Road Pricing: Is It Along America's Road to the Future?

An Honors Thesis

Presented to the Department of City and Regional Planning

of Cornell University

in Partial Fulfillment of the Requirements for a

Bachelor of Science with Honors in Urban and Regional Studies

by

Oren Hirsch

May 2009

ABSTRACT

In recent years, many cities around the world, including several in the United States, have implemented road pricing schemes as a way to reduce congestion, raise revenue for transportation projects, or a combination of these goals. Road pricing schemes take a variety of forms. The form most commonly found in the United States is high occupancy toll lanes. The federal government is starting to promote road pricing as sound and reliable transportation policy, but road pricing proposals often elicit the concern of many stakeholders, and case studies that would allow decision makers to draw upon previous experiences are limited.

This paper begins by outlining the history of road pricing, including Columbia University economics professor William Vickrey's initial proposals on the concept. It then discusses both the arguments in favor of and against road pricing and established best practices with regards to issues such as financing, revenue uses, and equity concerns to provide recommendations on what should be done to further improve road pricing policy and adequately address the concerns that frequently come up when road pricing is proposed. The paper's ultimate finding is that the established best practices are proving to be sound policy and equity concerns are not as large an issue as many initially fear when a project is proposed. However, additional pilot programs, including a cordon, need to be run before road pricing becomes accepted transportation policy in the United States.

TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENTS	
TABLE OF FIGURES	viii
GLOSSARY	ix
CHAPTER 1: SETTING AN ITINERARY TO EVALUATE ROAD PRICING IN TH	ΙE
UNITED STATES	1
1.1 Understanding this (Not so) New Phenomenon	2
1.2 Definitions and Other Important Terminology	
1.3 Mapping Out Our Itinerary	3
CHAPTER 2: HISTORY OF AMERICAN ROAD CONSTRUCTION, ROAD	
FINANCING, AND TOLLING PRIOR TO 1956	7
2.1 Road Financing in the Northeast United States Prior to 1900	7
2.1.1 Prior to the Turnpike Era	
2.1.2 The American Turnpike Era	
2.1.3 Lessons Learned from American Road Financing Prior to 1900	9
2.2 Road Financing in California Prior to 1900	
2.3 American Road Financing from 1900 to 1956	
2.3.1 Before the Interstate Highway System	
2.3.2 The United States Builds a National Road Network	
2.4 Conclusion	
CHAPTER 3: WILLIAM VICKREY'S CONGESTION PRICING THEORY	. 14
3.1 Who Was William Vickrey	. 14
3.2 Extending Efficient Pricing Principles to Transportation	. 14
3.2.1 Vickrey's Initial Proposal: Efficient Pricing on the New York City Subway	
3.2.1.1 Aspects of the Fare Collection Problem	. 15
3.2.1.2 Pricing the Subway to Meet Demand	. 16
3.2.1.3 Implementation Hurdles	. 17
3.2.1.4 Acknowledgement of Negative Impacts	. 18
3.2.2 Vickrey's Theories Applied to Roads	
3.2.2.1 Benefits of Road Pricing	. 19
3.2.2.2 Implementation	. 20
3.3 Vickrey's Principles of Efficient Congestion Pricing	
3.3.1 Establishing the Schedule of Charges	. 22
3.3.2 No Exceptions to the Rules	
3.4 The Initial Impact of Vickrey's Theories	
CHAPTER 4: THE ARGUMENTS FOR CONGESTION PRICING	
4.1 Early Academic Discussions of Road Pricing	
4.1.1 The Smead Report	
4.1.2 Response to the Smead Report	
4.1.3 Vickrey on Defense	
4.1.4 Continuing the Discussion	
4.2 What Makes Road Pricing Attractive in the First Place?	
4.2.1 The Rising Costs of Congestion	. 31

4.2.2 Increasing Capacity to Meet Demand	32
4.2.3 HOV Lanes	. 32
4.2.3.1 A History of HOV Lanes in the United States	. 32
4.2.3.2 HOV Lane Underutilization	
4.2.3.3 Explanations for HOV Lane Congestion & Underutilization	. 35
4.2.3.4 Solutions are Hard to Come By	
4.2.4 Public-Private Partnerships	. 37
4.2.4.1 Transportation Financing Options	. 37
4.2.4.2 Public versus Private Financing	. 38
4.2.4.3 Public-Private Partnerships: Combining Elements of Both Financing	
Options	
4.2.5 Benefits for Non-Users	. 41
4.2.5.1 Benefits for Business	. 41
4.2.5.2 Benefits for Public Transportation	42
CHAPTER 5: IMPLEMENTING A ROAD PRICING SCHEME	
5.1 Methods of Road Pricing Implementation	
5.1.1 Types of Road Pricing	
5.1.2 Picking the Proper Option	. 43
5.1.2.1 HOV Lanes versus HOT Lanes: Where to Implement Each Type	43
5.1.2.2 Cordons and Congestion Pricing Zones	. 47
5.1.2.3 An Alternative Form of Road Pricing	. 48
5.2 Changes in American Road Financing Policy	. 50
5.3 The Key Elements of a Road Pricing Proposal	. 52
5.3.1 Financing	. 53
5.3.1.1 Expenses to Cover	. 53
5.3.1.2 Potential Funding Sources	. 54
5.3.2 Setting Toll Rates	. 54
5.3.2.1 Priorities in Setting Toll Rates	
5.3.2.2 Variable Tolls	. 55
5.3.2.3 Electronic Toll Collection	. 56
5.3.3 Using Toll Revenues	. 58
5.3.3.1 Transportation Improvements	. 58
5.3.3.2 Reducing Taxes	. 59
5.3.3.3 Other Potential Uses	
5.3.3.4 Arguments for not Designating Specific Revenue Uses	. 60
5.3.4 Public Involvement	. 61
5.3.4.1 Identifying Winners and Losers	. 61
5.3.4.2 Identifying Stakeholders	. 63
5.3.4.3 Preconceived Notions can be Challenged	. 64
5.3.4.4 Case Study: Interstate 394 HOT Lanes	. 66
5.3.5 Equity Concerns	. 69
5.3.5.1 Defining Inequity in Transportation	. 70
5.3.5.2 The Truth about Inequity and Road Pricing	. 71
5.3.5.3 Allaying Equity Concerns	
5.4 Recapping the Implementation Strategies	
CHAPTER 6: ROAD PRICING IN THE FUTURE: NEXT STEPS	

6.1 Things to Test	79
6.2 Maintaining Standards	
6.3 Final Thoughts	
APPENDIX: ESTABLISHED BEST PRACTICES FOR FUTURE ROAD PRICING	3
SCHEMES IN THE UNITED STATES	86
REFERENCE LIST	92

REFERENCE LIST

- 407 ETR. Tolls & Fees. http://www.407etr.com/About/custserv_fees.asp [accessed March 5, 2009].
- Arnott, Richard. 1994. Introd. to *Pricing Urban Transportation* in *Public Economics*, ed. Richard Arnott, Kenneth Arrow, Anthony Atkinson and Jacques Dréze, 307-319. Cambridge: Cambridge University Press.
- Bae, Chang-Hee Christine and Alan Bassok. 2008. The Puget Sound (Seattle)
 Congestion Pricing Pilot Experiment. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee
 Christine Bae, 313-326. Cheltenham, UK: Edward Elgar.
- Bae, Chang-Hee Christine and Inge Mayeres. 2005. Transportation and Equity. In Social Dimensions of Sustainable Transport: Transatlantic Perspectives, ed.
 Kiernan P. Donaghy, Stefan Poppelreuter, and Georg Rudinger, 164-194. Hants, England: Ashgate.
- Banister, David. 2008. The Big Smoke: Congestion Charging and the Environment. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee Christine Bae, 176-197. Cheltenham, UK: Edward Elgar.
- Brownstone, David, Arindam Ghosh, Thomas F. Golob, Samilla Kazimi, and Dirk Van Amelsfort. 2003. Drivers' Willingess-to-Pay to Reduce Travel Time: Evidence from the San Diego I-15 Congestion Pricing Project. *Transportation Research*. *Part A: Policy and Practice* 37, no. 4: 373-387.
- Bryson, John M. 2007. What to Do When Stakeholders Matter: Stakeholder Identification and Analysis Techniques. *Public Management Review* 6, no. 1:21-53.
- Buckeye, Kenneth R and Lee W Munnich Jr. 2006. Value Pricing Education and Outreach Model: I-394 MnPASS Community Task Force. *Transportation Research Board* 1960:80-86.
- Carins, Shannon, Jessica Greig, and Martin Wachs. 2003. *Environmental Justice and Transportation: A Citizen's Handbook*. Berkeley, CA: University of California Institute of Transportation Studies.
- Dahlgren, Joy. 2001. The Prospects for High Occupancy/Toll (HOT) Lanes: Where They Should be Implemented. *California PATH Research Report*.

- Darity, William. 2008. Social Cost. International Encyclopedia of the Social Sciences 7, ed. 2: 581-583. http://find.galegroup.com/gvrl/infomark.do?&contentSet=EBKS&type=retrieve& tabID=T001&prodId=GVRL&docId=CX3045302487&source=gale&userGroup Name=cornell&version=1.0 [accessed March 29, 2009]
- DeCorla-Souza, Patrick. 2005. Trade-Off for Road Pricing Between Transportation Performance and Financial Feasibility. *Transportation Research Record* 1932: 23-32.
- Eliasson, Jonas and Lars-Göran Mattsson. 2006. Equity Effects of Congestion Pricing: Quantitative Methodology and a Case Study for Stockholm. *Transportation Research Part A* 40: 602-620.
- Fielding, Gordon J. and Daniel B. Klein. 1993. *High Occupancy Toll Lanes: Phasing in Congestion Pricing a Lane at a Time*. Reason Foundation.
- Glaister, Stephen and Daniel J. Graham. 2004. *Pricing Our Roads: Vision and Reality*. London: Institute of Economic Affairs.
- Gómez-Ibáñez, José A. and John R. Meyer. 1993. *Going Private: The International Experience with Transport Privatization*. Washington: The Brookings Institution.
- Holguín-Veras, Jose, Mecit Cetin, and Shuwen Xia. 2006. A Comparative Analysis of US Toll Policy. *Transportation Research Part A* 40:852-871.
- Kawamura, Kazuya. 2003. Perceived Benefits of Congestion Pricing for Trucks. *Transportation Research Record* 1833:59-61.
- King, David, Michael Manville, and Donald Shoup. 2008. The Political Calculus of Congestion Pricing. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee Christine Bae, 357-382. Cheltenham, UK: Edward Elgar.
- Klein, Daniel B. and Chi Yin. 1996. Use, Esteem, and Profit in Voluntary Provision: Toll Roads in California, 1850-1902. *Economic Inquiry* 34 (October): 678-92.
- Kockelman, Kara M. and Sukumar Kalmanje. 2004. Credit-Based Congestion Pricing: A Policy Proposal and the Public's Response. Paper presented at the 83rd Annual Meeting of the Transportation Research Board, January, in Washington, DC.
- Kwon, Eli and Scaba Kelen. 1998. Analysis of Minnesota Drivers' Perception for Toll Lanes. Paper presented at the annual meeting of the Institute of Transportation Engineers, Toronto, Ontario, Canada.

- Kwon, Jaimyong and Pravin Varaiya. 2007. Effectiveness of California's High Occpuancy Vehicle (HOV) System). *Transportation Research Part C:* 98-115.
- Layton, Lindsey and Spencer S. Hsu. 2008. Letting the Market Drive Transportation: Bush Officials Criticized for Privatization. *The Washington Post*, March 17, A section.
- Lee, Shin. 2008. The Transferring London Congestion Charging to US cities: How Might the Likelihood of Successful Transfer be Increased?. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee Christine Bae, 212-232. Cheltenham, UK: Edward Elgar.
- Levinson, David M. 2002. *Financing Transportation Networks*. Cheltenham, UK: Edward Elgar.
- Levinson, David M. 1998. Road Pricing in Practice. In *Road Pricing, Traffic Congestion, and the Environment*, ed. Kenneth J. Button and Erik T. Verhoef, 14-38. Cheltenham, UK: Edward Elgar.
- Lindsey, Robin. 2007. Congestion Relief: Assessing in the Case for Road Tolls in Canada. *C.D. Howe Institute Commentary* 248 (May): 1-30.
- Moon, Henry. 1994. *The Interstate Highway System*. Washington: Association of American Geographers.
- Morris, Eric. 2006. How Privatization Became a Train Wreck. *ACCESS* 28 (Spring): 18-25.
- Mylvaganam, Chandran and Sanford Borins. 2004. "If You Build It...": Business, Government, and Ontario's Electronic Toll Highway. Toronto: University of Toronto Press.
- Neuman, William. 2009. M.T.A. Hears Riders' Reaction to Plans for Service Changes: They're Angry. *The New York Times*, January 15.
- Port Authority of New York & New Jersey. 2005. *Lincoln Tunnel Exclusive Bus lane Enhancement Study.* New York: Port Authority of New York & New Jersey.
- Orange County Transportation Authority. 2008a. OCTA-Overview. http://www.octa.net/91_express.aspx [accessed December 25, 2008].
- Orange County Transportation Authority. 2008b. OCTA-Toll Schedule Effective January 1, 2009. http://www.octa.net/schedule_effective.aspx [accessed March 12, 2009].

- Rae, John B. 1971. *The Road and the Car in American Life*. Cambridge, MA: The MIT Press.
- Rajé, Fiona. 2003. The Impact of Transport on Social Exclusion Processes with Specific Emphasis on Road User Charging. *Transport Policy* 10:321-338.
- Richardson, Harry W., Peter Gordon, James E. More II, Sungbin Cho, and Qisheng Pan. 2008. Expansion of Toll Lanes or More Free Lanes? A Case Study of SR91 in Southern California. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee Christine Bae, 342-356. Cheltenham, UK: Edward Elgar.
- Rye, Tom and Stephen Ison. 2008. The European and Asian Experience of Implementing Congestion Charging: Its Applicability to the United States. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee Christine Bae, 273-292. Cheltenham, UK: Edward Elgar.
- Saleh, Wafaa and Séona Farrell. 2005. Implications of Congestion Charging for Departure Time Choice: Work and Non-Work Schedule Flexibility. *Transportation Research Part A* 39: 773-791.
- San Diego Association of Governments. I-15 Express Lanes FAQ. http://fastrak.511sd.com/PDFs/I-15_FAQv3.pdf [accessed March 6, 2009].
- Santos, Georgina. 2008. The London Congestion Charging Scheme, 2003-2006. In *Road Congestion Pricing in Europe: Implications for the United States*, ed. Harry W. Richardson and Chang-Hee Christine Bae, 159-175. Cheltenham, UK: Edward Elgar.
- Sharp, Clifford. 1966. Congestion and Welfare—An Examination of the Case for a Congestion Tax. *Economic Journal* 76, no 304 (December): 806-817.
- Small, Kenneth A. 1992. Using the Revenues from Congestion Pricing. *Transportation* 19: 359-381.
- Sullivan, Edward. 2000. Continuation Study to Evaluate the Impacts of the SR-91 Value-Priced Express Lanes. San Luis Obispo, CA: California Polytechnic State University. http://ceenve3.civeng.calpoly.edu/sullivan/SR91/final_rpt/FinalRep2000.pdf [accessed March 30, 2009]
- Sullivan, Edward C. 1998. Impacts and Lessons from Value Pricing the California State Route 91 Express Lanes. Paper presented at the annual meeting of the Institute of Transportation Engineers, Toronto, Ontario, Canada.

- Tuss, Adam. 2009. HOT Lane Plans Draw Skepticism. WTOP Radio. http://www.wtop.com/?nid=30&sid=1599541 [accessed February 12, 2009]
- Ungemah, David. 2007. This Land is Your Land, This Land is My Land: Addressing Equity and Fairness in Tolling and Pricing. *Transportation Research Record* 2013: 13-20.
- Ungemah, David and Tina Collier. 2007. I'll Tell You What I Think! A National Review of How the Public Perceives Pricing. *Transportation Research Record* 1996: 66-73.
- United Kingdom. 1964. *Road Pricing: The Economic and Technical Possiblities*. Ministry of Transport. London: Her Majesty's Stationary Office.
- U.S. Department of Transportation, Federal Highway Administration. 1976. America's Highways: 1776-1976. Washington, DC: Government Printing Office.
- U.S. Department of Transportation, Federal Highway Administration. 1996. *Buying Time: Guidebook for Those Considering Congestion Relief Tolls*. Prepared by David Van Hattum and Mariia Zimmerman of the Hubert H. Humphrey Institute of Public Affairs, University of Minesota. Washington, DC: Government Printing Office.
- U.S. Department of Transportation. Federal Highway Administration. 2006. Congestion Pricing: A Primer. Washington, DC: Government Printing Office.
- U.S. Department of Transportation, Federal Highway Administration. 2008. Federal-Aid Highway Program Guidance on High Occupancy Vehicle (HOV) Lanes (August 2008). Washington, DC: Government Printing Office.
- U.S. Department of Transportation, Federal Highway Administration. Public Private Partnerships. http://www.fhwa.dot.gov/PPP/defined_default.htm [accessed February 28, 2009].
- U.S. General Accounting Office. 2003. Testimony Before the Joint Economic Committee, U.S. Congress. *Reducing Congestion: Congestion Pricing has Promise for Improving Use of Transportation Infrastructure.* Washington, DC: Government Printing Office.
- U.S. General Accounting Office. 2004. Report to Congressional Requesters. *Private* Sector Sponsorship of and Investment in Major Projects Has Been Limited. Washington, DC: Government Printing Office.
- Vickrey, William. 1968. Congestion Charges and Welfare: Some Answers to Sharp's Doubts, *Journal of Transport Economics and Policy* 2: 107-118.

- Vickrey, William S. 1994a. A Proposal for Revising New York's Subway Fare Structure. In *Public Economics*, ed. Richard Arnott, Kenneth Arrow, Anthony Atkinson and Jacques Dréze, 277-306. Cambridge: Cambridge University Press.
- Vickrey, William S. 1994b. Pricing in Urban and Suburban Transportation. In *Public Economics*, ed. Richard Arnott, Kenneth Arrow, Anthony Atkinson and Jacques Dréze, 307-319. Cambridge: Cambridge University Press.
- Victoria Transport Policy Institute. 2008a. Financing Options: Options For Funding Transportation Programs. http://www.vtpi.org/tdm/tdm119.htm [accessed September 6, 2008].
- Victoria Transport Policy Institute. 1992. Principles of Congestion Pricing: William Vickrey. http://www.vtpi.org/vickrey.htm [accessed September 6, 2008].
- Victoria Transport Policy Institute. 2008b. Road Pricing: Congestion Pricing, Value Pricing, Toll Roads, and HOT Lanes. http://www.vtpi.org/tdm/tdm35.htm [accessed September 6, 2008].
- Weiss, Eric M. 2009a. HOV Cheaters Run the Numbers: 65 MPH vs. \$1,000. *The Washington Post*, February 25, A section.
- Weiss, Eric M. 2009b. LaHood Talks of Mileage-Based Tax: White House Dismissed Controversial Idea to Fund Transportation Projects. *The Washington Post*, February 21, A section.