Incorporating Congestion Pricing Into Highway Project Development

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Financial and environmental constraints are limiting the ability of metropolitan areas to address mobility needs with highway expansion alone. To accommodate growth in population and travel, many transportation agencies are incorporating conventional travel demand management strategies into their project alternatives. These include measures such as better transit services, HOV lanes, park-and-ride services, flextime and telecommuting. However, one travel demand management strategy that has not been given sufficient consideration in planning and project development processes is congestion pricing. This may be (in part) because of two common misunderstandings about the role and impact of congestion pricing. This paper discusses these two misunderstandings or "myths" and seeks to dispel the two myths. Thereby, we hope to achieve greater consideration by planners in including congestion pricing among highway project alternatives that seek to address congestion on freeway facilities.

Myth 1: Conventional Travel Demand Management is Sufficient

The first myth is that conventional travel demand management strategies that seek to attract commuters to other modes and times of travel or to telecommuting can be successful by themselves. Planners often propose such travel demand management measures a means to reduce peak period traffic demand.

There are two problems with this approach. First, the number and share of trips not involving work (i.e., trips that do not include a work purpose in the "tour") during the morning peak period has now reached almost 50%, and exceeds 75% in the afternoon peak period (FHWA 2007). Thus, conventional travel demand management strategies oriented towards work travel will have a smaller impact in the future. Another fact is that when some former drivers are taken off the road, the resulting faster traffic flow is noticed by others who were previously dissuaded from driving during peak times *because* of the delays. As a result, congestion returns – it will not be as severe as before, but will be sufficient to significantly reduce the cost-effectiveness of public expenditures on conventional travel demand management incentives.

Conventional travel demand management strategies may be termed "pull" strategies, because they attempt to reduce demand by *attracting* commuters to better transit services, HOV lanes, park-and-ride lots, etc. They will be minimally effective without a "push" strategy, i.e., one which *dissuades* commuters from highway use and keeps other motorists from taking the place of those attracted to other modes or times of travel. A "push" strategy might involve introducing a variable rush hour toll on the freeway corridor being subjected to new travel demand

[1] Disclaimer: The views expressed are those of the author and not necessarily those of the U.S. Department of Transportation or the Federal Highway Administration. This paper was prepared for presentation at the Transportation Research Board's Transportation Planning Applications Conference in May 2007 in Daytona Beach, FL

management incentives. The higher user charges would act as a *disincentive* to dissuade drivers from using the freeway at the same time that "pull" strategies attract them to other alternatives.

The toll price will need to be high enough that the total user-borne cost to drive on a priced highway (i.e., time cost plus money cost) will not be lower than the user-borne cost to drive prior to introduction of demand management strategies and pricing (i.e., time cost only). If the perceived user-borne cost were lower after implementing pricing, the inducement to drive could increase, endangering the free flow of traffic. To counter this effect, increased inducements would then need to be provided for other modes to compete effectively with driving (e.g., transit fare reductions).

Myth 2: Traffic Diversion as a Result of Freeway Pricing Will Increase Arterial Congestion

The second myth is that introducing new tolls to manage demand on an existing severely congested freeway will result in an increase in traffic and congestion on parallel arterials.

With peak-period highway pricing, a variable toll dissuades some motorists from using limited access highways (generally freeways) at critical locations where traffic demand is high, and where surges in demand may push traffic volumes on the highway over the threshold at which traffic flow collapses. Pricing prevents a breakdown of traffic flow in the first instance, and thus maintains a high level of vehicle speed and throughput throughout the rush hours. Collapse of traffic flow from overcrowding is avoided. Not only are *more* motorists able get to their destinations during each hour -- they also get there *faster*. Each priced lane in the median of State Route 91 in Orange County, California (on which traffic flow is managed using variable tolls) carries twice as many vehicles per lane as the adjacent toll-free lanes during the hour with heaviest traffic (US Department of Transportation 2005). Management of traffic flow through pricing has allowed twice as many vehicles to be served per lane at three to four times the speed on the free lanes.

If pricing increases the vehicle throughput in the corridor, traffic will be drawn to the freeway from parallel arterials, actually reducing traffic and congestion on arterials. It might appear counter-intuitive that imposing a new toll on a currently free road can actually reduce traffic on parallel facilities. Figure 1 and Table 1 attempt to demonstrate how this may happen.

Figure 1 shows the magnitude of the waste of time and vehicle capacity that occurs when traffic flow breaks down on the four eastbound lanes of I-66 outside the Capital Beltway in Northern Virginia, inbound towards Washington DC. Traffic flows freely up to 7 am. In the one hour period between 6 and 7 am, 8,000 vehicles are carried at an average speed of 55 mph. Traffic flow breaks down between 7 and 8 am, with speeds dropping to 30 mph and vehicle throughput dropping to 7,000 vehicles. From 8 to 9 am, throughput drops further to 6,000 vehicles, and average speed drops further to 25 mph. The reduced flow of 6,000 vehicles per hour continues between 9 am and 10 am, with speed increasing slightly to 30 mph.

FIGURE 1. TRAFFIC VOLUMES AND SPEEDS ON I-66 EASTBOUND IN NORTHERN VIRGINIA (FOUR LANES, MORNING PEAK PERIOD)

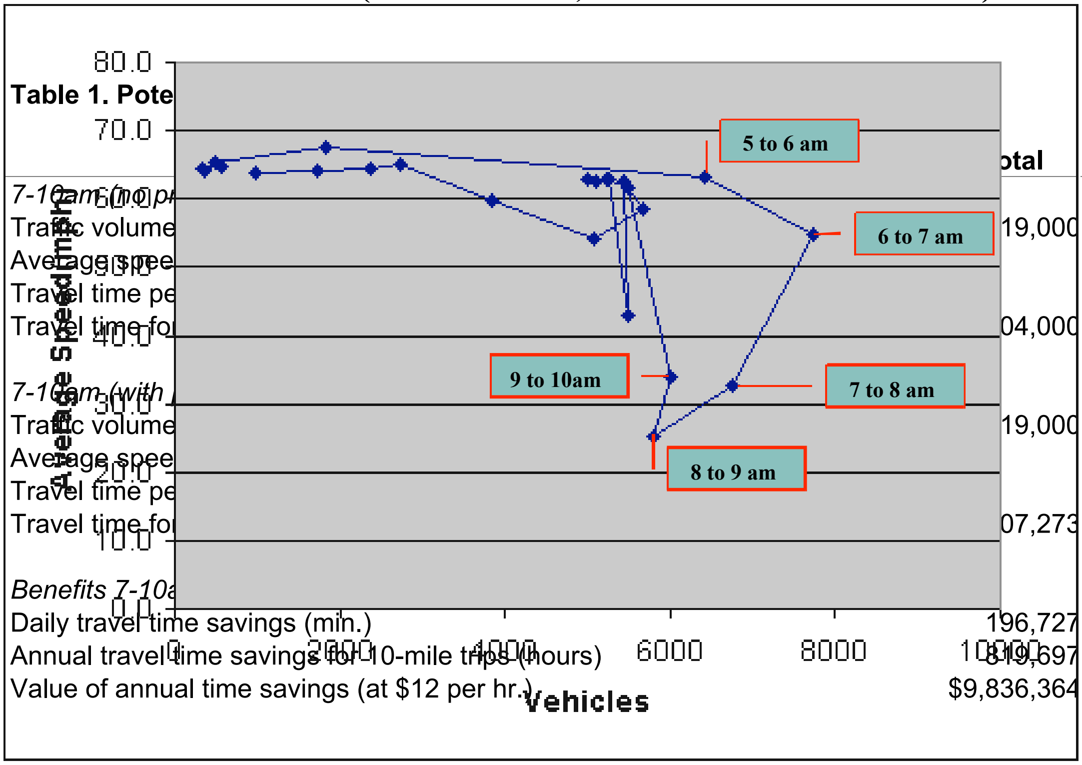

Table 1. Potential Impacts of Congestion Pricing on I-66 Eastbound

	7-8am	8-9am	9-10am	Total
7-10am (no pricing)				
Traffic volume	7,000	6,000	6,000	19,000
Average speed (mph)	30	25	30	
Travel time per mile (min.)	14,000	14,400	12,000	
Travel time for 10-mile trips (min.)	140,000	144,000	120,000	404,000
7-10am (with pricing)				
Traffic volume	8,000	8,000	3,000	19,000
Average speed (mph)	55	55	55	
Travel time per mile (min.)	8,727	8,727	3,273	
Travel time for 10-mile trips (min.)	87,273	87,273	32,727	207,273
Benefits 7-10am (with pricing)				
Daily travel time savings (min.)				196,727
Annual travel time savings for 10-mile trips (hours)				819,697
Value of annual time savings (at $12 per hr.)				$9,836,364

Table 1 provides estimates of time wasted, and the potential value of time savings on the freeway if free flow of traffic could be maintained. As much as $10 million annually could be saved on the 10-mile eastbound freeway segment with good traffic flow management in the morning peak period. What Table 1 also shows is that, after accommodating the 19,000 existing users of the eastbound freeway who travel during the 7 am to 10 am period, there will be spare capacity of up to 5,000 vehicles available for use from 9 am to 10 am. This available capacity will draw drivers from alternative routes and from other times of the day, i.e., those who currently try to avoid congestion on the freeway. Thus, pricing the freeway to maximize throughput will reduce traffic levels on alternative routes and at other times of the day.

It is true that when toll rates are raised on existing tollways, some drivers divert to toll-free arterials or surface streets to avoid paying the higher tolls. However, unlike conventional tollways, priced highways provide many more travel options. First, variable tolls would provide options to motorists to reduce or eliminate their costs for new tolls by shifting their time of travel. Second, introduction of variable tolls during congested periods would be accompanied by high-quality transit services and expanded availability of enhanced carpool and vanpool options on free-flowing freeways which would in effect behave like “virtual” networks of HOV lanes (i.e., all lanes would be HOV), so that some solo drivers would shift to using transit, vanpools or carpools, rather than diverting to parallel toll-free roadways. Third, low-income travelers could be provided with toll discounts or toll credits. Thus, there would be no incentive for them to divert from the freeway. Finally, if toll revenues are used to pay for optimizing traffic signal controls on parallel arterials (in cases where they may not currently be optimized), this could help to further improve traffic flow on them.

Conclusions

Planners seeking solutions to congestion are well-advised to consider incorporating pricing into the mix of demand management strategies if they desire to maximize cost-effectiveness of public investments. And they need not be concerned about causing increased congestion on parallel arterials (as traffic assignment models might suggest) because demand-responsive tolls will prevent freeway traffic flow breakdowns, and increase vehicle throughput on the freeway, drawing traffic away from other congested routes.

REFERENCES

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