FORESEEABILITY AND EXTREME WEATHER IN BUILDING AND INFRASTRUCTURE DESIGN

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In 2017, the Canadian federal budget included an announcement of a new Disaster Mitigation and Adaptation Fund (DMFA) to adapt infrastructure projects to extreme weather due to climate change. One project funded by DMFA is the construction of new flood barriers and effluent pumping stations in London, ON, to deal with flooding events brought on by climate change.

Additionally, as part of the Climate-Resilient Buildings and Core Public Infrastructure Initiative, the National Research Council Canada (NRC) has undertaken work to integrate climate resilience into building and infrastructure design, guides and codes. For example, because of this initiative, the recent 2019 Canadian Highway Bridge Design Code now includes provisions related to climate change, sustainability and resilience, as well as fully updated historical data.

In Ontario, after flooding affected several parts of the province, Ontario's Flooding Strategy was released, in part to reduce flood risk. And, under Ontario's Build Back Better program, municipalities can obtain funding to rebuild damaged infrastructure and make it more resilient to extreme weather.

PROFESSIONAL OBLIGATIONS AND CLIMATE CHANGE RISK

Canada, including Ontario and local municipalities, is taking initiatives to tackle the effects of extreme weather due to climate change, such as flash flooding. These initiatives will influence infrastructure and building design in the coming years. Considering these events, do practitioners have a duty to account for extreme weather due to climate change in their infrastructure and building designs?

A compelling assertion is made in the law article "Unexpected effects: Infrastructure stakeholders may soon find themselves liable for the effects of climate change," by Sabrina Gherbaz and Patricia Koval of Torys LLP. The authors point out: "On the basis of Canadian case law, it's easy to imagine circumstances in which liability could be extended to owners, design professionals, contractors and governmental authorities who negligently failed to adapt infrastructure to climate change–related risk or to warn of such risk."

Practitioners are reminded that section 72(1) of Regulation 941 of the *Professional Engineers Act* contains the following definition of negligence:

> "negligence" means an act or an omission in the carrying out of the work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances.

Furthermore, practitioners have a responsibility to follow current professional standards and account for foreseeable risks in their work, as per *The Canadian Law of Architecture and Engineering* (2nd ed., 1994). Authors Justice Beverley McLachlin, Wilfred Wallace and Arthur Grant say: "…the architect or engineer is to be judged by the professional standards prevailing at the time the work was done, not by what may be known or accepted at a later date, or what may be seen only with the benefit of hindsight…."

For more information on the relationship between professional negligence and foreseeable risks, refer to the Professional Practice article "Foreseeability and negligence in equipment and structure failures" (*Engineering Dimensions*, September/October 2019, p. 23).

Finally, it is important to note that legal definitions of professional standards not only include written standards such as codes, but also "knowledge or experience generally available in the…engineering community" as noted in the case *Hilton Canada Inc. v. S.N.C. Lavalin Inc., 1999 CanLII 1352 (NS SC)*.

Based on the above, a reasonable and prudent practitioner would make responsible provision to comply with current written standards and take heed of the prevailing knowledge or experience available in their engineering community to account for foreseeable risks. This concept applies perfectly to practitioners designing infrastructure and buildings considering climate change risks. They may need to design infrastructure and buildings to a higher standard than current written standards, if their engineering community determines, based on prevailing knowledge and experience, that adopting a higher standard is necessary to account for foreseeable climate change risk. The legal article "Climate risks become major regulatory concern for insurers" by Norton Rose Fulbright supports this conclusion: "Professionals such as architects, engineers and civil engineers can face liability claims where they fail to take climate risks into account in their designs if foreseeable damage to buildings occurs in extreme weather events."

STANDARDS NOW REFER TO FORESEEABLE CLIMATE CHANGE RISKS

Ultimately, practitioners are responsible for accounting for foreseeable climate change risks in their work even if these risks might not be covered in a specific written standard. However, some written standards now refer to the obligation to account for foreseeable or anticipated climate change risks, such as the Ontario Building Code, which notes that buildings constructed in flood plains shall be designed to withstand anticipated hydrostatic pressure:

3.1.1.3. Building in Flood Plains

(1) Buildings constructed on flood plains shall,

(a) be designed and constructed in accordance with good engineering practice to withstand anticipated vertical and horizontal hydrostatic pressures acting on the structure.…

How do practitioners account for foreseeable extreme weather risks in their designs of infrastructure or buildings, especially when current written standards might be considered outdated by their engineering community? We mentioned above that practitioners may need to design to a higher standard. However, how do they determine this higher standard?

CONSIDERING FORESEEABLE EXTREME WEATHER RISK

A key point is that foreseeable extreme weather risk can differ by project, specifically by location and type of infrastructure. For example, flooding and strong winds due to extreme weather vary by region—notably, some regions are more prone to flooding or damaging winds than others. Also, some types of infrastructure, such as stormwater drainage systems, are already stressed by climate change in several locations in Ontario. So, as often happens in professional engineering, there is no one answer; rather, the response would depend on the particulars of each situation. In other words, practitioners need to adopt a case-by-case approach when considering climate change risk in their work.

As per the Code of Ethics, practitioners have a duty to "act at all times with…knowledge of developments in the area of professional engineering relevant to any services that are undertaken." Consequently, practitioners are advised to research and become well informed on the latest climate change adaptation technical literature applicable to their projects and consider taking professional courses in this subject. A good starting point is the guide *Principles of Climate Change Adaptation for Engineers* from Engineers Canada (www.peo.on.ca/sites/default/files/2019-07/Principles%20of%20Climate%20Change%20Adaptation%20for%20Engineers%20.pdf). This above guide contains helpful principles and elements that assist practitioners in integrating climate adaptation into their practice, such as reviewing the adequacy of current standards, working with specialists and stakeholders and applying risk management principles for uncertainty, to name a few.

Practitioners should have conversations with their clients about incorporating climate change adaptation in their projects. Furthermore, because extreme weather risks could result in claims, practitioners should contact their professional liability insurance providers for advice in these matters. Because practitioners primarily rely on climatic design data contained in codes and standards, such as the various governments' building codes, these codes and standards agencies have a responsibility to update those documents to reflect current research and address climate change in a timely manner. However, practitioners are cautioned not to rely on a government agency doing so but rather to use their judgment to assess whether the design data they obtain from the current code being referenced is appropriate for the specific situation being considered. **e**

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FURTHER READING

1. "Unexpected effects: Infrastructure stakeholders may soon find themselves liable for the effects of climate change," by Sabrina Gherbaz and Patricia Koval of Torys LLP www.lexology.com/library/detail.aspx?g=89469eb0-13fa-4f6a-beab-2ccf318c79e1
2. "Climate risks become major regulatory concern for insurers," by Norton Rose Fulbright https://www.nortonrosefulbright.com/en/knowledge/publications/4ad1fb5f/01-sea-change-climate-risks-become-major-regulatory-concern-for-insurers

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