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A Business Case for Increasing RFID at the Canada - US Land Border

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BORDER POLICY RESEARCH INSTITUTE

A Business Case for Increasing RFID at the Canada-U.S. Land Border

October 21, 2015

Introduction

This business case presents results-to-date of ongoing work by the Whatcom Council of Governments (WCOG) and the Border Policy Research Institute (BPRI) to investigate the benefits and costs of significantly increasing the portion of cross-border traffic using radio frequency identification (RFID). Before reviewing the analysis, it is useful to review the current policy context as well as some details about travel documents and U.S.-Canada cross-border traffic operations.

Acknowledgements

This work is funded by a research grant from the U.S. Federal Highway Administration (FHWA) and additional funding from the British Columbia Ministry of Transportation and Infrastructure (BC MoTI). Regional and headquarters offices of U.S. Customs and Border Protection (CBP) and Canada Border Services Agency (CBSA) have graciously facilitated critical field research, provided additional traffic statistics, and, with other partners in the IMTC Program, reviewed model designs and assumptions for representativeness of facilities and operations.

Binational policy direction

The 2011 United States–Canada Beyond the Border (BtB) Action Plan, under the subsection titled, "Invest in Improving Shared Border Infrastructure and Technology," called out RFID as follows:

> ***"Facilitate secure passage and expedite processing through implementing radio frequency identification (RFID) technology at appropriate crossings."***

Figure 1. Currently issued, vicinity-readable RFID documents.

The 2011 Action Plan referred primarily to implementation of *inspection facility investments* (antennas, IT systems, software) that are needed to read and process RFID travel documents. But for an RFID strategy to result in the envisioned security and efficiency gains, a sufficient portion of travelers need to be using RFID documents. Compatible RFID documents available today include state and provincial enhanced drivers licenses (EDLs), the U.S. Passport Card, the NEXUS trusted traveler program card, and newer "Green Cards."

Key distinctions: RFID documents, passports & NEXUS cards

What *kind* of RFID?

RFID is a widespread electronic tag technology with applications extending well beyond the ones discussed here (e.g., product distribution logistics tracking, inventory control, etc.). In the travel-document application, there are two types of RFID that need to be understood. The BtB RFID initiative is focused on **vicinity**-readable RFID tags. Cards equipped with these tags can be read by an antenna from some distance (in the border environment, about two meters). This enables initiation of the primary-inspection process before the traveler comes face-to-face with the inspector.

Electronic Passports (widely produced since 2008) which meet standards set by the International Civil Aviation Organization (ICAO) may also contain an RFID tag. These tags, however, are **proximity**-readable. They must be in physical contact with an in-booth card-reader to be electronically read and so do not support initiation of the inspection process upstream of the booth in a vehicle-traffic environment. While passports and e-passports are valid travel documents and comply with the U.S. Western Hemisphere Travel Initiative (WHTI), only **vicinity** RFID cards support the operational benefits sought under the BtB RFID plan.

Another important distinction is that an RFID tag in a vicinity-readable document contains only a serial number. The associated personal information is present only in the card-issuing agency's server (and is accessed under the terms of a data-sharing agreement with the border inspection agency). The reason e-passports are *not* vicinity-readable is because, in the broader international travel environment, the RFID tag in a passport must contain all of the same personal data that is printed on the document itself. If RFID-equipped passports were readable from a distance, information could be obtained surreptitiously.

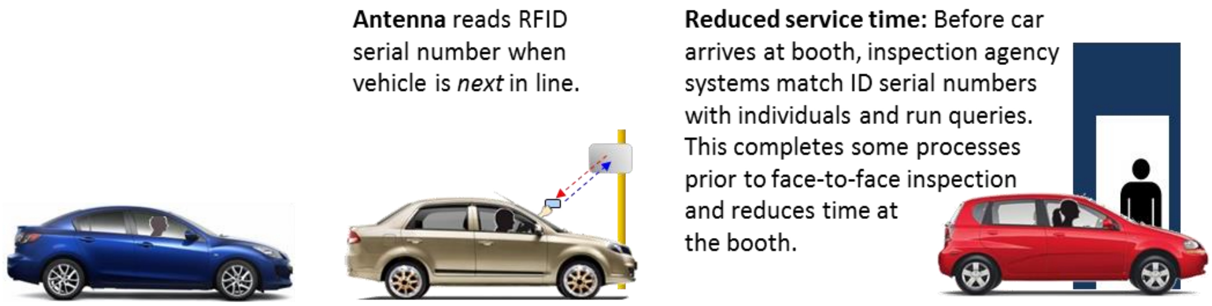
What about the NEXUS program?

The NEXUS trusted-traveler program is undoubtedly the most effective binational strategy for increasing security and mobility for travelers crossing the land border. The program has been a huge success, and 20-30 percent of cross-border traffic now makes use of NEXUS lanes; continued growth of the NEXUS program is another BtB action item. In NEXUS, U.S. and Canadian residents who voluntarily apply to the program are vetted and, if accepted, issued a NEXUS card. That card uses RFID technology identical to the other vicinity-readable RFID documents discussed here. But even though NEXUS facilitates the bypass of long traffic queues (NEXUS provides dedicated approach lanes to dedicated inspection booths)—a major benefit to the individual traveler—there is still a sizable population of frequent cross-border travelers who have not enrolled in NEXUS or who do not qualify. NEXUS should continue to be what travelers consider first. Other vicinity RFID is a second-best option, but one with arguably large untapped potential.

Land-border RFID basics

The graphic below illustrates the sequential processing of a vicinity-readable RFID – whether in approach lanes dedicated to the NEXUS program or in standard traffic lanes equipped with upstream antennas and corresponding booth systems.

Figure 2. RFID booth-approach illustration**.**



Field data has shown that relative to a standard primary inspection, the average reduction in service time from use of a vicinity RFID document at a U.S. customs booth is 20?? seconds per vehicle.

Why hasn't vicinity RFID resulted in the expected benefits yet?

Over the last several years, U.S. Customs and Border Protection (CBP) has installed RFID systems at all its land border inspection booths. As noted in the BtB Action Plan, Canada Border Services Agency (CBSA) plans to install the same type of equipment at many of its busiest ports of entry (POEs) soon. But even though non-NEXUS RFID options (EDLs, U.S. Passport Card) have been available since the implementation of WHTI in 2009, the proportion of cross-border travelers using these documents remains low – too low to generate substantial reductions in queue lengths. To raise the profile of RFID's potential, CBP started the ReadyLane program in 2012. This strategy clearly labels and dedicates a primary inspection booth for use by travelers with RFID (including NEXUS). Unlike the NEXUS program, however, ReadyLane vehicles use the same standard approach lanes as everyone else–i.e., they don't bypass lineups like NEXUS travelers do.

Benefits to an individual traveler vs. benefits to the system

Basic queuing theory assures us that if a sufficient portion of cross-border travelers switches to a process that reduces their service time (even by a small amount) the wait-time reduction for the *system* can be very large. But the last five years has shown that the prospects of *system* benefits don't influence individuals' choices. By contrast, NEXUS, a program that regularly provides *individual* benefits (i.e., bypassing a long queue), has continued to see strong enrollment growth. With non-NEXUS RFID, the individual only experiences a 20 second relative time savings once at the booth. So while RFID has potential to significantly decrease wait-times for *all* cross-border travelers, it appears that, as with public infrastructure, the investment will need to come by way of government.

BPRI takes a closer look at RFID's potential between BC & WA

In 2013, the International Mobility and Trade Corridor Program (IMTC) completed a cross-border passenger vehicle survey at the ports of entry between Northwest Washington State and Lower Mainland British Columbia. With fresh data on traveler characteristics, including travelers' reported cross-border trip frequency, the BPRI estimated the potential impact of RFID on wait-times for non-NEXUS vehicles. Key to the BPRI analysis was the basic observation that a large portion of total cross-border trips are made by a relatively small number of individuals. Survey analysis indicated that over 80 percent of the 3.2 million 2012 non-NEXUS trips through the Douglas-Peace Arch and Pacific Highway crossings in 2012 were made my fewer than 600,000 individuals. Exploring the notion of an RFID target market, **BPRI estimated that 40 percent of non-NEXUS cross-border trips here were made by fewer than 75,000 individuals.** In light of this estimate, a strategy to effectively increase the share of *trips* using vicinity RFID is likely not as challenging as previously imagined. (*The BPRI analysis went on to propose a specific pilot project strategy, but that is outside the scope of this general business case.*)

The IMTC Dynamic Border Management Project & RFID

In 2014, with funding from the U.S. Federal Highway Administration (FHWA) and the B.C. Ministry of Transportation and Infrastructure (B.C. MoTI), the IMTC coalition advanced the Dynamic Border Management (DBM) project. Being conducted jointly by WCOG and BPRI, two of the three components of this project are 1) to acquire and develop a general purpose micro simulation capability to test operational scenarios for the regional cross-border transportation and inspection system and 2) to use micro-simulation along with updated data and agency-validated parameters to follow on the initial BPRI proposal with a more detailed business case for targeted distribution of vicinity RFID.

Figure 3. The Cascade Gateway border region.

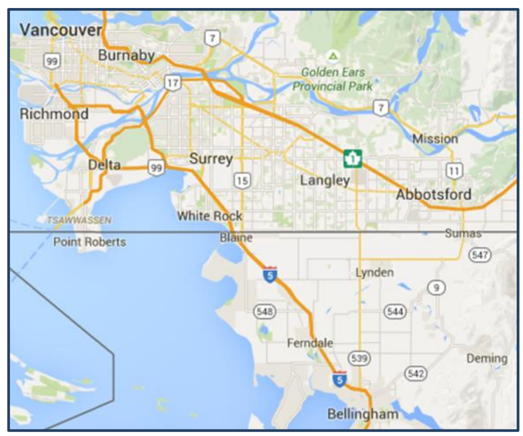
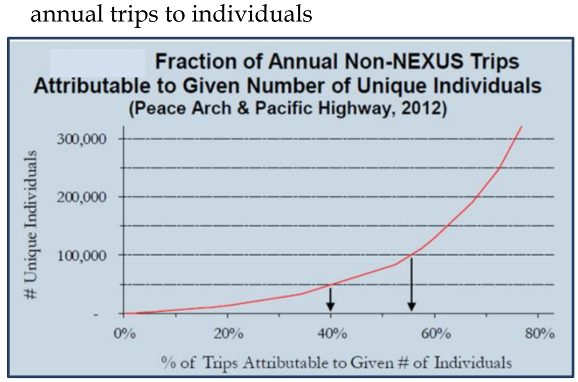
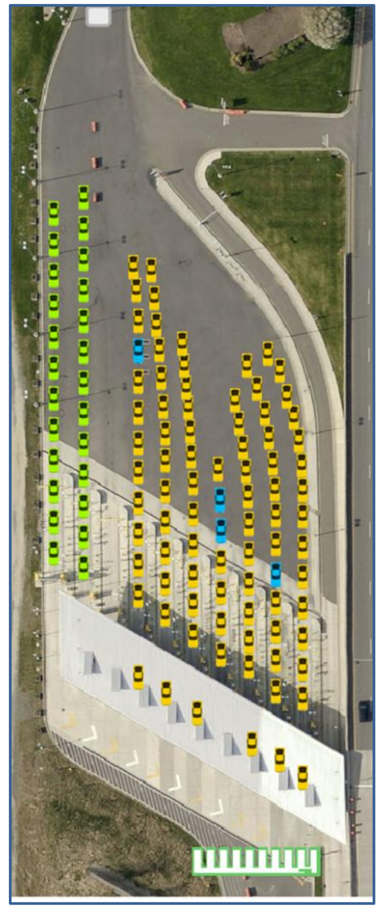


Figure 4. BPRI's estimated attribution of annual trips to individuals



Simulation of increased RFID at Douglas-Peace Arch

Figure 5. Animation screen from the Peace Arch model.



Modeling Douglas-Peach Arch

In September of 2015, WCOG procured an off-the-shelf discrete-event simulation modeling package – ExtendSim. WCOG staff completed ExtendSim company training and proceeded to develop a model of traffic flow at Douglas-Peace Arch, north- and southbound, for both the NEXUS and the non-NEXUS highway lanes and inspection booths. The model uses three primary data inputs described below.

Arrival rate. The rate at which cars arrive at a POE is easily retrieved from the Cascade Gateway wait-time system database, which provides archived data in aggregated five minute intervals for each highway approach lane (1 NEXUS lane, 2 standard lanes). The archived data is used to generate frequency distributions that represent the manner in which cars actually arrive at a POE—i.e., sometimes bunched in a group, sometimes more evenly spaced. A similarly derived distribution is used to assign the arrivals to the NEXUS lane or standard lanes consistent with the overall NEXUS proportion (35 to 45 percent) observed at Peace Arch-Douglas.

Number of open booths*:* For the model runs presented below, USCBP and CBSA provided hourly data on the number and type of booths staffed for heavy traffic days in spring of 2015.

Service times*:* In general, service time is the elapsed time between a vehicle's arrival at the primary inspection booth and the next vehicle's arrival at the same booth. It includes the drive-up time from the stop-bar to the inspector, the inspection, and any lag between a vehicle's departure from the booth and the next vehicle's departure from the stop-bar. For service time data, the BPRI deployed field teams in December 2014 and August 2015 to gather time-stamped observations at the Douglas and Peace Arch facilities. Data was gathered for five kinds of booths: CBSA NEXUS, CBSA standard, USCBP NEXUS, USCBP standard, and the USCBP ReadyLane booth.[1] The average values for each type of booth are shown in table 1 below. CBP's ReadyLane booth is accessible only to people using vicinity RFID documents. Most of the ReadyLane traffic consists of NEXUS vehicles that divert to the booth when there is a lineup at the NEXUS booth(s). But some cars reach the booth via the *standard* approach lanes. These cars

[1] For each booth type, data reflecting all segments of a vehicle's progress through the process was gathered—i.e. the amount of time it takes the car to roll forward to the booth from the final upstream stop bar; the amount of time the car is stopped at the booth; the amount of time after the vehicle's departure before the next car begins rolling forward to the booth. Hundreds of such observations are then used to construct frequency-distribution curves incorporated into the model, such that each simulated car is assigned characteristics based upon those curves.

are people using non-NEXUS RFID cards such as EDLs, and only those cars were included in the ReadyLane dataset. The service times of these cars are of vital interest because they are exactly the traffic-type that is envisioned in scenarios where a higher percentage of cross-border trips are using non-NEXUS, vicinity RFID documents.

The RFID service-time difference

Based on 243 observations of non-NEXUS RFID vehicles through the CBP ReadyLane booth (and over 5,000 observations of standard and NEXUS service times), the average inspection time of non-NEXUS RFID vehicles was found to be 30 seconds – 21 seconds less than CBP's average standard inspection at Peace Arch and 17 seconds less than CBSA's average standard inspection at Douglas. The distribution of the observed inspection time values is the current input for the simulation model for both CBP and CBSA operations.

NOTE: For CBSA RFID processing times, the U.S. CBP value (30 sec.) is being used as a place-holder. WCOG and BPRI will re-run the analysis for northbound operations with separate RFID inspection-time values for CBSA once upcoming equipment installations are completed and direct observations can be made.

Table 1: Summary of inspection process observations for various booth types

	CBSA Douglas		US CBP Peace Arch			
	Standard	NEXUS	Standard	NEXUS	RFID in ReadyLane	NEXUS in ReadyLane
Avg. Inspection	47	10	51	10	30	18
Drive-up + lag	12	9	11	10	10	18

Validation, model runs, and outputs

With specific, recent heavy travel dates identified by US CBP and CBSA, the simulation was calibrated so that the model-generated wait times matched as closely as possible to wait times estimated by the regional border wait time systems. This 24-hour wait time profile is then used as the baseline condition.[2]

To predict the effect of different RFID use rates, the ID-type parameters were changed to 20 and 40 percent RFID use. The model was run five times for each scenario. The graphs below show the model-generated *actual* wait times for each scenario. Results are plotted separately for southbound traffic (US CBP at Peace Arch) and northbound traffic (CBSA at Douglas).

[2] The simulation model is set up to generate *current* wait times and *actual* wait times per the definition of these measures established by the U.S.-Canada Border Wait Time Working Group.

Figure 6. Scenario wait time outputs – Peace Arch

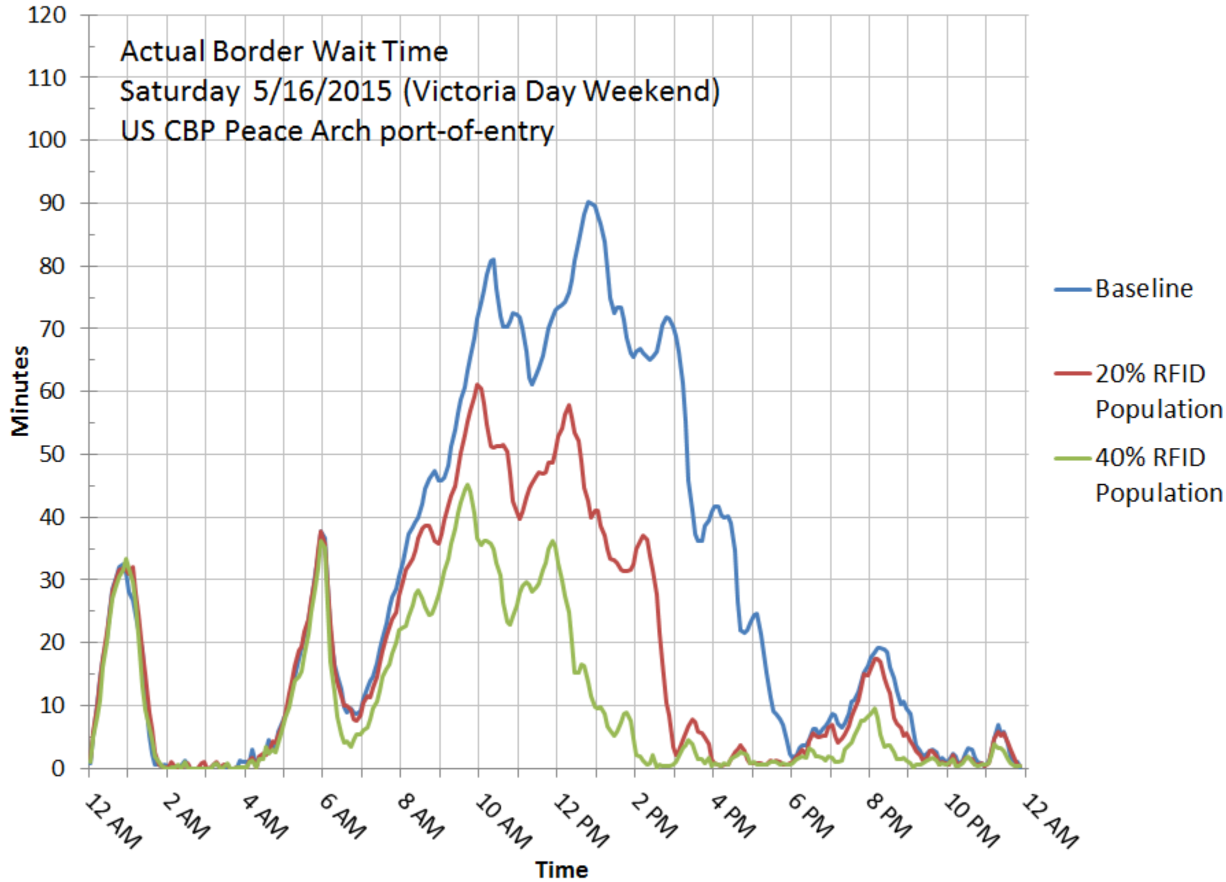


Table 2 below lists summarized scenario outputs for traffic between 07:00 and 21:00 hours.

Table 2. RFID scenario summary statistics – Peace Arch

USCBP Peace Arch
Standard vehicle wait times (minutes) 07:00 - 21:00

	Average	% Reduction	Maximum	% Reduction
Baseline	47		90	
20% RFID	25	46.6%	61	32.2%
40% RFID	16	65.4%	45	50.0%

Figure 7. Scenario wait time outputs – Douglas

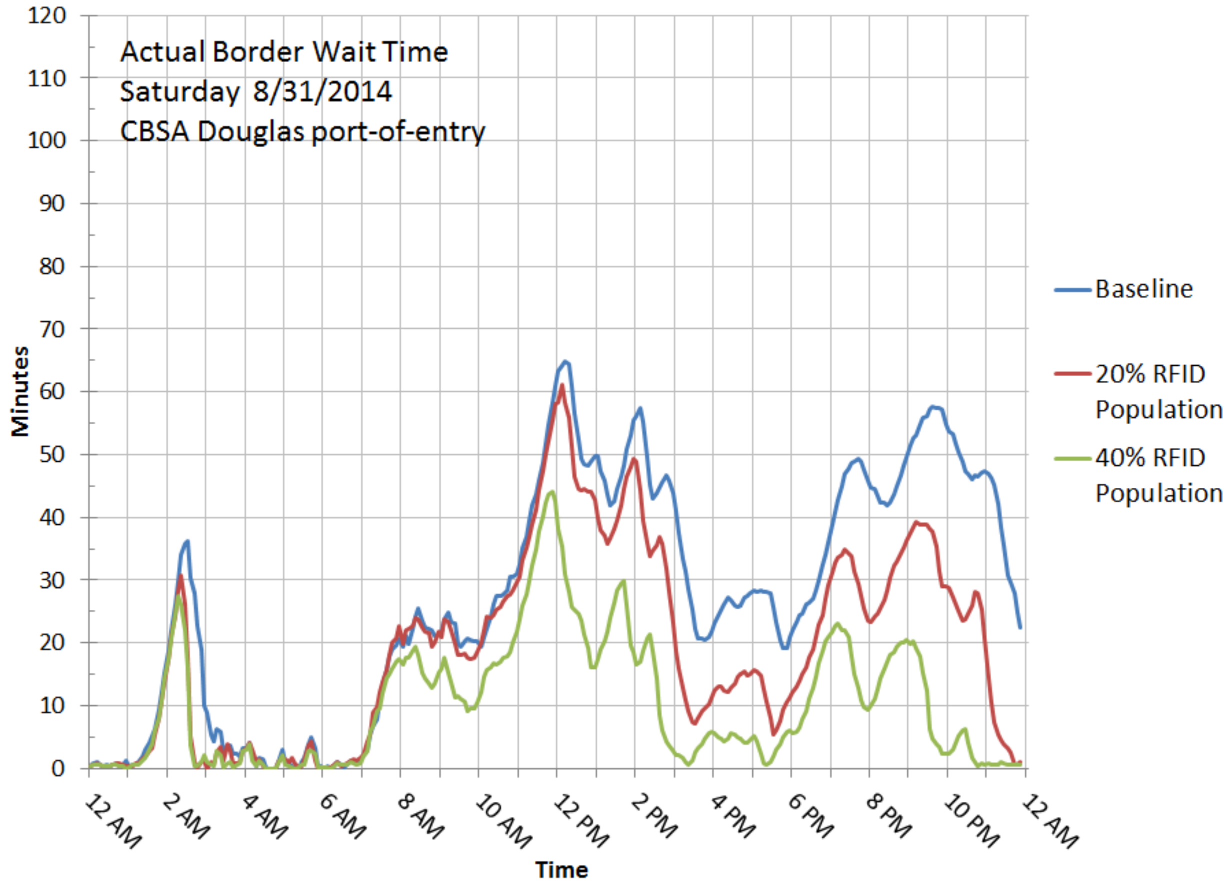


Table 3 below lists summarized scenario outputs for traffic between 07:00 and 21:00 hours.

Table 3. RFID scenario summary statistics – Douglas

CBSA Douglas

Standard vehicle wait times (minutes) 07:00 - 21:00

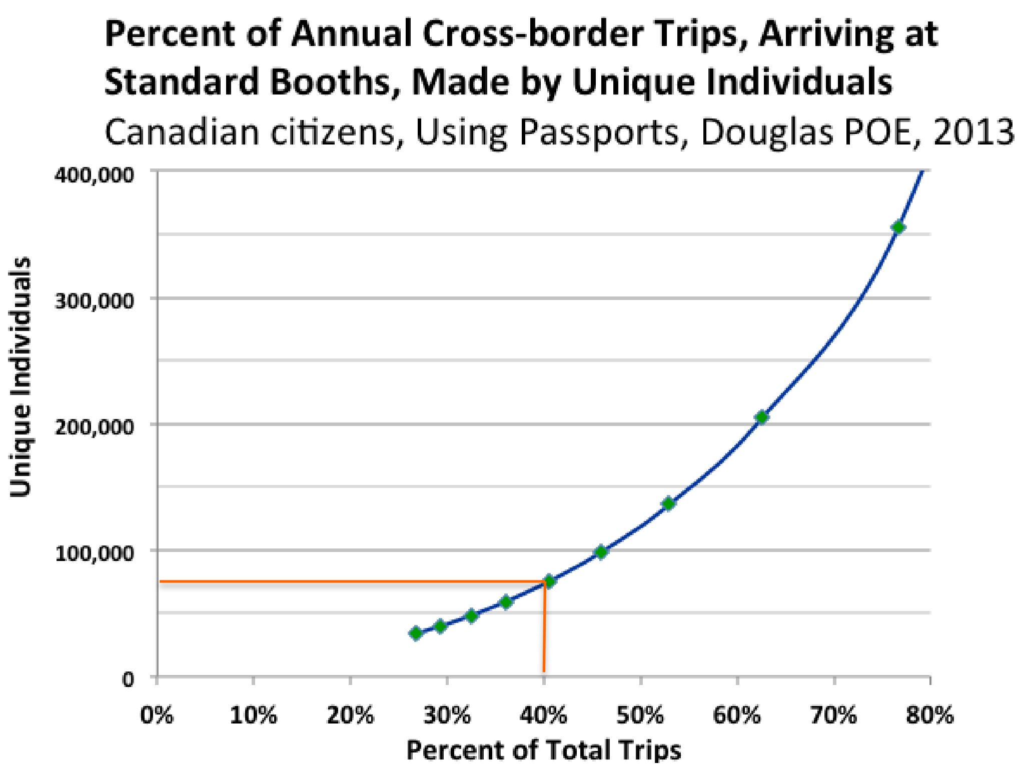
	Avgerage	% Reduction	Maximum	% Reduction
Baseline	36		65	
20% RFID	26	27.8%	61	6.2%
40% RFID	15	58.3%	44	32.3%

Validating traveler frequency assumptions

With very encouraging results from the simulation model based on agency-supplied staffing schedules and a recent and large sample of service time observations, the only remaining un-validated assumption from the 2014 BPRI proposal was the survey-based estimate of regional traveler frequency – the estimate that 40 percent of annual trips were being made by only 70,000 or so individuals.

During a review of the model framework and preliminary results with CBSA's RFID office in the spring of 2015, CBSA noted that they had conducted an analysis of border-wide traveler frequency for the 2013 calendar year and that they could share the summary-level results for use in this work. Specifically, CBSA had compiled a frequency distribution, by port-of-entry, and by ID type, of all Canadian residents who crossed the Canada-U.S. land border, through standard inspection booths, in 2013. Because 85 percent of all trips through the Douglas-Peace Arch and Pacific Highway ports are made by Canadian residents (in 2013), the CBSA traveler frequency data accurately describes the vast majority of Cascade Gateway cross-border travel behavior.

Figure 8. Graph of 2013 CBSA traveler frequency data. (Data provided by CBSA. Port specific analysis and chart by BPRI and WCOG).



The very complete, system-based data from CBSA compared very favorably with the initial BPRI estimates. 40 percent of non-NEXUS trips by Canadians can be attributed to about 75,000 individuals. Validation of this assumption is critical. While it is not a parameter for the simulation model, the existence of a target population of non-NEXUS frequent-travelers is a necessary condition for expecting the modeled benefits to result from any subsequent initiative.

Benefits, cost, and the cost of traditional strategies

This section will explore planning-level cost estimates of a 40 percent RFID strategy, an infrastructure-based strategy to achieve wait-time reduction commensurate with the estimated 40 percent RFID result, and other benefits of increased RFID uptake such as increased security through advanced information and greenhouse gas emissions reduction from shortened border lineups.

What would it cost to produce and distribute 75,000 RFID documents?

As noted above, this business case is stopping short of proposing a specific strategy for getting more vicinity-RFID documents into the hands of frequent travelers. This section more simply seeks to offer a conservatively high estimate of the cost of producing and distributing an already-approved form of vicinity-RFID to individuals who already meet the requirements for being issued one (minimally, people who already possess a valid U.S. or Canadian passport).

In general terms, a basic list of costs of a future strategy (undoubtedly dependent on interagency agreements and, possibly, legislative modifications) would consist of 1) identifying the target market of frequently crossing, eligible individuals, 2) producing the travel document cards for the chosen number of individuals, 3) mailing those cards, and 4) a sufficiently robust communications and education effort to optimize results.

An estimate of these costs is as follows.

Table 4: Breakdown of estimated cost of producing and distributing 75,000 vicinity-RFID documents ($US)

		Quantity	Unit	Unit est. cost	Est. cost
1	Data analysis – identification of target market individuals (Canada and U.S.)	75,000	Individuals	-	$5,000
2	Produce cards for distribution to current passport holders		Cards	$15	$1,125,000
3	Mailing		Letters	$1	$75,000
4	Communications effort	1	-	-	$60,000
	Total				**$1,265,000**

Note: Card cost ($15) is estimated as ½ of the current published price of a U.S. Passport Card for current U.S. passport holders. This assumes economies of scale for a concentrated, bulk production as envisioned here.

How many additional inspection booths would be required to achieve the same wait-time reduction as the estimated 40 percent RFID scenario and, what would that cost?

This section seeks to estimate the cost of an infrastructure and staffing strategy that would achieve the same reduction in border wait time as a 40 percent increase in vicinity-RFID use among non-NEXUS travelers. In the simplest terms, this means adding inspection booths to the Peace Arch and/or Douglas ports of entry.

Additional booths

To estimate the impact of building new booths, the same simulation model was used to estimate the amount of wait-time reduction that would result from adding one new primary inspection booth and from adding two new booths. To align with cost estimates for infrastructure and staffing in subsequent sections**, it is additionally assumed in these model runs that newly constructed booths would only be opened for eight consecutive hours during the modeled day**. Since inspection agencies currently apply dynamic-booth-management strategies during peak-hours of traffic, additional model runs were conducted to determine if more optimal allocations of available booths between NEXUS and standard traffic resulted in better performance. The resulting modeled average wait-time during peak hours ~~are~~ is shown in Table 5 (for CBP – Peace Arch) and Table 6 (CBSA – Douglas) below.

Table 5: Model results of adding inspection booths at the Peace Arch POE

USCBP Peace Arch - simulation model, 5/16/2015 scenario outputs
Average vehicle wait times (minutes) 07:00 - 21:00

	Standard	NEXUS
Baseline	46.7	13.0
40% RFID	16.0	10.4
Add 1 std booth	19.8	10.7
Add 1 std. booth with NEXUS optimization	22.5	6.4
Add 2 std. booths	7.7	4.8
Add 2 std. booths with NEXUS optimization	8.4	3.4

Comparing the results for CBP Peace Arch above, we conclude that it would require the addition of two new inspection booths at Peace Arch to equal or exceed the wait-time reduction estimated to result from a 40 percent vicinity-RFID use rate among non-NEXUS travelers at Peace Arch.

Table 6: Model results of adding inspection booths at the Douglas POE

CBSA Douglas - simulation model, 8/31/2015 scenario outputs
Average vehicle wait times (minutes) 07:00 - 21:00

	Standard	NEXUS
Baseline	36.4	5.5
40% RFID	14.6	3.3
Add 1 std booth	15.7	2.7
Add 2 std. booths	9.9	2.9

Model runs for CBSA Douglas with one new inspection booth added to the port produced wait-times only slightly higher than the 40 percent RFID scenario supporting a conclusion that one additional booth would generate a comparable wait time reduction. Two booths were significantly lower. Additionally, since average modeled NEXUS wait times were very low, modeling different allocations of available booths to NEXUS and standard traffic wasn't worth doing. Thus, Table 6 does not include the "NEXUS optimization" model runs.

Estimated costs of adding booths at Peace Arch and Douglas POEs

For the planning-level cost estimation in this section, it is helpful that Peace Arch and Douglas ports-of-entry are very similar. Both currently have ten primary inspection booths in a linear arrangement perpendicular to approaching traffic. Both have three approach lanes from the state or provincial highway to the inspection plaza. Both approach roads dedicate the rightmost of the three approach lanes to NEXUS vehicles.

Figure 9 below illustrates this layout and shows a basic concept for adding new booths at these locations. Neither location would be able to add booths to the existing array. Thus the concept below shows new booths nested within the existing plaza, ahead of the existing booths, with a newly created bypass.

Figure 9. Generalized schematic for both Peace Arch and Douglas comparing existing approach and booth layout to a concept for how to add primary inspection booths to similarly constrained facilities.

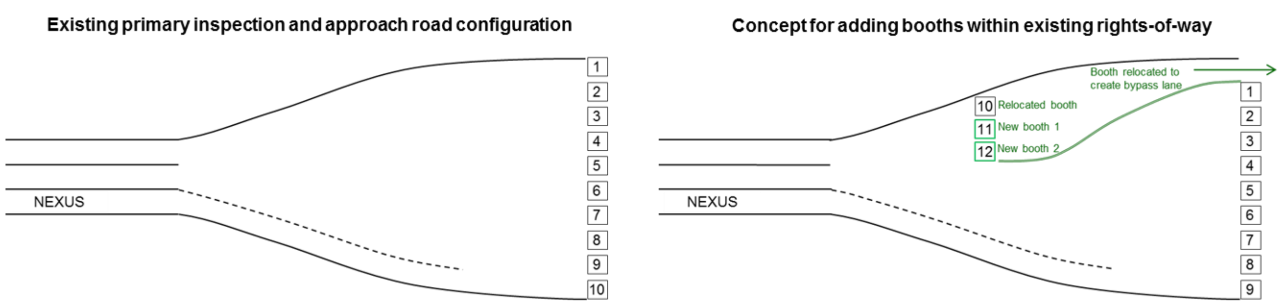


Table 7 below shows an estimate of the costs of adding one or two inspection booths inclusive of related pre-construction, the booths themselves, construction/installation/relocation, roadway modifications, and staffing. The estimate is presented as the capital and staffing costs for an investment expected to function for 15 years. Notes on cost-estimation assumptions accompany the table.

Table 7: Estimated cost of adding and staffing new primary inspection booths at Peace Arch and/or Douglas POEs

	1 booth	2 booths	
Infrastructure costs (one POE)	**Est. Cost**	**Factor**	**Est. cost**
Primary inspection booth(s)*	$300,000	2	$600,000
Existing booth relocation	$45,000	1	$45,000
Installation	$40,000	1.5	$60,000
Lane reconfigurations	$470,000	1	$470,000
Total	$855,000		$1,175,000
15 years annualized	$57,000		$78,333
Staffing (one POE)			
Annual added booth staffing**	$87,750	2	$175,500
Staffing + infrastructure (one POE)			
Annually	$144,750	2	$253,833
For 15 years	$2,171,250		$3,807,500
For 2 POEs (Peace Arch & Douglas)	**$4,342,500**		**$7,615,000**

Estimate notes:

* $300,000 per booth cost estimate provided by U.S. General Services Administration.

** Staffing costs assume 1) additional booths staffed Friday-Sunday during peak eight-hour periods for the six busiest months of the year (624 hrs./yr.), 2) opening one booth requires three inspection staff, and 3) all-inclusive hourly staff cost of $47.88 per employee per hour.

While modeling shows that CBSA's Douglas POE could expect to achieve about the same reduction in wait time with either 40 percent RFID or addition of one new inspection booth, it is unlikely that either federal agency would incur the other costs of any system modifications and only install one additional inspection booth at this location. Nevertheless, the total, two-port costs estimated above can serve as a useful range. For subsequent analysis a rounded midpoint value will be used for the estimated cost of an infrastructure and staffing alternative – **$6,000,000.**

GHG benefits: emission reductions estimated for the 40 percent scenario.

Vehicles idle at border crossings in the same way they idle at stop lights, toll plazas, or in bumper-to-bumper congestion. Because reduction of idling reduces the corresponding emissions of greenhouse gases (GHG, primarily carbon dioxide), it is important for benefit cost analyses to estimate and account for GHG effects of transportation strategies and investments.

This section presents an estimate of the GHG reduction benefits that would result from 40 percent use of vicinity RFID at the Peace Arch-Douglas ports-of-entry. To construct an estimate, published factors for rates of fuel use while idling, carbon dioxide emissions per unit of fuel, and social cost of carbon emissions were collected and are listed in Table 8 below.

Table 8. Factors used in GHG reduction estimation with sources.

Variable	Value	Source	Link
Avg. idling vehicle fuel use	0.28 gallons/hour	U.S. Dept. of Energy, 2015 Idle Fuel Consumption	http://energy.gov/eere/vehicles/fact-861-february-23-2015-idle-fuel-consumption-selected-gasoline-and-diesel-vehicles
CO_2 emitted per gallon of gasoline burned	19.6 pounds	U.S. Energy Information Administration, FAQ: How much carbon dioxide is produced by burning gasoline…?	http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=11
1 pound/1 metric ton	0.000453592		
US EPA Social Cost of CO_2 (2014 $US)	$40 per metric ton	U.S. Environmental Protection Agency, The Social Cost of Carbon. Mid-range 2015 value used for this estimate.	http://www.epa.gov/climatechange/EPAactivities/economics/scc.html
Average est. wait time reduction from 40% RFID use in standard lanes	63%	WCOG border simulatoin modeling	

Applying the above factors to 2014 traffic and wait-time data for Peace Arch and Douglas POEs, the following estimate was completed (Table 9). As seen in the table, only anticipated reduction in non-NEXUS wait times was included, traffic between 9:00 PM and 7:00 AM was excluded, and the estimated impacted of an existing anti-idling zone was accounted for.

Table 9. Estimation of possible GHG reduction from 40% RFID and monetized benefits

			Peace Arch - Douglas POEs				
Stepwise estimation of GHG reduction & $benefit attributable to 40% non-NEXUS RFID			Northbound		Southbound		
	Steps (and units)	*Notes*	Standard	NEXUS	Standard	NEXUS	
1	2014 historic, per car average wait time, 07:00 - 20:00 (**min.**)	*limted to hours with significant volume*	16.4	1.3	17.5	5.6	
2	85% of total, 2014 traffic volume (**cars**)	*est. share of 24-hr. volume during 07:00-20:00*	1,293,007	1,094,564	1,613,034	960,451	
3	Annual, cummulative wait time -- idling time (**hours**)	*(cars x minutes) / 60*	353,422		470,675		
4	Est. of annual wait time if 40% RFID (**hours**)	*model-estimated 63% average reduction*	132,093		175,916		
5	Est. RFID CO_2 emissions reduction (**metric tons**)	*applying DOE & EIA factors cited above*	542		722		
6	55% of emissions reduction is already achieved from BC's southoubnd anti idling zone (estimate). Net reduction from 40% RFID (**metric tons**):	*Estimate from BC Ministry of Transportation & Infrastructure*	542		325		**Totals**
7	Est. annual social benefit 2015(**$US**)	*EPA SC-C0 2 table cited above ($40/ton/yr)*	$21,689		$12,998		$34,687
8	**Est. 15-year, cummulative GHG reduction benefit ($US)**	*Multiplied by 15 years to align with previous analyses*	$325,334		$194,971		**$520,306**

By narrowing the amount of traffic affected by the higher RFID-use scenario and applying a mid-range value for the dollar benefit of carbon dioxide reductions, it is felt that the 15 year estimated benefit of GHG reductions from increased RFID, $520,000, is appropriately conservative. While it's not a very large dollar amount, it's large enough to have a measurable effect on this benefit-cost analysis.

Travel time benefits: reductions estimated for the 40 percent scenario.

The US Department of Transportation (US DOT) regularly updates guidance on estimating the value of travel time for use in economic analyses of transportation investments. Table 10 shows the steps in applying a dollar value to wait time reduction, starting with the same assumptions used in Table 9, but then multiplying the US DOT value by expected travel time reduction.

Table 10. Estimation of the value of travel time reduction from 40% RFID ($USD)

			Peace Arch - Douglas POEs				
Stepwise estimation of the value of reduced travel time attributable to 40% non-NEXUS RFID			Northbound		Southbound		
	Steps (and units)	*Notes*	Standard	NEXUS	Standard	NEXUS	
1	2014 historic, per car average wait time, 07:00 - 20:00 (**min.**)	*limted to hours with significant volume*	16.4	1.3	17.5	5.6	
2	85% of total, 2014 traffic volume (**cars**)	*est. share of 24-hr. volume during 07:00-20:00*	1,293,007	1,094,564	1,613,034	960,451	
3	Annual, cummulative wait time -- idling time (**hours**)	*(cars x minutes) / 60*	353,422		470,675		
4	Est. of annual wait time if 40% RFID (**hours**)	*model-estimated 63% average reduction*	132,093		175,916		
5	Est. of annual wait time AVOIDED if 40% RFID (**hours**)		221,329		294,759		**Total**
6	Est. value of travel time savings @ $17.20/hr. (intercity, personal travel) (**$US**)	*USDOT 2014 Guidance on valuation of travel time in economic analysis*	$3,806,864		$5,069,849		**$8,876,713**
7	Est. 15-year cummulative value of travel time savings (**$US**)	*multiplied by 15 years to align with previous analyses.*	$57,102,962.34		$76,047,728.13		**$133,150,690**

Over 15 years, the cumulative dollar value of reduced wait time expected from a 40percent RFID use rate is over $133 million. This estimate should not be interpreted as a value that the government (or the traveling public) should be willing to actually spend in order to reduce delays—rather, it is an estimate of public benefit that is useful when comparing multiple investment options.

Benefit-cost summary

The overarching objectives of improvements at our border crossings are efficient and effective connection for travel and trade, security, and effective law enforcement. The BtB Action Plan has supported investments in RFID systems to advance these goals, in large part because of expected efficiency gains with travel-document processing leading to more efficient throughput and reduced border wait times.

This section will summarize the preceding estimates of wait time reductions, costs of a generic RFID strategy, and costs of infrastructure alternatives to achieve comparable wait times. Finally, these costs will be looked at alongside the monetized value of expected benefits from GHG reduction and reduced travel-time.

Costs

Table 11 below compares the costs of the subject RFID initiative with the estimated cost of infrastructure (and staffing) over a 15 year period.

Table 11. Summary of Costs – 40% RFID vs. Infrastructure at Peace Arch – Douglas POE

Est. wait time reduction from 40% RFID	63%
Est. cost of producing and distributing the requisite number of RFID documents	$1,200,000
Est. cost of attaining the same wait-time reduction from adding booth & lane infrastructure	$6,000,000

As is seen above, an infrastructure approach for Peace Arch-Douglas is estimated to cost five times as much as an RFID strategy.

Benefits

Two categories of benefits were estimated for the assignment of a corresponding dollar value and are listed in Table 12, greenhouse gas (GHG) emissions reduction and travel time savings.

A third benefit has been pointed out that is not included for monetization – increased officer safety in inspection booths. Use of RFID travel documents enables officers to see information on screen about travelers several seconds before they arrive at the booth – valuable time if alerts come up related to potential dangers.

Table 12. GHG and Travel time benefits (over 15 years) at Peace Arch – Douglas POE

GHG reductions	$520,000
Travel time reductions	$133,150,690
Total estimated benefits	**$133,670,690**

Benefit cost ratios

Expressing the above comparisons as a benefit-cost ratio (BCR) produces the unsurprising result that, just like comparison of the cost estimates themselves, the BCR for the RFID strategy is five times higher than it is for the infrastructure option.

Table 13. BCRs.

Benefit/cost ratio	
40% non-NEXUS RFID	Infrastructure & Staffing
111	**22**

The BtB Forward Plan – a next step for RFID policy direction

The March 2015 BtB Implementation Report Forward Plan annex includes a specific objective for RFID documents which accords well with the expected benefits highlighted by this business case analysis.

> *"RFID Documents (CIC, CBSA // DHS/CBP)*
>
> - *Implement a strategy to promote, incentivize and support an increased number of RFID enabled documents used by cross-border travelers to optimize the lane segmentation technology deployed at the border."*

Additionally, a NEXUS strategy

As stated early in this paper, NEXUS has been the most effective strategy for increasing border efficiency and security. So, it's important to ask, what share of current standard traffic needs to shift to NEXUS to achieve the wait time reduction expected from the 40 percent RFID shift?

Using model outputs (from the May 16 southbound scenario at Peace Arch), it is estimated that a 16 percent shift to NEXUS would achieve the same wait time reduction as a 40 percent shift to RFID. Applying this estimate to the strategy of focusing on known, frequent travelers, a NEXUS strategy could achieve the "40 percent RFID wait time reduction" by engaging the top 30,000 highest-frequency non-NEXUS travelers rather than 75,000.

Because average NEXUS inspection times are less than half the time of non-NEXUS RFID inspection times, fewer travelers would need to change their current travel document. However, with the $50 NEXUS application fee, the cost of a NEXUS strategy involving 30,000 people (assuming a subsidy) could be as high as $1.5 million (not including administration and mailing). Essentially though, this cost estimate is very close to the non-NEXUS RFID strategy cost estimate presented here. It is not difficult to imagine a hybrid strategy centered on outreach to the top 75,000 known frequent travelers but then offering two options: a subsidized NEXUS application or a complementary non-NEXUS RFID travel document.

WCOG and BPRI, along with other regional partners coordinating through the IMTC Program, look forward to continued collaboration to advance strategies to optimize our shared transportation and inspection systems.

This work is funded by a grant from the U.S. Federal Highway Administration (FHWA) with additional funding from the British Columbia Ministry of Transportation (BC MoTI)

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