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#### **Parking Lot Design for Salt Reduction**

Presented by: Pam Strong

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The water component of STEP is a collaborative of:











### **About STEP**

STEP is a multi-agency initiative developed to support broader implementation of sustainable technologies and practices within a Canadian context.

The water component of STEP is a conservation authority collaborative. Current partners are:







#### Our key areas of focus are:

- Low Impact Development
- Erosion and Sediment Control
- Road Salt Management
- Natural Features Restoration

### Winter salt and parking lots

- Code of Practice for the Environmental Management of Road Salts has promoted the uptake of salt management best practices by municipal and provincial road authorities
- Contractors maintaining parking lots aren't bound by the Code of Practice
- Liability is the among the main concern and reason for overapplication
- These areas constitute ~20% of the salt that's applied each year in the Lake Simcoe watershed

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### Parking lot design guidelines for salt reduction

- Goal: develop design guidelines for parking lots to promote the construction of sites that don't require as much salt application for winter maintenance
- In other words, design parking lots that inherently need less salt applied to maintain the same level of service, without increasing liability





## The guideline package:

- 1. Detailed design drawings and factsheets (4 features)
  - Grading and stormwater collection
  - Snowpile placement and design
  - Pedestrian flow and walkways
  - Landscaping
- 2. Four site plan scenarios
  - Large (>10 ha) commercial development
  - Medium (5 ha) commercial development
  - Small (<5 ha) commercial development</li>
  - Small institutional development

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## The guideline package (cont'd)

- 3. Template municipal policies
- 4. Factsheet





### **Effective grading and stormwater collection**

Poor grading leads to pooling and the potential for refreezing

- Target grade 2-4%
- Maximum distance of meltwater flow
- Reduce flow over drive aisles and walkways





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# Snow pile storage location and design

Improperly placed snow piles can cause several issues

- Designated, signed areas
- Consider location grade, wind direction, traffic, sunlight
- Short distance to stormwater infrastructure









## Sidewalk design and pedestrian flow

Poorly planned or unnecessary sidewalks provide challenges for winter maintenance

- Efficient, intuitive use of sidewalks
- Consider covered or heated sidewalks near buildings
- Consider width accommodate snow machinery where possible







### Landscaping

Landscaping features can be used as part of storage infrastructure, and designed to improve winter maintenance

- Facilitate movement of snow removal equipment
  - Fewer islands and landscaping features
  - Landscaping features around perimeter
- Plant selection deciduous/coniferous, salt tolerant

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#### **Factsheets**

These accompany each feature drawing to provide additional details and recommendations:

1. General Description / Overview

#### 2. Design recommendations

- Salt reduction recommendations
- Design aspects to avoid
- 3. Operation and maintenance

4. Costing

5. Additional considerations

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#### Effective Grading and Stormwater Collection

1.1 General Description/Overview

Effective parking lot grading can minimize the freezing of wet pavement surfaces as well as prevent melt water from ponding and refreezing, reducing the need for re-application of salts. Practitioners of parking lot design have noted that when parking surfaces are graded at slopes less than 2%, there is an increased risk of depressions forming that can result in the pooling of water and ice formation. Slopes of 2 to 4% are recommended to minimize the potential for depressions forming, as well as better compaction of granular base materials and construction quality control to ensure that consistent slopes are provided during construction. Effective grading can also direct melt water towards strategically placed stormwater collection infrastructure (such as catch basins, vegetated swales, bio-retention and landscaped areas, etc.) thereby preventing salt application in heavy traffic areas that are also pathways for runoff. The key to effective stormwater collection during winter runoff is to ensure melt water from high traffic areas or snow

#### 1.2 Design Recommendations

Parking lots are used continuously year round, in all weather conditions. Effective grading and stormwater collection are design elements that impact parking lot drainage throughout all four seasons. This document specifically focuses on these two aspects with respect to the winter months and on how to reduce the use of salt.

The following sections present design recommendations to help reduce the amount of salt application on parking lots and identify design alternatives that should be avoided that may lead to the excessive application of salts.

#### 1.2.1 Salt Reduction Recommendations

Listed below are multiple design recommendations that designers should take into consideration and incorporate where feasible and practical. It is acknowledged that the design is optimized by taking into consideration multiple constraints and not all suggestions can always be accommodated. Some of these recommendations are illustrated on Figure 1 and 2, noted with an asterisk below.

- GS-1\* Parking lots should (where possible) be designed with a grade of 2 to 4% in order to prevent
  ponding and refreezing of meltwater in pavement undulations that result from either imperfect
  grading/paving during construction, or soil and pavement heaving due to weather exposure over time.
- GS-2\* Proper geotechnical design should be completed to ensure that the parking lot design grades
  can be maintained over the long-term to prevent settling and uneven grades. This also includes the
  proper design of parking lots to drain the underlying gravel base appropriately to minimize the
  potential of frost heave of the pavement structure during winter months which can cause uneven
  pavements.
- GS-3\* Strong construction quality control practices are recommended to ensure that sub-grade, granular bases, and asphalt compaction and grading tolerances are achieved.
- GS.4\* Parking lots should be graded away from building entrances and in such a way that major drainage pathways do not cross heavily used areas of the parking lot. Also, parking lots should drain

## Site plan drawings

These show how all four design features can work together on different property types:

- Large (>10 ha) commercial development
- Medium (5-6 ha) commercial development
- Small (<3 ha) commercial development</li>
- Institutional development public school



#### Large commercial site example



#### Institutional site example



#### **Fact Sheet**

A high-level fact sheet was also created to give a synopsis of the guidelines. It details:

- The issue of salt in the Lake Simcoe watershed
- Background on why the project was completed
- Descriptions of the four features with photos
- Template policies



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### **Template Policies**

Template policies were developed to aid in the implementation of the guidelines that can be included in:

- Official Plans
- Secondary Plans
- Engineering Design Standards
- Urban Design Guidelines
- Site Plan Agreements
- Policies have been adopted by five municipalities (so far)



# **CVC's salt management work**

- Long-term monitoring of water quality/chloride
  - Increasing trends at 17 of 24 monitoring sites
- Real-time monitoring of water quality/chloride
  - Concentrations as high as sea water
- Sharing information and resources
- Working with municipal partners
- Head office salt management plan





# **CVC Head Office**

- 200 + employees
- Two office buildings
- Multiple parks/conservation areas
- Most employees work out of Head Office (Mississauga)
- Salt management with municipal partners





# **Head Office Salt Management Plan**

- Guidance on selecting a contractor
- Guidance on writing a winter maintenance contract
  - "Procurement Guidance for Parking Lot Snow and Ice Management"
- Recommended training for our staff
- Property management: 6 zones
  - 1) Asphalt driveway
  - 2) Asphalt parking lot
  - 3) Permeable parking lots
  - 4) Loading areas
  - 5) Walkways
  - 6) Emergency exits
- Guidelines on practices, application rates, and materials by zone



Credit Valley Concervation Main Office Maintenance Zones



# **Liquids and Anti-Icing**

- Best Management Practice for parking lots
- Pro-active
- Prevents bonding to pavement
- Speeds up melting
- Requires less salt/chloride





#### Average Chloride Application Rates Pre-treatment with Liquid vs. Rock Salt only



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#### Average Chloride Application Rates Pre-treatment with NaCl Brine vs. Beet Brine





# Salt use on permeable pavements







# **Head Office Salt Study**

- Funded by MECP/STEP
- 2-year study
- Year 1 (2020/2021): business as usual (rock salt only)
- Year 2 (2021/2022): liquid anti-icing
- Data collected:
  - 15 minute-interval photos from 2 cameras (time to bare pavement)
  - Salt application data from contractor
  - Continuous conductivity of parking lot runoff
  - Pavement friction measurements after select events





# **Preliminary Results**

CVC Head Office Salt Study

# **Salt Application Rates**

- Truck operator provided with suggested application rate
- Can adjust at their discretion
- Office was closed
- Fleet vehicle parking
- No significant difference





# **Conductivity of Parking Lot Runoff**











## **Thank You**

For more information please contact:

Pamela Strong (she/her) Integrated Watershed Management Specialist Lake Simcoe Region Conservation Authority Mobile: (289) 926-8082 p.strong@LSRCA.on.ca Lorna Murison (she/her) Coordinator, Water and Climate Change Science Credit Valley Conservation Mobile: (647) 505-0479 Iorna.murison@cvc.ca

