Development and Results of the First Canadian Infrastructure Report Card

Nick Larson, MEPP, P.Eng.

CSCE National Lecture Tour
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THE CONTEXT
This is not what we mean by GREEN INFRASTRUCTURE
These are not TRAFFIC CALMING DEVICES
Seems to be a bit better on the water and wastewater side of the equation.
Really?
Investment Decisions ...

• Growth versus Existing

  – Growth – More taxes & development charge money! But...more to maintain and renew.

  – Existing - I have been paying taxes for 20 years and the road has never been so bad – when are you going to repair it?
… Decisions …

• **Capital vs. Operations & Maintenance**
  – **Capital**: Let’s borrow over 20 years to rebuild the roads!
  – **Operations and Maintenance**: our roads don’t last that long because we don’t take care of them!
... and more decisions!

Infrastructure vs. other services
Ooops! Bad decision !!!

- Physical condition: A+
- Capacity to meet demand: A+
- Functionality: F
It is really not complicated.
THE CANADIAN INFRASTRUCTURE REPORT CARD PROJECT
BACKGROUND

The Canadian Infrastructure Report Card provides a clear assessment of the condition of municipal infrastructure and the state of infrastructure management in Canada.
Project Objective

• Repeatable
• Defendable
• Raise awareness
• Facts, NOT advocacy
Project Objective

• Repeatable
• Defendable
• Raise awareness
• Facts, NOT advocacy

“What Gets Measured Gets Done”
- Lord Kelvin
Project Objective

• Repeatable
• Defendable
• Raise awareness
• Facts, NOT advocacy
Why Report Cards?

**REPORT CARD**

<table>
<thead>
<tr>
<th>GRADING PERIOD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>READING</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRITTEN COMMUNICATION</td>
<td>A</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATHEMATICS</td>
<td></td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIENCE/HEALTH</td>
<td></td>
<td>B</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>SOCIAL STUDIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ART</td>
<td></td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MUSIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYSICAL EDUCATION</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE A: 2009 Report Card for America’s Infrastructure**

<table>
<thead>
<tr>
<th>Infrastructure Type</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
<td>D</td>
</tr>
<tr>
<td>Bridges</td>
<td>C</td>
</tr>
<tr>
<td>Dams</td>
<td>D</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>D-</td>
</tr>
<tr>
<td>Energy</td>
<td>D+</td>
</tr>
<tr>
<td>Hazardous Waste</td>
<td>D</td>
</tr>
<tr>
<td>Inland Waterways</td>
<td>D-</td>
</tr>
<tr>
<td>Levees</td>
<td>D-</td>
</tr>
<tr>
<td>Public Parks and Recreation</td>
<td>C-</td>
</tr>
<tr>
<td>Rail</td>
<td>C-</td>
</tr>
<tr>
<td>Roads</td>
<td>D-</td>
</tr>
<tr>
<td>Schools</td>
<td>D</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>C+</td>
</tr>
<tr>
<td>Transit</td>
<td>D</td>
</tr>
<tr>
<td>Wastewater</td>
<td>D-</td>
</tr>
</tbody>
</table>

**THE CANADIAN INFRASTRUCTURE REPORT CARD**

**AMERICA'S INFRASTRUCTURE GPA**

**ESTIMATED 5 YEAR INVESTMENT NEED**

$2.2 TRILLION
International Perspective

Canada
America
UK
South Africa
Australia
America

• 4\textsuperscript{th} iteration
• “Coffee Table” style report
Australia

- Graded at State level then combined
- 4<sup>th</sup> iteration
- More of a standard report
South Africa

- 2\textsuperscript{nd} iteration
- 10 asset categories

**Water**

- D- for Department of Water Affairs infrastructure
- C+ for major urban areas
- D- for all other areas

There has been further deterioration in the ageing bulk water infrastructure portfolio as a result of insufficient maintenance and neglect of ongoing capital renewal. Persistent, serious salination of key river systems and eutrophication in many dams and rivers continues. These problems increase the cost of water treatment infrastructure and damage the environment. Acid mine drainage is a cause for concern in the vicinity of gold and coal mines. Large dams are developing capacity problems and require urgent refurbishment. Farm dams are deteriorating rapidly because of lack of maintenance, threatening accelerated sedimentation of bulk storage infrastructure.

The level of water supply in certain systems has fallen far below the 0.85% assurance of supply as recommended in the National Water Resources Strategy. Owing to long lead-times required for development of new supply schemes, the situation is likely to become worse before it becomes better. Serious concerns remain about funding for maintenance.

Major and ongoing strikes in provision of water since 1994, but focus on quantity, not quality, makes water services unsustainable.

Water quality is a serious problem, especially outside metros. Seeking Blue Drop status might assist in improving water quality in municipalities. Water wastage (through leaks) is still too high.

Serious shortage of skilled personnel and officials, governance failures increasing, increase in protests in urban and rural areas — efforts to force improvement in services.

**Sanitation**

- C- for major urban areas
- E- for all other areas

Serious problems with management of many wastewater sewage treatment works. Wastewater leakage and spillage, especially into major rivers, is still too high.

Frequent problems with inappropriate and unsuitable design, e.g. on-site sanitation VIPs not designed to be emptied once full. Sanitation backlog is increasing owing to unsustainable infrastructure.

Lack of buy-in from users. Inadequate operation and maintenance capacity, and shortage of skilled personnel.

**Solid waste management**

- C for waste collection in major urban areas
- D for waste collection in other areas
- C+ for waste disposal in major urban areas
- D for waste disposal in other areas

In general, approximately 60% of households receive adequate refuse removal service. In the major urban areas, the percentage is over 80%, while in the rural areas it is as low as 20%.

Landfill sites in metros are generally licensed, but not all are well managed.

Many other municipalities, especially rural municipalities, have unlicensed landfill sites or licensed sites that are not operated according to acceptable/appropriate standards.

Hazardous and health care risk waste disposal is a concern.
• 6 asset types
• 1st iteration
• Concise
## Similarities & Differences

<table>
<thead>
<tr>
<th>Country</th>
<th>Yr of 1st R.C. (# iterations)</th>
<th># Asset Types</th>
<th>Factors that Influence Grades</th>
<th>Level of Policy Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>2012 (1)</td>
<td>4</td>
<td><strong>Condition</strong></td>
<td><strong>Minimal</strong></td>
</tr>
<tr>
<td>Australia</td>
<td>1999 (4)</td>
<td>11</td>
<td>Condition, capacity, reliability, sustainability, funding, resiliency</td>
<td>Significant</td>
</tr>
<tr>
<td>US</td>
<td>1998 (4)</td>
<td>15</td>
<td>Condition, capacity, funding, need, public safety, resilience, maintenance</td>
<td>Significant</td>
</tr>
<tr>
<td>UK</td>
<td>2010 (1)</td>
<td>6</td>
<td>Condition, capacity, resiliency, sustainability, inter-dependency, funding</td>
<td>Significant</td>
</tr>
<tr>
<td>South Africa</td>
<td>2006 (2)</td>
<td>10</td>
<td>Condition, capacity, maintenance, resiliency</td>
<td>Significant</td>
</tr>
</tbody>
</table>
METHODOLOGY
Project Structure

• Paid for by CSCE, FCM, CPWA, CCA
• Felt like the right thing to do
• Do our own thing....no copying!
• Report Card Advisory Board – key input
# RCAB Composition

<table>
<thead>
<tr>
<th>RCAB Composition</th>
<th>(Chair)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Association of Canadian Engineering Companies - ACEC</td>
<td></td>
</tr>
<tr>
<td>Canadian Association of Municipality Managers – CIP</td>
<td></td>
</tr>
<tr>
<td>Canadian Network of Asset Managers – CNAM</td>
<td></td>
</tr>
<tr>
<td>Canadian Public Works</td>
<td></td>
</tr>
<tr>
<td>Canadian Institute of Planners – CIP</td>
<td></td>
</tr>
<tr>
<td>Municipalities – FCM (PSC)</td>
<td></td>
</tr>
<tr>
<td>Engineers Canada</td>
<td></td>
</tr>
<tr>
<td>Transportation Association of Canada – TAC (Observer)</td>
<td></td>
</tr>
</tbody>
</table>

**If all these people agree, who can argue?**
Data – The Key Input

NOT a bunch of smart people in a room who get together and write a Report Card!

• Voluntary Survey – real data
• Physical Condition?
• Capacity?
• Asset Management Info?
• Value?
## Sample Condition Rating - Water

<table>
<thead>
<tr>
<th>Physical Condition</th>
<th>Distribution System</th>
</tr>
</thead>
</table>
| 5 – Very Good      | No structural defects.  
                    | Little or no water loss through leakage. |
| 4 - Good           | Minor cracking, spalling or signs of wear.  
                    | Deterioration causing minimal influences on levels of service and less than 1 break/km/year.  
                    | Equivalent to OFWAT condition grade 2. |
| 3 - Fair           | Medium cracking, spalling or signs of wear.  
                    | Deterioration beginning to be reflected in deteriorating levels of service and/or increased operating costs.  
                    | Less than 3 breaks/km/year.  
                    | Equivalent to OFWAT condition grade 3. |
| 2 - Poor           | Fracture with deformation up to 10%.  
                    | Nearing the end of useful life, further deterioration likely, affecting levels of service.  
                    | Greater than or equal to 3-5 breaks/km/year.  
                    | Equivalent to OFWAT condition grade 4. |
| 1 – Very Poor      | Collapsed or collapse imminent.  
                    | No residual life expectancy, requires urgent replacement.  
                    | Equivalent to OFWAT condition grade 5. |
The Canadian Infrastructure Report Card

The Canadian Infrastructure Report Card provides a clear assessment of the condition of municipal infrastructure and the state of infrastructure management in Canada.

ANALYSIS
<table>
<thead>
<tr>
<th>Weighted Average</th>
<th>Definition of the rating used in the report card (physical condition only)</th>
</tr>
</thead>
</table>
| ≥ 80%            | VERY GOOD: FIT FOR THE FUTURE  
The infrastructure in the system or network is generally in very good condition, typically new or recently rehabilitated. A few elements show general signs of deterioration that require attention. |
| 70% to 80%       | GOOD: ADEQUATE FOR NOW  
The infrastructure in the system or network is in good to very good condition; some elements show general signs of deterioration that require attention. A few elements exhibit significant deficiencies. |
| 50% to 59%       | FAIR: REQUIRES ATTENTION  
The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies. |
| < 50%            | POOR: AT RISK  
The infrastructure in the system or network is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. |
|                  | VERY POOR: UNFIT FOR SUSTAINED SERVICE  
The infrastructure the system or network is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure and is impacting service. |

Rating was done using physical condition only
RESULTS – WHAT ARE THE STORIES WE CAN TELL?
Participation

Total number of municipalities included in the analysis: 123
Distribution of municipalities that provided data used in the report card analysis

<table>
<thead>
<tr>
<th>Population</th>
<th>Stormwater</th>
<th>Wastewater</th>
<th>Water</th>
<th>Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 250,000</td>
<td>19.1</td>
<td>16.7</td>
<td>16.3</td>
<td>15.3</td>
</tr>
<tr>
<td>100,000 - 250,000</td>
<td>11.8</td>
<td>11.9</td>
<td>9.3</td>
<td>12.7</td>
</tr>
<tr>
<td>50,000 - 100,000</td>
<td>19.1</td>
<td>17.9</td>
<td>17.4</td>
<td>16.1</td>
</tr>
<tr>
<td>10,000 - 50,000</td>
<td>22.1</td>
<td>21.4</td>
<td>18.6</td>
<td>19.5</td>
</tr>
<tr>
<td>&lt; 5,000</td>
<td>5.9</td>
<td>6</td>
<td>10.5</td>
<td>5.9</td>
</tr>
</tbody>
</table>
Use of AM - Potable Water

Source of Physical Condition Information

<table>
<thead>
<tr>
<th>Source</th>
<th>Plants</th>
<th>Pumping Stations</th>
<th>Reservoirs</th>
<th>Local Linear</th>
<th>Transmission Linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other source</td>
<td>13.2%</td>
<td>14.7%</td>
<td>11.7%</td>
<td>17.2%</td>
<td>24.7%</td>
</tr>
<tr>
<td>Opinion of qualified individual</td>
<td>57.4%</td>
<td>70.6%</td>
<td>64.9%</td>
<td>65.5%</td>
<td>61.6%</td>
</tr>
<tr>
<td>Reliable and complete data</td>
<td>29.4%</td>
<td>19.1%</td>
<td>23.4%</td>
<td>17.2%</td>
<td>13.7%</td>
</tr>
</tbody>
</table>
Potable Water

GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to very good condition; some elements show general signs of deterioration that require attention. A few elements exhibit significant deficiencies.
Wastewater Systems

GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to very good condition; some elements show general signs of deterioration that require attention. A few elements exhibit significant deficiencies.

Wastewater - Physical Condition: plants, pumping stations and storage tanks

- Very Good: 43.7%
- Good: 16.0%
- Fair: 34.5%
- Poor: 5.7%
- Very Poor: 0.1%

Wastewater - Physical Condition: collection system (pipes)

- Very Good: 33.7%
- Good: 36.1%
- Fair: 22.4%
- Poor: 6.5%
- Very Poor: 1.2%
Storm Water Systems

**Storm Water - Physical Condition: pumping stations and storm water management facilities**

- Very Poor, 0.6%
- Poor, 5.0%
- Fair, 6.9%
- Good, 30.7%
- Very Good, 56.8%

**Storm Water - Physical Condition: collection systems (pipes)**

- Very Poor, 0.8%
- Poor, 4.9%
- Fair, 17.7%
- Good, 36.2%
- Very Good, 40.5%

**VERY GOOD: FIT FOR THE FUTURE**

The infrastructure in the system or network is generally in very good condition, typically new or recently rehabilitated. A few elements show general signs of deterioration that require attention.
Municipal Roads

Road Network - Physical Condition

- Very Good, 21.8%
- Poor, 16.9%
- Good, 25.7%
- Fair, 32.0%
- Very Poor, 3.7%

FAIR: REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies.
In terms of $, $$$, $$$...

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal roads</td>
<td>$173.1 billion</td>
</tr>
<tr>
<td>Drinking water</td>
<td>$171.2 billion</td>
</tr>
<tr>
<td>Wastewater</td>
<td>$121.7 billion</td>
</tr>
<tr>
<td>Storm water</td>
<td>$69.1 billion</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$538.1 billion</strong></td>
</tr>
</tbody>
</table>

$171 billion (31%) in fair, poor or very poor condition

~$13 billion per year to renew!

$16,000 for every person in Canada!
Why should we care today?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Today</th>
<th>in 20 yrs</th>
<th>in 40 yrs</th>
<th>in 60 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>15%</td>
<td>5%</td>
<td>10%</td>
<td>30%</td>
</tr>
<tr>
<td>Good</td>
<td>40%</td>
<td>15%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>Fair</td>
<td>30%</td>
<td>40%</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>Poor</td>
<td>10%</td>
<td>30%</td>
<td>40%</td>
<td>15%</td>
</tr>
<tr>
<td>Very Poor</td>
<td>5%</td>
<td>10%</td>
<td>30%</td>
<td>40%</td>
</tr>
</tbody>
</table>

$ $ $$ $$$ $$

Investment needed to reconstruct infrastructure in “very poor” condition

The Canadian Infrastructure Report Card
Sustainability – the “IN” word

Meet Present Needs/Services    Without Compromising Future

Sustainability and Infrastructure?

Provide Levels of Service that can be sustained!
Construct infrastructure that anticipates the future!

Do the right project....    Then do the project right.
CSCE – Leadership in Sustainable Infrastructure

- Civil Engineers are the stewards of our Infrastructure
- If we don’t think about it, will anyone?
Thank you

Nick Larson, MEPP, P.Eng.
Chair, CSCE Infrastructure Renewal Committee

nlarson@rvanderson.com
416-497-8600