Application of Freight Flow Measurements

Presentation at TRB/OECD Workshop, Vancouver, British Columbia
October 15-16, 2009
Welcome / Bienvenue
Transport Canada Policy Context: Gateways and Trade Corridors

- Transport Canada’s Reliability concepts based on the following:
  - Transparency of Country’s Performance
  - Build credibility of supply chains
  - Based on “Time-to-Market” Concept
  - Time-consistency of the supply chain taking into account seasonality and landmark events
  - Variability of Transport
  - Predictability for the users
  - Competitiveness
Canada’s Gateways and Trade Corridors: System-wide Approach

October 2006+

Efficient, reliable and secure gateways to North America

Aligning trade & transportation

Integrated package of investments and policy aimed at enhancing Canada’s competitiveness

System-wide approach
Role of Transport Canada’s Economic Analysis Directorate

- Transportation price and productivity performance measurement
- Impact of transportation productivity
- Recognize the need for new performance indicators – more horizontal than vertical
- System wide performance indicators recognizing horizontal integration compared to traditional vertical measurement
Example of Modal Productivity Measures

Total Factor Productivity - Selected Modes
**System-Wide Approach to Gateways & Corridors**

- Looking at performance of Canadian system through a Total Logistics and Global Value Chain lens.

- Objective: develop system-wide performance indicators that would allow for the periodic evaluation of Canada’s gateways and corridors’ performance and possibly the competitiveness of our Gateways.

- Support the Department in the following ways:
  - Increase our ability to monitor major system choke points;
  - Support marketing initiatives of gateways & corridors, policy-making, environmental measures, air cargo competitiveness, Security and border crossings delays etc..., and
  - Build a foundation/rationale to guide possible intervention/investment;

- 3 key projects:
  - Total Logistics Costs Index;
  - Fluidity Indicator; and
  - Port Utilization Indicators.
Integrated Research Approach

Reliability and efficiency of Canadian supply chains

- Fluidity Indicator
- Total Logistics Cost Index
- Port Utilization Indicators
Total Logistics Costs

- Using a model developed in North America in the 1960s and improved since
- Model tested in 2008 and 2009 with various industrial sectors
- Proof-of-concept completed and results show that for most industrial sectors the model can be applied and repeated.
- Tool to use as a Proxy to indicate monetary impact of variability in “time-to-Market”
- Tests show that data gathering exercise can be minimized provided the participants have in place data management systems (six sigma, continuous improvement process, etc.)
- The sectors we are exploring:
  - Retail sector for imports (container movements)
  - Grain and specialty crops for exports (bulk and containers)
  - Processed food and beverages sector for both imports and exports (container movements)
Total Logistics Cost Model

\[ TLC = RD + \frac{UCTD}{365} + \frac{SD}{Q} + \frac{QCI}{2} + rIC + K\left(\frac{D}{Q}\right)N(Z)S \]
Total Logistics Costs: Preliminary Results

**TLC as % of sales: 12.7%**

Canadian food products exporter – exports to Asia

- **Transportation cost**: 86%
- **Carrying Cost of In-Transit Inventory**: 4%
- **Carrying Cost of Standing Inventory**: 8%
- **Stockout Cost**: 1%
- **Cost of Holding Safety Stock**: 1%
Total Logistics Costs: Preliminary Results

Total Logistics Cost
Time Series Feb 09-Jun 09

- Stockout Cost
- Cost of Holding Safety Stock
- Carrying Cost of Standing Inventory
- Carrying Cost of In-Transit Inventory
- Transportation cost

Feb-09 Mar-09 Apr-09 May-09 Jun-09
Fluidity project

Import Movements

Export Movements

Rail/truck transit

Fluidity

- Some parts of the model exist at the mode level
- Difficulty is to integrate all modes into one model
- Proof-of-concept should be completed in January 2010
- Up to now we have concentrated on the data acquisition components and issues such as data quality and validation
- Data acquisition from all four modes is on a voluntary and partnership basis
- Data acquisition exercise is near completion and validation tests are on-going
- Transport Canada’s team – 8 people with various specializations
- Working in cooperation with Texas Transportation Institute to develop system-wide model with a mandate from October 2009 till April 2010
# Port Utilization Indicators

- Data is provided by Port Authorities on a monthly basis or collected directly by Transport Canada.

- Indicators being currently implemented at Canada’s Container ports:
  1. Gate Fluidity Indicator [Min.]
  2. Average Truck Turnaround Time [Min.]
  3. Berth Utilization [TEU /m]
  4. Vessel Turnaround Time [Sec/TEU]
  5. Vessel Dwell Time in Port Waters [Hr/Vessel]
  6. Average Container Dwell Time [Days]
  7. Port Productivity [TEU/ Ha]
  8. Crane Productivity [TEU/ Crane]

- Indicators being currently developed at Canada’s ports for Bulk Commodities:
  1. Berth Occupation Rate [%]
  2. berth Productivity [Tonnes/berth/Hr ]
  3. Average Vessel Turnaround Time [Hrs]

Container Ports: Vancouver, Prince Rupert, Montréal, Halifax and St. John’s
## PUI for British Columbia Container Ports

<table>
<thead>
<tr>
<th>Measure</th>
<th>Jan-09</th>
<th>Feb-09</th>
<th>Mar-09</th>
<th>Apr-09</th>
<th>May-09</th>
<th>Jun-09</th>
<th>Jul-09</th>
<th>Aug-09</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gate Fluidity - Minutes</strong></td>
<td>n/a</td>
<td>n/a</td>
<td>12.8</td>
<td>13.8</td>
<td>13.5</td>
<td>12.4</td>
<td>12.2</td>
<td>17.0</td>
</tr>
<tr>
<td><strong>Avg. Truck Turnaround Time - Minutes</strong></td>
<td>n/a</td>
<td>21.9</td>
<td>22.1</td>
<td>22.3</td>
<td>20.4</td>
<td>21.0</td>
<td>20.1</td>
<td>19.4</td>
</tr>
<tr>
<td><strong>Berth Utilization - TEU/Meter</strong></td>
<td>60.0</td>
<td>56.6</td>
<td>63.9</td>
<td>67.4</td>
<td>70.5</td>
<td>70.5</td>
<td>71.2</td>
<td>73.4</td>
</tr>
<tr>
<td><strong>Vessel Turnaround Time - Seconds/TEU</strong></td>
<td>51</td>
<td>46</td>
<td>45</td>
<td>42</td>
<td>40</td>
<td>41</td>
<td>36</td>
<td>34</td>
</tr>
<tr>
<td><strong>Vessel Dwell in Port Waters - Hours/Vessel Call</strong></td>
<td>n/a</td>
<td>31.7</td>
<td>33.2</td>
<td>30.0</td>
<td>30.9</td>
<td>33.4</td>
<td>31.6</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Avg. Container Dwell - Days</strong></td>
<td>3.2</td>
<td>2.7</td>
<td>2.3</td>
<td>3.0</td>
<td>1.8</td>
<td>2.5</td>
<td>2.8</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Port Productivity - TEU/ha</strong></td>
<td>1,286</td>
<td>1,119</td>
<td>1,386</td>
<td>1,375</td>
<td>1,470</td>
<td>1,396</td>
<td>1,465</td>
<td>1,487</td>
</tr>
<tr>
<td><strong>Crane Productivity - TEU/STS crane</strong></td>
<td>8,046</td>
<td>7,018</td>
<td>8,676</td>
<td>8,642</td>
<td>9,250</td>
<td>8,796</td>
<td>9,298</td>
<td>9,510</td>
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<tr>
<td><strong>Container Throughput - TEU</strong></td>
<td>179,742</td>
<td>158,305</td>
<td>194,455</td>
<td>195,935</td>
<td>210,095</td>
<td>200,331</td>
<td>213,455</td>
<td>218,717</td>
</tr>
</tbody>
</table>

Notes:

Figures are aggregated results of the five container terminals at Port Metro Vancouver and Port of Prince Rupert. All figures are weighed averages.

1: For fully cellular container ships only. Excludes ro-ro and mixed cargo ships

2: Dwell time calculation between the 2 ports differ. Figures represent dwell times for import containers to rail only (exports and empties excluded)

3: As of July 13, 2009, CN discontinued service at inner-harbour terminals at Port Metro Vancouver

TC means that the data is collected directly by Transport Canada
GPS-based Methodology for Truck Movements
Gate Fluidity Indicator

Example: Centerm, Vancouver, B.C.

Calculating average wait times of trucks at terminal gates

GPS technology

‘Geofencing’
Rail Transport

- Data to be obtained from Class 1 railroads
  - Data provided by Class 1 rail carriers
  - Specific corridors related to our Gateways
  - Intermodal and some bulk commodities
  - Origin (if loaded)
  - Destination (if loaded)
  - Event type (i.e. passed an EDI station, placed empty, arrived at destination terminal, etc.)
  - Event time (day, hour, minute)
  - Location: Station Number
  - Time of transit last month
  - Time of transit last quarter
  - Time of transit last year with seasonality variability
Air Cargo Fluidity Study

Data collected through our Electronic Collection of Aviation Statistics (ECATS) system – monthly files directly from major air carriers

Based on IATA Cargo 2000 project and collects timestamp data at critical steps during the supply chain

12% of the transit time of an air cargo shipment occurs in the air (IATA)

Air cargo’s supply chain is complex. Many air cargo shipment delays are caused by the need for paper documentation and reconciliation
Road Transport

- Started data collection in 2008
- In 2009 - data collected from transport fleets on a daily basis (near-real-time)
  - Daily records from 30,000 units
    - Satellite data
    - Dispatch files
  - Points of Origin and Destination (latitude and/or longitude)
  - Total distance traveled and waiting time (border crossings, intermodal yards, etc.)
  - Date and time of departure and arrival
  - Vehicle type
  - Loaded/Empty
  - Fuel consumption (including idling time)
O/D Trip Times (Fluidity)

**LEGEND:**

<table>
<thead>
<tr>
<th>Time Index</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.1</td>
<td>Light Green</td>
</tr>
<tr>
<td>1.2-1.3</td>
<td>Purple</td>
</tr>
<tr>
<td>1.1-1.2</td>
<td>Green</td>
</tr>
<tr>
<td>&gt;1.3</td>
<td>Red</td>
</tr>
</tbody>
</table>

0:00 / 0:00 - AM Peak
Average Travel Time / Free-Flow Travel Time (hours: minutes)

- **TORONTO**
  - SARNIA: 1:06 / 1:03
  - WINDSOR: 2:01 / 1:54
  - LONDON: 2:05 / 1:57

- **NIAGARA FALLS**
  - 2:15 / 2:06

- **THOUSAND ISLANDS**
  - 1:30 / 1:20

- **OTTAWA**
  - 1:35 / 1:30

- **100 km**
# Data acquisition

<table>
<thead>
<tr>
<th>Two Types</th>
<th>Pro’s</th>
<th>Con’s</th>
</tr>
</thead>
</table>
| **Data Acquisition Through Third Parties**  
(I.e. Drewry, Turnpike, OAG, MIDT) | - Simple process  
- Already cleaned  
- Cost efficient  
- Copyright protection | - May not have all information you need (I.e dispatch details)  
- Do not know the validation & cleansing procedures  
- Limit analysis capabilities  
- Frequency of availability |

| **Direct Access**  
(Electronic Collection of Air Transportation Statistics (ECATS), GPS truck and dispatch records, rail carriers through AAR and Port data) | - Granularity  
- Timeliness  
- Industry feedback  
- Get exactly what you want  
- 24 x 7 x 365  
- Protected when legislated  
- Easier for small universe  
- Easy adaptation to any new technology  
- Platform independent | - Resource demanding  
- Cleansing & validating is very challenging  
- Long process to involve all partners when there is a large universe (I.e. trucking sector)  
- More costly than data acquisition  
- Requires confidentiality agreements when not legislated |
Questions / Comments

Thank you / Merci

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