Towards Sustainability: A Third Urban Revolution:

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A sustainable urban transportation system must be built upon four pillars:

- Good governance
- Adequate & sustainable financing
- Sound infrastructure
- Good urban form and neighbourhood design

“The Four Pillars of Sustainable Urban Transportation”, Kennedy, et. al. (2005)
Throughout history the location, size, shape and economic & social functioning of cities has been fundamentally influenced by transportation technology, infrastructure and services.

Transportation networks literally give spatial definition to land and, by making the land *accessible*, they make it useful.
Pre-industrial cities were small, dense and extremely compact.

- Walking and animal-powered vehicles were the only options for intra-city travel:
  - To be accessible, everything had to be close at hand.
- Wind and animal-powered transport were the only inter-city options:
  - Cities were largely tied to rivers, lakes and ocean ports: water-based travel was so much faster and cost-effective than land travel.
- Largely a person-based (individual) supply of transportation (other than the roads/streets).
The “first revolution” in transportation came with the Industrial Revolution:

- Steam engines and, later, electrically-powered vehicles made mechanized transport possible for the first time, providing much higher speed and higher capacity transport services.
- This permitted the size of cities to expand dramatically, leading to:
  - Lower (but by modern standards still high) densities.
  - Vastly larger cities.
  - The ability to accommodate much larger populations (& economic activity).
The “second revolution” in transportation is due to the automobile, starting in the early 20\textsuperscript{th} Century, but not having full impact until after WWII*.

With it’s much higher speeds, flexibility of use and its provision of an affordable** personal means of transportation, the auto again revolutionized transportation by freeing people from fixed-service public transit and freeing urban development to further spread out (“sprawl”) in a dramatically increased, indeed explosive, way.

“Suburbs” first started to develop with the introduction of commuter railways and (even more so) electric urban street railways. But the private automobile made possible the development of the post-WWII low density “mass” suburbs that characterize much of current North American cities.

* Autos were starting to significantly impact cities in the 1920’s, but the Great Depression, followed by WWII significantly retarded the growth in auto usage until after 1945.

** Starting with Ford’s Model T.
As cities have grown in size, we have discovered very clearly that large cities cannot be served by roads/cars alone.

The transportation system must be multi-modal:
- Roads (cars/trucks)
- Transit (rail, bus, …)
- Non-motorized (walk, bike).

And, in particular, transit and non-motorized modes of travel must play a more significant role in the daily functioning of our cities.
Over & above environmental and land use impacts, roadways become very inefficient means of moving people as they become increasingly congested.
As cities grow, they simply cannot build enough roadways to carry all the traffic.

North American congestion rankings

1. Los Angeles: 34%
2. Vancouver: 34%
3. San Francisco: 33%
For short trips, walking & biking are by far the best way to move people.

But in a large urban area, many trips are too long to be viable by walk or even bike.
Public transit can be much more efficient in carrying large volumes of people.

The Yonge St. subway has a capacity of up to 35,000 persons/hour/direction. This is the equivalent of up to 14 lanes of highway!
An excellent transit system is an essential component of every great city.
The challenge is to build a transit system that is sufficiently competitive with the automobile to provide an attractive alternative, in a cost-effective manner.
The viability of transit is tied directly to urban form: how we build our urban region directly determines how much and what type of transit will be cost-effective.
**1986 Population Distribution by Region**

- Toronto: 52.5%
- Durham: 14.2%
- York: 8.5%
- Peel: 7.8%
- Halton: 6.5%
- Hamilton: 10.4%

905 Total: 37.0%

**2006 GTHA Population Distribution by Region**

- Toronto: 41.7%
- Durham: 19.1%
- York: 14.6%
- Peel: 9.2%
- Halton: 8.3%
- Hamilton: 7.2%

905 Total: 50.0%

**1986-2006 Percentage Change**

- Population
- Households

Bar chart showing percentage change for Toronto and Hamilton.
### Changes in Trips by Origin & Destination, 1986-2006

#### % Change, All Trips, 1986-2006

<table>
<thead>
<tr>
<th></th>
<th>Toronto</th>
<th>Durham</th>
<th>York</th>
<th>Peel</th>
<th>Halton</th>
<th>Hamilton</th>
<th>Total</th>
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<tbody>
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<td>184.1%</td>
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<td>161.4%</td>
<td>101.1%</td>
<td>33.6%</td>
<td>3.0%</td>
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<td>Total</td>
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<td>89.9%</td>
<td>52.9%</td>
<td>6.1%</td>
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#### % Change, Transit Trips, 1986-2006

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<tr>
<td>Hamilton</td>
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<td>-14.4%</td>
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<tr>
<td>Total</td>
<td>8.9%</td>
<td>77.0%</td>
<td>136.5%</td>
<td>105.2%</td>
<td>34.6%</td>
<td>-14.3%</td>
<td>17.4%</td>
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The “Business-As-Usual” (BAU) trend of the past decades is NOT sustainable.

We need a “third revolution” in how we build our cities and in how we travel in them.

**System Measures:**
- Vehicle-kilometres travelled
- Greenhouse Gases
- Congestion/Delay

... A new path into the future is essential for sustainability:
- Environmentally
- Economically
- Socially

Unacceptable:
- Environmental disaster
- Economically uncompetitive
- Degraded quality of life
This “third revolution” involves a fundamental rebalancing of our usage of private (car) versus public (transit) and mechanized (car, transit) versus non-motorized (walk/bike).
Elements of the 3rd Revolution

- Sustainable urban design
- Investment in transit
- Pricing
- Technology

The third revolution will be as much cultural & political in nature as it will be technological.
The 3rd revolution requires the design of every new suburb, brownfield redevelopment, and master plan to recognize that the design principles of the 20th-century auto-first city are not working and have not been working for some time. The longer we cling to them, the more we will compound our problems and the less likely we will be able to build the cities that we and our children need. In many cases, this means a return to earlier, “traditional” forms of neighbourhood design.

Sprawl (above) versus the traditional neighborhood (below): in contrast to the traditional network of many walkable streets, the sprawl model not only eliminates pedestrian connections but focuses all traffic onto a single road.
In combination with improved urban design we must make more and better use of public transit, walking and bicycling. For this shift to occur, three things must happen. We must:

- Invest aggressively, innovatively and wisely in major upgrades to our public transit systems.
- Rethink the street so that it is consistently an attractive and safe place to walk and bicycle.
- Reconfigure our urban form so that transit and non-motorized travel are cost-effective, attractive alternatives to an automobile stuck in traffic.
Keys to Better Transit

- Need a coordinated, systematic plan for both the short and long runs.
- Design & build **networks**, not individual lines.
- Increase frequency.
- Improve reliability: give transit priority
  - Exclusive right-of-ways (ROW).
  - On-street signal priority.
- Choose technology appropriate to the task at hand.
- Put all the pieces together.

Major investment in transit is not an option – it is a necessity.
• Technological advances will continue to play a critical role in improving system efficiencies and capacities.
• Next generation vehicles:
  – Electric
  – Automated/connected
  – Automated transit vehicles?
• Dynamic signal control
• Dynamic road pricing
• Continuing advances in real time information systems
• Advanced/dynamic transit priority
• Car (& bike) sharing
• Big data
The sustainability and liveability of our cities depends on us acting now to build the better city of tomorrow.

Failure to do so is not an option.

Thank you for your attention.

Questions?