

Climate Change Impacts & Adaptation in Ontario: Water and Transportation Infrastructure

Overview of Climate Change Impacts on Water and Transportation Infrastructure in Ontario

Every day Ontarians rely on water and transportation infrastructure to support a wide range of social, economic and environmental functions such as public health, safety, economic development and environmental protection. While gradual changes in temperature and precipitation can often be dealt with through normal maintenance and upgrades, extreme events such as flooding, droughts, storms and extreme heat events can damage or destroy infrastructure resulting in significant disruptions of service, high repair costs and dangerous conditions for the affected communities (Andrey et al., 2014).

Older infrastructure is more often vulnerable to climate change impacts as it weakens with age, reducing its ability to withstand extreme weather events and provide adequate levels of service. Moreover, older infrastructure was designed to earlier standards, most of which did not consider changing climate. In Ontario, this vulnerability is exacerbated in many communities due to an ongoing infrastructure deficit, which means that investments in infrastructure maintenance, retrofit or replacement are being delayed due to funding challenges (Government of Ontario, 2011).



Figure 1: Damage to Highway 552 in northeastern Ontario after a heavy rain event (CBC News, 2013)

The Canadian Infrastructure Report Card assessed the condition of current infrastructure and determined that it would cost \$171.8B to replace the infrastructure in Canada that was ranked fair, poor or very poor (Félio, 2012). This dollar amount, however, does not consider the cost of retrofitting or replacing infrastructure to withstand future climate conditions and challenges. In Ontario, municipalities alone face an infrastructure gap of \$60 billion which could take 10 years or more to close (AMO, 2012).

Ontario communities have already experienced some climate impacts on transportation and water infrastructure (see Table 1).

Table 1: Summary of climate change impacts on transportation and water infrastructure in Ontario.

Infrastructure Type	Climate Change Impact
Transportation	<p>Flooding: In 2005, extreme precipitation caused flooding which washed away a large part of Finch Ave. in Toronto, damaging culverts and severing utility lines (Toronto Star, 2012).</p> <p>Flooding: In 2013, flooding in Northern Ontario prompted six towns to declare a state of emergency when roads were washed out, cutting off transportation in and out of the towns (CBC News, 2013).</p> <p>Freeze-thaw: Freeze-thaw cycles have been a source of annual damage to Ontario roads (particularly in northern regions of the Province) (PIEVC, 2008).</p> <p>Extreme Heat: Sustained high temperatures can cause changes in asphalt composition, damaging roadways (Emery, 2010).</p>
Water	<p>Flooding: Stormwater infrastructure has been overwhelmed in several communities including Toronto, Peterborough, London, Peel Region and Halton Region causing extensive damage from flooding.</p> <p>Flooding: Water treatment plants in Toronto have been overwhelmed by flooding, leading to raw sewage flowing into Lake Ontario (Irving, 2013).</p>

Adaptation Opportunities

Engineers Canada established the Public Infrastructure Engineering Vulnerability Committee (PIEVC) to lead an ongoing national initiative to determine and mitigate the engineering vulnerability of Canadian public infrastructure to the impacts and risks of current and future climate. The PIEVC facilitates the development of practices, guidelines and tools to aid Professional Engineers and Geoscientists in their day-to-day practice of designing, constructing, operating and maintaining public infrastructure. PIEVC assessments have focused on buildings, roads, stormwater/wastewater systems, and water resource systems (PIEVC, 2015).

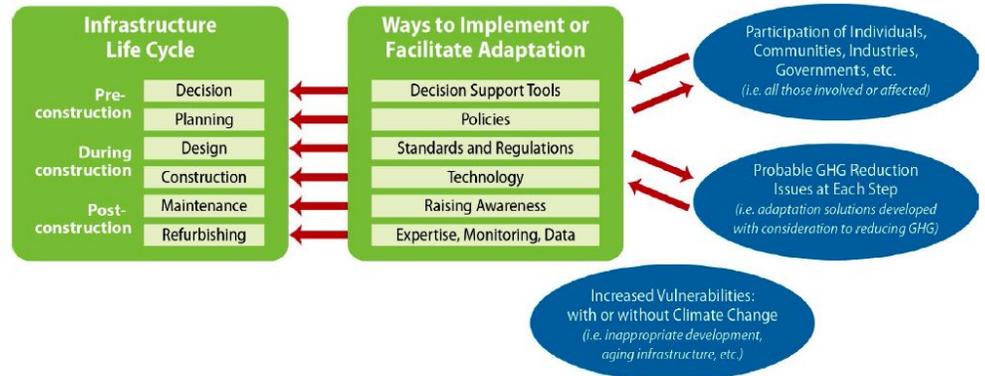


Figure 2: This diagram shows approaches to implement or facilitate adaptation at various stages of the infrastructure life cycle, and factors that influence the success of those approaches (Larrivée and Simonet, 2007).

There are many examples of adaptation for water and transportation infrastructure in Ontario:

- During the spring thaw, roads are much more susceptible to damage than any other time of year. Under the Ontario Highway Traffic Act, the province enforces reduced load restrictions on trucks to protect Ontario's highways during spring thaw, when road damage is most likely to occur (IHSA, 2013).
- Climate change is expected to result in more intense and frequent precipitation events. In response, Richmond Hill and Brampton are building/retrofitting stormwater management infrastructure to address the future challenges related to climate change. As well, Grand River Conservation Authority is developing regulations and policies to protect wetlands and other green infrastructure in order to improve their local stormwater management.
- The City of Toronto undertook a critical infrastructure resilience study to determine where and how climate change may affect their infrastructure. Water management and transportation infrastructure were examined to determine their interdependence on other critical infrastructure. This work was completed to help the city understand how a particular climate event may impact the core functions of the city by affecting the infrastructure, upon which it relies.

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