Brave New World: The Role of TDM in Congestion Management
“Honey, when do we need to leave?” Carol asked anxiously. This was an exciting night for her and her husband, Bill. Not only were they going to a movie they both desperately wanted to see, but they also had a babysitter for the first time since the children were born. They had decided to see the 8:00 pm showing. But, they couldn’t be late — not with the movie regularly selling out.

“We need to leave by 6:45 in order to arrive on time,” Bill replied.

Carol must have heard wrong. “Bill, it’s only 10 miles away. It doesn’t take over an hour!”

Bill ran the numbers through his head again. Let’s see, it’s a 20 minute trip in the middle of the day, but it can be almost twice that with just normal evening congestion. And, we can’t miss this show, so we have to plan for the worst — in case there’s an accident or something. “Carol, I’m pretty sure we need to leave by 6:45 if we don’t want to miss it. I’m sorry — there won’t be time for dinner. I guess it’s just popcorn tonight. Happy anniversary, though!”

This scene plays out countless times across countless cities each day of the year. As is well documented by every traffic report on the FM dial, travel time varies for the same trip on a day-to-day basis. Breakdowns, construction, weather, sporting events, and just day-to-day flow variations means that the “normal” travel time is anything but normal. Planning for irregularity is key to reliably arriving at important destinations on time.

As is demonstrated in the Texas Transportation Institute’s 2007 Urban Mobility Report, the difference between the “average” congested travel time and “worst average monthly” travel time is huge. Furthermore, this does not even account for the difference between uncongested travel time and congested travel time for any
given segment of highway in the United States. Figure 1 illustrates this issue with three key “lines” for the sample highway trip:

1. The uncongested travel time, reflected by the flat component of the average time plot. If highway capacity met highway demand at all times, this would be the traveler’s anticipated travel time.
2. The normal congested travel time, shown by the peaks of the average time plot. On any given day in the month, this would be the normal “congested” experience – a few minutes of delay here and there, with predictability and regularity.
3. The worst day travel time, shown by the worst day of the month plot. As mentioned, events can cause additional travel time delays to travelers on any given day of any month. However, unlike normal congestion, these events are unpredictable and irregular.

Unreliability is a key component of the congestion problem. If your arrival time is important for your trip – as in the case of Bill and Carol – then you must allow extra time to ensure that trip is not impeded by events that cause severe congestion. As reliability problems and congestion occur at the same time, so much extra time must be planned for these trips beyond that which simply normal congestion would require.

**Managed Lanes: Solving the Reliability Problem**

Managed lanes have evolved to address the reliability problem.

Initially conceived as the allowance of previously prohibited vehicles to high occupancy vehicle (HOV) lanes in exchange for the payment of a fee, otherwise known as high occupancy / toll (HOT) lanes, managed lanes have expanded in scope to include a variety of implementations, without any inherent policy regarding HOVs. Of particular interest are managed lanes that collect a toll for use of the facility. Originally developed under one of two applications — HOT lanes or express toll lanes (ETL) — managed lanes are studied and implemented with many operational variants. The broad definition of managed lanes not only includes these variants, but any application that involves system-management techniques such as time-of-day restrictions, vehicle-type restrictions, and congestion pricing. In addition to HOT lanes and ETL facilities, common types of managed lanes in the United States are HOV lanes, truck-designated lanes, and limited-access express lanes.

In many ways, managed lanes are selling an uncongested trip in the HOV facility against the possibility of severe congestion in adjacent general purpose lanes. The expectation, in return for accepting inconvenience (through picking up and dropping off carpoolers) or cost (through tolls) associated with the trip, is that the use of the HOV lane will provide some travel-time savings and, more importantly, insurance against severe congestion. As a result, carpooling rates have increased significantly within managed lane corridors (over 100 percent) even as carpool rates nationwide have declined (30 percent) during the past two decades (Bureau of Transportation Statistics, 2005). However, the very same severe congestion in the general purpose lanes that managed lanes insure against has tended to cause animosity on the part of the general public toward HOV lanes if they are underutilized. As a means of mitigating the “empty lane syndrome,” HOT lanes have been promoted as an effective way of utilizing the excess capacity without compromising the travel time reliability and insurance of the managed lanes.

In addition to HOT lanes, which include explicit benefits for carpoolers, ETL concepts have also been promoted as a means of enhancing mobility within congested corridors and regions. First implemented in Orange County, CA, as the privately built and operated State Route 91 (SR-91) express toll corridor, ETL facilities provide the same benefits of HOT lanes (exclusive right-of-way with congestion-free trips along the length of the corridor), but they do not carry the same implied benefit to carpoolers and vanpoolers. The SR-91 express toll facility has, at times, provided free use by three-people-or-more (HOV-3+) users, but has also at other times required partial toll payment by these users in the past nine years of operations.

Altogether, contemporary managed lanes have shown themselves to be a reliable congestion-free alternative, providing travelers a means of escaping severe congestion and reducing the extra time required to plan for important trips.

**Moving Forward with Managed Lanes**

In January 2008, the National Surface Transportation Policy and Revenue Commission clearly stated the case for using pricing as a tool for managing demand: “The Commission believes the National Interest in quality transportation is best served when transportation systems are appropriately priced. To avoid imbalances between the transportation capacity available at any particular time and the demand for it, pricing can help provide a guide for the most efficient use of scarce investment dollars.” Furthermore, the Commission established a very specific recommendation for the future of transportation investment in the United States: “In brief, the new user-financed Federal surface transportation program the Commission proposes will be performance-driven, outcome-based, generally mode-neutral, and refocused to pursue activities of genuine national interest”
Priced managed lanes are no longer simply an experiment to utilize excess capacity in HOV lanes; they are now a primary mechanism to achieve the Commission’s goal for transportation infrastructure. Managed lanes are only successful when they perform to users’ expectations, otherwise the convenience and cost penalties would be insufficiently rewarded with travel time savings and reliability. At their core functionality, then, managed lanes are “performance-driven” and “outcome-based”.

What is left undetermined in the assessment of managed lanes is the “mode-neutral” objective for infrastructure. The Commission emphasizes the need to balance the transportation system, with greater attention to multiple modes of travel — both for passengers and freight. As the functional limit of managed lanes are capped at the maximum volume per hour while still ensuring free-flow speeds (generally around 1,600 vehicles per hour), the ability to serve growing populations and economic transactions requires attention to not only vehicular demand management, but also person demand management. Higher person throughput can extend the effectiveness of the managed lane facility, thereby yielding a better return on investment and greater life-cycle performance of the system. This can only be achieved by positively affecting the balance of modes towards high-occupancy vehicles, particularly multi-person carpools, vanpools, and transit.

Despite these benefits, person throughput may not be the dominant concern for transportation agencies as they consider implementing managed lanes. As metropolitan regions and states consider adding new roadway capacity, managed lanes have become an attractive alternative due to their revenue generation potential. What tends to be lost in the dollars-and-cents is the value of actively managing demand and use of capacity within corridors. Increasingly, ETL concepts are more attractive than HOT lanes for those transportation agencies seeking enhanced sources of revenue and ease of enforcement. Many planners presume that the provision of access to carpools is detrimental to the generation of sufficient revenue to pay for the construction of the facility. In many ways, this presumption reflects the low rates of revenue generation on existing HOT lane facilities, such as I-15 (San Diego), I-25 (Denver), and I-394 (Minneapolis), all generating less than a few million dollars per year.

In short, the operational value of high-occupancy vehicle benefits on managed lanes may be artificially constrained by revenue generation. This computation does not account for the total net economic benefit to the region by providing for greater person throughput. As an illustration, the 2007 Urban Mobility Report isolated the cost-of-congestion reduction in those corridors with HOV or HOT lanes. The study found managed lanes corridors yielded an annual delay reduction of 33 million hours, totaling $620 million / year in cost savings across 15 metropolitan regions. This increase in economic productivity is independent of toll payments and is the result of focusing upon person throughput in managed lanes. As the HOV and HOT lanes carried one-third of the peak-direction passenger load, it also provided consistent high speeds and low travel times.
Managed Lanes – TDM Style

TDM practitioners hold the key to ensuring managed lanes are implemented with the full intent of mode-neutrality. The more successful the industry is in deploying carpools, vanpools, and buses in these facilities, the greater the person throughput and return-on-investment.

TDM professionals should be as creative as the industry they work within, considering multiple ways to “pay for” HOV benefits in priced managed lanes. If planners and engineers see HOV’s as “give-away trips” unworthy of benefit in managed lanes, TDM professionals can point to economic productivity gains and return-on-investment. If the cost of providing benefits makes the development of a project financially unviable, the TDM professional can look to alternative financing mechanisms to buy-down the cost of HOV benefits. These mechanisms could include tax increment financing for those areas positively affected by congestion reduction, special assessment districts wherein employees’ commutes become reliable and timely, or reallocated financial incentives from established programs for encouraging ridesharing. In short, the TDM professional should not simply let prejudgment determine how managed lanes are implemented in their communities.

As managed lanes gather increasing steam throughout the U.S., TDM professionals will become the enablers of the performance-driven, outcome-based, and mode-neutral transportation infrastructure that is envisioned. Only through TDM can managed lanes continue to provide reliable free-flow travel in growing communities into the future.

Carol experienced a sense of déjà vu. “Bill, it’s only a few miles away. It doesn’t take 45 minutes!”

Bill ran the numbers through his head again. Let’s see, it’s a 15 minute trip in the middle of the day, but it can be almost twice that with just normal evening congestion… Bill stopped his train of thought. He had almost forgotten about that new lane on I-28 that had opened a few months ago. Bill recalculated. *We pay the toll of $2.50, and get there with an hour to spare. That allows us to grab a quick dinner at Chateau Covoiturage.*

“Carol, you’re right. We’ll just use the Fast Lanes. How does Coq au Vin sound to you? Oh, and, happy anniversary!”

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