Transport Canada –
Utilization of Transportation Data to Evaluate Supply Chain Performance in Canada

Presentation to the International Maritime Statistics Forum

Transportation and Economic Analysis Directorate

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Outline of this Presentation

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  - Evidence-based Approach
- Supply Chain Fluidity Indicators
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  - Methodology & Data
  - Application Metrics Example
- Challenges
  - Data Needs
- Conclusion and Next Steps

Current Context

Context: Transportation Demand Outlook

Demand for Canadian transportation system is expected to be largely affected by:

- Changing global poles of growth (e.g. Asia, U.S., BRIC)
- Canadian direct and indirect access to global supply chains and markets (e.g. new trade agreements and Canadian comparative advantages)
- Demand for key Canadian commodities/manufacturing goods
- Demographic and environmental factors
- Expected growth of 5 key commodities over the next 10 years (coal, crude oil, grain, potash, wood products)

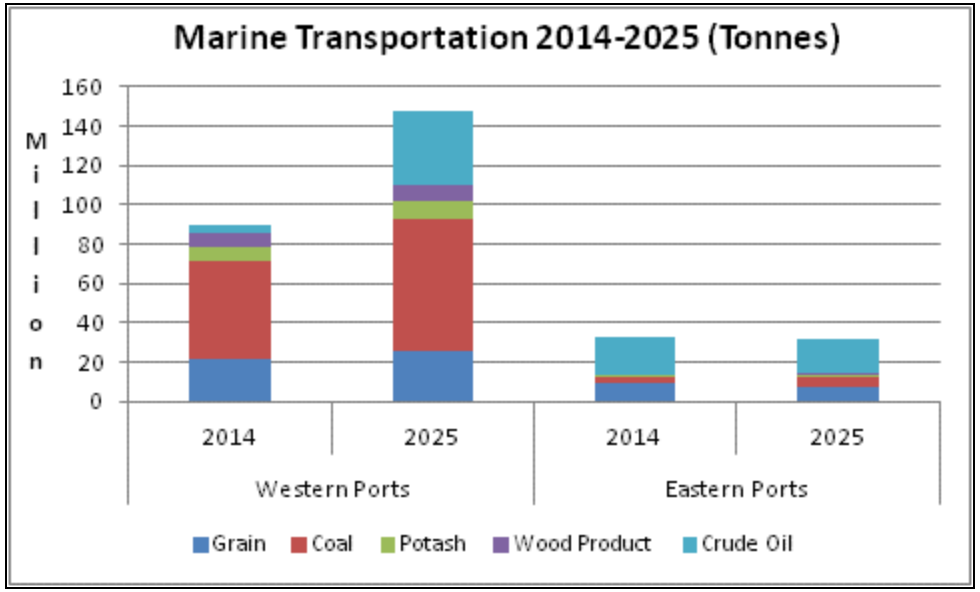
Context: Pressure on Canadian Ports

➢ Western ports are dominant:

- Overall, the Western ports handled about 75% of the tonnage and this is expected to increase around 80% in the future.
- In 2014, coal represented about 45% of all tonnage shipped.
- The volume of shipping containers moving through the Asia-Pacific Gateway and Trade Corridor has more than doubled over the last decade (2002-2012).

➢ Major growth on Western ports

- In the Western ports, coal is expected to grow by 35% from 2014 to 2025 due to the increasing demand in Asia.
- Overall, crude oil exports should increase from 22.2 Mt in 2014 to 54.5 Mt in 2025.
- Volume of Western containers throughput should increase by **70%** from 2014 to 2025



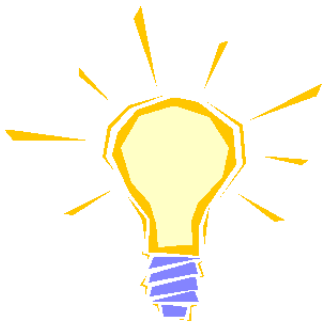
Source: Transport Canada, November 2014

➢ Risks in the System

- Congestion at ports (Vancouver and Prince Rupert).
- Infrastructure pressures

Context: Policy Questions...

- Has the performance of Canada's supply chains improved or deteriorated over time? If performance has deteriorated, can it be improved through increased operational efficiency or are infrastructure investments required?
- To what extent does the transportation system infrastructure enable or limit Canada to capitalize on export opportunities?
- How to evaluate the performance of the network?



Context: Evidence-based Approach

TC has been developing evidence-based approaches to identify and address transportation system issues and to improve the reliability, efficiency, and effectiveness of the supply chain.

- **Monitor performance of the Canadian transportation system**
  - Supply Chain Fluidity indicators
  - Port Utilization Indicators
  - Exports/Imports – international and North American corridors
- **Monitoring/Understanding Canadian commodity supply chains**
  - Grain, coal, potash, forest products, crude oil
  - Containers
- **Monitoring border crossings performance – 13 border crossings points**
- **Access capacity of the Canadian transportation system**
  - Asia-Pacific corridor
  - East/Atlantic corridor
  - Canada-U.S.-Mexico auto supply chain corridor

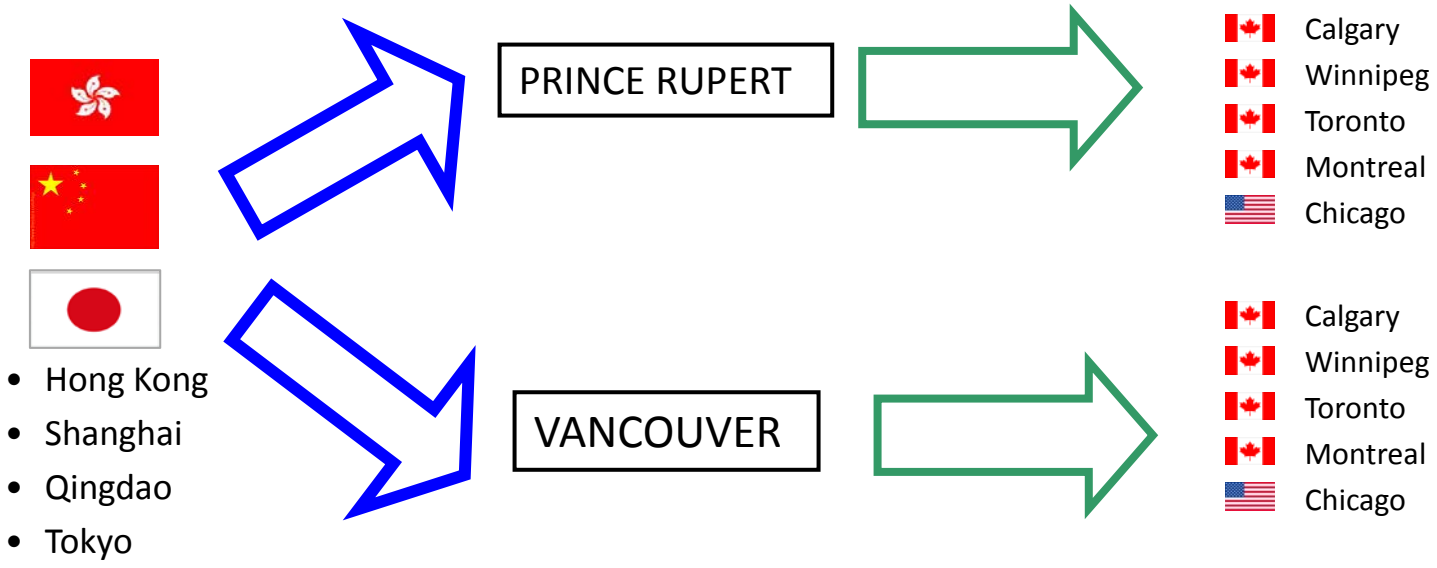
Example of Evidence-based Metric: Supply Chain Fluidity Indicators

Fluidity: Concept

- Emergence of global freight supply chains requires an understanding of the reliability and resiliency of geographically dispersed transportation and logistics systems.
- Fluidity indicator is a multi-modal, integrated supply chain tool that measures in near-real time the performance of individual segments of the supply chains as well as end-to-end transit time of freight flows.
- The indicators measure the dynamic performance of Canada's supply chain for the import of container goods and the export of bulk commodities.
- Examples of 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
  - ✓ Effect of routing on marine transit times
  - ✓ Estimating border wait times
  - ✓ Measuring carbon footprint
  - ✓ Benchmarking: comparing push versus pull inventory model

Fluidity: Concept – Import Flow

Import Container Corridors: Asia-Pacific (B.C. Ports)



Import Container Corridors: Continental

Fluidity: Supply Chain Multi Modal Components

Ocean & Port

- Ocean transit [1]
- Marine Terminal Dwell [2]

Rail

- Dwell at origin rail yard [1]
- Rail transit time (intra-urban) [2]
- Rail transit time (inter-urban) [3]
- Dwell at dest. rail yard [4]

Trucking

- Truck from marine terminal to origin rail yard [1]
- Truck from marine terminal to end customer [2]
- Truck from marine terminal to transload facility [3]
- Truck from transload facility to origin rail yard [4]
- Truck from transload facility to end customer [5]
- Truck from shipper warehouse to origin airport [6]
- Truck from primary destination airport to secondary destination airport[7]
- Truck from destination airport to DC/warehouse [8]

Air

- Dwell at origin airport [1]
- Air transit [2]
- Dwell at destination airport [3]
- Dwell at secondary destination airport[4]

Logistics and Warehousing

- Dwell at transload facility

Fluidity: Time Component Definition & Data

- **Fluidity metrics are developed with industry on a voluntary basis;**
- **Development of metrics were made through partnerships and collaboration on harmonization and benchmarking tools (ex. Port Utilization Indicators)**

Ocean & Port

Ocean transit: from vessel departure at port of origin to vessel arrival at port of destination

- **Data**: Lloyd's List Intelligence *Seasearcher,* AIS Database

Marine terminal dwell: from container discharge to loaded to rail car

- **Data**: Canada Port Authorities, Terminal Operators, GT Nexus

Rail

(Supply Chain 1)

Inter-urban rail transit: from out-gate (at marine terminal / origin yard) to in-gate at destination yard

Dwell at destination rail yard: from in-gate to offloaded from rail car

- **Data**: CN Rail & CP Rail

Trucking

(Supply Chain 5)

Truck transit times are calculated using GPS tracking

(On an urban boundary principle for long haul movements)

- **Data**:

Shaw Communications, Turnpike, Various trucking fleets across Canada, Inter-urban: large sample

- 90 major O/D pairs
- Border wait times

Transloading

Transload dwell: total elapsed time shipment spends at transload facility (precise cut-offs unspecified)

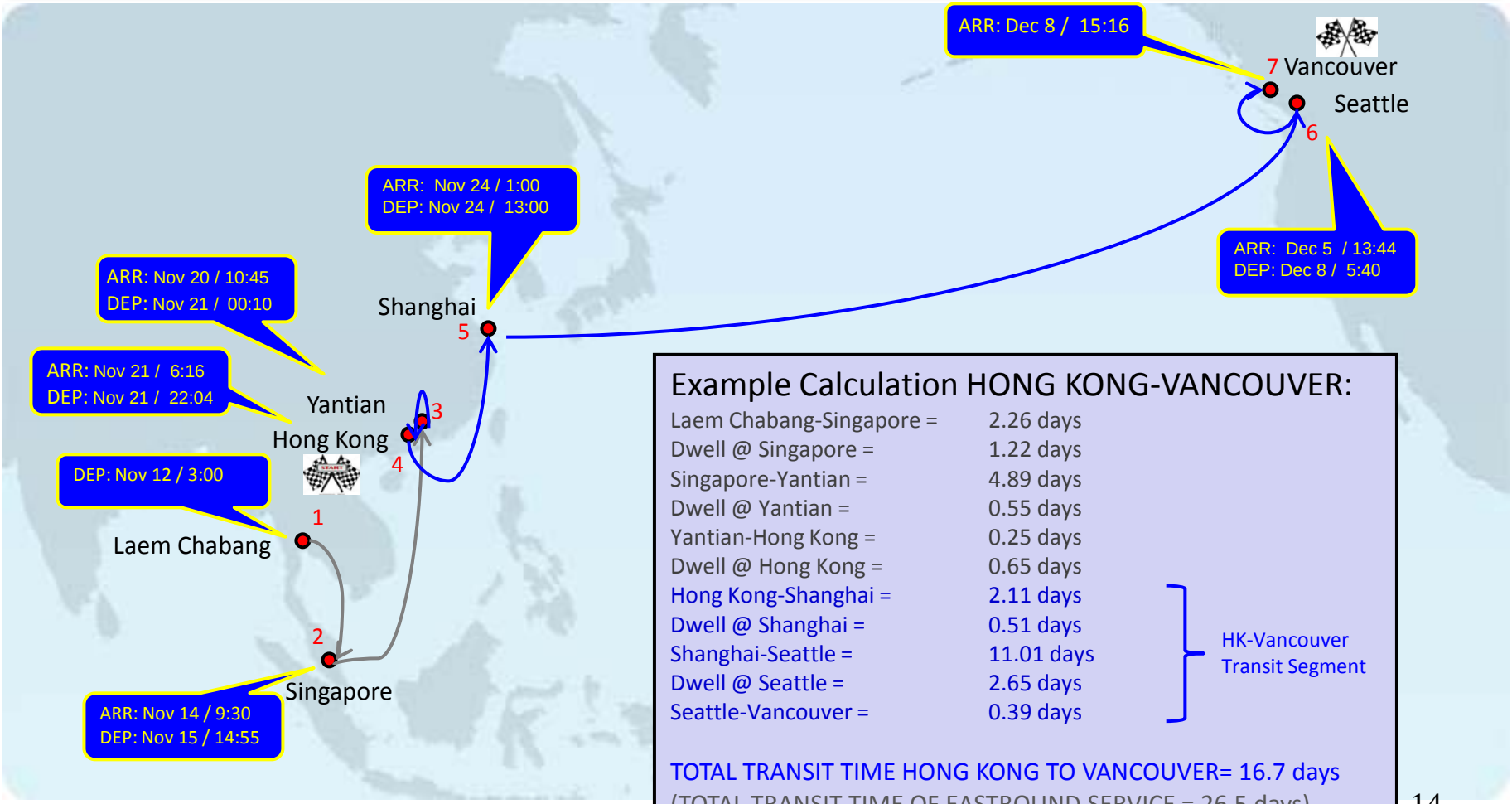
- **Data**: *Lower Mainland Transload Mapping Study 2010* (Culham Business Solutions)

Application of Metrics:
Fluidity Indicators – Marine Portion

Transit Component – Example

Pacific South 1 – Service eastbound – November 2010

Port Rotation: Laem Chabang → Singapore → Yantian → Hong Kong → Seattle → Vancouver



Example Calculation HONG KONG-VANCOUVER:

Laem Chabang-Singapore =	2.26 days
Dwell @ Singapore =	1.22 days
Singapore-Yantian =	4.89 days
Dwell @ Yantian =	0.55 days
Yantian-Hong Kong =	0.25 days
Dwell @ Hong Kong =	0.65 days
Hong Kong-Shanghai =	2.11 days
Dwell @ Shanghai =	0.51 days
Shanghai-Seattle =	11.01 days
Dwell @ Seattle =	2.65 days
Seattle-Vancouver =	0.39 days

HK-Vancouver Transit Segment

TOTAL TRANSIT TIME HONG KONG TO VANCOUVER= 16.7 days

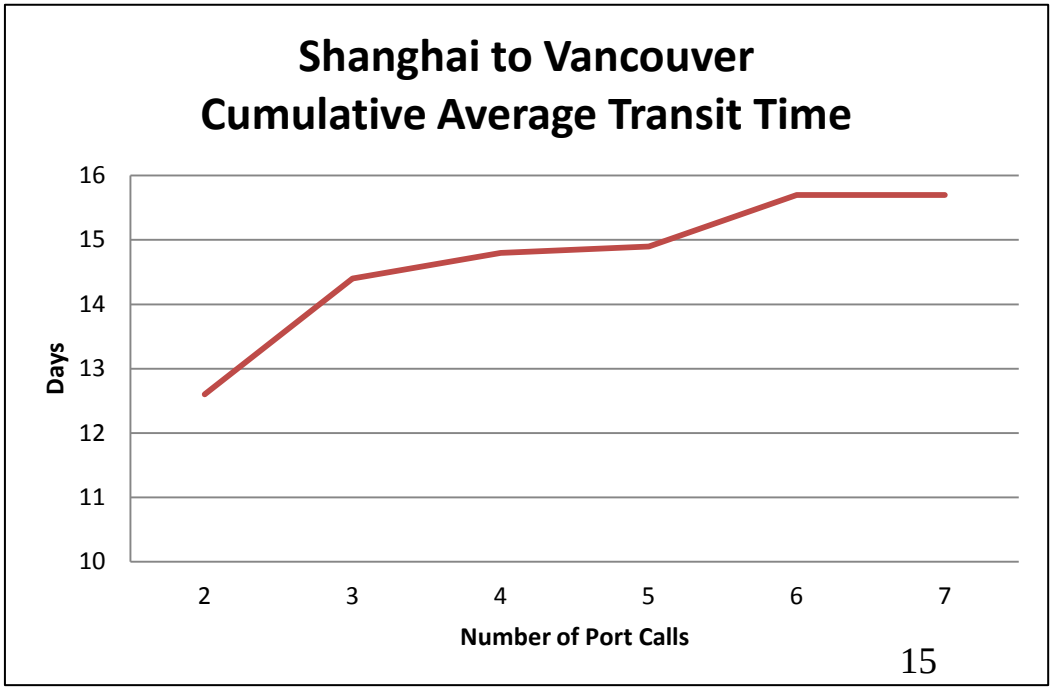
(TOTAL TRANSIT TIME OF EASTBOUND SERVICE = 26.5 days)

Routing Effect on Marine Transit Times

- As expected, adding port calls increases average transit time for marine vessels
- Marine transit is not a homogeneous dataset
- Adding another port call from 5 to 6 ports, increases the average transit time from 14.9 days to 15.7 days

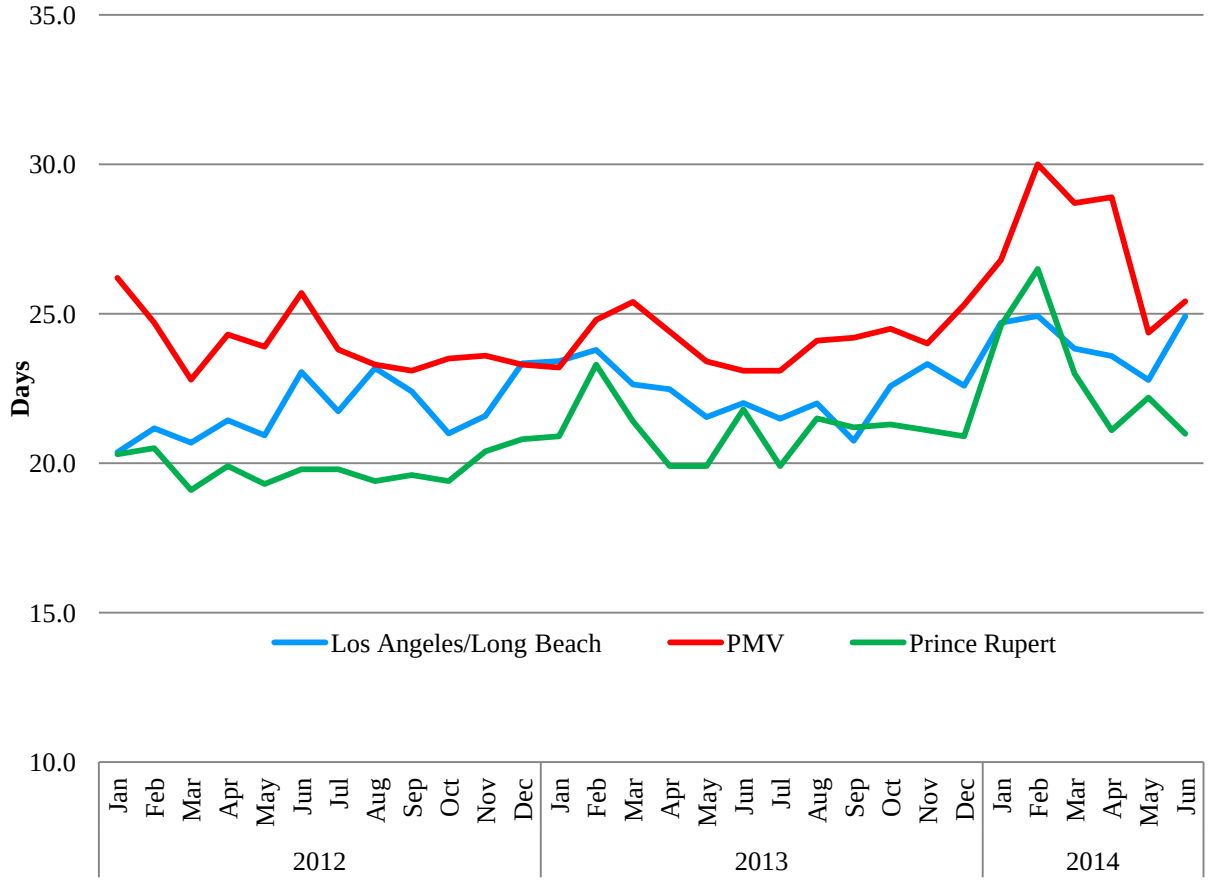
2012 Shanghai to Vancouver

Port Calls	Cumulative Vessels	Cumulative Average Transit (Days)	% of total vessels
2	4	12.6	1.4%
3	120	14.4	41.1%
4	232	14.8	79.5%
5	241	14.9	82.5%
6	288	15.7	98.6%
7	292	15.7	100.0%



Comparison to U.S. Ports Transit Times

Total Transit Time from Shanghai to Chicago



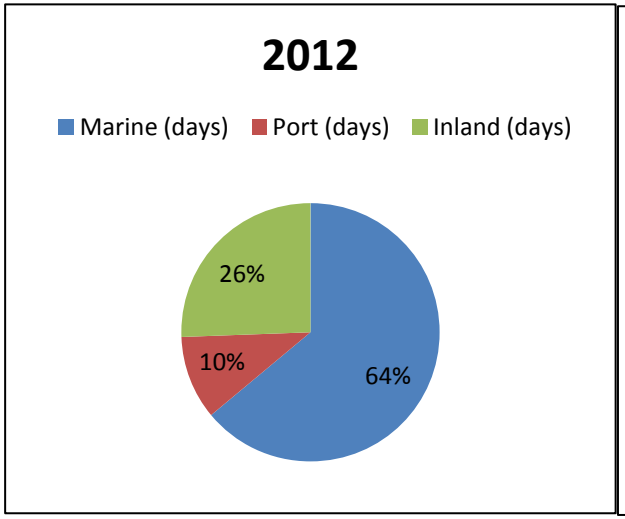
- Under the Moving Ahead for Progress in the 21st Century Act (MAP-21), the United States is starting to establish performance metrics for its supply chains.
- The Government of Mexico is also starting work on supply chain performance metrics and is consulting with our group.

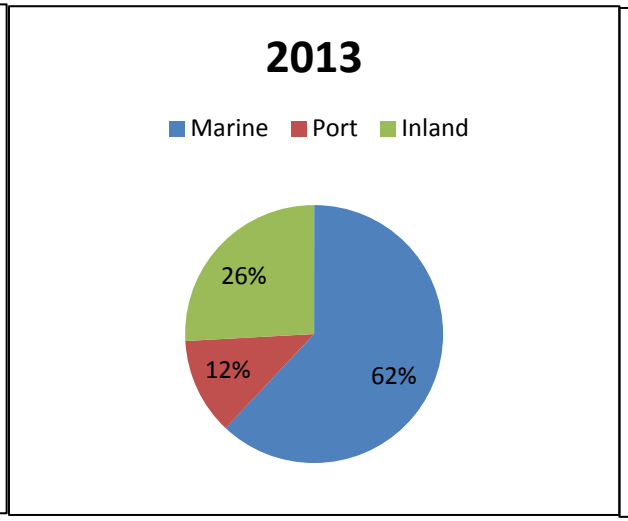
Increased Variability and Dwell Times at Ports

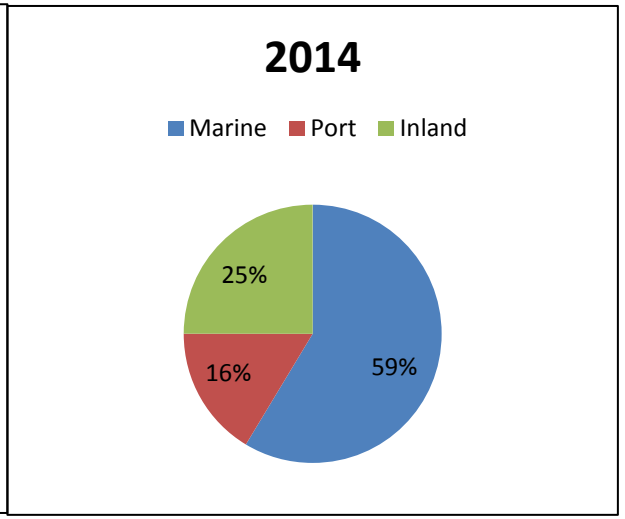
- The volume of import containers through the Asia-Pacific Gateway has more than doubled since 2002 and is expected to double again by 2025.
- While the average import container dwell time at B.C. ports represented just 10% of the end-to-end transit time, its variability is much greater than the transit times of the marine and inland segments.

Total Transit Time from Shanghai to Toronto via B.C. Ports, 2012-2014

Year	Marine transit	% Change	Port dwell	% Change	Inland transit	% Change	Total
2012	15.1	8.2%	2.5	2.5%	6.0	2.0%	23.6
2013	15.0	-0.3%	2.9	19.0%	6.3	4.3%	24.3
2014	15.4	2.3%	4.3	46.5%	6.6	4.4%	26.2





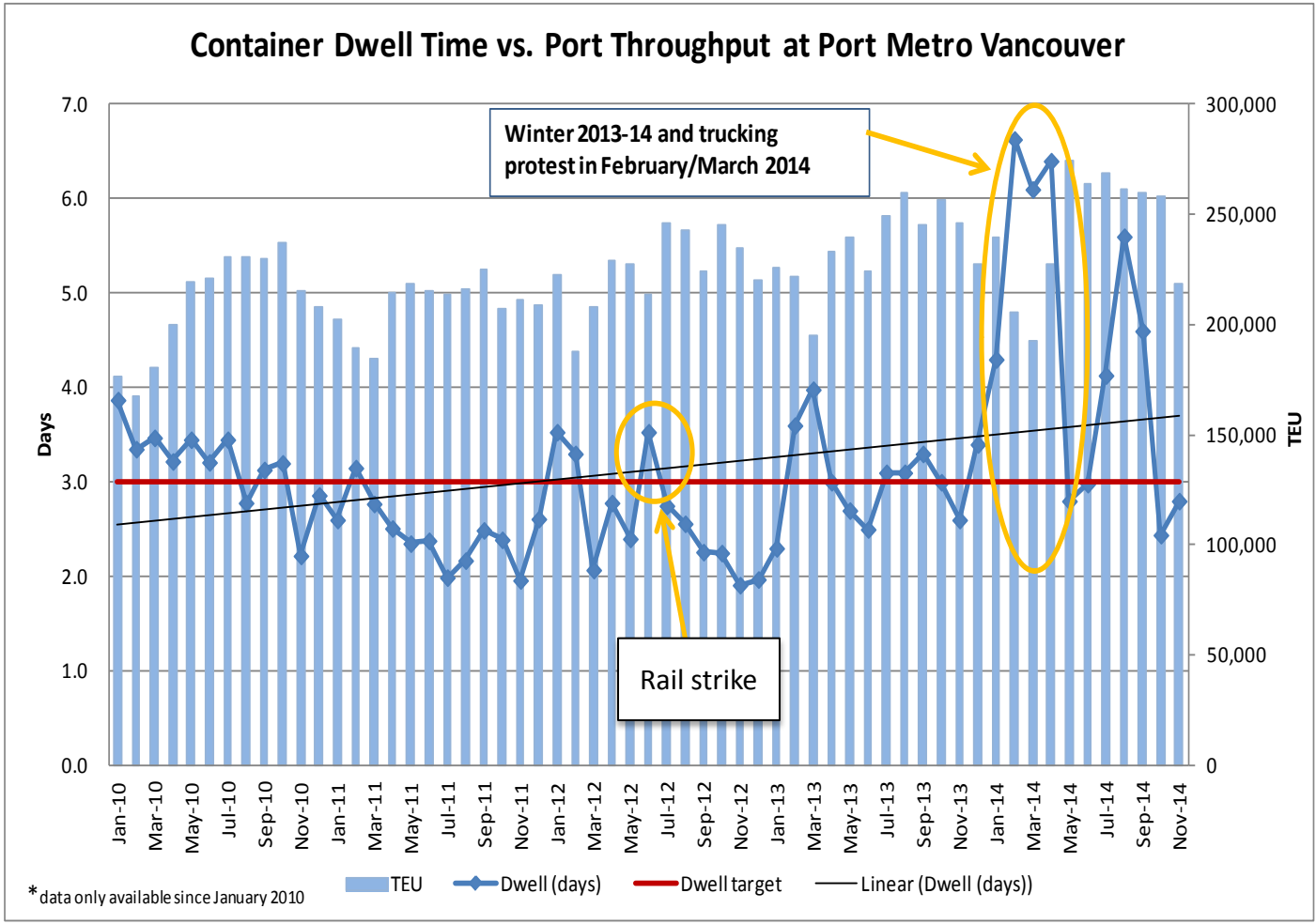


Source: Transport Canada Fluidity database. Please note the data presented is an aggregate of both class 1 rail carriers.

Combining Indicators for Enhanced Analytical Power

Vulnerabilities of supply chains to unexpected events

- Performance variability analysis of a segment of the import container supply chain.
- Investigation of those points provides information on disruptions and their immediate or residual impact on the specific supply chain segment and on the network.



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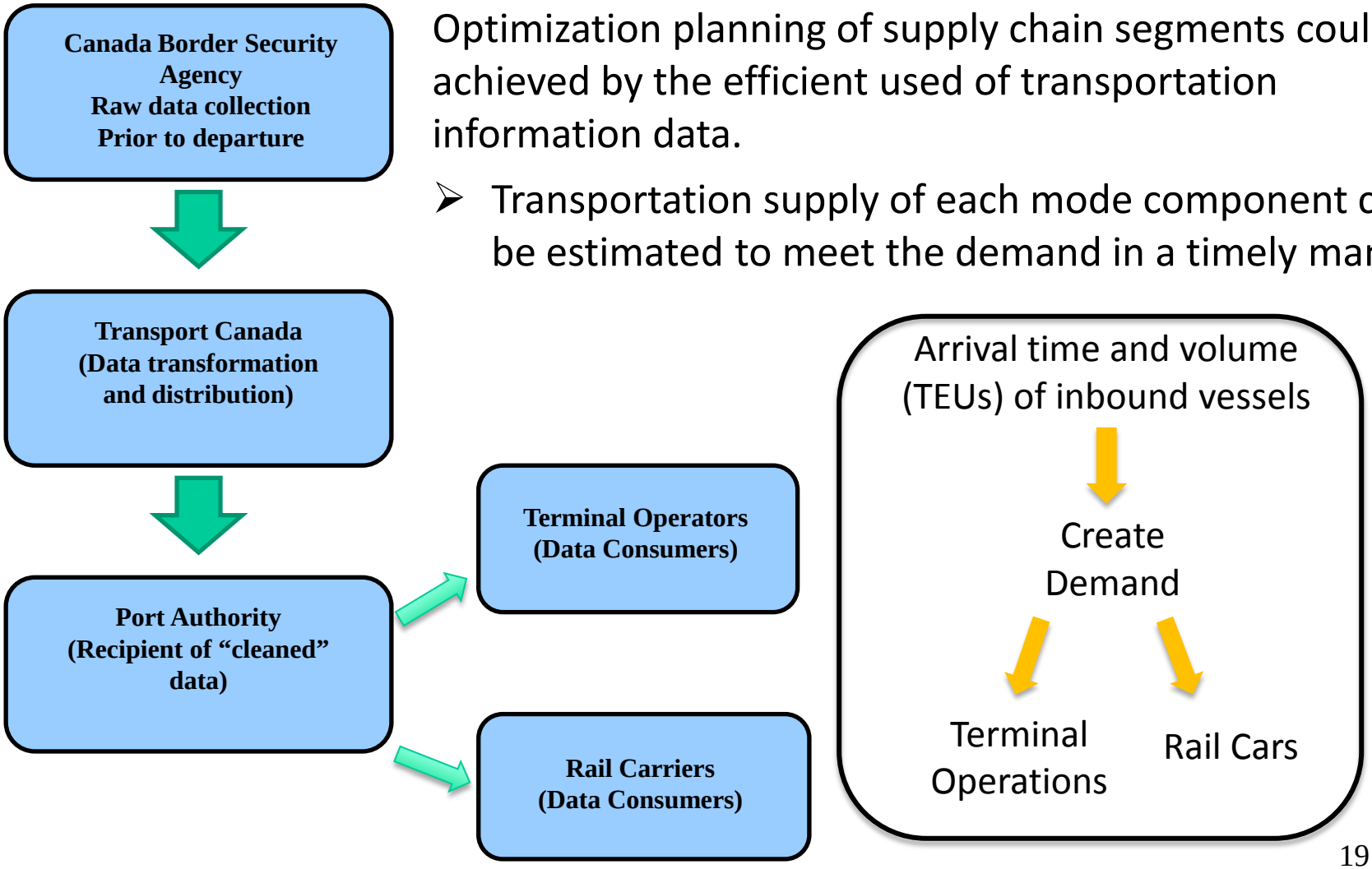
Using Data to Improve Performance



Optimization planning of supply chain segments could be achieved by the efficient used of transportation information data.

- Transportation supply of each mode component could be estimated to meet the demand in a timely manner.

Challenges

Challenges Faced by the Transportation Sector

- **Accessibility to market: Trade**
  - Key commodities – domestic/international
  - Energy – domestic/international

- **Supply chain performance/resilience/connectivity**
  - Growing complexity of global supply chains
  - Direct/Indirect access to global supply chains
  - Vulnerability of supply chains to unexpected events

- **Coordination/Planning of transportation capacity**

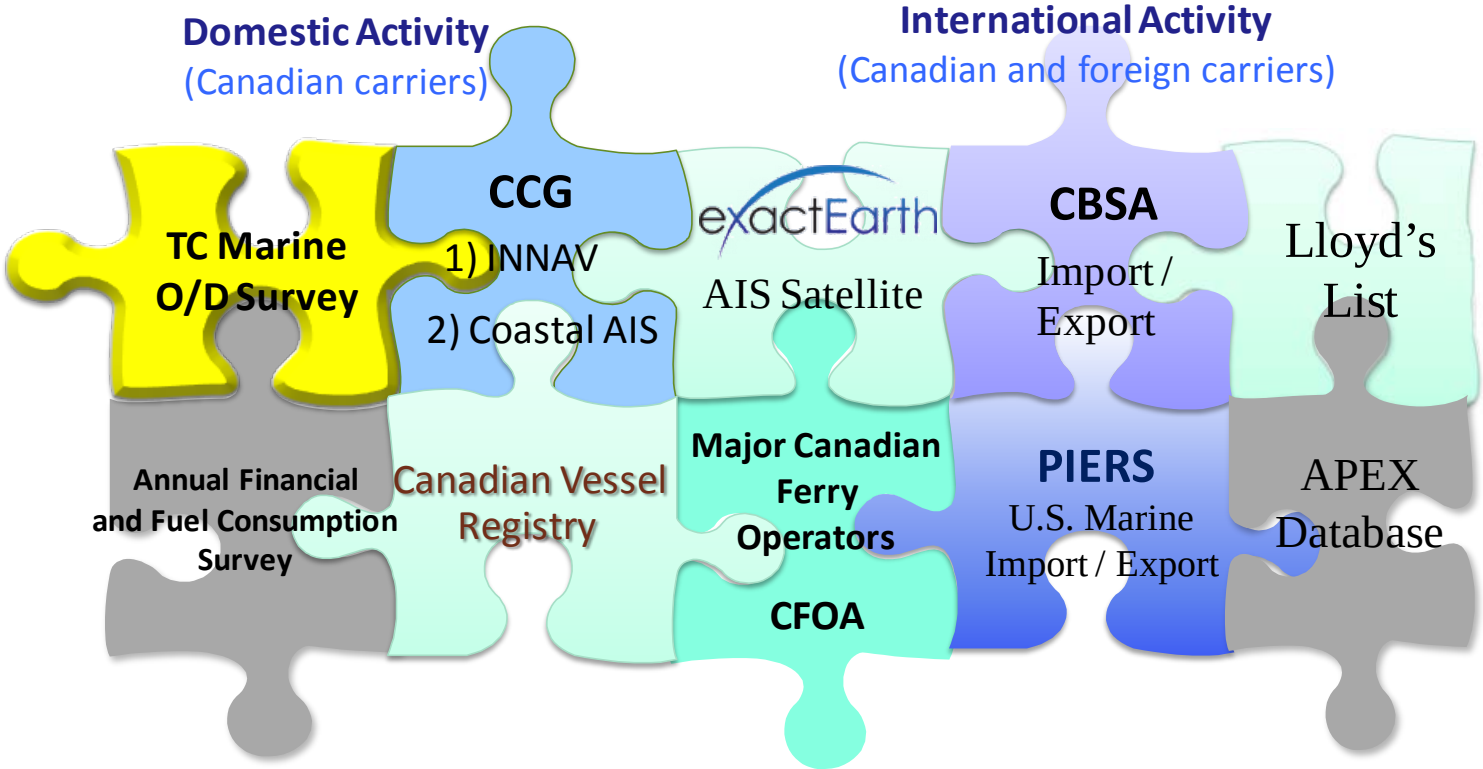
- **Examples of specific transportation sector challenges**
  - Port Metro Vancouver and multi-modal functions in the Lower Mainland
  - Pressures on the East-West rail corridor due to expected commodity growth
  - Market access issue for energy
  - Increased congestion in urban areas
  - Domestic road system and the National Highway System

Data Needs to Address Challenges

I. Enhance the marine traffic analysis with improved data on **VOLUME**, **MOVEMENT** and **TIME** elements

II. Assess the demand for transportation both at a national and international levels

III. Consultation/validation with stakeholders (other federal departments, industry, provinces, international agencies, U.S.)



Development of New Metrics: Export Supply Chains

- Canada is a major producer and exporter of five key commodities: grain, coal, potash, forest products and crude oil, as well as containers.
- These commodities represent more than 40% of the rail tonnage carried in Canada and most of the products are exported, is estimated at about 30% of the value of our total exports.
- Transport Canada's supply chain analysis for key export commodities is based on five pillars.

Commodity Production/Supply	Projections on commodity production or supply
Stocks/Inventory	Indicators of volumes to be moved on the transportation system
Rail/Truck Movements	Indicators rail/truck movements and network fluidity, including border crossings
Port /Marine Movements	Aggregate measures of port activities (rail, truck terminal, vessel)
Corridor Analysis	Monitoring of selected supply chains on a regular basis

Conclusion and Next Steps

Conclusion and Next Steps

- Currently, the Canadian transportation system is responding well to the evolving international and domestic conditions and markets.
- However, the sector is facing a number of challenges , such as enabling market access, system fluidity, and planning of transportation capacity.
- To address transportation system challenges, better alignment of economic needs with transportation infrastructure is needed.
- In order to support allocation of resources and investments, key elements need to be in place such as adequate, timely and consistent data and research/forecasts to identify current and future performance and capacity issues of the multi-modal transportation system.

Conclusion and Next Steps

- Develop demand forecasts for transportation and scenario planning.
- Enhance our analysis and knowledge on demand drivers.
- Develop performance metrics for export supply chains; bulk commodities and containers.
- Understand future trade flows and impacts of trade agreements on infrastructure.
- Update our analysis of current and future performance and capacity of the multi-modal transportation system:
  - Performance – Fluidity, connectivity, and vulnerability.
  - Capacity – Optimization of existing infrastructure and new requirements.

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