Canadian Construction Association

Strength, resilience, sustainability

# A guide to implementing climate resilience in construction risk management

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## A. INTRODUCTION AND OVERVIEW

The significant impact of a changing climate is not a surprise for the Canadian construction sector. Ensuring that infrastructure can withstand extreme weather conditions that vary across the country has always been a key tenet to project planning, design, and execution.

However, the frequency of extreme weather events as well as the chronic impacts of a changing climate have added another complex layer to the process, compounded by the uncertainty of future effects. As with any sector, uncertainty makes it all the more challenging. Fortunately, the case for investing upfront in climate-resilient materials and design has already been made by numerous reports including the Canadian Construction Association's (CCA) own recent submission: *Strength, resilience, sustainability: Canada's construction sector recommendations on adapting to climate change*. However, this upfront investment may be constrained by short-term thinking that does not serve the project or Canadians at large.

The inclination to constrain scale and stringency of efforts to address climate change in the construction sector and instead opt for incremental change can limit the adoption of new or time-tested technologies, having a lasting detrimental effect, both environmentally and economically.[1]

The question to be answered then is, "What needs to be done to ensure the Canadian construction sector has the ability to entrench itself as part of the solution, both in terms of reducing greenhouse gas emissions (GHGs) and fortifying existing and new infrastructure against the impacts of climate change?"

In its recent report, CCA surveyed national and international research and data to explore the linkages between climate risk and infrastructure decisions; the cost of addressing the issue and the cost of doing nothing; how other jurisdictions are responding to the same challenges; and efforts already underway in the Canadian construction industry. The report then made concrete recommendations to governments and other key stakeholders to help ensure that Canada is taking a comprehensive and proactive approach to climate adaptation in the construction sector.

This companion report is more inwardly focused. It has been written for companies, organizations, and individuals that make up Canada's construction sector so that they may better equip themselves to manage the changes that are already underway and that will only accelerate in the years ahead. It guides companies, at a high level, on how to implement a climate resilience framework to reduce and manage project uncertainty by developing data, structuring processes and accountability, and fostering a continuous feedback loop. The aim is to help move companies from uncertainty to proactivity.

The benefits of proactivity are well documented. An assessment by the Council of Canadian Academies holds that targeted adaptation in responding to physical infrastructure-related risks can reduce the damages or costs that could arise as a result of climate change. At the higher end of the spectrum, the assessment determined that over 75 per cent of the associated costs, damages, or disruptions from climate risks to physical infrastructure could potentially be avoided over a 20-year timeframe.[2]

Building climate resilient infrastructure also makes sense for developers. The payback for resilience efforts can be measured in many ways, including cost savings from preventing damages and reducing operating costs, as well as revenue enhancements from improved marketing, company brand, and project image. These efforts also demonstrate the private sector commitment and leadership that is necessary for strong public/private collaborations in tackling climate change, including in reducing buildings' contributions to climate change.[3] The bottom line is that planned adaptation can result in lower costs and is often more effective than reactive adaptation.

CCA recognizes that every member company is operating within a specific set of parameters and that each is at a different point on its pathway to integrate climate change considerations into day-to-day decision-making. This

guide has been designed to be broadly applicable by setting out a framework that can help validate an already robust approach or can serve as a step-by-step checklist for a company getting started on its path to greater climate resilience.

To the extent possible, organizations should apply existing risk-management processes and philosophies. Those organizations that have a robust risk-management system in place simply need to ensure that climate change risk is integrated. While some of the impacts of climate change and extreme weather may pose new or more significant risks, the principles of risk management are still applicable. Risks need to be periodically revisited and reassessed as new information comes to light.

The end goal is for each CCA member company, if they desire, to have a system in place to integrate climate change considerations into its risk management framework, establish executive accountability and employee input, and be in a position to confidently anticipate the challenges and recognize the opportunities that lie ahead. CCA hopes that this guide contributes meaningfully towards that outcome.

## B. RISK MANAGEMENT CYCLE

The model that forms the basis of this guide follows a standard approach to risk mitigation. Risk identification feeds into risk analysis, which informs mitigation planning. The plan is then implemented and is continuously monitored and evaluated. The framework then feeds back into the identification of new—or the modification of existing—risks, which creates a looped system of continuous improvement. Each of the five elements of the framework are discussed in greater detail below.

## C. RISK IDENTIFICATION

Physical infrastructure has been assessed as one of six major climate change risk areas that are nationally significant and could lead to significant losses, damages, or disruptions over the next 20 years in Canada.[4] It has been estimated that infrastructure failures linked to climate change could cost Canada $300 billion over the next decade if no further changes are made to existing practices.[5]

The challenge for Canadian construction companies is to apply the broadly recognized set of evolving risks to a very specific portfolio of assets and projects in development.

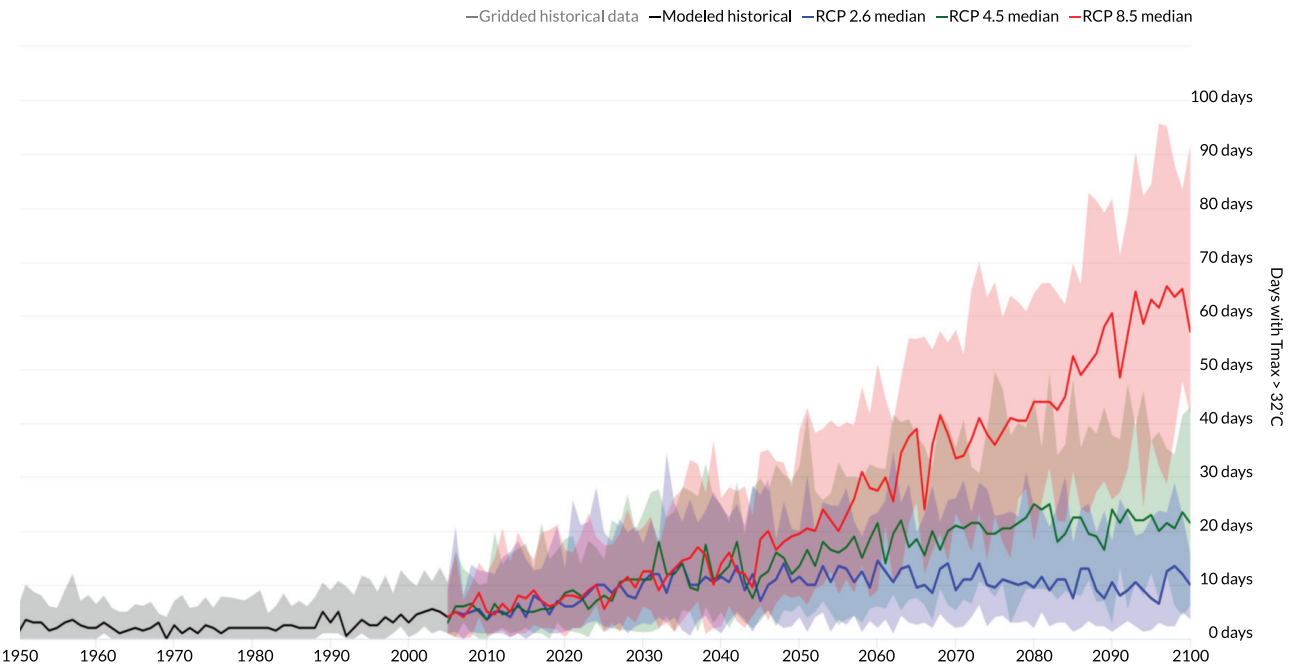
The first step is for companies to inventory the vulnerabilities inherent in their assets and projects under development. The United Nations defines climate vulnerability as "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes."[6] Without clearly identifying and documenting asset-specific risks, companies will not be able to analyze and mitigate them.

For example, climate risks associated with bridges typically include issues such as:

- accelerated material degradation from high heat and extreme weather;
- higher flood levels and more frequent flooding;
- damage to pavement and railways via heatwaves and intense precipitation events;
- higher risk of forest fires; and,
- more violent storms.

The next step is for companies to familiarize themselves with the changes that are expected as the climate changes. Often the focus is on the pervasive gradual changes in average global temperatures, seasonal precipitation patterns, and sea level rise. However, in the case of infrastructure it is often the more acute short-duration events like intense precipitation (which can lead to flooding), storm surges, freezing rain (which can cause ice accretion), snow load, hail, high winds, extreme heat, and heat waves that can affect the integrity and reliability of infrastructure.

Fortunately, Canada has improved access to climate data significantly in recent years with the launch of the website ClimateData.ca which "provides high-resolution climate data to help decision makers build a more resilient Canada." Users can query city or town-specific data to view how the prevalence of extreme weather events change over time. For example, the chart below shows that the City of Toronto currently experiences about five days per year of temperatures above 32 degrees Celsius. Under the scenario of a global average temperature increase of 4.5 degrees Celsius (green line), this will increase to an average of 20 days per year by 2070 (in 50 years, well within the expected useful life of many infrastructure assets). Under the 8.5 degrees average global temperature increase scenario (red line), it balloons to 40 days per year, an eight-fold increase over the current baseline.




Risk identification involves recognizing and defining problems. It requires a careful assessment of the vulnerabilities of different types of infrastructure, construction methods and materials. It also requires the development of an understanding of how weather patterns will change over time. The next step is to join the two in an analysis of asset or project-specific risk.

## D. RISK ANALYSIS

For modeling results to be meaningful and to inform an actionable assessment of real risks, the body of knowledge generated in steps one and two must now be focused on a specific asset or asset class.

To move from risk identification to risk analysis it is important to determine:

- the relevant climate parameters to be modeled (e.g. precipitation and temperature);
- the specific criteria (e.g. heat waves, humidex, cumulative precipitation, freezing rain accumulation, and specified wind gusts);
- the appropriate timeframes (near, mid, and/or long-term – generally aligned with the remaining useful life of the asset or asset class being considered); and
- the geographic range and appropriate spatial resolution (local for vertical infrastructure, regional for linear infrastructure).

This data will provide a clear picture of what an asset must withstand over its useful life. The next step is to determine how the asset or asset class will perform – that is, what will be the probable impact of accelerated degradation. It may be that an asset will require more maintenance investment or repair work over time to keep it in good shape. Or climate change may introduce a very real risk of catastrophic failure that would put lives at risk. Whether in terms of cost or safety, the risk to an asset or asset class must be understood as an impact with a probability of occurrence.

With this information, the next step is to plot risks on a heat map as a function of impact and probability.

Impact →

| Likelihood ↑ | Negligible | Minor | Moderate | Significant | Severe |
|---|---|---|---|---|---|
| **Very likely** | Low Med | Medium | Med Hi | High | High |
| **Likely** | Low | Low Med | Medium | Med Hi | High |
| **Possible** | Low | Low Med | Medium | Med Hi | Med Hi |
| **Unlikely** | Low | Low Med | Low Med | Medium | Med Hi |
| **Very unlikely** | Low | Low | Low Med | Medium | Medium |

Every organization will have its own unique tolerance for risk. It is critically important, however, that a climate adaptation framework allows and indeed requires an organization to make risk-tolerance decisions with a full set of facts. Climate information and asset vulnerability assessments should be supplemented with other considerations, such as cost-benefit analysis and hazard mapping to help ensure that actions generate results that mitigate risk, are economically feasible, and are socially acceptable.

## E. RISK MITIGATION PLANNING

Risk treatment involves implementing one or more options to mitigate a risk. It is a cyclical process of assessing risk controls, determining the acceptability of residual risks, generating a new risk treatment if residual risks are not tolerable, and assessing the effectiveness of the treatment. Response strategies need to be tailored, taking into account a set of variables, including local and/or regional conditions such as specific climate and extreme weather projections, stakeholder expectations, regulatory regimes, and the risk tolerance of individual organizations.

Risk treatment options include:

- *avoidance:* removing the risk source and/or eliminating involvement in activities that lead to the possibility of the risk being realized;
- *sharing or transferring:* shifting the burden of the risk to another party through vehicles such as insurance or through joint ventures;
- *mitigation:* applying appropriate techniques to reduce the likelihood of an occurrence, its conse¬quences, or both; and
- *acceptance:* accepting the consequences and likelihood of a particular risk where mitigation is either impossible, not cost effective, or resources are better directed to other higher profile risks.

Controls typically focus on high and medium risks, with low risks being tracked or monitored on a watch list. The purpose of tracking low risks is to ensure that their profile does not change as circumstances do. Risk-control strategies must be planned and implemented.

Once areas of mitigation are determined, organizations should review Canadian and international solutions to similar issues. Chances are that another company has worked on, or is currently working on, a similar challenge. Organizations should also keep an open mind to mitigation solutions, which range from hard engineering solutions to soft solutions like administrative controls.

## F. RISK MITIGATION PLAN IMPLEMENTATION

While the approach to managing climate risk must be tailored to each organization, implementing a framework should feel familiar to most. In effect, climate change is simply being added to the broader risk management framework that is likely already in place to manage financial, operational, and strategic risks.

To avoid or overcome common challenges experienced when adding climate risks to a broader enterprise risk management framework, it is suggested that organizations take on the following tasks, some of which were discussed in more detail in previous sections:

- identify a clear executive sponsor/champion to support the implementation of a climate adaptation framework;
- establish a climate risk committee;
- adequately resource the development of the framework and the data required to inform decisions;
- identify and describe the risks in a "risk inventory";
- implement a risk-ranking methodology to identify unacceptable risks;
- explore the cost-benefit of risk mitigation options;
- develop action plans to ensure the risks are appropriately managed;
- develop consolidated reporting for various stakeholders; and,
- monitor the results of actions taken to mitigate risk.

Beyond these internal management considerations, companies should also develop an approach to communicating findings with potential clients and project development partners. As was recognized in CCA's report *Strength, resilience, sustainability*, while the overall positive cost-benefit of investments in infrastructure resilience are clear, it is another matter to have customers, whether governments or the private sector, willingly add those costs to their projects. By developing a robust climate adaptation framework for assessing risks, evaluating impacts and analyzing mitigation options, companies can present thoughtful and hopefully persuasive rationales for investing a bit more now to avoid significant costs later.

## G. MONITORING AND EVALUATION

Addressing climate resilience is not managing towards a new status quo. The climate is warming, and for the foreseeable future, extreme weather events will worsen while becoming more frequent. An organization's climate resilience framework similarly must evolve as risks to infrastructure become more apparent through lived experience, as climate models continue to improve, and as mitigation options mature.

Similarly, the climate risk framework implemented within a company must continue to evolve. The climate risk committee, led by the executive sponsor, should periodically take stock to ensure that:

- the framework is generating the desired results;
- buy-in across the organization remains high;
- new data is continuously being studied and incorporated;
- the framework is informing discussions with clients and partners at an early stage in the construction planning process; and,
- required adjustments are being addressed in a timely manner.

As risks, technologies, regulations, and societal expectations evolve so too will the climate adaptation framework and a company's approach to managing risks. That consideration will flow back to step one in the process—risk identification—in a positive cycle of better risk management and greater mitigation rewards.

## H. CONCLUSION

CCA hopes that this guide is a useful tool for members in preparing for climate change. As noted above, there is no uniform approach to managing climate risks. Each company must develop and implement a framework that aligns with its own corporate objectives and existing management frameworks. That said, CCA also believes that no company can afford to ignore climate risks altogether. Climate change is happening and will continue to accelerate in the coming years. It is incumbent upon the Canadian construction sector to build infrastructure today that can withstand the extreme weather patterns of tomorrow. In doing so, the sector will ensure that Canada has a solid foundation for future prosperity and public safety.

# I. ENDNOTES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