Great Lakes and St Lawrence Cities Initiative
Alliance des villes des Grands Lacs et du Saint-Laurent

Municipal Adaptation and Resiliency Service (MARS)

WEBINAR 4

MUNCIPAL TRANSPORTATION INFRASTRUCTURE

OCCIAR
Ontario Centre for Climate Impacts and Adaptation Resources

Clean Air Partnership

MARS TRAINING SERIES OVERVIEW

- 9 webinars
- Webinar 1: *Introduction to Municipal Climate Adaptation and Climate Projections for Great Lakes Region*
- Webinar 2: *Portal tour*
- Webinar 3: *Financial and Legal Implications of Climate Change for Municipalities*
- Webinar recordings stored on MARS Community of Practice (CoP) Portal: https://www.ccadaptation.ca/en/mars

SECTOR SPECIFIC WEBINARS (4-8) OVERVIEW

- Webinar 5 – Building Infrastructure and land use planning, ***February 27th***
  Guest Speakers: Brian Kyle, PIEVC
  Barb Hodgins, Town of Ajax

- Webinar 6 – Vulnerable Populations, **March 6th**
  Guest Speaker: Karina Richters, City of Windsor

- Webinar 7 – Urban Natural Systems, **March 20th**
  Guest Speaker: TBD

- Webinar 8 – Water / waste water / storm water, **March 27th**
  Guest Speaker: John Nemeth, Region of Peel

- Webinar 9- (Not sector specific), Communication and Collaboration, **April 10th**

WEBINAR 4 OVERVIEW

1. MARS Training Series Overview

2. Municipal transportation infrastructure in a changing climate

3. Recent municipal efforts to adapt transportation infrastructure to a changing climate in Canada

4. Road infrastructure climate vulnerability assessment: City of Toronto

   David Macleod, Senior Environmental Specialist at the City of Toronto Environmental Office

   Vesna Stevanovic-Briatico**,** Transportation Coordinator, City of Toronto Transportation Services Division

5. Resources

2 MUNICIPAL TRANSPORTATION INFRASTRUCTURE IN A CHANGING CLIMATE

MUNICIPAL INFRASTRUCTURE IN A CHANGING CLIMATE

- Exposure to weather extremes not accounted for in original design; construction occurred on assumption that past climate extremes will represent future conditions
- Shorter life span and reduced performance
- Increase in maintenance and operating costs
- Disruption to municipal operations and public safety compromised
- Severe and unanticipated economic losses because of damaged or overwhelmed infrastructure
- Climate related risks further aggravated by:
  - -Aged infrastructure that has exceeded normal service life
  - -Frequent co-location and interdependency
  - -Decline in public spending
  - -Ballooning populations

ACCELERATED FREEZE THAW CYCLES

Greater instability among paved structures, particularly:

- Ditches
- Culverts
- Drains
- Ramps
- Bridges
- Tunnels

Increase in the frequency and intensity of :

- Bleeding
- Cracking
- Rutting

SNOW & ICE VARIABILITY

Increase in frequency and severity of:

- Freezing rain
- Rain on snow events

Resulting issues:

- Winter road maintenance
- Road safety
- Increase in de-icing costs
- Salt corrosion to bridges
- Salt degradation to natural environment

HOTTER & DRIER SUMMERS

Increase in frequency and severity of:

- Pavement softening
- Pavement distortion in wheel paths
- Reduced maximum loads among transport vehicles on paved surfaces

- Traffic related rutting, flushing or bleeding to old or poorly constructed paved surfaces
- Reduced ride quality and performance, increase in maintenance costs
- Reduced lifecycle among roads, rail, bridges and culverts

EXTREME RAIN & FLOODING EVENTS

Increase in frequency and intensity of:

- Drainage issues and erosion to road and bridge structures
- Collapsed culverts
- Wash out/ inundation of causeways, bridges and low-lying roads
- Pavement and bridge joint expansion
- Asphalt softening
- Soil moisture generating; unstable slopes, landslides; causing road and bridge damage, service disruption
- Integrity of bridge structures compromised by high winds and high channel flow

LOWER GREAT LAKES LEVELS

- Increased evaporation of surface waters in Great Lakes due to higher temps
- Limits to the amounts cargo vessels can carry
- Cost intensive dredging required in order to deepen harbors for commercial shipping- treatment costs and environmental risks related to contaminated materials brought up during dredging
- More frequent adjustment of docks and water intake pipes
- Estimated $7.9 million spent by Georgian Bay municipalities in 2013 in response to low water levels

1994

2013

FINANCIAL IMPLICATIONS FOR TRANSPORTATION INFRASTRUCTURE

- Costs related to premature replacement of deteriorated transportation infrastructure
- Increased in maintenance and operating costs
- Expenditures during & after weather emergencies ; repair to weather-related damage
- Increased insurance costs
- Loss of taxes, incomes due to business disruptions and decreased tourism revenues
- Lawsuits due to transportation and safety issues

3 RECENT CLIMATE CHANGE ADAPTATION IN MUNICIPAL TRANSPORTATION INFRASTRUCTURE

GENERAL RULES FOR ADAPTING TRANSPORTATION SYSTEMS

- identify the critical components of the transport system potentially at risk

- monitor the changing climate conditions and relevant impacts on the transport system

- set out how operating and maintenance practices need to change to take account of these risks and changing conditions

- identify how standard design and procedures need to change; and

- relocate vulnerable infrastructure

GIULIANI v. HALTON

- April 1, 2003 at approximately 7:00 a.m. Giuliani was travelling on Derry Road when she lost control of her vehicle on the icy roadway and travelled into the oncoming lane where a head-on collision occurred with another vehicle

- In the three hours prior 2cm of snow had fallen

- Municipality WAS in full compliance with Minimum Maintenance Standards (2002) as they relate to snow accumulation and icy roadways, this formed the basis of their defense

GIULIANI v. HALTON

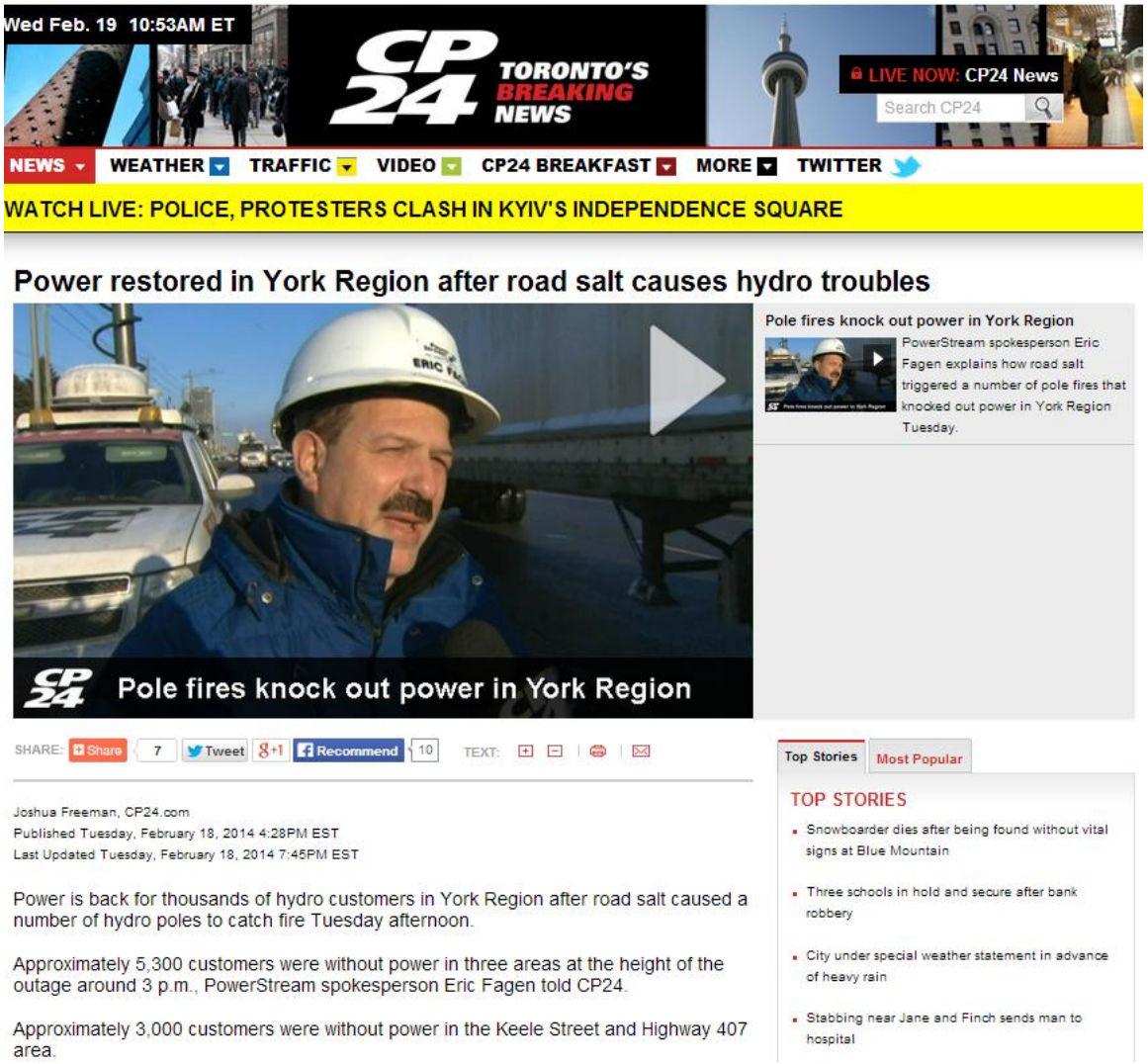
- The municipality had four hours to treat an icy roadway after becoming aware that the road was icy

- Failing to monitor the road conditions appropriately meant that de-icing did not commence until 7:15am, within four hours of becoming aware that the road was ice

- The minimum maintenance standard only addressed the requirement to deploy resources once the municipality had knowledge that a roadway was icy, not by knowledge that it *may* or *would* become icy

- Appeal Judges reaffirmed Trial Judge's finding that failure to monitor was key here, not failure to treat the roadway

++NaCl = ++Problems



Wed Feb. 19 10:53AM ET

CP24 TORONTO'S BREAKING NEWS

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WATCH LIVE: POLICE, PROTESTERS CLASH IN KYIV'S INDEPENDENCE SQUARE

Power restored in York Region after road salt causes hydro troubles

Pole fires knock out power in York Region

Pole fires knock out power in York Region

PowerStream spokesperson Eric Fagen explains how road salt triggered a number of pole fires that knocked out power in York Region Tuesday.

SHARE: Share 7 Tweet +1 Recommend 10 TEXT:

Joshua Freeman, CP24.com
Published Tuesday, February 18, 2014 4:28PM EST
Last Updated Tuesday, February 18, 2014 7:45PM EST

Power is back for thousands of hydro customers in York Region after road salt caused a number of hydro poles to catch fire Tuesday afternoon.

Approximately 5,300 customers were without power in three areas at the height of the outage around 3 p.m., PowerStream spokesperson Eric Fagen told CP24.

Approximately 3,000 customers were without power in the Keele Street and Highway 407 area.

Top Stories | Most Popular

TOP STORIES

- Snowboarder dies after being found without vital signs at Blue Mountain
- Three schools in hold and secure after bank robbery
- City under special weather statement in advance of heavy rain
- Stabbing near Jane and Finch sends man to hospital

YORK REGION

Issues:

- Increase in population, vehicle use and road usage
- Increase in road widening, resulting in lack of space to store snow
- Increasing weather variability and extreme weather, particularly; freezing rain, freeze/ thaw and extreme cold
- Increase in road salting, risks to environment and watershed

Adaptation Measure: Salt Management Plan

- Pre treated Rock Salt
- Road Weather Information System (RWIS)
- Vehicle global positioning system (GPS)

KINGSTON

Issues:

- Aging road surfaces and increase in weather variability
- Increase in the incidences of large potholes, pavement surface cracks
- Increase in traffic jams due to road maintenance
- Soaring road maintenance costs

Adaptation Measure: Academic Partnership & New Road Construction Standards

- Scientific testing and support by Queen's University Chemical Engineering Dept.
- Mandatory new standards in asphalt used in arterial and collector road construction and repaving
- Use of asphalt free of cheap and harmful additives and modifiers

SUDBURY

Issue:

- Potential impact of climate change on performance of road and associated structures was unknown

Adaptation Measure: PIEVC Engineering Assessment of Sudbury's road and associated structures

Vulnerabilities	
Climate Effect	*Infrastructure Component*
Increased frequency of high intensity rain	Washouts & damage of gravel road surfaces Surcharging / flooding of drainage systems
Rising temperatures (extreme / sustained summer)	Softening of asphalt road surfaces
Ice accretion	Functionality, operations, safety
Increased intensity / volume of rain > ground water table rise	Embankment failure; slope stability

Recommendations

- Review / revise design standards for drainage infrastructure
- Review / revise maintenance procedures for roads / sidewalks
- Improve materials / modify mix designs (asphalt, high temperature conditions)
- Perform sensitivity analyses

SUDBURY (cont'd)

Assessment resulted in 104 recommendations, top 5 recommendations were:

1. Develop a database with hydraulic information for all culverts

2. Perform a capacity evaluation of minor and major drainage systems

3. Perform impact assessments on functionality and environmental effects of increased rainfall intensity and frequency on gravel surfaced roads

4. Perform a risk and criticality assessment of the roads and associated infrastructures, design standards, and operations and maintenance procedures that could be impacted by ice accretion and ice storms

5. Evaluate the possibility of changing the asphalt mixes to accommodate higher temperatures. Alternatively, consider the use of trees to provide shade on low-speed roads to reduce the urban heat island effects

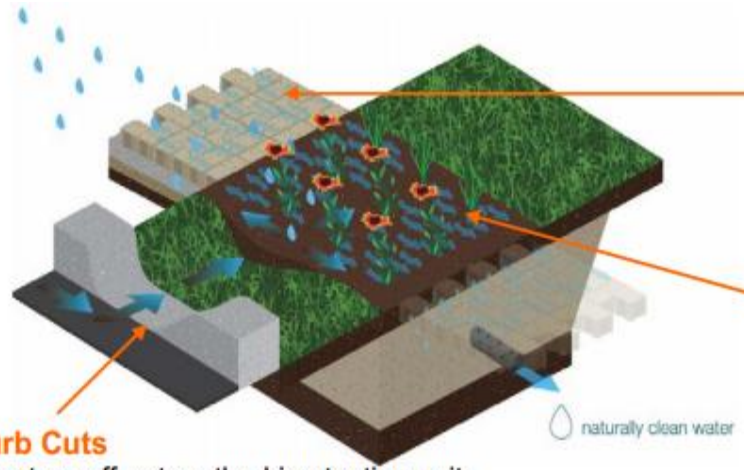
http://www.pievc.ca/e/casedocs/sudbury-roads/PIEVC%20Case%20Study%20Summary_City%20of%20Greater%20Sudbury.pdf

PEEL REGION

Issue:

- Rainfall and runoff management

Adaptation Measure: LID Road retrofits



Curb Cuts
Street runoff enters the bioretention units through the curb cuts.

Permeable Pavers
An alternative to traditional asphalt this LID allows rainfall and road runoff to be filtered as it flows through the pavers and returns to the ground.

Boulevard Bioretention Units
The bioretention units located in the boulevard absorb and filter rainfall and road runoff as the water flows through the plants and soils and back into the ground.

ACTIVE TRANSPORTATION

- Growing area all over Ontario
- Both a mitigation and adaptation response
- Can result in reduced infrastructure costs
- Can help achieve emission reduction targets
- Reduced health care costs
- Complete streets policies lead to more aesthetically pleasing streetscapes
- More efficient land use
- Local economic development benefits

4 Beyond the Storm: Risk-Based Process and Tool to Enable Better Understanding and Management of Climate Change Risk

David MacLeod, Senior Environmental Specialist, City of Toronto
Vesna Stevanovic-Briatico, Transportation Coordinator, City of Toronto

PORTAL ACTIVITY

Has your municipality experienced shortfalls in winter maintenance budgets due to this winter's escalated snow removal and de-icing costs?

Has your municipality considered active transportation as a transportation adaptation measure? How is active transportation being implemented in your jurisdiction?

Would the Deloitte Departmental Risk Assessment Tool be a viable risk assessment option in your municipality? Is there any potential for a consortium of GLSCI members to run the tool on different departments and share results?

5 RESOURCES

- FCM/ CSA Infrastructure Adaptation Training:
  http://shop.csa.ca/en/canada/infrastructure-solutions/adapting-your-infrastructure-to-climate-change/invt/2703207wt/&bklist=icat,4,shop,training,infrastructuretrain

- IISD Literature Review on Climate Adaptation and Canadian Infrastructure:
  http://www.iisd.org/publications/pub.aspx?pno=2854

- City of Toronto Vulnerability Assessment Info &
  RFP for project
  http://www.merx.com/English/SUPPLIER_Menu.asp?WCE=Show&TAB=1&PORTAL=MERX&State=7&id=183752&print=Y&src=osr&ForceLID=&HID=&hcode=psexcgqiP32jggDNO6ttqA%3D%3D

- York Region De-Icing Strategies
  http://www.cleanairpartnership.org/files/2%20Case%20Study.pdf

5 RESOURCES

- Road Construction Standards in Kingston:
  http://www.thestar.com/news/gta/transportation/2014/01/15/potholefree_roads_yes_its_possible_with_better_asphalt_says_queens_university_professor.html

  http://www.cbc.ca/news/canada/ottawa/kingston-asphalt-program-takes-aim-at-potholes-1.2505845

- Case Study of PIEVC Road Infrastructure Assessment in City of Sudbury:
  http://www.pievc.ca/e/doc_list.cfm?dsid=3

- LID road retrofits in Peel Region
  http://www.creditvalleyca.ca/low-impact-development/showcasing-water-innovation-2/road-right-of-ways/

- Case study of Prince George
  http://princegeorge.ca/environment/climatechange/adaptation/Documents/2012_PGRAC_Transport_volume%20with%20Exec%20Sum.pdf

NEXT TRAINING WEBINAR

Webinar 5

Municipal Building Infrastructure & Land Use Planning
February 27th 2014

Presentations by:

- Brian Kyle, Chair of the PIEVC Buildings Expert Working Group
- Barb Hodgins, Senior Policy Planner, Town of Ajax

For more information, please visit:
https://www.ccadaptation.ca/en/mars