Facade Tectonics FORUM TORONTO

BUILDING FUTURES

Anticipating Tomorrow's Needs With Future-Ready Strategy

SPEAKERS

DAVID DE ROSE, M.A.SC., P.ENG., BSSO

Managing Principal

Synergy Partners

LORI O'MALLEY, M.A.SC., P.ENG.

Building Envelope Engineering Specialist

PCL Constructors Canada Inc.

ALEX LUKACHKO, M.ARCH.

Principal and Senior Building Science Specialist

RDH

KEVIN DAY, LEED AP

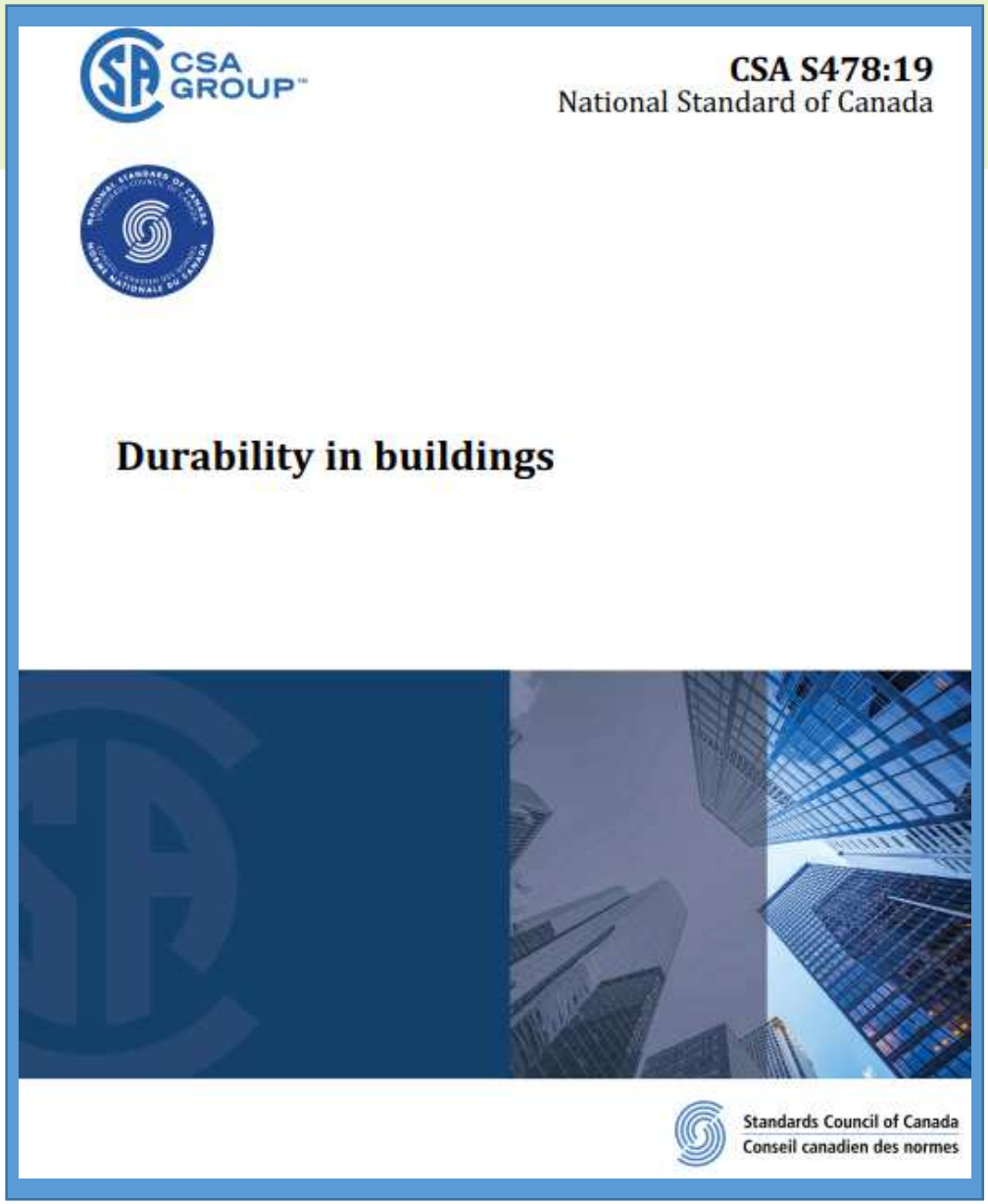
President

Krisro Metal Industries

CSA S478
Durability in Buildings

David De Rose, M.A.Sc., P.Eng.
Synergy Partners
May, 2019

New CSA Standard



Source: **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Copyright

Durability in Buildings CSA S478-19

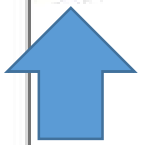
- Supercedes Guideline issued in 1995 that focused on avoiding “Premature Degradation”
- Developed as a standard to be referenced in NBC but can also be used by building owners (e.g. IO)
- Sets minimum requirements in creating durable buildings and elements
- Emphasizes the need to consider initial and long-term costs, maintenance, access & replacement in the selection of building elements
- Applies to Building envelope and structure

Climate Change

- New perspective – introduces climate change and potential effects on building elements – standard will evolve as information on environmental loads evolves
- Loads - look forward as well as at past environmental data

Building DSL

Design service life category	Building type	Minimum design service life for building, years	Range of design service life, years
Long life	• Single-unit residential • Multi-unit residential • Mid- and high-rise commercial and office buildings • Post-disaster buildings (e.g., hospitals, power generating stations, public water treatment facilities, and emergency response facilities) • Performing arts buildings, arenas, schools and colleges, and other assembly occupancies • Detention, care, and treatment occupancy	50	50 to 99



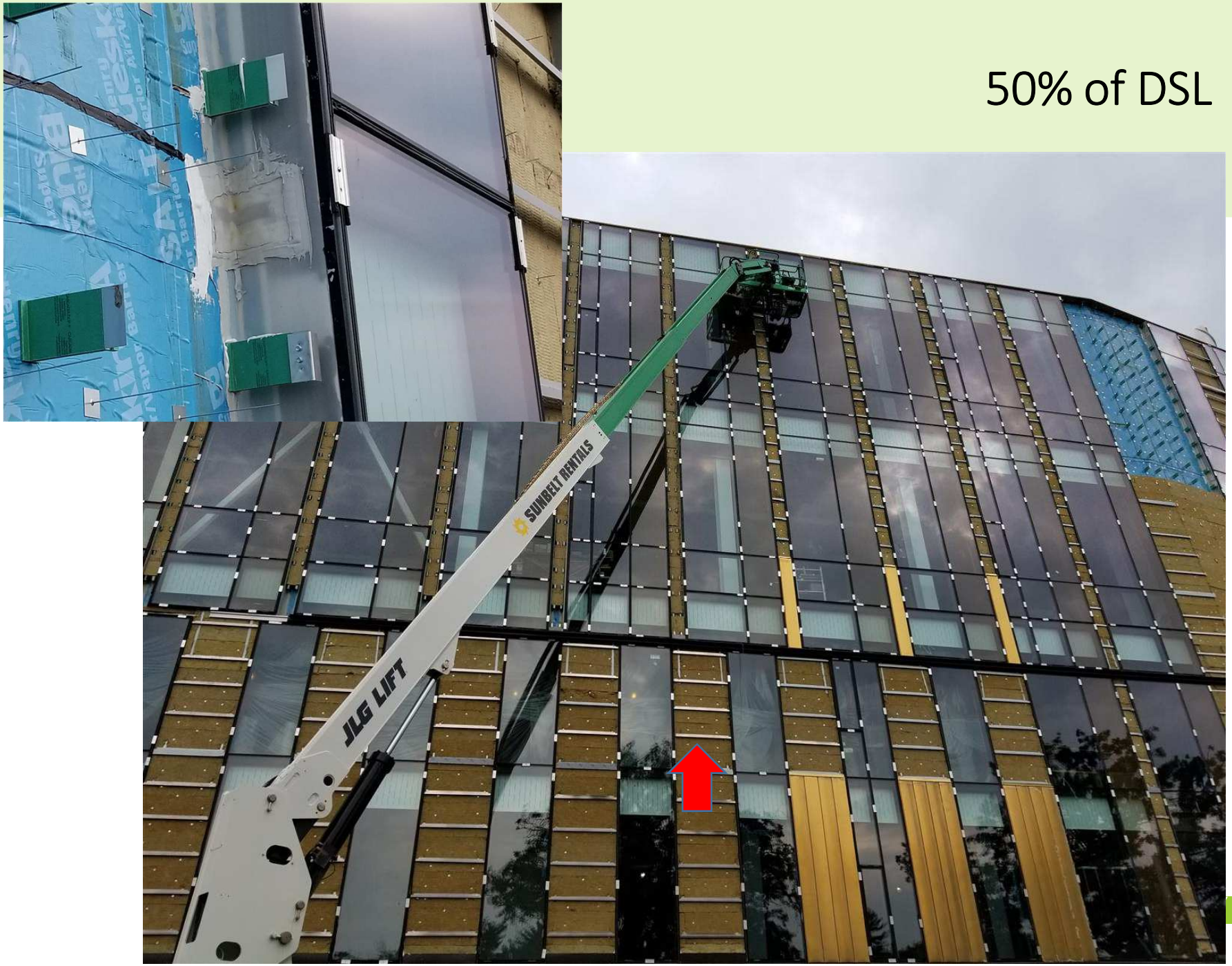
Source: Table 1, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Element DSL & Categories of Failure

Category	Consequences of failure	Description of failure	Examples	Minimum design service life of building element
4	Loss of resistance capacity OR High repair cost	Loss of building or building element resistance capacity or function OR Repair to the building or building element is costly because of difficulty in execution or accessibility (e.g., specialized equipment, engineered scaffolding, swing-stage use), or repair requires extensive replacement of materials or components	• Roof or waterproofing replacement • Isolated roof leak in a protected roof membrane system that is difficult to access • Concealed cladding attachments or guard elements that are easily accessible for inspection and repair but where repairs require extensive use of materials • Inner seal of a two-stage joint • Insulating glass unit failure • Protective coatings on unserviceable elements (e.g., long-span roof over a pool)	50% of building design service life

Source: Table 2, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

50% of DSL



Element DSL & Categories of Failure

Category	Consequences of failure	Description of failure	Examples	Minimum design service life of building element
5	Risk to health and safety of building users	Unacceptable risk of illness for building users or the public (e.g., personal injury, biological growth potentially affecting human health, release of toxic chemical substances)	• Cladding falling hazards • Examples shown for categories 6 and 7 that also pose a risk to health	100% of building design service life
6	Injury, loss of life, or loss of asset	Unacceptable risk of injury, loss of human life, or loss of building; building elements are hidden or not readily inspected.	• Cladding primary support members and infill structural wall systems • Cladding connectors and secondary support framing members • Guard elements that are difficult to access for inspection and repair	

Source: Table 2, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

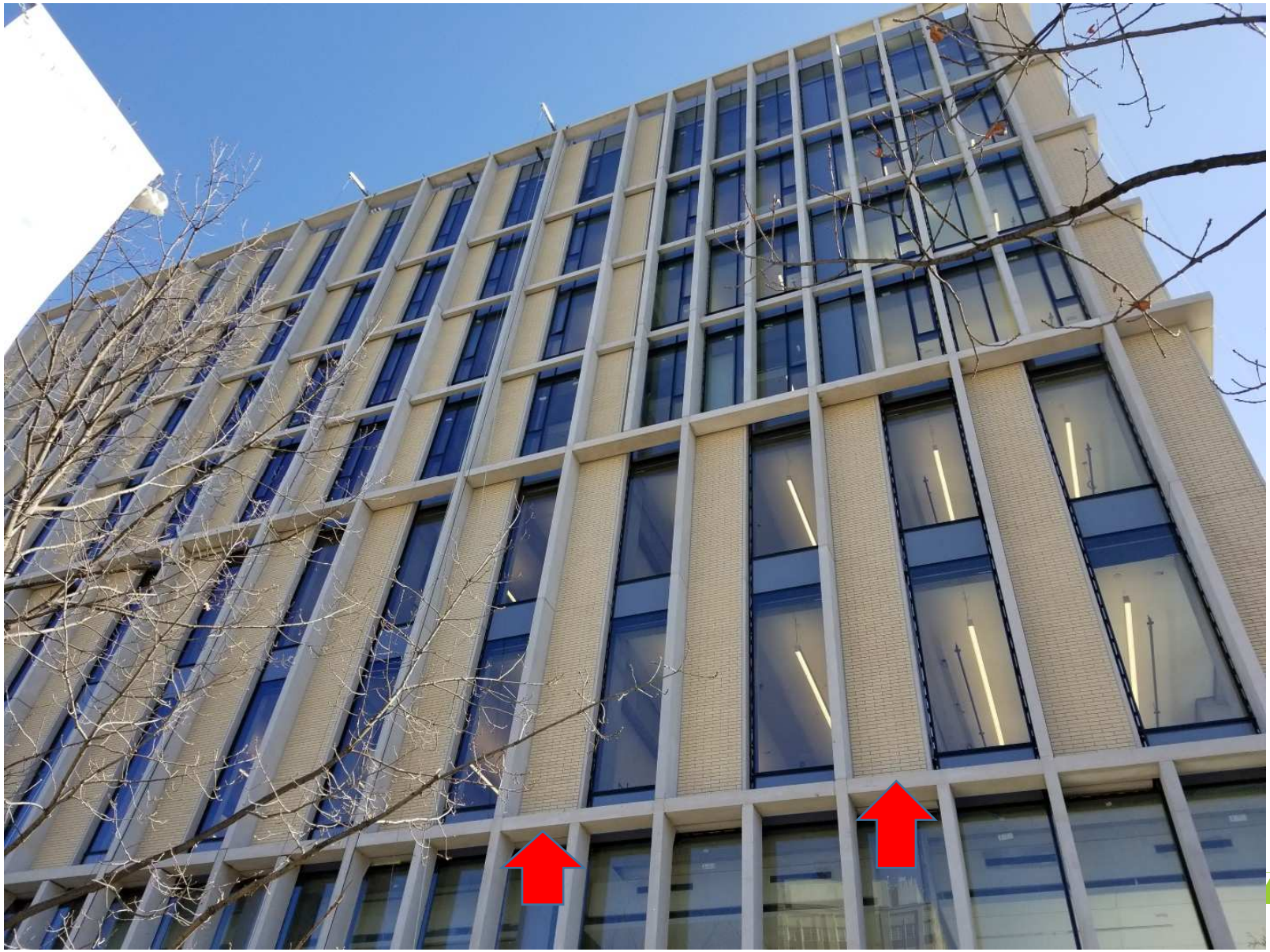
100% of DSL

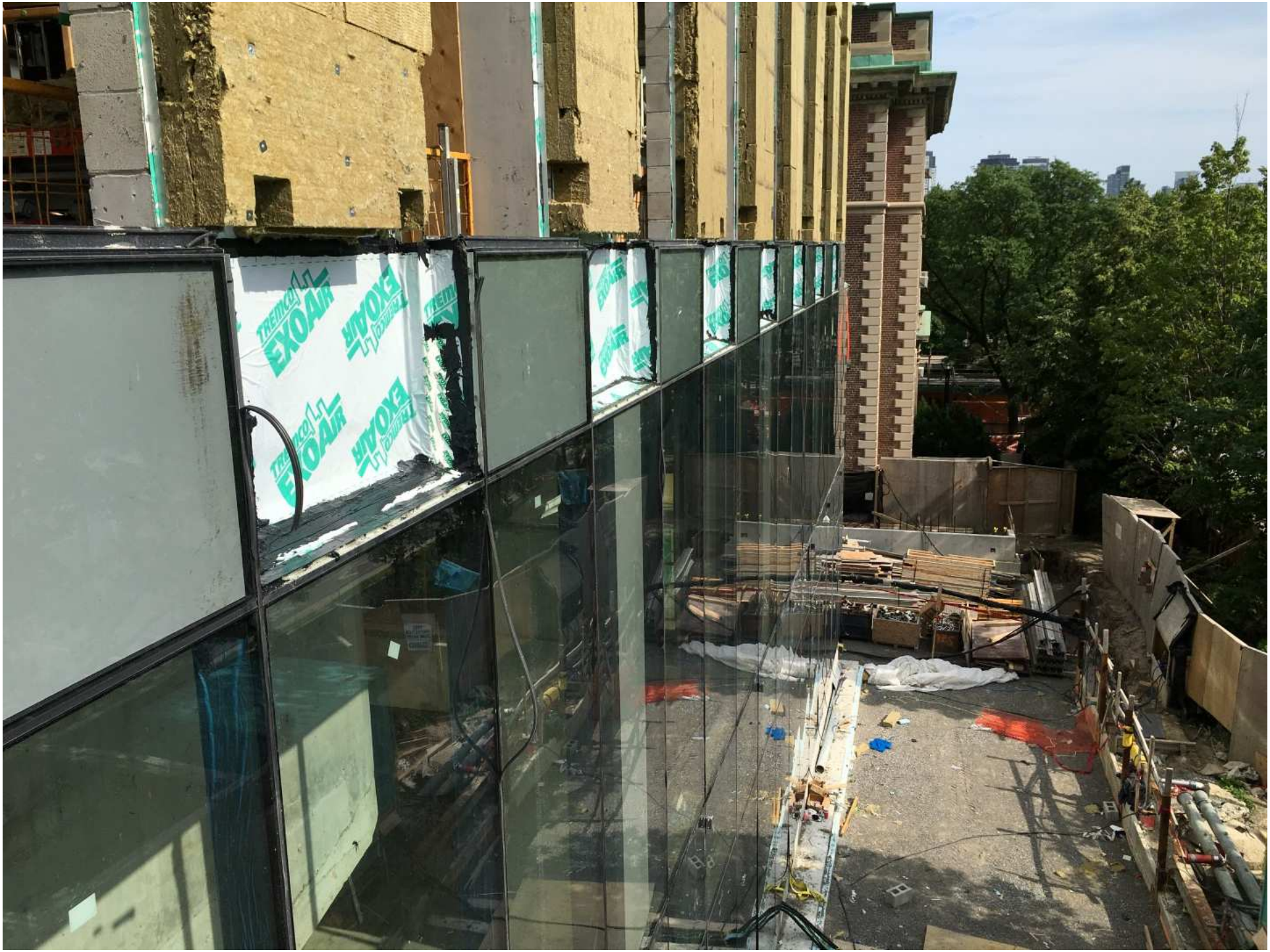
Element DSL & Categories of Failure

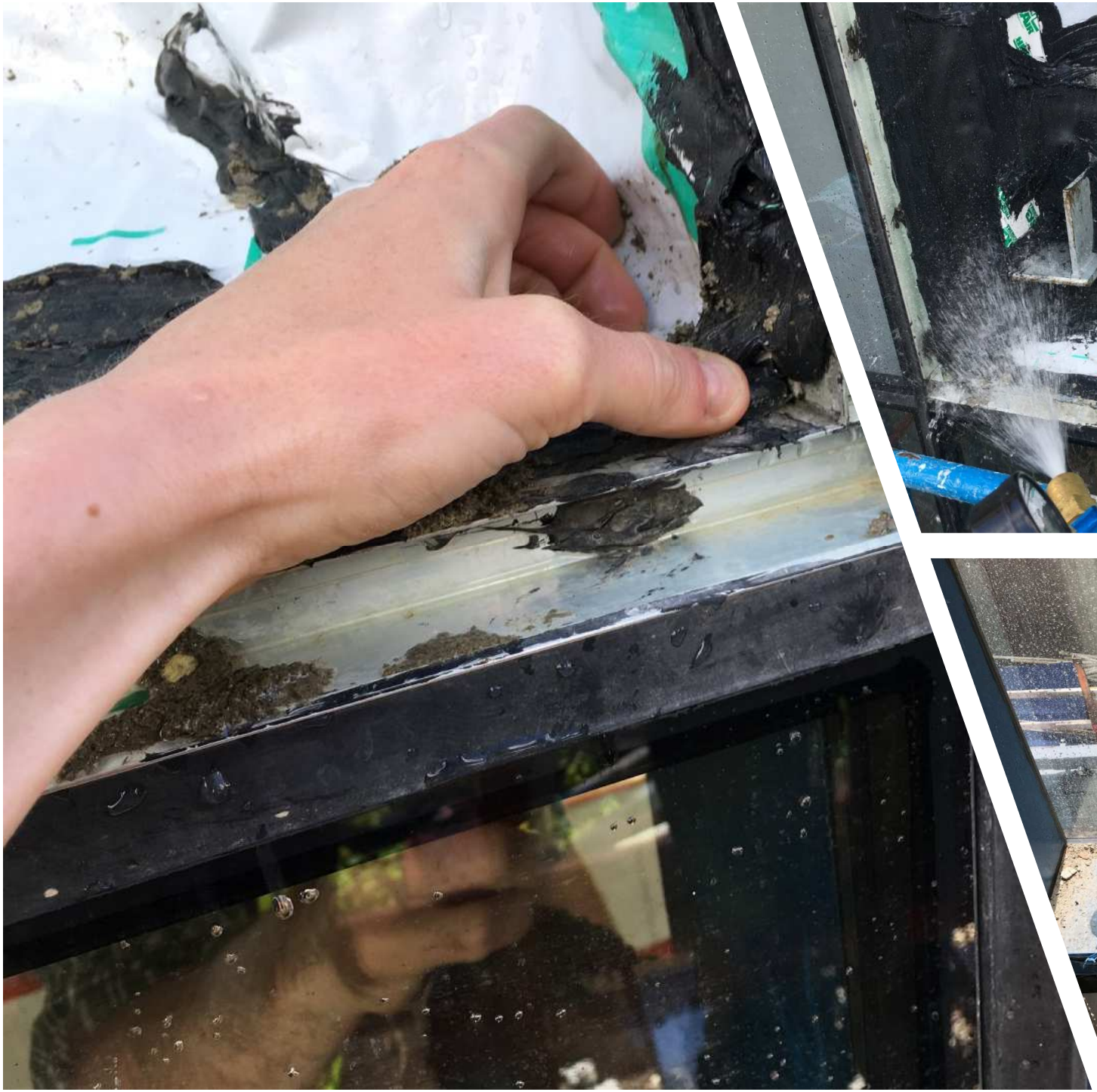
Category	Consequences of failure	Description of failure	Examples	Minimum design service life of building element
7	Prohibitive repair cost	Extensive reconstruction required to repair or replace the building element	• Waterproofing system below overburden • Through-wall flashings and inaccessible drainage • Elements of the building or building enclosure that are difficult or costly to access for inspection and repair on mid- and high-rise buildings • Concealed sheathing, air barriers, and insulation • Foundation wall waterproofing and dampproofing • Corrosion of unserviceable elements	100% of building design service life

Source: Table 2, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

100% of DSL

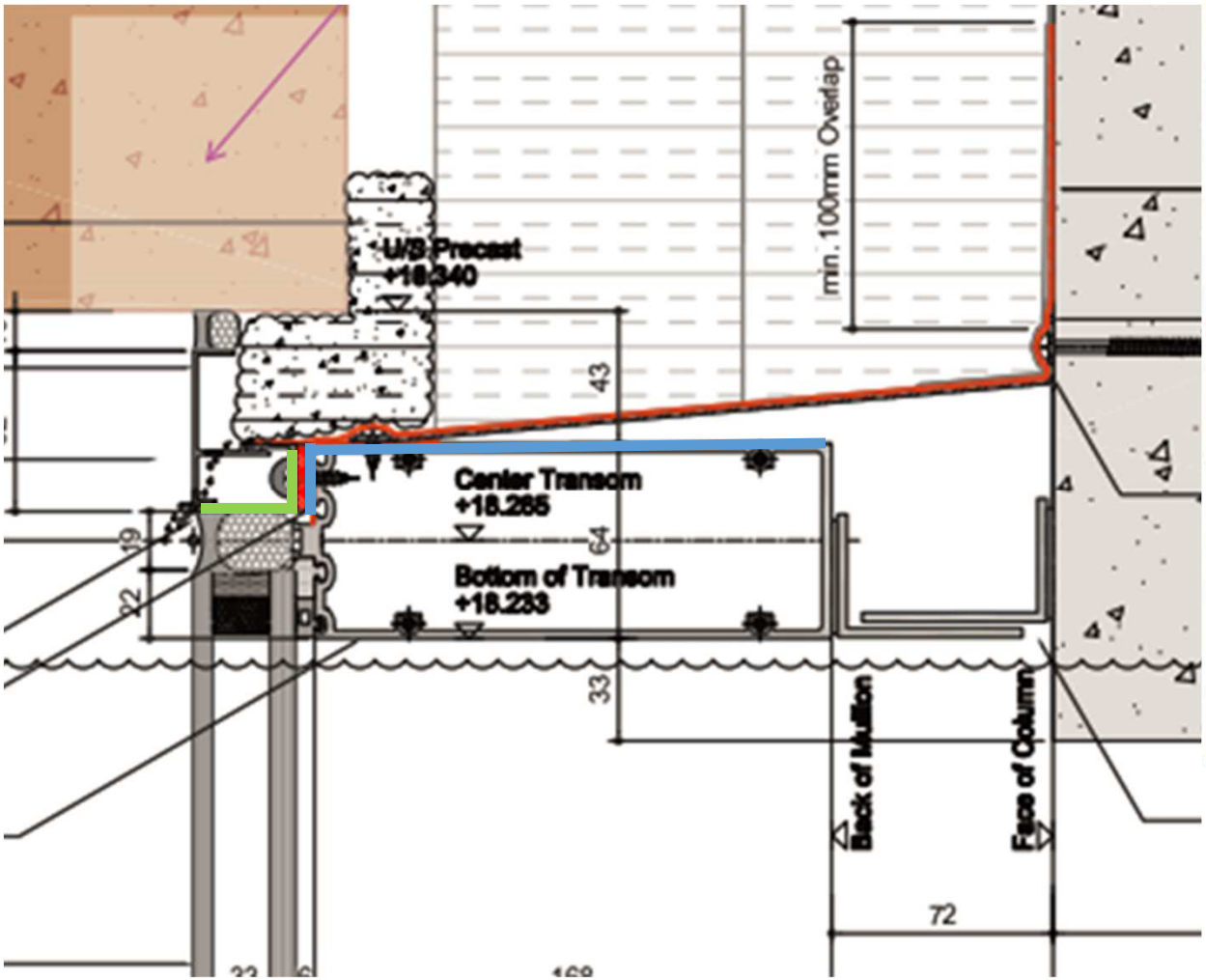



THERMOWALL
EXOAIR




ATTENTION

Compatibility Issues



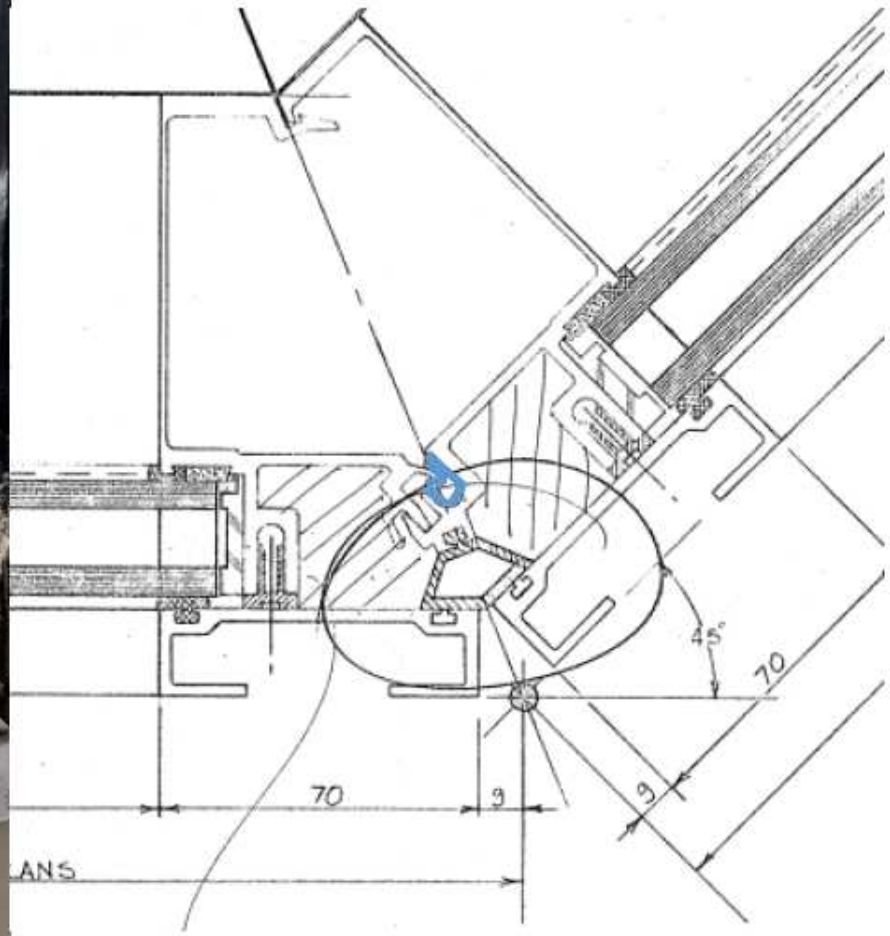
Element DSL & Categories of Failure

Category	Consequences of failure	Description of failure	Examples	Minimum design service life of building element
7	Prohibitive repair cost	Extensive reconstruction required to repair or replace the building element	• Waterproofing system below overburden • Through-wall flashings and inaccessible drainage • Elements of the building or building enclosure that are difficult or costly to access for inspection and repair on mid- and high-rise buildings • Concealed sheathing, air barriers, and insulation • Foundation wall waterproofing and dampproofing • Corrosion of unserviceable elements	100% of building design service life

Source: Table 2, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

100% of DSL

100% of DSL



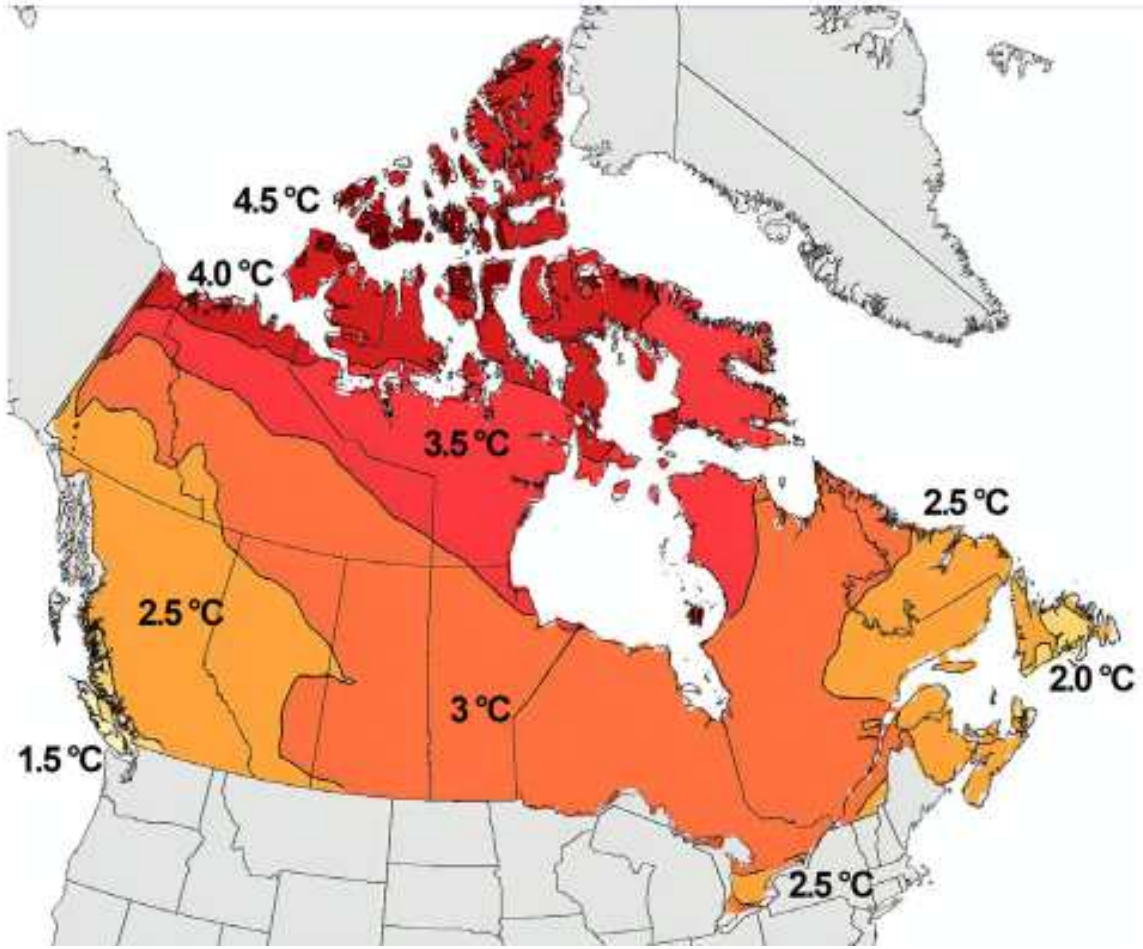
Building Durability Plan

Includes the following:

- A maintenance plan;
- A quality assurance plan (design, construction, operation, etc.)
- An operation and maintenance manual; and
- Documentation required to support predicted service life (demonstrated effectiveness, modelling, testing, life-cycle cost analysis)

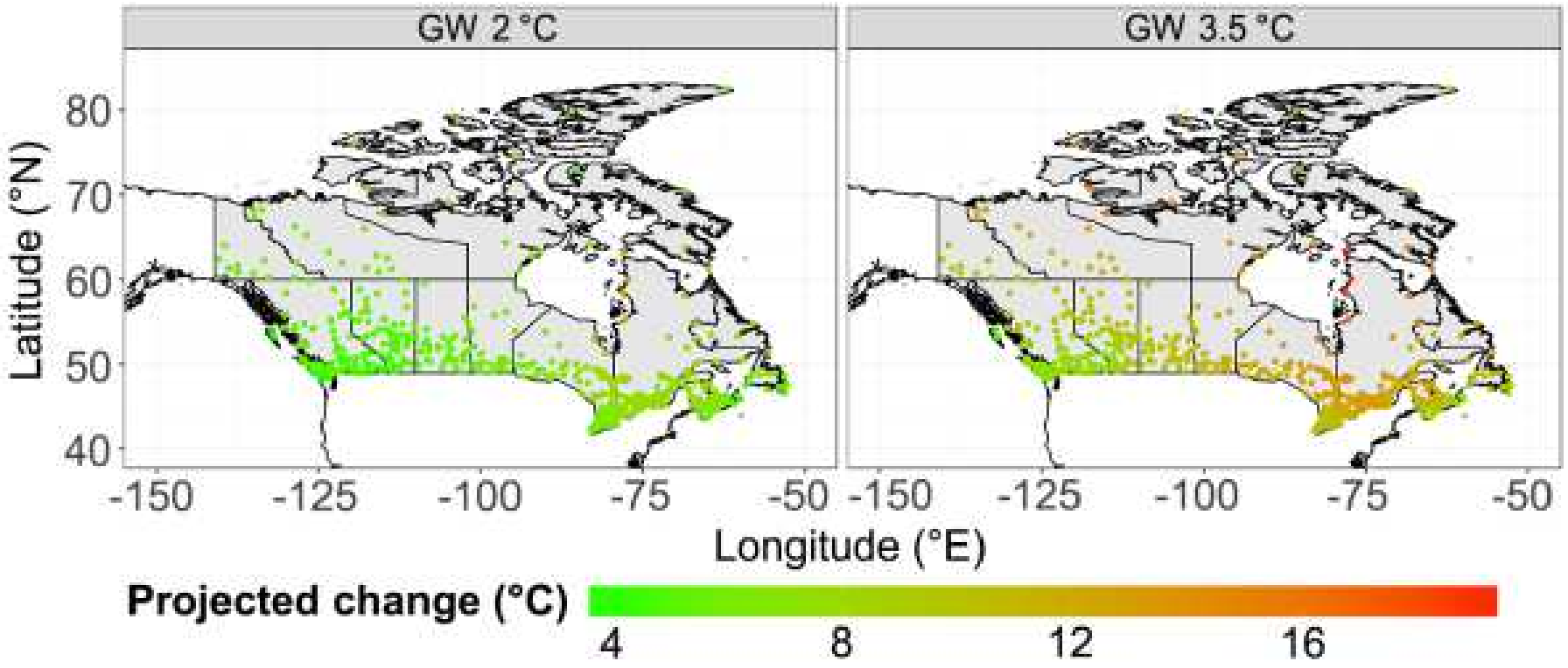
Source: Clause 13, **CSA-S478:19 Durability in Buildings**.

Projected Increase in Annual Average Temperature



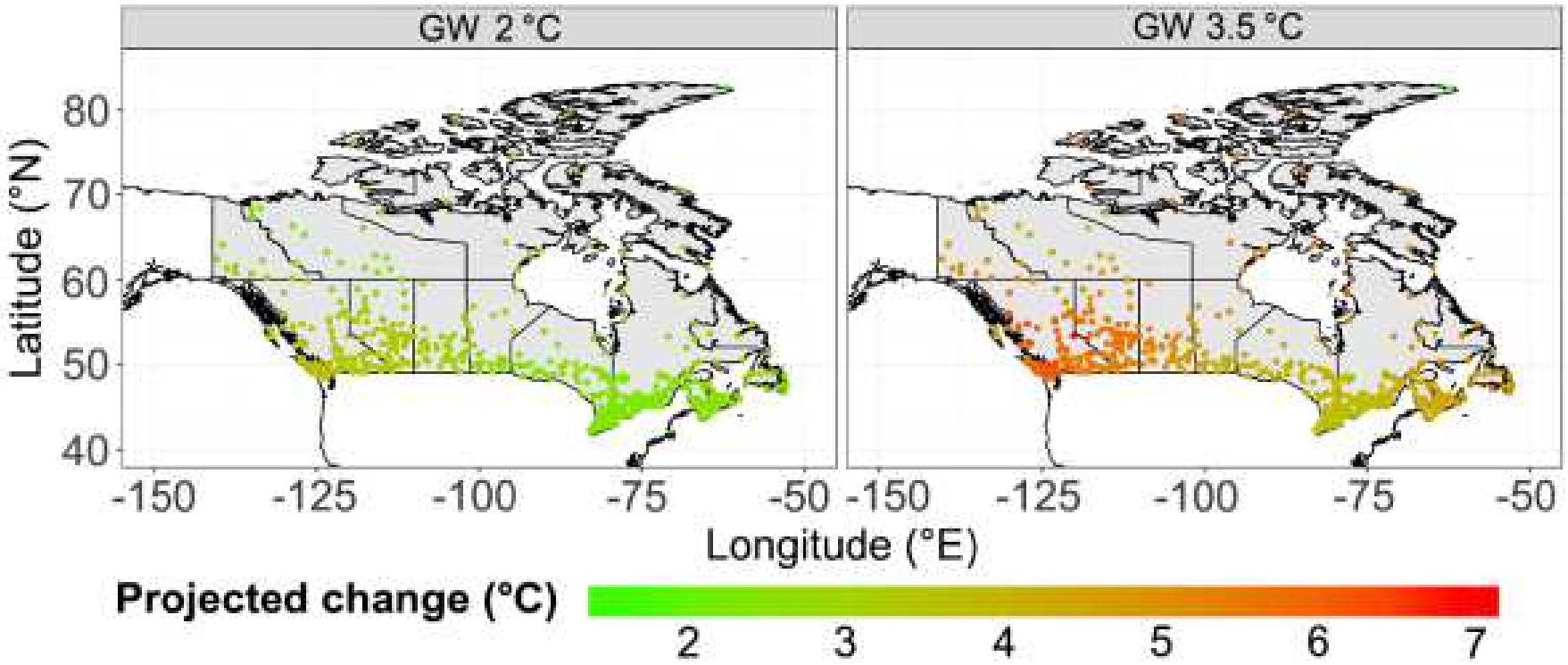
Source: Figure E.2, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Projected Changes in 2.5% Jan. DT



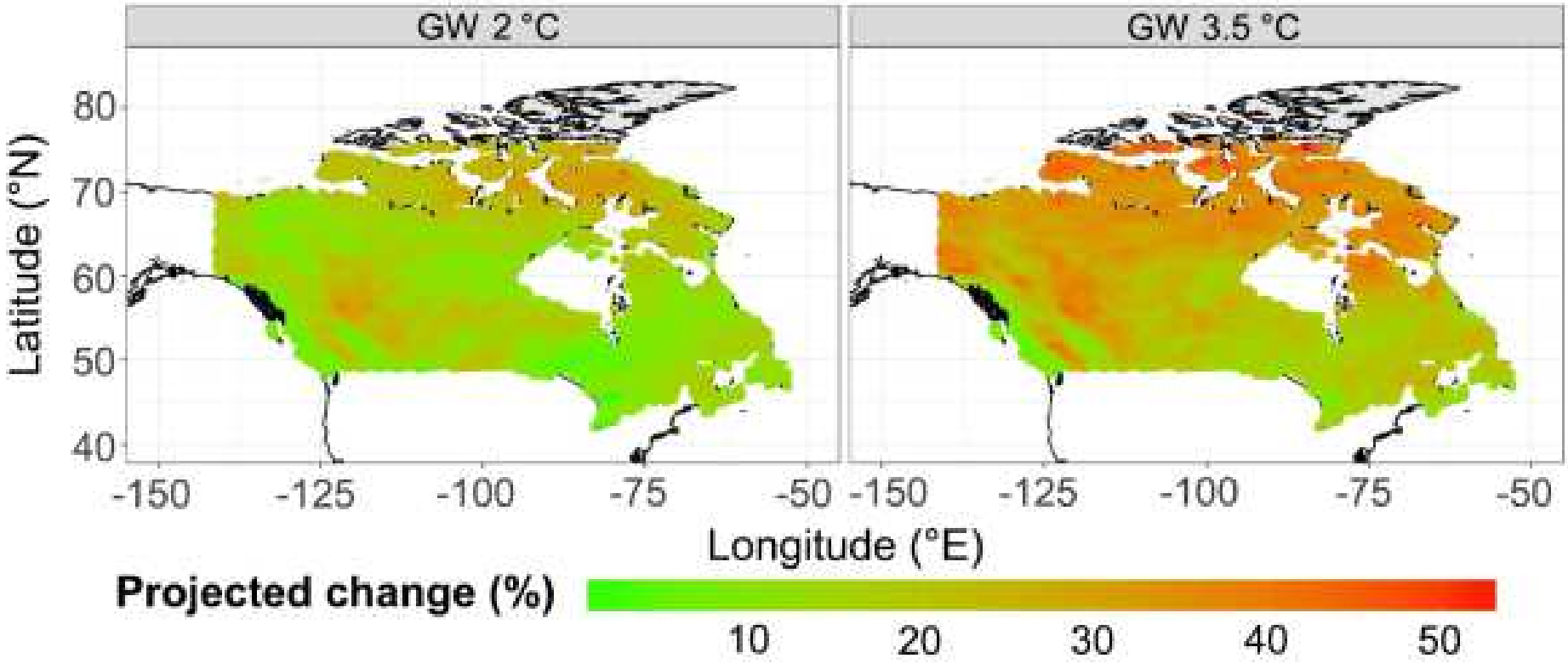
Source: Figure E.4, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Projected Changes in 2.5% July DT (wet)



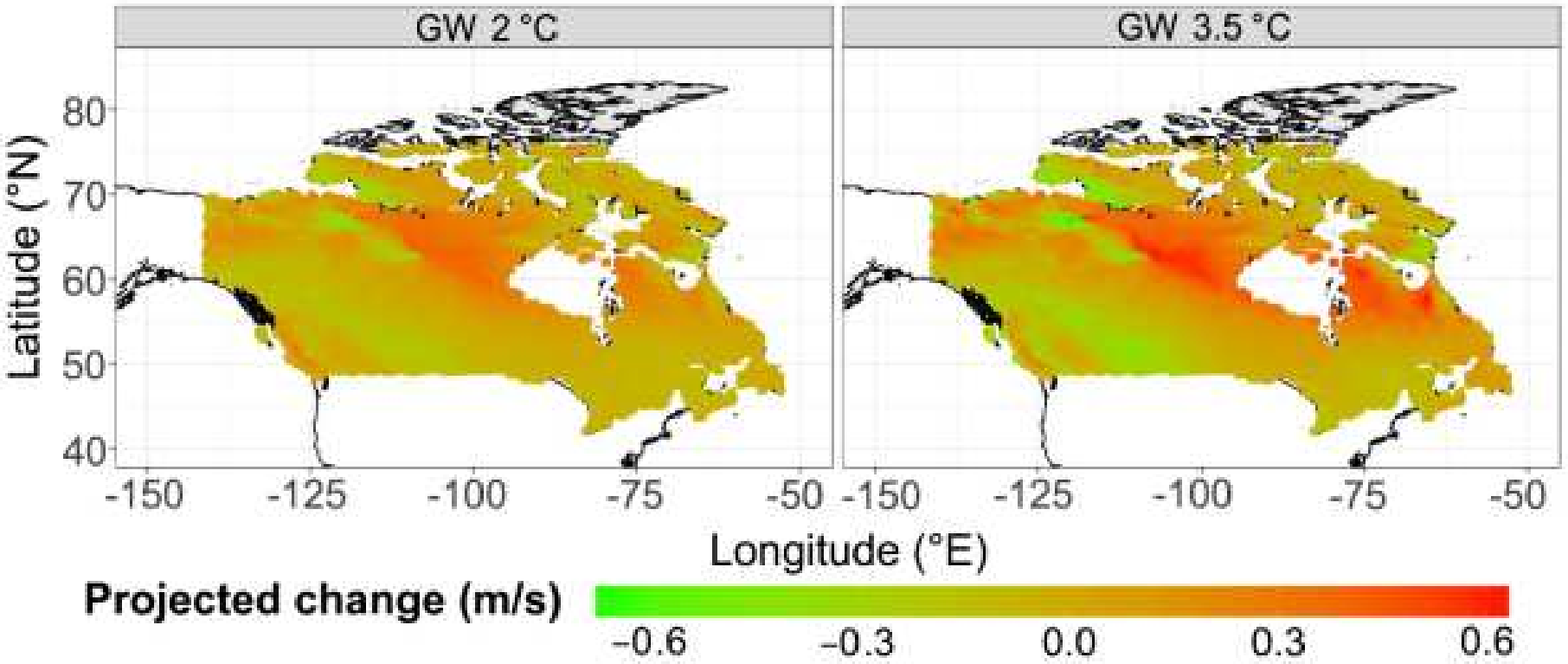
Source: Figure E.6, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Projected % Changes in Total Precip.



Source: Figure E.8, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Projected changes in avg. wind speed (m/s)



Source: Figure E.9, **CSA-S478:19 Durability in Buildings**. © 2019 Canadian Standards Association

Guidance for Climate Change Resilient Design

Item	Suggestions
Higher temperatures and temperature ranges	- Dimensionally stable products with lower coeff. of thermal expansion - Products with enhanced elasticity (e.g. low modulus sealants)
Higher temperature and exposure to UV	- products of proven resistance to heat aging and UV
Increase in Wind-Driven Rain Loads (in concert with higher average temperature and humidity)	-More robust design approaches that enhance drainage and min. retention -products with enhanced resistance to hydrolysis -products with enhanced corrosion resistance

Source: Table E.1, **CSA-S478:19 Durability in Buildings**.

Durability and Climate Change – Selected Studies in Various Countries

- Frost decay of masonry materials
- Concrete Carbonation
- Corrosion of embedded metals in concrete
- Degradation of wood products
- Corrosion of Metals
- Effect of Solar Radiation on plastics

Source: Annex E, **CSA-S478:19 Durability in Buildings**.

Facade Tectonics FORUM TORONTO

LORI O'MALLEY, M.A.SC., P.ENG.

Building Envelope Engineering Specialist
PCL Constructors Canada Inc.

Presentation Unavailable

Facade Tectonics FORUM TORONTO

ALEX LUKACHKO, M.ARCH.

Principal and Senior Building Science Specialist
RDH

Presentation Unavailable

Facade Tectonics FORUM TORONTO

BUILDING FUTURES

Anticipating Tomorrow's Needs With Future-Ready Strategy

SPEAKERS

DAVID DE ROSE, M.A.SC., P.ENG., BSSO

Managing Principal

Synergy Partners

LORI O'MALLEY, M.A.SC., P.ENG.

Building Envelope Engineering Specialist

PCL Constructors Canada Inc.

ALEX LUKACHKO, M.ARCH.

Principal and Senior Building Science Specialist

RDH

KEVIN DAY, LEED AP

President

Krisro Metal Industries