Resilient Residential Retrofits

Exploring the NRC's research of enhancing the climate resilience of existing residential buildings

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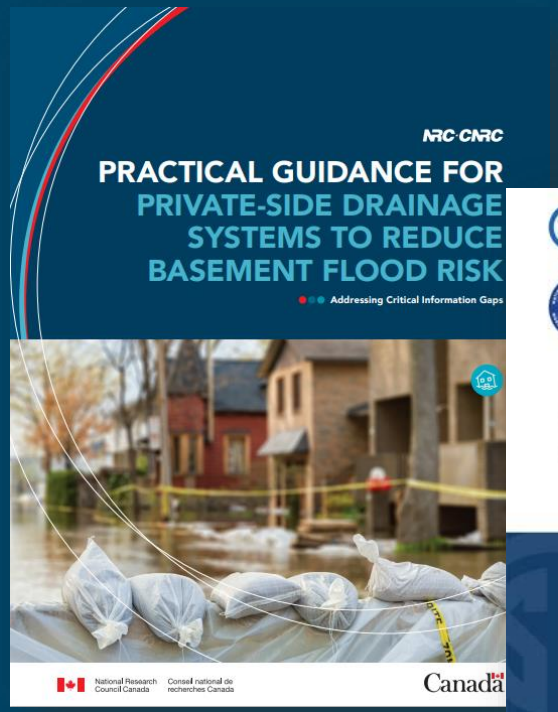
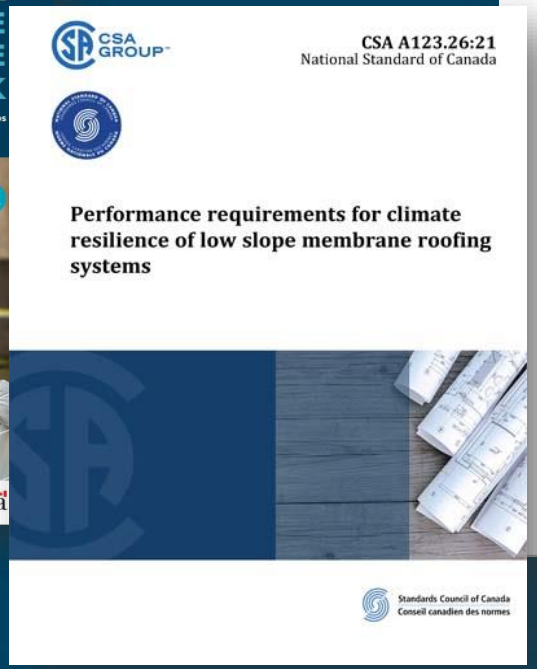
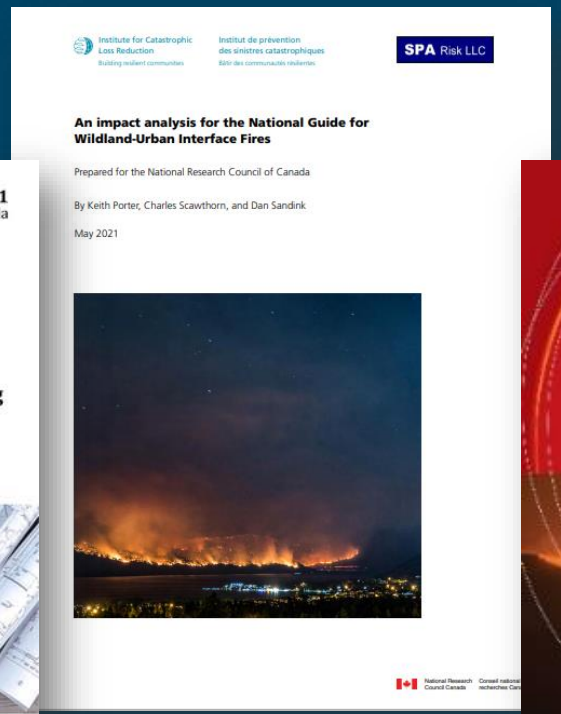
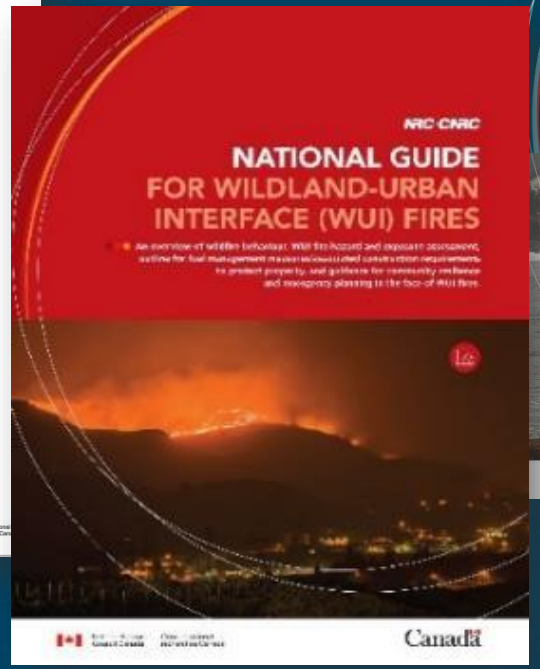
Climate Resilient Built Environment Initiative

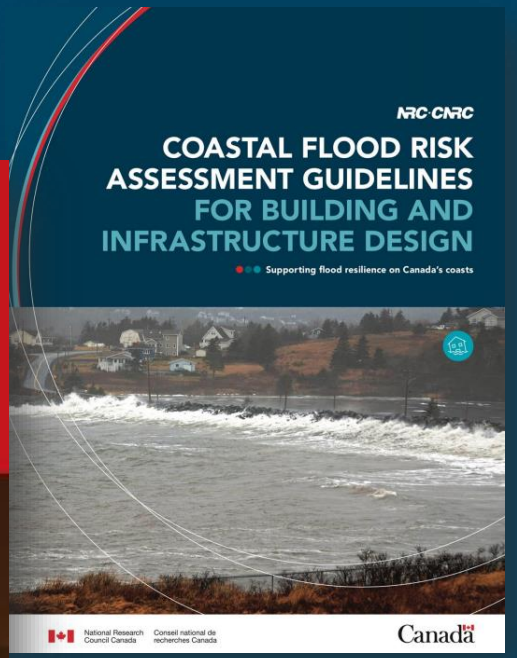
Ongoing partnership with Infrastructure Canada to integrate climate-resilience into guidance documents, research data, codes and standards.











Resilient Residential Retrofit Logic Model

Inputs

- Funding
- Staff at NRC
- Advisory board members
- Collaborators
- Facilities
- Existing knowledge from CRBE

Activities

- Networking & targeted stakeholder surveys
- Knowledge gap identification
- NRC Internal research projects
- Collaborative research projects
- Advisory board

Outputs

- National guidelines, best practices, standards, code change requests
- Successful pilot-studies to de-risk applied tools/technology and recommended resiliency retrofit measures
- Build new partnerships/ strengthen collaboration across key players in Canada
- Knowledge dissemination through partners to increase awareness and capacity to undertake resiliency retrofit measures

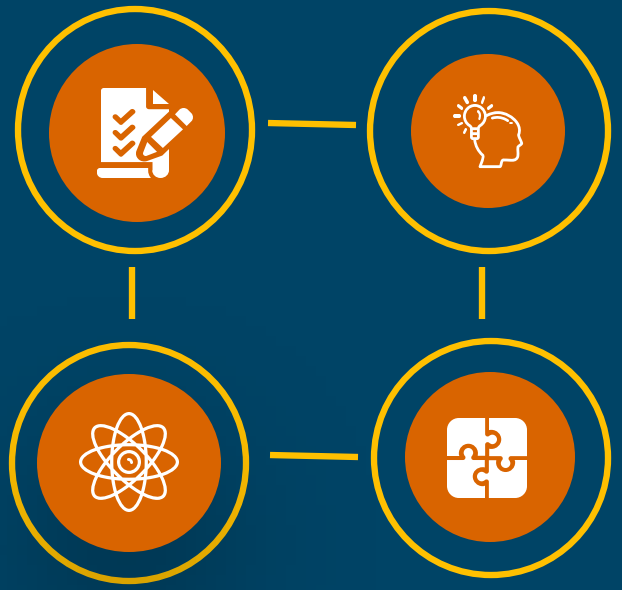
Impact

- Project outputs adopted by industry, insurance and government incentive programs leads to holistic national retrofit strategies to improve on climate resiliency of residential buildings, targeting the vulnerable population/communities as well as Reduce loss of life, property, and financial costs associated with impacts of climate change
- Support other voluntary retrofit programs by providing the required tools and technologies

Resilient Residential Retrofit (R^3) Activities - Overview

Scientometric Study (Winter 2023)

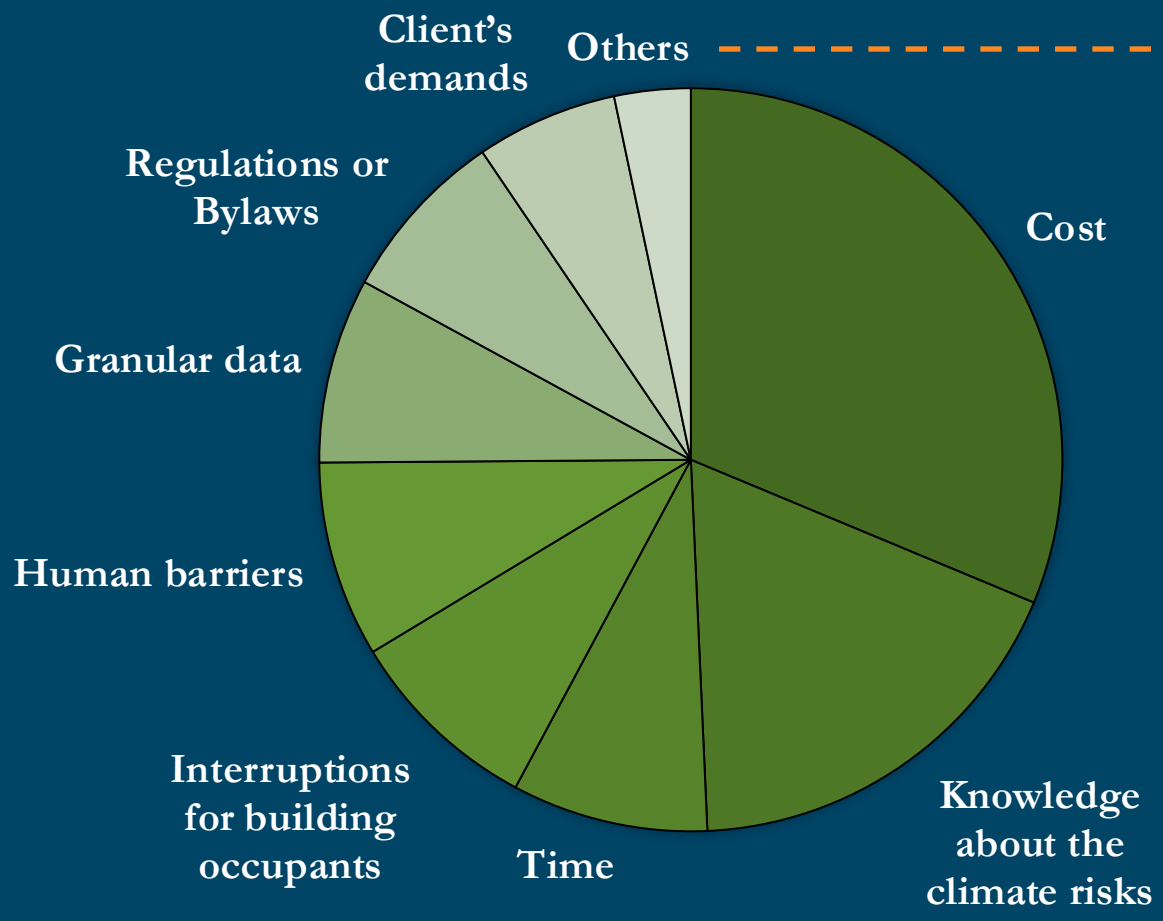
Consultation (Aug-Sep 2023)



Workshops (Oct-Dec 2023)

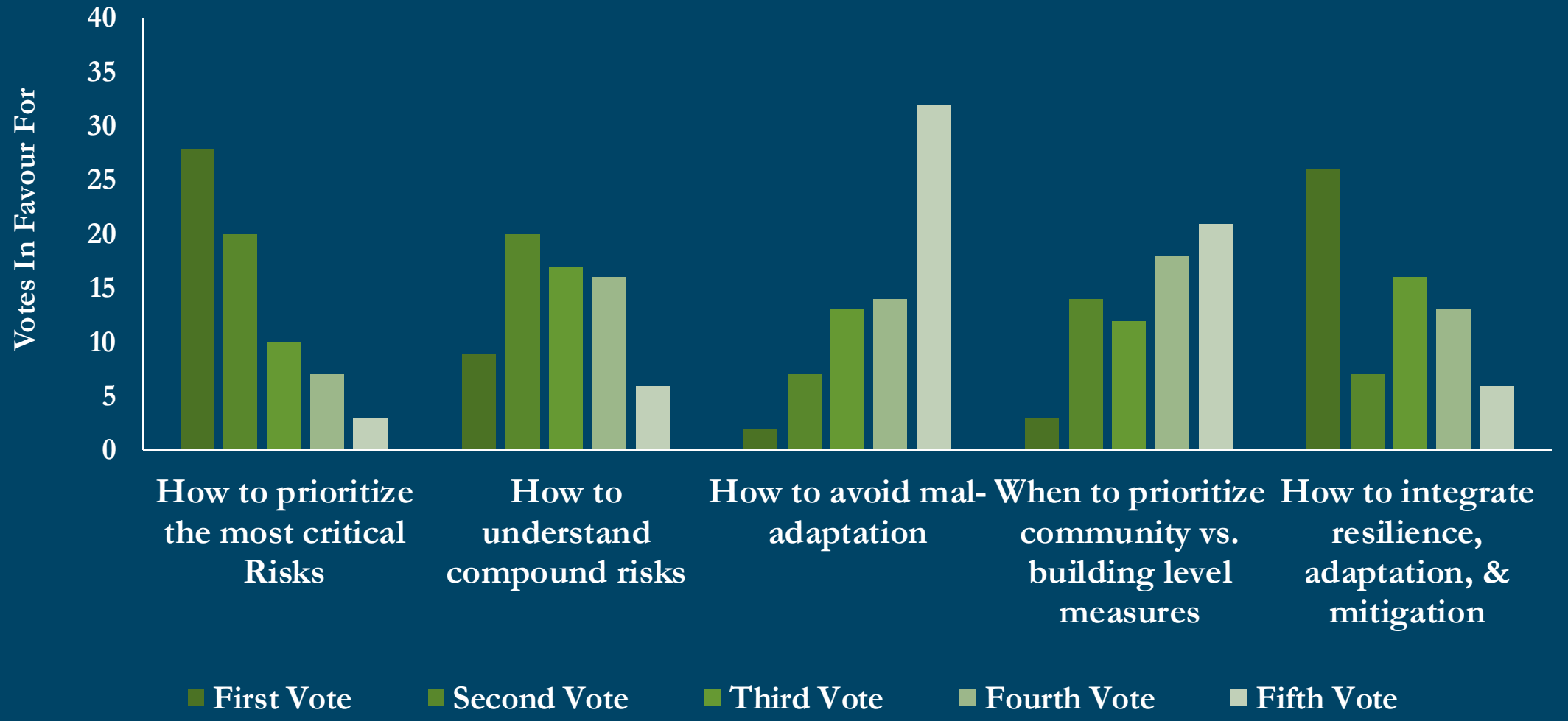
Call for Proposals (April 2023- Ongoing)

Consultation Result: Key Barriers to Implementation of Climate Resilient Retrofit Measures

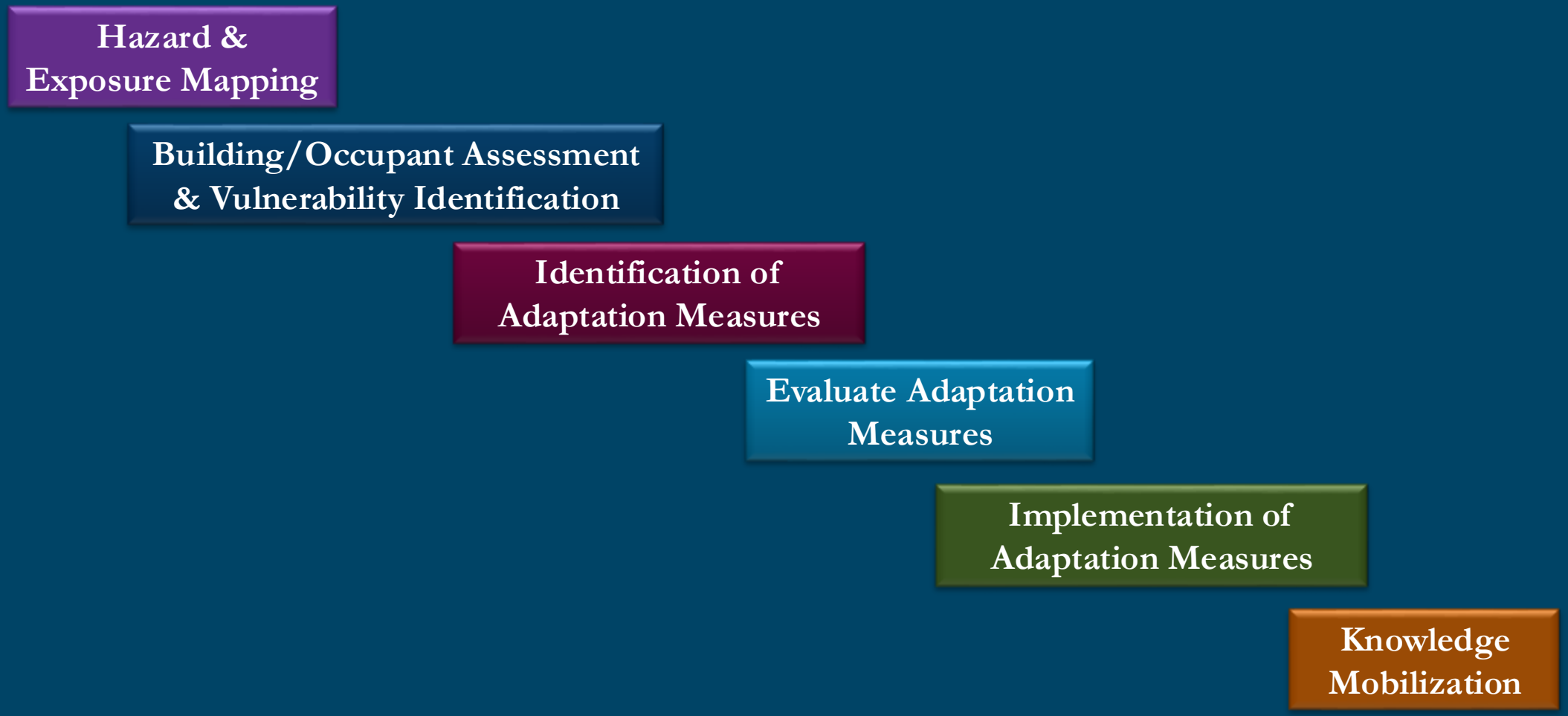


- Inability
- Capacity of trades/availability of tradespeople for retrofit work
- Labour pool
- Contractor knowledge on new requirements/implementation
- Not an emergency
- Building literacy

Consultation Result: Most Important Research Focus to Support Retrofit



R^3 Proposed Roadmap to Enabling Adaptation Retrofits



NRC's Research Areas in Resilient Residential Retrofit

Wildfire

Permafrost Melt

Extreme Wind

Flooding

Extreme Heat

Wildfire Smoke

Development and Cost-Benefit Analysis of Residential Building Envelope Retrofit Packages to Mitigate Climate Change

Objectives

- Develop a database of climate adaptation measures for envelope retrofits
- Identify municipalities at the greatest climate risks and Create representative archetypes
- Analyze operational costs/performance of the archetypes under the scenario no climate adaptation measures are adopted to establish baseline performance and identify the magnitude of the risks and their impacts
- Perform cost/benefit analyses of location-specific building envelope retrofit packages designed to address multiple risks

Collaborators

- CMHC, University of Waterloo (Partners for Action)

Resilient and Sustainable Retrofit Solutions to Mitigate Overheating

Objectives

- Investigate resilient and sustainable retrofit strategies of residential buildings to mitigate overheating
- Evaluation of promising technological solutions for market adoption in Canada
- Field demonstration of selected technologies to de-risk them
- Guidelines to increase the market deployment of successful technologies in different Canadian climates.

Collaborators

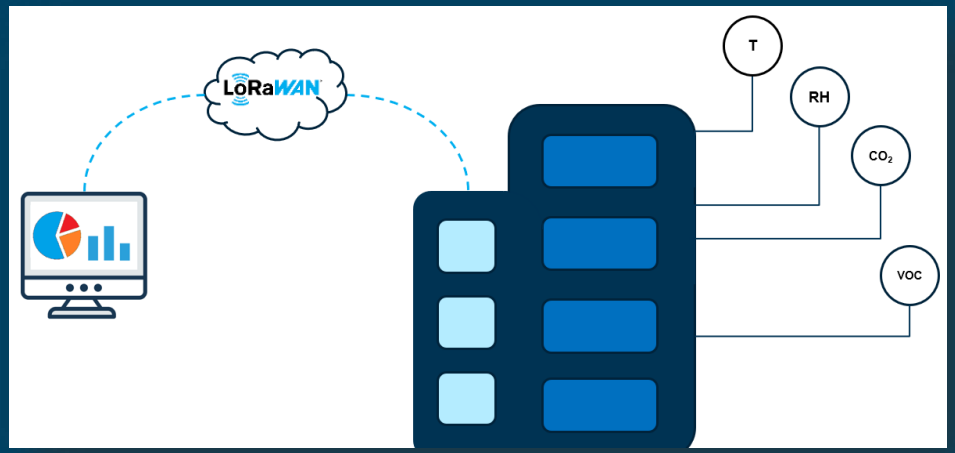
- Concordia U, UBC, Product manufacturers, Building developers, City of Hamilton/St. John's, SAIT

Promising retrofit strategies of residential buildings

Overheating Risk Mitigation Strategies in Social Houses

Objectives

- Assess indoor overheating events in selected social houses
- Develop data-driven forecasting tool to alert for future indoor overheating events
- Identify and evaluate retrofit scenarios using calibrated building simulations to reduce overheating risk
- Recommendations for retrofit scenarios to mitigate indoor overheating



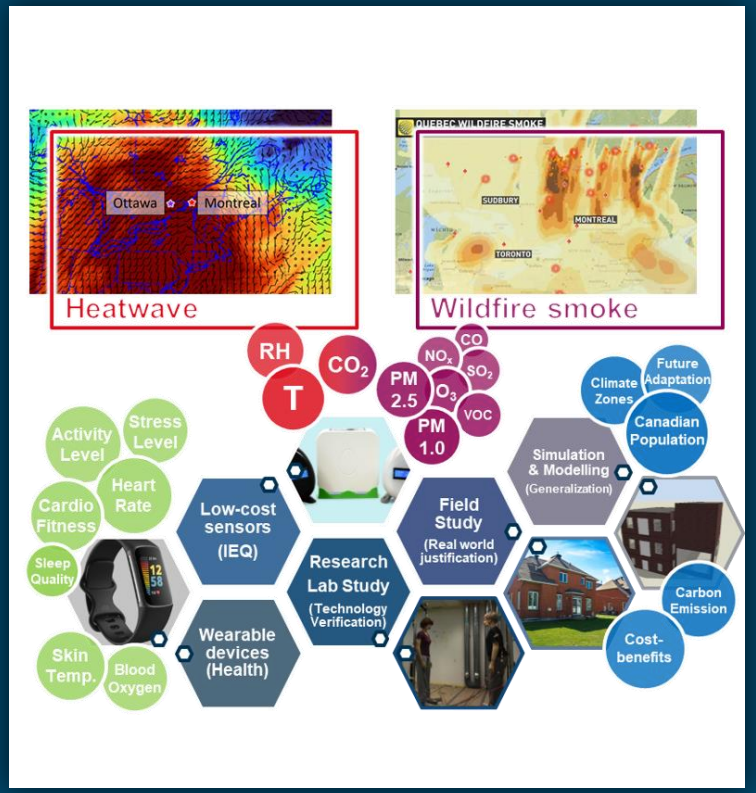
Collaborators

BC Housing

Retrofits to Improve Resilience to Overheating Stress and Wildfire Smoke Exposure

Objectives

- Conduct field study to collect IEQ data & occupants health info
- Identify efficient intervention strategies
- Quantify impacts of interventions on IEQ and occupant health
- Generalize results through building simulation
- Cost-benefit analysis of intervention technologies
- Updates of building standards, codes, retrofit guidelines



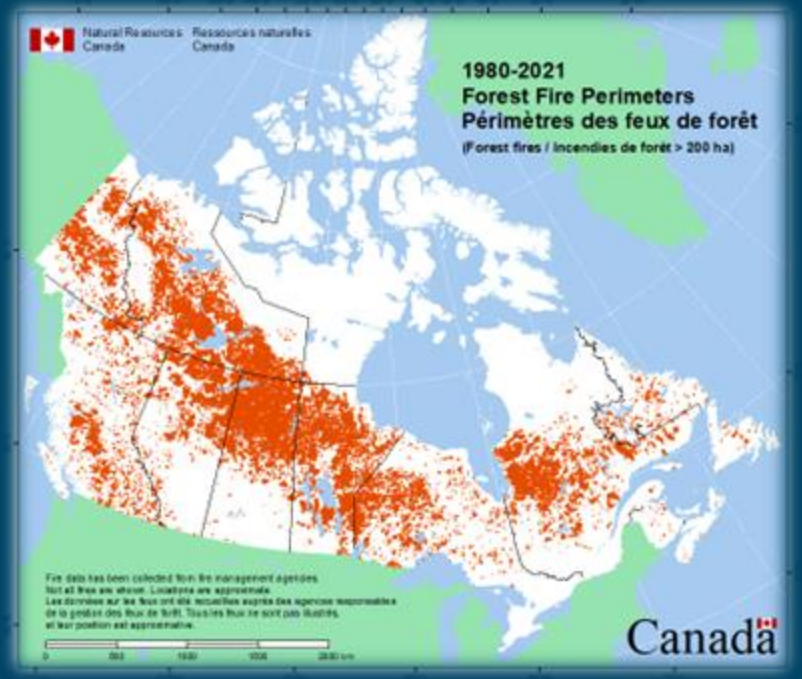
Collaborators

- Health Canada, BC Housing, Société d'habitation du Québec, Ottawa Community Housing, Carleton University, Concordia University, Le Groupe Maurice, Grace Village, QEA tech

Retrofitting Existing Residential Buildings for Resiliency against Wildfires following the WUI Guide

Objectives

- Assess the designs of existing residential buildings in select Canadian cities and identify their wildfire resiliency construction class as defined in the WUI Guide.
- Identify recommended construction classes of buildings under past, present, and future projected climates following the WUI Guide.
- If an upgrade in buildings design is needed, identify when, in which buildings, and the level of upgrades needed.
- Estimate costs and benefits associated with the needed upgrades.



Collaborators

- ICLR, U of Alberta, NRCan, Public Safety Canada, ECCC

Flooding Resiliency Retrofit in Residential Buildings

Objectives

- Identified the existing technologies and knowledge gaps
- Return on Investment from flood resiliency retrofit measures
- Update CSA-Z800 Guideline on basement flood protection
- Develop a CSA standard for Emergency Flood Barriers
- Testing to assess performance of Opening Barriers

Collaborators

Architecture Sans Frontières Québec (ASFQ), SCC, CSA Group, Ville de Gatineau, Climate Ready Together

Residential House Foundation Systems in Permafrost Zones (Assessment, Monitoring and Remediation)

Objectives

- Studying the current condition of aging foundation systems in residential houses in NWT
- Define permafrost foundations performance under climate change conditions
- Research best practices for foundation assessment, effective monitoring systems and remediation techniques based on community engagement and established partnerships.

Collaborators

NWT Government, Geological Survey of Canada, International/Canada Permafrost Association, U Calgary

The Role of Balconies in Resilient MURBs Retrofit: A Survey in Canadian Context

Objectives

- Develop a knowledge database of Environmental Performance (improving IEQ, thermal comfort, and health) as well as Behavioral Performance in Canadian climatic zones.
- Develop a case study database on retrofitting MURB balconies (based on climate zones) in order to identify retrofit strategies and their impact on residents
- Planning resident surveys on retrofitted MURBs across Canada.

Collaborators

- UofT, Ottawa Community Housing, City Housing Hamilton , Montreal municipal housing, Metro Vancouver, RDH

Performance Evaluation of Residential Balconies in a Changing Climate: State-of-Practice

Objectives

- Review existing evaluation and retrofitting procedures;
- Identify needs and steps to develop evaluation and testing guidelines.
- Develop a plan for evaluation, modelling and testing guidelines and updating CSA A500 standard: building guards

Collaborator

- CSA

2010 St-Laurent balcony collapse (Radio-Canada)

Climate Resiliency Retrofit of Residential Roofs with Asphalt Shingles

Highlights

- Reviewing industry's common practice for retrofitting roofs as well as existing standards and guidelines
- Determine the wind and rain resistance of asphalt shingle roof system following various retrofitting options
- Developing an evaluation protocol to identify the appropriate resilient retrofitting option
- Develop climate resiliency retrofit guidelines for increasing the climate resiliency of residential

Collaborators

Roofing Contractors Association of British Columbia, Canadian Roofing Contractors Association, ICLR, Malarkey Roofing Products, GAF

Roof sheathing and shingles blown off during the Barrhaven Tornado on July 13, 2023

Next Steps

- Climate Resilience Guidelines for Canadian Homes: Technical Sheet Development (contract with ICLR)
- Understanding the embedded resiliency measures and gaps in the National Building Code of Canada (internal research project partially funded by NRCan)

Thank You