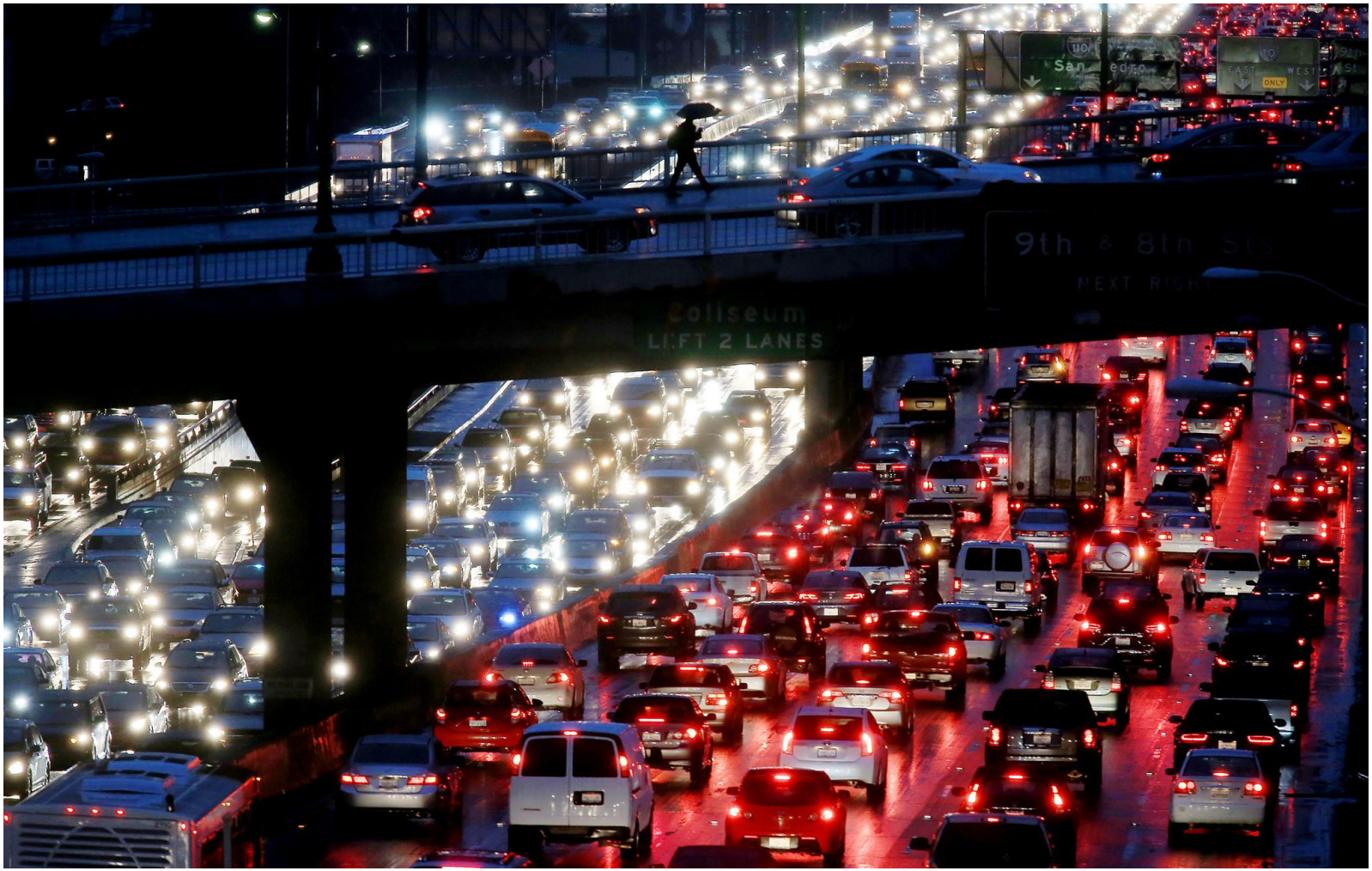
Importance of Data in Transportation Engineering

UNIVERSITY OF WATERLOO
FACULTY OF ENGINEERING

Highway 110 - Los Angeles, California



Source: LA Times

Highway 401 - Toronto, ON

Source: ShutterStock

North America INRIX Ranking

RANK	CITY	COUNTRY	PEAK HOURS SPENT IN CONGESTION	INRIX CONGESTION INDEX	AVERAGE CONGESTION RATE
1	Los Angeles; CA	USA	104	18.6	12.7%
2	New York; NY	USA	89	17.4	12.8%
3	San Francisco; CA	USA	83	14.4	12.8%
4	Atlanta; GA	USA	71	12.2	10.0%
5	Miami; FL	USA	65	11.8	8.7%
6	Washington; DC	USA	61	10.5	11.3%
7	Dallas; TX	USA	59	9.9	6.6%
8	Boston; MA	USA	58	10.2	13.4%
9	Chicago; IL	USA	57	10.1	10.2%
10	Seattle; WA	USA	55	9.6	12.6%
11	Montreal	Canada	52	9.7	14.0%
12	Houston; TX	USA	52	8.5	7.1%
13	Portland; OR	USA	47	7.7	10.4%
14	Austin; TX	USA	47	8.0	11.9%
15	San Diego; CA	USA	46	7.5	9.8%
16	Toronto	Canada	46	8.4	11.8%
17	Minneapolis; MN	USA	40	6.4	6.9%
18	Stamford; CT	USA	39	7.1	13.8%
19	Philadelphia; PA	USA	38	6.8	7.9%
20	San Juan	Puerto Rico	37	6.6	11.4%
21	Tacoma; WA	USA	37	6.4	10.0%
22	Phoenix; AZ	USA	37	6.0	5.7%
23	Baton Rouge; LA	USA	36	6.1	10.6%
24	Denver; CO	USA	36	6.4	8.3%
25	Detroit; MI	USA	33	5.9	6.1%

Source: INRIX

- Peak Hours Spent in Congestion: Applying the average peak period congestion rate to travel times allows a derivation of daily time spent in peak period congestion. Assuming 240 working days a year, the average number of hours spent in congestion during peak hours is estimated for every city. This a metric for the impact on the typical car commuter.
- INRIX Congestion Index: The seven congestion rates are weighted by relative volumes to provide a more realistic average congestion rate that reflects typical driving patterns, which is then weighted by the Median Travel Time. This, in effect, adjusts the congestion rate by the city's size and associated average journey times. This is the metric for transportation officials.
- Average Congestion Rate: The simple (i.e. unweighted) average of the seven (Peak periods on highways in and out of the city, Peak periods within a city, Day time travel on highways in and out of a city, Day time travel within a city, Late night on highways in and out of a city, Late night within a city, Weekend travel on all roads) congestion rates, which therefore estimates the percentage of total drive time the average driver spent in congestion averaged across all periods of the day and all sections of the road network. This is a metric for the impact on the typical driver.

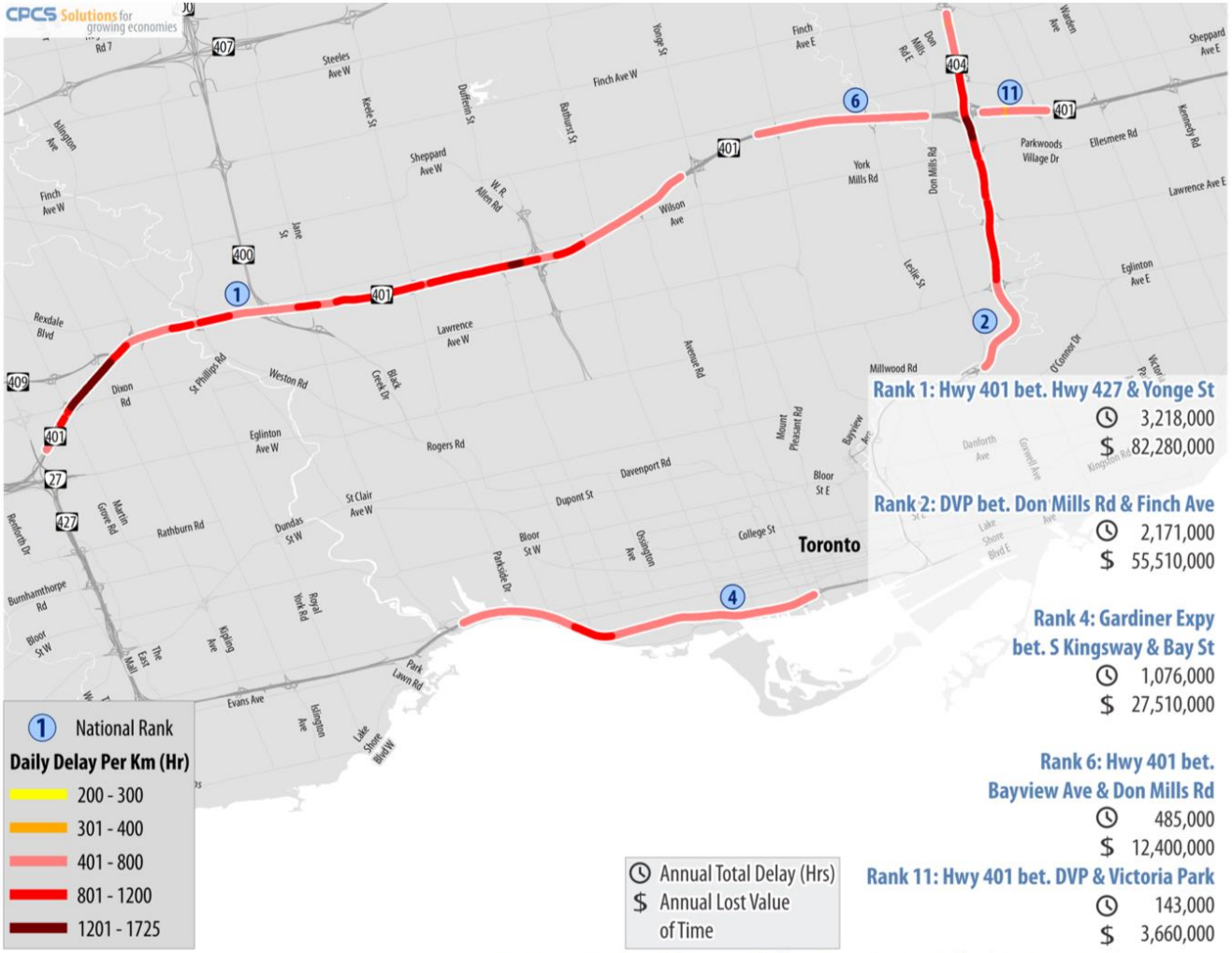
Annual Congestion Costs (in $ Millions) in Canadian Cities (2006)

City	50% Congestion Threshold	60% Congestion Threshold	70% Congestion Threshold
Vancouver	$518 M	$652 M	$755 M
Edmonton	$85	$103	$120
Calgary	$149	$171	$180
Winnipeg	$73	$100	$125
Hamilton	$13	$24	$37
Toronto	$1,298	$1,672	$2,014
Ottawa-Gatineau	$220	$304	$380
Montreal	$697	$811	$910
Quebec	$63	$89	$118
Total	$3,116 M	$3,927 M	$4,640 M

Source: Transport Canada

Cost of Traffic

- Fun Fact: Highway 407 ETR, a 108 kilometre barrier-free all-electronic toll highway that runs north of the City of Toronto, shows no excess congestion.

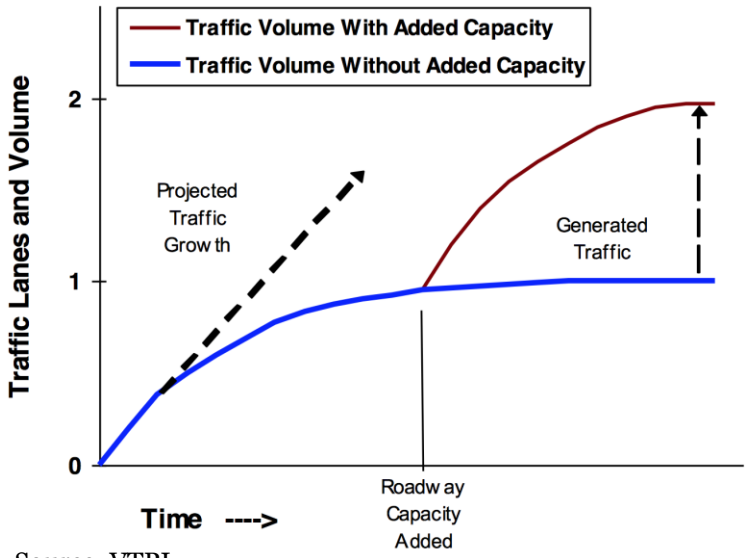


Source: CPCS analysis of data provided by HERE and provincial/local departments of transportation.

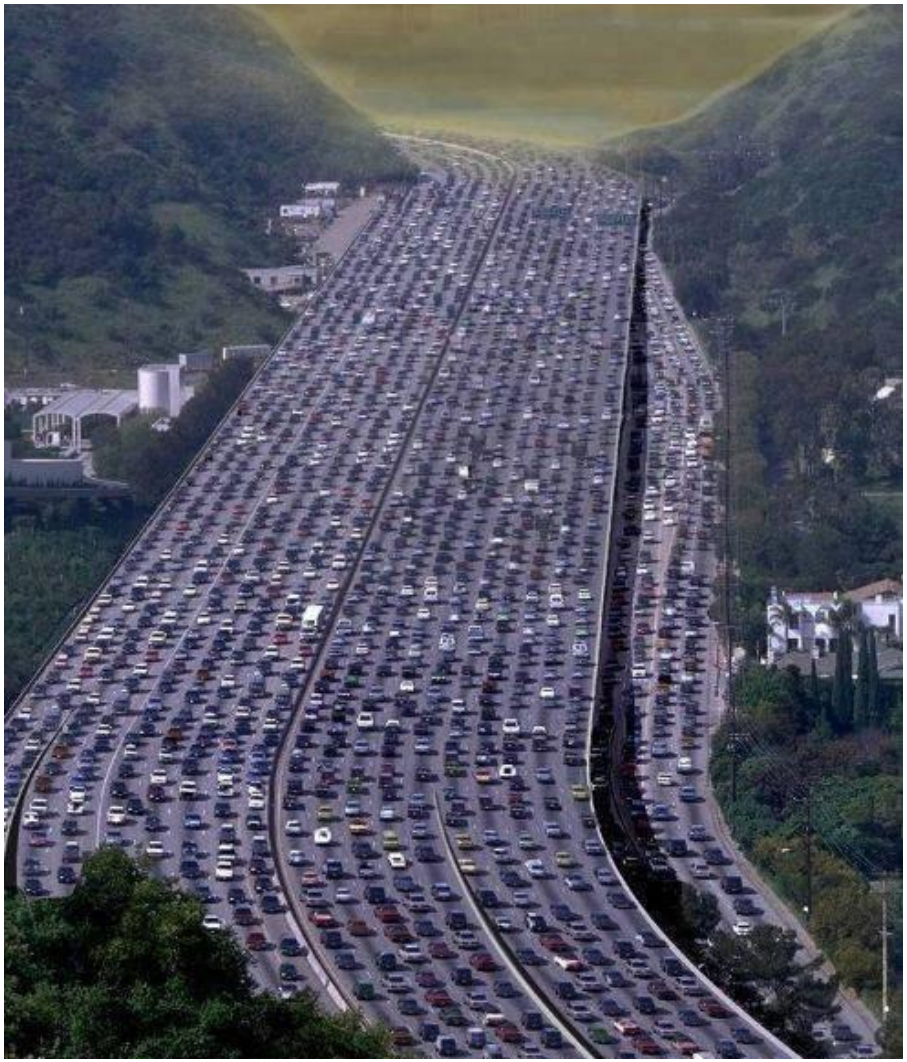
POTENTIAL SOLUTIONS

Induced (Latent) Demand

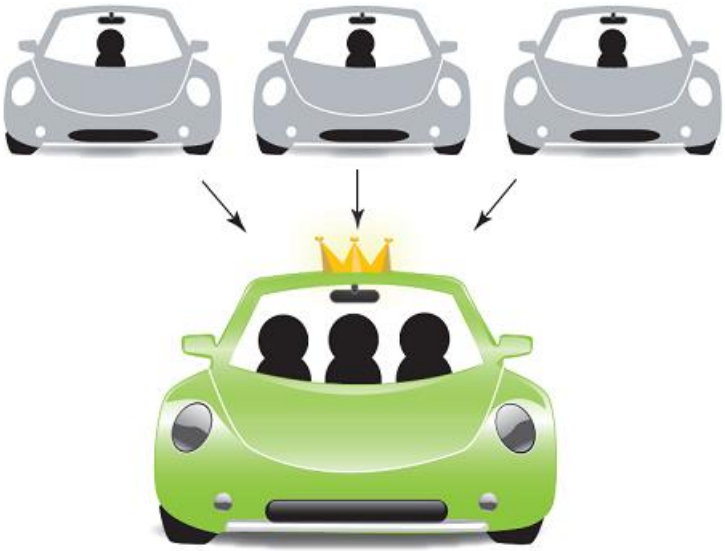
Latent demand: Additional trips that would be made if travel conditions improved (less congested, higher design speeds, lower vehicle costs or tolls).



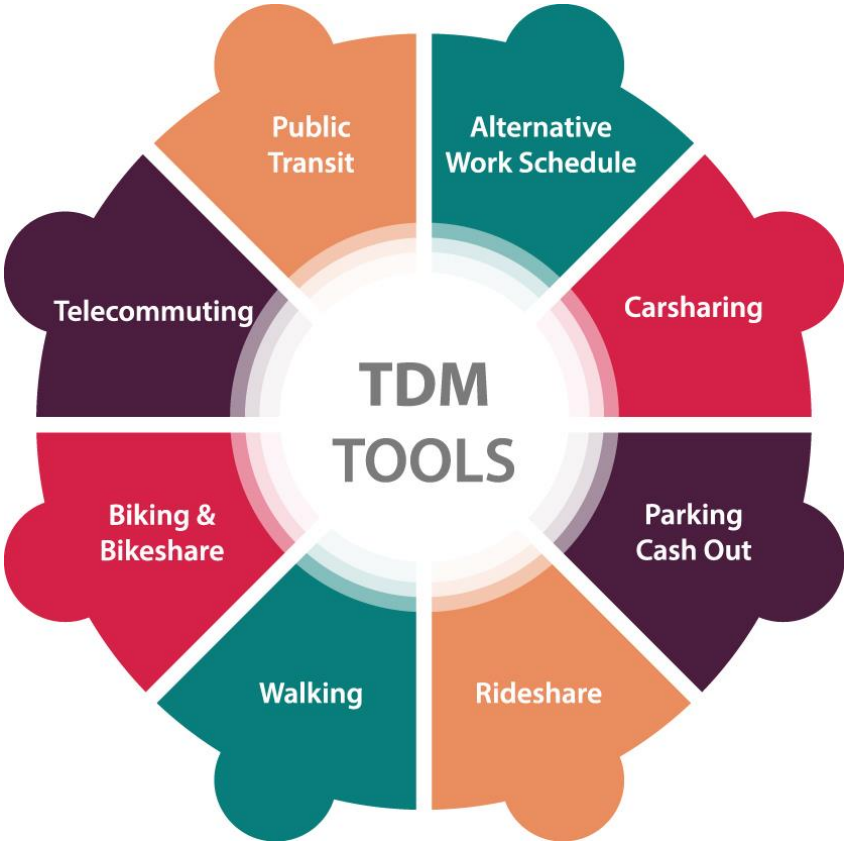
Source: VTPI



Source: LA Metro



Source: Chamonix

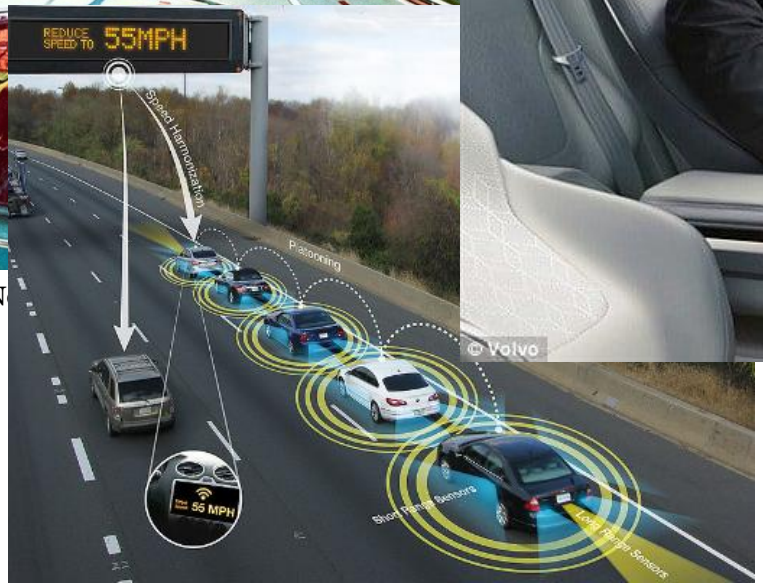


Source: TDOT

Autonomous and Connected Vehicles

Source: MondayN

Source: DisruptionHub



Source: SunCam

Hours of operation

Weekday and Saturday service approximately 6 a.m. to 1:30 a.m.
Sunday service approximately 8 a.m. to 1:30 a.m.
Holiday start times vary

ttc.ca | Information: 416-393-4636 | Customer Service: 416-393-3030
Toronto Transit Commission @TTCnotices @TTChelps

So How much are We Spending?

- Investments in Transit and Transportation over the Next 10 Years

$56B in public transit 

- Rapid transit projects will be built in Waterloo, Hamilton, Mississauga and Brampton, Ottawa and Toronto.
- The GO rail system will be transformed through the GO Regional Express Rail initiative, which will quadruple the number of weekly trips from about 1,500 to nearly 6,000 by 2024–25.

$26B in highways 

- About 5,000 kilometres of highways and more than 750 bridges will be built or rehabilitated across the province by 2021–22.
- About 2,400 kilometres of these highways and 200 of these bridges will be in northern Ontario.

Source: Ministry of Finance

Examples of Greater Toronto and Hamilton Area (GTHA) Rapid Transit Projects

Project	Provincial Investment in Construction Costs	Description
Eglinton Crosstown Light Rail Transit (LRT)	$5.3 billion	This LRT will include 25 stations and stops that will link to 54 bus routes, three subway stations, three GO Transit lines and the UP Express, speeding up commutes and helping people get where they need to go.
Finch West LRT	Up to $1.2 billion	This LRT will connect Humber College to the new Finch West TTC Subway Station on the Toronto-York Spadina Subway Extension and move more people faster through the busy Finch West corridor.
Hamilton LRT	$1.0 billion	This LRT will provide safe, rapid and reliable transit on tracks separated from traffic through downtown Hamilton.
Hurontario LRT	$1.4 billion	This LRT will connect the GO Transit network and the Mississauga and Brampton transit systems. It will have 22 stops on its own dedicated right-of-way, with service expected to begin in 2022.
Mississauga Transitway	$113 million	In December 2017, Renforth Station opened, marking the completion of this project that makes east-west travel through Mississauga faster and more convenient.

Source: Ministry of Finance

CHALLENGES

Urban Sprawl

Source: Cities Digest

Political Bureaucracy

TORONTOIST

NEWS

MARCH 30, 2017 AT 8:54 AM | 32 COMMENTS

Politics Should Be Removed from Transit Planning

The governance of public transit in Toronto is a bit of a shambles.

BY TRICIA WOOD

News · City Hall

thestar.com

How politics, not evidence, drives transit planning in Toronto

Political interference, misleading analysis and a lack of transparency have characterized contentious transit plans for decades.

Photo by tapesonthefloor via Torontoist Flickr Pool.

Transportation Tomorrow Survey (TTS)

- Comprehensive travel survey conducted in the Greater Golden Horseshoe Area once every five years;
- 5% random selection of households throughout the survey area.

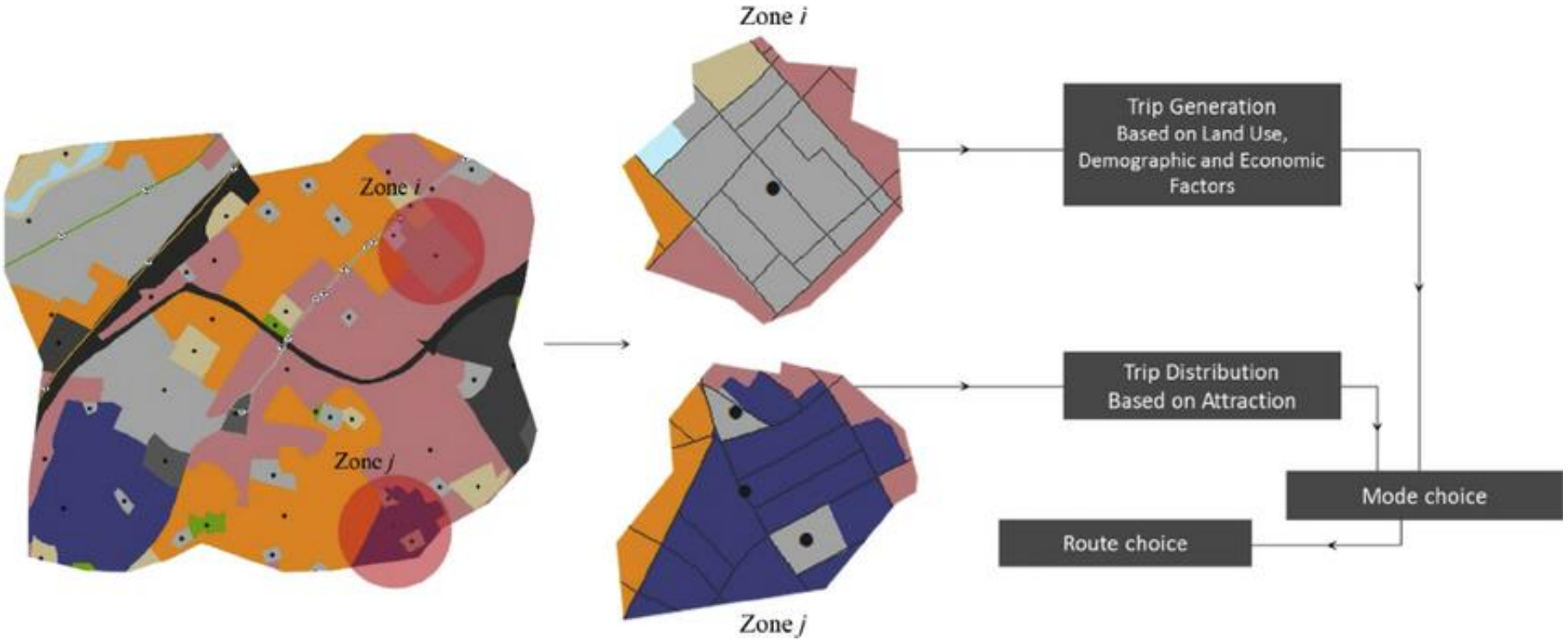
Good

Source: GIGAOM

ne Publishing

"Give people better data, give governments better data, and you can have a huge impact on one of the biggest of the biggest problems in our society." - Bryan Mistele

Four Step Travel Demand Model



Source: ResearchGate

Need for Calibration!

- Trip Distribution ➔ O-D Surveys
- Trip Assignment ➔ Traffic Counts

Source: RL Magazine

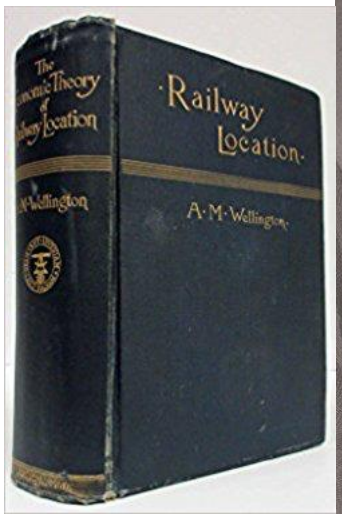
What will we achieve?

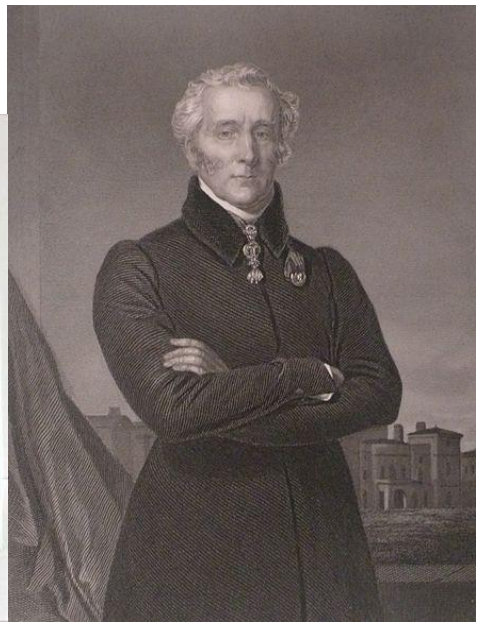
- Better understanding of users needs;
- Accurate planning;
- Efficient government spending; and
- Etc.

Source: CityLab

Lesson from the Past

- "the distorted pre-eminence given by engineers, and by those who teach them and employ them, to the pettiest details of *how* to build the separate works which make a railway, to the neglect of the larger questions of **where** to build and when to build, and whether to build them at all, has in it something at once astounding and discouraging." – Arthur Mellen Wellington (1887)





THANK YOU!

Sources

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