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Collective intelligence gridlock fight key

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Harnessing collective intelligence is one way to help mitigate traffic gridlock, points out a new report released by the **Residential and Civil Construction Alliance of Ontario** (RCCAO).

“Many organizations, no matter how agile they think they can be are never going to be as agile as the broader universe of people, let’s tap into that,” said RCCAO executive director Andy Manahan.

The report, “Congestion Management in the GTHA: Balancing the Inverted Pendulum” authored by a team from the University of Toronto’s Intelligent Transportation Systems Centre, led by its director professor Baher Abdulhai, makes a case for investing in technology to improve the capacity of existing and new infrastructure.

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“Let’s use what we have more effectively and let’s also start building more. We’re falling behind and the population keeps on growing and we can’t keep on going in that general direction without making the proper investments,” said Manahan.

The report looks at adopting open source innovation to harness collective intelligence. It studies connected vehicles, which establishes two-way communication with cars that can enable real-time transmission of various vehicle data to a central server.

While this could lead to a “tsunami” of data, report authors say the “fusion of sensory information offers improved accuracy and retains healthy redundancy in the system in a technology agnostic fashion.”

The report also explores intelligent transportation systems to maximize infrastructure efficiency. It notes that Toronto used to be on the leading edge in terms of traffic light signals, but has slipped behind the time.

The authors tested smart, self-learning traffic lights to cut down intersection delay and improve traffic flow on several simulated networks, including a fairly large simulation of the lower downtown Toronto network and two smaller networks in Burlington.

The daily economic benefits, such as travel time savings, were estimated to be around $53,000.

The report said that the latest generation, level 4, of the MARLIN-ATSC, developed at the University of Toronto, would cost about $1.2 million to implement across a network of 59 intersections with a payback period of 23 days.

Manahan noted that though this should be a “fairly easy sell” with municipalities, the direct benefit of traffic movement is toward the general economy, taxed by the federal and provincial government, and not as much by municipalities.

Report authors found that an optimized large-scale emergency evacuation could cut down evacuation time

by as much as 75 per cent.

The report says Optimal Spatio-Temporal Evacuation (OSTE) can be achieved through optimizing the evacuation scheduling and the destination choice simultaneously.

The authors tested the evacuation of the city of Toronto using rapid transit, shuttle buses and automobiles. It also presents a new transit module that provides an optimal scheduling and routing plan for transit vehicles.

When applying the multi-objective structure of the model to the city of Toronto, the OSTE clears the network four times faster than the do-nothing strategy, evacuees travel eight times less than in the do-nothing strategy, and evacuees stop 11 times less than in the do-nothing strategy; in which case the average automobile-based evacuation time across 1.22 million people is about two hours.

Furthermore, transit systems can substantially improve the evacuation process due to the readily available capacity of transit vehicles.

Manahan said emergency evacuation is something that rarely gets talked about in the public domain.

“It’s not something that RCCAO or other groups would necessarily normally get behind, but I think some of the things they’ve learned from modeling evacuation can be applied to other things about how you make sure traffic flows more efficiently in the city,” he said.

The report says to toll or not to toll is no longer the question.

“While transportation authorities and society at large would like to optimize travel and minimize overall cost of travel, travellers act very differently,” says the report.

“Travellers act independently and rationally, consulting only their self-interest, i.e. minimizing their direct cost while not paying attention to the societal cost and the detriment to others.”

Among its recommended congestion pricing policies, the report recommended a robust optimizer to determine the optimum toll schedules under mild or hyper-congested traffic to produce the minimum total travel delay and maximum social welfare.

The report says on average the optimal toll schedule would not change from day to day and travellers would adjust their chosen mode of transportation and departure time in a way that minimizes the total travel delay.

“Over time you would see differences in traffic flow to be able to optimize what that ideal price was at a certain time to minimize the standstill traffic that happens from time to time,” said Manahan.

“Most people are never going to be driving around thinking about that externality of how they impact other people by having their car on the road.”

Toronto is currently one of the top 10 most congested North American cities costing commuters $3.3 billion per year, which is expected to rise to $7.8 billion a year by 2031, according to the report.

“This, in fact, strengthens the need to explore, analyze, test, and deploy various traffic control policies, including dynamic pricing, in order to tackle the alarming congestion problems,” says the report.