CHRONIC STRESSORS

Climate change driven chronic stressors include freeze-thaw cycles, wind-driven rain, wetting and drying, frost penetration, wind-driven abrasive materials, atmospheric chemical deposition on materials, and broad spectrum solar radiation and ultraviolet (UV) radiation.

Risks to Buildings, Occupant Safety & Environment

- Premature and accelerated deterioration of concrete, pavement, building facades. Concrete is especially subject to deterioration caused by absorption of moisture and thermal expansion and contraction resulting in fractures and spalling.
- Uncontrolled moisture accumulation in structural materials can reduce the structural integrity of building components through mechanical, chemical and biological degradation.
- Roof ice damming, increased rain penetration and moisture absorption, efflorescence and surface leaching concerns
- Increased decay processess, specifically for wood products
- Changes in hydraulic conductivity, unconfined compressive strength, and longitudinal resonant frequency of the structural performance of cement-treated soils.

Site Strategies

Strategy	Cost	Impact	Alignment
Ensure proper site drainage so that water, rain, and snowmelt is prevented from entering the building. This can be achieved through increased soil infiltration, decreased impervious surfaces, and grey infrastructure such as retention tanks	$$	***	
Reduce water infiltration directly adjacent to the buildings foundation, especially if a below grade structure is present. Apply moisture and vapour barriers to below grade concrete to prevent moisture problems	$$	***	
Use permeable paving materials and grade the site away from structures to improve overall rainwater infiltration capacity of the site, reducing water and moisture inundation to buildings	$	**	

Design Strategies

Strategy	Cost	Impact	Alignment
Use concrete mixes with reduced water content to minimize risk of structural degradation from changes in freeze-thaw cycles	$	**	
Avoid mass and barrier exterior wall designs and select pressure-moderated rain screen walls to shed water at the face with back up drainage. For high-rise buildings, consider pressure equalized rain screen walls for exterior walls	$$	**	
Include flood vents to allow floodwater to escape and ensure all materials installed below the DFE are water and moisture resistant	$	**	
Design the envelope to prevent weather elements from entering the structure and becoming trapped inside the walls. Ensure wall assemblies are designed to resist penetration of moisture through vapour and moisture barriers, and that the dew or condensation point does not lie within the dry portion of the wall assembly	$$	***	
Perform air sealing, high performance insulation, and attic venting to eliminate the escape of heat from conditioned areas which can result in ice dams	$$	***	

As some of BC's regions become warmer and wetter, interior and exterior moisture will become an increasing threat to buildings. In BC's northern latitudes, warmer winters may lead to more frequent freeze-thaw cycles, while regions with milder winter climates could see freeze-thaw cycles decline. These changes are expected to result in higher rates of weathering of building material, as well as general moisture damage. Concrete buildings are particularly vulnerable to weathering impacts that can compromise their durability and resilience over time. As a result, it is important to ensure building envelopes and enclosures are able to resist these changes and prevent moisture from entering the structure.

Design Strategies

Strategy	Cost	Impact	Alignment
Consider the drying potential of both cladding and the wall sheathing/framing and cavities and back venting introduced for drainage purposes	$	*	
Avoid constructing with wet materials throughout the construction process. Ensure all products that will be contained within the building envelope are dry before being sealed in place	$	***	
Ensure placement of dehumidification and exhaust ventilation fans in moisture-rich interior environments, such as bathrooms or basements where moisture may be prevalent	$	***	
Optimize the HVAC system to ensure the indoor air condensation point is low enough to prevent building on cold surfaces and moisture absorption	$	***	
Maintain relatively low moisture levels in conditioned spaces. Protect building systems from getting wet from the interior and allow them to dry toward the outdoors	$	***	
Ensure air is well distributed and the HVAC system can provide sufficient air changes per hour to prevent humidity accumulation	$	**	
Use concrete mixes with reduced water content to minimize risk of structural degradation from changes in freeze-thaw cycles	$	**	

Operations Strategies

Strategy	Cost	Impact	Alignment
Inspect regularly for signs of moisture damage, waterproofing performance, and proper drainage around the building	$	***	
Inspect plumbing and water conveyance systems to ensure they are free of leaks or symptoms of future leaks	$	***	
Application and maintenance of proper drainage systems (i.e. gutters or other diversion methods) to ensure rainwater runoff is controlled and diverted away from the building	$$	***	
Develop a maintenance plan to maintain the permeable and impermeable surfaces that contribute to water diversion	$	**	

Severe Storms — Heat Waves — Flood Events

Relative Cost/ Cost Premium

Low	Medium	High
$	$$	$$$

Relative Impact

Low	Medium	High
*	**	***

Additional Resources

- European Commission. (2017). Science for Environment Policy Future Brief: Noise abatement approaches
- Hong Kong Environmental Protection Department. Environmental Noise Mitigation Measures
- Toronto Public Health. (2017) How Loud is Too Loud? Health Impacts of Environmental Noise in Toronto
- Engineering Services City of Vancouver. City of Vancouver Noise Control Manual
- Moisture Control Guidance for Building Design, Construction and Maintenance.