

A Total Logistics Cost Approach to Measuring Collateral Benefits of Security and Supply Chain Improvements at International Gateways

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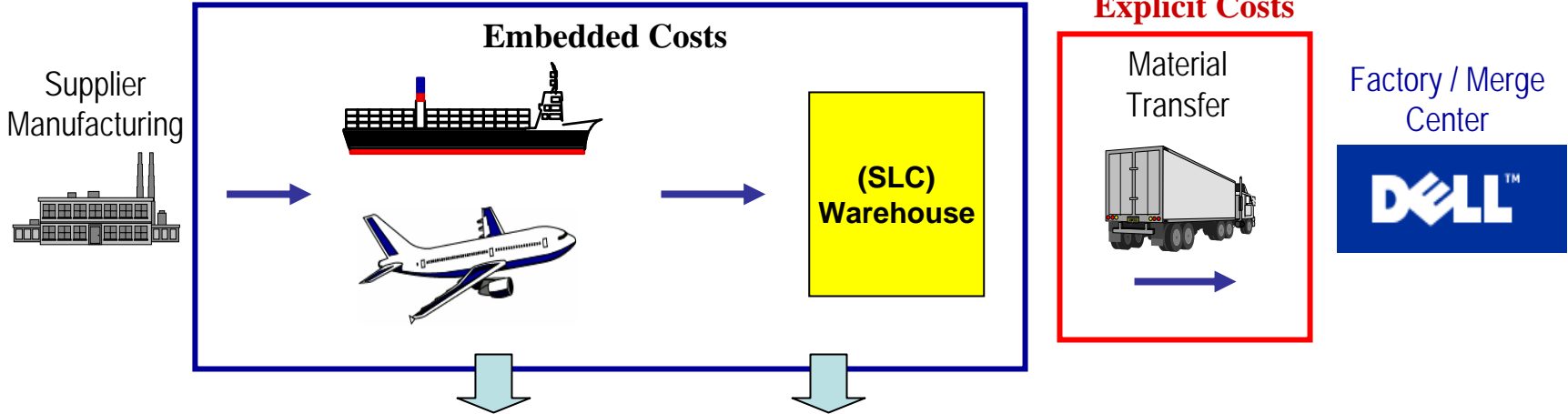
Total Logistics Costs





- Long tradition in transport demand analysis
- Core principle in logistics decision making
- Differentiates alternatives by service quality as well as price

DELL USES TOTAL LANDED COST MODEL WITH INVENTORY COSTS

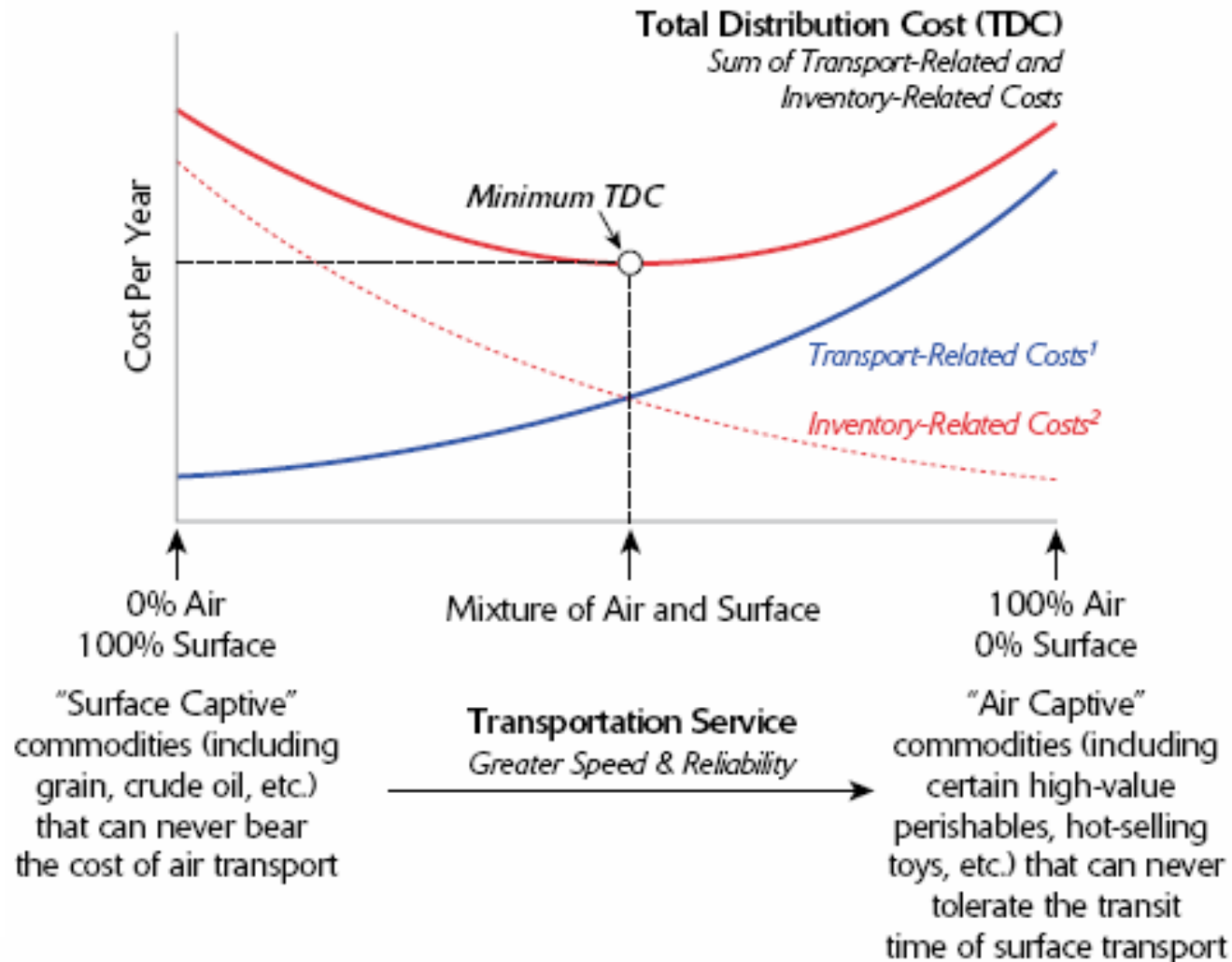
VMI (supplier owns until title transfers)

Title Transfer



	+		+		+		=	Total Landed Cost
Material		Freight		SLC		Other (CCI)		
\$90		\$5		\$2		\$1	=	\$98

Total Logistics Cost Application Applied to Competitiveness of Alternative Transportation Services



Competition in the Supply Chain

- Services
- Carriers
- Modes
- Transportation routing
- Gateways and corridors
- International sourcing

Core Components in Total Logistics Cost Model

Total Logistics Cost =
Direct Transportation Cost +
In Transit Carrying Cost +
Ordering Cost +
Cycle Stock Carrying Cost +
Safety Stock Carrying Cost +
Stock out costs

What about these costs?

- loading and unloading costs (usually embedded in direct transportation costs)
- shelf life loss (usually included in cost of holding cycle and safety stock costs)
- emergency shipping costs (usually included in stock out costs)
- loss and damage claims and losses (usually embedded in insurance premiums associated with each alternative)

Total Logistics Cost Analysis of Competing Gateways

- Shanghai to Toronto trade lane
- Shanghai to Chicago trade lane
- Alternative gateway routings are:
 - Via Vancouver
 - Via Los Angeles/Long Beach
 - Via Halifax
- Marine-rail and Marine-truck

The Hard Part – Comparative Performance Data Across Gateways and Corridors

- 90 % of effort
- Compilation of:
 - Estimates from shippers
 - Anecdotal evidence from studies and service providers
 - Quotes from service providers

In Our Search

- No consistent – single source
- Different answers from different shippers and service providers
- "It changes from day to day, week to week!"
- Some shippers and lines have relationships
- Past doesn't reflect future!

Data application is Demonstrative rather than Indicative

- Find best and worse cases, minimum and maximum ranges
- Simulate different scenarios
- Be as realistic as possible
- Always seek to compare apples to apple
- Ask what if?

Some Observations on Comparative Data

- Marine container rates
- Marine transit times
- Marine transit variability
- Port dwell time
- Port dwell time variability

Some Observations on Comparative Data

- Rail line haul rates
- Rail transit times
- Rail transit time variability
- Truck line haul rates
- Truck transit times
- Truck transit time variability

Commodity Selection

- Compared the top containerized imports at Vancouver, LA/Long Beach and Halifax (weight)
- Cross referenced with top imports from China to Canada (value)
- Commodities selected:
 - Apparel (CAD\$96,500 / tonne, \$1,750/cwt)
 - Machinery/auto parts (CAD\$70,250 / tonne, \$1,250/cwt)
 - Electronics (CAD\$60,500 / tonne, \$1,000/cwt)
 - Toys (CAD\$32,250 / tonne, \$600/cwt)

Apparel

- Value - \$1,750 per cwt.
- Annual demand – 540,000 lbs.
- Weekly container load – 45,000 lbs.
- Service requirement – max. 5 % stock out during lead time goal
- Inventory carrying cost – 25%
- Inventory carrying cost in transit – 15%
- Stock out cost - \$10 per cwt.

Shanghai – Toronto Input Data

Variables	Descriptions	Gateway		
		VC	LB	HF
C	Value of Commodity (\$/cwt)	1750.00	1750.00	1750.00
U	Carrying Cost of In-transit Inventory (% of value)	15	15	15
I	Carrying Cost of Standing Inventory (% of value)	25	25	25
K	Stockout Cost (\$/cwt)	10.00	10.00	10.00
S	Order Processing Cost (\$/order)	50.00	50.00	50.00
D	Annual Demand (cwt)	5,400	5,400	5,400
L	Customer Service Level (max. % stockouts)	5	5	5
R	Transportation Rate (\$/cwt)	7.00	8.00	6.50
T	Transit Time (days)	23	26	25
V	Delivery Time Variability (days)	10	4	9
Q	Minimum Shipment Size required to use Rate R (lbs.)	45,000	45,000	45,000

Shanghai to Toronto

Total Logistics Cost Comparisons

Variables	Descriptions	Gateway		
		VC	LB	HF
EOQ	Economic Order Quantity (cwt)	72.85	72.76	72.89
Q(cwt)	Minimum Shipment Size (cwt)	450.00	450.00	450.00
Qa	Actual Order Quantity (cwt)	450.00	450.00	450.00
Ds	Standard Deviation of Demand Over Transit Time (cwt)	147.95	59.18	133.15
Z	Z-Value For Customer Service Level (# of Standard Deviations)	1.65	1.65	1.65
N(Z)	Unit Loss (from Unit Loss Integrals Table)	0.02	0.02	0.02
Ta	Annual Transportation Cost (\$)	37,800.00	43,200.00	35,100.00
Ua	Annual Carrying Cost of In-transit Inventory (\$)	20,416.44	23,079.45	22,191.78
Sa	Annual Order Processing Cost (\$)	600.00	600.00	600.00
Ia	Annual Carrying Cost of Standing Inventory (\$)	22,893.75	22,950.00	22,865.63
SS	Annual Cost of Holding Safety Stock (\$)	24,838.15	9,959.67	22,326.87
Ka	Annual Stockout Cost (\$)	366.43	146.57	329.79
TC	Total Annual Relevant Cost (\$)	106,914.77	99,935.70	103,414.07

Shanghai – Toronto – Apparel Marine – Rail Total Logistics Cost

(CAD\$)	Vancouver	LA/Long Beach	Halifax
Best Scenario	\$251,250	\$ 259,500	\$305,250
Worst Scenario	\$511,500	\$ 515,000	\$411,000

Shanghai – Toronto – Apparel Marine – Truck Total Logistics Cost

(CAD\$)	Vancouver	LA/Long Beach	Halifax
Best Scenario	\$291,750	\$ 281,500	\$321,000
Worst Scenario	\$362,500	\$ 345,500	\$409,750

Shanghai – Chicago – Apparel Marine – Rail Total Logistics Cost

(CAD\$)	Vancouver	LA/Long Beach	Halifax
Best Scenario	\$251,500	\$ 241,500	\$314,500
Worst Scenario	\$472,250	\$ 508,000	\$394,250

Shanghai – Chicago – Apparel Marine – Truck Total Logistics Cost

(CAD\$)	Vancouver	LA/Long Beach	Halifax
Best Scenario	\$261,000	\$ 265,000	\$336,250
Worst Scenario	\$337,500	\$ 328,750	\$429,000

Non Transportation costs are significant

- Non transportation costs range from 52 to 67 percent of total logistics cost!
- Importance rises with value of commodity

Significant TLC Impact of Service Variation within Route

- Vancouver routing to Toronto of apparel
- 100 percent higher TLC for worst case to best case for movement of apparel by marine-rail
- 25 percent higher TLC for worst case to best case for movement of apparel by marine-truck

Lowest Total Logistic Cost to Toronto

Scenario Routing	Best Case	Worst Case
Marine-Rail	Vancouver	Halifax
Marine-Truck	LA/Long Beach	LA/Long Beach

Lowest Total Logistic Cost to Chicago

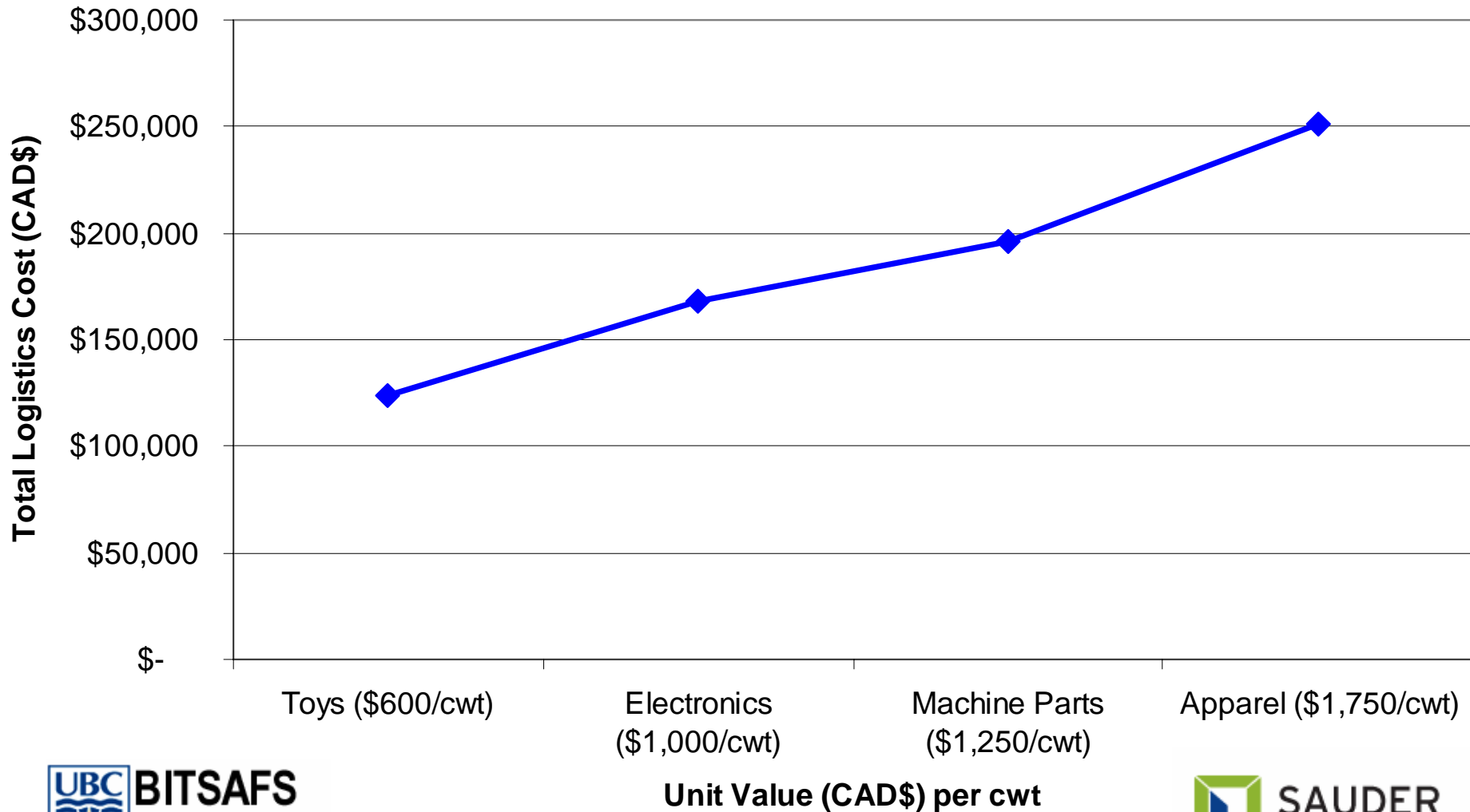
Scenario Routing	Best Case	Worst Case
Marine-Rail	LA/Long Beach	Halifax
Marine-Truck	Vancouver	LA/Long Beach

Impact of Commodity Value

- Shanghai – Toronto – Marine Rail Base case
- Lower service alternative becomes more competitive as product value decreases
- Higher service alternative becomes more competitive as product value increases

Impact of Commodity Value on Total Logistics Cost

Shanghai-Toronto Marine-Rail Vancouver Best Scenario



Impact of Operational Inefficiencies, Environment and Security on the Supply Chain

- Port terminal capacity, rail capacity, operating hours, local and line haul congestion, weather
- Higher transportation and shipping costs
- Longer scheduled transit times
- More shipping delays and transit time variability
- Supply chain costs and effectiveness
- Impact on trade

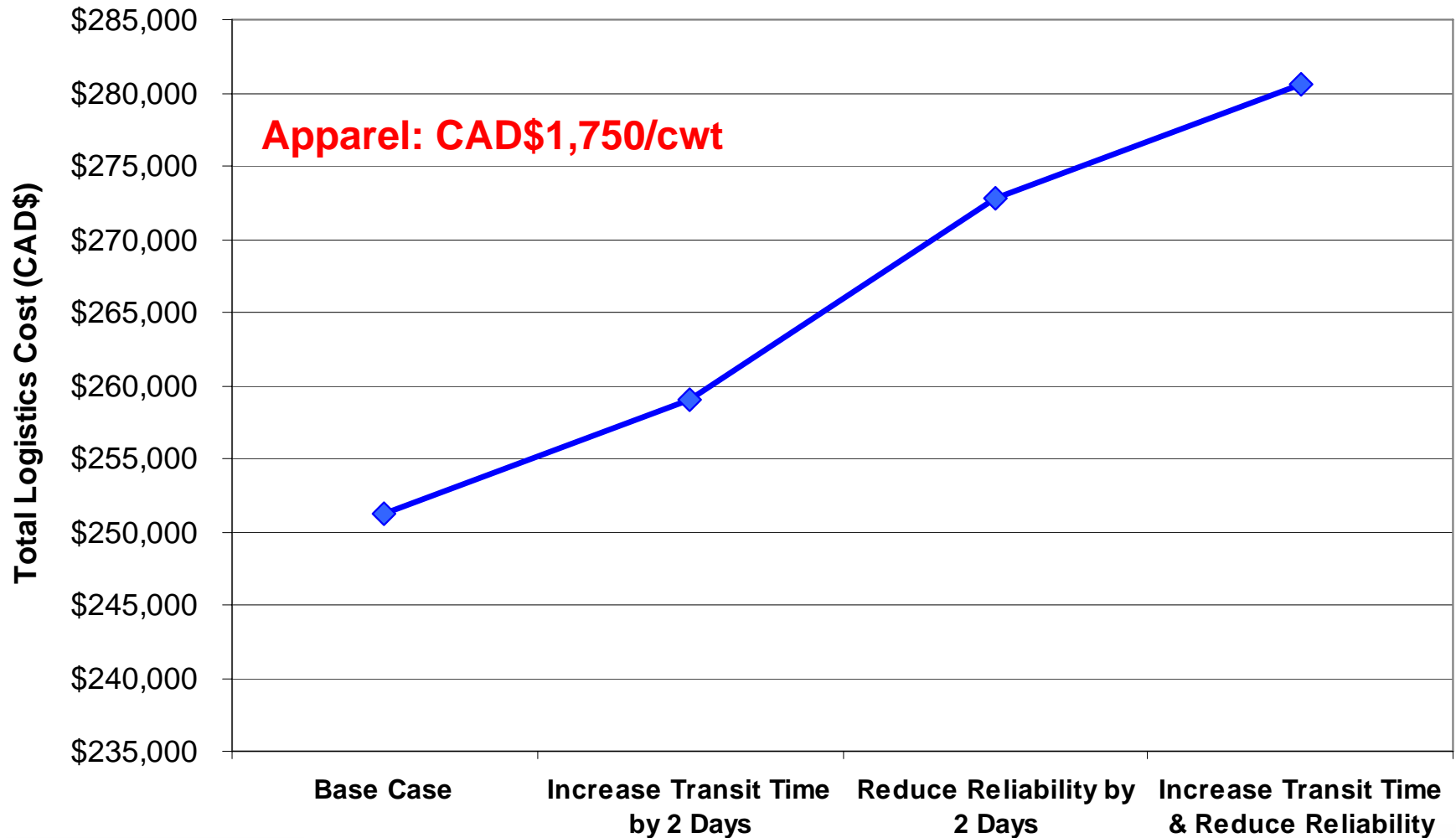
Impact of Transit Time and Reliability

- Apparel from Shanghai to Toronto via Vancouver, Marine-rail base case
- Increase transit time by 2 days
- Decrease reliability by increasing range by 2 days
- Both
- Holding service at LA/LB and Halifax constant

Results of Sensitivity Analysis – Shanghai-Toronto via Vancouver Base Case

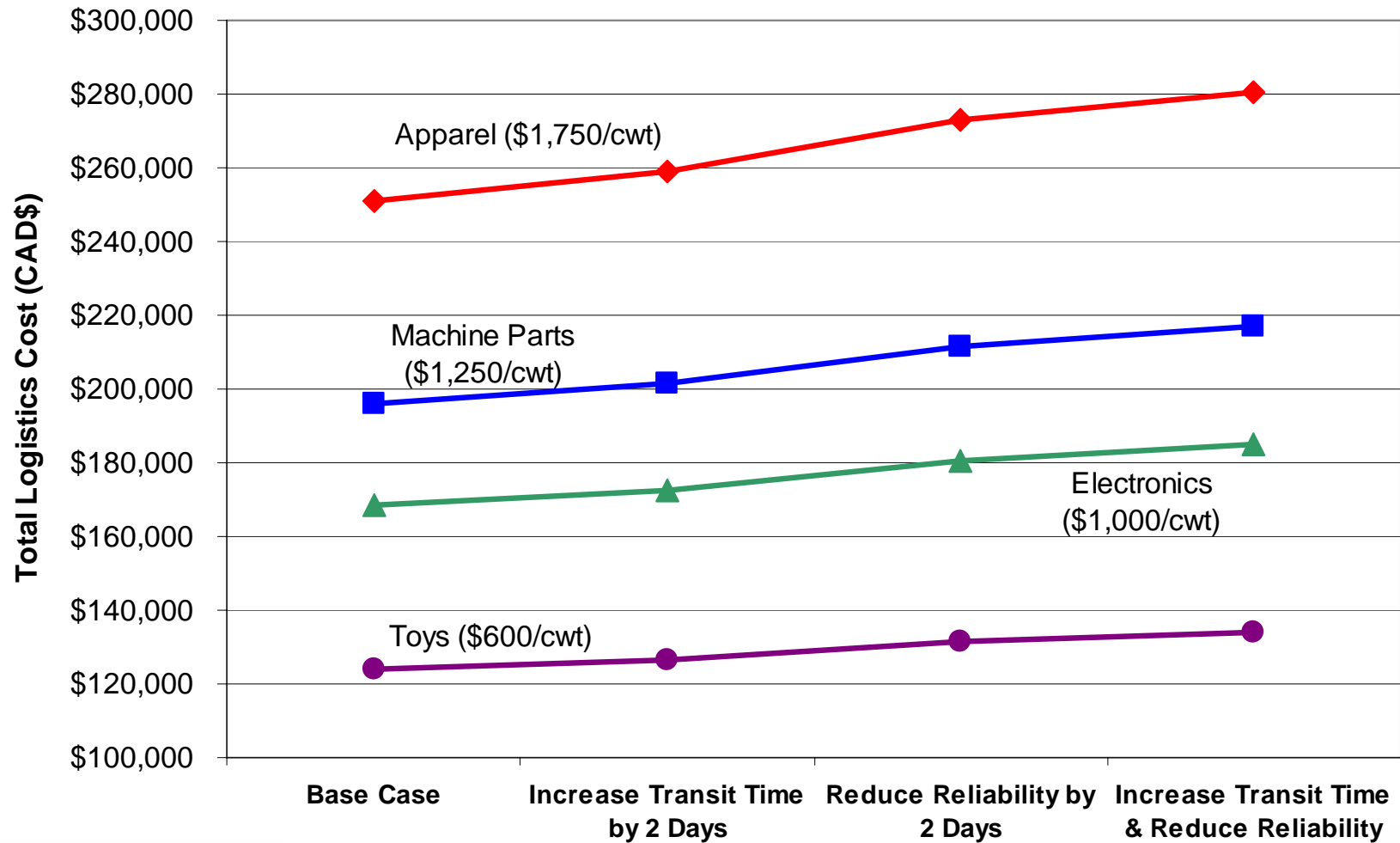
Scenario	Transit Time	Transit Time Variability	Total Logistics Cost (CAD\$)	% Added Cost
Base Case	19	2	\$251,250	
Increase Transit Time by 2 Days	21	2	\$259,000	+ 3
Reduce Transit Time Reliability by 2 Days	19	4	\$272,750	+ 8.6
Both	21	4	\$280,500	+ 11.6

Impact of Decreasing Performance on Total Logistics Cost Shanghai-Toronto Marine-Rail Vancouver Best Scenario



Impact of Decreasing Performance on Total Logistics Cost

Shanghai-Toronto Marine-Rail Vancouver Best Scenario – Commodity Value Comparison



Where's Security?

- 9/11 Heighten security concerns going southbound
- Probability of substantial disruptions increases
- Increased regulations and intensified inspections
- Higher transportation and shipping costs
- More shipping delays and transit time variability
- Impacts Supply chain costs and effectiveness

Where's Security?

- Security requirements and activities may change cost – service characteristics of alternative trade routes.
- Has an impact on trade
- Need to ensure that security impacts are reflected in comparative cost – service characteristics

Security Impact Observations from Industry – Ocean Gateways

- Delays in Ocean shipping is not major concern – function of weather and number of intermediate port calls (assumes reduce vessel velocity due to port delays is part of port delay)
- Minimum direct security impact on domestic line haul movements
- Delays in Truck and Rail line haul is major concern when normal operating conditions superseded by weather and work stoppages

Security Impact Observations from Industry – Ocean Gateways

- Security requirements have minimally contributed to ship or port process delays
- Delays in port processing cited frequently as the cause of variable transit times in the door to door movement of container shipments
- Lack of rail capacity causes port delays
- Port delays are the joint result of factors internal and external to the port terminal

Delay Observations from Industry – Ocean Gateways

- Dwell time: e.g. 80 % of containers leave port terminal within 72 hours (or 3 days)
- The dwell time for containers leaving the port terminal by truck is generally shorter than for containers leaving by rail
- On dock rail delays often result in congestion and delays for containers departing by truck

Asia-Pacific Gateway and Corridor: International – Domestic and Cross Border Supply Chains



BITSAFS

Source: BCMOT 2006



SAUDER
School of Business
University of British Columbia

Higher Security Barrier into US versus into Canada May Have Impacted Balance of Trade

- Since 9/11
- No significant export (US to Canada) shortfall forBlaine
- Significant import (Canada to US) shortfall of around 13% for Blaine

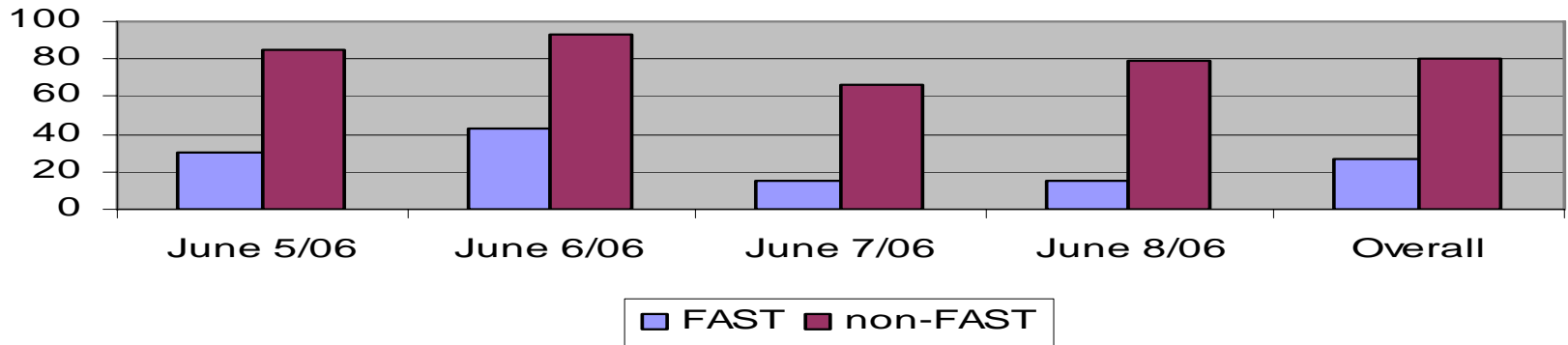
Source: Border Policy Research Institute, Western Washington University 2006

Security Impact Observations from Industry – Land Borders

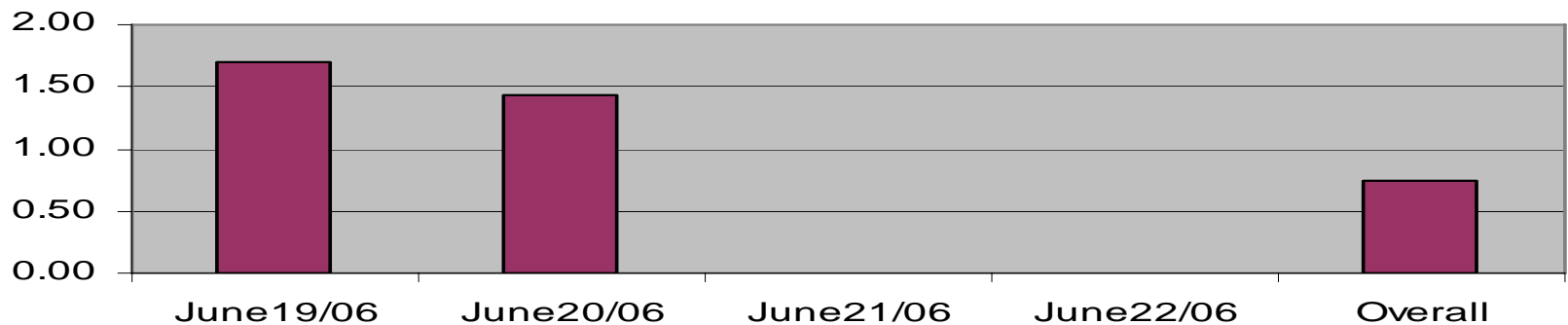
- Northbound truck delays and uncertainty minimal
- Southbound truck delays and uncertainty significant
- Northbound and southbound rail delays minimal

Southbound Wait Times Significantly Longer than Northbound

**Average Waiting Time Prior to Primary Inspection,
Southbound Commercial Traffic Via Pacific Highway
(in min.)**

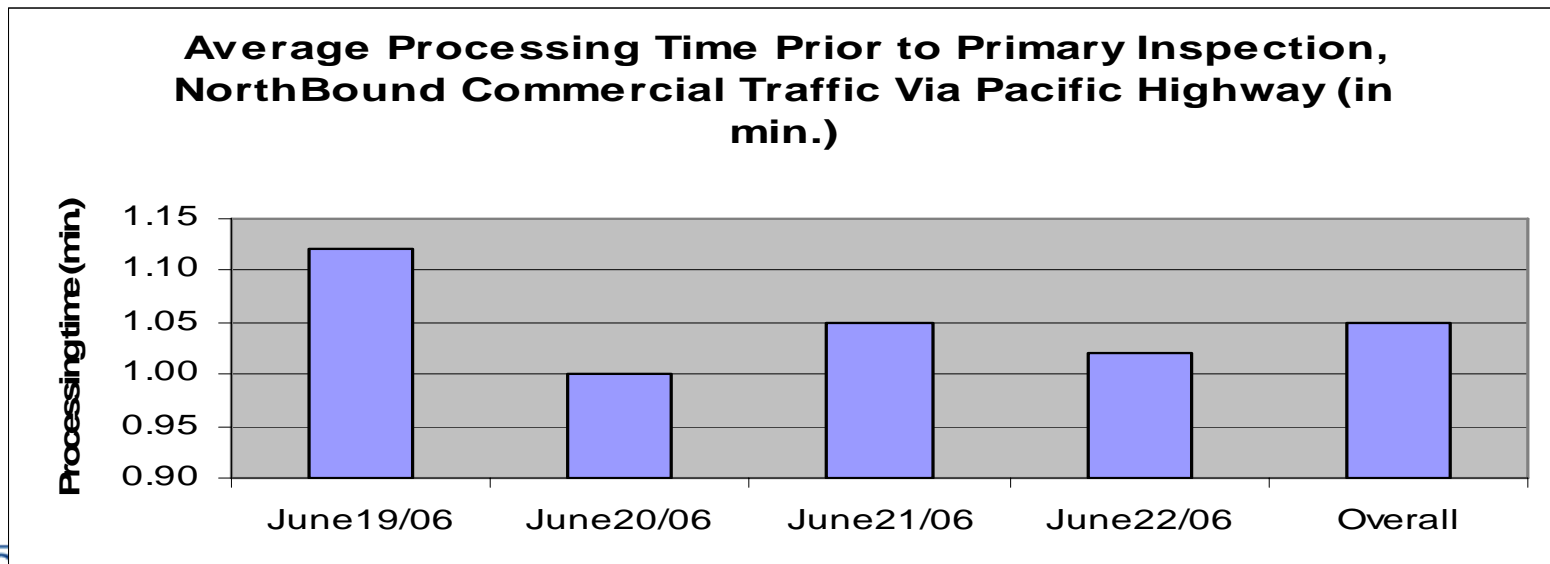
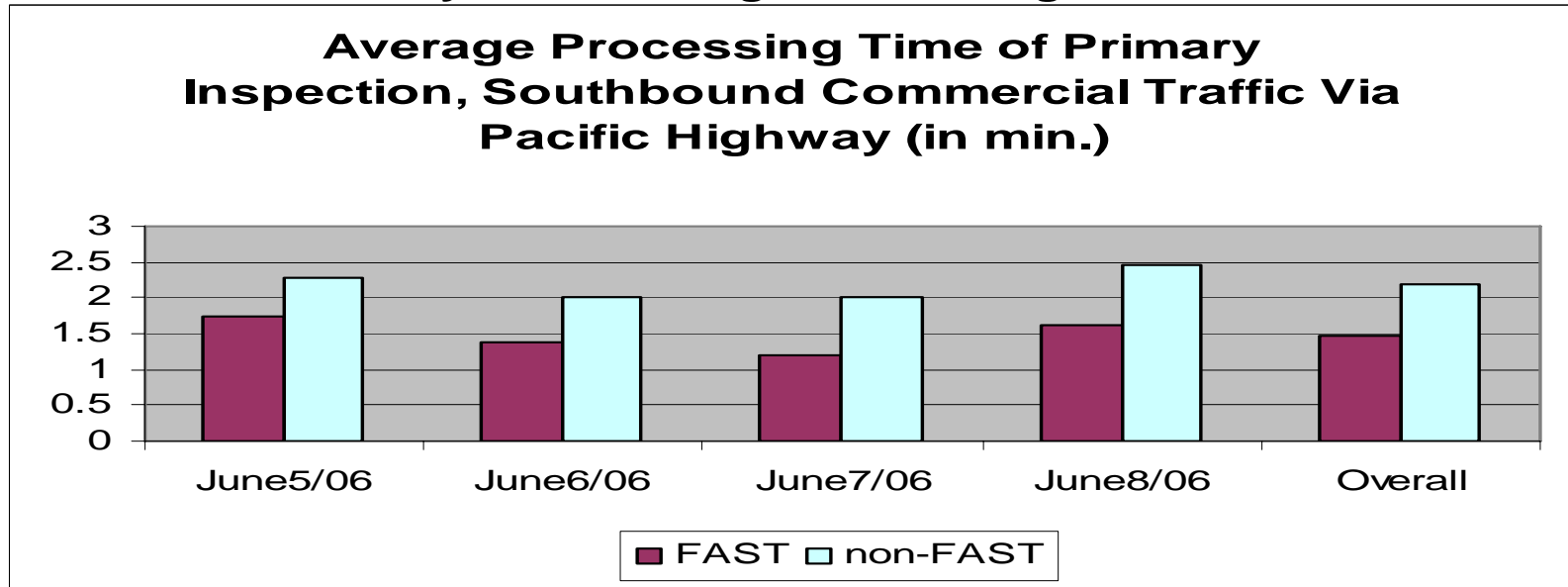


**Average Waiting Time Prior to Primary Inspection,
Northbound Commercial Traffic Via Pacific Highway
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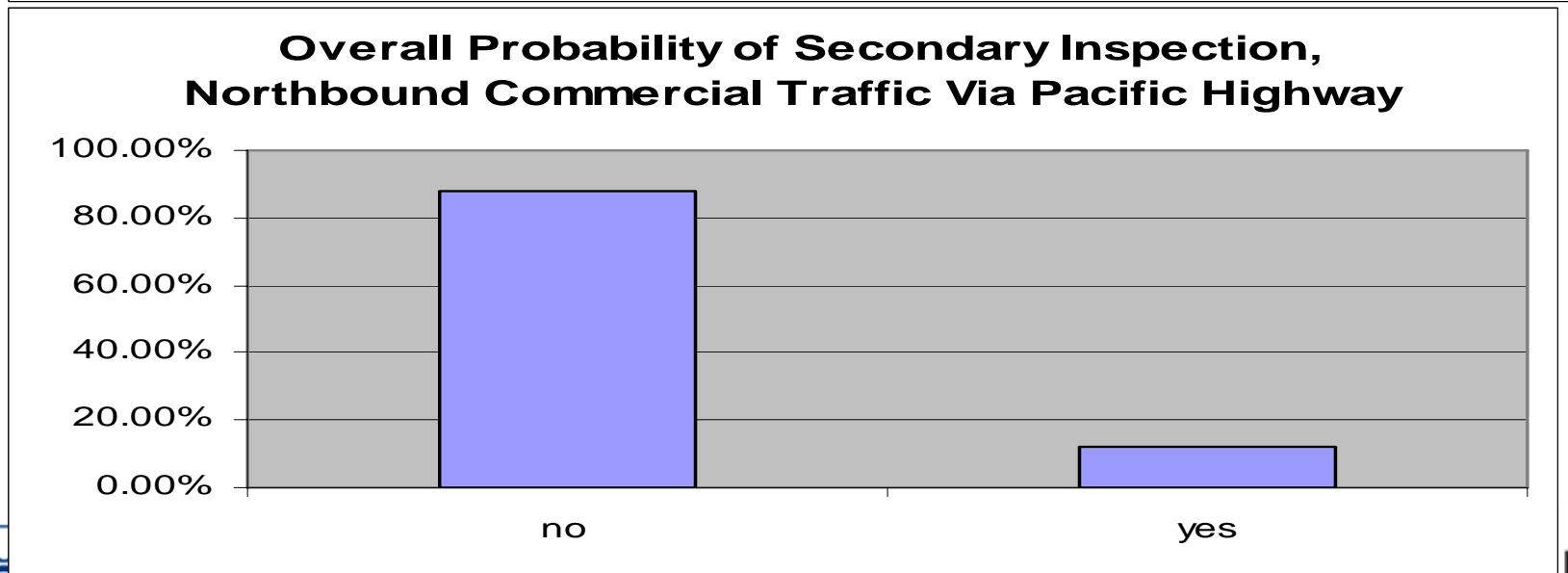
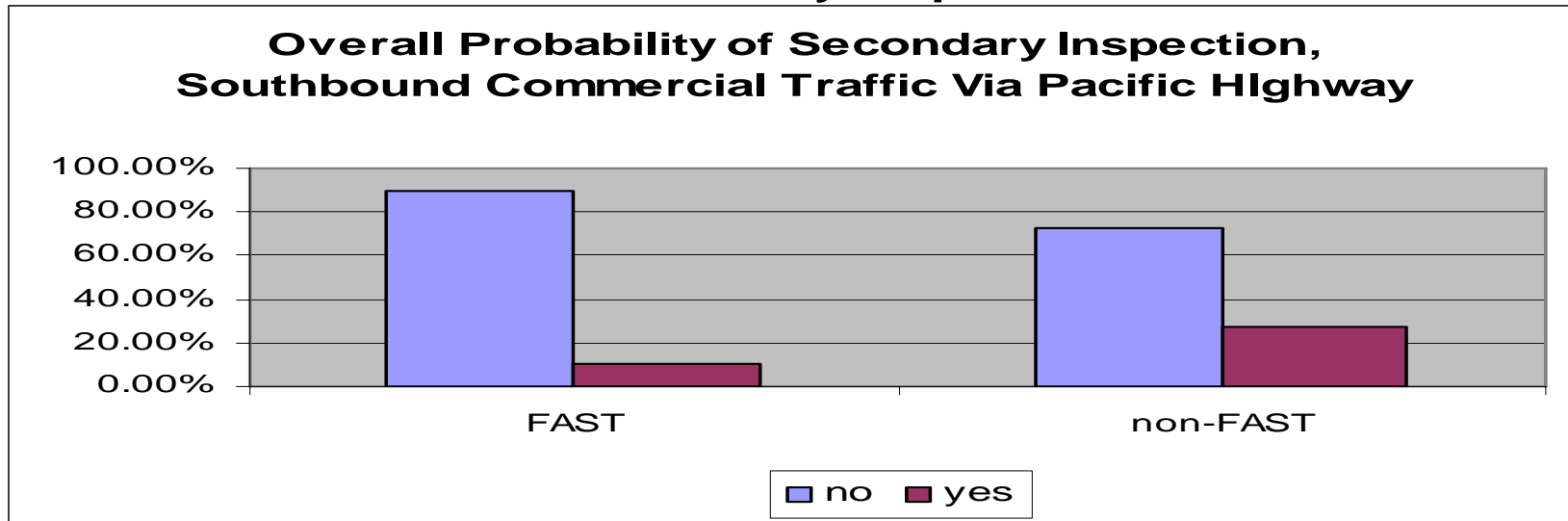


Source: Data from Pacific Crossing Commercial Vehicle Border Delay Survey files, 2006.

Southbound Primary Processing Time is Higher than Northbound



There is a Greater Probability That a Southbound Truck will Go Into Secondary Inspection



Source: Source: Data from Pacific Crossing Commercial Vehicle Border Delay Survey files, 2006.

Security Impact Observations from Industry – Land Borders

- Delays measured in hours
- Several hours delay can add significantly to direct truck costs
- Secondary inspection adds most delay
- FAST certified vehicles experience significantly lower delays and secondary processing
- Negative impact on routing alternatives that involve southbound movement.

Impact of Security on Trucking Industry Cost

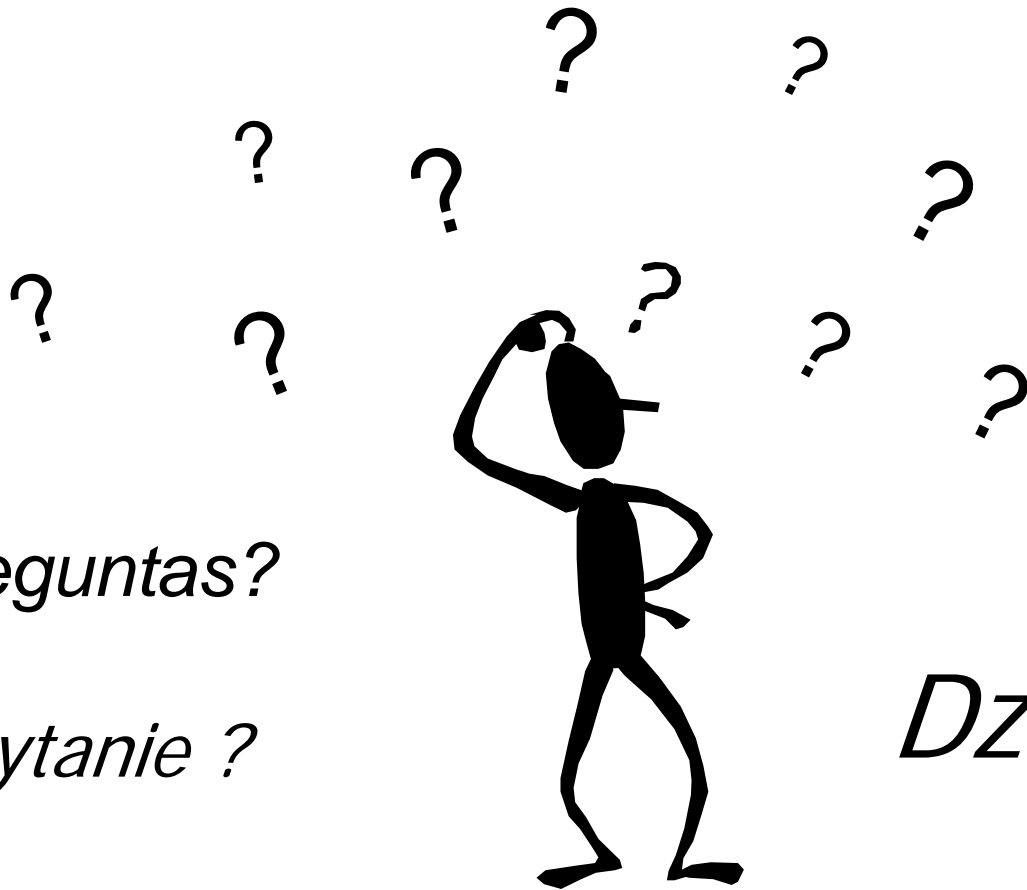
- Post-9/11 costs to the Canadian trucking industry due to the changes in U.S. border security measures ranges to be from \$179 million to \$406 million per annum (national)
- Waiting times approaching the border cost the trucking industry \$13.8 million and at the booth another \$0.8 million (Cascadia border crossings)
- Embodied in truck rates or absorbed by carriers for competitive reasons

What if?

- Public sector and private sector collaboration
- Has a common vision of intelligent gateway/corridor
- From BC to Ontario (and points on the way)
- That provides best-in-class security, safety, efficiency and sustainability
- Thru seamless, efficient, fast and reliable movement

Questions?

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Preguntas?

Pytanie ?

Dziękuję!