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Urban Transportation

by Kenneth A. Small

The defining trait of urban areas is density: of people, activities, and structures. The defining trait of urban transportation is the ability to cope with this density while moving people and goods. Density creates challenges for urban transportation because of crowding and the expense of providing infrastructure in built-up areas. It also creates certain advantages because of economies of scale: some transportation activities are cheaper when carried out in large volumes. These characteristics mean that two of the most important phenomena in urban transportation are traffic congestion and mass transit.

Traffic congestion imposes large costs, primarily in terms of lost time. (Economists measure the value of this time by examining situations in which people can trade time for money, such as by choosing different means of travel.) Researchers at the Texas Transportation Institute regularly estimate the costs of urban congestion; their estimate of annual congestion costs per capita in 2001 for 75 large U.S. metropolitan areas was $520, representing 26 hours of delay and 42 gallons of fuel. This totals nearly $70 billion. [1]

But is the cost of congestion too high? Density dictates that we cannot expect to provide unencumbered road space for every person who might like it at 5:00 p.m. on a weekday—any more than one would expect to build a dormitory with a shower for every resident who wants to use one in the morning. Just as an architect might decide how many showers to provide for the dormitory, economists, by knowing how much people value their time and how much it costs to save time by increasing road capacity, can estimate the optimal amount of roadway capacity and the resulting level of congestion.

Virtually all economists agree that congestion in cities around the world is greater than this optimum. They also agree on the reason: driving in the rush hour is priced far below its real social cost. The social cost is the driver's cost to himself plus the congestion imposed on other drivers. People often drive, therefore, even when the social cost is more than the trip is worth to them because they don't bear the cost of the congestion they cause. Whereas this social cost varies by time of day and location, the individual's trip price (consisting of operating costs, fuel taxes, and the occasional toll) is more uniform. Even if the price covers the costs of providing road infrastructure, which it probably doesn't in U.S. cities, it is not serving the purpose of allocating road capacity at peak hours to those who value it most.

These observations lead directly to the frequent recommendation for "congestion pricing:" a system of prices that vary by time and location, designed to reduce congestion by encouraging people to shift their travel to less socially costly means, places, or times of day. Singapore has had applied congestion pricing since 1975. London adopted an ambitious pricing system in 2003, requiring £5 (about US$8) to drive in its central area during weekdays. Singapore's tolls are collected electronically and London's through various off-site means, in both cases with enforcement by video recordings of license plates. In its first year, the London scheme appeared to have increased speeds to and in the central area by 15-20 percent and eliminated or diverted 67,500 weekday automobile trips there, with half of these shifting to public transit and another quarter diverting to less congested routes. [2]

A partial form of congestion pricing has recently been adopted in several U.S. locations. Known as "value pricing," it applies only to a set of "express lanes" that are adjacent to an unpriced roadway. This scheme has the advantage that paying the price is voluntary, but also the disadvantage that congestion is eliminated for only a fraction of travelers and is even greater for the others than would be the case if the express lanes were opened to everyone. Value pricing has been in place on State Route 91 in the Los Angeles region since late 1995 and on Interstate 15

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[1] See David Schrank and Tim Lomax, *2003 Urban Mobility Report*, available at http://mobility.tamu.edu/ums/

[2] See the Singapore Land Transport Authority website on electronic road pricing at http://www.lta.gov.sg/motoring_matters/index_motoring_erp; and the Transport for London web site on congestion charging at http://www.tfl.gov.uk/tfl/cclondon/cc_intro. For other examples around the world, see University of Minnesota's Value Pricing Homepage at http://www.hhh.umn.edu/centers/slp/projects/conpric/.

near San Diego since late 1996.[3] Proposals have emerged for a nationwide network of such express lanes to replace the present system of intermittent carpool lanes.[4]

Since examples of congestion pricing are so few, the consequences of underpricing congested highways are far-reaching. People and businesses have rearranged themselves and their activities in time and place to lessen the impacts of congestion, probably leading to more spread-out land-use patterns (although the land-use impact cannot be precisely predicted from theory). Furthermore, public authorities have responded by building more roadway capacity, including very expensive, wide expressways designed to allow high speeds, even though peak-period users cannot maintain those speeds. The result is a more spread-out urban area with bigger roads than would evolve if congestion pricing were in place.

The effectiveness of building capacity to relieve urban congestion is limited not only by its high cost, but also by the phenomenon of "latent demand" or "induced demand." Because many potential peak-hour trips are already deterred by the congestion itself, any success in reducing that congestion is partially undone by an influx of these previously latent trips from other routes, hours of the day, or travel modes. As a consequence, adding capacity may still provide considerable benefits by allowing more people to travel when and where they want to, but it will not necessarily reduce congestion. The same problem afflicts other anti-congestion policies, such as employer carpooling incentives, mass transit improvements, and land-use controls; moreover, these policies usually provide only weak incentives to change travel behavior.

Now consider mass transit, where economies of scale are critical. Researchers who have compared the costs of serving passenger trips in a given travel corridor via various modes consistently find that automobiles are most economical at low passenger densities, bus transit at medium densities, and rail transit at very high densities. (There is some disagreement about exactly where these thresholds occur, but not about their existence.) The reason for this is that, as passenger density increases, it becomes worthwhile at some point to pay one driver to serve

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[3] See the operators' web sites at http://www.91expresslanes.com/ and http://argo.sandag.org/fastrak/

[4] Poole, Robert W. Jr., and C. Kenneth Orski. "HOT Networks: A New Plan for Congestion Relief and Better Transit," Reason Public Policy Institute, Policy Study 305, Feb. 2003. Available at http://www.rppi.org/ps305.pdf

many passengers by carrying them in a single vehicle, and eventually to incur the high capital cost of building a rail line. However, many rail transit systems recently constructed in the U.S. are uneconomical because the passenger volumes they carry are too low.[5] An attractive alternative in such cases is "Bus Rapid Transit," in which local bus transit is configured to offer rail-like service quality at costs between those typical of bus and rail. Bus Rapid Transit was pioneered in Brazil and also operates on selected corridors in Ottawa, Los Angeles, Seattle, Boston, and other cities.[6]

In addition to the transit agency's costs, scale economies have another dimension—costs incurred by its users. People using mass transit first have to access a station or bus stop and wait for the vehicle to arrive. Even if they know the schedule, they have to adjust their plans to match it, which is a cost to them. The more transit lines there are in a given area and the more frequent the service, the lower is each user's cost to reach the station and wait for a vehicle to arrive. Empirical evidence reveals that people care even more about avoiding time spent walking or waiting than about time spent inside a vehicle. So these access costs are quite significant, as are the scale economies that result when increased passenger density leads to greater route coverage and/or frequency of service.

Scale economies are behind proposals to use land-use regulation to bolster transit demand by creating areas of high-density residential, commercial, or industrial development. However, many analysts are skeptical about how effective a given measure would be and whether such "transit-oriented developments" can overcome the preferences for low-density living that accompany rising income levels.

Scale economies create a *prima facie* case for transit subsidies because the social cost of handling a passenger is lowered by the favorable effects on the average cost for everyone. Another argument for transit subsidies is to overcome the inefficiently low price on peak-hour

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[5] See "The Public Purpose" web site (http://www.publicpurpose.com/) for unabashedly critical and informative evaluations of many rail projects and other topics.

[6] See the Bus Rapid Transit Policy Center website at http://www.gobrt.org/; also Aaron Golub, "Brazil's Buses: Simply Successful," *Access*, University of California Transportation Center, Berkeley, Vol. 24, 2004, available at http://www.uctc.net/access/access.asp

highway travel, if congestion pricing is deemed infeasible. Countering these arguments is the well-documented tendency of transit subsidies to be partly absorbed in higher wages to transit workers, less efficient use of employees, and excessive capital expenditures. This problem could be alleviated by giving the subsidies in the form of fare discounts rather than as grants to transit agencies. However, if subsidies are justified because of economies of scale in transit, then they would be justified for the many other industries with scale economies: it is infeasible and probably unwise to subsidize them all.

Because of scale economies in mass transit, it makes sense to focus service on those few markets with potentially high passenger density: especially suburb-to-downtown commutes and local travel in densely populated low-income areas. Unfortunately, this dictum collides with the political balance typically achieved in metropolitan-wide transit systems, where every participating jurisdiction is eager to receive some service in return for its financial contribution.

Scale economies might make a case for highway subsidies as well, but it is even less clear-cut. Scale economies exist in construction of a given highway, but somewhat less so in an entire network because the cost of intersections rises more than proportionally to their capacity. Furthermore, because highways occupy a significant fraction of scarce urban land, expanding them drives up land prices and/or requires expensive mitigation measures, offsetting any scale economies in constructing them. On balance, there is probably not a strong case for subsidizing urban highway travel.

Today, government provides most urban transportation services and facilities, but this is not necessary, nor was it historically always the norm. Privately built and financed canals, and later "turnpikes," were important in the industrialization of Britain in the 18th century and of the U.S. in the 19th century. And today, innovative private transit providers supply highly valued jitney service or specialized taxi service—sometimes illegally—in many cities around the globe, especially, but not exclusively, in the third world. Ubiquitous private taxi fleets also play an important role in urban travel, and deregulating entry would bring down taxi fares substantially.

Private enterprise is making something of a comeback in infrastructure provision. A private company is completing Paris's A86 ring road via tunnels under Versailles, financed by tolls. A similar proposal may break a 30-year impasse over completing the final link in the Long Beach Freeway near Los Angeles. London is undertaking a controversial privatization of its subway system. In 2004, Texas solicited proposals for private construction and operation of new toll roads, and Chicago sought private offers to buy its Skyway, an important segment of Interstate 90 bringing traffic into the city from the east.[7]

Evidence suggests that the private sector can carry out transportation activities more cheaply than the public sector can. Many experiments with the private sector have been motivated by huge subsidy increases or evident inefficiency of public sector operations. During the 1980s, all of Britain's urban bus services outside London were privatized and the markets opened to free entry, resulting in cost savings but also some competitive problems. In most instances, some sort of regulation is needed to offset the market power that can accompany privatization. Success depends on specifics of the situation and details of any accompanying regulatory or franchising arrangements.

Urban transportation has historically had a dramatic influence on land-use patterns. Upon the invention of horse-drawn and then electric streetcars, "streetcar suburbs" quickly arose along newly laid tracks. Following World War II, widespread construction of express highways had a similar but even stronger effect, especially in the U.S., causing development to spread more ubiquitously because automobiles relaxed the need for proximity to a transit line. These developments provided many desired amenities to residents, but also created problems. Whatever one's judgment about the wisdom of those past decisions, the longevity of buildings makes such trends virtually impossible to reverse. In particular, a dispersed land-use pattern undermines the market potential of mass transit, making it ineffective as a means to counter the automobile's dominance, even if promoting mass transit might have been a better policy in the first place.

[7] On privatization initiatives, see the periodicals *Public Works Financing* (mailto:PWFinance@aol.com), and the Reason Foundation's *Privatization Watch* (http://www.rppi.org/privwatch) – especially "Urban Toll Tunnels Solve

Urban transportation is a vital part of economic activity and responds to well-designed economic policies. Much can be accomplished to improve urban life by using our basic knowledge of economic incentives.

Tough Problems" by Robert W. Poole, Jr. (http://www.rppi.org/urbantolltunnels.html).

About the Author

Kenneth A. Small, Professor of Economics at the University of California at Irvine, specializes in urban, transportation, and environmental economics – especially highway congestion, air pollution from motor vehicles, and travel demand. Professor Small served five years as Co-Editor of the international journal, Urban Studies, and is now Associate Editor of Transportation Research B as well as on the editorial boards of four other professional journals. He received the Distinguished Member Award of the Transportation and Public Utilities Group of the American Economic Association in 1999, and the Distinguished Transportation Research Award of the Transportation Research Forum in 2004. He has served on several study committees of the National Research Council, most recently one that examined a federal program on congestion management and air quality. In 2004 he was Visiting Patterson Scholar at Northwestern University. At Irvine, he has served as Chair of Economics and Associate Dean of Social Sciences.

Further Reading

Introductory

Altshuler, Alan, and David Luberoff. *Mega-Projects: The Changing Politics of Urban Public Investment*. 2003.

Insightful description and analysis of the political changes behind the extraordinary increase in costs of large US urban infrastructure projects starting around 1970.

Arnott, Richard, and Kenneth Small. "The Economics of Traffic Congestion," *American Scientist*, 82. 1994.

Explanation of traffic paradoxes including induced demand, for a scientifically but not economically literate audience.

Downs, Anthony. *Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*. Brookings Institution, 2004.

A comprehensive look at numerous anti-congestion policies and their effectiveness, concluding largely that the only ones that are effective are politically infeasible.

Klein, Daniel B., Adrian T. Moore, and Binyam Reja. *Curb Rights: A Foundation for Free Enterprise in Urban Transit*. 1997.

Policy-oriented analysis of how the public sector can establish property rights to encourage successful private transit.

Meyer, John R., and José A. Gómez-Ibáñez. *Autos, Transit, and Cities*. 1981.

A thorough analysis of urban transportation policy for an educated lay audience.

National Research Council. *Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion.* 1994.

Full report by a study panel on congestion pricing. Volume 1 is the report, aimed at a general audience. Volume 2 is a collection of commissioned papers.

Pickrell, Don H. “Rising Deficits and the Uses of Transit Subsidies in the United States.” *Journal of Transport Economics and Policy*, 19. 1985.
Decomposes the dramatic increase in US transit deficits into its sources, finding that about three-fourths of new subsidies were absorbed in higher costs.

White, Peter. “Deregulation of Local Bus Service in Great Britain: An Introductory Review.” *Transport Reviews*, 15. 1995.
Reviews results of British bus deregulation of 1980s.

Winston, Clifford. “Government Failure in Urban Transportaion,” *Fiscal Studies*, 21. 2000.
A non-technical summary of inefficiencies in US urban transportation policy drawing on the UK privatization experiment for perspective.

Advanced

Gómez-Ibáñez, José A., William B. Tye, and Clifford Winston, eds. *Essays in Transportation Economics and Policy: A Handbook in Honor of John R. Meyer.* 1999.
Collection of essays, some technical, on analytical and issue-oriented topics. Can serve as introductory textbook.

Santos, Georgina, ed., *Road Pricing: Theory and Evidence*. 2004.
Collection of scholarly articles about congestion pricing and related topics.

Small, Kenneth A., *Urban Transportation Economics*. 1992, second edition forthcoming 2005.
Advanced textbook and reference book.

Small, Kenneth A., and José A. Gómez-Ibáñez. "Urban Transportation," in *Handbook of Regional and Urban Economics, Vol. 3*, ed. by Paul Cheshire and Edwin S. Mills, 1999.
Survey of selected topics, aimed at professional economists.

Winston, Clifford, and Chad Shirley. *Alternate Route: Toward Efficient Urban Transportation*. 1998.
Analysis of mass transit policy in the US, with emphasis on quantifying the inefficiencies of transit and highway investment and pricing in the US.