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.
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
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.
Objectives

• To reduce:
  – Stops (#)
  – Travel time (hr)
  – Delay (hr)
  – Fuel consumption (l)
  – Emissions (kg)

• Optimise traffic signal operations using:
  – Synchro v7
  – SimTraffic
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
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
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
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.
**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
## Completed Studies

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

<table>
<thead>
<tr>
<th>MOE</th>
<th>Before</th>
<th>After</th>
<th>Difference</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Delay (hr)</td>
<td>9,935,000</td>
<td>8,740,000</td>
<td>-1,195,000</td>
<td>-12%</td>
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<tr>
<td>Stops (#)</td>
<td>1,300,289,000</td>
<td>1,163,751,500</td>
<td>-136,537,500</td>
<td>-10.5%</td>
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<tr>
<td>Average Speed (km/h)</td>
<td>28.95</td>
<td>30.39</td>
<td>1.44</td>
<td>+5%</td>
</tr>
<tr>
<td>Total Travel Time (hr)</td>
<td>42,148,500</td>
<td>40,333,000</td>
<td>-1,815,500</td>
<td>-4.3%</td>
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<tr>
<td>Fuel Consumed (l)</td>
<td>155,960,500</td>
<td>148,035,500</td>
<td>-7,925,000</td>
<td>-5.1%</td>
</tr>
<tr>
<td>Emissions (kg)</td>
<td>3,658,170</td>
<td>3,467,895</td>
<td>-190,275</td>
<td>-5.2%</td>
</tr>
</tbody>
</table>
Current Work (2015)

• Seven bids received for RFP (313 signals)
• Two consultants retained:
  - HDR Corporation (161 signals 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
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
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