Transport Canada Transports Canada

MEASURING PERFORMANCE AND RESILIENCY OF TRADE CORRIDORS

ITF Transportation Statistics Group

April 10th 2014

Introduction

- Tracking the performance of strategic freight routes provides governments and stakeholders impartial evidence-based results on the competitiveness of Canada's supply chains
- The Fluidity indicator is a web-based multi-modal tool that measures in near real-time the performance of individual segments of the supply chains as well as the end-to-end transit time of freight flows
- The metric is focusing on bottlenecks and impediments along major trade corridors; with a special attention given to port infrastructure
- Transport Canada's fluidity indicator enables Canada to measure its own performance and do comparative analysis within the North American marketplace.

Phase 1: IMPORT SUPPLY CHAIN

CORRIDORS IMPORT: ASIA-PACIFIC

- Hong Kong
- Shanghai
- Qingdao
- Tokyo

PRINCE RUPERT

- Calgary
- Winnipeg
- Toronto
- Montreal
- Chicago

VANCOUVER

- Calgary
- Winnipeg
- Toronto
- Montreal
- Chicago

PHASE 2 CORRIDORS: CONTINENTAL

- Toronto
- Chicago

MONTREAL

- Antwerp
- Valencia

Phase 2: EXPORT SUPPLY CHAIN

CORRIDORS EXPORT: CANADA-ASIA

Japan

Ocean Transit Times

Marine Terminals

Port Metro Vancouver (PMV)

Prince Rupert

Rail Transit Times

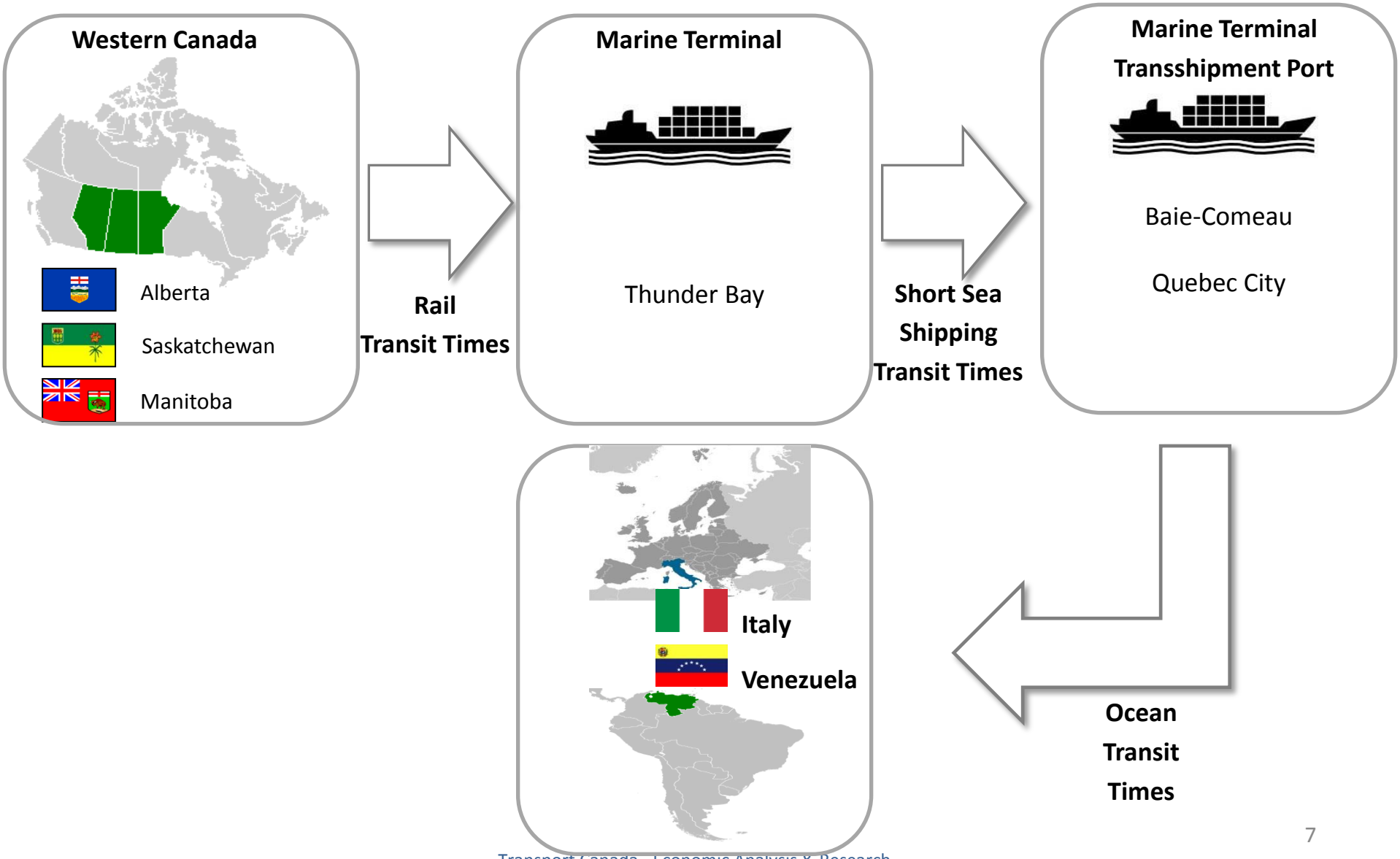
Western Canada

Alberta

Saskatchewan

Manitoba

CORRIDORS EXPORT: CANADA-ITALY/VENEZUELA



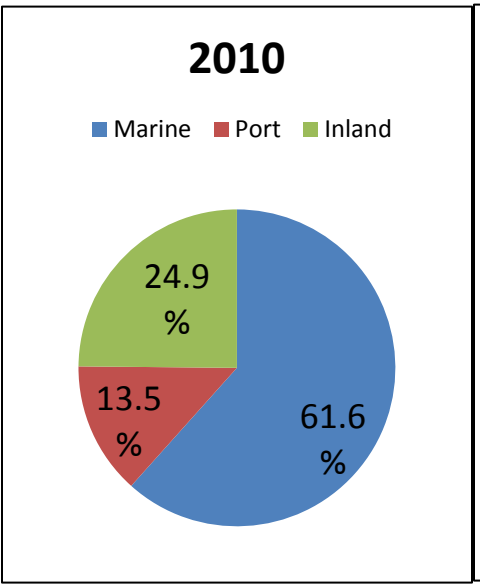
Examples of TC Fluidity Analysis

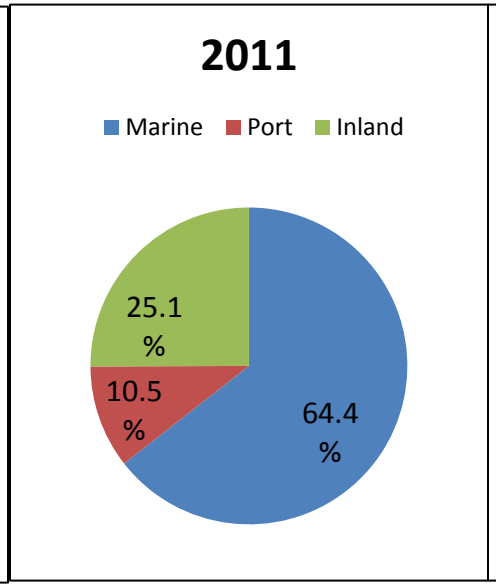
- Measuring/Analyzing the reliability and variability in transit times
- Identification of bottlenecks/impediments
- Immediate and residual impacts of disruptions to the transportation network
- Estimating border wait times
- Measuring carbon footprint

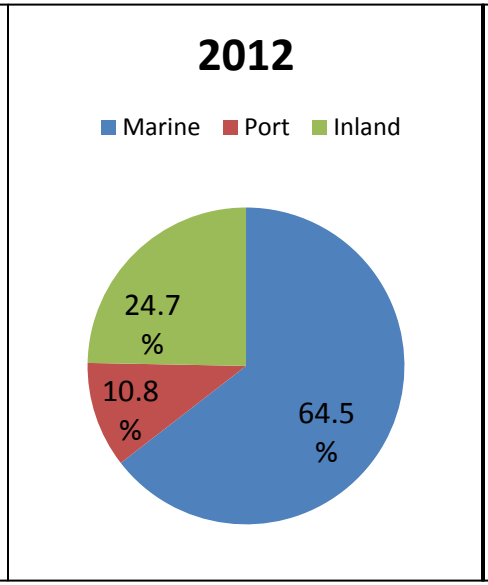
Reliability

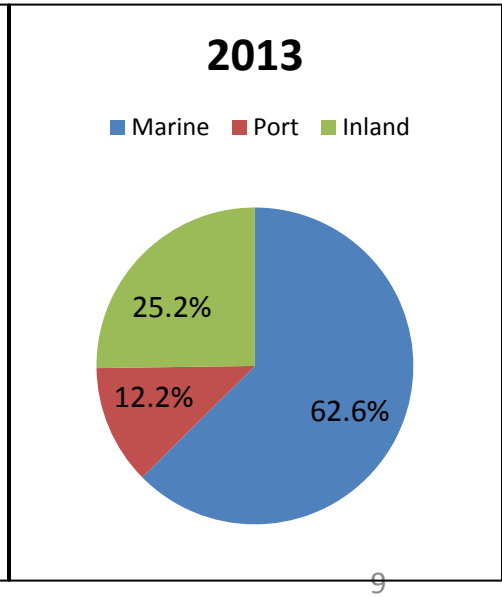
Total Transit Time from Shanghai to Toronto via Port Metro Vancouver 2010-2013

Year	Marine	% Change	Port	% Change	Inland	% Change	Total Transit	% Change
2010	14.2	-	3.1	-	5.7	-	23.1	-
2011	15.1	5.8%	2.5	-21.3%	5.9	2.0%	23.4	1.2%
2012	15.8	5.0%	2.6	7.7%	6.1	3.4%	24.5	4.9%
2013	15.6	-1.6%	3.0	14.4%	6.3	3.5%	24.9	1.4%







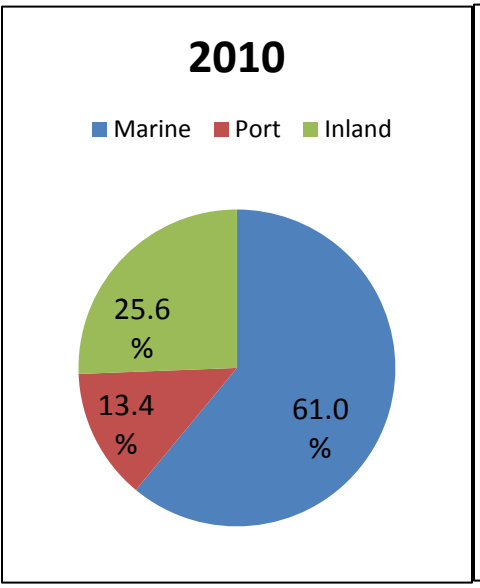


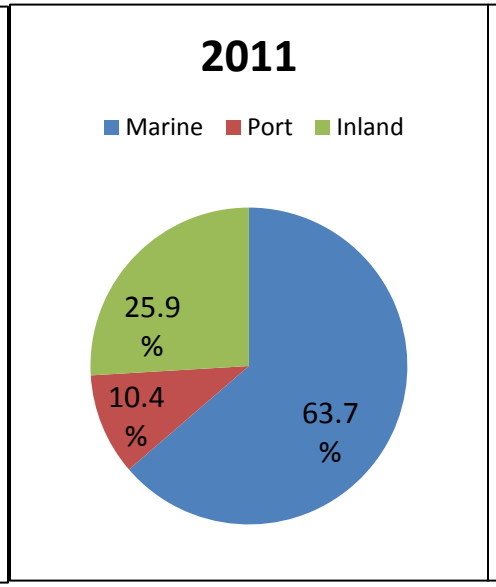
*Totals may not add due to rounding

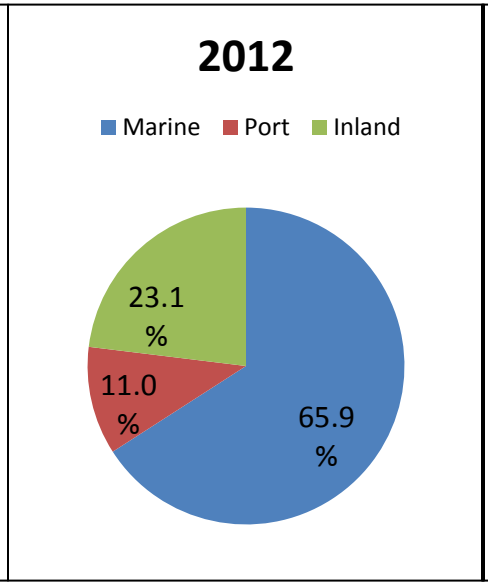
Reliability

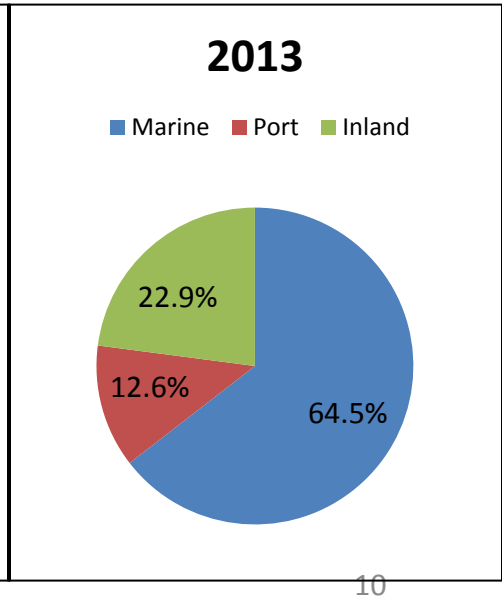
Total Transit Time from Shanghai to Chicago via Port Metro Vancouver 2010-2013

Year	Marine	% Change	Port	% Change	Inland	% Change	Total Transit	% Change
2010	14.2	-	3.1	-	6.0	-	23.3	-
2011	15.1	5.8%	2.5	-21.3%	6.1	2.7%	23.7	1.4%
2012	15.8	5.0%	2.6	7.7%	5.5	-9.8%	24.0	1.4%
2013	15.6	-1.6%	3.0	14.4%	5.5	-0.1%	24.1	0.5%



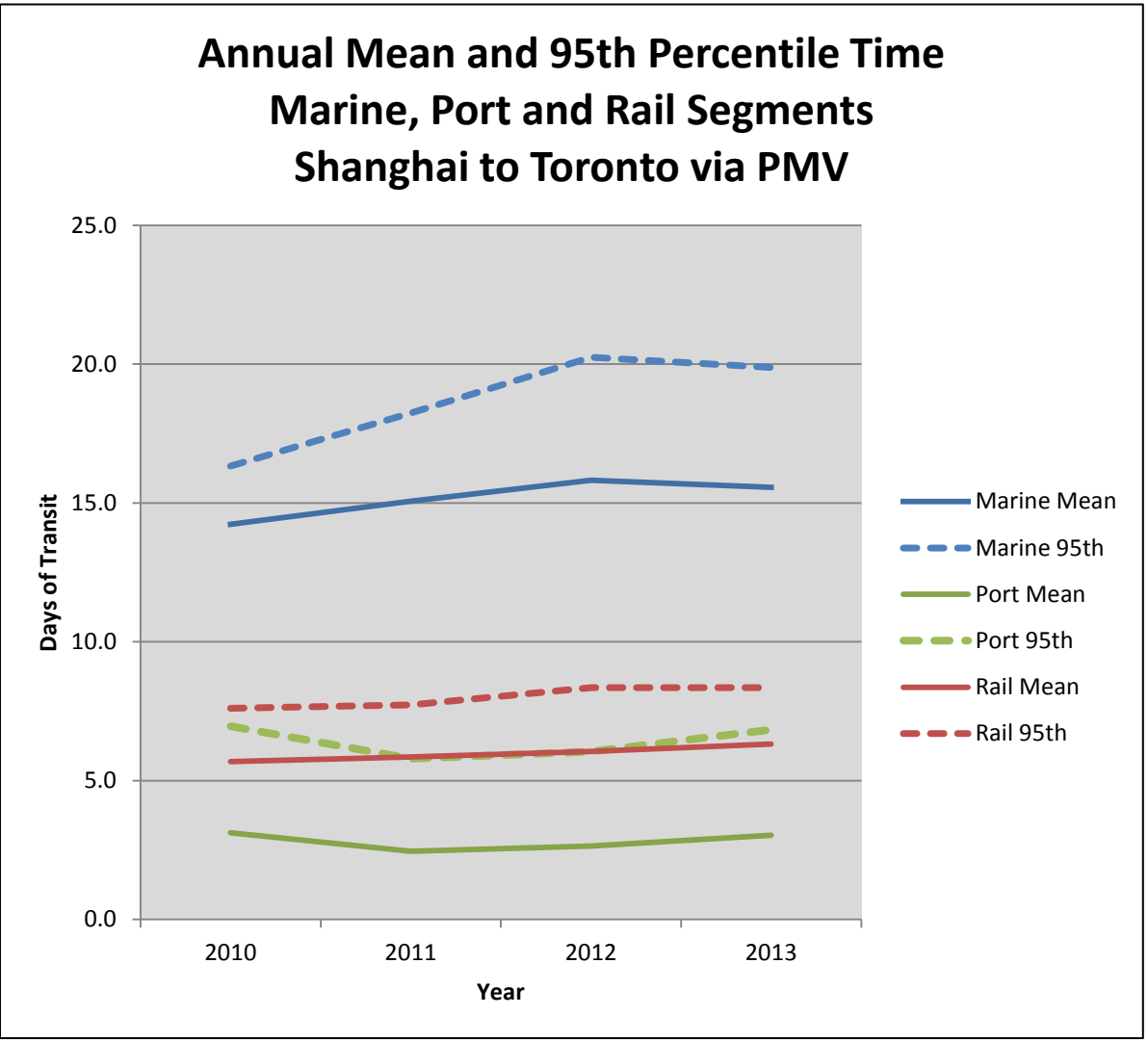






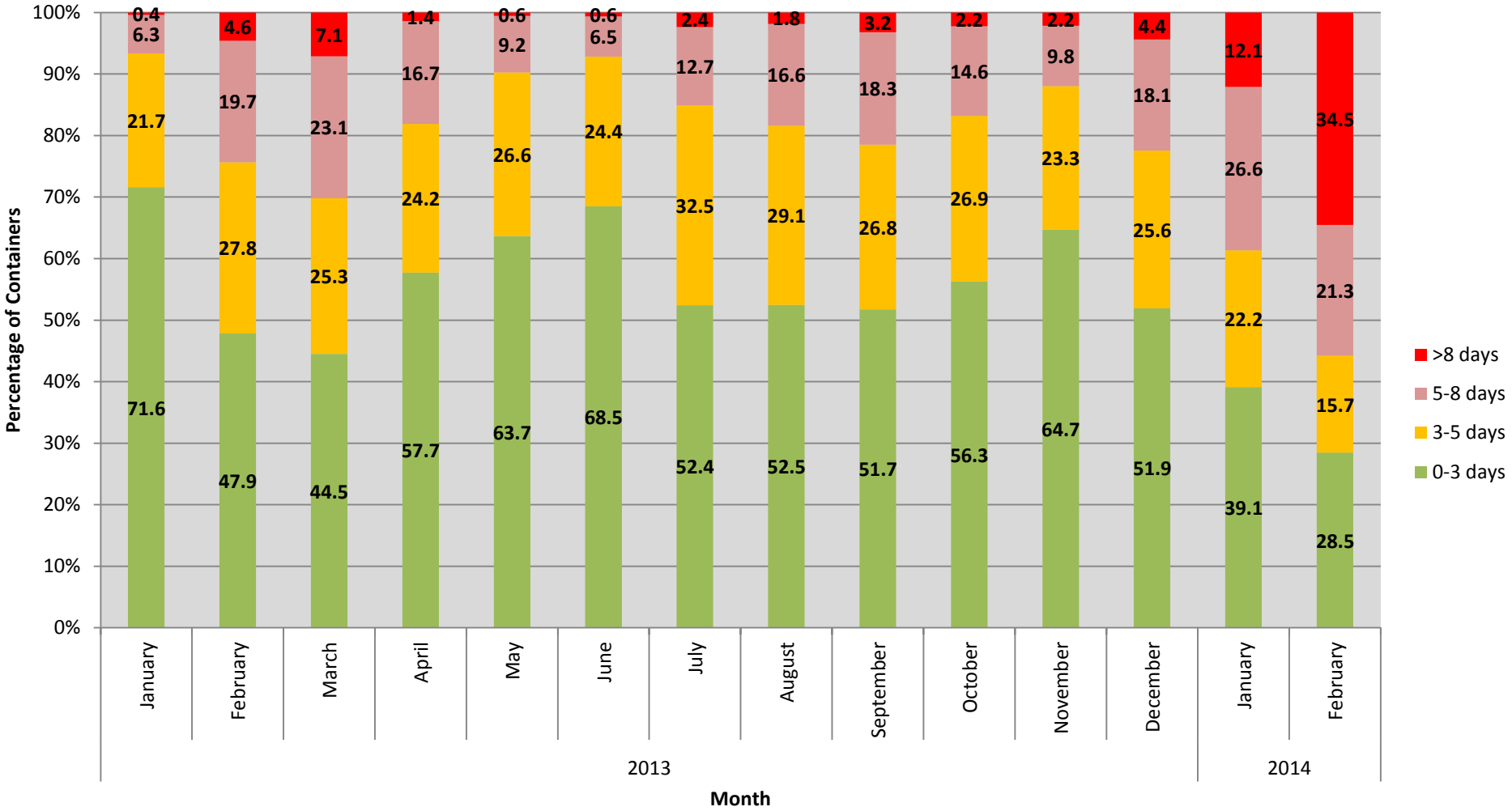
*Totals may not add due to rounding

Reliability/Variability



Days of Transit	2010	2011	2012	2013
Marine Mean	14.2	15.1	15.8	15.6
Marine 95th	16.3	18.2	20.2	19.9
Port Mean	3.1	2.5	2.6	3.0
Port 95th	7.0	5.8	6.0	6.8
Rail Mean	5.7	5.9	6.0	6.3
Rail 95th	7.6	7.7	8.4	8.4

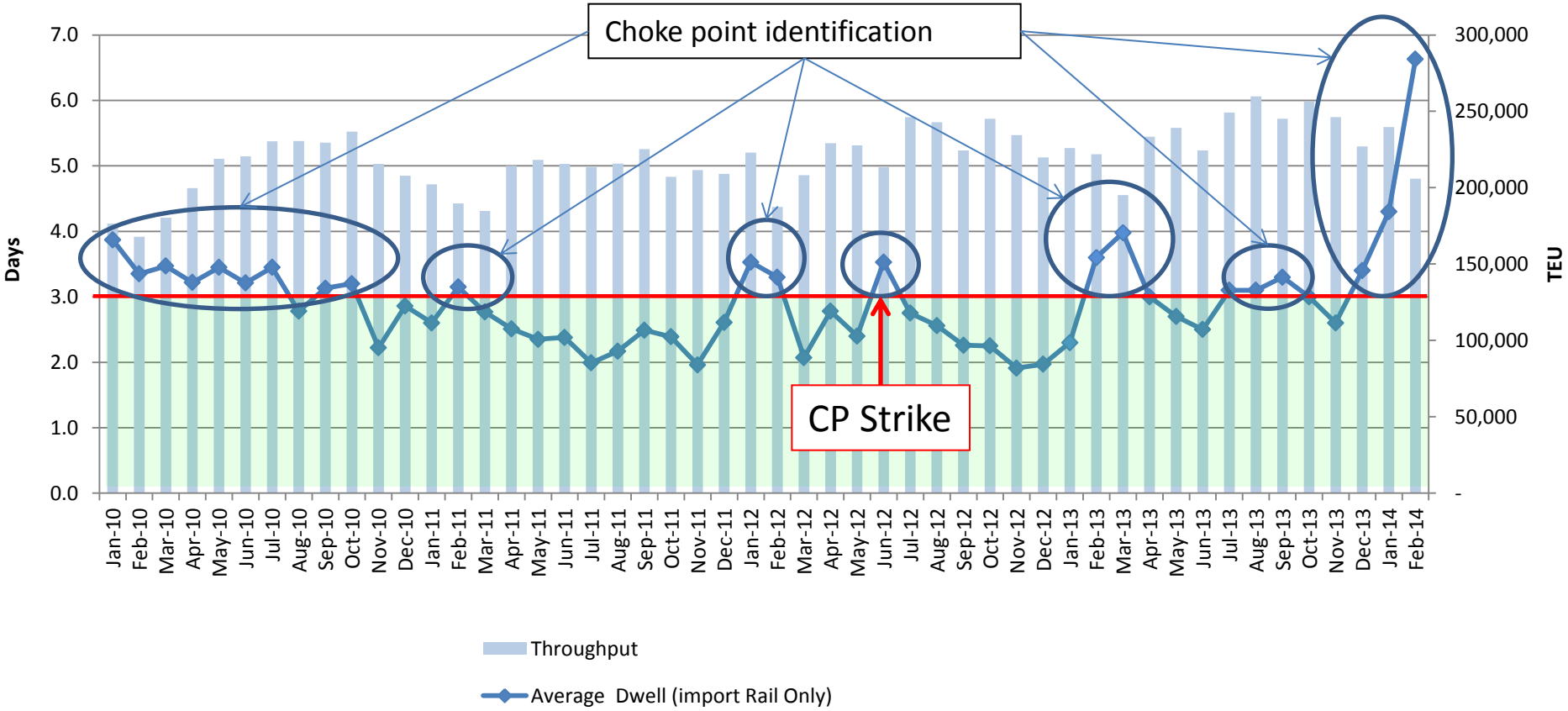
Monthly Import Container Dwell at Port Metro Vancouver
January 2013 to February 2014



Source: Data sample provided to Transport Canada by Port Metro Vancouver

Combining Indicators for Enhanced Analytical Power

Container Dwell Time vs. Port Throughput at Port Metro Vancouver 2010 - 2014

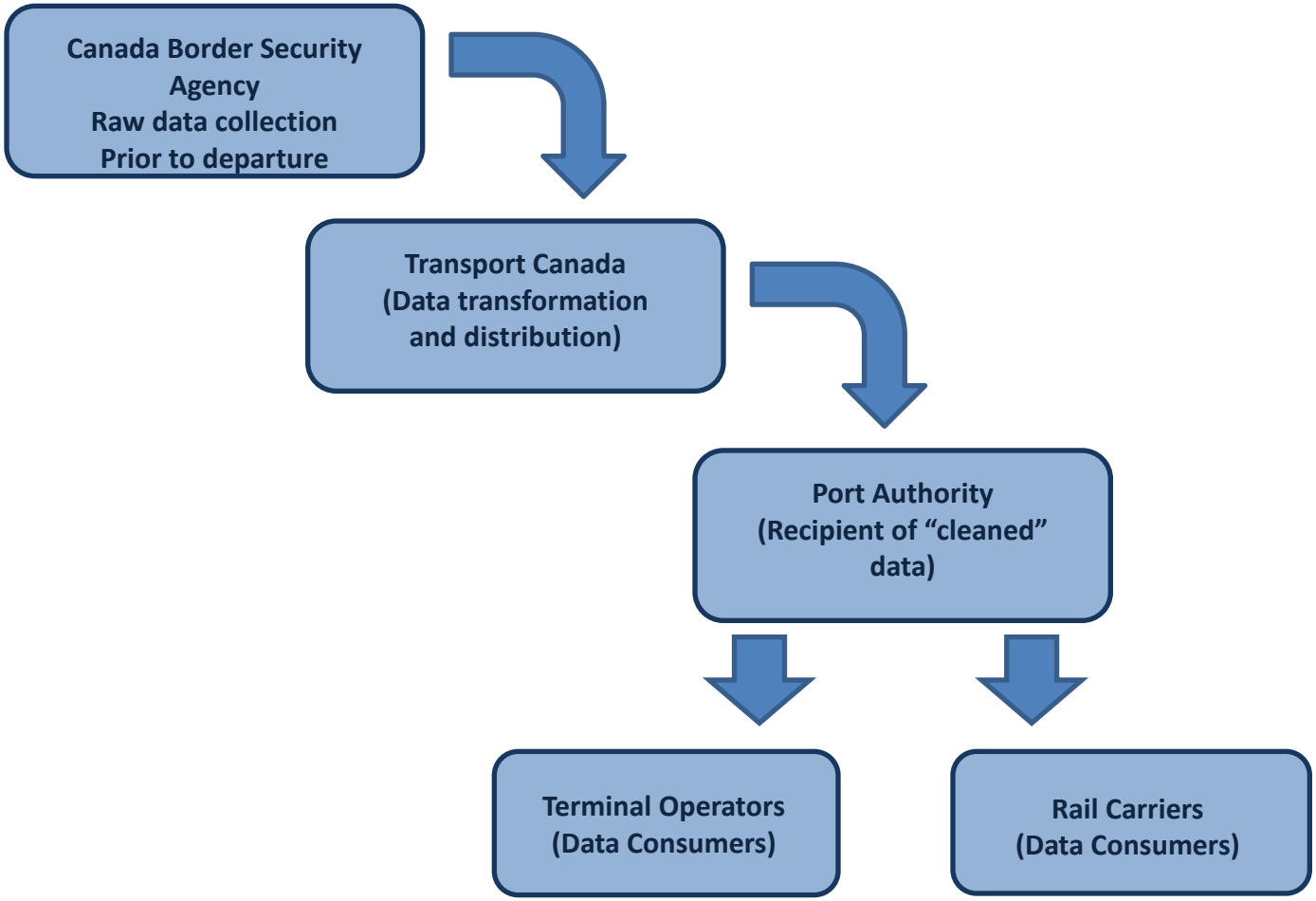


Port Utilization Indicators

Monthly Intermodal Indicators (5 container ports)

1.	Average Truck Turnaround Time	[Min.]
2.	Berth Utilization	[TEU/meter of workable berth]
3.	Average Vessel Turnaround Time	[Sec./TEU]
4.	Average Vessel Turnaround Time	[Hours]
5.	Average Container Dwell Time	[Days]
6.	Dwell Target - % under 72 Hours	[%]
7.	Port Productivity	[TEU/Gross Ha]
8.	Vessel On-Time Performance	[%]
9.	Crane Productivity	[Lifts per hour]
10.	Number of Vessel Calls	[Number/month]
11.	Average TEU per Vessel Call	[Number/month]
12.	Container Throughput	[Number/month]

Using Customs data for better planning



ALIGNING PERFORMANCE and RESILIENCY

Definitions:

A **supply chain** is a connected network of suppliers, manufacturers, shippers, distributors and retailers where transportation plays the role of unifying link among all the actors.

A **resilient supply chain** may be defined as one that has the ability to recover quickly from a disruption in order to achieve output at, or near, the pre-event level.

Risks to supply chains are potential actions negatively affecting supply chain performance, such as major natural events and operational and economic issues causing lengthy stoppages and/or disruptions.

Supply chain vulnerabilities are weak spots within the supply chain, including physical locations (e.g., areas susceptible to floods, avalanches), potential labour disruptions, cyber threats, and choke points

Introduction to Resliency

Purpose of the Initiative: to support Canada's economic competitiveness by increasing the efficiency of Canada's supply chains linked to transportation infrastructure

Goals

- Increase the efficiency of Canada's supply chains
- Support Canada's Economic Competitiveness

Objectives

- Identify the risks facing Canada's supply chains
- Identify vulnerabilities in Canada's supply chains linked to multi-modal transportation and infrastructure
- Develop a framework to assess economic and competitiveness impacts linked to resilience
- Investigate the role of technologies and other measures to assist in this initiative
- Identify policies, tools and mitigating factors to address resilience issues

Outcomes

- Improve information sharing between industry and government and between governments
- Develop expertise and predictive tools using an archive of supply chain disruptions and their impact on resiliency
- Define when resilience becomes a system issue requiring government involvement
- Build supply chain efficiency, visibility and resilience and improve Canada's economic competitiveness

Importance of Supply Chain Resilience

- In the global economy, the role of supply chains has become increasingly important especially for international trade
- The increasing complexity and interconnectedness of global supply chains raises concerns about major disruptions
- The risk of disruptions (natural disasters, extreme weather, sudden demand shocks, cyber security) has been increasing in recent years
- International organizations (e.g., World Economic Forum) are recommending that countries develop strategies around resilience with the aim to build agile, transparent and diversified systems
- While industry has responsibility for the day-to-day efficiency of supply chains, governments are responsible for the broader public goals of managing long-term risks that affect regional and national economies
- To achieve national objectives, governments act as coordinators for supply chain stakeholders, ensuring that the system as a whole is resilient to disruptions

Transport Canada's Role

- Transport Canada's mandate to ensure an efficient, clean, safe and security transportation system provides the policy imperative to address supply chain resilience
- The *Canada Transportation Act* provides Transport Canada with the authority to intervene to restore supply chain operation in the event of a disruption
- Intervention to improve supply chain resilience tends to fall into four categories:
  1) Mitigation
  2) Preparedness
  3) Response
  4) Recovery
- Transport Canada has developed an *Emergency Management Framework that* addresses 3 aspects of supply chain resilience:
  1) Reducing the probability of a disruption
  2) Reducing the severity of a disruption
  3) Reducing the recovery time after a disruption takes place

Source: "Supply Chain Resilience and Economic Impacts of Transportation Disruptions". Transport Canada Internal Study. March 2012. Roger Roy.

Current Supply Chain Resiliency Research at Transport Canada

Currently 5 primary research initiatives in the Policy Group that address resiliency:

1. **Supply chain analysis through the fluidity portal**
   - Provides end-to-end and segment-specific network visibility
   - Examines the impact and recovery of specific disruptions on supply chain performance (see annex for example)
   - Provides estimates of operational and economic impact of disruptions at various ports
   - Provides a normative approach to resiliency and evaluation of risks
2. **Vulnerability analysis of the rail network linked to geophysical characteristics**
   - Identifies ground hazards linked to vulnerable locations
3. **Climate Change Adaptation**
   - Natural Resources Canada/TC assessment of climate risks to the transportation sector
   - Monitoring of extreme weather conditions and impacts
4. **Transportation Resilience in the North**
   - Northern Transportation Action Plan (NTAP)
   - Analysis of the capacity and resilience of northern supply chains to handle increased activity, climate change impacts and enhanced connectivity
5. **Transpacific Supply Chain Performance**
   - Research, analysis, and cooperation between TC and Ministry of Transport of China

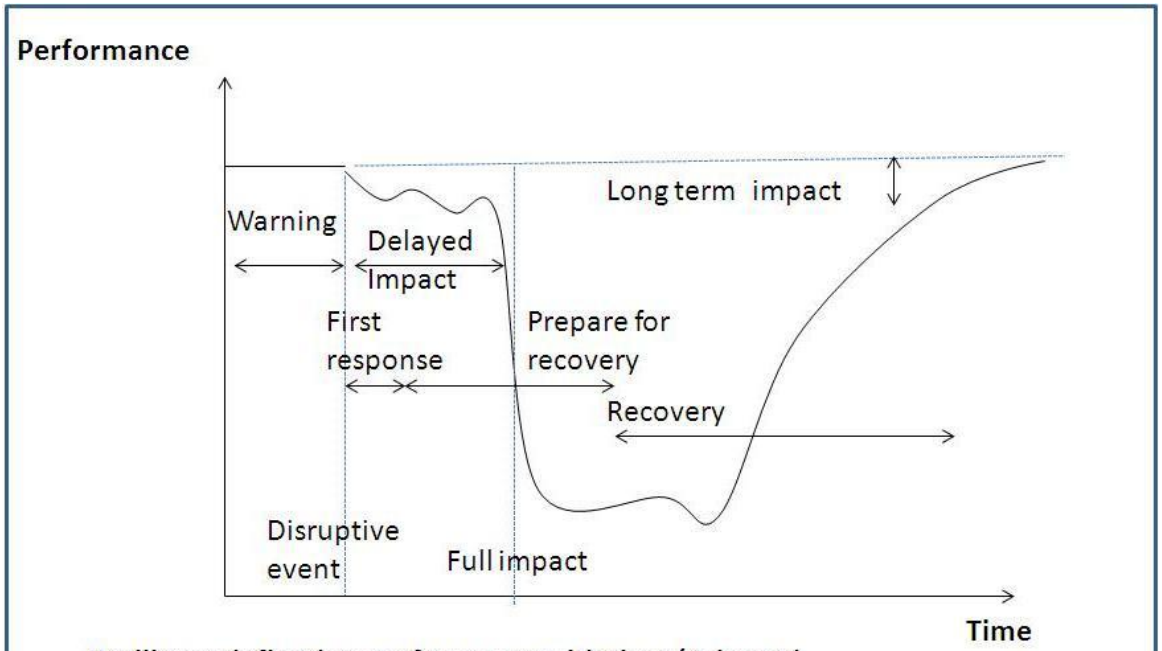
Disruption Analysis

Differentiation between transportation disruptions and supply chain disruptions:

- Transportation (infrastructure) disruptions affect the flow of goods, while supply chain disruptions affect the supply of inputs or outputs linked to an integrated economic activity
- The resilience of a supply chain and the impacts of disruptions propagate through to other links at a much larger scale

Two measurements of a supply chain disruption:

1) The **severity** of the disruption: defines the reduction in performance due to the disruption
2) T**ime of recovery**: defines the amount of time it takes to achieve pre-disruption output levels



Resiliency defined as performance with time (Adapted from Sheffi, 2005)

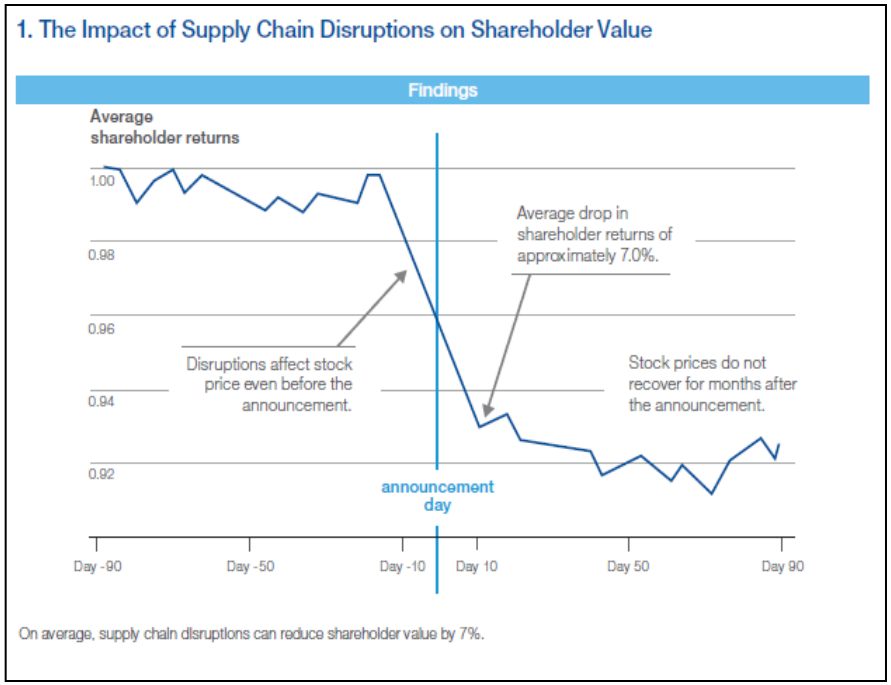
Disruption Analysis:

Economic Impact of Supply Chain Disruption

Decision makers need to understand the risks of supply chain disruption and the consequences of not intervening.

Case study: Japan

- Japan's GDP contracted 3.7% in the quarter following the earthquake and tsunami in 2011. It eventually recuperated but supply chains had to be altered.
  - Specifically, supply chain disruptions led to a 33% decline in operating profits for a sample of 15 multinational companies in the quarter following the disaster.



World Economic Forum. "Building Resilience in Supply Chains". January 2013

Identification of Vulnerabilities

Supply chain vulnerabilities may be classified into 4 distinct categories:

1. **Region specific** vulnerabilities (i.e., climate, geophysical characteristics)
2. **Network specific** vulnerabilities (i.e., critical infrastructure, single mode serving a region)
3. **Operational** vulnerabilities (i.e., physical disruption, cyber issues)
4. **Economic** vulnerabilities (i.e., labour disruption with national scope, market volatility)

Example: Analysis of rail network vulnerabilities due to landslides near Ashcroft, British Columbia. Note that both national railways are subject to the same vulnerabilities due to close proximity.

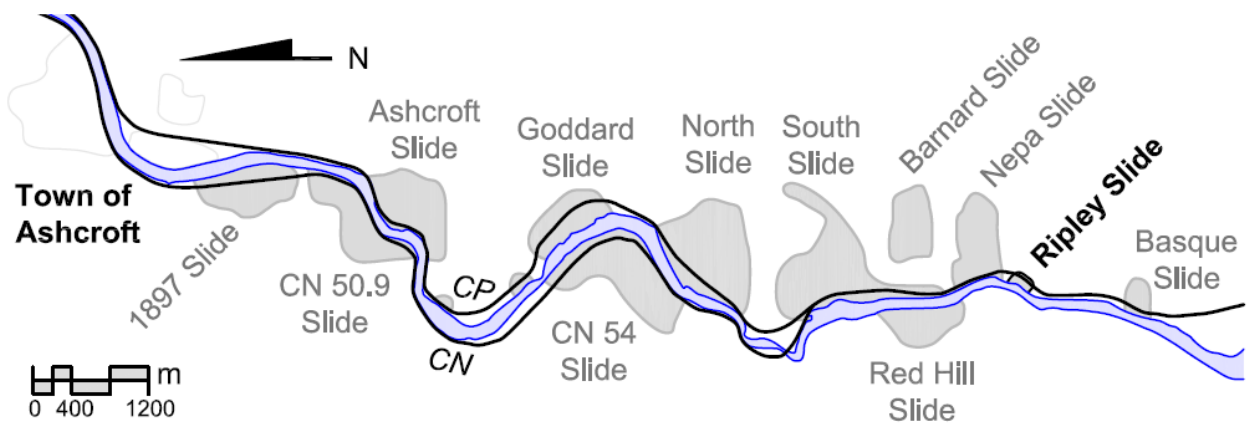


Figure 1. Map of major landslides within the Thompson River valley.

Climate Change Resilience and Adaptation

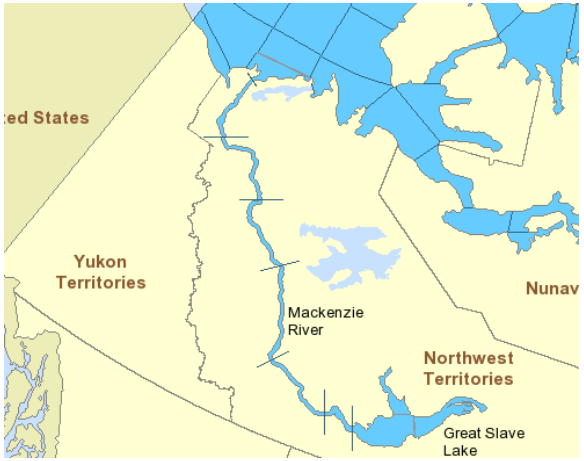
- Climatic changes bring risks that can disrupt supply chains and these risks appear to be growing
- Gradual changes in temperature, precipitation, permafrost thaw and sea level rise
- Increases in the frequency and magnitude of extreme events: flooding, ice and wind storms
- While climate resilience is a key challenge in the North, it is not just a northern issue

Current TC initiatives to improve resilience and/or reduce the transportation system's vulnerability to climate change:

- Continue to support R&D and capacity building in North (e.g. NTAI)
- Build and share knowledge on climate risks and adaptation practices with transportation industry
- Opportunities for new TC adaptation initiatives as part of federal adaptation programming (Proposed MC Spring 2015)
- TC proposals could focus on various themes including <u>Supply Chain Resilience</u>

Transportation Resilience in the North

- The northern transportation system is critical to ensuring economic and social development.
- Transportation resilience in the North is affected by similar factors as those impacting southern parts of Canada, but these impacts are exacerbated and its capacity for resilience constrained by:
  - Underdevelopment (e.g., lack of infrastructure)
  - Severe impacts of climate change (e.g., permafrost degradation)
  - Increased traffic (e.g., mining, tourism, new marine routes).
- TC's Northern Transportation Adaptation Initiative helps build resiliency into the northern transportation system by supporting projects that develop adaptation measures/strategies and cultivate northern expertise.
- The Northern Transportation Action Plan focuses on strategic transportation corridors to support community re-supply and resource development
- Target extreme vulnerabilities and deficiencies in northern systems



Source: weather.gc.ca

The Mackenzie River is an essential transportation corridor for the re-supply of communities and resource development projects in the Northwest Territories. Impacts of climate change on the Mackenzie River will have important implications for barge transportation and ferry operations along and across the river.

Proposed Initiative on Supply Chain Resilience

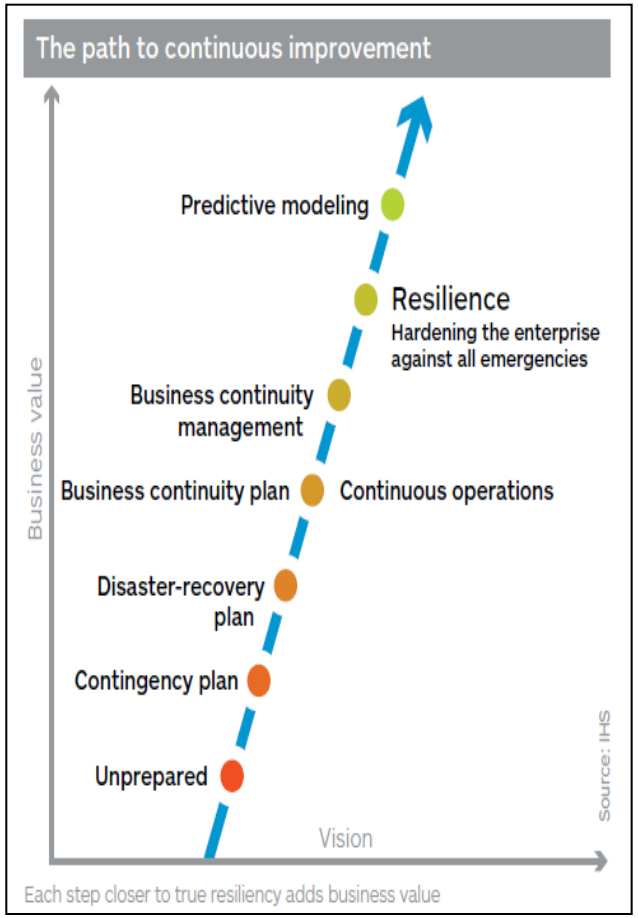
Proposed Approach in Three Phases:

Phase 1 (internal):

- Develop standardized (normative) metrics for measuring resiliency of supply chains
- Define at what stage resilience becomes a system issue – where the economic risks and market failures necessitate evidence-based government involvement
- Identify the multi-modal static and dynamic (i.e., infrastructure and non-infrastructure) vulnerabilities of our supply chains
- Determine the threshold for government intervention

Phase 2 (internal):

- Investigate technologies to improve identification of vulnerabilities and assist in mitigation and prediction
- Involve all Policy Directorates and other federal departments to allow a reconciliation of objectives among the various groups
- Allow for discussions with the Safety and Security Group responsible for TC Emergency Management Framework



Source: IHS Global Insight

Proposed Initiative on Supply Chain Resilience

Improvement of resiliency requires collaboration of key stakeholders because it cannot be achieved in isolation.

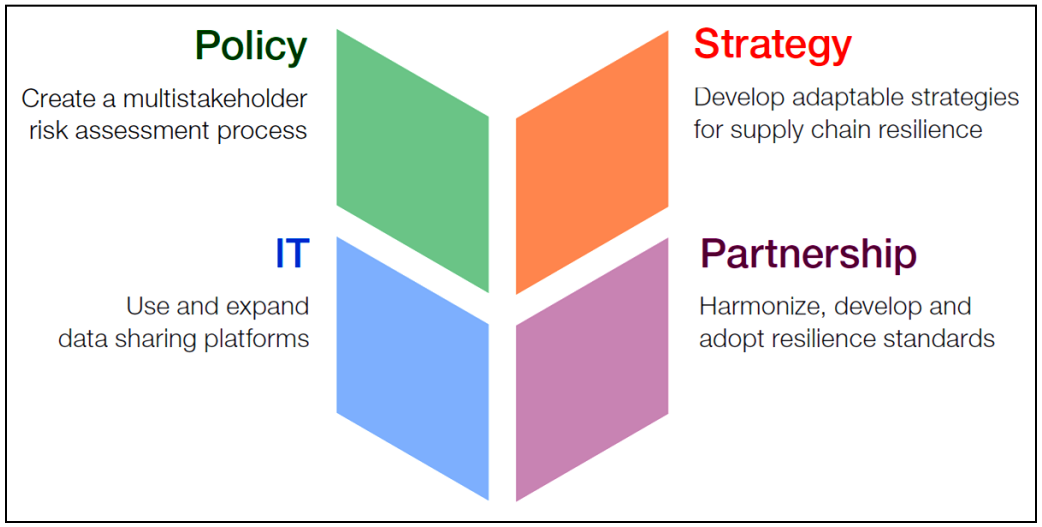
Proposed Approach in Two Phases:

Phase 3 (involves external partners):

- Improve the flow of information between industry stakeholders and government, and between governments (both domestic and international)
- Explore predictive analytical frameworks using an archive of evidence-based data sources from past events
- Identify policy actions and tools to deal with specific vulnerabilities and resilience situations

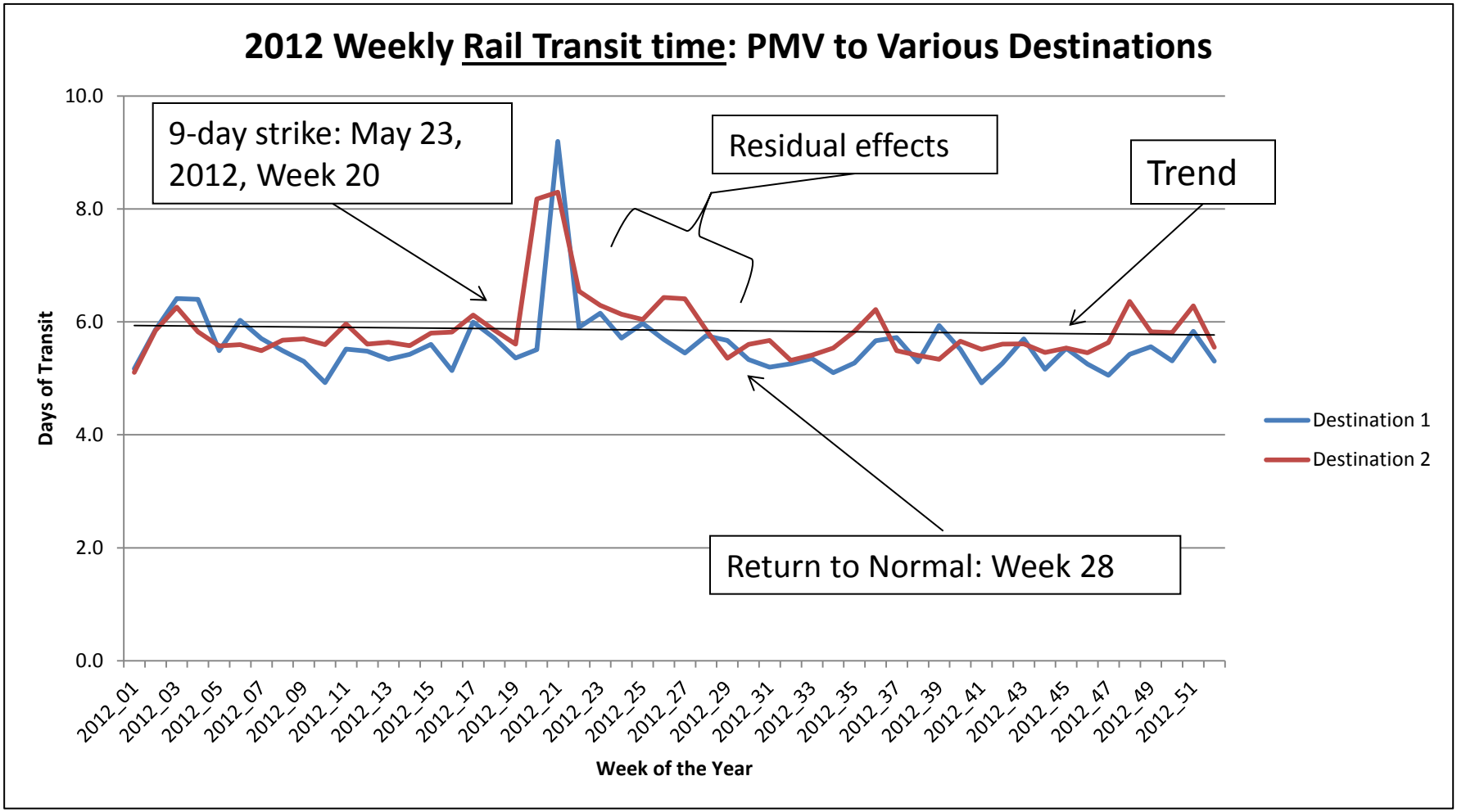
Budget and Timeline:

- 2014-2017
- $150,000 TC R&D Central Fund Research Project on Supply Chain Resilience
- $100,000 may be leveraged from other government departments



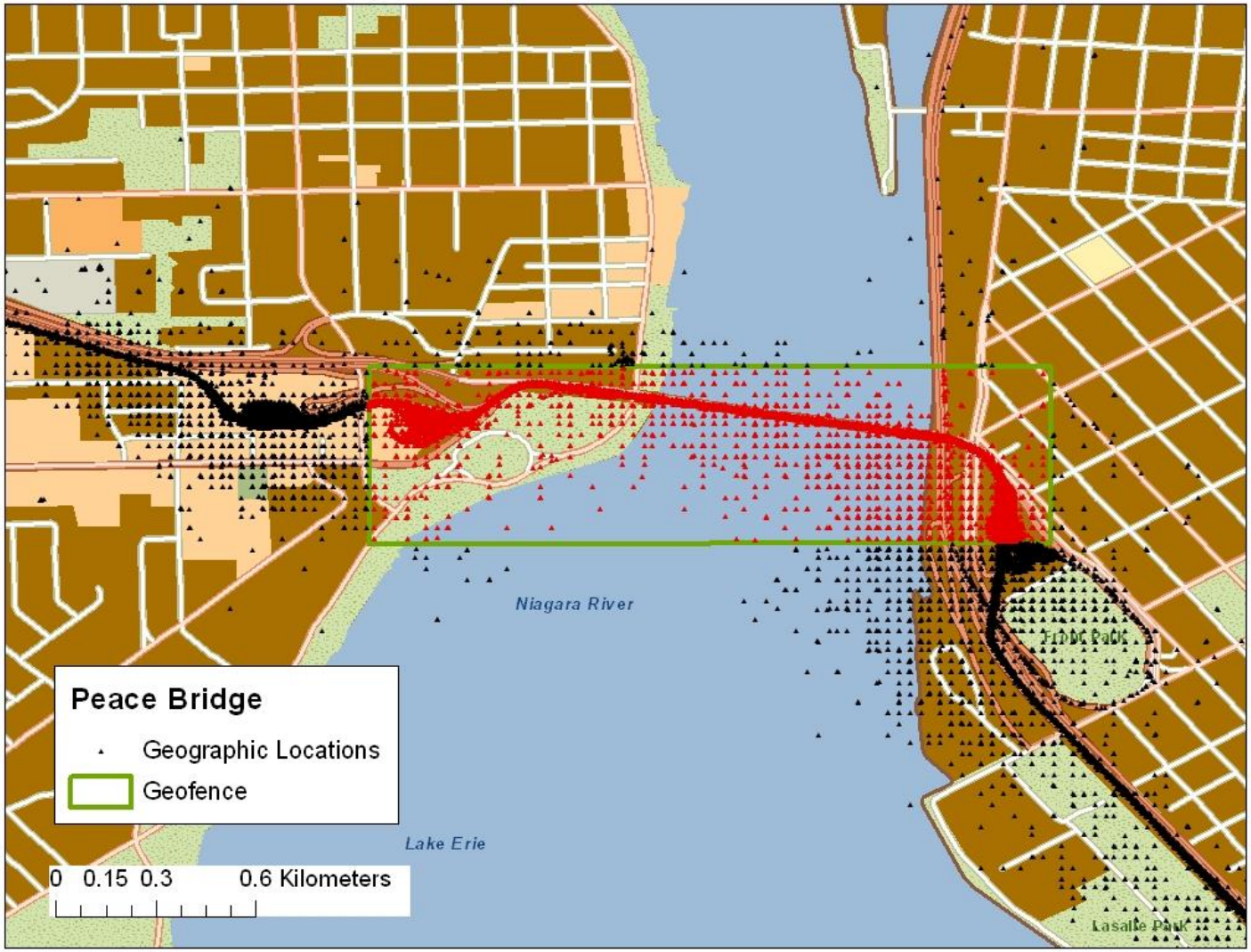
World Economic Forum. "Building Resilience in Supply Chains". January 2013

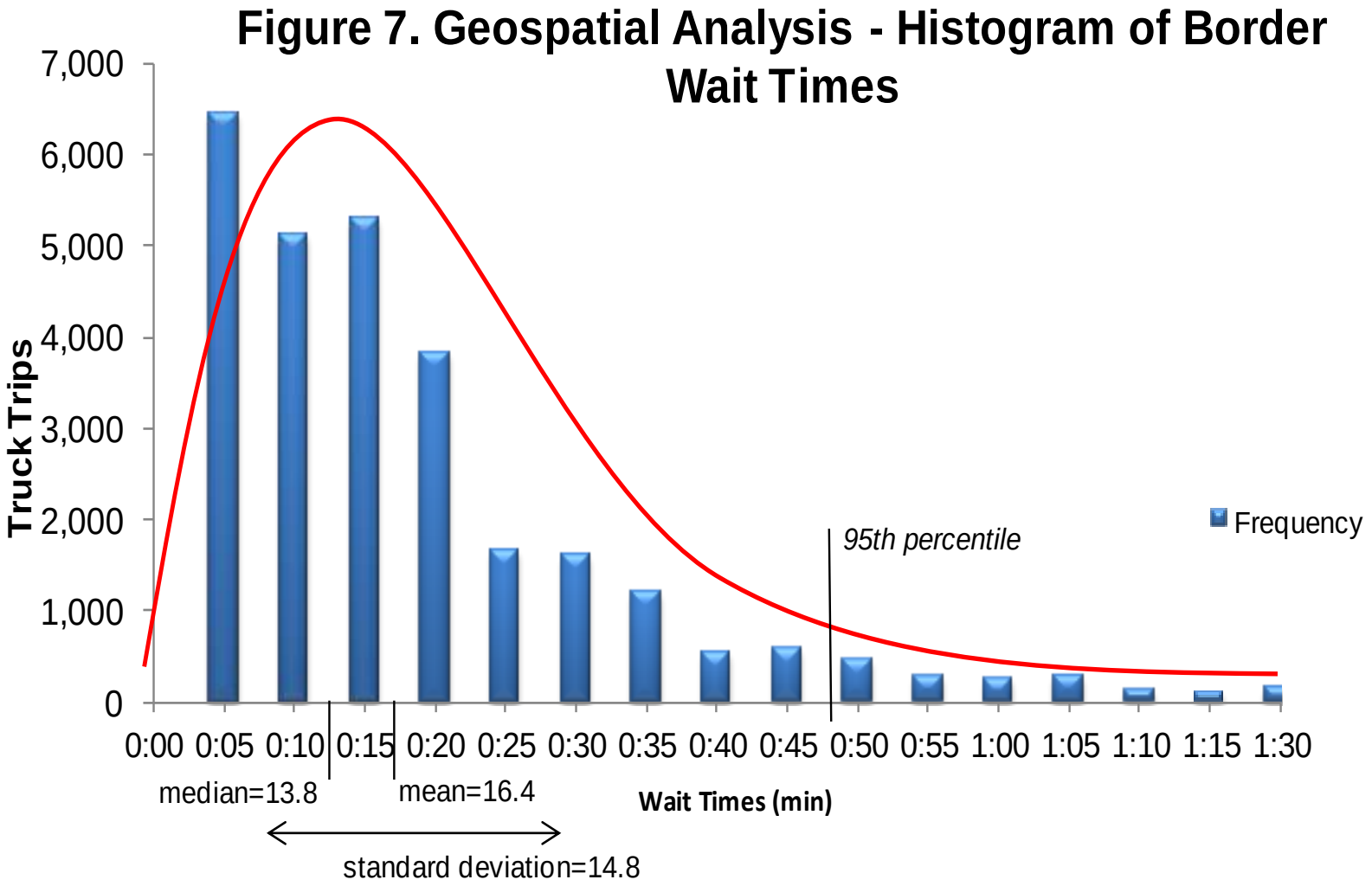
Quantify immediate and residual impacts of disruptions on the rail network such as strikes and/or weather events.



Source: Transport Canada Fluidity database. Please note the data presented is an aggregate of both class 1 rail carriers.

Estimating Southbound Truck Border Wait Times Using Geospatial Data





Source: Transport Canada

POLICY IMPLICATIONS

- The fluidity indicator is evidence-based information to assess and analyze the efficiency of our supply chains.
- The project assists Transport Canada's work on the identification of constraints in the transportation system.
- It provides strategic information on the resilience of our supply chains by measuring the recovery rates of the supply chains after major disruptions.
- It is a horizontal project serving other government departments and initiatives:
  - Department of Foreign Affairs and International Trade and Development: Investment, Trade and Pre-clearance Files
  - Public Safety: Critical Infrastructure
  - Infrastructure Canada
  - Provincial Governments: BC and Saskatchewan
  - Foreign Governments: United States and Japan

Fluidity Web Portal

Here's what you see when you login onto the Fluidity Web Portal application.

Login procedures are provided by Transport Canada.

Fluidity | Port Utilization Indicator | Border Wait Times | Carbon Footprint Model

Fluidity > Container Import

Transit Times | Segment Proportions | U.S. Comparisons | Variability

West Coast

Origin:	Gateway:	Destination:	Segment:	Supply Chain:	Year:
☑ Shanghai	☑ BC Ports	☑ Toronto	☑ Landside (P+I)	☑ 1	☑ All
☐ Hong Kong		☐ Montréal	☐ Marine (M)	☐ 5	☐ 2013
☐ Qingdao		☐ Calgary	☐ Port (P)	☐ 7	☐ 2012
☐ Tokyo		☐ Winnipeg	☐ Inland (I)		☐ 2011
		☑ Chicago	☐ End-to-End		☐ 2010

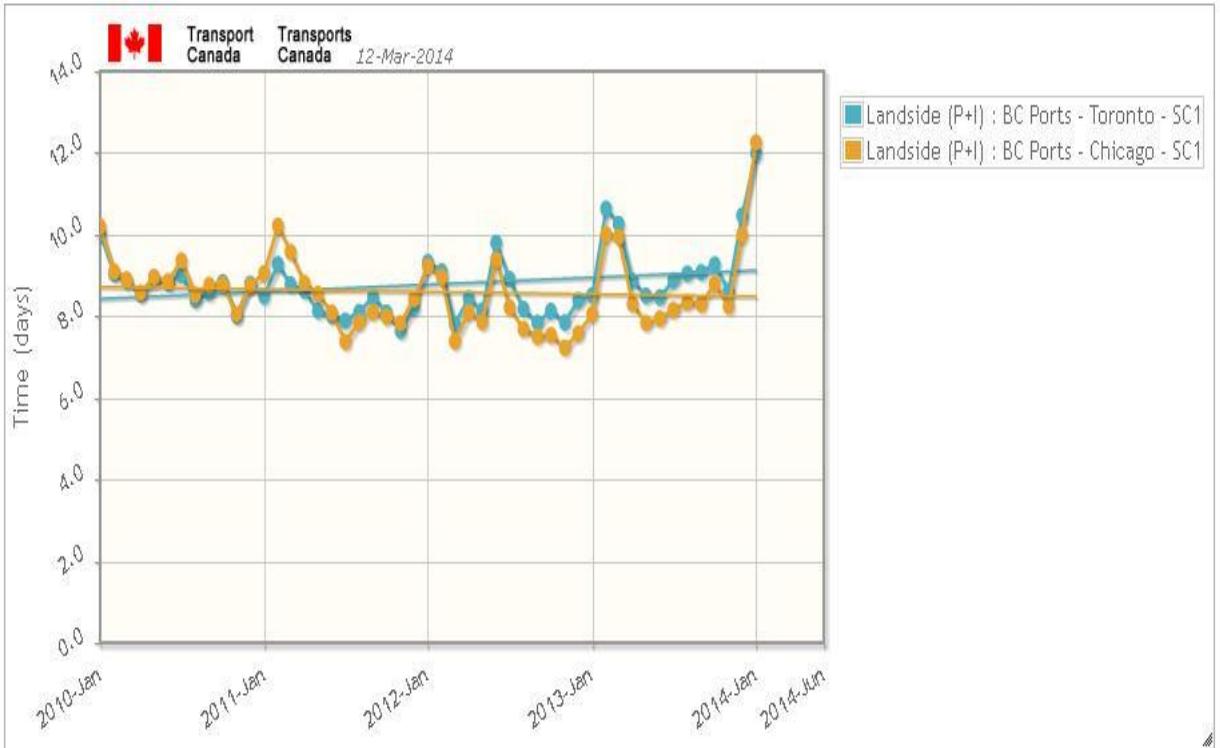
Data Consistency

Policy Dialogue

Leave Comment

Plot

East Coast



THANK YOU