



# Breaking the Bottlenecks : Congestion Solutions for Canada

## Executive Summary

### INTRODUCTION

Most of us know what it's like to be mired in traffic on a busy Canadian roadway. Often tempers flare, blood pressure shoots up. Fuel is wasted, pollution increases, and our productivity takes a tumble as we are late for work. Road congestion takes a huge toll on our quality of life, our economy, and our environment.

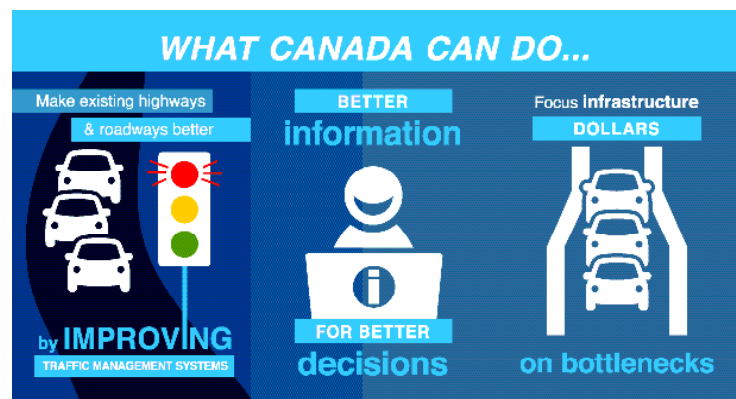
The Canadian Automobile Association (CAA) commissioned CPCS, a Canadian-based international transportation consulting firm, to examine best practices to ease congestion. The result is **Congestion Solutions** – a toolkit to help policy makers and the public identify potential ways, big and small, to alleviate traffic congestion.

This latest research is a follow-up to a first of its kind study released by CAA in 2017 called *Grinding to a Halt – Evaluating Canada's Worst Bottlenecks*, which examined in detail some of the most congested highways and urban arteries in our country. The study showed that traffic bottlenecks affect Canadians in every major urban market, increasing commute times by as much as 50 per cent. Three of Canada's bottlenecks rank among the worst in North America rivaling U.S. megacities like New York and Los Angeles. Motorists burn an extra 22 million liters of fuel per year which sends an additional 58 million kg of CO2 pollution into the atmosphere.

## WHAT CANADA CAN DO: RECOMMENDATIONS FOR ACTION

There are immediate actions that Canada can take to relieve the symptoms of urban congestion. At a high level, there are three areas where action is warranted now.

- **Pick the Low Hanging Fruit:** The biggest impact at the lowest cost would come from making our existing roads and highways work better by improving traffic management systems.
- **Better Information for Better Decisions:** It is remarkable how little public information is available in Canada on innovative solutions to address urban congestion. The Government of Canada or the Council of Ministers of Transportation could play a useful role in identifying and disseminating good practices.
- **Focusing Infrastructure Dollars on Bottlenecks:** Fixing the urban bottlenecks which are literally choking our cities should be a key focus for government. Ride-sharing, carpooling, bike sharing and investments in bicycle infrastructure are relatively low-cost solutions that could relieve congestion.



# SPECIFIC MEASURES THAT CAN BE TAKEN INCLUDE:

1. Congestion can be greatly reduced through such simple measures as re-timing traffic lights, better managing the response to breakdowns and collisions, implementing speed limits that adjust to smooth traffic flow, and regulating the volume of traffic entering highways. The City of Toronto shows the exponential impact of a modest investment in traffic light re-timing, with a return of \$64 in time, fuel and air pollution benefits for every dollar spent.
2. Collisions and breakdowns are leading causes of traffic congestion and the way we respond to these incidents can have a profound impact. Introducing simple measures such as “privacy screens” or freeway service patrols can reduce unnecessary gridlock on busy highways.
3. Ramp metering and active traffic management are being adopted to great success in France and other countries. The Paris region tested ramp metering from 2007 to 2010 and achieved time savings of 15%, an increase in average traffic speed of 10 km/h in peak periods as well as a 20% reduction in collisions and a 30% reduction in air pollution.
4. Experience in other countries shows that building segregated bike lanes that makes cycling commuters feel safe and secure can be a relatively low-cost way to reduce urban congestion. Policymakers should also consider better integrating bike sharing with transit systems as a true “last mile” solution.
5. Carpooling rates vary among Canadian cities from as high as 20.0% in Halifax down to 12.3% in Montreal. Emerging technologies and changing preferences have the potential to generate a significant increase in carpooling.

## CONGESTIONS SOLUTIONS: A SUMMARY

This report finds that on a global scale, Canada performs only in the middle of the pack in acting to reduce congestion. The report identifies eight categories of innovative tools and technologies to relieve bottlenecks used in other countries, and in some cases within Canada, that could be implemented more broadly.



**Investment in Active  
Transportation**



**Congestion Charges**



**Changing Driver  
Behaviour**



**Investments in  
Urban Transit**



**Ridesharing and  
Carpooling**



**Traffic Management  
Systems**



**Road Infrastructure**



**Traffic Incident  
Management**

# 1. TRAFFIC MANAGEMENT SYSTEMS

Traffic management systems (TMS) are technologies designed to improve traffic flow and safety, from traffic signals to automated enforcement and variable speed limits. Improved TMS can be a low-cost means of getting more capacity out of existing infrastructure and avoiding far more costly investment in new roads or transit.

**Improving Traffic Signals** can reduce congestion by speeding up traffic, increasing reliability and reducing collisions. Sophisticated signals can detect traffic patterns and adjust timing potentially reducing delay by up to 40%.<sup>1</sup>

The City of Toronto has undertaken a program of signal re-timing, spending \$850,000 per year from 2012 to 2015. Analysis shows that for every dollar spent, the public saved \$64.<sup>2</sup>

The Colorado Department of Transportation installed two adaptive signal control systems along 6-km stretches of highway with signalized intersections. Results showed a 6-9% decrease in travel time on weekdays and an 11-19% reduction on weekends.

Freeways in Minneapolis/St. Paul have 433 ramp flow control signals, among the most extensive systems in the United States.<sup>3</sup> A study found benefits of the system outweighed the costs by 15 to 14<sup>4</sup> with significant improvements in travel times, traffic flow and a reduction of collisions.

## VARIABLE SPEED LIMITS AND TEMPORARY SHOULDER USE

Variable speed limits (VSL)<sup>5</sup> are systems that reduce speed when traffic congestion is imminent. British Columbia has implemented variable speed limits on Highways 1, 5 and 99 and the City of Edmonton has a pilot project to implement advisory VSL on Whitemud Drive.

VSL are used in many high traffic autobahns in Germany, usually in combination with other variable message signs that display information on road conditions, weather, and incidents. Roads with VSL have seen travel times reduced by 5-15% and collisions reduced by 30%.<sup>6</sup>

Temporary shoulder use allows all vehicles, or in some cases only transit vehicles to use the paved shoulder of a freeway during peak periods to alleviate congestion. In the Vancouver area, paved-shoulder use is in place on the Highway 99 corridor, as it is on the Don Valley Parkway and Highway 403 in Ontario.

<sup>1</sup> Texas A&M Transportation Institute (n.d.)

<sup>2</sup> City of Toronto (2017)

<sup>3</sup> US Department of Transportation (2014a)

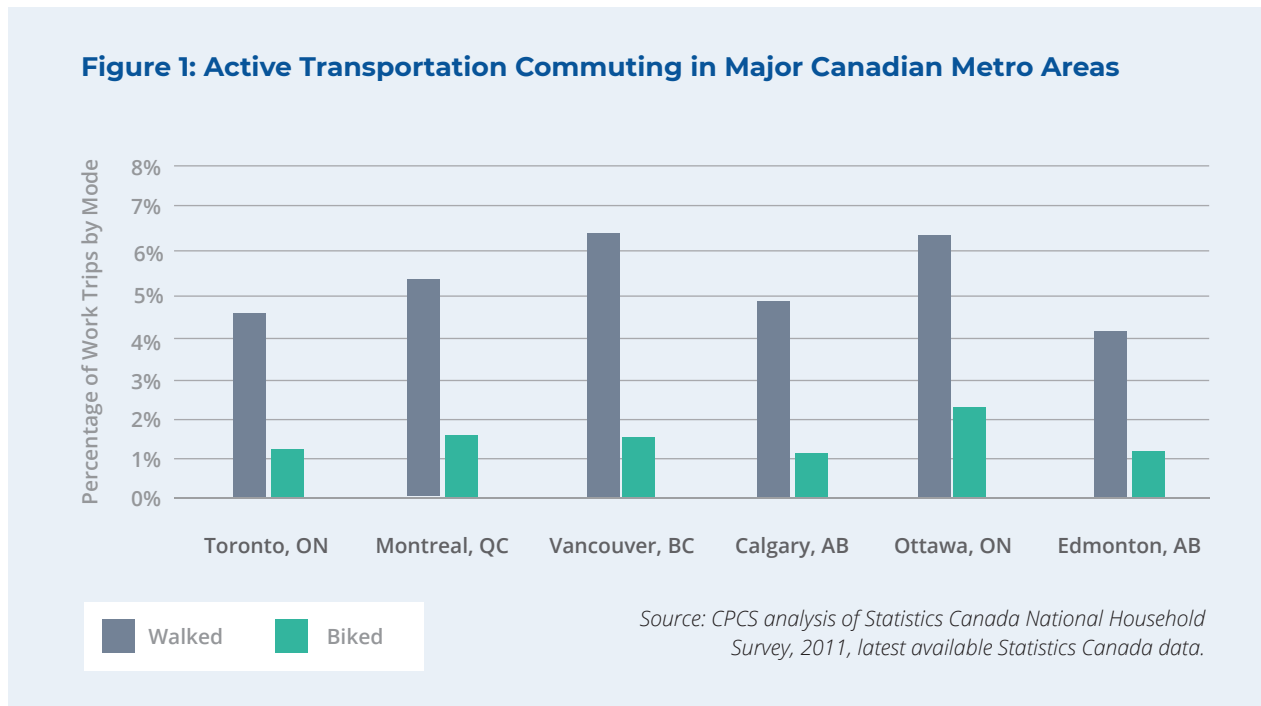
<sup>4</sup> US Department of Transportation (2014a)

<sup>5</sup> Also known as harmonization or dynamic speed limits.

<sup>6</sup> Texas A&M Transportation Institute (n.d.a)

## 2. INVESTMENT IN ACTIVE TRANSPORTATION

Increasingly, Canadians are getting to work by biking and walking which reduces traffic while also improving health and quality of life. Across Canada, 1.1 million people use active transportation to get to work, which is 7.0% of commuters (5.7% walked, 1.3% cycled).<sup>7</sup> The share of commuters using active transportation ranges from under 4% (Abbotsford, BC, and Oshawa, ON) to 16% (Victoria, BC). Active transportation commuting share for major metropolitan areas of over one million people is shown in Figure 1 (ranges from 9% for Ottawa to 5% for Edmonton).



In Canada, weather and other issues may be challenges in an effort to expand bike sharing. However, building segregated bike lane infrastructure to increase safety is a relatively low-cost solution to entice more commuters to pedal rather than taking their automobile to work. Separating bicycles from cars and trucks has significant safety benefits. Studies in Montréal, Toronto and Vancouver have found that bike lanes and cycle tracks reduce the risk of bicycle accidents by 14% to 31%.<sup>8,9</sup>

Cities in Germany including Munich, Berlin and Hamburg have significantly reduced the share of trips made by automobiles over the past 20 years. Between 2002 and 2011, trips made by automobiles in Munich decreased from 41% to 33% while bike trips increased from 10% to 17%. Bicycle highways designed to separate cyclists from other road users have been introduced in Xiamen, China, the Rhine-Ruhr region of Germany, and Copenhagen, Denmark.

<sup>7</sup> According to the 2011 National Household Survey. Journey to work data from the 2016 Census is scheduled to be released in November 2017 and was not available as of the date of writing.

<sup>8</sup> Teschke (2012)

<sup>9</sup> Lusk (2011)

## BIKE SHARE SYSTEMS

Bicycle sharing has been gaining in popularity worldwide as a solution to congestion, including some of the world's largest cities (e.g. Vélib in Paris has 20,000 bikes and Santander Cycles in London, UK has 13,600). Policymakers should also consider better integrating bike share with transit systems, for example providing free bike share use for commuters transferring from transit routes so that bike share can function as a true “last mile” solution.

In Canada, Social Bicycles Hamilton (SoBi Hamilton), which started operations in 2015, is an example of a bike share system in a moderately-sized Canadian city. SoBi Hamilton uses “smart bike” technology that allows them to collect route data for trips (as distinct from many other systems which can only track origins and destinations). SoBi is self-sufficient for operating costs and relies on public support for capital costs.

Across the United States, the number of bike share trips increased from just 2.3 million in 2011 to 28 million in 2016, a more than 12-fold increase in just five years. The 28 million trips in 2016 corresponds approximately to the annual ridership of the entire Amtrak (intercity rail) system.<sup>10</sup>

## 3. TRAFFIC INCIDENT MANAGEMENT

Traffic incident management (TIM) is a planned and coordinated approach to deal with incidents as quickly and safely as possible to restore traffic flow.<sup>11</sup> Because of Canada's severe winter conditions, cost-effective TIM is even more important here than in most other countries.

**Freeway Service Patrols** (FSP) involve highly trained personnel with specially equipped vehicles who patrol congested highways. They have an important role in clearing incidents quickly and safely. Successful programs include the Florida Road Rangers which has been operating on the interstate highways since 1999. Road Rangers typically respond within 15-30 minutes<sup>12</sup> and are estimated to generate \$6.70 in benefits for every dollar spent.

Highway 407 ETR Highway Patrollers play a major role in keeping Ontario's Highway 407 clear.

The Maryland Coordinated Highways Action Response Team (CHART) operates 43 emergency patrol vehicles. CHART estimates that 225-250 secondary crashes are prevented every year which reduces fuel costs by \$1 billion per year. Major incident duration has been cut by 40-50% in the past decade.<sup>13</sup>

## NEW APPROACHES TO INCIDENT INVESTIGATION AND CLEARANCE

Having the right equipment to manage and clear incidents can have major impact on congestion. Incident screens are a simple TIM tool being deployed in the United Kingdom. An **incident screen** blocks motorists' view of an accident thereby reducing “rubbernecking” which can slow traffic and cause accidents. The UK Highways Agency estimated the average economic benefit from using incident screens is \$300,000 per incident.<sup>14</sup>

<sup>10</sup> NACTO (2016)

<sup>11</sup> TIM does not include incident prevention, other than the prevention of “secondary” incidents that result from the disruption of the initial, primary incident. For instance, a variety of training, regulatory, infrastructure and vehicle improvements in recent years have made contributions to reducing incidents, and associated congestion. However, such preventative measures are not the subject of this briefing.

<sup>12</sup> Florida Department of Transportation (n.d.)

<sup>13</sup> Maryland Department of Highways (N.D.)

<sup>14</sup> Department for Transport (2013)

**Drones** are now being used by authorities to photograph incidents which can reduce road closure times by 30-45 minutes.

**Effective Coordination of Incident Response** among police, ambulance, and fire services as well as tow truck operators and other first responders can have a major impact on reducing congestion. Putting in place service standards and accountability measures will help in improving communications and coordination. For example, Florida's Rapid Scene Incident Clearance (RISC) program aims to clear highways even after major multi-vehicle accidents that block highways in 90 minutes or less.

## 4. RIDESHARING AND CARPOOLING

Despite the efforts of urban planners and policy makers, most commuters drive solo which increases congestion. Statistics Canada estimated that in 2011, 83% of those who drove to work were alone.<sup>15</sup> The benefits of increased carpooling and ridesharing are immense. In Toronto as an example, at present for every 100 vehicles on the road only eight are carrying a second person. If 12 more of these drivers carried a passenger, we would save \$750 million a year in operating and infrastructure costs.<sup>16</sup>

Ridesharing companies have been around for a long time, but technology has caused them to take off in recent years with the integration of mobile devices, their geolocation systems, and electronic payments. In Canada, the best-known brand is Uber; Lyft operates in Toronto and Ottawa, while TappCar operates in Edmonton and Calgary. Ridesharing complements and encourages transit use while also reducing the need for parking.<sup>17</sup>

Emerging technologies and changing preferences have the potential to generate a significant increase in carpooling rates. Autonomous vehicles, particularly if electric, have the potential to significantly reduce the economic and environmental cost of ridesharing and carpooling.

**Employer Carpool Programs.** While the ridesharing companies often garner significant attention, there are more traditional approaches that remain underexplored. A good example is employer carpool programs which have significant potential to relieve congestion at low cost.

**Smart Commute** is a program run by Metrolinx, the regional transit agencies, and governments in the Greater Toronto and Hamilton Areas. Smart Commute offers site tools to understand employee commute behaviour, customized action plans to encourage employees to explore smart travel options as well as exclusive carpool ride-matching programs and emergency ride home programs. In 2014, Smart Commute worked with 340 workplaces involving 730,000 commuters and generated an impressive \$6.00 in benefits for each dollar spent, significantly better than most transit expansion projects. Loblaw which moved its offices from Toronto to Brampton, collaborated with Smart Commute to create a successful carpool program. Within three years, Loblaw saw a 16% decrease in the share of staff driving alone and a 20% increase in carpooling.

<sup>15</sup> According to the 2011 National Household Survey. Journey to work data from the 2016 Census is scheduled to be released in November 2017 and was not available as of the date of writing.

<sup>16</sup> CPCS (2017).

<sup>17</sup> Hahn and Metcalfe (2017)

## 5. INVESTMENTS IN URBAN TRANSIT

Governments in Canada and worldwide are investing billions of dollars to build infrastructure and upgrade technology to improve traffic flow. These include large and costly new infrastructure projects, such as light rail, subway, commuter rail and bus rapid transit.

**Ridesharing Supplementing Transit-** One area where improvements can be made without massive investment is by integrating transit services with ridesharing where possible. With rapid advances in technology, ridesharing supplements and in some cases replaces traditional public transit services.

The Town of Innisfil, north of Toronto is a good Canadian example of successful integration of transit and ridesharing. The town has collaborated with Uber to provide on-demand ridesharing services, which subsidize flat rate fares from local transit hubs and the matching of riders heading the same direction to share vehicles.

Vanpools are relatively common in the United States. One example, Way to Go Vanpooling involves groups of 5 to 15 people who pay a monthly fare based on distance.

## 6. CONGESTION CHARGES

Congestion charges can be an effective way of changing behaviour to reduce congestion and pay for infrastructure. These include traditional tolls, cordon charges and mobility charges which are based on distance travelled. A mobility charge encourages drivers to use the shortest route to a destination.

In Vancouver, the Mobility Pricing Independent Commission is examining ways to improve how transportation is priced including use of roads and bridges. The goal is to manage congestion, promote fairness, and support investment in transportation infrastructure. The Commission is looking at options for mobility pricing which includes road usage charges, transit fares, and charges for services like taxis, bike sharing, and ride sharing.

London, UK implemented a cordon charge in 2003, covering 22 square km of central London. The current charge for driving a vehicle within the zone is £11.50 daily (\$20). Traffic levels have declined and transit use has increased since the scheme was implemented. Other jurisdictions including Stockholm, Singapore and Oregon have developed different models for mobility pricing to reduce bottlenecks.

## 7. CHANGING DRIVER BEHAVIOUR

There is no easy fix for congestion caused by poor driving behaviour, but we do know that motorists driving responsibly can save lives and ease bottlenecks. For example, there's a concept called the "zipper merge" which has been found in some jurisdictions to improve traffic flow. Motorists are encouraged to fill up the closing lane and merge by alternating with drivers in the through lane with the effect being like a zipper coming together.

Distracted driving caused by smart phone use also causes collisions and congestion and both legal sanctions and awareness campaigns are necessary to influence behaviour. Technology solutions can be employed to block motorists from using their phones while driving while in-vehicle technologies can also be improved to encourage smart driving behaviours.

## 8. ROAD INFRASTRUCTURE

The traditional solution to congestion is to build more infrastructure. However, as cities have grown, the amount of land available for roads and highways has dwindled. Some cities have chosen to build tunnels and elevated roadways, but these solutions come with big price tags and years of planning and construction. Nonetheless, sometimes building more infrastructure is the best option. Building more does not necessarily mean totally new roads or highways; instead it could include new highway interchanges, smaller upgrades or the widening of existing roadways.

Building smaller and lower cost projects makes more sense now than in the past. With the rapid pace of technological change, including the advent of automated and electric vehicles, predicting how much infrastructure will be required in the future has become more challenging. For this reason, big projects with long lead times are increasingly risky. Two types of infrastructure solution that stand out as generally underexplored in Canada are city-wide bottleneck removal programs and roundabouts.

Bottleneck programs target sections of highways, or busy intersections, that experience daily congestion due to inefficient road design, lane reductions, off-ramp overload and grade changes. Eliminating bottlenecks using auxiliary lanes, ramp metering and widening ramps has the ability to significantly reduce traffic delays at a much lower cost than building new road capacity. Minnesota's three most impactful projects saved drivers a cumulative 1.3 million hours due to reduction in traffic delays.<sup>18</sup> Washington converted a shoulder to a full-use lane for a limited distance to boost vehicle volume by 10%.<sup>19</sup>

Roundabouts are growing in popularity in Canada due to proven results: fewer collisions and improved traffic flow. But more intersections can be converted. Roundabouts slow vehicles, providing a safer environment, while the absence of stoplights shortens idling time and benefits left-turning vehicles. A study in the Northeastern United States found that roundabouts had reduced delays during peak times by a minimum of 83%, while congestion dropped by at least 58%.<sup>20</sup>

<sup>18</sup> Minnesota Department of Transportation (2007).

<sup>19</sup> Spiller (2017).

<sup>20</sup> Transportation Research Board (2006).