Incorporating Climate Change Considerations into Asset Management

An Integrated Approach

Donghui Lu, PhD., IAM. Cert.
Asset Management Consultant
AECOM

Agenda

1. Introduction
2. Background
3. Purpose and Objective
4. Four AM Core Elements - leading to an Integrated Approach
5. Closing
6. Q&A

Introduction

Introduction

Donghui Lu, Ph.D., IAM Cert.
Asset Management Consultant
AECOM Mississauga Office

Chris Lombard, P.Eng., MBA,
Canada Asset Management Lead
AECOM, Burnaby

My Field

- Asset Management Strategy & Planning
- Canadian Infrastructure Performance Benchmarking
- Climate Change Risk & Vulnerability Assessment

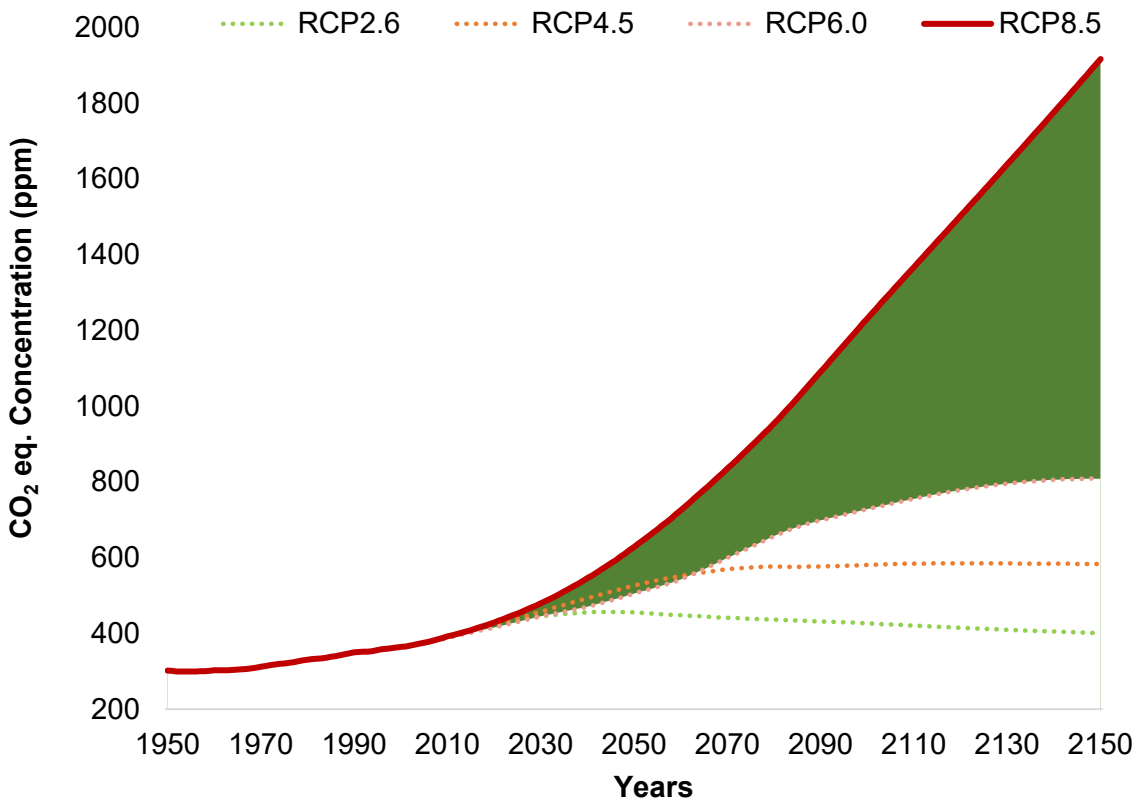
Hassan Rouhani, Ph.D., P.Eng.,
Climate Change Specialist
AECOM, Markham

Background

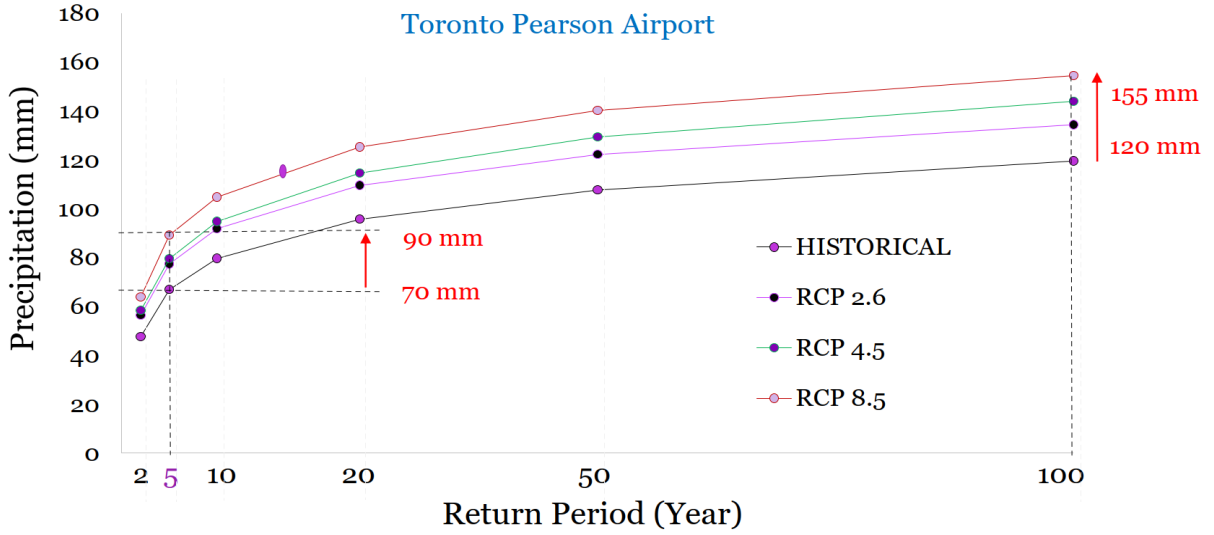
Regulations and opportunities

Federal, Provincial, and Municipal

Background – Climate Change and Assets



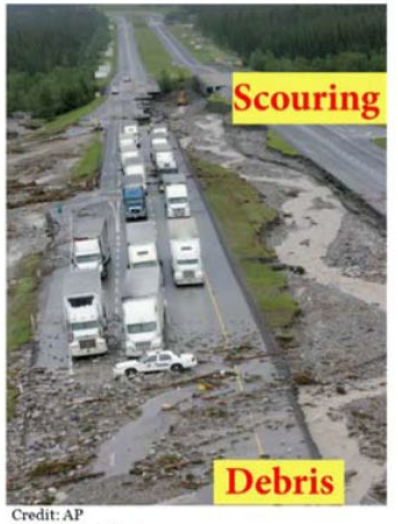
Data source: 5th *Intergovernmental Panel on Climate Change (IPCC)* report



Data generated from IDF-CC tool: http://www.idf-cc-uwo.ca/

Credit: AP
2013 Toronto Flood

Credit: Luke Hendry/The Intelligencer



Credit: AP
2013 Alberta Flood

Source: Donghui Lu, PhD Thesis, University of Waterloo, 2020

Background – Climate Change and Municipal Opportunities in Canada

Federal

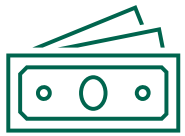
- Federal Sustainable Development Strategy (2022-2026)
- National Adaptation Plan (2023)
- Canadian Net-Zero Emissions Accountability Act (2021)
- Greening Government Strategy (2017)

Provincial

- Clean BC Plan (2018)
- Ontario Regulations e.g., 588/17 (2017)
- Ontario Provincial Policy Statement (2020)
- Quebec 2030 Plan for a Green Economy (2020)
- Etc.

Municipal

- Declare Climate Emergency
- Develop Climate Change Plans
- **Asset Management Plans and Climate Change**
- Municipal Energy Plan
- Green Building Standards
- Sustainable Transportation Initiatives



Financial Supports: Green Municipal Fund, Municipal Energy Plan Program, Infrastructure Canada Green Infrastructure stream, etc.

Purpose and Objective

Purpose and Objective

- Introduce an integrated approach to consider Climate Change in Asset Management
  - The Four Core AM Elements

Source: AMBC AM Framework

The Approach
Four Core AM Elements

Four Core Elements leading to Integrated Approach

- **Assets** – Inventory and State of Assets
- **Information** – Climate Change Assessment Results incl. Mitigation and Adaptation plans
- **People** – Climate Change AM Governance
- **Finances** – Risk, Cost, & Levels of Service

Asset

Where are the assets located? climate hazard area (e.g., floodplain)?

What services are provided by these assets can be impacted by climate change ?

What assets should we perform mitigation and adaptation assessment ?

What are their attributes? (e.g., size, material, etc.)

What is their replacement value?

What condition are they in?

What is their expected remaining life?

Information – Climate Change Assessment

Climate Change Mitigation Plans

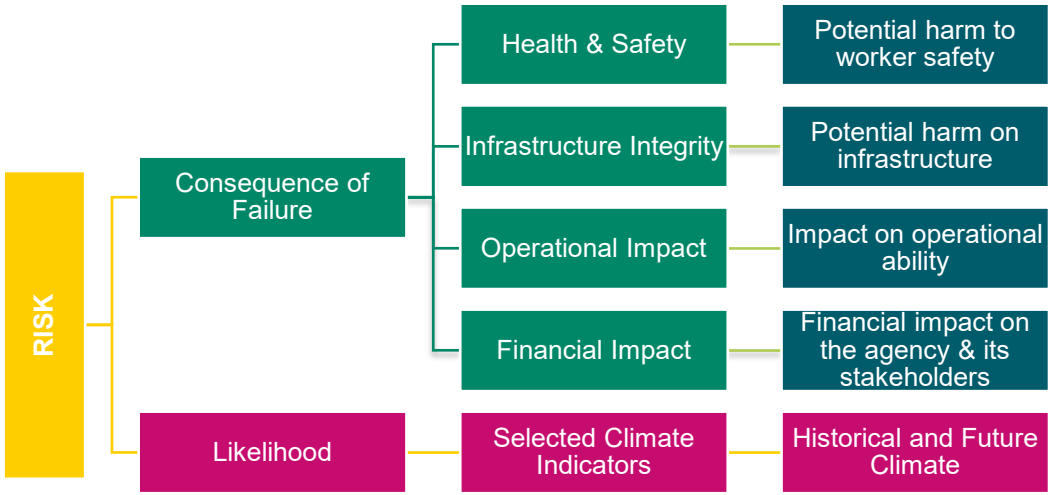
- Assess potential impact GHG emissions
- Develop solutions to reduce the GHG emissions
- Benefits of the GHG emission reduction strategies

Risk Assessment and Adaptation Plans

- Identify the key climate variables & vulnerable assets
- Assess risks under climate change conditions
- Suggest implementable adaptation measures
- Evaluate financial impact of strategies

Information – Climate Change Adaptation – Risk Assessment

Climate change Risk Framework



Risk Result Sample

	High Temperature			Multi-Day Heavy Precipitation		
Project Elements	**Historical**	**2040s**	**2080s**	**Historical**	**2040s**	**2080s**
Building Envelope (All Buildings)	0	0	0	8	10	10
Building Mechanical HVAC and Electrical System (All Buildings)	8	10	10	8	8	10
Emergency Power Distribution System	8	10	10	0	0	0
Process Mechanical System (In All Buildings)	12	15	15	16	20	20

Risk Classification

Risk Score (R)	Risk Classification		
1 - 9		Low Risk	Risks requiring minimal action
10 - 16		Medium Risk	Risk that may require further action
17 - 25		High Risk	Risks that require action

Consequence					
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	Likelihood				
	1	2	3	4	5

Source: PIEVC High Level Screening Guide

Information - Adaptation Measures

Policy: To develop policies that maintain safe and healthy working conditions

Design: To improve the design criteria to accommodate future conditions

Operations & Maintenance: Develop O&M strategies to sustain LoS & reduce risk

Sample Adaptation Recommendations to Increase Climate Resilience

Risk Event	Project Components	Current	Risk (2040s)	Risk (2080s)	Potential Impacts	Adaptation Measure	Risk Treatment	Effectiveness	Cost Impact
High Temperature	Building Mechanical HVAC System	8	10	10	Strain HVAC systems, increase building heat, stress power systems. Wildfire smoke can hinder HVAC performance.	Design	- Implement passive design strategies	High	High
						Design	- installing solar panels on the roof	High	High
						Design	- Use white "cooling" boxes for outdoor electrical equipment	High	Low
						Design	- Sizing HVAC systems	High	Low
						O&M	- Monitor energy use more frequently	Medium	Low
						O&M	- Enhance the surveillance of HVAC cooling needs	Medium	Low

Information – Climate Change Return on Investment (RoI) Tool

- **Purpose**: a toolkit to analyze RoI for Adaptation Capital Projects considering natural hazard & climate change.
- **Monetize benefits** and consider **lifecycle cost** incl. capital cost, O&M cost, and inflation in the asset life.

- **Climate Hazard Covered**:
  - **Riverine Flood**
  - **Wind**
  - **Wildfire**
  - **Extreme Temperature**
  - **Ice Storm**

- Defense Research and Development Canada (DRDC) & Public Safety Canada (PSC) project
- MS Excel free available by end of 2023

Information - Climate Change Mitigation Assessment

Example of CC Mitigation Measures

Asset Lifecycle Phase	Anticipated GHG	Examples of Climate Change Mitigation Options
Construction: Operation of gasoline or diesel fuel powered construction vehicles & equipment	Emissions from diesel or gasoline powered vehicles & equipment	• Maintaining vehicles to achieve optimal emissions. • Minimizing on-site vehicle idling • Implementing a vehicle maximum idling policy.
Operations and Maintenance: Gasoline and diesel fueled passenger and commercial vehicles travelling to site	Increased vehicle kilometers travelled along the project corridor increase GHG emissions	• Improvement to vehicle emission efficiencies via new manufacturer standards, low-carbon fuels and electric vehicles
Disposal: Downstream emissions from material waste practices or recycling practices	Emissions from landfilling of project materials, incineration of project materials, or recycling/reuse of project materials	• Employing a plan for carbon neutral modes of material disposal and/or recycling programs • Encouraging reuse of available material (e.g., recycling of concrete components into new concrete construction)

- *Climate Protection (PCP) Milestone Tool*: user-friendly, web-based, helps municipalities prepare GHG inventories, set targets, build action plans and track progress on implementation.
- **Cover five sectors**: Buildings and Facilities; Fleet Vehicles; Streetlights and Traffic Signals; Water and Wastewater; and Solid Waste

Finances – Levels of Service, Risk & Cost

1 What is the state of infrastructure?

2 What is the Level of Service (LoS)?

3 What is the Asset Risk?

1.1 Inventory Assets

1.2 Assess Condition

1.3 Determine Residual Life

2.1 Determine LoS

3.1 Consequence x Probability =Risk

4.1 Asset Acquisition Strategies

4.2 Operations and Maintenance Strategies

4.3 Renewal and Replacement Strategies

4.4 Disposal Strategies

5.1 5, 10, 20 Year Funding Needs

6.1 Recommendations for Continuous Improvement

4 What are the asset lifecycle strategies?

5 What are the funding needs?

6 How can AM Planning be improved?

AM Planning Approach – A Tactical View

Finances – Levels of Service, Risk & Cost

Climate Change Adaptation & Mitigation Strategies and Plans

1 What is the state of infrastructure?

2 What is the Level of Service (LoS)?

3 What is the Asset Risk?

1.1 Inventory Assets

1.2 Assess Condition

1.3 Determine Residual Life

2.1 Determine LoS

3.1 Consequence x Probability =Risk

Priorities

- Unacceptable Climate Risk
- Unacceptable GHG Emission
- Unacceptable LoS gap

4.1 Asset Acquisition Strategies

4.2 Operations and Maintenance Strategies

4.3 Renewal and Replacement Strategies

4.4 Disposal Strategies

5.1 5, 10, 20 Year Funding Needs

6.1 Recommendations for Continuous Improvement

4 What are the asset lifecycle strategies?

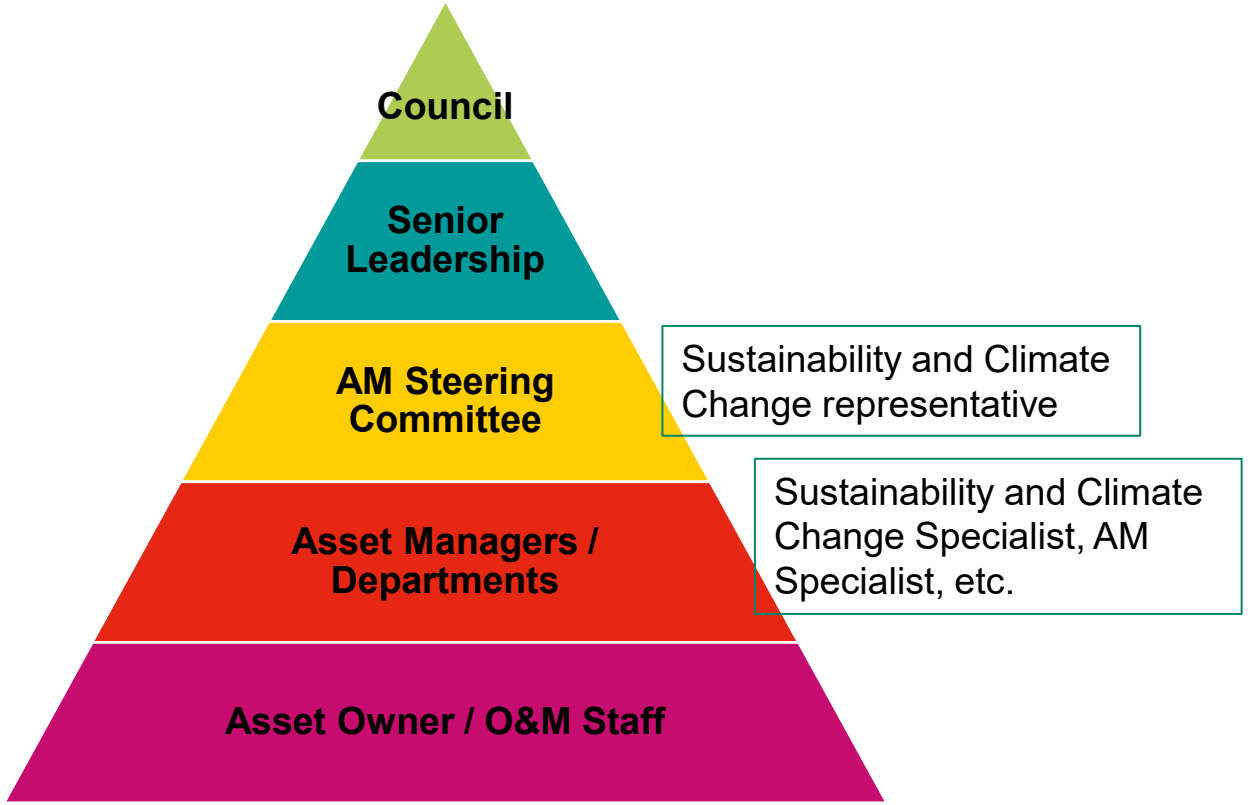
5 What are the funding needs?

6 How can AM Planning be improved?

aecom.com

AM Planning Process – A Tactical View

People - AM Governance for Climate Change



Integrate Sustainability & Climate Change Roles in Typical AM Governance Structure

- **Integrate Climate Change Related Roles and Responsibility** in AM Governance Structure to support implementation of Climate Change related AM policies and strategies, and plans.

- Effective AM **Governance**:
  - Roles and responsibilities are clearly defined
  - Communication plans are established
  - Decision-making processes are streamlined.

Closing

The Key for Integrating Climate Change in Asset Management

- **Asset & Information**:
  - Perform Assessment for **critical** infrastructure
  - Use Climate Change information to **inform decisions** on infrastructure investments and maintenance considering future climate conditions.
- **People & Governance**:
  - Develop formalized Climate Change **Governance structure**
  - Develop a **communication plan**
  - **Training** or workshop for **education** and buy-in.
  - **Integrate** climate change in related **decision-making** process
- **Finances**:
  - Set appropriate **levels of service** and manage **risk**
  - **Take actions** (e.g., capital projects, further studies, applying grant funding, etc.)

Q&A

Thank you for your attention.

Delivering a better world

aecom.com

AECOM Delivering a better world

Contact:
donghui.lu@aecom.com