



# THE ROAD TO EFFICIENCY

Rethinking Traffic Flow in Toronto

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## Objective

Reducing traffic congestion in  
Toronto

02

## Data & Limitations

Data visualization and  
limitations with the data

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## Data-Driven Solutions:

Actionable recommendations  
based on findings

# Introduction

- Toronto was ranked 25th in the Highest Traffic Delay Times By City, Globally (INRIX, 2024)

Why care?

- Improve safety
- Create better traffic flow
- Creating a healthier, and more efficient environment for everyone

We can do this through solving the problem of  
CONGESTION!

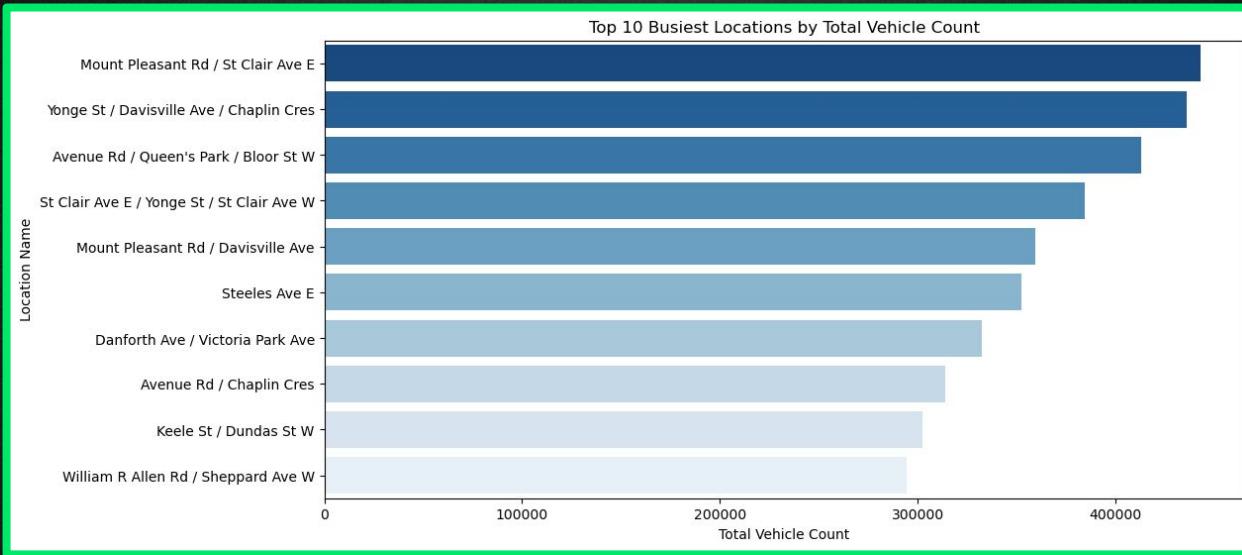


# LIMITATIONS

- **Inconsistent Data Dates:** Data collected on non-continuous dates, missing some days (e.g., Mondays), affecting weekly traffic analysis.
- **Lack of Real-Time Variability:** Data doesn't capture fluctuations from weather, road closures, or events impacting traffic flow.
- **Seasonal Bias:** Data from January may not reflect patterns during warmer months or peak tourist seasons.

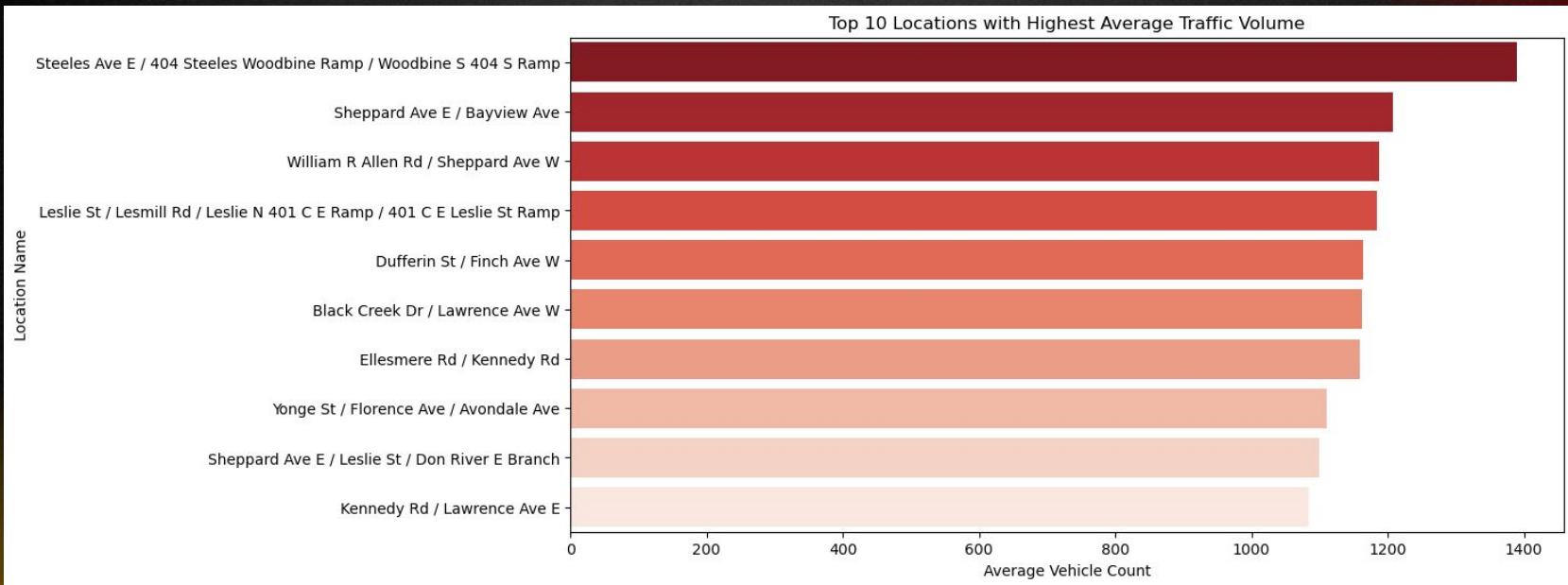


# BUSIEST LOCATIONS



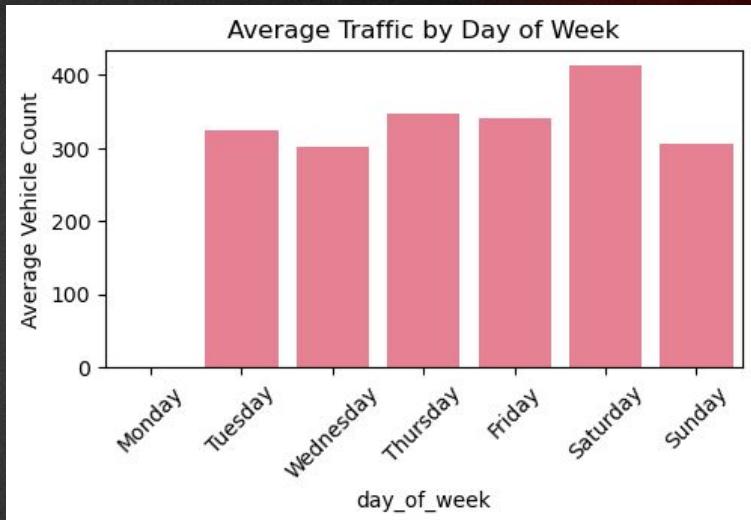
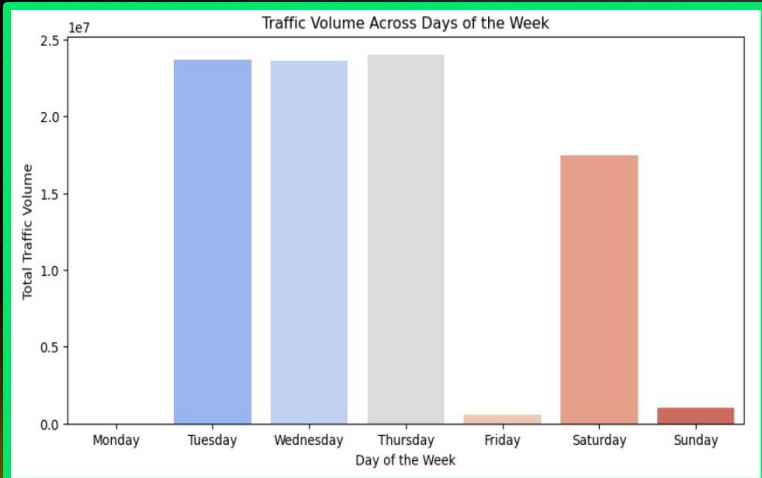
- Major intersections like **Mount Pleasant Rd, Yonge St, and Avenue Rd** experience the highest total vehicle counts, reaching up to **443,065 vehicles**.

# HIGHEST AVERAGE TRAFFIC VOLUME



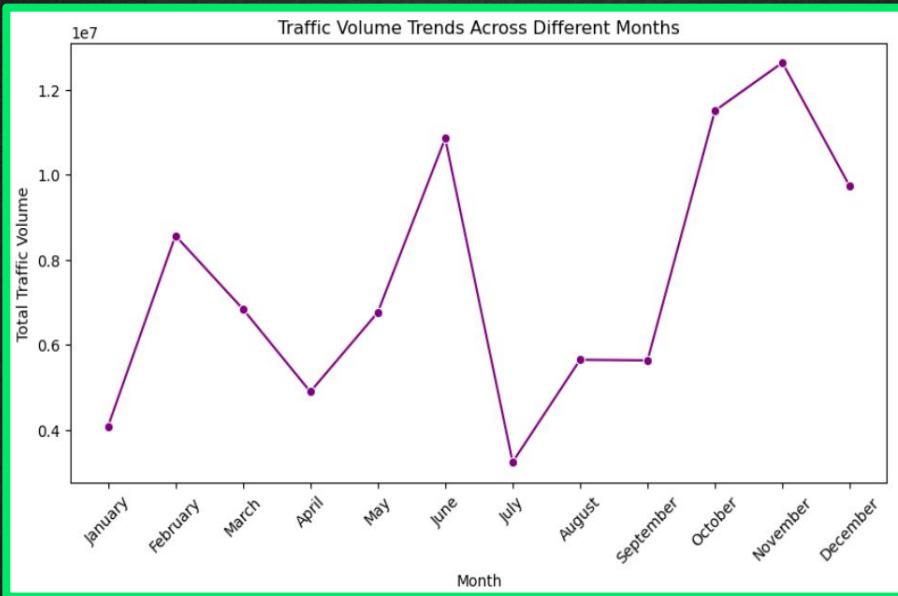
- The busiest roads include **Steeles Ave E**, **Sheppard Ave E**, and **William R Allen Rd**, with daily averages exceeding **1,389 vehicles**.

# TRAFFIC VOLUME ACROSS DAYS OF THE WEEK



- The analysis shows that traffic is highest on Saturdays (414 vehicles) and lowest on Tuesdays (324 vehicles). This suggests that weekends see more activity, possibly due to recreational travel or shopping. The relatively lower traffic on Tuesdays could indicate a mid-week dip in movement.

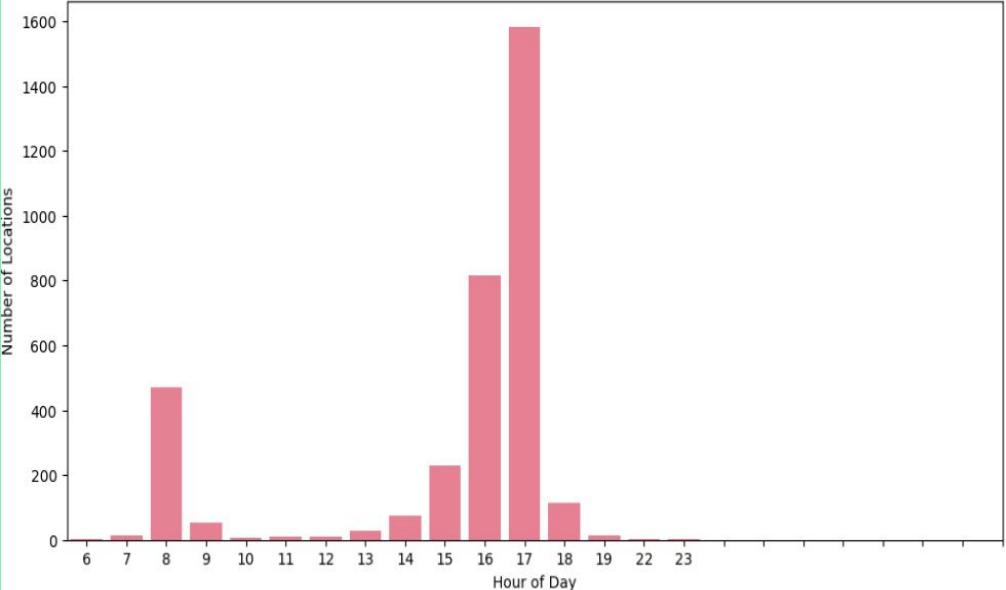
# MONTHLY TRAFFIC TRENDS



- Highest Traffic: November
- Lowest Traffic: January & February (start of year)
- Higher traffic later in the year

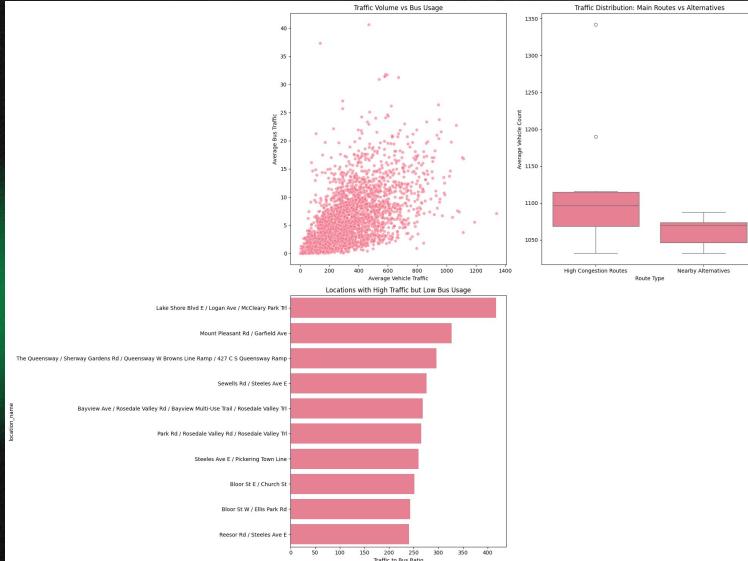
# TRAFFIC VOLUME ANALYSIS

Distribution of Peak Traffic Hours Across All Locations



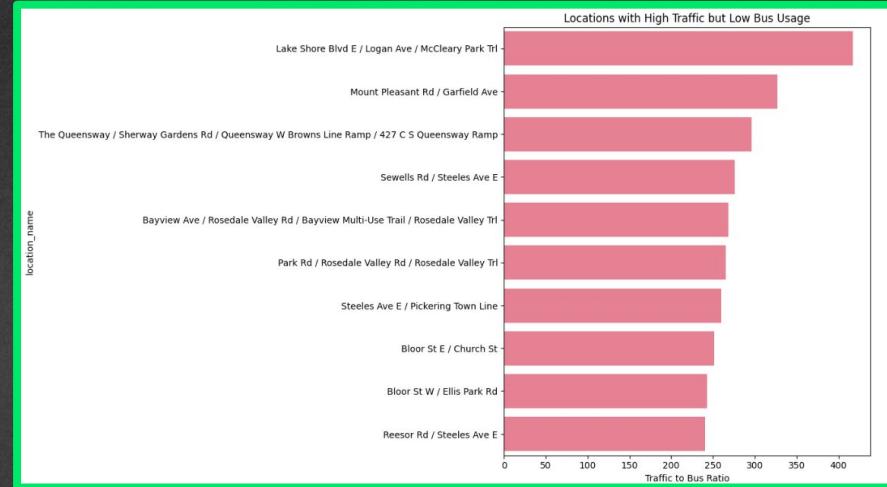
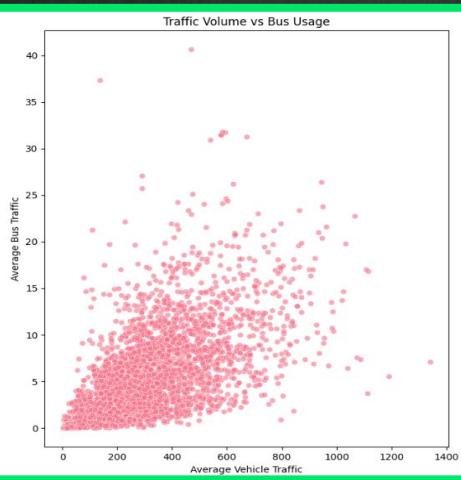
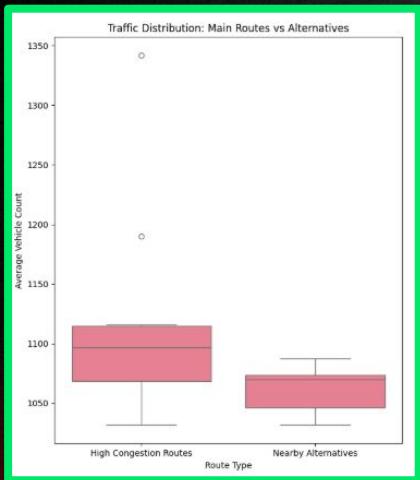
- Peak Hours:
  - Morning Rush Hour (7-9am)
  - Evening Rush Hour (4-6pm)
- Peak times by Location:
  - Bathurst St / Saranac Blvd → 07:00 AM
  - Leslie St / Lesmill Rd / 401 C E Ramp → 08:00 AM
  - Sheppard Ave E / Bayview Ave → 4:00 PM
  - Steeles Ave E / Woodbine Ramp → 5:00 PM
- 73.5% locations peak during evening rush hours
- 15.7% locations peak during morning rush hours

# ALTERNATIVE ROUTES & TRAFFIC REDISTRIBUTION



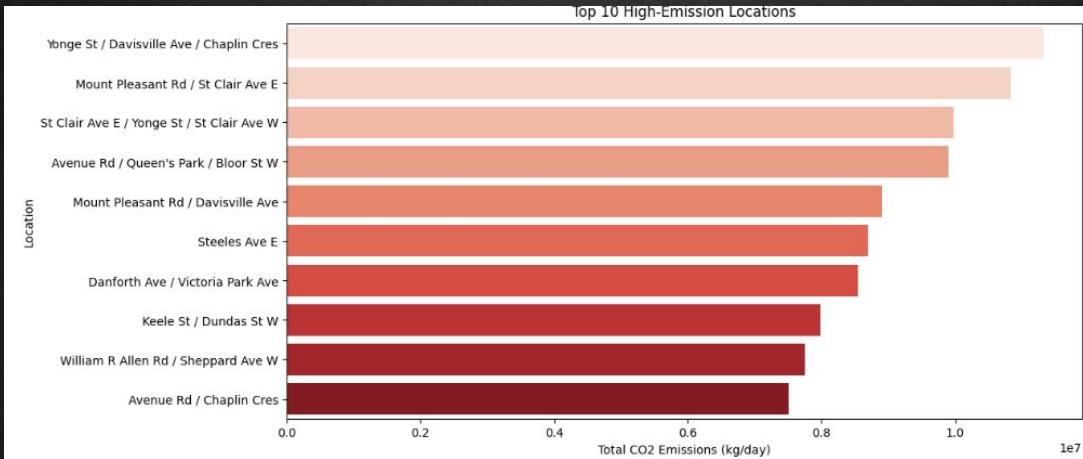
- Major congestion hotspots rely heavily on private vehicles.
- Some alternative routes have significantly lower traffic volumes but remain underutilized.
- Example: Steeles Ave E / Woodbine Ramp (1342 vehicles, 7 buses) vs. Victoria Park Ave / Gordon Baker Rd (59-150 vehicles, similar bus volume).
- **Improving signage and awareness for lesser-used roads would help divert excess traffic.**

# BUS USAGE ANALYSIS



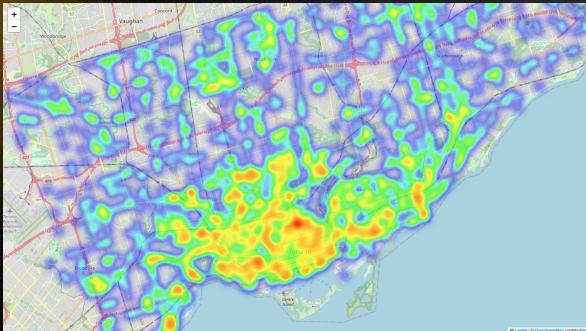
- Most congested location: Steeles Ave E / 404 Steeles Woodbine Ramp
  - a. Avg. traffic volume: 1,342 vehicles
  - b. Bus volume: Only 7 buses → High reliance on private vehicles
- Congested locations = Low bus usage → Need for better transit planning
- We recommend **implementing dedicated bus lanes, optimizing transit schedules, and using smart traffic signals** to improve overall efficiency.

# ENVIRONMENTAL ANALYSIS



- Target High-Emission Locations for Interventions:
  - Implement bus priority lanes to boost public transit.
  - Improve traffic signal timing to reduce congestion-related emissions.
- Bus Expansion Alone is Insufficient:
  - Additional policies needed: Congestion pricing, carpool incentives, bike lanes.
  - Consider electric buses to reduce transit emissions further
- Address Peak-Hour Congestion Separately:
  - Analyze time-based emission patterns for targeted interventions

# HEAT MAPS BASED ON FREQUENCY

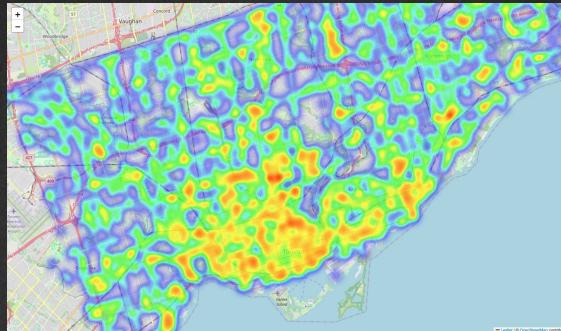


## Total Bikes

- Less bike use further from downtown area
- Higher bike use in downtown area

## Overall Correlation:

- Relationship between total vehicles and total pedestrians are very similar
- Pedestrians and cyclists could be causing delays in traffic signals from the switching of signals more often



## Total Vehicles

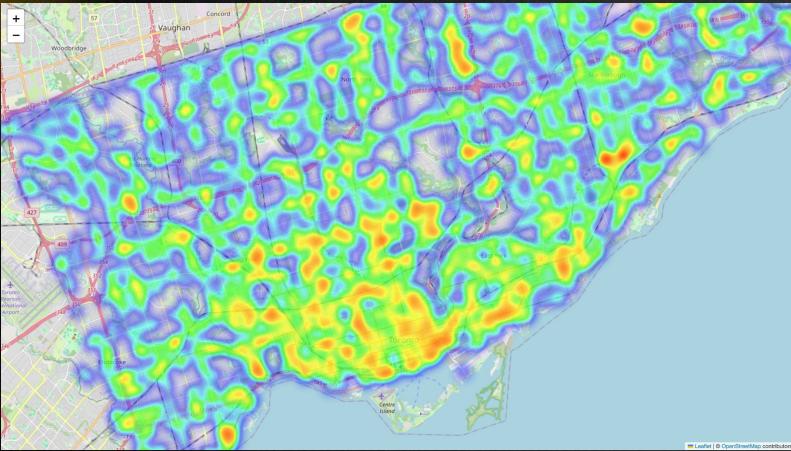
- Higher traffic around downtown area and university of Toronto area



## Total Pedestrians

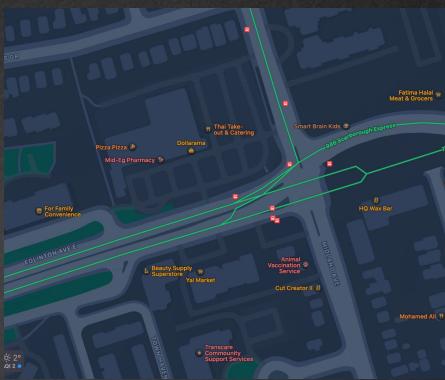
- More pedestrians than cyclists further out
- More pedestrians downtown area

# HEAT MAPS BASED ON FREQUENCY



## Total Bus

- High frequency around downtown area and university of Toronto area, as well as Union Station
- Significant red at intersection: Bloor street west & queen's park/avenue road "Culture Corridor"



## Investigating a key point

- Several bus stops in this area
- Solution: Implement dedicated bus lanes or a Bus Rapid Transit (BRT) system
- express bus routes continuing from the 986 Scarborough express
- Separate bike line instead of combined

# RECOMMENDATIONS

01

## AI-Powered Traffic Retiming

- Optimize signal timings to prioritize high-traffic directions during peak hours.
- Implement AI-based adaptive traffic control systems to adjust signal timing in real time based on traffic density.

02

## Turn Lanes

- Introduce additional turning lanes at high-traffic intersections to prevent congestion from through-traffic.

03

## Bus Lanes

- Improve public transit efficiency by adding dedicated lanes in high-traffic areas (e.g., Steeles Ave E, Sheppard Ave E).

# RECOMMENDATIONS

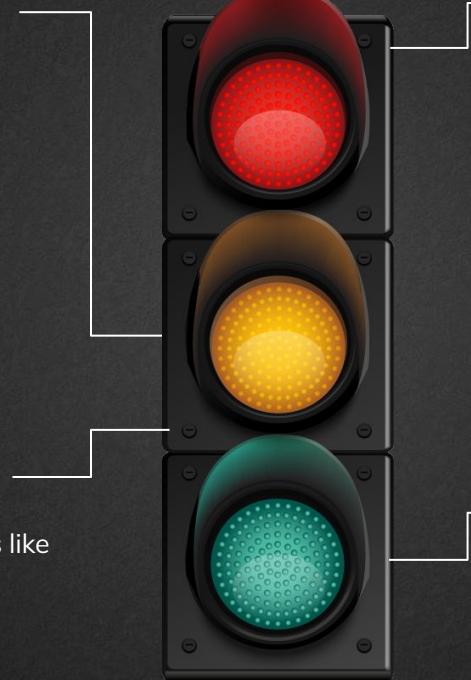
## Bike Lanes

- Introduce protected bike lanes on high-traffic streets to encourage alternative commuting methods.



## Reduced Fares

- Promote transit use through incentives like reduced fares and commuter benefits.
- Implement summer discounts.



## Park & Ride

- Create transit hubs where commuters can park vehicles and switch to public transit.



## Roundabouts

- A way to reduce traffic congestion from constant stopping from traffic lights (reducing vehicle emissions)

THANK YOU!