

# Driving Changes

## A draft policy agenda for vehicle automation in Canada

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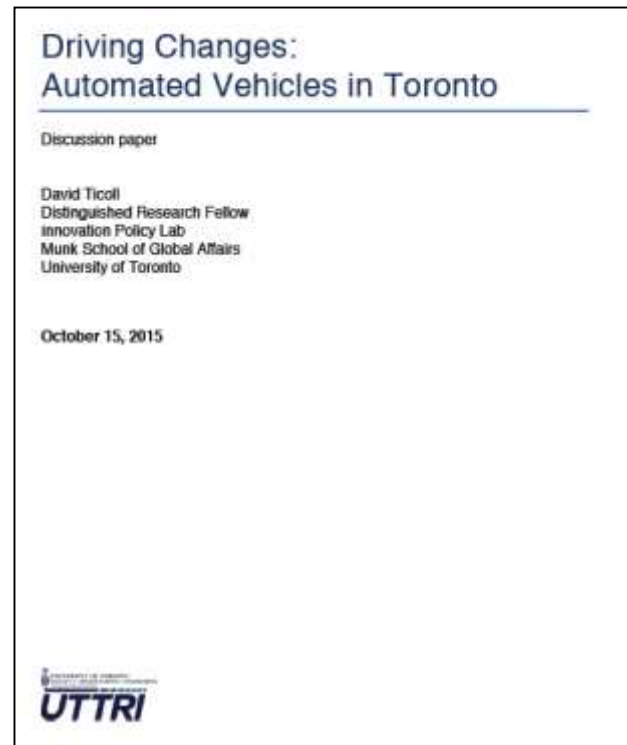
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Mercedes-Benz F015 driverless concept car in San Francisco



Yonge Street looking north from Adelaide Street, 1929



Yonge Street looking north from Adelaide Street, 1900

# Canada's vehicle automation challenge

- What is our vision of an AV-enabled Canada
  - ◆ How will the pieces fit together?
- How will we maximize the benefits and minimize the downsides?
- What role will governments play in shaping the AV future?

# AVs are smart, road-informed, careful

Therefore:

- 90%+ safer
- Small & light
  - ◆ Road efficient
  - ◆ Energy efficient
  - ◆ Quick-charge electric
- Mobility services potential
  - ◆ Can be configured:
    - Number of passengers
    - Function (work, play, eat, sleep, love, kids, cargo, ability)



# The case for vehicle automation

- Greenhouse gas reduction
- Safety, health
- Accessibility, social equity
- Cost savings – individuals, organizations, governments, economy
- Congestion reduction
- Land use opportunities

Collisions	\$1.2
Commuting	2.7
Insurance	1.6
Parking fees & fines	0.5
	<hr/>
	\$6.0

Some projected Toronto savings due to AVs  
(current \$B)

# The case for vehicle automation quantified

- Share of Canada's GHG emissions (Environment Canada 2009)
  - Road transportation 19%
  - Fossil fuel production 8%
- Traffic fatalities (2013) (Statscan) 1,923
  - Serious injuries 10,315
  - Total injuries 165,306
- Premature deaths from emissions (CMA) 21,000/year
  - Implied premature hospitalizations 60,000+/year
- Transit challenged seniors w/severe disability 75,000 Toronto 2031 (est.)
- Cost of car ownership (BMO):
  - Share of household budgets 15%
  - Average all-in annual costs \$5,250
  - Light vehicles in Canada, 2014 23,500,000
  - Economy-wide cost \$123,375,000,000
  - Typical rate of daily use 5%
- Toronto cost of congestion (Toronto BOT) \$6-10B
- Urban street space devoted to parking ~30%
- Plus: Impacts on street life & urban design, sprawl, physical activity

## Commercial availability: vehicle technology developers

2019-2020	Google
2020	Ford, Nissan, Tesla, Toyota
2024	Jaguar, Land Rover
2025	Daimler

## What analysts have said

2015	Morgan Stanley: limited driver substitution begins to roll out
2018	Morgan Stanley: complete autonomous capability begins to roll out
2020	PwC: semi- and full-AVs have 9-10% global share in basic scenario; 12-13% in disruptive scenario
2025	PwC: semi- and full-AVs have 14-16% global share in basic scenario; 19-22% in disruptive scenario <b>Goldman Sachs: Full AVs will be "commonplace"</b>
2028	McKinsey: Consumers begin to adopt AVs
2030	PwC: semi- and full-AVs have 15-18% global share in basic scenario; 28-30% in disruptive scenario <b>Gartner: AVs are 25% of passenger vehicle population in use in mature markets</b>
2035	Morgan Stanley: 100% autonomous penetration
2040-50	McKinsey: AVs become the primary means of transport

# How to tackle policy? In Toronto, AVs impact everything!

## Accountability Officers

- [Auditor General](#)
- [Integrity Commissioner](#)
- [Lobbyist Registrar](#)
- [Ombudsman](#)

## Divisions that report directly to City Council

- [City Clerk's Office](#)
- [Legal Services](#)

## Divisions that report to the City Manager

- [Equity, Diversity and Human Rights](#)
- [Executive Management](#)
- [Human Resources](#)
- [Internal Audit](#)
- [Strategic Communications](#)
- [Strategic & Corporate Policy](#)

## Divisions that report to Deputy City Manager, Giuliana Carbone

- [Affordable Housing Office](#)
- [Children's Services](#)
- [Court Services](#)
- [Economic Development & Culture](#)
- [Employment & Social Services](#)
- [Long-Term Care Homes & Services](#)
- [Parks, Forestry & Recreation](#)
- [Public Health](#)
- [Shelter, Support & Housing Administration](#)
- [Social Development, Finance & Administration](#)
- [Toronto Office of Partnerships](#)
- [Toronto Paramedic Services](#)

## Divisions that report to Deputy City Manager, John Livey

- [City Planning](#)
- [Engineering and Construction Services](#) (formerly Technical Services)
- [Fire Services](#)
- [Major Capital Infrastructure Coordination Office](#)
- [Municipal Licensing & Standards](#)
- [Office of Emergency Management](#)
- [Policy, Planning, Finance & Administration](#)
- [Solid Waste Management Services](#)
- [Toronto Building](#)
- [Toronto Water](#)
- [Transportation Services](#)
- [Waterfront Secretariat](#)

## Divisions that report to Deputy City Manager & Chief Financial Officer, Roberto Rossini

- [Chief Corporate Officer](#)  
Josie Scioli
  - [311 Toronto](#)
  - [Environment & Energy](#)
  - [Facilities Management](#)
  - [Fleet Services](#)
  - [Real Estate Services](#)
- [Corporate Finance](#)
- [Finance & Administration](#)
- [Financial Planning](#)
- [Information & Technology](#)
- [Treasurer](#)  
Mike St. Amant
  - [Accounting Services](#)
  - [Pension, Payroll & Employee Benefits](#)
  - [Purchasing and Materials Management](#)
  - [Revenue Services](#)



# A framework for AV policymaking & planning

- **Unifying scenario**
- Nation building
  - ◆ **Environment \***
  - ◆ **Industries \***
  - ◆ **Jobs & incomes \***
- Quality of life
  - ◆ **Transportation \***
  - ◆ **Urban design/land use \***
  - ◆ Accessibility
- Enablement
  - ◆ **Information \***
  - ◆ **Roads \***
  - ◆ Licensing
  - ◆ Insurance
- Governments
  - ◆ Leadership strategy
  - ◆ Fiscal impacts
  - ◆ Policy mandates, commitment, competencies, resources

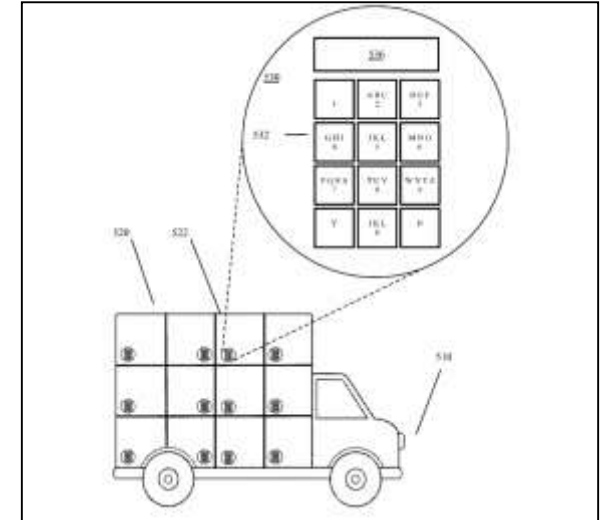
# Vehicle technology development sector: new actors in transportation ecosystems

Convergence of information technology, vehicle manufacturing and transportation services

Essential, like land developers

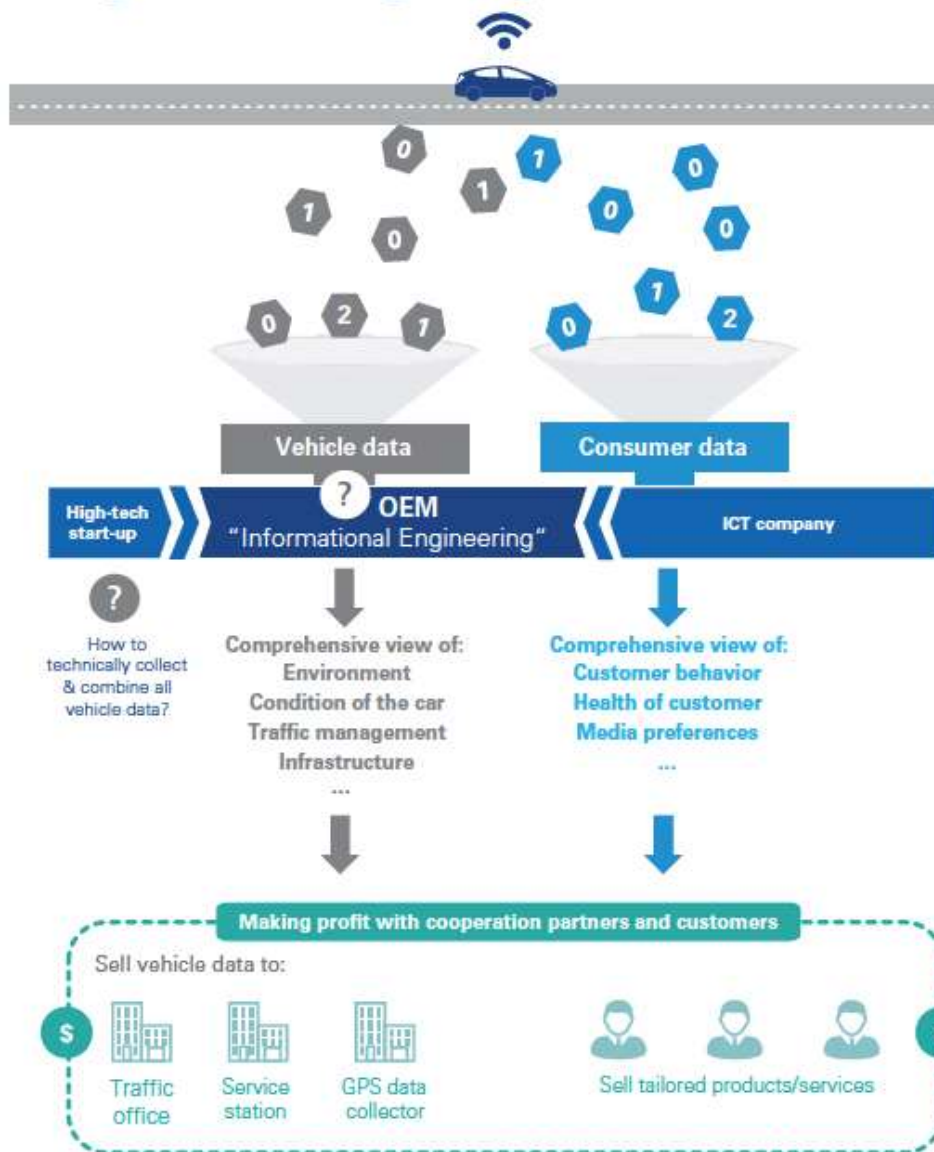
Key differences:

- Highly competitive, innovation-driven global corporations
- Core assets & capabilities:
  - ◆ Intellectual property, patents
  - ◆ Continually updated big data & data flows
  - ◆ Advanced information & communication technologies
  - ◆ Will know more about streets, travel dynamics, traveller behaviours than anyone
- McKinsey: Digital data flows now exert larger impact on GDP growth than trade in goods (such as land and buildings)
- Aim for deep, permanent involvement in urban life
- Possible dominant role in transportation: central, most visible network of urban life
- Potential winner-take-all dynamics as in parts of the technology sector



**A new regulatory challenge:** Just as governments define public interest policies for land use, they now must consider public interest policies for digital data.

# The car is a gigantic data generating engine



Informational engineering needs to become a core competence for manufacturing companies

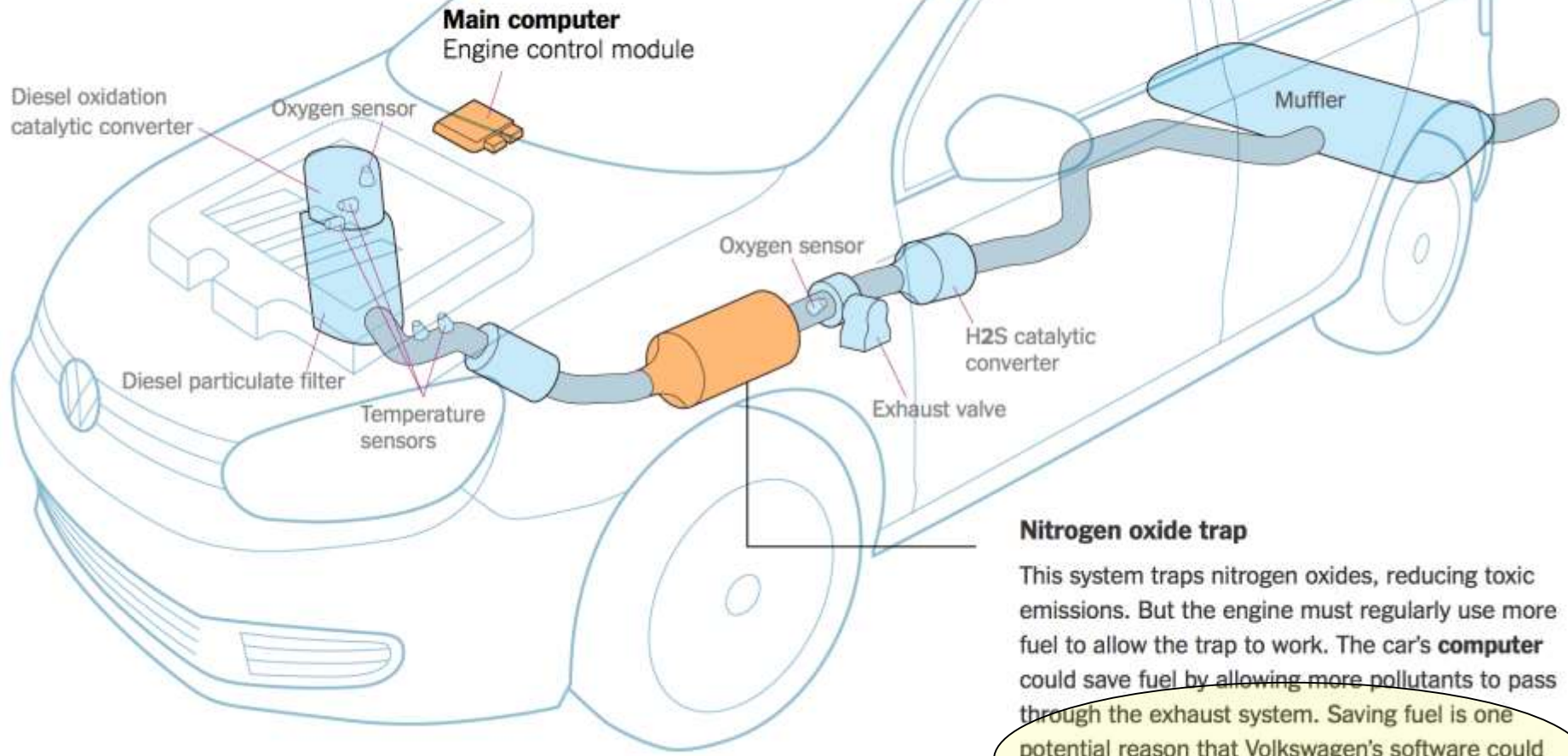
# Trans Pacific Partnership

## Article 14.17: Source Code

1. No Party shall require the transfer of, or access to, source code of software owned by a person of another Party, as a condition for the import, distribution, sale or use of such software, or of products containing such software, in its territory.
2. For the purposes of this Article, software subject to paragraph 1 is limited to mass-market software or products containing such software and does not include software used for critical infrastructure.
3. Nothing in this Article shall preclude:
  - (a) the inclusion or implementation of terms and conditions related to the provision of source code in commercially negotiated contracts; or
  - (b) a Party from requiring the modification of source code of software necessary for that software to comply with laws or regulations which are not inconsistent with this Agreement.

## Exhaust system of a Volkswagen Golf

Volkswagen has used two basic types of technology to reduce emissions of nitrogen oxides from diesel engines, by either trapping the pollutants or treating them with urea. The first type is shown here.



### Nitrogen oxide trap

This system traps nitrogen oxides, reducing toxic emissions. But the engine must regularly use more fuel to allow the trap to work. The car's **computer** could save fuel by allowing more pollutants to pass through the exhaust system. Saving fuel is one potential reason that Volkswagen's software could have been altered to make cars pollute more, according to researchers at the International Council on Clean Transportation.

# Transportation & Roads

- How to optimize policy objectives
  - ◆ GHG
  - ◆ Safety
  - ◆ Accessibility
  - ◆ Congestion
- Transportation planning for a new multimodal context
  - ◆ Roads and transit
  - ◆ Active transportation
  - ◆ Innovating traffic management & control
- Information technologies in the streets
  - ◆ Transportation data ownership
  - ◆ Operational access
  - ◆ User access, open data
  - ◆ Security, privacy
- Facilitating vehicle automation
  - ◆ Changing traffic control & management (role of VTDs)
  - ◆ Physical affordances, signage
  - ◆ Vehicle to infrastructure technologies
  - ◆ Street design
  - ◆ Fuel



# Urban design/land use: policy issues

- When/how to incorporate implications of AVs on land use planning, zoning & development policies, long term planning exercises
- Example impact areas in Toronto/Ontario:
  - ◆ Crombie report
  - ◆ Midtown planning
  - ◆ Tall building parking, pickup/dropoff
  - ◆ Street parking, complete streets policies
- Sprawl/densification
- Parking intensive e.g., shopping malls, industrial parks, commercial roads

# Industries, jobs, incomes

Massive productivity improvements across all sectors due to vehicle capital & operating cost savings, reduced congestion, climate & health benefits, productivity gains, product/service innovations

**Beyond these, policy issues include:**

- **Business/productivity, job growth opportunities**
  - ◆ Auto/ICT convergence
  - ◆ Road & building construction
- **Business/productivity opportunities, job risks**
  - ◆ 15-50% potential job impact
    - Truck transportation
  - ◆ 2-15% potential job impact
    - Manufacturing (non-automotive)
    - Wholesale & retail trade
    - Bus/transit systems
    - Municipal services (some could be >15%)
- **Business & job risks**
  - ◆ 50-90% potential job impact
    - Taxi/limo
    - Auto rental/leasing
    - Vehicle parts
  - ◆ 15-50% potential job impact
    - Traditional vehicle manufacturing
    - Auto repair
    - Gas stations
    - Insurance



## Some employment numbers (2011 census)

- Occupations
  - ◆ Transport truck drivers 261,775
  - ◆ Taxi, limo drivers 48,545
  - ◆ Delivery & courier drivers 90,075
  - ◆ Mail, postal, courier workers 92,825
  - ◆ Police officers (x 0.25) 20,000
  - ◆ Insurance agents & brokers 66,205
  - ◆ Auto service & body shop 166,100
- Subsectors
  - ◆ Auto manufacturing 125,000
  - ◆ Auto dealers & distributors 195,160
  - ◆ Auto rental & leasing 16,660
  - ◆ Gas stations 52,300
- Total: 1,130,000 i.e. 6.8% of measured labour force of 16,595,000
- TBD: eventual pace and number of job displacements/losses

# Environment & potential unifying scenarios

	Ownership leads	On-Demand leads	Split outcome
Automated taxis	22,000	92,000	57,000
Automated minibuses	1,000	3,000	2,000
Private AVs/legacy	1,010,000	260,000	650,000
<b>Toronto light vehicle ownership - total</b>	<b>1,033,000</b>	<b>355,000</b>	<b>709,000</b>
GTHA vehicles entering Toronto (all combined)	1,000,000	350,000	700,000
New 'accessibility' users - -----→ Automated taxi	120,000	120,000	120,000
-----→ Automated minibus	30,000	30,000	30,000
<b>Toronto daily vehicles</b>	<b>2,183,000</b>	<b>855,000</b>	<b>1,559,000</b>

# On-demand leads: a 'utopian' scenario?

- Up to 90% cut in GHG emissions
- Up to 90% cut in emission-related premature deaths & hospitalizations
- Equity of access for young, old, disabled, financially challenged
- New land use opportunities (eliminate much off-street, all street parking)
- Reduced congestion & related costs
- Ownership & operating cost savings
- Transit innovation

# Many questions...

- Will car culture proponents – consumer or corporate – pose obstacles to an on-demand scenario?
- Cost, convenience, accessibility, and time use improvements could drive substantial growth in AV kilometres travelled. How to minimize and mitigate this growth, and its potential impacts on congestion, land use and active transportation?
- How should we rethink transit strategies in light of on-demand mobility?
- Who will own and provide automated mobility services and technologies?
  - ◆ Will they be almost entirely private sector vehicle technology developers or will the public sector play a significant role?
  - ◆ Will global, non-Canadian companies dominate, or will Canadian-based firms play a significant role in these services?
- What is the impact on governments' fiscal assumptions including operating and capital budgets and revenues?

# “The best way to shape the future is to invent it”

- What is our vision of an AV-enabled Canada
  - ◆ How do the pieces fit together?
- How will we maximize the benefits and minimize the downsides?
- What role will governments play in shaping the AV future?

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