



Transportation Applications of the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol

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VIRTUAL | VIRTUEL

XVI WORLD WINTER SERVICE AND ROAD RESILIENCE CONGRESS
XVI^e CONGRÈS MONDIAL DE LA VIABILITÉ HIVERNALE ET DE LA RÉSILIENCE ROUTIÈRE
XVI CONGRESO MUNDIAL DE VIALIDAD INVERNAL Y RESILIENCIA DE LA CARRETERA



Institute for Catastrophic Loss Reduction

- Formed in 1997: Protect people and property from the impacts of extreme natural events
- Independent, non-profit
- An institute of Western University
- Regular funding from a membership that represents ~90% of Canadian P&C insurance market
- Additionally: Research & projects for/with government agencies, private industry, co-funding with NSERC, SSHRC, etc.
- Manage the PIEVC Program and the PIEVC Protocol for infrastructure climate risk and vulnerability assessment
- www.iclr.org www.pievc.ca pievc@iclr.org

Western  Institute for Catastrophic Loss Reduction (ICLR)



1998 Eastern Canadian Ice Storm
\$2 Billion (2018 CAD – IBC, 2019)

Photo: Ryan Remiorz/Canadian Press





August 2005 Storm - Toronto

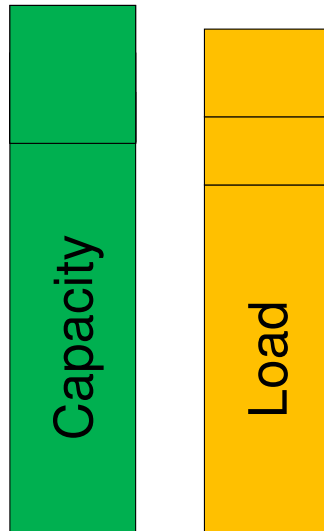
Photos courtesy
Jane-Finch.com

Infrastructure Interdependencies



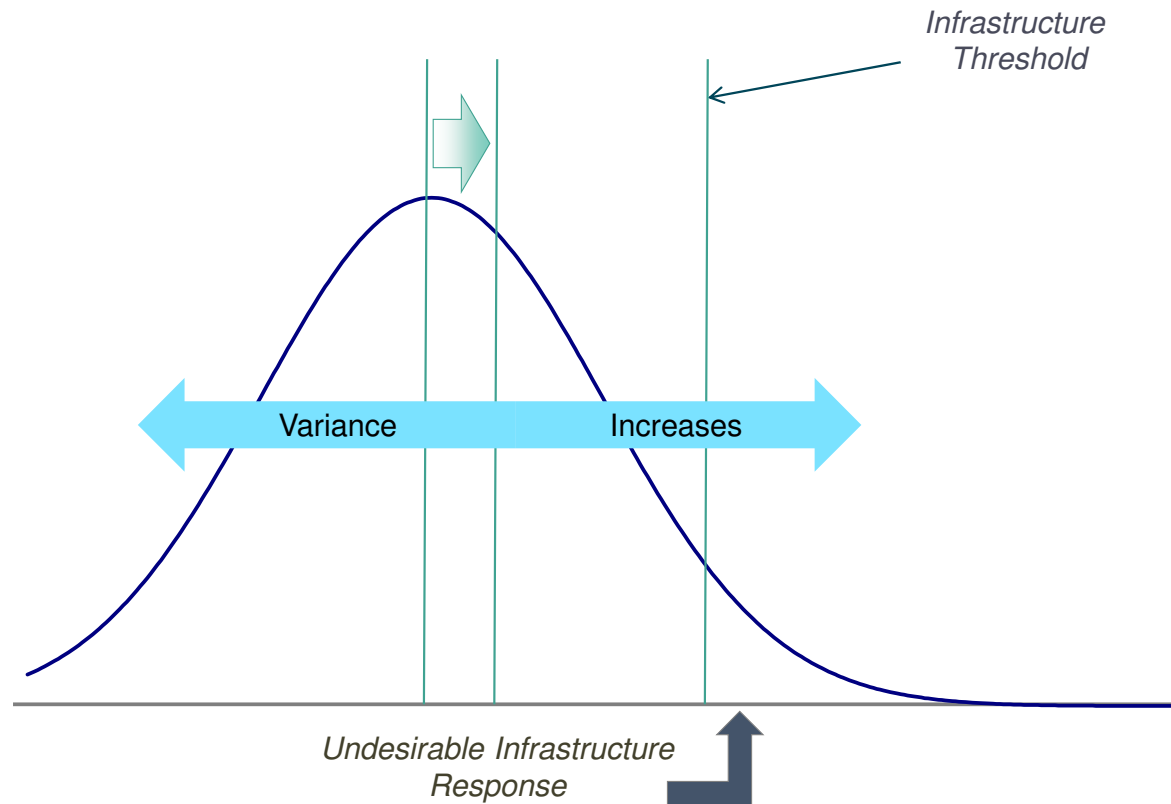
How do Small Changes Lead to Catastrophic Failure?

Failure



- Design Capacity
- Safety Factor
- Impact of age on structure
- Impact of unforeseen weathering
- Design Load
- Change of use over time
 - e.g. population growth
- Severe climate event

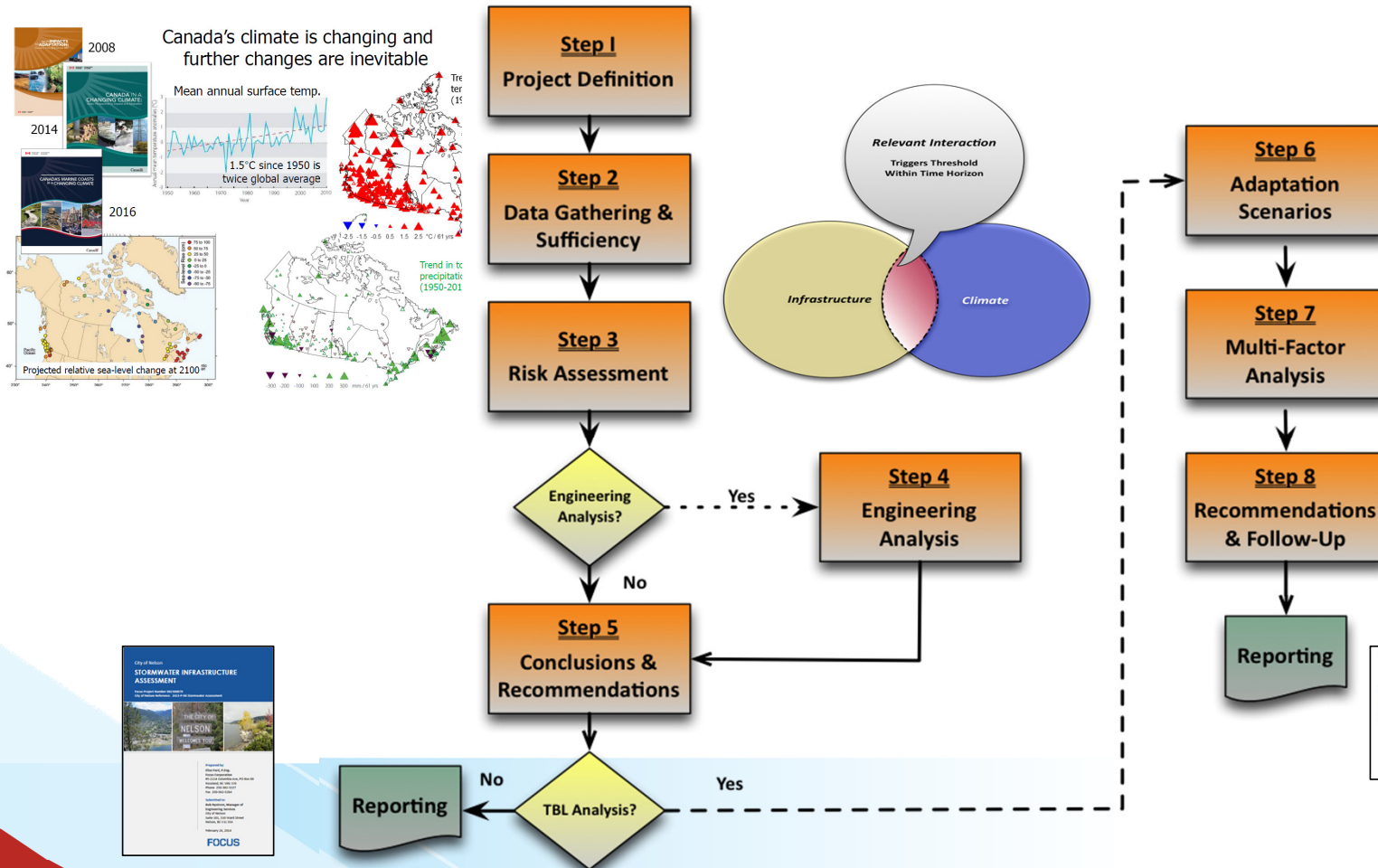
Impact on Mean & Variance



Risk Assessment Matrix

Consequence	7	Flood	CLIMATE CHANGE					Flood	49
	6	6	12	18	24	30			42
	5	5	10	15	20	25			35
	4	4	8	12	16	20			28
	3	3	6	9	12	15			21
	2	2	4	6	8	10			14
	1	1	2	3	4	5		Flood	7
		1	2	3	4	5	6	7	
		Probability of Occurrence							

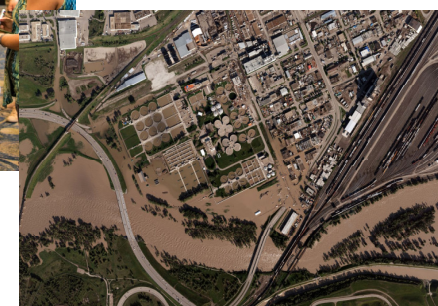
PIEVC Process – Brief Overview



PIEVC Protocol – Transportation Infrastructure Climate Risk Assessment Examples -1



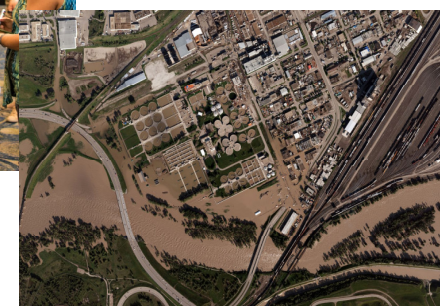
- BC Ministry of Transportation and Infrastructure
 - Coquihalla Highway, Yellowhead Highway 16
- NWT Department of Transportation - Hwy 3 West of Yellowknife
- City of Sudbury - City-wide road assessment
- City of Toronto – Road culverts
- City of Edmonton – Quesnell Bridge
- City of Miramichi – Inter-provincial road assessment
- Province of Saskatchewan – Hwy 6 and 39 Corridor Improvements
- Government of NWT – Mine roads – Economic impact of climate change
- Honduras – Assessment of four bridges



PIEVC Protocol – Transportation Infrastructure Climate Risk Assessment Examples - 2



- Transport Canada Airports
 - Churchill MB, Inuvik NWT, Cambridge Bay NWT, Sandspit, BC
- Greater Toronto Airport Authority – Pearson Airport
- National Defense – Esquimalt Port
- Port of Belledune, NB
- Cornerbrook, NL bridge assessment
- Fisheries and Oceans - Small harbor infrastructure
- Manitoba – NWT Transportation Link
- Honduras – Assessment of four national highway/road bridges
- Brazil - Port of Itaaji
- Government of NWT – Mine roads – Economic impact



PIEVC Program – (2005-2020)



- Engineers Canada Program Operator
- ~45 completed assessments - ~15 transportation related (roads/highways, airports, ports)
- ~30 introductory training workshops (live and on-line)
- Operation and maintenance of www.pievc.ca
- Infrastructure Canada Climate Lens, Transport Canada TARA Program, PWPS Asset Assessment
- Expanded international engagement
 - Honduras – Assessment of four bridges
 - UNFCCC and WFEO training workshops
 - GIZ Climate Services for Infrastructure Investment (CSI) Project – Brazil , Costa Rica, Vietnam, NBI



PIEVC Program – Present (2020-2022)

- Divestment of the Program from Engineers Canada to ICLR and the PIEVC Program Partnership (CRI and GIZ) – April 2020
- ~16 completed assessments since transfer ~ half are transportation related (roads/highways, airports, ports)
- ~46 assessments in progress – about 1/3 transportation related
- Operation and maintenance of www.pievc.ca
- Infrastructure Canada Climate Lens, Transport Canada TARA Program, PWPS Asset Assessment
- GIZ CSI Project Continuation with Brazil, Costa Rica, Vietnam and Nile Basin Initiative
- Application to Other Countries – Republic of Georgia, Lesotho



Institute for Catastrophic
Loss Reduction

Building resilient communities

CLIMATE
RISK
INSTITUTE

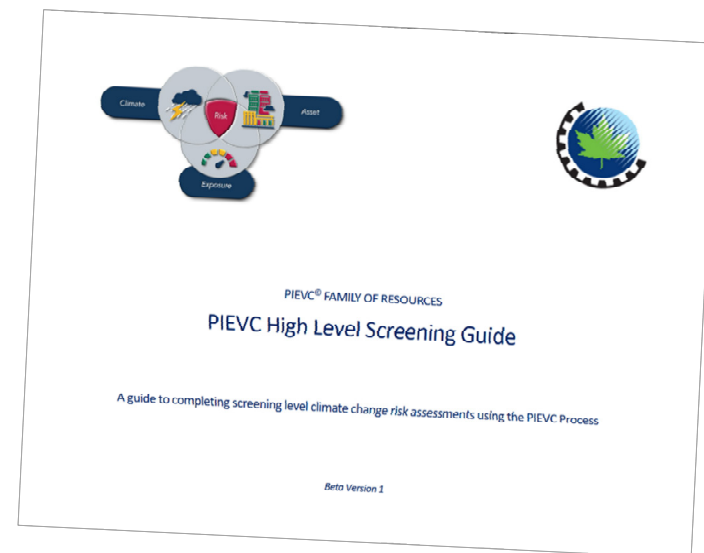
giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH



PIEVC High Level Screening Guide- 2022



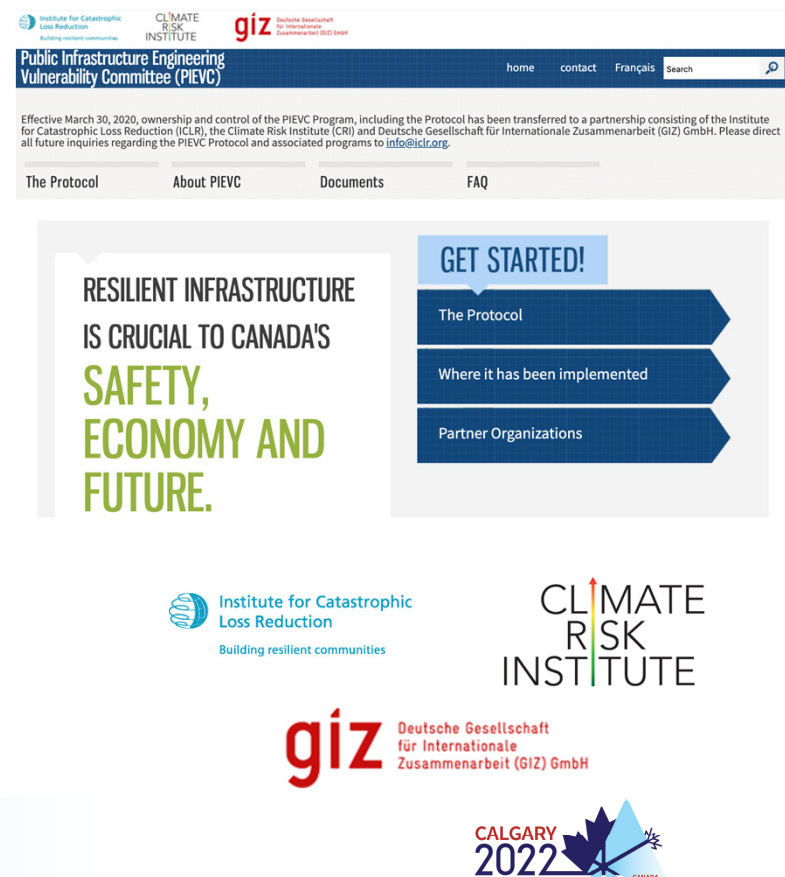
- Expedited screening level version of the full Protocol
 - Uses readily available information sources (e.g., published climate data)
 - High degree of professional and engineering judgement
 - Can be initial step for other processes (full Protocol assessment, asset management, climate lens screening)
- Features include:
 - Using smaller number of elements to define infrastructure system or portfolio
 - Readily available infrastructure data and operator/maintenance personnel knowledge
 - Requires considerably less effort and time



PIEVC Program – The Future (2022 and beyond!)



- ICLR PIEVC Program Operation and Protocol Administration – with PIEVC Program Partnership (CRI and GIZ)
- PIEVC High Level Screening Guide (HLSG) (launch on-line 01/02/2022)
 - Single asset/Portfolio analysis
- PIEVC Family of Resources Guide (Q1 2022)
 - Informs selection of assessment process, planning
- PIEVC Portfolio Assessment Manual (Q2 2022)
 - For large portfolios
- PIEVC Protocol Step 1 and 2 Utility (Q2 2022)
 - Detailed guidance on project definition and data strategies
- Infrastructure Resilience Professional (IRP) Credential - CRI
 - Six course training program including PIEVC Protocol



PIEVC Program – A Body of Knowledge

Over 125 completed and in-progress projects to date, more than 85 reports on the website:

- Water resources systems
- Storm & wastewater systems
- Roads and bridges
- Ports
- Airports
- Buildings
- Energy infrastructure
- Healthcare infrastructure
- Parks and natural infrastructure

Applied across Canada, and internationally (translated to French, Spanish, Portuguese, Vietnamese)



www.pievccan.ca

Questions?

www.pievc.ca

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Thank You!

