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Toronto's Signal Optimisation Program (SOP)

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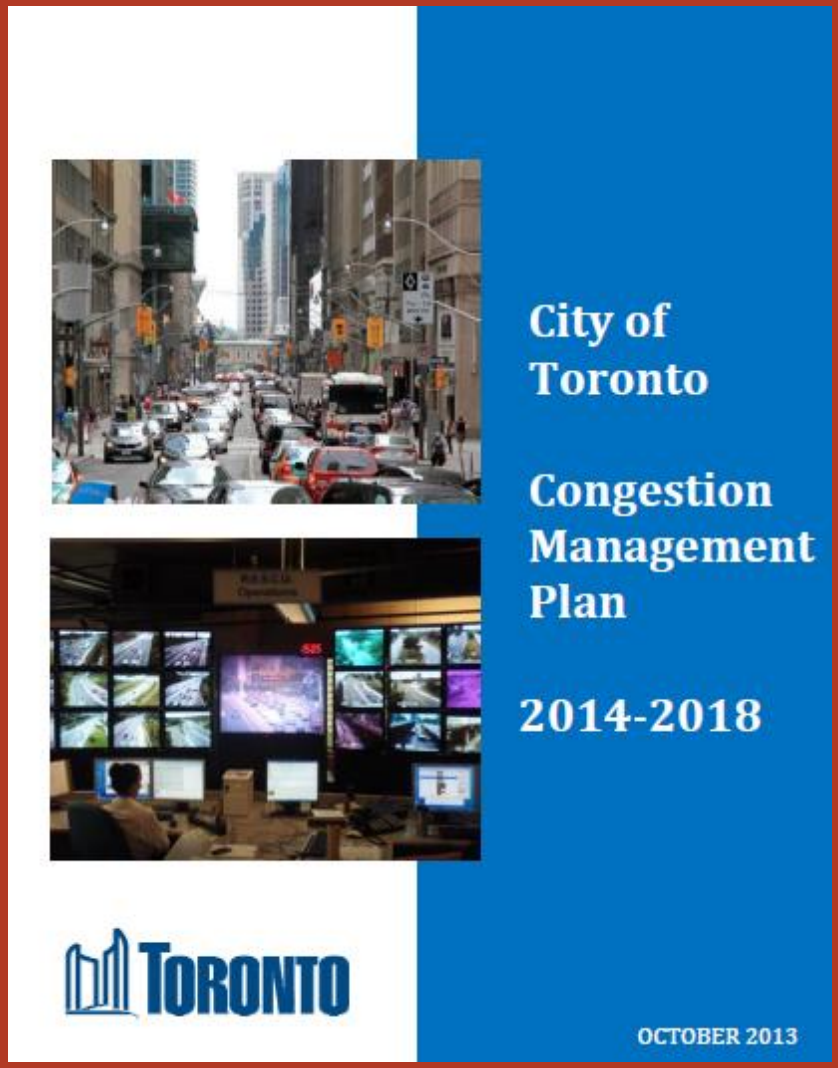
Introduction

The Signal Optimisation Program is a fundamental part of Toronto's Congestion Management Plan which mandates that the City's signal timing plans must be kept current and its traffic management strategies up-to-date.



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Scope of SOP

Make Toronto's traffic signals more efficient by:

- Improving signal communications
- Gathering up-to-date traffic data
- Repairing defective equipment
- Upgrading controllers and cabinets
- Installing warranted left turn phases
- Making timing adjustments
- Creating auxiliary timing plans.
- Creating special event plans

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Traffic Control Systems

2288 traffic signals – 2280 on four traffic control systems:

- TransCore TransSuite Traffic Control System (TCS) – 1714 signals
- Siemens SCOOT (Split Cycle Offset Optimization Technique) – 329 signals
- Main Traffic Signal System (MTSS) – 97 signals
- Econolite Aries – 8 signals

The current SOP is focused on the TransSuite and MTSS signals.

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Objectives

- To reduce:
  - Stops (#)
  - Travel time (hr)
  - Delay (hr)
  - Fuel consumption (l)
  - Emissions (kg)
- Optimise traffic signal operations using:
  - Synchro v7
  - SimTraffic

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Challenges

- Reliable communication
- Staff resources
- Central software (MTSS) issues
- Damage to inductive loop detection
- Aging field equipment
- Curb-lane parking
- Lane reductions due to road construction, development, filming and special events
- Unconditional transit signal priority (TSP)
- Two way roadways with balanced traffic flows

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Solutions

- Cellular wireless communication
- Hiring consultants
- Non-intrusive detection
- Controller/cabinet replacement program
- MTSS replacement by TransSuite TCS
- Extend no-parking periods
- Lane rental charges that reflect actual cost
- Review TSP
- Provide better one-way green band if two-way green band is not achievable

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Signal Timing Policy

Need to develop a signal timing policy that provides guidance on signal coordination

- *Peak Period Guidelines*
  - Consistent cycle lengths between all signals
  - Operate larger control areas
  - Operate minor intersections at long cycle lengths
  - Feasibility of gating
- *Off-Peak Period Guidelines*
  - Operate major intn signals with different cycle lengths
  - Coordinate fixed and semi-actuated signals that are spaced less than 150 m apart
  - Double cycle between major and minor signals
  - Aim to equitably serve land uses

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Request for Proposals

- City staff:
  - Determine the routes to be coordinated
  - Develop a Request for Proposal (RFP)
- Consultants are evaluated in a two stage process:
  - First: technical component (70%)
  - Second: cost component (30%)
  - Consultant must score 55% of 70% in first stage to be considered for stage 2.

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Study Tasks

- *Data collection* – counts, geometry, concerns, MOC assessment, hardware assessment, existing control area
- *Coordination with stakeholders* – construction, special events, district offices
- *Base traffic model development* – Synchro/Simtraffic , travel time study, site observations, calibration
- *Analysis of alternatives* - Synchro/Simtraffic, options and MOE's, preferred option
- *Implementation* – timing changes, phase changes, travel time study study supplemented by Bluetooth data.
- *Reporting* – biweekly, monthly, interim, final

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Completed Studies

Year	2012	2013	2014	2012-2014
Signalised Intersections	112	245	224	581
Annual benefit	$11,952,943	$21,044,820	$16,823,880	$49,821,643
3-year Life Cycle Benefit	$35,858,829	$63,134,460	$50,471,640	$149,464,929
Cost	$392,000	$811,800	$803,729	$2,007,529
Cost per Intersection	$3,500	$3,500	$3,688	$3,455.30
Benefit/cost Ratio	91:1	71:1	63:1	**74:1**

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Benefits (2012 – 2014)

MOE	Comparison			
	Before	After	Difference	% Difference
Total Delay (hr)	9,935,000	8,740,000	-1,195,000	**- 12%**
Stops (#)	1,300,289,000	1,163,751,500	-136,537,500	**- 10.5%**
Average Speed (km/h)	28.95	30.39	1.44	**+ 5%**
Total Travel Time (hr)	42,148,500	40,333,000	-1,815,500	**- 4.3%**
Fuel Consumed (l)	155,960,500	148,035,500	-7,925,000	**- 5.1%**
Emissions (kg)	3,658,170	3,467,895	-190,275	**- 5.2%**

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Current Work (2015)

- Seven bids received for RFP (313 signals)
- Two consultants retained:

  - HDR Corporation (161signals on Bathurst St, Lake Shore Blvd E, Woodbine Ave, Kipling Ave and Steeles Ave)

  - IBI Group (152 signals on McCowan Rd, Dundas St, Danforth Ave and Warden Ave)
- Contract values: HDR: $633k, IBI: $698k
- Scope includes TSP evaluation using Aimsun for Bathurst St (bus) and Dundas St (streetcar); Bluetooth travel time comparisons on Warden Ave and Kipling Ave

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Current Work (2015)

- Average consultant cost per intersection is $4,253 (excluding City staff costs).
- City staff providing supervision of consultants – 1 Project Lead (full time), 1 Engineer (part time), 7 Engineering Technologists (part time)
- Three routes to be done by City staff – 30 signals on Steeles Ave E, Wellington St, Front St

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Future Work

- 351 signals in 2016 for a total of 1275 over the five year period, 2012 – 2016.
- Expect to complete all major arterials by 2017
- Continue to use consultants aiming for a 2/3 (consultant) 1/3 (City staff) split by 2017
- Undertake coordination studies for
  - Major arterials on a five-year cycle
  - Minor arterials and collectors on a ten-year cycle

More Information

- City of Toronto website (www.toronto.ca) - search for “Signal Optimisation (Coordination)”

http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=0c9d9325bd1ec410VgnVCM10000071d60f89RCRD&vgnextchannel=9452722c231ec410VgnVCM10000071d60f89RCRD

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QUESTIONS