysis
5. Network Safety Analysis using Truck Engine and Telematics Data
6. Supply Chain Analytics During/After Pandemic

Theme 2) Logistics Network Design for New E-commerce Delivery Models

1. Behavioural Location Models for Last-mile E-commerce
2. Impacts of E-commerce in Neighbourhoods
3. Environmental Justice Impacts of E-commerce
4. Crowd-shipping Optimization
5. Logistics for Novel Last-Mile Delivery Systems
6. Operational Challenges of Same-day Delivery
7. Predictive Analytics in the First-Mile to Improve the Last-Mile

Theme 3) City Logistics Pilot Studies

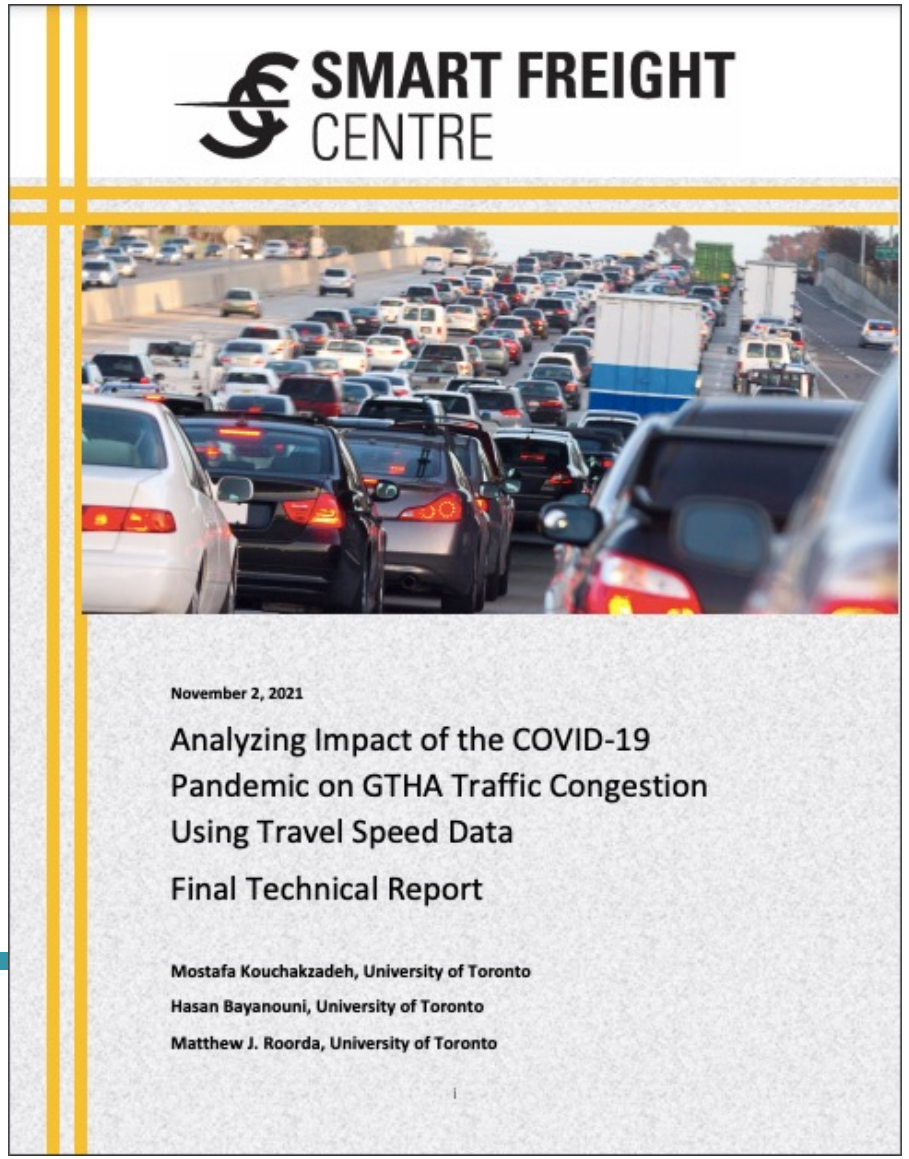
1. Off-peak Delivery (OPD) Evaluation
2. Cargo Tricycle Delivery Pilot
3. Autonomous Vehicle Delivery Pilot
4. Curbside Loading Zone Pilot



Theme 4) Safety, Environment and Labour Force Dynamics

1. Truck Driving Simulator for Pedestrian / Cyclist Safety
2. Reducing Fatigue Collisions by Optimizing Long-Haul Truck Parking Supply
3. Air pollution Monitoring using Truck Mounted Sensors
4. Truck Managed-Lane Tactics
5. Long-Combination Vehicle Corridor Traffic Signal Management
6. Multi-modal Transportation of Hazardous Materials
7. Labour Dynamics in Freight and Logistics

First example project



Determined the most congested GTHA freeway segments in

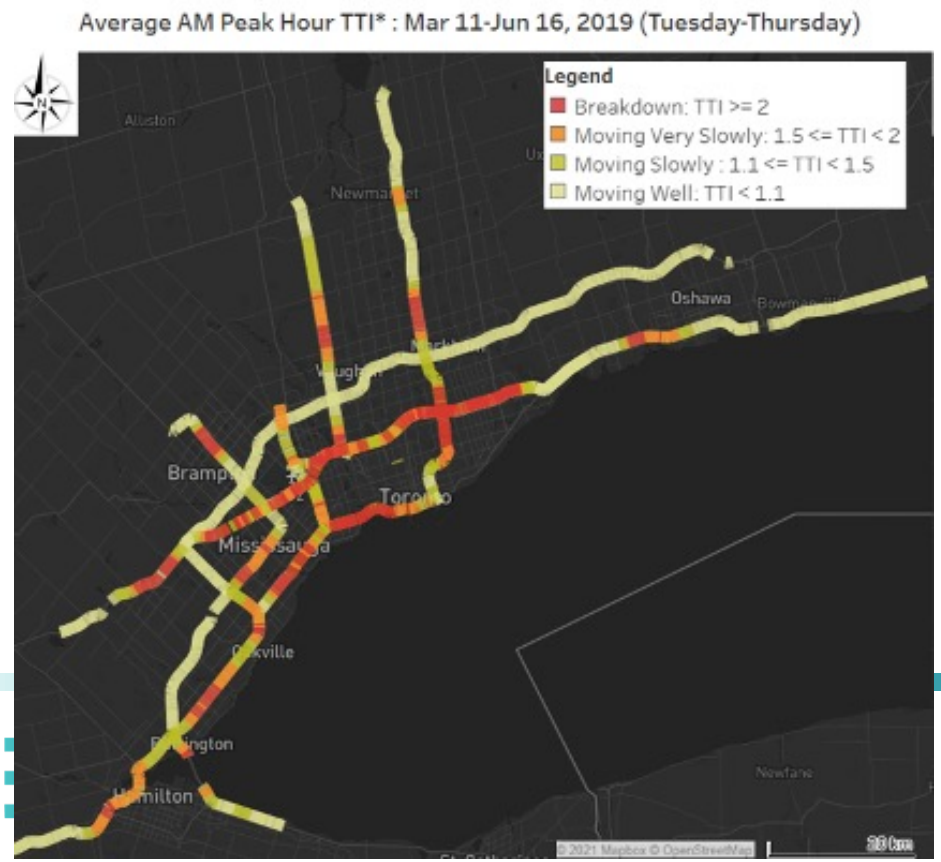


Table 5-Congested freeway segments under analysis

Freeway	From	To	Peak Hour	Direction
DVP	Sheppard Ave E	Millwood Rd	AM	SB
DVP	Sheppard Ave E	Lawrence Avenue East	PM	SB
DVP	Gerrard St E	Lawrence Avenue East	PM	NB
Hwy 400	King Rd	Major Mackenzie Dr W	AM	SB
Hwy 400	Sheppard Ave E	Wilson Ave	AM	SB
Hwy 400	Wilson Ave	Major MacKenzie Dr W	PM	NB
Hwy 401	Conlins Rd	Yonge St	AM	WB
Hwy 401	Dixie Rd	Weston Rd	AM	EB
Hwy 401	Winston Churchill Blvd	Creditview Rd	AM	EB
Hwy 401	Hwy 25	Trafalgar Rd	AM	EB
Hwy 401	Highway 404	Highway 427	PM	WB
Hwy 401	Highway 427	Highway 404	PM	EB
Hwy 401	Brock Rd	Lake Ridge Rd	PM	EB
Hwy 401	Mississauga Rd	Trafalgar Rd	PM	WB
Hwy 403	Appleby line	Bronte Rd	AM	EB
Hwy 403	Winston Churchill Blvd	Mavis Rd	AM	EB
Hwy 403	Dundas St E	Chartwell Rd	AM	WB
Hwy 403	Chartwell Rd	Dundas St E	AM	EB
Hwy 403	Appleby line	Plains Rd W	PM	WB
Hwy 403	Eglinton Ave E	Mavis Rd	PM	WB
Hwy 403	Dundas St E	Plains Rd W	PM	WB
Hwy 403	Plains Rd W	Dundas St E	PM	EB
Hwy 404	19th Avenue	16th Avenue	AM	SB
Hwy 404	Finch Avenue E	Sheppard Ave E	AM	SB
Hwy 404	Steeles Ave E	Major MacKenzie Dr W	PM	NB
Hwy 409	Martin Grove Rd	Islington Ave	AM	EB
Hwy 409	Martin Grove Rd	Islington Ave	PM	EB
Hwy 410	Mayfield Rd	Queen St E	AM	SB
Hwy 410	Hwy 407	Queen St E	PM	NB
Hwy 427	Hwy 7	Finch Avenue W	AM	SB
Hwy 427	N Queen St	Burnhamthorpe Rd	AM	NB
Hwy 427	Goreway Dr	Finch Ave W	PM	NB
Hwy 427	Bloor St W	The Queensway	PM	SB
Gardiner	Royal York Rd	Bathurst St	AM	EB
QEW	Clarkson Rd N	Dixie Rd	AM	EB
Gardiner	Bay St	Bathurst St	PM	WB
Gardiner	Dufferin St	Park Lawn Rd	PM	WB
QEW	Highway 427	Southdown Rd	PM	WB

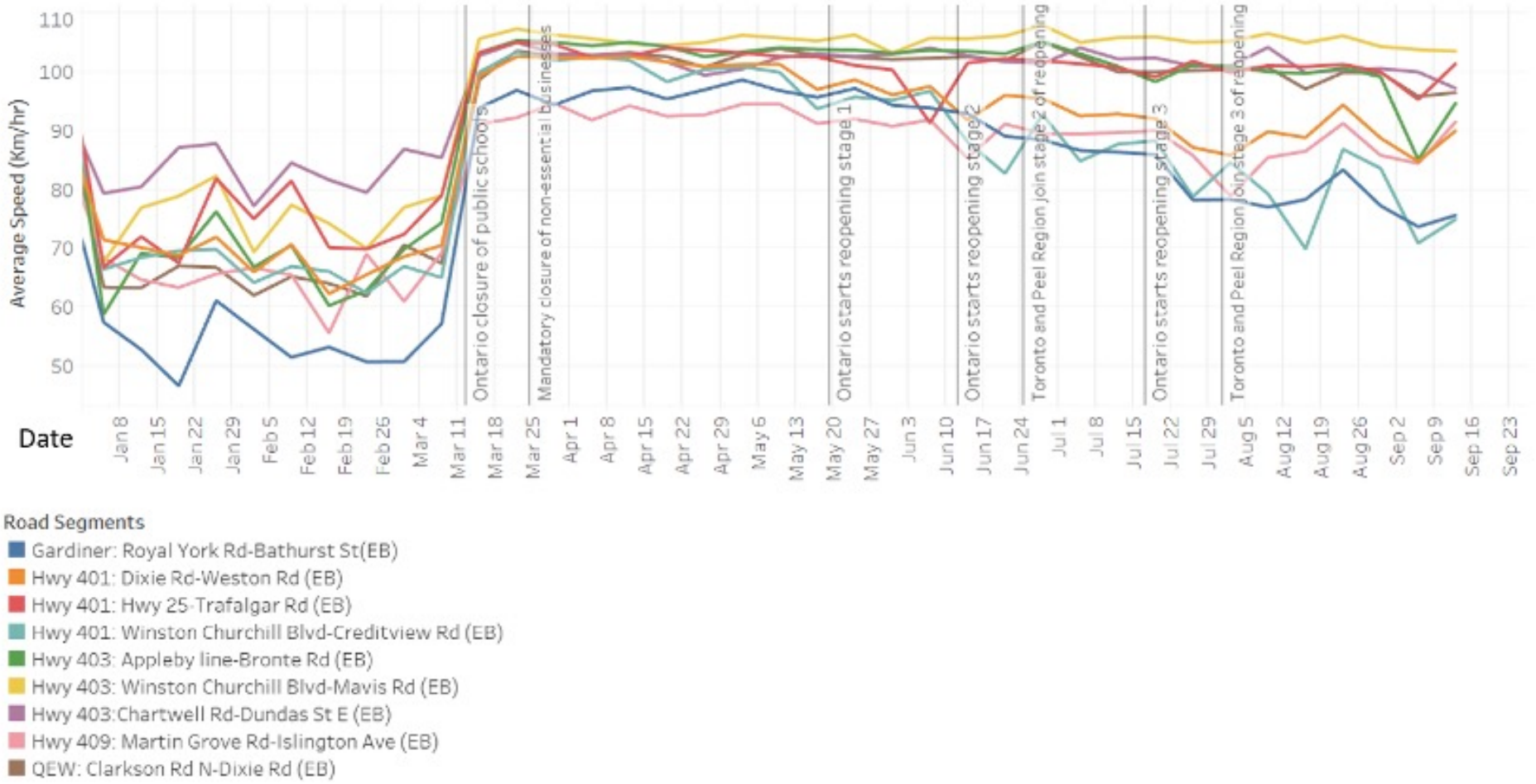


Figure 12-Road segment travel speed AM peak hour (7 AM-8 AM) (EB)

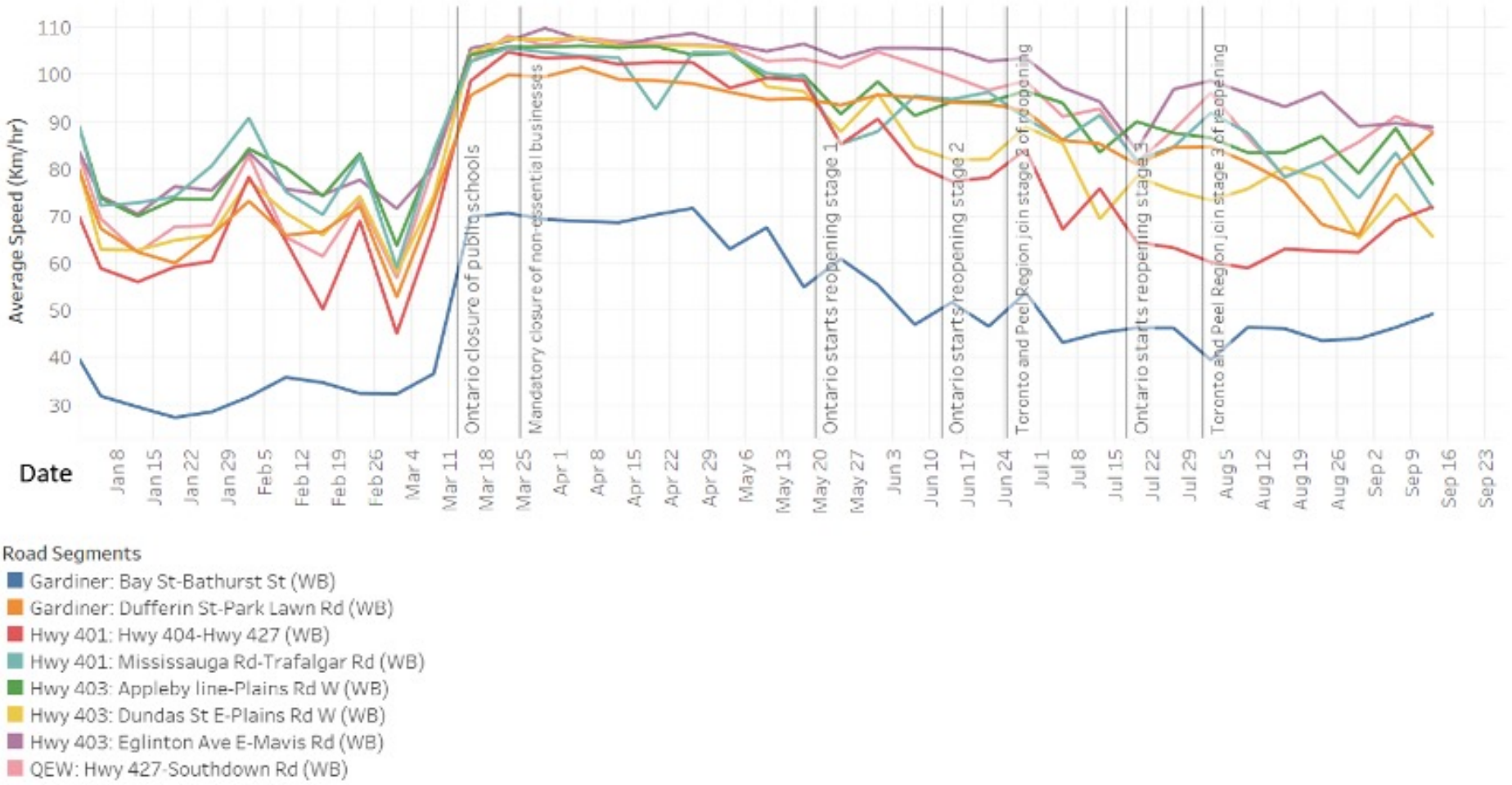


Figure 16-Road segment travel speed PM peak hour (4 PM-5 PM) (WB)

Conclusions

All freeway bottlenecks in the GTHA experienced increase in travel speed after the COVID-19 pandemic began

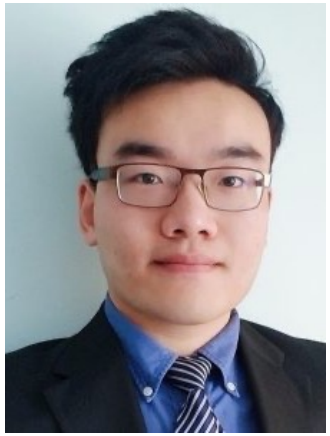
Even at the end of August, the travel speed in 2020 was significantly higher than 2019.

Over various stages of reopening, travel speeds decreased again, most quickly in the City of Toronto

Travel speeds returned to normal faster during PM peak hour compared to AM peak hour.

Second Example Project

Impacts of Off-Peak Deliveries in the Toronto Area Before and During the Pandemic



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Funding Partners:
Natural Science and Engineering Research Council
The Atmospheric Fund, Region of Peel, City of Toronto

CLUE

What is Off-Peak Delivery?

Off-peak delivery (OPD) refers to the delivery of goods during the evening and overnight hours

7 PM – 7 AM

Region of Peel 2019 – Pilot Results

Participation:

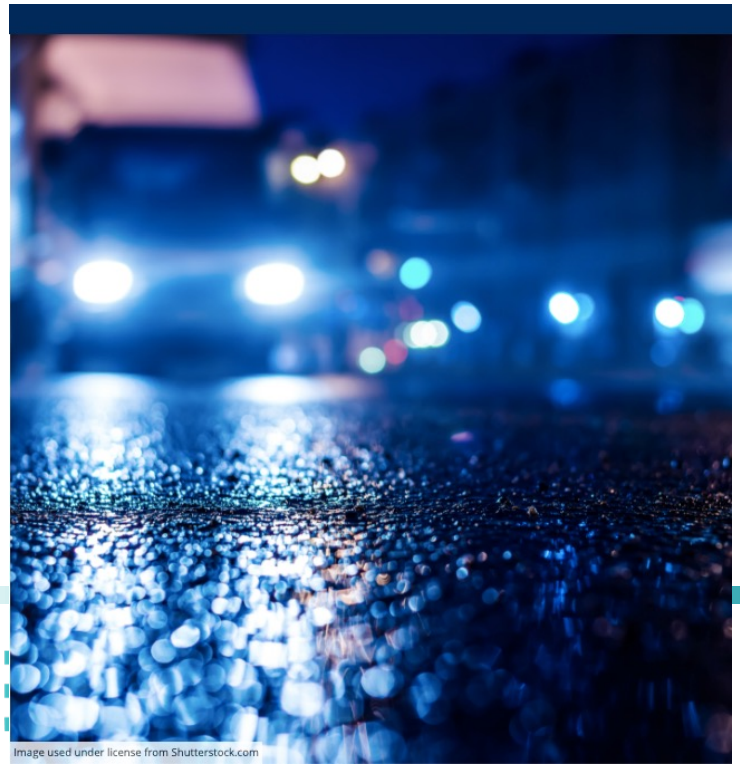
3 large retail companies permitted to operate during off-peak hours in Peel Region

- **14 stores in Peel Region**
- **6 month pilot**

~1600 truck trips (30%) of trips to participating retail stores shifted to off-peak hours

Region of Peel 2019 – Pilot Results

Travel Times



15.3 percent lower travel times during off-peak hours

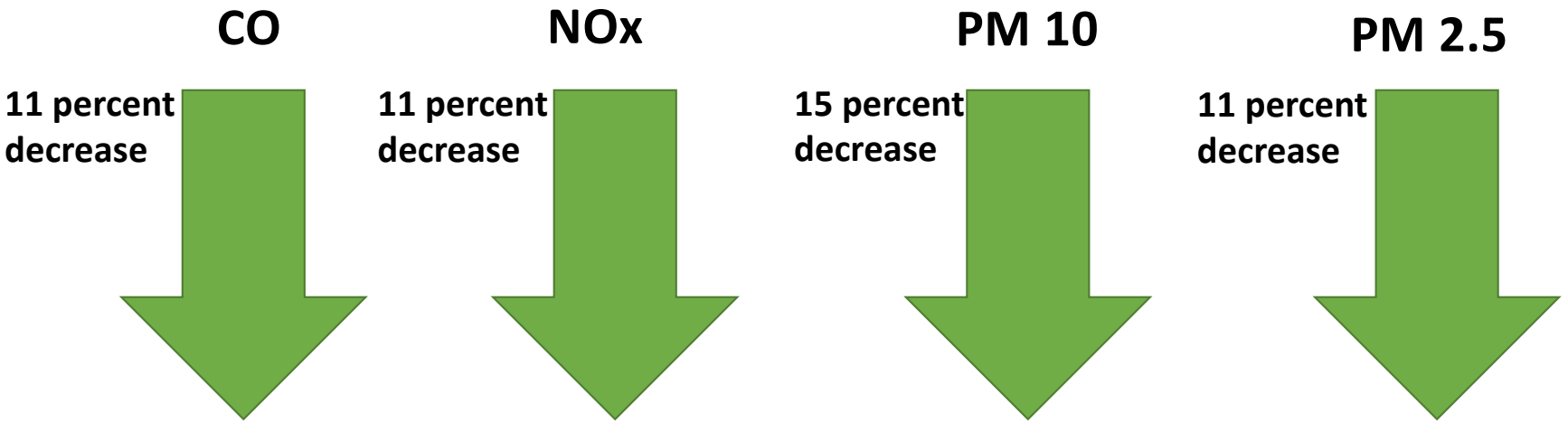
Region of Peel 2019 – Pilot Results

GHG emissions

10.6 percent decrease in GHG emission factors (grams/km) during off-peak hours

Region of Peel 2019 – Pilot Results

Air quality pollutants



March 19, 2020 … days after COVID-19 lockdown in Ontario

"The *Municipal Emergency Act, 2020* will ensure that for the near future, the delivery of goods to Ontario's businesses and consumers isn't impacted by municipal noise by-laws that may unintentionally be impeding such deliveries when they are most urgently needed."

Ontario – Office of the Premier

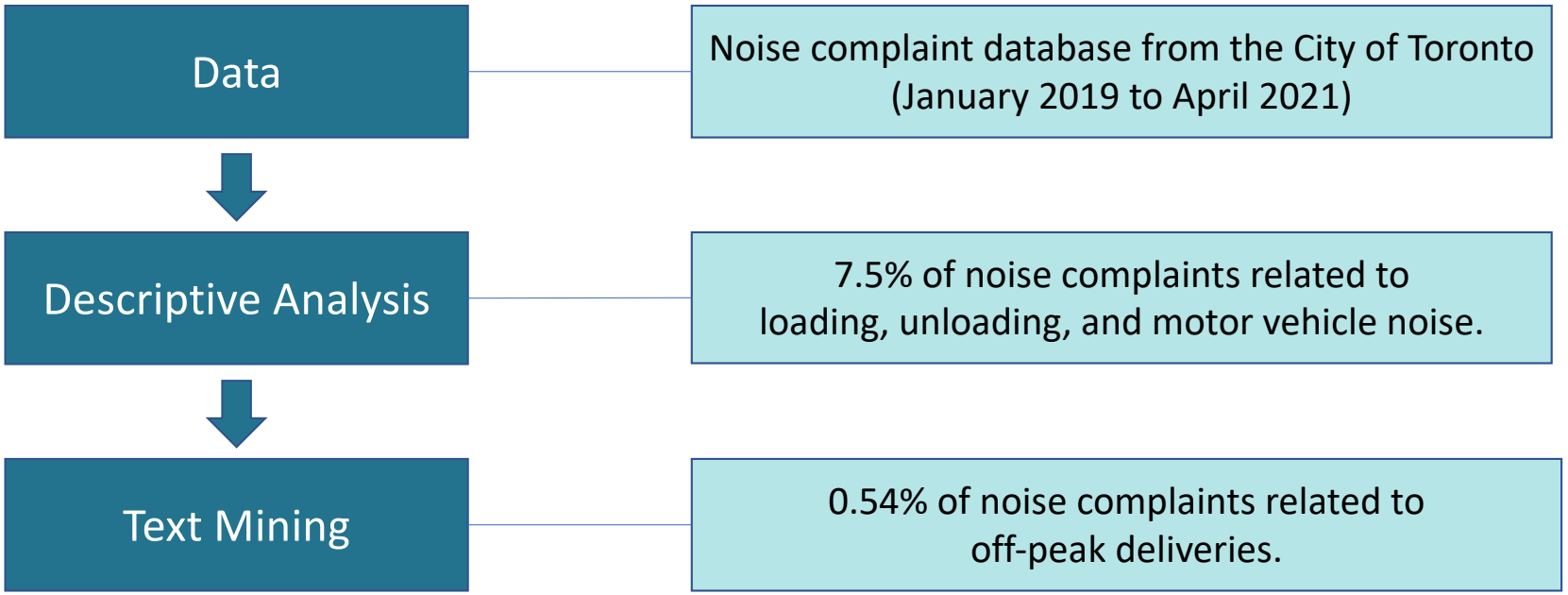
Followed with the Mainstreets Recovery Act 2020 – November 30, 2020 – Essentially making these OPD permanent

Natural Experiment

Assess off-peak deliveries at a regional scale

- Analysis of noise complaints
- Community noise survey
- Truck collision analysis
- Truck GPS Analysis for 3 major firms
- Transportation planning model of OPD and emissions

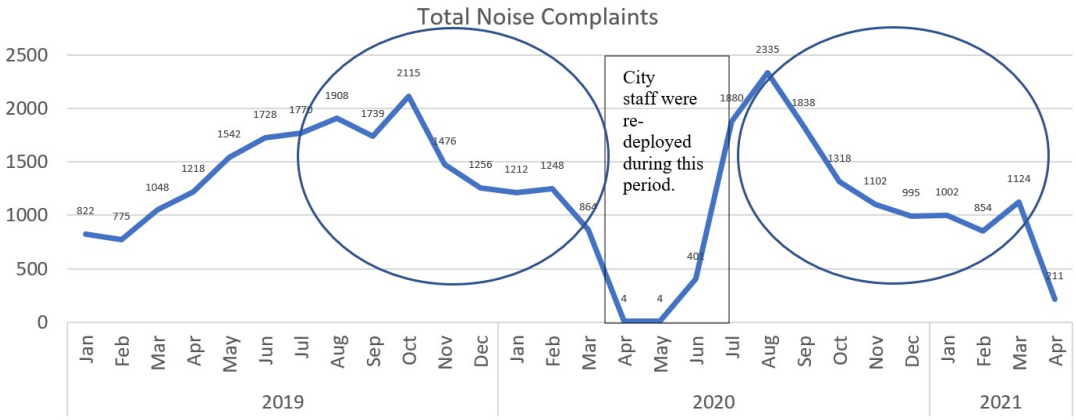
Analysis of the City of Toronto noise complaints



Total noise complaints

(City of Toronto)

In the August to March period after the pandemic began, no major change in total noise complaint frequency was evident.



OPD noise complaints

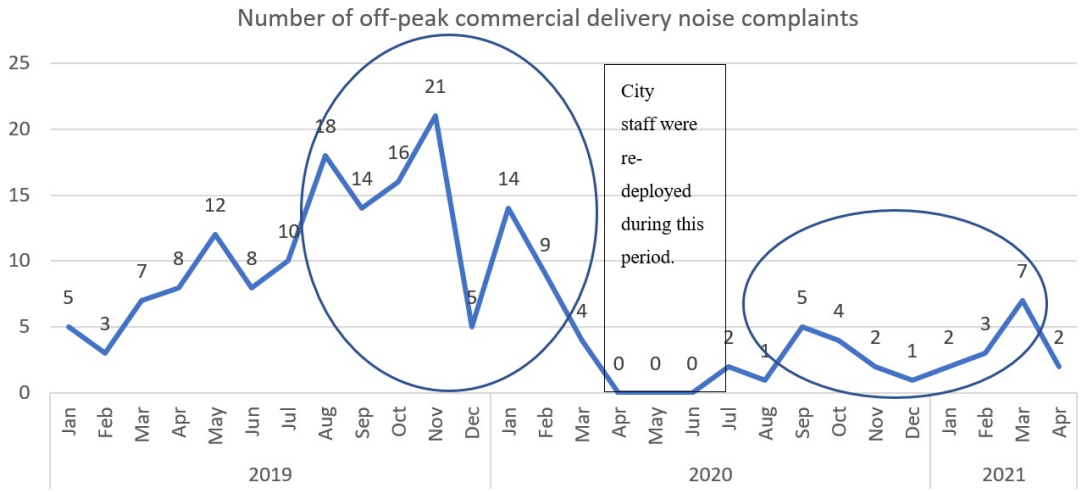
(City of Toronto)

Pre-pandemic

101 complaints

During pandemic

25 complaints



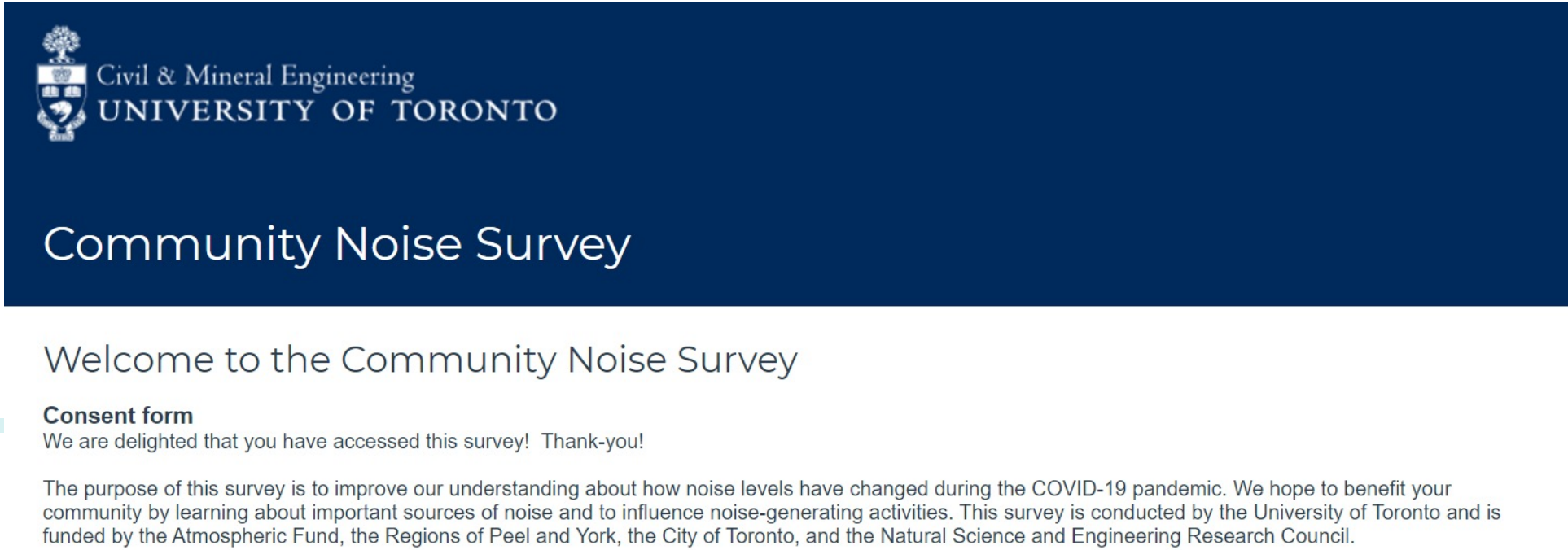
Preliminary conclusions

- OPD are a small but non-negligible portion of the noise experienced in Toronto.
- No evidence that noise by-law relaxation on March 19, 2020 has exacerbated residents' perceptions of noise from commercial deliveries.
- But:
  - Less frequent deliveries to many stores during the pandemic.
  - Complaints are an imperfect indication of the impact of noise on residents. BARRIERS TO REGISTERING A COMPLAINT.

Community Noise Survey

Community Noise Survey

- An anonymous online questionnaire with 16 questions that take approximately 10 minutes to answer.

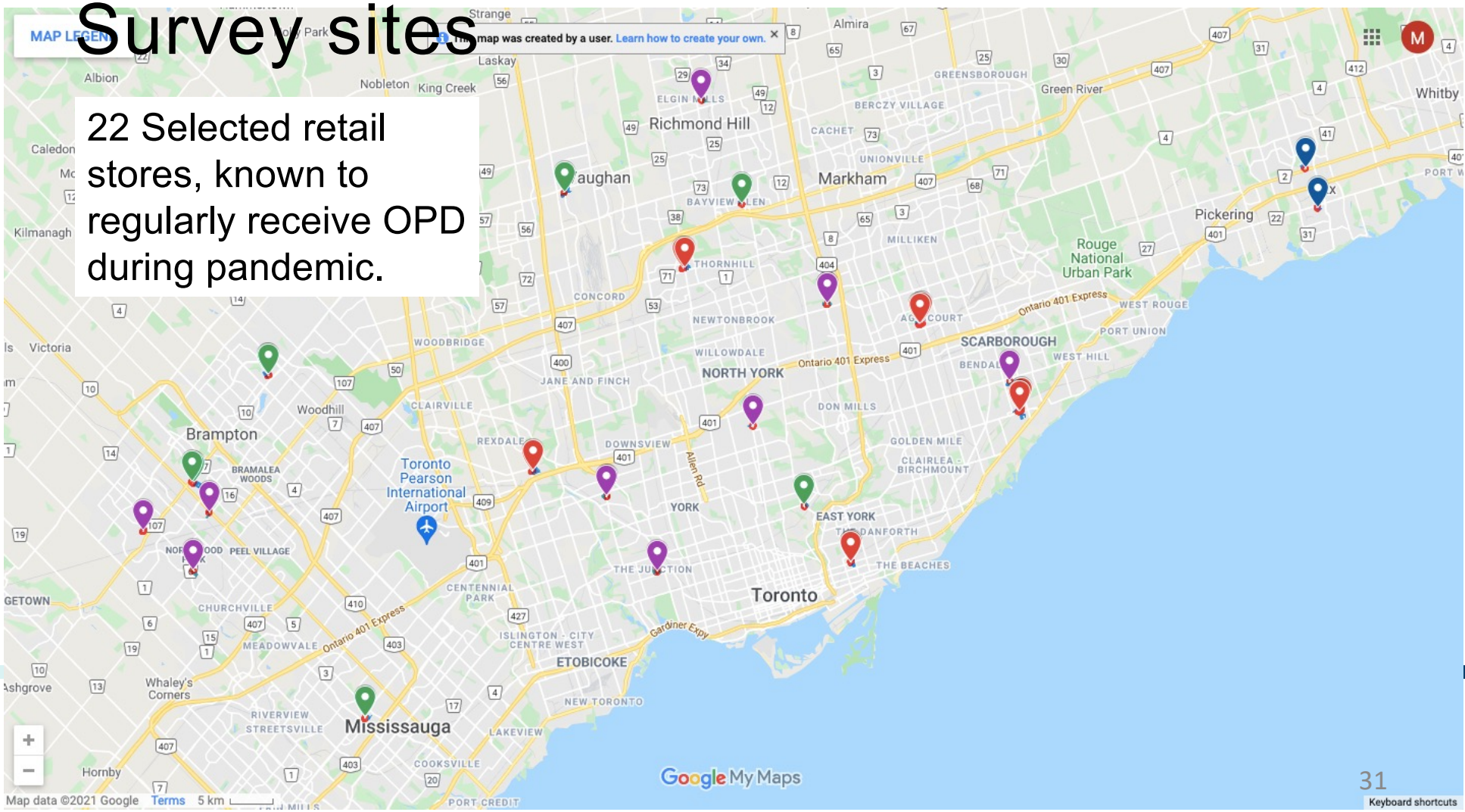


Online questionnaire

- Noise related questions: where, when, and what source?
- Demographic information

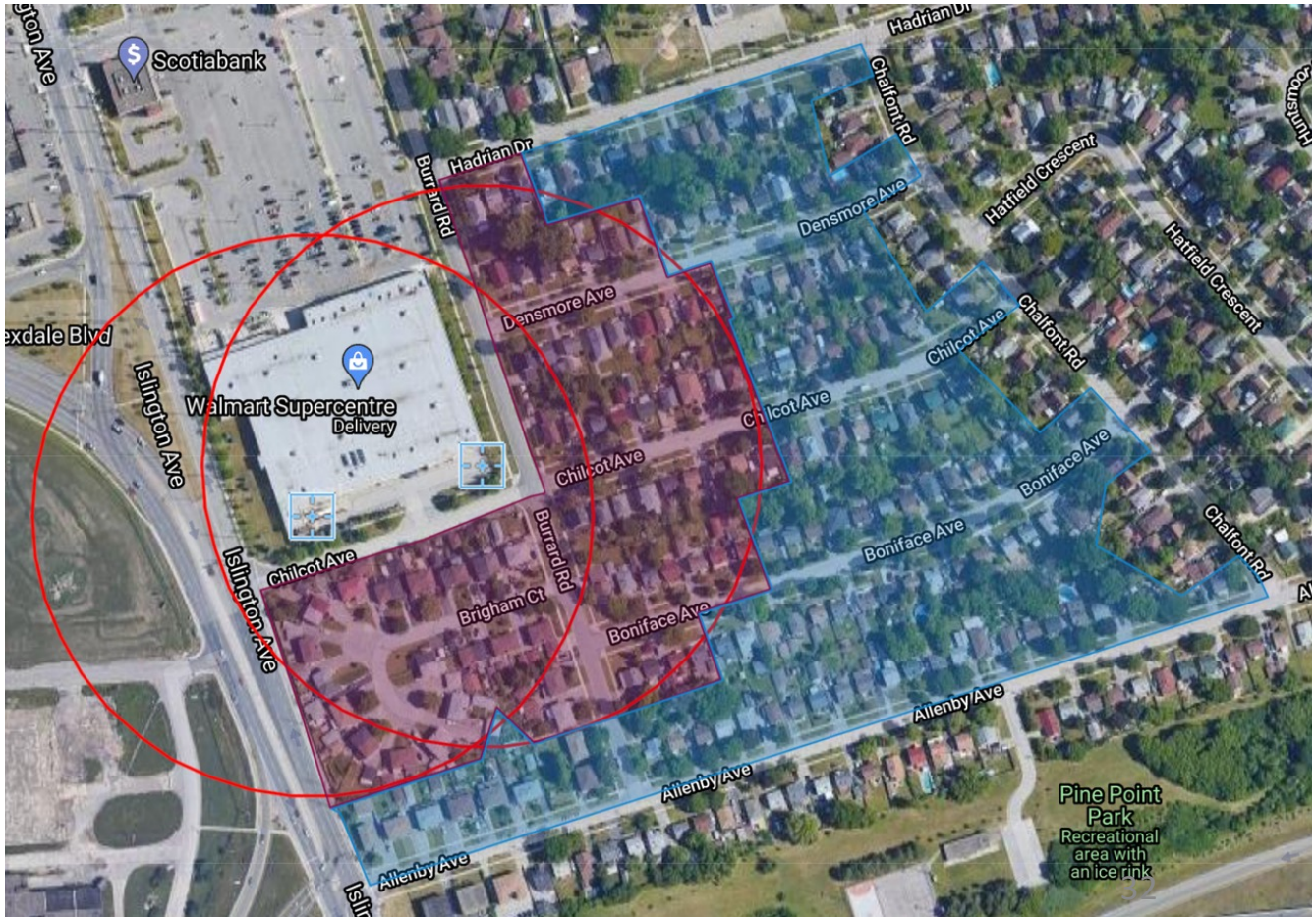
Survey sites

22 Selected retail stores, known to regularly receive OPD during pandemic.



Surveyed households

- Red: 150m radius circles centred on loading docks
- Red: ‘experimental’ households within 150m
- Blue: ‘control’ group, outside 150m
- Beyond 150m, noise is reduced by 40dB.

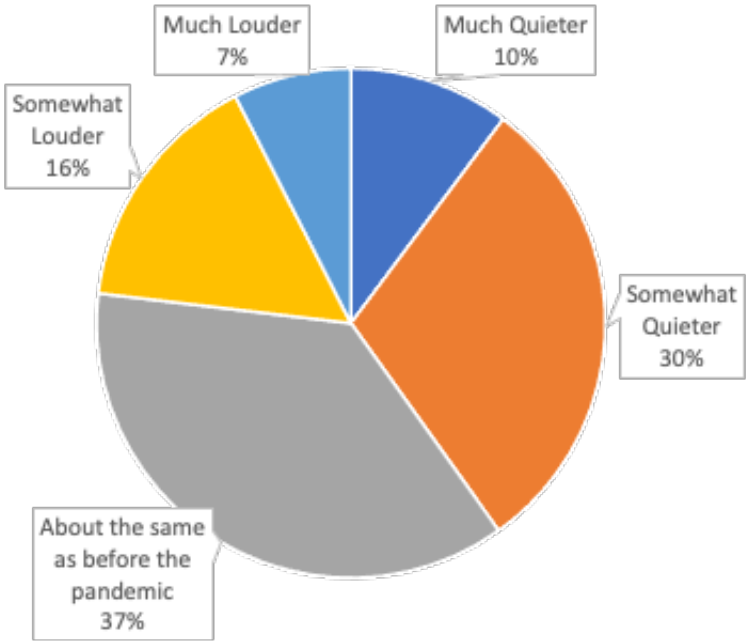


Survey outcomes

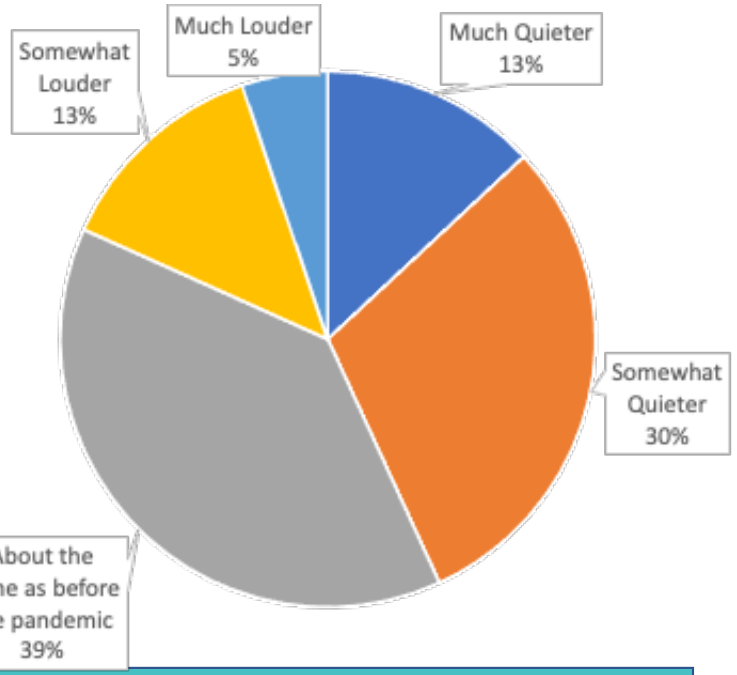
- 327 responses out of 3346 postcards distributed
- 48% within 150m,
- 52% outside 150m

Response rate is 10%

“How has the noise level where you live changed since the March 2020 pandemic lockdown began?”



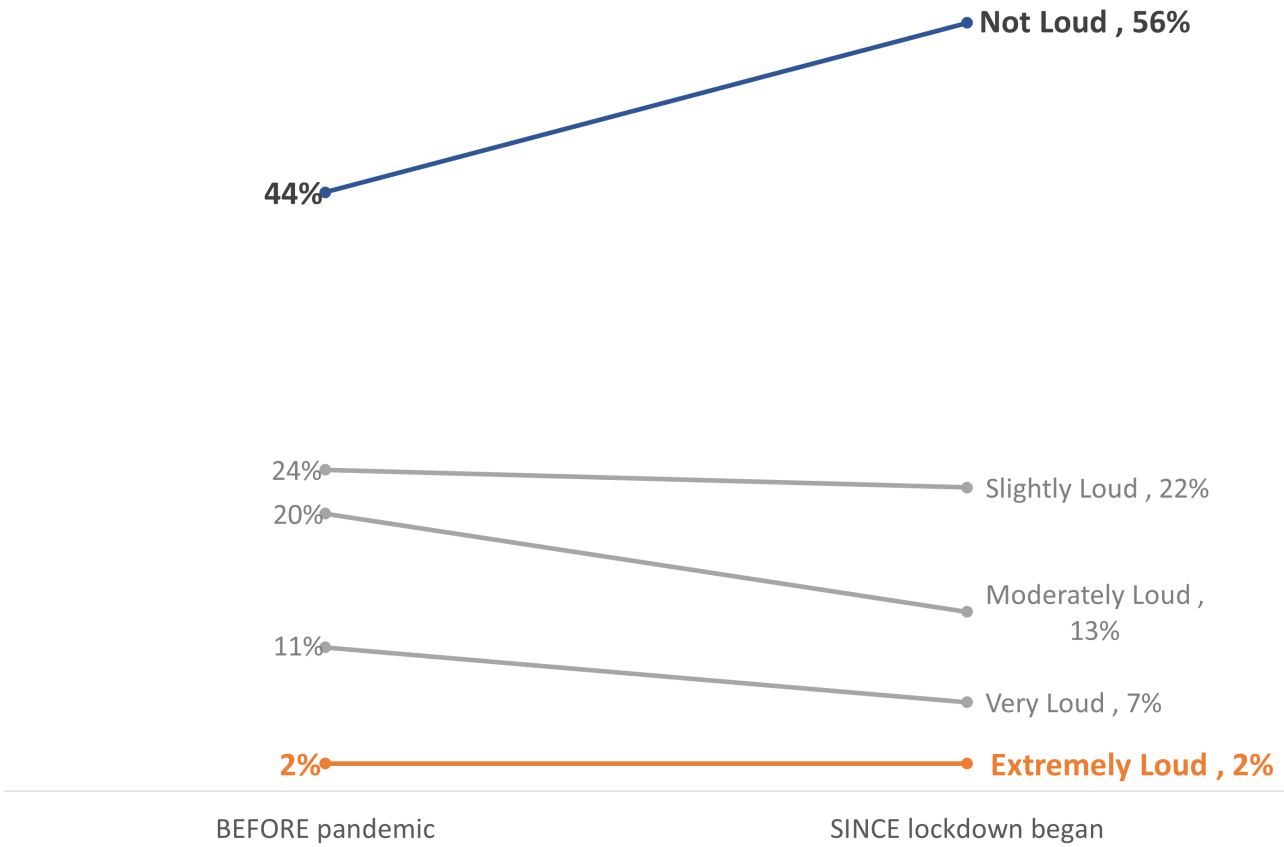
Responses within 150m of known site of OPD



Responses beyond 150m of known site of OPD

From inside your home, how would you rate the noise coming from nearby business establishments?

Percentage of responses in communities that are within 150m of known site of OPD.

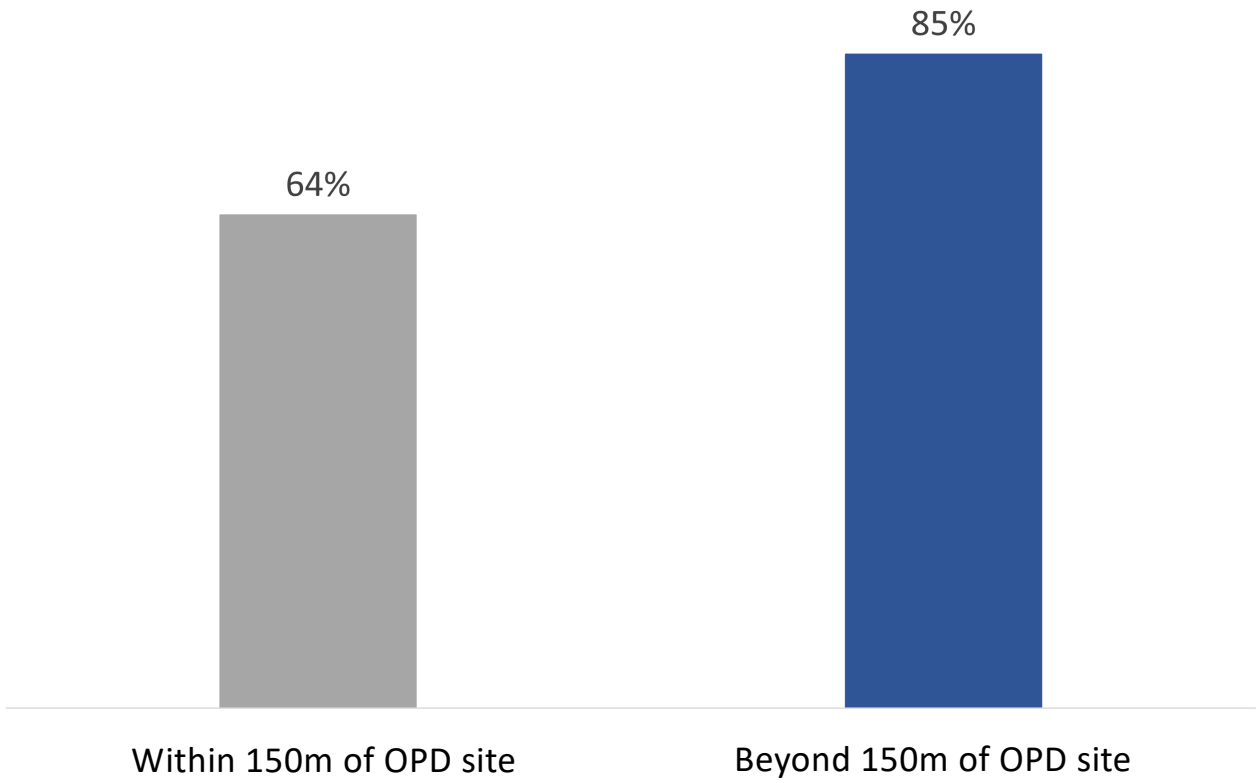


In the past year during the pandemic, how often did you hear these sounds from inside your home?

Within 150m of OPD		Beyond 150m from OPD
Ambulance, police, and fire trucks	Most Often Heard	Garbage pick-up, Street sweepers
Garbage pick-up, Street sweepers		Ambulance, police, and fire trucks
Road/highway traffic		Construction
Day-time truck deliveries to nearby businesses		Car horns and car alarms
Car horns and car alarms		Road/highway traffic
Construction		Loud music and party
Evening/night-time truck deliveries to nearby businesses		Day-time truck deliveries to nearby businesses
Loud music and party		Airport noise
Train / streetcar noise		Train / streetcar noise
Airport noise	Least Often Heard	Evening / night-time truck deliveries to nearby businesses

In the past year during the pandemic, how often did you hear evening / night-time truck deliveries to nearby businesses from inside your home?

Percentage of Never' and 'Rarely' responses in in two communities beyond and within 150m of known site of OPD.



Community Noise Survey conclusions

- Reduced noise during pandemic near off-peak delivery sites.
- Reduced noise from ‘nearby business establishments’ during the pandemic, despite off-peak deliveries
- Most people ‘never’ or ‘rarely’ hear evening/nighttime deliveries to the nearby businesses.
- But some do, so not entirely problem free!
- No clear evidence that OPD are problematic for most people living in neighbouring communities.

Thank you!
Questions?