Engineers Canada's testimony to the Standing Senate Committee on Transport and Communications

Study of the impacts of climate change on critical infrastructure in the transportation and communications sectors and the consequential impacts on their interdependencies

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Honourable chair, vice-chairs, members of the transport and communications standing committee, thank you for inviting us today to provide input to the study of the impacts of climate change on critical infrastructure in the transportation and communications sectors. My name is Gerard McDonald. I am a professional engineer and I am the Chief Executive Officer at Engineers Canada.

Engineers Canada is the national organization that represents the 12 provincial and territorial engineering regulators that license the more than 300,000 members of the engineering profession in Canada. Our organization has a long-standing history of working and collaborating with the federal government to help inform and develop legislation, regulations, and policies.

Engineers Canada has been engaged in work on climate change and extreme weather events for over 15 years with a focus on infrastructure climate vulnerability and risk assessment, as well as proposing adaptation policies, strategies, and professional practices to improve resilience. Between August 2005 and June 2012, Engineers Canada, with funding from Natural Resources Canada and in collaboration with partners from all levels of government and other sectors, formed the Public Infrastructure Engineering Vulnerability Committee, better known as PIEVC. The committee developed and validated the PIEVC Protocol, a tool to be used for vulnerability assessments of infrastructure systems. As of 2021, over 100 infrastructure risk assessments have been completed using the PIEVC Protocol across a wide range of infrastructure systems in Canada that include: buildings (residential, commercial and institutional); storm water/wastewater systems, roads and associated structures (e.g., bridges and culverts), water supply and management systems, electricity distribution and airport infrastructure. The Protocol has also been applied internationally. The experiences and outcomes from these assessments have enabled the engineering profession to engage with stakeholders on climate-related infrastructure policy and procurement. The Institute for Catastrophic Loss Reduction assumed ownership of the PIEVC Program in April 2020.

Extreme weather and rapid changes to Canada's climate present a profound risk to both public safety and the reliability of Canada's infrastructure. The disruption and cost to Canada's economy when infrastructure is damaged or destroyed by extreme weather events is growing and becoming more frequent across Canada. In 2020, it is estimated that severe weather events and climate-related disasters resulted in $2.4 billion of insured damages in Canada alone. The Insurance Bureau of Canada stated that the November 2021 flooding in southern British Columbia is estimated to have caused $450 million in insured damage calling it the "most costly severe weather event in the province's history.'' The storms resulted in the tragic loss of life, as well as devastating mudslides and flooded homes, farms and businesses. Public infrastructure, including major highways, were destroyed, choking supply chains and resulting in a State of Emergency. An expert panel of engineers concluded that better forecasting and co-ordination could help prepare British Columbia for natural disasters, while warning the spring thaw and rain could further compound damage caused by recent floods. In northern communities like Tuktoyaktuk, Northwest Territories, for example, permafrost thaw regularly threatens homes, roads and important cultural sites as well as marine and coastal environments. This is having a profound effect on

Northern and Indigenous traditions, especially for those who rely on the land, sea and ice for their livelihood.

Climate change is happening, but the frequency and magnitude of these changes remain uncertain. What is clear is that licensed engineers, other professionals, policy- and decision-makers need to consider the changing climate and its impact on Canadians' safety and quality of life as supported by public infrastructure. These concerns are not unique to transportation and communications infrastructure. Well-designed, properly built, continually maintained, and reliable infrastructure is critical to public safety, quality of life, and a competitive economy.

Therefore, much of Canada's core public and private infrastructure requires significant immediate and future investments to ensure its sustainability for its complete life and service cycle. Building new infrastructure or rehabilitating existing infrastructure across Canada without considering climate change and extreme weather events has the potential to cause service disruptions and premature failures in the future, thus negatively impacting public safety, increasing business and social disruptions, and increasing costs to government, public, and business sectors.

There are two main recommendations that I will discuss today.

Firstly, as the federal government works to consider the impacts of extreme climate events now and into the future, it is imperative that engineers be consulted to provide evidence-based environmental assessments to support climate adaptation, mitigation, and rehabilitation of climate impacts on public infrastructure. Engineering is on the front line in the provision of infrastructure to society. For this reason, engineers have a significant role to play in addressing climate change issues and incorporating them into engineering practice in Canada.

Secondly, that the federal government extend current climate parameters to adapt public infrastructure. A climate index provides a diagnostic quantity that is used to characterize the state of and/or changes in a climate system, such as a circulation pattern. There are a variety of methods that can be used to derive assorted indices, including classically, selected station, grid point, or regional average data. Most indices use a single variable, such as sea level pressure, sea surface temperature, geopotential height, while others use a combination of variables (i.e., temperature and precipitation). Each climate index has certain measurable parameters that influence the properties of a climate system. Engineers Canada recommends that the federal government work with the engineering profession to align engineering needs with climate projections to include specific climate parameters that go beyond temperature, rainfall, and precipitation. Including additional climate parameters will build confidence in climate projections, support accurate risk assessments in built environments, and will provide engineers with defensible and authoritative climate data when supporting resilient communities across Canada.

There are several climate parameters that can be included, such as:

1. Wind speed and direction

2. Fog
3. Snow accumulation, duration, and intensity
4. Freezing rain and hail
5. Freeze-thaw cycles
6. Long duration rainfall / Atmospheric river tracking

The role of various climate parameters on various types of infrastructure, including transportation and communication, is of high importance and impacts must be anticipated. Understanding meteorological and climate parameters, such as temperature, local changeability, heavy snow, fog, etc., is essential before designing and constructing physical infrastructure across Canada. The combination of extensive climate parameters and infrastructure indicators provides sufficient evidence for professionals to assess specific infrastructure responses to an identified climate condition.

Additionally, it would be beneficial to see a database of climate impacts attributed to climate parameters, which provides strong forensic evidence that is often needed to support the development of new climate change-integrated standards for increased climate resiliency in decision-making. For example, a climate and infrastructure forensic database capturing high impact climate events and the associated failures of assets or services would help to inform many standards, risk assessments, decisions, and designs on important “breaking point” climate thresholds.

Mr. Chair and honourable members, thank you for allowing Engineers Canada to present to the committee today. We truly hope that the committee will recognize the integral role that engineers play in Canada’s transportation and communications sectors, and I wish to assure you that our profession is ready and willing to ensure that Canada’s critical infrastructure is resilient, safe, and continues to be an enabler of the economy. I welcome any questions or comments.