ATMS Project Background

• Increasing traffic volumes
  – Roadway network is near capacity, and in some areas, at capacity during am/pm peak periods.

• Increased urbanization

• Other transportation agencies
  – Need to integrate our efforts with Region of Peel/MTO who are also stakeholders in the transportation network.
ATMS Project Background

• Public expectations
  – The public expects the City to provide an efficient transportation network, to be able to respond to issues, and to provide timely/accurate information.
ATMS Project Background

• Operational needs
  – The existing Traffic Control System is at the end of its life cycle and needs replacement.
  – There is a need to upgrade to a more robust traffic signal communication.
  – A Traffic Management Centre is needed to provide staff with the workspace/resources to pro-actively manage traffic.
ATMS Project Background

• The Advanced Transportation Management System (ATMS) Project provides a means to meet our operational needs and the expectations of the public.
ATMS Project Vision

• To move from “passive” to “active” management.
ATMS Project Goals

- Maximize the available capacity of the roadway network
- Minimize the impact of roadway incidents to users
- Pro-actively manage traffic
- Assist in the provision of emergency services
- Create and maintain public confidence in traffic management
A well designed ATMS will make it possible to:

- Monitor travel conditions
- Influence the operation of traffic signals
- Disseminate information
- Interact with other transportation modes and agencies
ATMS Project Components

The following components are in various stages:
1. Build a Traffic Management Centre (TMC)
2. Upgrade traffic signal communications
3. Replace the traffic control system
4. Implement Intelligent Transportation Systems (ITS)
5. Explore future ATMS initiatives
1. **Traffic Management Centre (TMC)**

- The design and construction of a physical central space where traffic staff can monitor and respond to traffic.
- This component of the project is substantially complete.
1. Traffic Management Centre
2. Traffic Signal Communications

- Leverage the City’s Ethernet IP Network
  - Hybrid of wired fibre, Wi-Fi and cellular
- 120 traffic signals have migrated to the new communication network
- Remaining signals to be completed by the end of 2018
Public Sector Network (PSN)
What's at an intersection?

Intersection of Burnhamthorpe Rd & Central Parkway
Typical Fibre & Wireless Communication Scenario at an intersection
The “IT Cabinet” connects the devices at the intersection to the City’s fibre network.
What's up on the pole?

Traffic Cameras & Wireless Access Points
It starts with fibre nodes ...
Then we add WIFI access points ...
Finally, we spread the coverage ...

(which enables the Internet of Things (IoT))

Any network-connected device can be added in the future.
3. Traffic Control System Replacement

- Replace Traffic Control System
- Replace Traffic Signal Controllers in the field
3. Traffic Control System Replacement

Objectives:

- Accommodate future modules and technology advancements (ex. traveler information)
- Ability to share information with the Region of Peel, MTO and neighbouring municipalities
- Ability to integrate with Transit and Fire (ex. traffic signal priority)
- Use the City’s network to communicate to Traffic Signal Controllers and other devices (ex. traffic cameras)
- Pro-actively manage traffic signals
3. Traffic Control System Replacement

Step 1: Install new system

Parsons iNet System Selected
Installed on City Servers
Tested against an approved Acceptance Plan
Tested on 10 bench controllers (3 ATC CU’s)
Documentation and training
3. Traffic Control System Replacement

Step 2: Proof of Concept

- Deploy to 30 Intersections in the field
- Operate the System as Normal
- Document Performance
- Report Anomalies
- Establish / Re-create Processes
- Select the System Controller Unit (Timer)
3. Traffic Control System Replacement

Step 3: Full Deployment

- Establish the process (760 intersections to deploy)
- Flowchart (story board)
- Group together “tasks” from the flowchart
- Establish Realistic Timelines for Each Task
- Divide Related Tasks into Realistic Time Blocks
- Established a 6 Week Deployment Cycle
- Capable of Deploying 10 Intersections per Week
3. Traffic Control System Replacement

Step 3: Full Deployment

Establish the process (760 intersections to deploy)

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Traffic Control System Replacement

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- Flowchart (storyboard)
- Group together “tasks” from the flowchart
- Establish realistic timelines for each task
- Divide related tasks into realistic time blocks

Established a 6 Week deployment cycle

Capable of deploying 10 Intersections per week

iNet Full Rollout Process
<table>
<thead>
<tr>
<th>CU Delivery Date</th>
<th>Deployment</th>
<th>Feb. 9, 2017</th>
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<tbody>
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<td>02-Oct</td>
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**Notes:**
- Christmas Week
- 1) Cawthra Rd. @ South Service Rd.
- 2) Cawthra Rd. @ QEW E/B Off Ramp (South Terminal)
- 3) Cawthra Rd. @ QEW W/B Off Ramp (North Terminal)
- 4) Cawthra Rd. @ North Service Rd.
- 5) South Service Rd. @ Ogden Ave.
- 6) South Service Rd. @ Hagar Blvd. / Dixie Mall Access
- 7) South Service Rd. @ Dixie Mall Access
- 8) North Service Rd. @ Stanley Dr. / Mall Access
- 9) Dixie Rd. @ Rometown Dr. / Mall Access
- 10) Dixie Rd. @ South Service Rd.
<table>
<thead>
<tr>
<th>Weekly Activities</th>
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<tr>
<td>Publish</td>
<td>Send notification e-mail</td>
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<td><strong>Week One</strong></td>
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<tr>
<td>Collect Intersection Data</td>
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<tr>
<td>Send Intersection Data to Parsons</td>
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<tr>
<td>Detail Communication Requirements to IT</td>
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<td><strong>Week Two</strong></td>
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<tr>
<td>Parsons builds Database</td>
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<tr>
<td>Prepare CU Field Installation Checklist</td>
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<tr>
<td><strong>Week Three</strong></td>
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<tr>
<td>Receive DB from Parsons</td>
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<tr>
<td>Receive Cell Modems</td>
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<td>CU Burn in</td>
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<td><strong>Week Four</strong></td>
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<td>Bench Test CU</td>
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<td>Collect Required Field Equipment</td>
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<td><strong>Week Five</strong></td>
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<td>Complete Pre CU Installation</td>
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<td>Define Intersection on iNET</td>
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<td><strong>Week Six</strong></td>
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<tr>
<td>Complete CU Field Installation</td>
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<td>Complete Central Confirmation</td>
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<tr>
<td>CU Delivery</td>
<td>Date</td>
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<td>5 CU's arr</td>
<td>14-Nov wk1</td>
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<td>21-Nov wk2</td>
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<td>28-Nov wk3</td>
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<td>05-Dec wk4</td>
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<td>70 CU's arr</td>
<td>19-Dec wk6</td>
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<td>23-Jan wk11</td>
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<td>30-Jan wk12</td>
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<tr>
<td>75 CU's arr</td>
<td><strong>06-Feb wk5</strong></td>
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<td>13-Feb wk6</td>
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<td>20-Feb wk7</td>
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<td>27-Feb wk8</td>
</tr>
<tr>
<td>75 CU's arr</td>
<td>06-Mar wk9</td>
</tr>
</tbody>
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**Christmas Week**

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9) Dixie Rd. @ Rometown Dr. / Mall Access
10) Dixie Rd. @ South Service Rd.
4. Intelligent Transportation Systems (ITS)

- ITS involves the use of smart technologies.
- Currently, 38 traffic monitoring cameras set-up along high profile corridors.
  - Target: 150 cameras throughout the City in the long term
- Piloting new detection technology (i.e. Radar) to detect vehicles, bicycles and pedestrians.
4. Intelligent Transportation Systems

- ATMS Demonstration to take place along Dundas Street (Ninth Line to Mississauga Road)
- Test and evaluate different traffic management technologies (ex. adaptive traffic control, incident management, traveller information)
- Targeted to start in 2017
WP#4 OVERVIEW

- Intelligent Traffic Responsive Control of 13 Intersections
- Adaptive Signal Control of 13 Intersections
- VISSIM Micro-simulation Model of Corridor (3 Time Periods)
- Travel Time:
  - Travel Time Detection with Bluetooth Readers
  - Display of Travel Times on Trail Blazer Signs
WP#4 OVERVIEW

• Arterial VMS (Optional)

• iNET Incident Management Module
  ▪ Enter and Track Events
  ▪ Provide Selection of Timing Plan Patterns

• Integration with 5 City CCTV Traffic Cameras

• Integration with MTO COMPASS Video Feed and Event Feed
Intelligent Traffic Responsive Control (iRC)

- Monitors Historical and Current Traffic Flow Characteristics, and Identifies Unusual Traffic Congestion

- During “Normal” Recurrent Traffic Conditions:
  - Implements Scheduled Time Based Operations (TBC)

- During Non-recurrent Traffic Congestion Conditions:
  - Implements Suitable Timing Plan

- Timing Plans Selections include:
  - No Plan (TBC)
  - Inbound Plan (AM Peak)
  - Outbound Plan (PM Peak)
  - Balanced Congestion Plan
  - Event Plan

- Polls Detector Data on Periodic Intervals, Processes, and Compares to Historical Data (e.g., every 5 min)
iRC – Detector Requirements

• Required Data: Volume and Occupancy
  ▪ Data used to Identify Historical and Current Traffic Flow Characteristics
    ▪ e.g., Inbound, Outbound, Balanced

• Locations: Mid-block or Link Entry
  ▪ Located Upstream of where Recurrent Queues Typically Extend
  ▪ Corridor Entry Locations
  ▪ Downstream of Major Traffic Sources / Major Intersections
iRC – Detector Requirements
Adaptive Signal Control (ASC)

• Cycle-by-cycle Traffic Measurements & Signal Timing Updates
  ▪ Designed Based on Predicting Traffic Trend

• Modifies Current Timing Plan CSO Values
  ▪ Controllers Still Operate with Existing Local VA

• Once per Cycle, iNET/ASC:
  ▪ Uploads Traffic Volumes per Movement per Phase for Past Cycle
Adaptive Signal Control (ASC)

• In Current Cycle, Central Algorithms:
  ▪ Calculate Sat. Flows per Lane for Past Cycle (Stop Line Detectors)
  ▪ Predict Traffic Volumes for Next Cycle
  ▪ Optimize & Download Cycle, Splits and Offsets for Next Cycle
  ▪ Download Small Increment Changes to CSOs

• Controller Implements Updated CSOs at Top of Next Cycle
ASC – Detector Requirements

• Locations: Stop Line
  ▪ Data primarily used to Optimize Cycle Lengths & Green Splits
  ▪ Major Multi-phase Intersections
    ▪ Measure Left and Thru Movements

• Locations: Link Entry
  ▪ Data primarily used to Improve Downstream Traffic Predictions
  ▪ Corridor Entry Locations
  ▪ Upstream of Major Intersections
    ▪ Measure Demand to Major Intersection

• No Detectors at Very Minor Intersections
ASC – Detector Requirements
Available Detector Technologies

- **MS Sedco Radar Detectors**
  - Tracking Radar (Range of 150 m)
  - 4 Detector Inputs per Unit

- **Reno S1201 4-Channel Detector Cards**
  - Works with Existing Presence Detection Loops to Provide:
    - Vehicle Presence
    - Vehicle Stop Line Counts

- **Existing System Detectors (Pulse Loops)**
Proposed Detector Technology Strategy

- MS Sedco Radar Detectors
  - All Mainline Stop Line Locations
  - All Mainline Link Entry Locations

- Reno S1201 4-Channel Detector Cards
  - All Sidestreet Stop Line Locations

- Won’t be using Existing System Detectors for Control
  - Dundas @ Ridgeway/Winston Park – EBL & WBL (MS Sedco)
  - Dundas @ Mississauga – EB & WB, East of Intersection (Too Close)
  - Dundas @ Hampshire Gate – EBL, WBL and NB (MS Sedco & Reno)
Travel Time Subsystem

- Provides Motorists with Current Travel Times along Dundas Street West Corridor

- TPANA Travel Time Service
  - Collects and Processes Measured Travel Times
  - Provides Travel Time Estimates every 1 Minute
Travel Time Subsystem

• iNET ATMS
  ▪ Integrated with TPANA
  ▪ Displays Current Travel Times on Dynamic Signs

• Field Equipment
  ▪ Bluetooth Readers
  ▪ Trail Blazer Signs
  ▪ Arterial VMS (Optional)
Travel Time Subsystem

Travel Time to
Winston Churchill Blvd 03 min
Erin Mills Pkwy 07 min
Mississauga Rd. 11 min

Travel Time to
Erin Mills Pkwy 03 min
Winston Churchill Blvd 07 min
Hwy 403 11 min
Travel Time – Equipment Locations

• Locate BT Readers at Major Signalized Intersections
  ▪ Provides Precise Travel Time(s) to Destination(s)
  ▪ Pick up Traffic Entering Corridor
  ▪ Easier Access to Power and Communications (at Controller)

• Locate Trail Blazer Signs in Advance of Alternate Route (Decision Point) so that Drivers have Option take Alternate Route
  ▪ At Signalized Intersection Upstream of Major Arterial Street
    ▪ Easier Access to Power and Communications (at Controller)
  ▪ Traffic Signal Pole (Downstream Side of Intersection)
Travel Time – Equipment Locations
Arterial VMS (Optional)

• Full Matrix Dynamic Message Sign

• On Dundas St Upstream of Ninth Line & Hwy 403
  ▪ Provides adequate reaction time for drivers to read the message and react before they reach the downstream diversion decision point

• Typical Messages:
  ▪ Travel Time – Eastbound on Dundas St W
  ▪ Incident – on Dundas St W or Hwy 403
# Arterial VMS – Sample Messages

<table>
<thead>
<tr>
<th>EVENT</th>
<th>MESSAGE CAPTION</th>
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<tbody>
<tr>
<td>Travel Time</td>
<td>TRAVEL TIME TO MISSISSAUGA RD 6 MIN</td>
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<tr>
<td>Incident along Dundas St</td>
<td>1 LEFT LANE BLOCKED AT WCB</td>
</tr>
<tr>
<td>Traffic Congestion on Hwy 403</td>
<td>HWY 403 NB SLOW TO HWY 407</td>
</tr>
</tbody>
</table>

Min 8” Character Height for Typical Approach Speed
Proposed Arterial VMS Location

Proposed PVMS Distance from Downstream Intersection: 330 m

VMS Legibility Distance: 80 m

Posted Road Speed: 60 km/h
5. Future ATMS Initiatives

- Awareness of future smart technologies to ensure that our Traffic Control System has the ability to incorporate these and other advancements.
- Subject to the business planning process.
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<td>Traffic Signal Control Replacement</td>
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Questions