Applying Big Data to Small Projects
A Toronto Model

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Toronto's Topline Planning Goals and Challenges

Goals

- Create vibrant neighborhoods that are part of complete communities
- Create mix-use neighbourhoods around future transit infrastructure supported by active and shared mobility networks
- Build multimodal transportation network and infrastructure needs assessments

Challenges

- High fraction of single occupant vehicle trips
- Poor understanding of areawide travel patterns
- High impact of ongoing transit construction activities
- Disconnected neighbourhoods and fragmented transportation network
- Short study timelines
- Lack of resources

Today, We'll Discuss Two Planning Studies that Used Big Data to Overcome Key Challenges

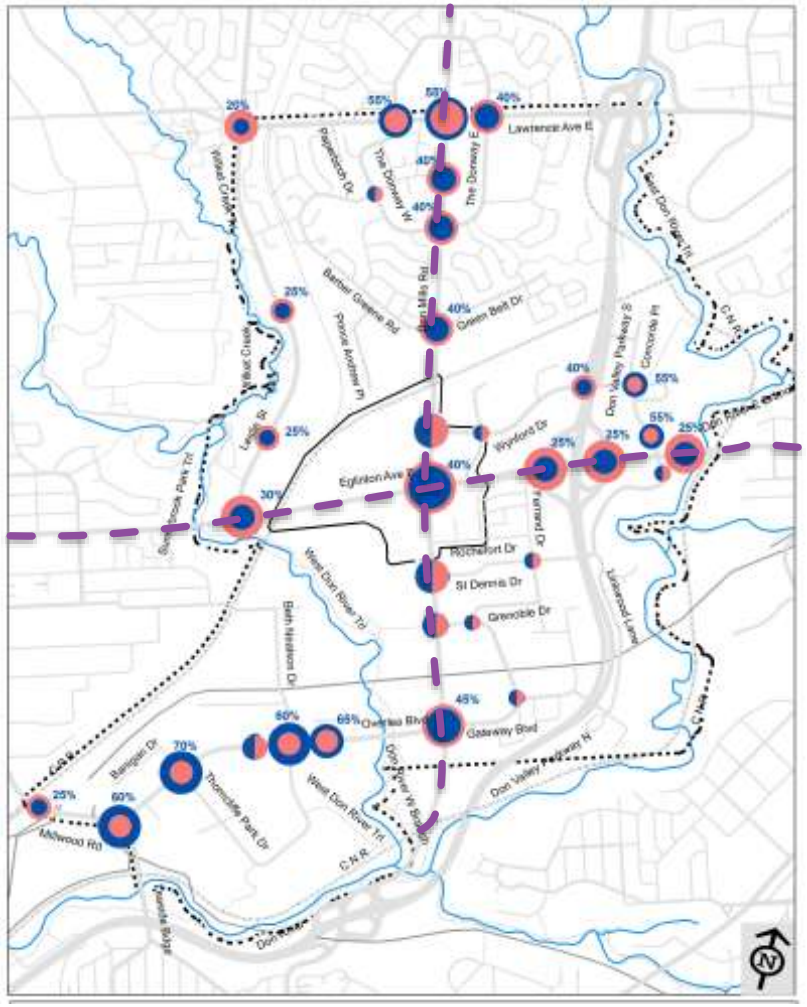
These study areas are "Gateway Mobility Hubs." They are key to bringing convenient, affordable multimodal transit options to the outskirts of Toronto – beyond the urban core.

Don Mills Crossing: Area Profile

The study is a Phase 1 review of existing policies, strategic plans, local area characteristics, land use dynamics, travel patterns and the transportation conditions for all modes of travel.

Study Goals:

- Shape and manage the anticipated growth as a result of the LRT construction (currently underway)
- Develop common and sustainable principles to address social inequality and guide the future transportation plan for all mobility users
- Develop comprehensive multimodal mobility assessment with creative design and incorporating smart technologies



Keele Finch Plus: Area Profile

This study is a Phase 1 report that uses a qualitative and quantitative method to understand why, when, and where people travel using the transportation modes available in the study area.

Study Goals:

- Address existing transportation issues in this residential and industrial zone
- Determine the future transportation framework for future and LRT intersecting node and find multimodal solutions
- Evaluate where multimodal infrastructure should be expanded and which modes to focus on

Decision Drivers: Why We Used Big Data and StreetLight Insight For These Studies

1. 1st Time – Our Trial Run to Test the Data Source

2. Lack of Areawide Data and Disrupted Local Network due to Construction

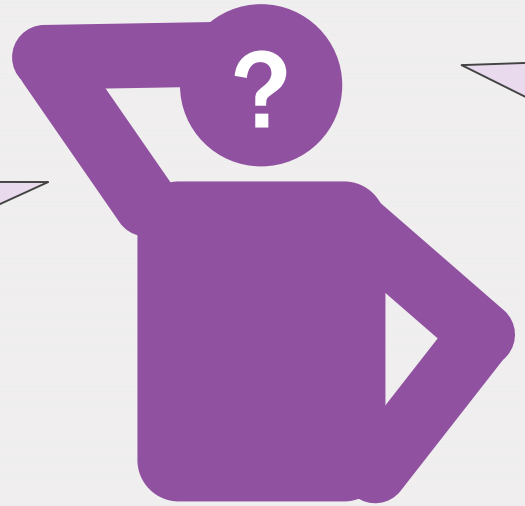
3. Potential to Understand "Hard-to-Study" Travel Patterns (i.e.: vehicle trip origins, passby trip percentages)

Understanding Vehicle Behavior is Key for Multimodal Planning

Where can vehicle trips be converted to other modes?

Are there opportunities for active transportation?

How will new mode choices change vehicle travel patterns?



How can shared mobility be integrated?

Deep-Dive: Putting Big Data to Work

Michael Bailey

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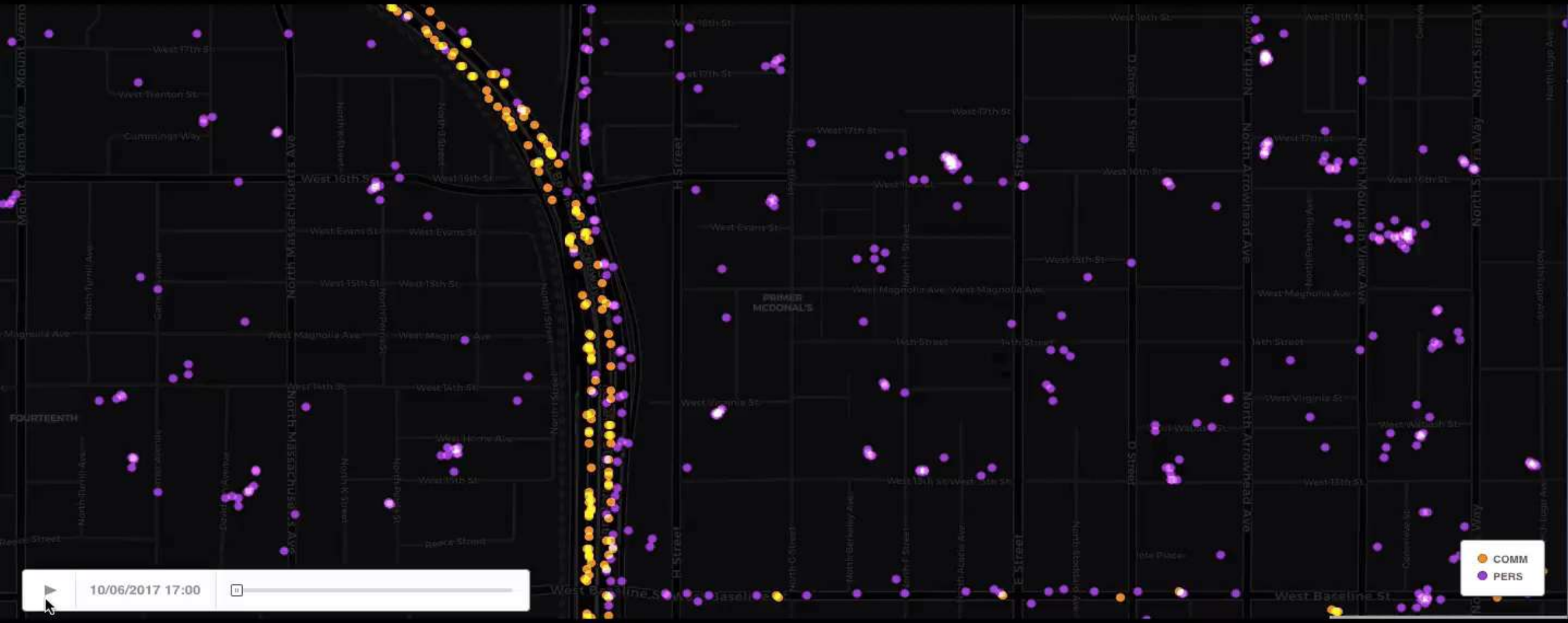
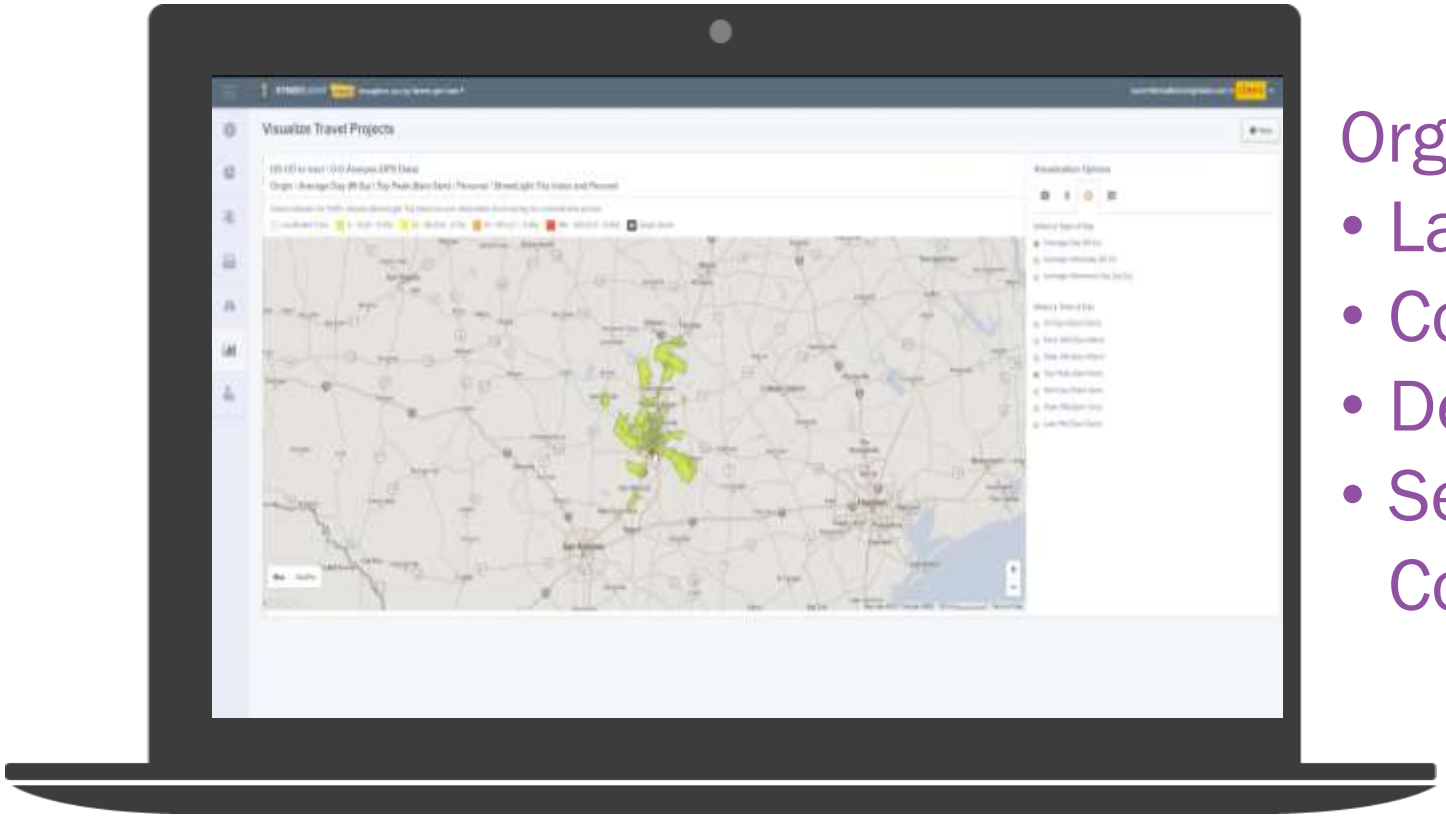
What Data are We Working With?

GPS data from Navigation and Fleet Management Systems and Video shows a subset of Oct 8, 2017 in San Bernardino



Actionable Analytics From Billions of Raw Data Points



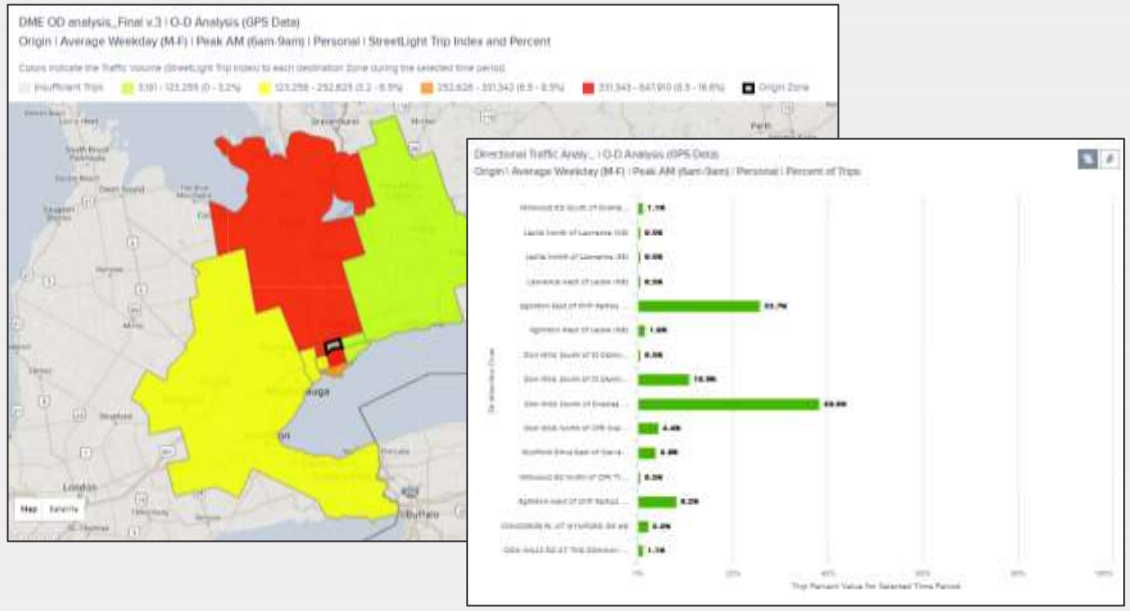
Organize – Synthesize - Contextualize

- Large Sample (Urban or Rural)
- Complete Origin to Destination
- Detailed Route Segment Analysis
- Segregated Personal and Commercial Data

StreetLight InSight®: The Only On-Demand Platform For Running Actionable Transportation Analytics

Data and Analytics Inform Decisions - Knowing What To Do With Information Is Critical

Iterate and Optimize



For Don Mills, Toronto planners ran 14 *StreetLight InSight* studies in just two weeks –that's much faster than it takes to run most traditional studies.

Calibrate to Counts

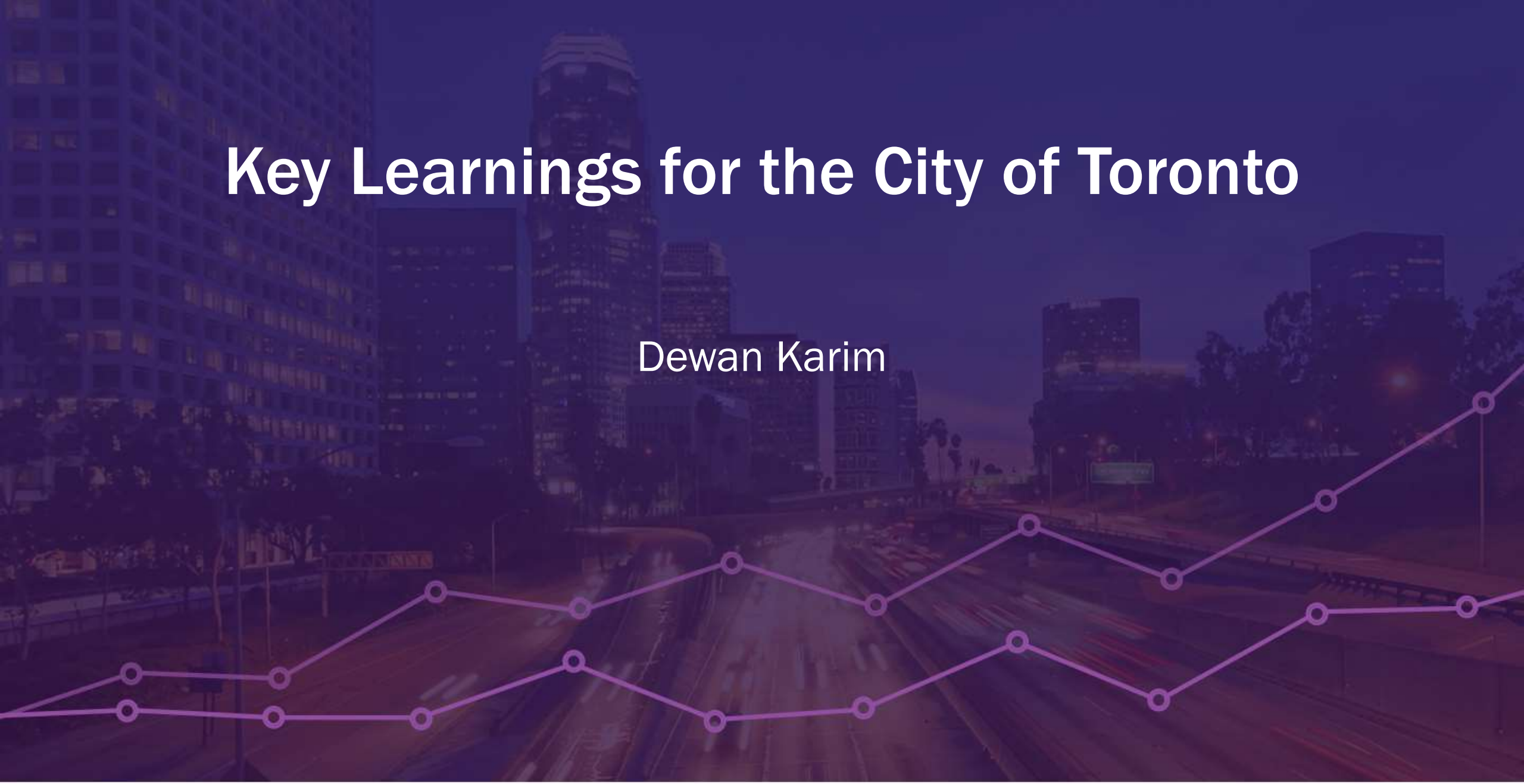
Toronto planners uploaded local sensor data into *StreetLight InSight* so that the platform automatically scaled index values Metrics to estimated counts.

The City of Toronto Used *StreetLight InSight* to Obtain Four Key Types of Information

1. Identify sources of personal and commercial vehicle trips to study area
2. Corridors specific O-D (and how it differed)
3. Measure travel times between key activity centers to the study area
4. Differentiate truck trip patterns from personal vehicles

Key Learnings for the City of Toronto

Dewan Karim



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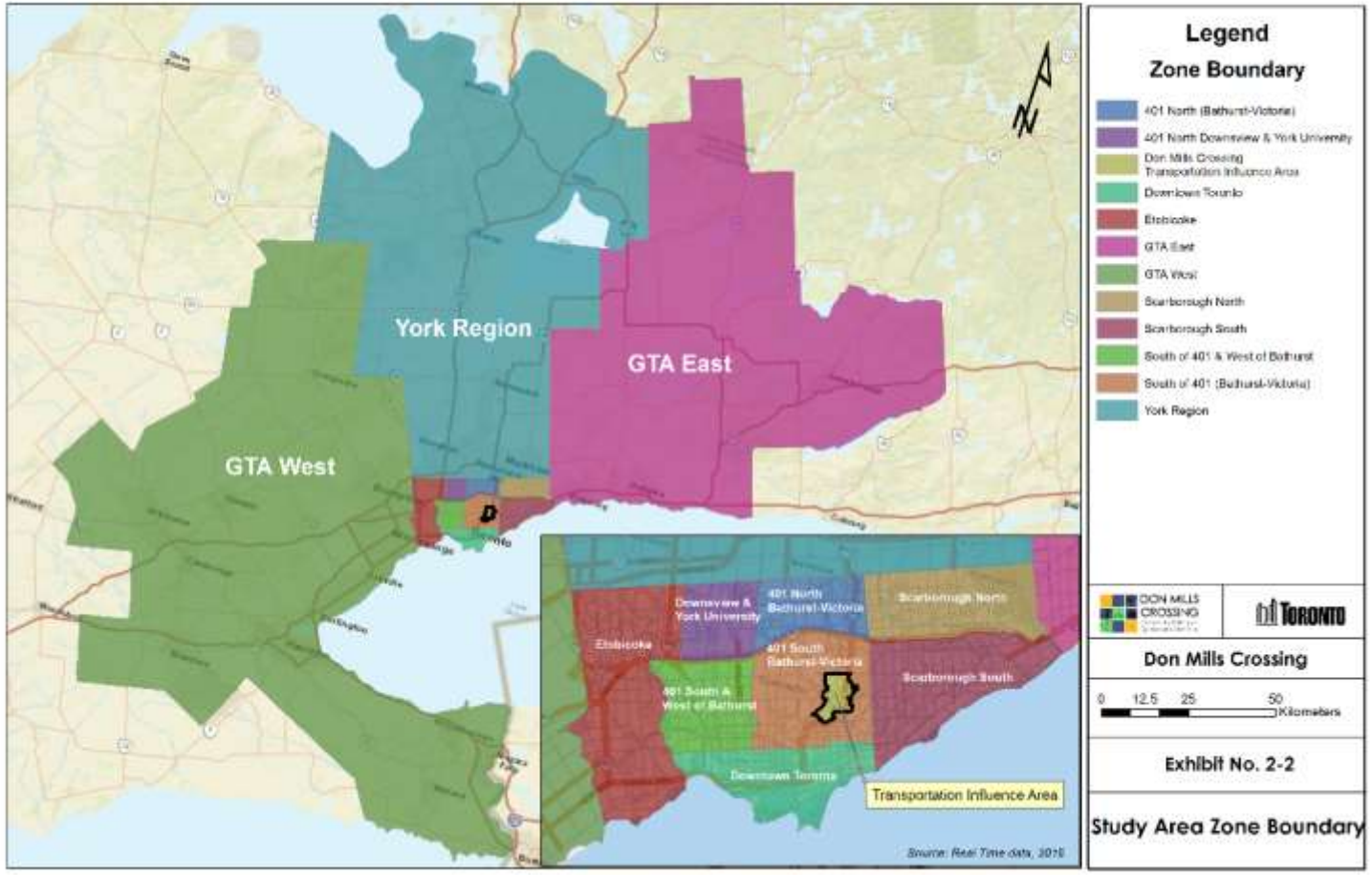
Study Area: Selecting Data

Data Configuration - Area Selection

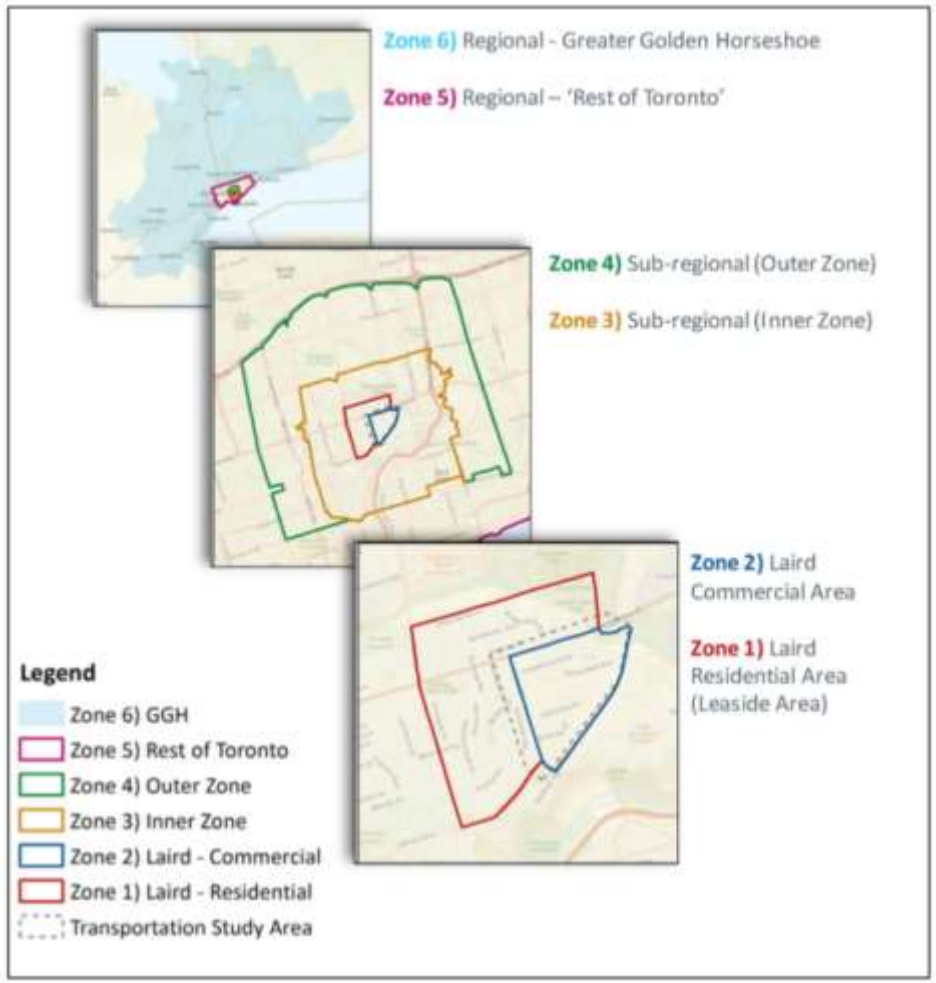


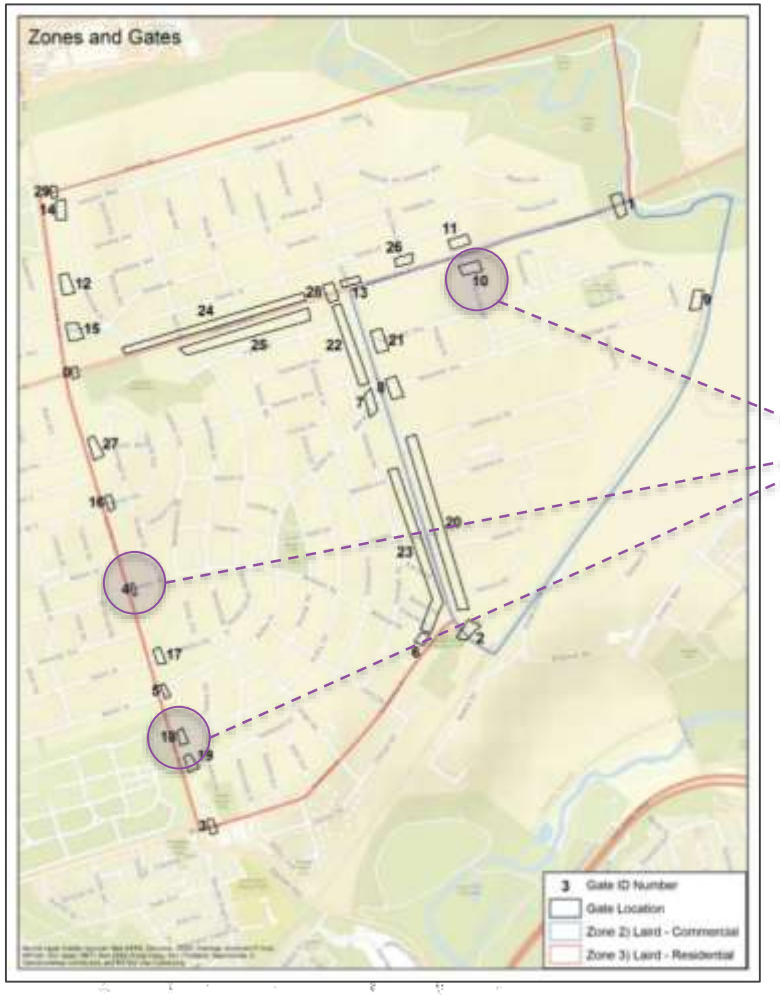
Selection of Area and Zones:

- Characteristics and proximity
- Nature of land use
- Matching local traffic zone boundary

Layering Sub Area: Data Selection and Boundaries

Data Configuration – Sub-Area Selection





- Regional influence
- Local neighbourhoods
- Immediate study area

Supplementary Pass-through Select Link or "middle filters" reveal network assignment

- Data calibration
- Trips distribution in fine detail
- Trip conversion

Data Contents

Data Configuration: Attributes and Temporal Distribution

1. Origin-Destination

Origin

Pass-by

Destination

2. Trip Attributes

Travel Time, Speed

Share of Trip Source (Int/Ext)

Trip Distribution in Network

Binned By:

Trip Type:
- Personal
- Commercial

Day Types:
- Average Day (Mon – Sun)
- Average Weekday (Mon – Fri)
- Average Weekend (Sat – Sun)

Day Parts:
- All Day (12 am – 12 am)
- Early AM (12 am – 6 am)
- Peak AM (6 am – 9 am)
- Mid-Day (9 am – 4 pm)
- Peak PM (4 pm – 7 pm)
- Late PM (7 pm – 12 am)

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Internal Trips: Complete Community & Mixed-Use Policies

Findings: Big Data and City Policies

Using Big Data

60% Internal Trips

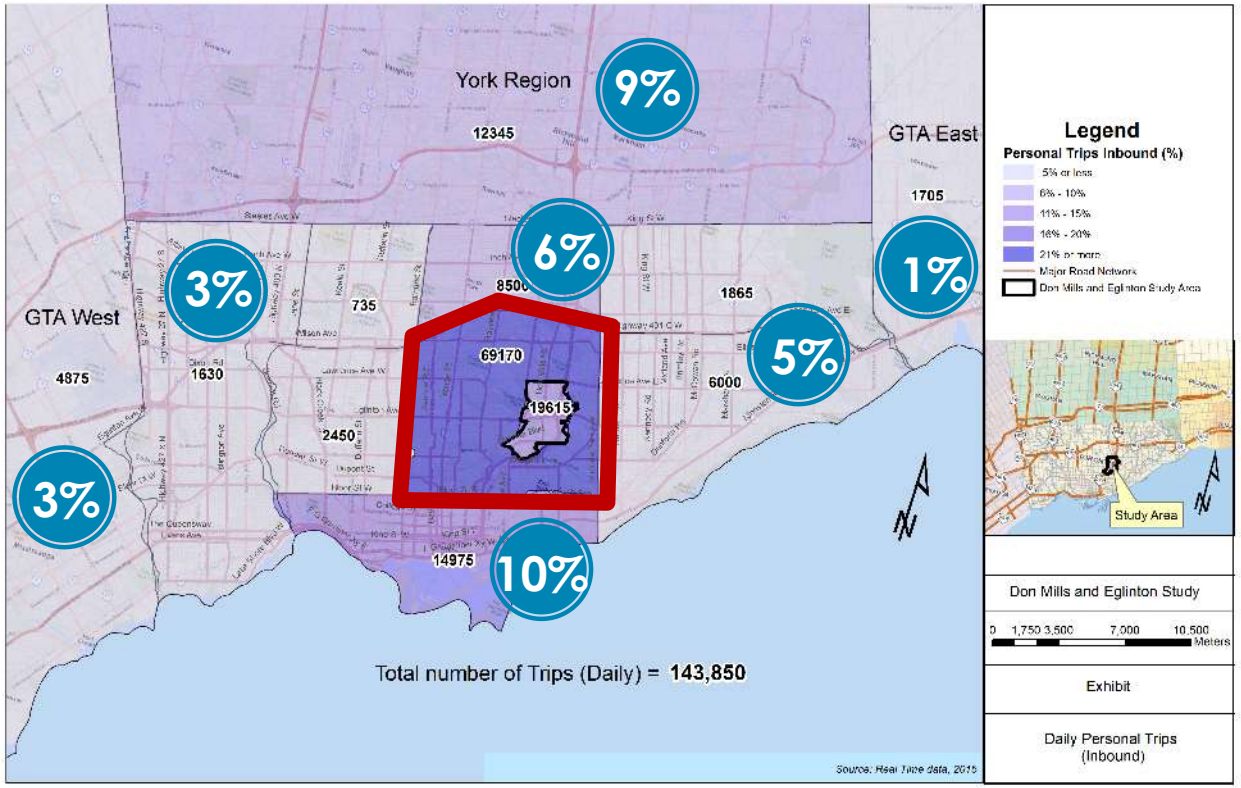
+

Using TTS Data

10% 5%

=

~75% Total Internal Trips



Higher Internal Trips are associated with:

- Higher population
- Higher income

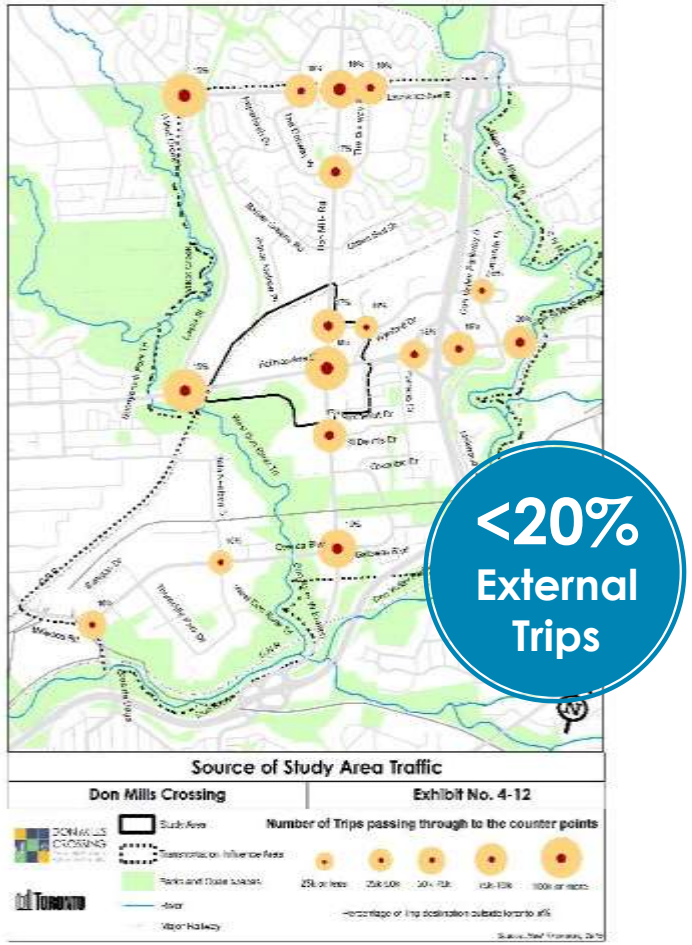
Short and Shared Mobility Trip Candidates:

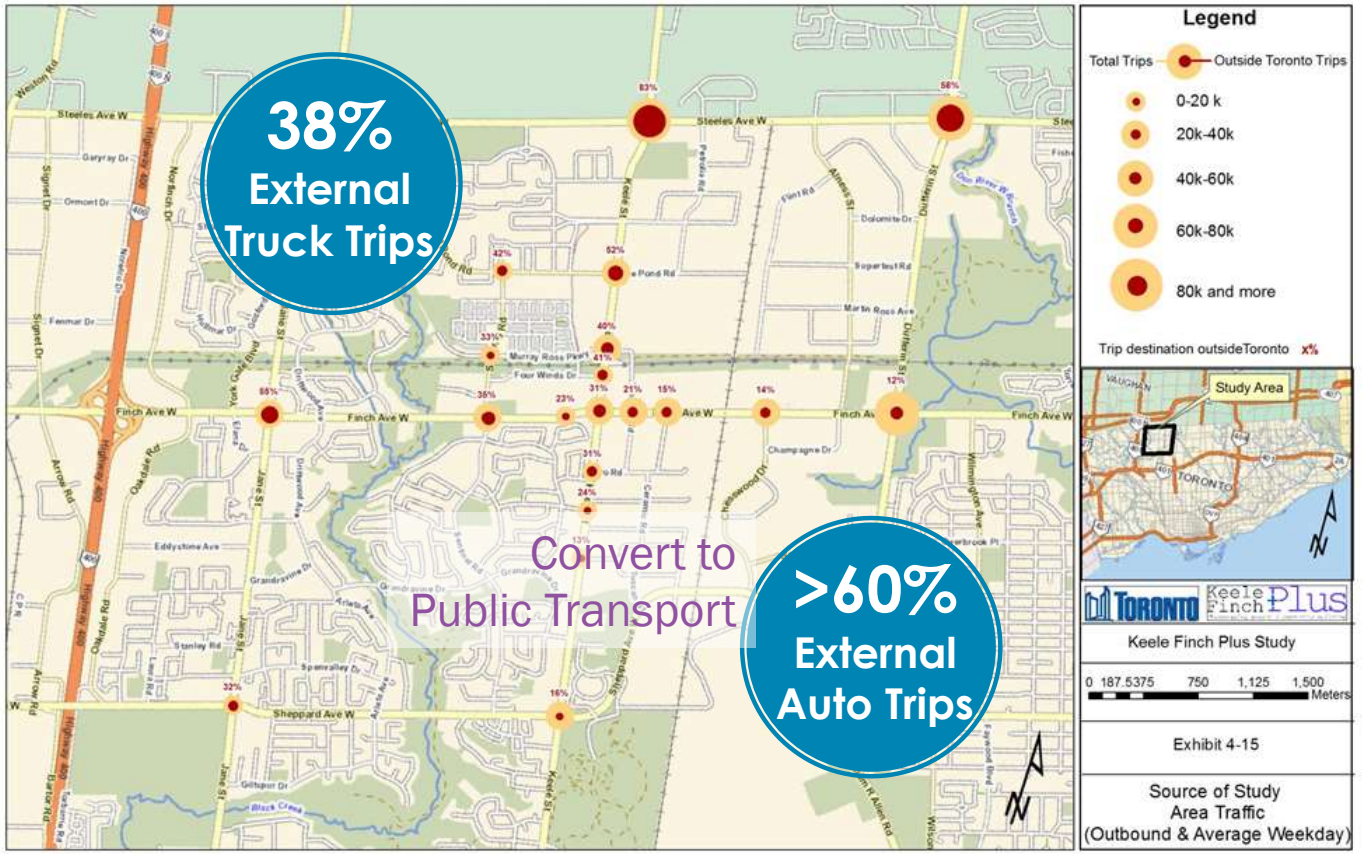
- Connectivity Index
- Walkshed
- Active Transportation
- Shared Mobility Modeling

Source: What's Driving Your County's Vehicles Miles Traveled? U.S. Streetlight Report, 2016. https://www.streetlightdata.com/whats-driving-your-countys-vehicles-miles-traveled

Multimodal Infrastructure Priority

Findings: Source of Traffic





Transit and Active Transportation produce maximum benefits to local community

Traffic Infiltration

Findings: Source of Traffic

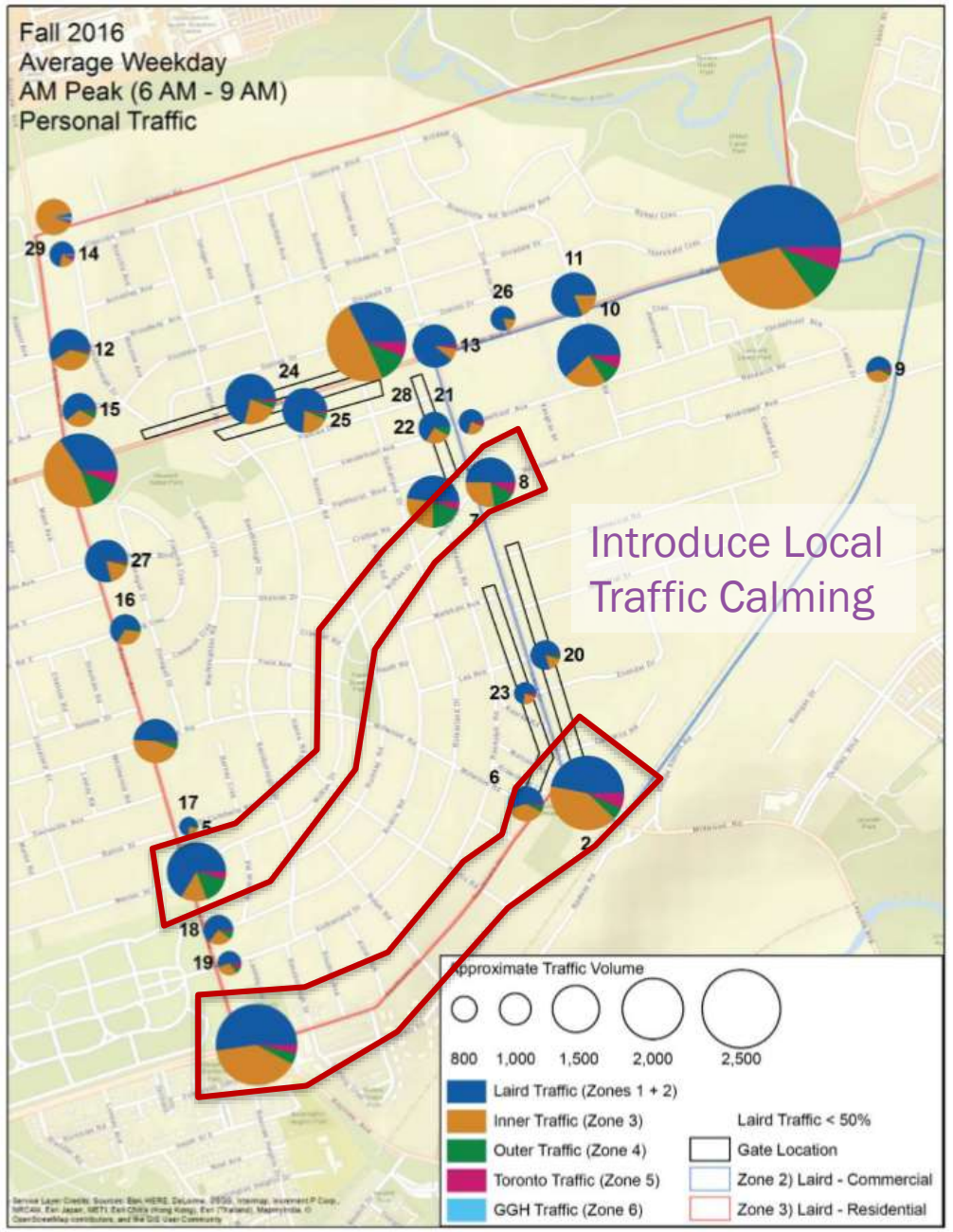
New Approach to "Traffic Infiltration"

- Typical approach is license plate tracing, but there is no information on origin, destination and streets being used
- Big Data clearly identifies actual source, path and scale of traffic infiltration

~75% Inner Zone Trips

~50% Local Trips

<25% Long-distance Pass-by Trips

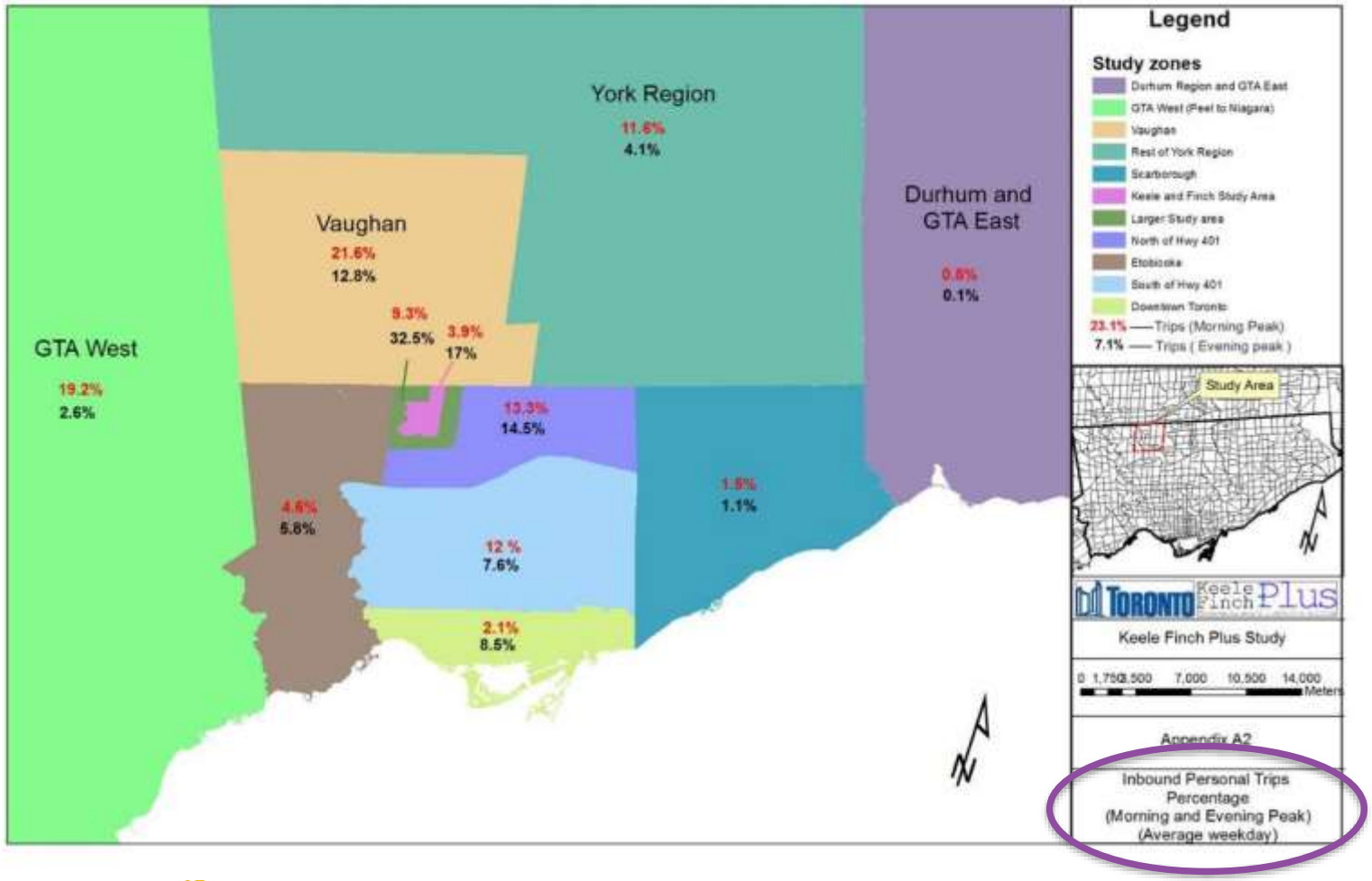


Origin-Destination of Trips: Travel Pattern and Changes

Findings: Drastically Different Travel Behaviour

Big Data helps to:

1. Avoid generalizing assumption of distribution of trips
2. Accurately project the trips to be converted to transit, specially after opening of Spadina subway
3. Enable quantitative analysis of short trip and associated infrastructures



Key Takeways: The Advantages of Using Big Data and an Integrated Analytics Platform

1. When we combined the Big Data with other data sources, we got the best results
2. The Big Data not only provided new insights, it helped make existing information more valuable
3. Big Data provided key findings that weren't available from other sources (vehicle trip origins, pass through trip percentages)
4. Big Data yielded a better understanding multimodal and trip-chain issues
5. Using Big Data for predictive analytics drastically reduced study time and expense

Thank You!

For more information on Multimodal Planning in the City of Toronto.

Pick up the one-pager at the back of the room

Or Go To

https://www.toronto.ca/city-government/planning-development/planning-studies-initiatives

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