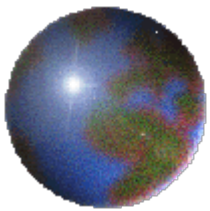
2008 York Region Climate Change Workshop



Adaptation of Infrastructure to Address Impacts of a Changing Climate

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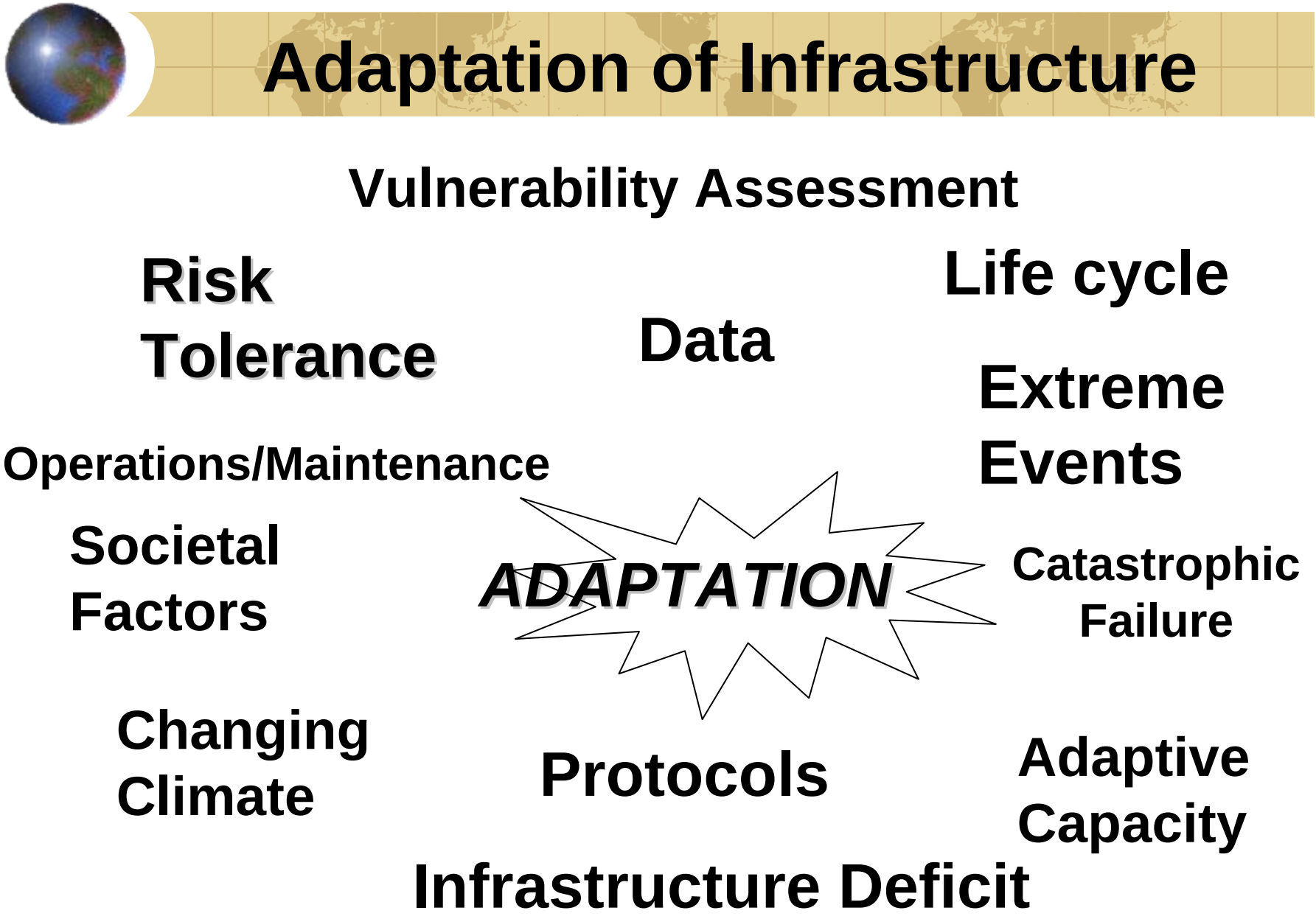
A Changing Climate

A Communities Framework

- A society's Quality of Life depends on its:
  - Social network and security
  - Living spaces
  - Consumptive cycle
  - Environmental footprint
  - Physical Infrastructures
  - Mobility
  - Workplace/economy
  - Governance

A Common event

Adaptation of Infrastructure

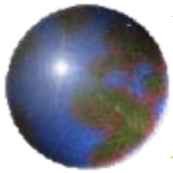


Infrastructure and Climate Change

- Up to $ 100 billion infrastructure deficit in Canada
- $??? trillion replacement costs
- Existing infrastructure is designed on historical climatic design values, including extremes of those values
- Difficult and expensive to upgrade if climate changes
- Critical infrastructures have huge impacts on the well-being and operation of society e.g. electrical power
- It’s not just a matter of design – operations and maintenance, monitoring are other critical factors
- Infrastructure is normally built for the long term

Infrastructure Lifecycle Timeframes

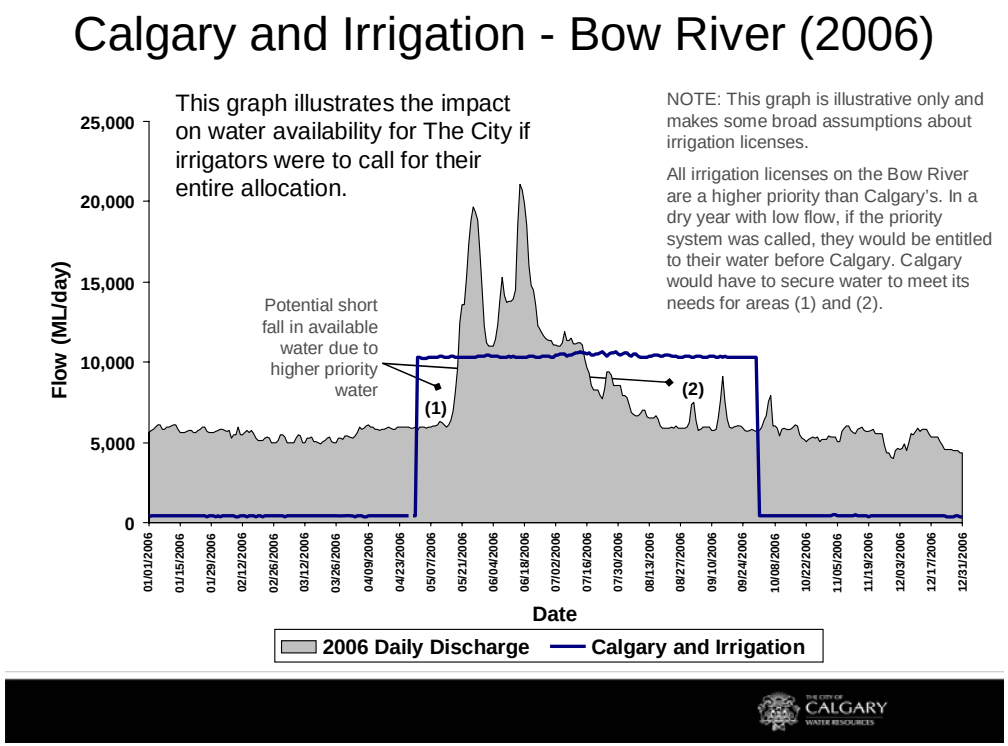
Structures	Expected Lifecycle
Houses/Buildings	Retrofit/alterations 15-20 yrs Demolition 50-100 yrs
Sewer	Major upgrade 50 yr
Dams/Water Supply	Refurbishment 20-30 yrs Reconstruction 50 yrs
Bridges	Maintenance annually Resurface concrete 20-25 yrs Reconstruction 50-100 yrs

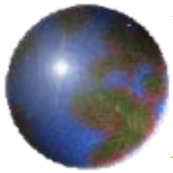


Climate Change: What do we know?

- Climate change is occurring and producing effects, especially in Canada's Northern Regions
- Climate Change unknowns:
  - Rate of climate change
  - Magnitude of climate change
  - Exact local impacts
  - Comprehensive historical data
- Climatic changes could call into question the rule and current standards of design

Impact on quantity

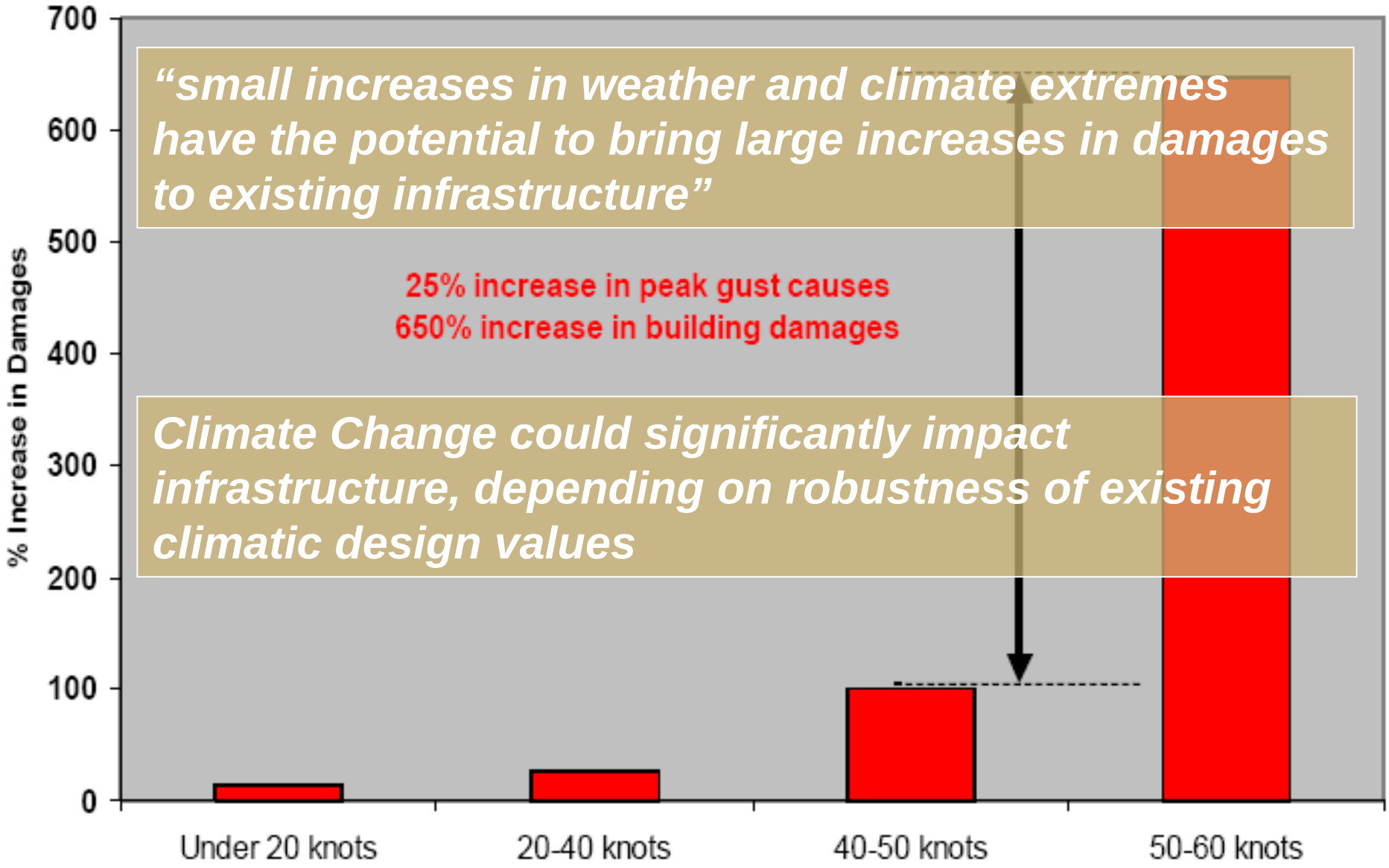




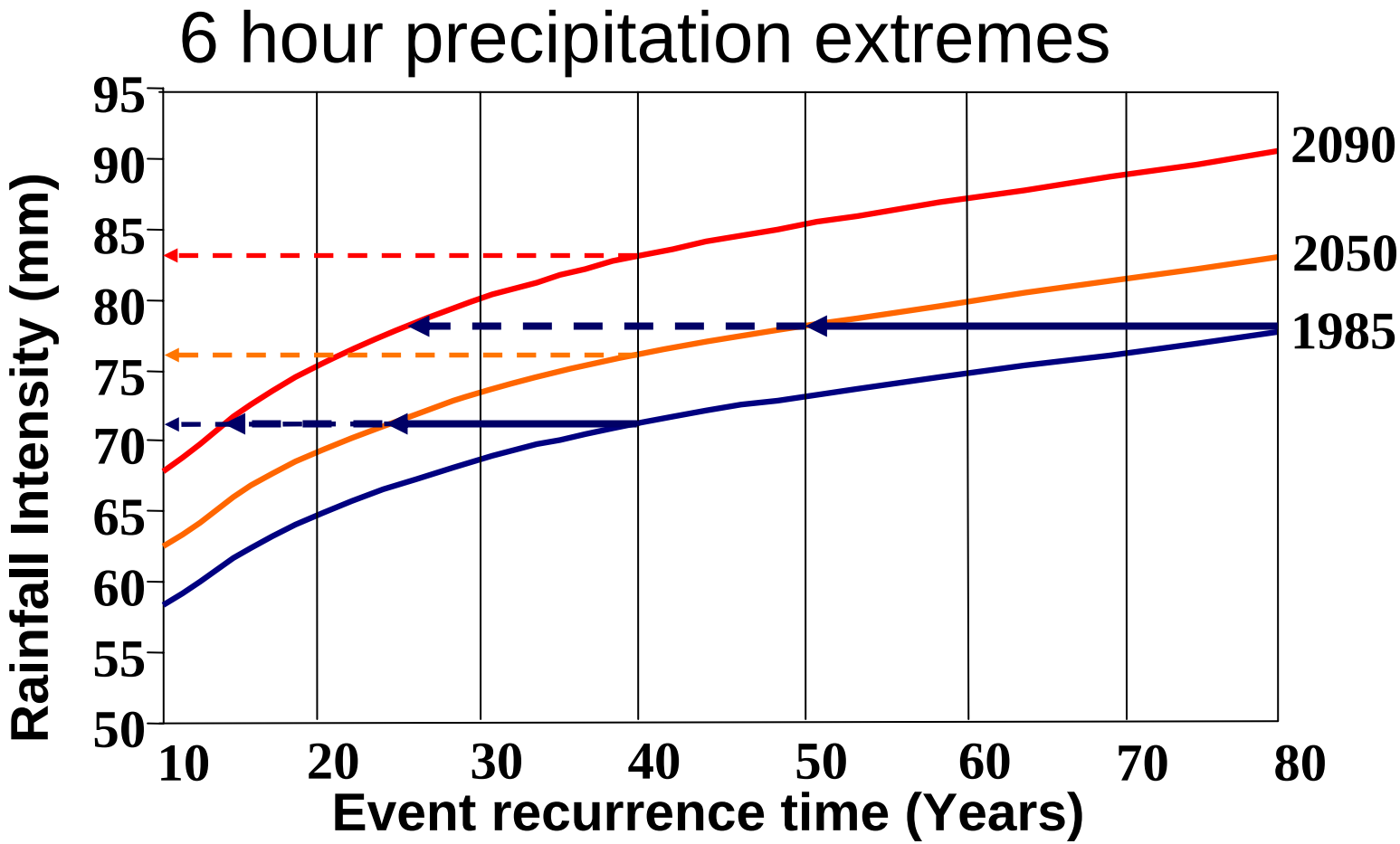
Climate Change: What do we know?

- The past will not project to the future
- Existing infrastructure is designed based on historical design values that need updating
- Climatic design values based on historical data will be less and less helpful
- However, knowledge of the past is essential to understand risks of future climate changes
- Shifts in extremes will increase damage and destruction of infrastructure

Small Increases = Escalating Infrastructure Damages

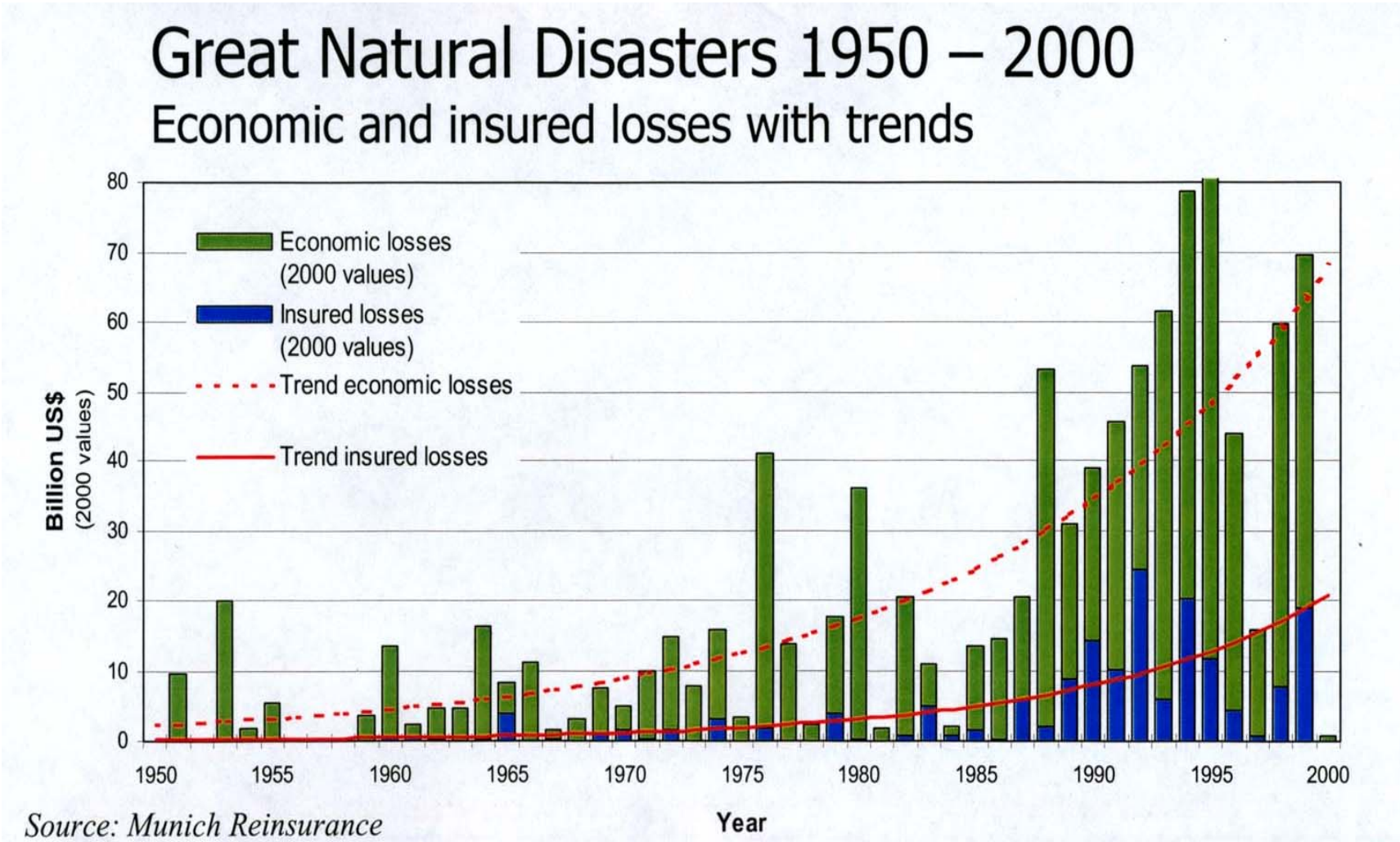


Climate Change Impacts – Shifts in Extremes



Trends in Disaster Losses

Property loss claims with exponential growth



Engineering Considerations

Current Practice

- Designed for extremes
- Has resilience
- Often neglected – deficit
- History of extreme events
- Everyday plans and procedures in place
- Professional team in place

Uncertainties

- Are design extremes relevant?
- Have climatic factors changed?
- Risk priority – life/ economy/security?
- Risk tolerance?
- Do you have the data?
- Definition of a catastrophic failure?

Public Infrastructure Engineering Vulnerability Committee (PIEVC)

- Oversee a national assessment of the engineering vulnerability of public infrastructure to climate change in Canada
- Facilitate the development of best engineering practices that adapt to climate change impacts
- Utilize results to recommend reviews of infrastructure codes and standards
- Partnership between Engineers Canada and Natural Resources Canada
- Further information at www.pievc.ca

PIEVC Engineering Protocol

- Five-step, systematic risk assessment process that evaluates the probable interactions and consequences of climatic changes on an infrastructure system
- Considers infrastructure as a system of components and evaluates at the component level
- Draws relationships between climate changes and infrastructure responses
- Identifies vulnerabilities and recommended actions to deal with them

An Adaptation Framework

- People
  - Engineers, planners and other professionals, policy-makers, politicians and the public
- Tools
  - Vulnerability assessments
  - Local/provincial codes, standards and practices
  - Climate change models and projections
  - Land use planning and zoning
  - Economic and social impact analysis
  - Risk management
- Processes
  - Regulatory, political, social, outreach, education

Adaptation of Infrastructure is:

Building resilience into our systems by:

- Increasing our ability to deal with current climate
- Preparing to take advantage of new opportunities
- Reducing risks and costs of future climate change impacts

Drainage systems that can handle more intense precipitation events

Energy systems that withstand extreme events

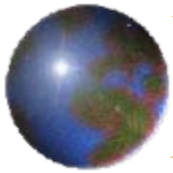
Roads that can withstand higher temperatures

The Way Forward

- Adaptation of infrastructure is not necessarily a complex problem but the magnitude is huge
- Incorporate adaptation in plans to address the infrastructure deficit
- Tie adaptation planning to infrastructure life cycles
- Develop the tools and knowledgeable people to use them
- Bring impacts of changing climate into the front line thinking of engineering projects

Areas for Discussion

- Engineering vulnerability and risk management
- Review of codes, standards and practices
- Examine severe climate events and cumulative impacts
- “No regrets” actions
- Need for infrastructure and climate data
- Methods to estimate future climate changes
- Coordination between different levels of government



Thank-you!