"Feasibility of a Metropolitan Truck-only Toll Lane Network: The Case of Atlanta, Georgia"

by

Michael D. Meyer, P.E.
Professor and Director, Georgia Transportation Institute
Georgia Institute of Technology

Abstract

The movement of commercial vehicles through already congested metropolitan freeway networks is an important policy challenge today for transportation officials, and will become even more important in the future. This paper reports on a study of truck-only toll (TOT) lanes that was conducted in the Atlanta metropolitan region. This study focused on a regional network of TOT lanes with varying levels of pricing strategies and vehicle eligibility criteria applied in the analysis. The paper describes the overall planning approach for the study, the analysis that was conducted to determine which corridors were feasible for TOT application, and the different strategies that were investigated. In addition, this paper examines the relative effectiveness of managed lane strategies—high occupancy vehicle (HOV) lanes, high occupancy toll (HOT) lanes, and TOT lanes. The paper concludes that the TOT lane strategy is the most effective from a road management perspective. Importantly, the paper examines the institutional dynamics of both the public and private sector participants in this process, and their different responses to the study results. The TOT study produced estimates of the productivity benefits to the trucking industry as well as congestion reduction benefits to other users of the freeway network. The benefits were significant in the context of what other transportation strategies would likely produce.

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INTRODUCTION

The movement of freight within and through metropolitan areas is likely to be one of the most important and daunting challenges facing transportation officials over the next several decades. In the case of Atlanta, Georgia, the level of freight movement internal to the metropolitan area is likely to increase dramatically in the next 25 years due to expected increases in metropolitan population and employment. In addition, the metropolitan area's location along a major north-south freight corridor (to and from Florida), as well as it being a logistics center serving international freight movement through the Ports of Savannah and Brunswick on the Georgia coast, will likely result in significant increases in freight movement through the region as well. With congestion on the region's road network already considered some of the worst in the nation, how to handle additional truck movements is considered by the region's transportation agencies as one of the metropolitan area's most significant planning and policy challenges.

This paper describes the process followed in assessing the feasibility of a regional network of truck-only toll lanes in the Atlanta metropolitan area. In particular, the analysis approach and modeling tools are highlighted, as are the institutional issues associated with implementing a concept that is considered very much outside the planning norm for the region. In addition, the paper assesses the relative effectiveness of three managed lane strategies—high occupancy vehicle (HOV) lanes, high occupancy toll (HOT) lanes, and truck-only toll (TOT) lanes. The final section presents lessons

learned from the Atlanta experience that could be applied in other metropolitan areas in the U.S.

THE ATLANTA CONTEXT

The Atlanta metropolitan area has been one of the fastest growing metropolitan areas in the U.S. over the past two decades, and this growth is expected to continue in the foreseeable future. Compared to 2005, an additional 2.5 million people and 1.3 million more jobs are expected in the Atlanta region by 2030 (ARC, 2004). Due primarily to this substantial growth, the regional transportation plan (called *Mobility 2030*) predicts a 41% increase in vehicle miles traveled (VMT), a 52% increase in vehicle hours traveled (VHT), and a 10% decrease in regional average speed (with average speeds in congested corridors declining even further). *Mobility 2030* also predicts that commercial vehicle trips per weekday will grow 50% by 2030. For both major highways and arterial roads, congestion is expected to increase significantly. Given that just under 93% of the freight movement in Atlanta occurs via trucks, this increase in congestion will have a significant effect on freight movement within and through the region. As the major logistics and warehousing center in the southeastern U.S., as well as a major nexus of interstate highways (thus attracting significant numbers of through trips), the Atlanta region is a prime candidate for considering innovative strategies for managing truck flows (Metro Chamber, 2005).

Given the transportation challenges facing Atlanta, it is not surprising that many studies have been undertaken to identify possible strategies for improving mobility in the region. The Georgia Department of Transportation (GDOT) prepared a regional high occupancy vehicle (HOV) plan in 2003 that identified HOV projects in the Atlanta region

over the next 20 years (GDOT, 2003). In addition, GDOT conducted a study in 2002 that examined different strategies for improving truck flows on the major interstates in the region (GDOT, 2002). Perhaps the most important plan is *Mobility 2030,* which represents over $54 billion in investment in the region's transportation system, with much of this investment going to implement GDOT's HOV system. And yet, with all of the planned projects in the region's plan, levels of congestion on the region's freeway system are expected to worsen. Figure 1 shows expected levels of congestion in the region's general purpose lanes in the year 2030 during the afternoon peak hour. Many corridors are approaching capacity, whereas others have already reached this level.

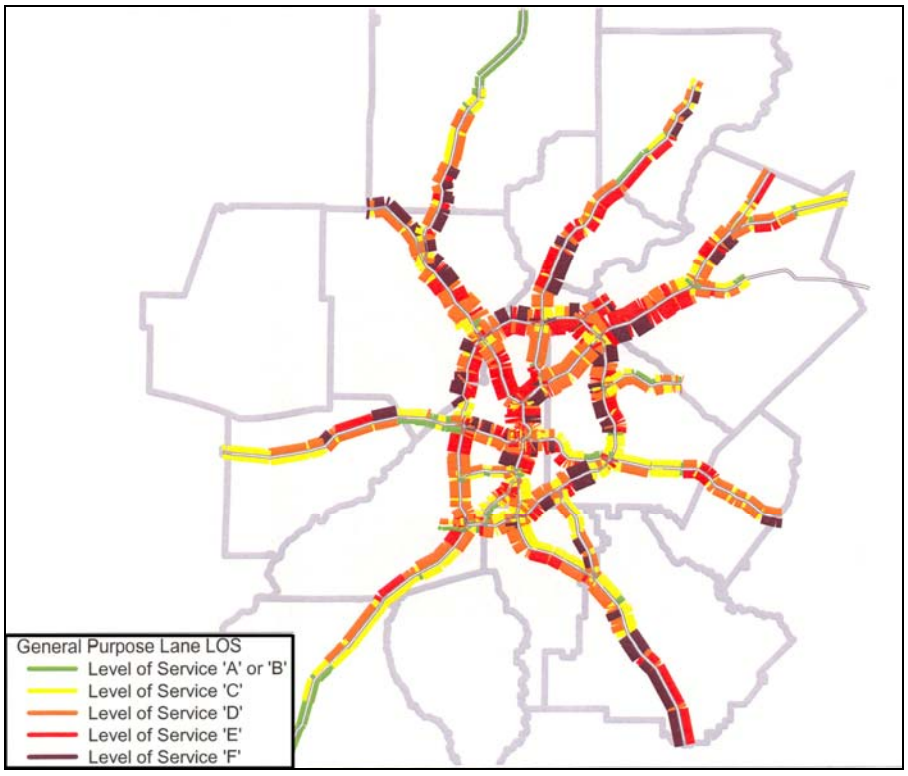


FIGURE 1: "The Challenge"-- General purpose lane level of service, 2030 PM peak hour

The challenge represented in Figure 1 raises the question of whether there is another strategy for enhancing mobility that should be given some attention, a strategy that best utilizes the limited amount of available road capacity. Two such strategies were investigated starting in 2004 when the Georgia State Road and Tollway Authority (SRTA) initiated a two phase study that examined the feasibility of high occupancy toll (HOT) lanes and truck-only toll (TOT) lanes in the Atlanta region (SRTA, 2005a,b). This study was the first of its kind in Atlanta and has resulted in major steps being taken to implement truck-only facilities in the region. The following sections will describe the planning efforts for the TOT lane phase of the study.

THE ATLANTA TOT LANE STUDY

The SRTA study on TOT lanes was viewed as a "proof-of-concept" study. Although network modeling was conducted as part of this effort, this modeling was at a regional level and was not considered specific enough to be used for investment grade decisions. However, the network modeling was sufficient to estimate the expected commercial vehicle flows on the TOT lanes as well as the resulting impact on freeway congestion.

A study steering committee consisting of representatives from transportation agencies and from the Georgia trucking industry was established to guide this study. As one of its first acts, the steering committee identified the following potential benefits of TOT lanes.

Enhance transportation options. Shippers and service providers will have the option of traveling more reliable routes in the Atlanta region, especially during peak periods.

Improve safety and efficiency in the road corridor. By encouraging commercial vehicles to use the TOT lanes, the mix of vehicles remaining in the freeway general purpose lanes becomes more uniform. Thus, not as many trucks and personal

vehicles will be sharing the same roadway as previously. This should improve the efficiency of travel on the road, as well as reduce the risk of truck/automobile crashes.

Improve freight productivity. The efficiency of freight movement in and around major metropolitan areas will likely be even more of a concern to the business community in the future. In addition, for logistics centers like Atlanta, freight mobility and productivity could become an important factor in the competitiveness of Atlanta versus other comparable regions. TOT lanes can greatly improve commercial vehicle productivity by saving travel time and increasing trip reliability.

Manage congestion levels for truck travel and improve general purpose highway congestion. By imposing fees when demand levels reach capacity on TOT facilities, the level of congestion on TOT facilities is controlled. If a large number of trucks are removed from the general purpose lanes and the local road network, congestion levels might be reduced for other traffic as well.

Generate revenue for TOT lane operation. Tolls can provide an additional source of revenue to pay for transportation improvements, especially for the operations and maintenance of the TOT lanes themselves.

Given that the TOT study was undertaken at the proof-of-concept level, several assumptions had to be made concerning TOT lane operations, including:

- Lanes would be operated 24 hours daily, seven days per week; commercial vehicle use of the TOT lanes would be entirely optional.
- A variable fee structure would be used in which the fee changes to reflect different levels of congestion in the TOT lane; no minimum fee rate is assumed, however there is a maximum fee rate. No fees would be charged from 7 p.m. to 6 a.m.

- Heavy duty vehicle fee rates, where imposed, are twice that of light duty vehicle fee rates. Qualified transit vehicles can use TOT lanes for free. TOT lane level of service 'D' was the target performance level for establishing a fee rate structure.

- Research findings of freight operators' value of time (Smalkowski, 2003; Kawamura, 1999) and recommendations from the steering committee led to a value of time of $18 per hour for light duty commercial vehicles and $35 per hour for heavy duty commercial vehicles. Considerable discussion surrounded these values, and although they appear low compared to other studies, these were selected by the study's steering committee.

- A current restriction (except by permit) of heavy duty truck movements inside of I-285, a circumferential freeway around the center city remains.

- Access to TOT lanes occurs at exclusive interchanges, which were identified in the GDOT HOV plan. No intermediate access is provided except at freeway system-to-system interchanges.

- The Georgia DOT's typical cross section for managed lanes recommended in the HOV Plan is assumed for all new managed lane projects in the study network. This cross section allows the phasing of managed lane configuration, starting with one lane in each direction, but possibly adding two or three more in each direction, if warranted. For analysis, two barrier-separated TOT lanes were assumed in each direction (where applicable) outside of and on I-285.

Three alternative TOT strategies were defined from existing truck flow data in the region. Although the three TOT strategies did not represent the entire range of possible

strategies, they did represent an adequate point of departure for investigating whether the TOT lane concept merited further investigation.

Each of three TOT strategies was analyzed for the 2030 horizon year, the same horizon year for *Mobility 2030*. The reference alternative was the *Mobility 2030* network strategy, which included HOV lanes that allowed vehicles with two or more occupants to use the region's managed lane network without paying a fee. The three 2030 TOT strategies were:

Strategy 1: Major Truck Corridors: Strategy 1 is intended to serve primarily through truck trips. Initial analysis of truck travel patterns and steering committee input suggested that the corridors indicated as TOT lanes in Figure 2 serve such trips in the region. Two TOT lanes are added in each direction in each of the indicated freeway corridors (I-75 north and south of I-285, I-85 north of I-285, and on I-285 west between I-85N and I-75S). This strategy results in 472 TOT lane miles being added to the region's freeway network.

Strategy 2: Service to Commercial Deliveries: This strategy assumes that the primary purpose of HOV lanes is to encourage carpools during the commute trip at peak travel times and that these lanes could be made available for other purposes during off peak times. Thus, during the midday period (from 10 a.m. until 3 p.m.), current HOV lanes inside of I-285 will operate as TOT lanes for light-duty commercial vehicle use only (see Figure 3). TOT lanes will still be provided in the corridors identified in Strategy 1. This represents 134 lane miles of TOT lanes inside of I-285 and 472 TOT lane-miles outside of I-285.

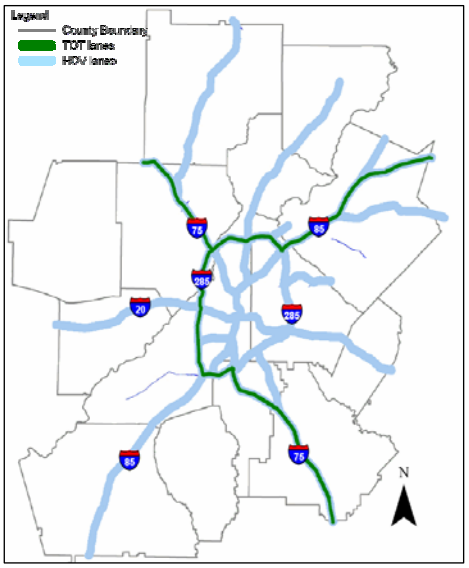


FIGURE 2: Strategy 1: Major truck routes

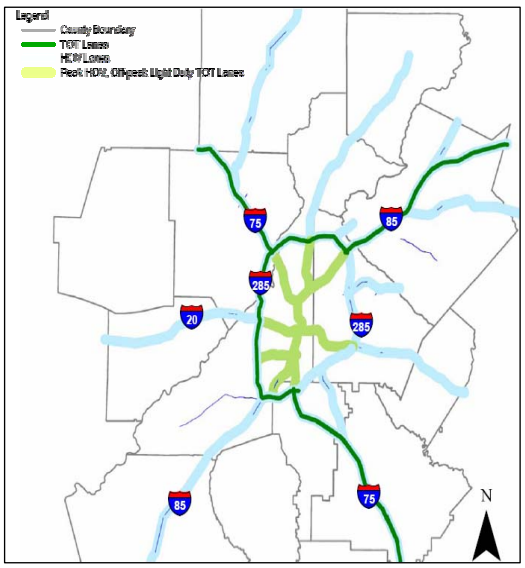


FIGURE 3: Strategy 2: Preference to goods delivery during midday

Strategy 3: TOT Regional Network Replacing HOV Lanes: Strategy 3 provides an opportunity to assess the performance of a network of TOT lanes outside of and on I-285 relative to a network of HOV lanes in the reference alternative. All existing and proposed HOV lanes on or outside of I-285 are turned into TOT lanes with 2 lanes in each direction (see Figure 4). The HOV network still operates on all limited access facilities inside of I-285 with one HOV lane in each direction as currently exists. This strategy results in 1,307 TOT lane miles added to the network.

TECHNICAL ANALYSIS

Four managed lane networks were coded for the limited access road network in the 10-county region, one for each of the TOT strategies described above, and one for the HOV network in the *Mobility 2030* plan. The travel demand model used in developing *Mobility 2030* was used for all analysis runs. Adjustments were made to the commercial

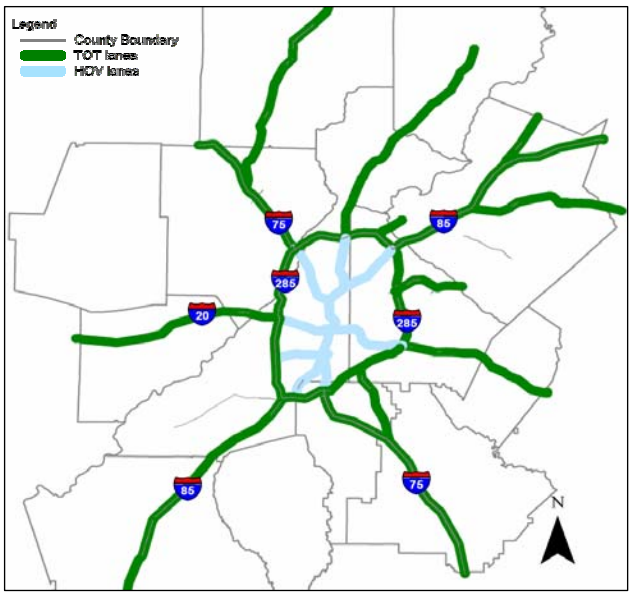


FIGURE 3: Strategy 3--Regional TOT network using HOV lanes

vehicle trip table by assuming percentages of light and heavy duty vehicles (based on data collection) and by refining time-of-day distribution of commercial vehicle trips as determined through vehicle classification counts.

Per mile fee rates were assigned to the TOT lanes, and a commercial vehicle assignment was run with the model. As noted above, a level of service D was the target lane performance. If too many commercial vehicles were assigned to a TOT network link such that the level of service was less than D, the fee rate was increased and another model assignment was run with the increased trip costs. This approach was followed for all TOT lanes in the freeway network until a level of service D was obtained.

Five performance measures were used to determine the relative effectiveness of the alternative TOT strategies: 1) illustrative trip time savings for TOT lane users, 2) vehicle hours traveled in the region, 3) vehicle miles traveled in the region, 4) impact on congestion in the general purpose lanes of limited access highways, and 5) impact on the

region's local road network. Measures were developed at the system and trip-specific level in order to assess potential TOT lane benefits as well as the impacts on freeway general purpose and HOV lane operations.

Trip Time Savings for Trucks in the TOT Lanes – The primary purpose of the TOT lanes is to provide reliable (and hopefully faster) trip times through the Atlanta region. Given the design of the TOT network, not surprisingly, travel time savings did occur. In 2030, compared to commercial vehicle trips traveling on the general purpose lanes, through trips in the TOT lanes are expected to save from 51 to 80 minutes during the PM peak from one end of the region to the other.

Vehicle Miles Traveled and Vehicle Hours Traveled - Vehicle miles traveled (VMT) during the weekday is an indication of the utilization of highway facilities. In the Atlanta region, in particular, VMT is also an important input into air quality analysis; potential policies that increase regional VMT threaten the attainment of air quality standards. VMT increased slightly (0.2%) with Strategies 1 and 2, and decreased slightly (-0.06%) with Strategy 3, both in comparison to the reference alternative. However, all three TOT strategies resulted in lower VHT traveled on the network, with these reductions ranging from 6.5% for Strategies 1 and 2 to 4.8% for Strategy 3.

Weekday Performance of General Purpose Lanes - The impact of TOT lanes on adjacent freeway general purpose lanes is one of the important questions that will likely arise in any discussion on the feasibility of the TOT lane concept. Given the level of congestion expected on the Atlanta freeway network as indicated in Figure 1, this issue is of particular interest in Atlanta. The portion of the freeway general purpose lanes operating under free flow conditions increases from 40% to 46% and 48% for Strategies

1 and 3, respectively, while the portion of congested general purpose lanes decreases from 29% to 22% and 24%, respectively (see Table 1). These conditions represent a 17% to 24% reduction in congested general purpose directional miles under the TOT strategies. Strategy 1 (which is the same as Strategy 2 during the PM period) includes additional highway capacity for TOT use, therefore the improved general purpose lane performance is not surprising. However, the improved freeway general purpose lane performance under Strategy 3 indicates that using the region's current and proposed HOV lanes for truck operation may be more productive in terms of congestion reduction than the currently planned use.

One of the expected benefits from the separation of trucks and personal vehicles will be the decrease in truck/auto crashes and the corresponding reduction in incident-related delay. It was very difficult determining the reduction in such crashes given the different TOT strategies. According to data from the New Jersey Turnpike Authority for the period from 1994-2003, "in each of the ten years, the crash rate on the dual-dual roadways was 28%-40% less than on the segments of the Turnpike without separated roadways" (Federal Motor Carrier Safety Association, 2002). That is, where trucks are required to use a parallel roadway (which also allows auto traffic), there is a much lower crash rate than where trucks operate in the general purpose lanes. This result was used as an indication of potential safety benefits associated with the TOT lanes in Atlanta.

Weekday Performance of Arterials and Collectors - The impacts on the region's local road networks are also an important consideration in assessing the impact of TOT facilities. Table 2 shows the regional performance of arterials and collectors under the reference alternative and the TOT strategies. As shown, minor improvements in the

TABLE 1: Impact of TOT Lanes on Freeway General Purpose Lanes

Travel Conditions on General Purpose (GP) Lanes during the PM Peak Hour			
2030 TOT Strategy	**Percent GP Lanes Operating at Given Condition**		
	Free Flow	**Near Capacity**	**At Capacity / Congested**
HOV 2+ Reference General Purpose Lanes	40%	31%	29%
Strategies 1 and 2: Major Truck TOT Corridors	46%	32%	22%
Strategy 3: Regional TOT Network	48%	28%	24%

Percentages are calculated by dividing the distance operating under specific levels of service by the total regional general purpose directional facility mileage. Free flow denotes levels of service 'A'-'C'. Near Capacity denotes level of service 'D'. At capacity/congested denotes levels of service 'E'-'F'.

TABLE 2: Travel Conditions on Arterials and Collectors During PM Peak Hour

2030 TOT Strategy	Percent Arterials and Collectors Operating at Given Condition		
	Free Flow	**Near Capacity**	**At Capacity / Congested**
HOV 2+ Reference General Purpose Lanes	66%	16%	18%
Strategies 1 and 2: Major Truck TOT Corridors	69%	16%	15%
Strategy 3: Regional TOT Network	68%	16%	16%

performance of such roads may result from implementation of TOT lanes. Strategies 1 and 2, which include additional miles of TOT lanes, have slightly better impacts on the local road network than Strategy 3, which converts proposed HOV lanes into TOT operation. The change in afternoon peak "at capacity/congested" miles represents a 10-15% reduction in congested miles on arterials and collectors under the TOT concepts.

Potential Revenues - While revenue generation was not considered a primary goal of the TOT managed lanes, charging a fee for TOT lane use is necessary to manage the operations of the TOT lanes. Potential revenues were calculated based on the miles traveled in a TOT corridor and the fee rate for that corridor. Using the regional travel

demand model, fee rates for three weekday time periods (morning, midday, and evening) were established to achieve a target level of service D in the TOT lanes. Where insufficient commercial vehicle demand existed, no fees were charged. Table 3 presents the regional revenue estimates for the three TOT strategies. This table shows that Strategy 3, with an assumed TOT network on all limited access facilities outside and on I-285, generates the greatest gross revenue. However, the revenue per TOT lane mile is greatest under Strategy 1, which has a greater fee-paying demand than do many corridors in Strategy 3.

TABLE 3: Summary of Regional Revenue Estimates for 2030 Strategies

2030 TOT Strategies	Light Duty Truck Weekday Revenue (000's)	Heavy Duty Truck Weekday Revenue (000's)	Total Weekday Revenue (000's)	Weekday Revenue per TOT Lane Mile	Projected Annual Revenue (000's)
Strategy 1: Major TOT Corridors	$186	$142	$327	$694	$89,400
Strategy 2: Service Delivery	$219	$153	$372	$614	$101,000
Strategy 3: Regional TOT Network	$429	$296	$724	$554	$198,000

Note:
1. Heavy and light duty truck categories are as defined by the ARC travel demand model for heavy and light duty commercial vehicles, respectively.
2. Revenue projections are based on fees that vary across scenarios by direction on each TOT corridor.
3. Assumes 30 year bonds at 5% interest; annualized costs include TOT incremental capital, and operations and maintenance costs. These are 2004 dollar values.

COMPARISON OF HOV, HOT AND TOT NETWORK STRATEGIES

The previous sections presented the results of a TOT-specific strategy for the region's freeway network. From a freeway manager's perspective, one of the most important questions is, what strategy or combination of strategies provides the best overall roadway network performance? In the case of Atlanta, this question focused on whether the

currently proposed regional transportation plan strategy (that is, significant investment in HOV lanes) makes sense, or whether high occupancy toll lanes and/or truck-only toll lanes are more effective. In order to answer this question, the TOT study was expanded to include a comparative analysis of three strategies—the *Mobility 2030* HOV strategy (which reserved the HOV lanes for vehicles with two or more people), the best TOT strategy from the perspective of congestion reduction (Strategy 3 as selected by the steering committee), and the best HOT strategy (SRTA, 2005c). The *Mobility 2030* HOV and the TOT strategies have been described previously. The HOT strategy will be described in the next paragraph.

An HOT lane allows vehicles with fewer occupants than required to use an HOV lane to use the lane for a fee. Similar to the TOT pricing strategy, the fee varies with the level of traffic on the HOV lane itself. The more congested the lane, the higher the fee. The SRTA study examined three HOT strategies – allowing vehicles with less than two occupants (HOT 2+) to pay to use the HOV lane, allowing vehicles with less than three occupants (HOT 3+) to pay to use the HOV lane, and allowing vehicles with less than four occupants (HOT 4+) to pay to use the HOV lane (SRTA, 2005a). The HOT 3+ strategy showed the best results from the perspective of moving the most travelers and of reducing congestion, and was selected for the comparative assessment.

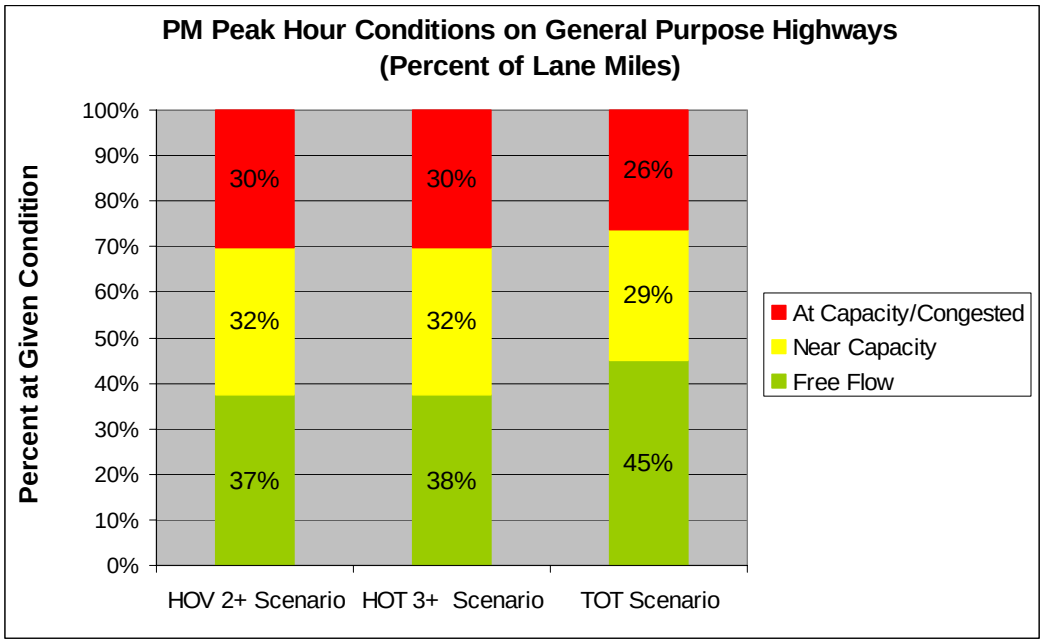
The following paragraphs discuss the results of the comparison among the HOV, HOT and TOT network strategies.

Vehicle Miles Traveled and Vehicle Hours Traveled - The total amount of vehicle miles traveled is similar for each strategy. The HOT 3+ strategy shows a 0.4% reduction in VMT (633,000 vehicle miles per day) compared to the HOV reference alternative; the

TOT strategy shows a negligible change. While VMT changes very little, the regional total of vehicle hours traveled is affected on a proportionate basis more significantly. The HOT 3+ strategy reduces VHT by 1% (74,000 vehicle hours per day), whereas the TOT strategy reduces VHT by 5% (296,000 vehicle hours per day). The combination of these results indicates that the transportation infrastructure is being used more efficiently (the same travel distances can be covered in less time overall) when compared to the investment strategy proposed in the regional transportation plan.

Vehicle-Carrying Efficiency of Regional Highways - As would be expected, the *Mobility 2030* HOV strategy, with facilities dedicated to HOVs, carries the most HOV trips (1,009,000 vehicle trips), while the TOT scenario, with facilities dedicated to trucks, carries the most commercial vehicle trips (2,069,000 passenger car equivalents). When converted to passenger car equivalents (pce's) , the HOT 3+ scenario carries 65,000 more pce vehicle trips than the HOV scenario, almost equal to 1% of daily traffic. The TOT scenario carries 132,000 more pce vehicle trips than the HOV scenario, equal to almost 2% of daily traffic. This result indicates that the region's limited access highways would carry a greater portion of daily trips than under the proposed regional plan HOV scenario, while local roads would carry a lesser proportion (which is discussed in a later section). However, not all vehicle types would likely benefit equally.

Weekday Benefits for General Purpose Lanes – Figure 4 shows the relative percentage of freeway lane miles at different levels of congestion for the three strategies during the PM peak hour. As indicated, the HOT 3+ strategy does not appear to worsen conditions (when compared to the HOV strategy), whereas the TOT strategy actually



Note: Highways refer to limited access facilities. Percentages are calculated by dividing the distance, in lane-miles, operating under specific levels of service by the total general purpose facility distance, in lane-miles. Percentages may not sum due to rounding. Levels of service 'A'-'C' are characterized as free flow; Level of service 'D' as near capacity; Levels of service 'E' and 'F' are characterized as at capacity/congested.

Figure 4: Afternoon (PM) Peak Congestion on General Purpose Limited Access Highway Lanes (Percent of Lane-miles)

improves the operations of the adjacent highway lanes. The TOT strategy results in an estimated 15% reduction in the number of limited access lane miles that operate under 'at capacity' or congested conditions.

To understand the magnitude of the travel time benefits to general purpose lane users, two "regional boundary to regional boundary" trips were modeled. A trip coming from the north and going to the south on the region's freeway network during the PM peak period is estimated to take 190 minutes in the *Mobility 2030* plan. The HOT 3+ and TOT strategies reduce this trip time by 21 minutes (-11%) and 32 minutes (-17%), respectively. A similar type of trip coming from the west and heading east during the same time period (trip time of 161 minutes) is expected to take four minutes longer (+4%) under the HOT 3+ strategy and 10 minutes (-6%) shorter with the TOT strategy. Although most

travelers in Atlanta do not make these long trips, the results of the analysis suggest that the average freeway user will benefit from either of the HOT 3+ or TOT strategies, but moreso with TOT.

Impacts on the Local Road Network - In order to quantify the impacts on the local road network, local road lane-mileage was tabulated by level of service or operating condition. With both the HOT 3+ and TOT strategies, there are fewer congested local roads than under the HOV scenario. With the HOT 3+ strategy, there is a 2% reduction in congested local roads during the PM peak hour; with the TOT strategy, this reduction is 10%.

In addition, the TOT strategy shifts truck trips away from local roads. During the PM peak period, in general, there is less truck traffic on local roads, while some roads and ramps that access the TOT network carry more truck traffic. However, because the TOT strategy removes HOV lanes from the freeway network, there is very little difference in *total* local road traffic under the TOT strategy as some HOV trips are diverted to the local road network.

Potential Revenues and Costs - Table 3 showed the estimated $198 million in revenues (2004 dollars) that would be generated by the TOT strategy. The HOT 3+ strategy is expected to raise approximately $90 million (2004 dollars). Given the operations strategy for the HOV network, no revenues would be raised from this strategy. Interestingly, the capital costs of each strategy were estimated to be similar to the HOV network investment in *Mobility 2030* in that this level of funding could design a network that would satisfy most of the needs for an HOT 3+ or a TOT strategy. Some additional costs associated with barrier design and for fee collection infrastructure would be

necessary. In addition, the annual operating costs for the HOT 3+ and TOT strategies would be greater than those for HOV.

Value of Time Benefits to Network Users - The Atlanta metropolitan area has consistently ranked high on national cost-of-congestion rankings, and thus the study steering committee and state/local officials were interested in knowing the positive economic benefits of each strategy. Table 4 shows the estimated value of the time savings described earlier. When HOV lanes are replaced by HOT or TOT lanes, carpools spend more time traveling, and are shown with a negative benefit. However, the region as a whole saves travel time. The TOT scenario, in particular, could save the trucking industry an estimated $900 million a year, which does not include the added logistics benefit of more reliable travel times. TOT lanes also save single occupant vehicles 5% of their total travel time (due to reduced congestion on the general purpose highway lanes), which is estimated as another $905 million benefit to these travelers.

Table 4: Annualized Value of Time Saved by the Traveling Public in the Atlanta Region

Managed Lanes Scenario	Noncommercial Vehicle Savings (at $15 per hour)		Light Duty Commercial Vehicle Savings (at $18 per hour)	Heavy Duty Commercial Vehicle Savings (at $35 per hour)	Total Annual Value of Time Savings
	SOV	HOV			
HOT 3+ Scenario	$ 379 M	- $ 101 M	$ 22 M	$ 13 M	$ 313 M
TOT Scenario	$ 905 M	- $ 260 M	$ 492 M	$ 367 M	$ 1,504 M

Note: Time savings is based upon VHT savings as compared to the HOV 2+ Scenario and value of time assumptions, as shown, for each vehicle class.

WHAT IS THE BEST USE OF THE REGIONAL INVESTMENT IN MANAGED LANES?

This study of three regional managed lane strategies for the Atlanta region resulted in a better understanding of the consequences of each for transportation system performance. The study shows that all three, that is, HOV, HOT and TOT, are feasible and provide potential benefits to the region's transportation system. However, the three strategies focus on different travel markets and offer various benefits to the region as a whole. Overall, the study shows that:

- HOT and TOT lanes offer more reliability (due to the managed operations through pricing) and travel time savings for commercial vehicles versus the HOV lane strategy in the *Mobility 2030* plan. HOT lanes also offer increased reliability and time savings to HOVs over that expected in the *Mobility 2030* HOV plan and to those willing to pay a fee to use the lanes. TOT lanes offer reliability and travel time savings to truck operators willing to pay a fee to use the TOT lanes.
- When examining the use of either HOT and TOT lanes in the same corridor, each results in more corridor person trips than does the HOV strategy.
- Of the three strategies, TOT lanes reduce congestion the most on adjacent freeway lanes.
- When HOT or TOT lanes replace HOV lanes, HOV travel times increase, but the total time the region spends traveling is reduced because of the increased efficiency of the road network.
- TOT lanes on a highway remove truck traffic from the general purpose highway lanes and also remove traffic from the local road network.

IMPLEMENTATION CONSIDERATIONS

The concept of a regional TOT lane network in Atlanta was so new that significant questions were raised by agency participants about institutional responsibilities and important design decisions (Douglas, 2004). A policy framework focusing on these issues was developed to guide the regional discussion on how such a network would be implemented. Of particular concern were the institutional responsibilities of the TOT lane owner, developer, service and maintenance providers. In addition, proposed enforcement strategies and the use of revenues generated from TOT lane use were important issues.

The following recommendations should not be considered as recommendations that other jurisdictions would adopt when considering the implementation of TOT lanes. Rather, they are illustrative of the types of issues that might have to be considered. The specific recommendations that resulted from the Atlanta TOT implementation assessment included the following:

Issue 1: The range of responsibilities for TOT lane planning, development, operation, maintenance and enforcement are likely to be shared by a number of separate agencies. To ensure success of these concepts, some of which are likely to be controversial, coordination among the agencies responsible for these functions cannot be left to chance. A formal mechanism should be established (such as a regional committee, task force, or a memorandum of agreement) to ensure that coordination is achieved among the agencies involved in regional planning, design and funding.

This group would focus on such activities as: developing a regional operating plan for TOT lanes, determining the pricing/vehicle eligibility requirements of TOT lanes,

collecting data on travel behavior characteristics and lane use, and determining financing strategies for covering the costs of operating and maintaining TOT managed lanes if revenues do not cover such costs.

Recommendation*: *A formal interagency process and mechanism should be established to ensure coordination among the state and regional partners in regional planning, data collection, design, modeling and funding of a TOT managed lane program.

***Issue 2**:* The collaborative effort described above is best guided by common principles and visions of what such a program would look like for the region.

Recommendation*: *The regional transportation agencies should adopt a policy statement or resolution supporting the TOT lane concept as a direction that should be pursued in regional planning and investment decisions. The focus of such a policy statement should be on the mobility enhancing goal of TOT lanes.

Issue 3: One of the key decisions that will have to be made in the early stages of implementing a TOT managed lane program in the region is the pricing/vehicle eligibility strategy. The TOT concept is to allow commercial vehicles and buses into the TOT lanes in order to support the adopted plan for regional transit service, which means that transit operations in all highway corridors should have the opportunity for uncongested and reliable operations. Whatever policy is adopted, experience suggests that it will be very difficult to change a pricing and vehicle eligibility policy once it is in place. Especially when a new TOT lane is opened, the newness of the facility provides a unique opportunity to put in place a pricing and vehicle eligibility strategy that in the eyes of the user can be related directly to the new facility.

Recommendation*: *Whatever pricing/vehicle eligibility strategy that will likely be necessary in the 2030 context should be the pricing/vehicle eligibility strategy adopted when new TOT lanes open.

Issue 4: Given that this study examined the TOT managed lane concept as a regional system, additional data and feasibility studies should be undertaken on a corridor-by-corridor basis to determine the specific characteristics of how TOT lanes could be implemented in each context.

Recommendation: Additional data collection and feasibility studies should be undertaken on a corridor by corridor basis to refine the physical attributes and operational characteristics of each promising TOT corridor.

Issue 5: It is very important that the TOT lane concept be consistent with the region's transportation plan and other policies and plans that focus on regional mobility. The TOT group described in Recommendation 1 should work closely with the region's metropolitan planning organization (MPO) as it begins the next cycle of updating the regional transportation plan.

Recommendation: The TOT lane coordinating group should work closely with the MPO to consider the concept of TOT lanes in future transportation plans.

Issue 6: Given that several managed lane projects are currently under design by GDOT, project planning/environmental analysis for such projects should include a TOT concept, with flexibility incorporated into project planning to allow for the implementation of such a strategy.

Recommendation: All project planning for current and expected managed lane projects should consider pricing options through the NEPA need and purpose process as appropriate.

Issue 7: The institutional framework for developing, operating, and maintaining a TOT lane network in the Atlanta region will require clear roles and responsibilities for the many different agencies involved.

Recommendation: For state roads, the GDOT should be considered the owner of the facility (for non-state roads, the local government would be responsible for the road);

SRTA should be considered the default service provider of all services associated with management and operation of the facility(ies);

The developer of a HOT lane could be an agency, private firm, or a consortium that builds a new managed lane with TOT capacity or adds incremental TOT capacity to existing HOV lanes, and possibly as well acts as the service provider;

The maintenance provider of the managed lane should be provided either by the owner, service provider, developer, some arrangement among them, or through an agreement with a private entity; and

The enforcement provider (of both fee collection and occupancy requirements) should be the responsibility of the service provider with the potential for arrangements with separate entities and/or secondary occupancy enforcement provided by the Department of Motor Vehicle Safety or an agency with similar powers.

Issue 8: One of the important characteristics of potential TOT managed lanes is that they could very well be developed and operated through a public/private partnership. In this case, specific roles for private entities should be defined on a project-specific basis, and could include developer or service provider of the managed lanes.

Recommendation: For potential TOT application on managed lanes on a state highway with a private service provider, GDOT and SRTA should maintain oversight of operating and technology strategies, including, but not limited to, fee rates and eligibility requirements. For non-state roads, SRTA should provide oversight with respect to technology strategies to assure regional compatibility.

Issue 9: Revenues will be generated from the fees paid by TOT lane users. The issue of what to do with these revenues is an important consideration, often one that becomes involved in the overall determination of the political feasibility of the lanes themselves. Any annual revenues remaining from those allocated to primary cost coverage purposes should be considered excess fee revenues ("excess revenues") for that corridor. Other

uses for the revenue should not be prohibited as long as they are used for transportation purposes and are higher in priority in that corridor than the three uses suggested above.

Recommendation: The annual fee revenues from the TOT use of managed lanes should first be used to cover:
--the annual operations and maintenance (O&M) costs for TOT operations in the corridor, and then the annual payments to repay most or all of the incremental capital costs of developing the TOT capacity.

Recommendation: Excess revenues, if available in a corridor, should be considered generally for the following uses, in no order of priority:
--operations and maintenance costs for other managed lane corridors,
--annual payments to repay capital costs for the managed lanes in the corridor [in order to provide flexibility to fast-track an TOT project using these fee revenues].

Recommendation: A decision-making and consultation structure should be developed for allocating excess revenues. Such consultation structure should include state and regional agencies in addition to managed lane operating agencies and should establish strategies for three possible cases: revenues do not cover the annual costs revenues are equal to the annual costs, and revenues exceed annual costs.

Issue 10: The capital cost of managed lanes will likely be funded with a combination of fee-supported bond funds and non-fee capital funds. However, the annual operations and maintenance costs are an important factor in determining cost feasibility and institutional responsibilities.

Recommendation: The extent to which operations and maintenance costs are not covered by annual fee revenues, these costs should be assumed by the service provider and/or developer with possible contributions by the owner.

Issue 11: Public outreach and marketing will be a critical element of success in any managed lane program, especially a TOT component. Importantly, regional public outreach and education on the managed lane concept should occur, while corridor-specific outreach efforts focus on TOT-specific projects. Regional transportation management associations and community improvement districts are also potential

partners in a coordinated outreach effort. It might be desirable to have a designated central location and website for information on managed lanes. During the initial planning of a managed lane application in a corridor, a targeted public outreach campaign should be used in the corridor to inform, educate, and solicit feedback from the traveling public. This information portal should be used to convey information on the fee structure and how it will be applied on the managed lane. Such a portal can also be used during managed lane operation to support public outreach and marketing.

Recommendation: The regional transportation agencies (including, but not limited to, ARC, GDOT, GRTA, and SRTA) that have the strongest connection to managed lanes should coordinate their public outreach efforts with respect to TOT information.

Issue 12: The TOT lane fee collection technology should leverage existing fee infrastructure and intelligent technology infrastructure in the near term. The deployed technology needs to support the operational strategies of the managed lane facilities and specifically the pricing strategies and vehicle/user eligibility requirements. The current vehicle identification systems, including smart card application on one of the region's freeways, are capable of supporting the desired TOT functions.

Recommendation: The TOT fee collection capability should be provided through an extension of SRTA's existing system either directly with SRTA or a service provider using compatible technology, and that video based fee enforcement be applied at the fee collection points, supplemented with on-site enforcement.

LESSONS LEARNED

Less than one year after the SRTA study on TOT lanes was released, the GDOT has begun looking at their application seriously in many freeway corridors in the Atlanta region. One corridor design study that was already underway was amended to include TOT lanes in the potential final design. The State Transportation Board has adopted a policy encouraging the consideration of TOT lanes where appropriate, and the update of the regional transportation plan is including a serious examination of where such corridors exist in the region. The Metropolitan Atlanta Chamber of Commerce and other business groups have strongly endorsed the concept of TOT lanes. All of these actions have occurred in a very short period of time, which is very unusual for the Atlanta region (and most likely for other regions as well), especially for a concept that is considered so different from other strategies considered by regional transportation agencies.

The Atlanta experience with the TOT study provides some interesting lessons to other jurisdictions contemplating similar types of strategies.

1. The regional travel demand model was used successfully for providing an analysis-driven debate on the merits of TOT lanes. Assumptions had to be made with respect to operating strategies and physical design, but in general the modeling capability that is found in most major metropolitan areas can be used to provide answers to the critical questions concerning truck strategies.
2. The rapid acceptance of the TOT concept as a potential strategy for freeway management was the direct result of a confluence of technical analysis and political advocacy. Once the potential benefits of TOT lanes became known, the

business community and influential local officials sought opportunities to advocate for their consideration.

3. Having representatives from the trucking industry as participants in the study as members of the steering committee was essential in garnering the industry's support for the study results. These representatives, in essence, became ambassadors to their trade associations and professional logistics groups in conveying the importance of advocating for TOT lanes.
4. The TOT strategy in Atlanta allowed buses in the TOT lanes (or more accurately, those vehicles driven by professionally trained drivers). As such, the TOT strategy was directly tied to a regional strategy of promoting long-distance express bus service. By pricing the lane use (buses ride for free), a congestion-free trip could be guaranteed to transit riders, something that was not going to occur in the *Mobility 2030* HOV plan, where congestion on key segments of the HOV network would most likely back up transit service. Tying express bus service to TOT service was a sound, constituency-building strategy.
5. One of the key assumptions of the study, that is, that the TOT lane use would be voluntary, was critical for getting industry support. It is not clear at this time whether any TOT lanes built in the Atlanta region would maintain this voluntary aspect, or whether commercial vehicles would be forced to use the lanes. One of the reasons why the voluntary use of the lanes was not considered too onerous a restriction was that a mandatory use of the TOT lanes caused the lanes to be overly congested, thus removing the major benefit of trip reliability and trip speed associated with the strategy.

6. In most cases, implementing TOT lanes will create as many institutional issues as it does technical design issues. This study spent considerable time discussing the institutional responsibilities and the operating strategies associated with the TOT lane concept. The result was an agreement on the part of the transportation agency partners to form a management committee that would continue to advocate for managed lanes in the region's transportation system. Although agency participants in the study often did not agree on some of the institutional issues, their identification became an important point of departure for further discussions among the partners.
7. Although a regional study such as the one reported on in this paper provides important input into the policy debate on whether TOT lanes make sense, the specifics on lane feasibility will really be determined on the individual corridor level, where engineering feasibility and more detailed traffic studies can occur. Thus, it is important for planning agencies to have the capability to conduct corridor-level studies that include freight movement.
8. One of the debates that did not occur in the Atlanta region was the trade-off between HOV users and TOT lane users, especially in Strategy 3, which converts HOV lanes to TOT use. The strategy currently being followed by GDOT is to build both HOV and TOT lanes within the corridor right-of-way, in essence, negating the need to discuss the trade-offs between HOV and TOT use. However, the analysis results showed that the "best" or most cost effective strategy for using the limited right-of-way available in the Atlanta network was to use existing and proposed HOV lanes as TOT lanes. This raises serious questions concerning the

value to society of HOV lanes, and other non-monetary benefits that they might provide to a region. This debate has not yet occurred in Atlanta; this could be a critical issue in other regions.

The most important lesson learned in Atlanta is perhaps the most basic. Until the TOT study, very little attention had been paid to truck movement through the region. The MPO is just now conducting the first-ever regional freight study. The TOT study produced very surprising results (at least to many in transportation planning in Atlanta). Not only did it show the significant benefits to the trucking industry of providing TOT lane capability, but it illustrated similarly substantive benefits to the general traveling public. Improving freight movement in a metropolitan area like Atlanta is thus not just a freight issue, it is really one of improving mobility for everyone.

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REFERENCES

Atlanta Regional Commission. (2004) *Mobility 2030*, Atlanta, GA.

Douglas, James D. (2004) *Handbook for Planning Truck Facilities on Urban Highways, 1999 William Barclay Parsons Fellowship Monograph 15,* New York: Parsons Brinckerhoff, Inc.

Federal Motor Carrier Safety Administration. (2002) *Large Truck Crash Facts 2000*. (USDOT). Retrieved March 3, 2005 from: http://ai.volpe.dot.gov/CrashProfile/NationalCrashProfileMain.asp.

Georgia Department of Transportation. (2002) *Guidebook to Foster Improved Truck Movement on Atlanta's Interstates*, Office of Traffic Operations, Atlanta, GA.

Georgia Department of Transportation. (2003) *HOV Strategic Implementation Plan for the Atlanta Region,* Atlanta, GA.

Kawamura, Kazuya. (1999). *Commercial vehicle value of time and perceived benefit of congestion pricing,* Doctoral dissertation, University of California at Berkeley.

Metro Atlanta Chamber of Commerce. (2005) Logistics in Georgia: Opportunity for Growth. Retrieved April 28, 2005 from http://media.geda.org/1.

Smalkowski, Brian. (2003). *Value of Time for Commercial Vehicle Operators in Minnesota*. (University of Minnesota, 2003).

State Road and Tollway Authority. (2005a) *High Occupancy Toll (HOT) Lane Study: Potential for Implementation in the Atlanta Region,* Atlanta, GA, found at: http://www.georgiatolls.com/pdf/HOT_Final_Report_July2005.pdf

State Road and Tollway Authority. (2005b) *Truck-Only Toll (TOT) Lane Study: Potential for Implementation in the Atlanta Region,* Atlanta, GA, found at: http://www.georgiatolls.com/pdf/TOT_Final_Report_July2005.pdf

State Road and Tollway Authority. (2005c) *Comparison of Truck Only Toll, High Occupancy Toll, and High Occupancy Vehicle Facilities: A Companion Report:* Atlanta, GA, found at: http://www.hotandtotstudy.com/study_info/pdf/companionfinal102805.pdf