Institute for Homeland Security Solutions

Applied research • Focused results

February 2010

Border Crossing Improvements, Induced Travel, and Security

Project

Understanding the Unintended Consequences of Border Crossing Improvements: Induced Travel and Security

Project Lead

Brooks Depro, PhD, RTI International[1]

Statement of Problem

Commercial freight truck border crossings have increased considerably over the last decade. Recent statistics show the number of trucks entering the United States rose from 8.7 million in 1996 to 11.4 million in 2007 (U.S. Department of Transportation [DOT], 2008a) (Figure 1). As border traffic grows, public agencies continue to try to identify innovative ways to relieve congestion while still maintaining security (U.S. DOT, 2008a). Achieving the "right balance" between open borders and security continues to be a top national priority (Homeland Security Advisory Council, 2008).

To meet the challenge, governments have implemented new trusted shipper/traveler programs. Under the programs, low-risk shippers and travelers can voluntarily give up information in exchange for a promise of quicker clearance (Hale, 2009; Sands, 2009). For example, the Free and Secure Trade (FAST) program attempts to meet efficiency and security goals by coordinating the screening and clearing of low-risk commercial traffic and frequently allows compliant participants access to the newly dedicated FAST lanes ("California's new fast lane," 2005; Biederman, 2008; U.S. Customs and Border Protection, 2009a). Similarly, the NEXUS and Secure Electronic Network for Travelers Rapid Inspection (SENTRI) programs are

---

[1] Additional research assistance provided by Dallas Wood of RTI International, and comments from several reviewers also contributed to this manuscript.

designed to allow pre-approved and low-risk travelers to cross the U.S.-Canadian and U.S.-Mexican borders faster. U.S. Customs and Border Protection (CBP) reports that over 265,000 people were enrolled in NEXUS and 16 U.S.-Canadian border crossing locations had NEXUS lanes (U.S. CBP, 2009b).

Stakeholders continue to advocate trusted shipper/traveler programs and other border improvements because reduced congestion encourages commerce. Better crossings ultimately make goods less expensive, give people more choices, and potentially increase other local and national economic opportunities (U.S. DOT, 2004a; SANDAG, 2007; U.S. Department of Agriculture, 2000). However, route-switching and other "induced travel" responses to border crossing improvements may offset anticipated benefits (reduced congestion). In addition, some crossing improvements may indirectly affect undesirable crossings (e.g., those that pose a security risk) and make the border improvements less valuable to selected stakeholders. We review and discuss how social scientists have studied induced travel in order to help decision makers better understand and prioritize ways to improve border crossing benefit-cost analysis.

Figure 1. Truck Crossings into the United States from Mexico and Canada: 1996–2007
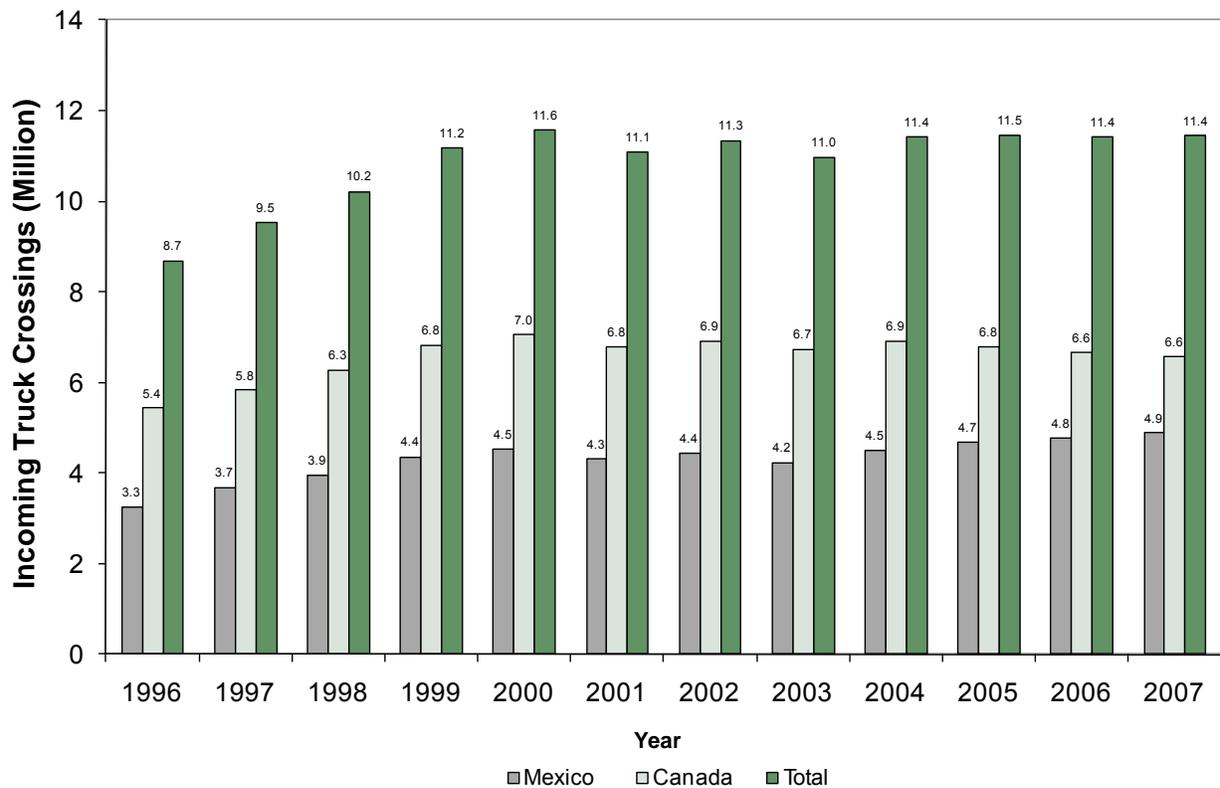
Source: U.S. DOT, 2008b, Table 2-4-5.

Institute for Homeland
Security Solutions
Applied research • Focused results

Background

The concept of induced travel has a long history in urban transportation research. Cervero (2002) and Noland (2001) provide excellent comprehensive reviews and critiques of existing theory and empirical work. Although there are some differences in the taxonomies used to describe the concept (Small & Verhoef, 2007), the central idea is that policies that lower travel prices (e.g., reduce congestion) are likely to encourage new sources of traffic. For example, people who had not used improved roads may now choose to travel, some people decide to switch routes or modes, and others are willing to drive longer distances. Over longer periods, improved roads may also attract new residential and commercial development that indirectly adds additional travelers and congestion (Cervero, 2003).

Most empirical studies measure induced travel using some form of the following ratio:

$$\text{Behavioral Response} = \%\Delta \text{ Traffic} / \%\Delta \text{ in Road Capacity}$$

Social scientists, particularly economists, commonly use the term "elasticity" to describe this ratio. A study conducted by Barr (2000) is typical of empirical studies in this area. Using a cross-section design for 25,000 households taken from the 1995 Nationwide Personal Transportation Survey (NPTS), he examined the correlation between vehicle miles traveled and changes in travel time and from this reports a travel time elasticity of approximately 0.4. A 1% increase in travel time reduced vehicle miles traveled by 0.3% to 0.4%.

Small and Verhoef (2007) suggest that some of the better empirical studies continue to report response ratios between 0.2 and 0.8. These ratios are quite high and suggest that a 1% increase in capacity may lead to a 0.2% to 0.8% increase in traffic. From a benefit-cost perspective, these estimates suggest that new traffic can soak up new road capacity and reduce anticipated travel time savings (i.e., reduce benefits of the site improvement).

In addition to diminished road improvement benefits, induced demand studies have recognized other undesirable policy consequences associated with traffic pattern changes (Noland & Lem, 2002). For example, Lwebuga-Mukasa, Oyana, Thenappan, and Ayirookuzhi (2004) found that asthmatic residents living near a U.S.-Canadian crossing point tended to use more health care after commercial border traffic increased. The authors speculated that the policy-induced traffic had unintentionally increased air pollution levels and led adults and children to have more asthma symptoms. Changes in the composition of the new traffic influences these and other types of secondary effects; however, evidence related to sources of traffic growth currently is very limited (Cervero, 2002).

Institute for Homeland
Security Solutions
Applied research • Focused results

Synthesis

There is general agreement that induced travel is a real phenomenon and should be considered in traffic improvement benefit-cost analysis. However, induced travel questions have traditionally been evaluated within the context of legitimate travelers; security applications have not been addressed to date.

Induced travel studies do suggest that crossing improvements designed to reduce congestion may attract new low-risk traffic; consequently, the promise of quicker clearance for travelers may not materialize. Over the long-run, this can reduce the incentives to participate in trusted shipper/traveler programs and undermine their security goals. This dynamic will be particularly important in areas where a substantial number of border-crossing alternatives are readily available (e.g., Great Lakes Gateway).

There is new evidence that increased security delays have reduced Canadian exports (Globerman & Storer, 2009). As additional empirical evidence emerges, policy makers may consider reducing security measures to alleviate congestion. The induced travel literature provides a behavioral story about the consequences of security reductions. High-risk travelers are more likely to respond to changes that affect their likelihood getting caught. As a result, security reduction may lower the implicit travel "price" and may change high-risk travelers' chosen point of entry. Although behavioral responses among high-risk travelers are unknown, empirical studies of legitimate travelers suggest that planners either overlook induced traffic effects or underestimate their size.

The best way to identify, measure, and interpret induced traffic responses remains contested. In addition, current research has tended to focus on quantifying the increases in legitimate low-risk traffic versus high-risk traffic. The gaps raise several issues within the context of border-crossing improvements:

- Are existing induced-travel methods/metrics produced by previous studies directly applicable or transferable to future analyses of border crossing improvement (particularly security-related changes)? If not, can and should existing metrics be refined, or should new ones be created?

- What are the similarities and differences between border crossing areas and more thoroughly studied areas of induced traffic? For example, zoning laws influence the extent to which changes in land use (new residential/commercial activities) add new travelers.

- If border improvements do induce new traffic, what is the composition of the new traffic and to what extent will it be higher or lower risk?

- If traffic is diverted from other crossings, are there benefits or costs for unimproved crossings? Should these be incorporated into benefit-cost analyses?

Institute for Homeland Security Solutions
Applied research • Focused results

Future Directions

An emerging economic literature uses discrete choice statistical models to understand congestion and simulate how people move or "sort" themselves across locations (e.g., Timmins & Murdock, 2007). RTI International has explored the benefits and challenges of adapting the frameworks to border crossing issues (Depro & Timmins, 2007). The sorting framework emphasizes

- a traveler's best choice or optimization problem (picking a crossing with the highest "payoff");
- the role of congestion—a site attribute that ultimately depends on all travelers' responses to significant crossing improvements; and
- determining "equilibrium" after a crossing improvement (e.g., a set of choices where no traveler wishes to switch crossings).

The sorting model's premise is that the new wait time is a function of initial improvement *and* all travelers' behavioral responses to initial wait time reductions:

New Wait time = f[Policy, all traveler responses (e.g., "equilibrium" choices)]

Once a sorting model's parameters are estimated using historical data, one can use the system of estimated equations to measure *equilibrium* behavioral responses to a proposed infrastructure or security policy. A comparison of the crossing payoffs with and without the proposed policy also can provide a more complete measure of the size and distribution of the crossing's benefits (Table 1).

Table 1. Models Measuring Benefits

Model Type	Does Traveler Re-Evaluate Crossing Choice?	Stakeholder	
		People and Businesses at Improved Site	People and Businesses at Unimproved Sites
Standard	No	Direct Benefit: site improvement	No Effect
Sorting	Yes	Direct Benefit: site improvement Indirect Costs: increased congestion from induced traffic	Indirect Benefits: reduced congestion from induced traffic

Although sorting models show some promise, particularly when close substitutes are available, they are more appropriate for policies that bring about substantial changes in congestions, since small improvements are not likely to lead travelers to reevaluate crossing

Institute for Homeland
Security Solutions
Applied research • Focused results

choices. In addition, such changes are more appropriate when applied to legitimate low-risk crossings. However, sorting models may provide some new ways to think about, address, and quantify border improvement benefits in the presence of induced demand. In addition, they can complement other existing border-crossing models specifically designed for budgetary planning (e.g., the Border Wizard). Developers have suggested that complementary models and tools would be highly valued by regional/state transportation planners and modelers (U.S. DOT, 2004b).

Contact Information:

Brooks M. Depro

RTI International

3040 Cornwallis Road

Research Triangle Park, NC 27709

bmd@rti.org

Brooks M. Depro is a senior economist with RTI International. He manages and conducts benefit-cost analyses for the U.S. Environmental Protection Agency and other federal agencies. He specializes in applied microeconomic simulation models and other statistical models used to measures a policy's benefits and costs. Dr. Depro has a PhD in economics from North Carolina State University.

References

Barr, L. C. (2000). Testing for the significance of induced highway travel demand in metropolitan areas. *Transportation Research Record 1706*, 1–8.

Biederman, D. (2008). Crossing into efficiency. *Traffic World,* July 21,19–22.

Cervero, R. (2002). Induced travel demand: Research design, empirical evidence, and normative policies. *Journal of Planning Literature, 17*(1), 3–20.

Cervero, R. (2003). Are induced travel studies inducing bad investments? *Access*, 22, 22–27.

Depro, B. M., & Timmins, C. (2007). Which freight crossing will they choose now? Measuring the benefits of border facility improvements using sorting model logic. Unpublished manuscript.

Globerman, S., & Storer, P. (2009). Border security and Canadian exports to the United States: Evidence and policy implications. *Canadian Public Policy-Analyse De Politiques, 35*(2), 171–186.

Hale, G. (2009). In search of effective border management: A changing world. *Canadian Foreign Policy Priorities, 3*. Retrieved January 15, 2010, from http://www.canadianinternationalcouncil.org/research/canadianfo/insearchof

Homeland Security Advisory Council. (2008). The Top 10 challenges facing the next Secretary of Homeland Security. Retrieved September 16, 2009, from http://www.dhs.gov/xlibrary/assets/hsac_dhs_top_10_challenges_report.pdf

Lwebuga-Mukasa, J. S., Oyana, T., Thenappan, A., & Ayirookuzhi, S. J. (2004). Association between traffic volume and health care use for asthma among residents at a U.S.-Canadian border crossing point. *Journal of Asthma, 41*(3), 289–304.

Noland, R. B., & Lem, L. L. (2002, January). A review of the evidence for induced travel and changes in transportation and environmental policy in the U.S. and the UK. *Transportation Research Part D-Transport and Environment, 7*(1), 1–26.

Noland, R. B. (2001, January). Relationships between highway capacity and induced vehicle travel. *Transportation Research Part A-Policy and Practice, 35*(1), 47–72.

California's New Fast Lane Opens. (2005). *Pacific Shipper*, January 28, p. 23.

Sands, C. (2009). Toward a new frontier: Improving the U.S. Canadian border. Retrieved January 15, 2010, from http://www.brookings.edu/reports/2009/0713_canada_sands.aspx

San Diego Association of Governments (SANDAG). (2007, September). *2007 Update: Economic impacts of wait times in the San Diego–Baja California border region: Fact sheet.* Retrieved February 15, 2010, from http://www.sandag.org/uploads/publicationid/publicationid_1181_5101.pdf

Small, K. A., & Verhoef, E. T. (2007). *The economics of urban transportation.* London: Routledge.

Timmins, C., & Murdock, J. (2007). A revealed preference approach to the measurement of congestion in travel cost models. *Journal of Environmental Economics and Management, 53*(2), 230–249.

U.S. Customs and Border Protection. (2009a). FAST: Free and Secure Trade program. Retrieved September 11, 2009, from http://www.cbp.gov/xp/cgov/trade/cargo_security/ctpat/fast/

U.S. Customs and Border Protection. (2009b). NEXUS: Fact Sheet. Retrieved January 15, 2010, from http://www.cbp.gov/linkhandler/cgov/newsroom/fact_sheets/travel/nexus_fact.ctt/nexus_fact.pdf

U.S. Department of Agriculture, Economic Research Service. (2000, September). Transportation bottlenecks shape U.S.-Mexico food and agricultural trade. *Agriculture Outlook, AGO-274*, 24–31.

U.S. Department of Transportation, Federal Highway Administration. (2004a). Freight transportation: Improvements and the economy. Retrieved February 9, 2010, from http://ops.fhwa.dot.gov/freight/freight_analysis/improve_econ/index.htm

U.S. Department of Transportation, Federal Highway Administration. (2004b). Intermodal freight technology: 21st century operations using 21st century technology. Retrieved February 15, 2010, from http://www.ops.fhwa.dot.gov/aboutus/one_pagers/intermod_frt_tech.pdf

U.S. Department of Transportation. (2008a). Transportation Border Congestion Relief Program. *Federal Register, 73*(105), 31183–31184. Retrieved February 23, 2010, from http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2008_register&docid=E8-12055.pdf

U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics. (2008b). *Transportation Statistics Annual Report.* Washington, DC: U.S. Department of Transportation. Retrieved September 11, 2009, from http://www.bts.gov/publications/transportation_statistics_annual_report/2008/