ANALYSIS OF FLEET COMPOSITION AND VEHICLE VALUE FOR THE ATLANTA I-85 HOT LANE

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ABSTRACT

This paper evaluates the difference in fleet composition between HOT (High Occupancy Toll) lane and adjacent GP (general purpose) lanes on I-85 in Atlanta, GA. The conversion of HOV lane to HOT lane has been implemented in 16 miles of Atlanta I-85 and is under consideration for more widespread adoption throughout the Atlanta metro region. Before the Atlanta I-85 HOV to HOT conversion, HOV users had to have two or more passengers per vehicle to be able to use the lane (HOV2). However, after the conversion to a HOT facility, only registered vehicles carrying three or more persons (HOT3) are allowed to use the lane for free. License plate data were collected quarterly, one year before and one year after the conversion, producing a very large and detailed data set for analysis. The State motor vehicle registration database was employed to obtain vehicle make, model and model year data from license plate observations, which were then processed to estimate vehicle value. Using the HOT toll payment data for the identified license plates using the HOT lane over a three month period, this study examines the relation between HOT lane usage and vehicle value. Prior studies show that vehicle value is correlated with household income. Hence, the study provides a preliminary look at the user demographics associated with congestion pricing without delving into detailed household surveys.

INTRODUCTION AND BACKGROUND

Transportation agencies are faced with growing challenges of congestion and a limited ability to expand freeway capacity due to construction costs, right-of-way constraints, and environmental and societal impacts. Transportation officials are taking advantage of opportunities to address mobility needs and provide travel options through a combination of limited capacity expansion coupled with operational strategies designed to manage travel demand, improve transit service, and support other forms of ridesharing. The managed lane concept is gaining interest around the country as an approach that combines these elements to make the most effective and efficient use of a freeway facility (1).

High-occupancy vehicle (HOV) lanes have been in existence since 1969, and the introduction of high-occupancy toll (HOT) lanes in the 1990s has added another alternative for highway management (2). Researchers have suggested that in some areas, HOV lanes do not function properly, in that the lanes operate below capacity or the lanes become congested like their general purpose lane counterparts (3).

HOT lanes promise to make better use of existing HOV lanes, to provide capacity more efficiently than either conventional HOV lanes or general purpose lanes, and to reduce the number of lanes needed on new freeways by managing demand. Experience indicates that HOT lanes are politically feasible. HOT lanes benefit those drivers who use conventional lanes as well as those drivers who use the hot lanes. HOT lanes can continue to serve as HOV lanes as long as carpools and buses continue to have good access to them. Some environmental groups actively support HOT lanes, concluding that they reduce emissions by reducing stop and go traffic. Stated preference work indicates that HOT lanes are desired by upper and lower income drivers as a transportation option and experience has shown that hot lanes are not used solely by the affluent because drivers at all income levels use HOT lanes when they really need to get somewhere on time (4, 5).

On the Atlanta I-85 HOV corridor, the effective capacity of the HOV lane was 1550 vph, much lower than the adjacent GP (general purpose) lanes which were 2200 vph (3) and the lane regularly became congested like the neighboring general purpose (GP) lanes.

The conversion of HOV lane to HOT lane has been implemented in 16 miles of Atlanta I-85 (from Chamblee Tucker Road to Old Peachtree Road) on Oct, 1 2011 and is under consideration for more widespread adoption throughout the Atlanta metro region (6). Further conversion of HOV lanes to HOT lanes requires in depth planning and policy analysis and the I-85 experience can help in this regard.
Before the Atlanta I-85 HOV to HOT conversion, HOV users had to have two or more passengers per vehicle to be able to use the lane (HOV2). However, after the conversion to a HOT facility, only registered vehicles carrying three or more persons (HOT3) are allowed to use the lane for free. Because 3-person carpools are more difficult to form than 2-person carpools, the demand for free use of the lane significantly decreases. The resulting capacity on the lane is then sold to 2-person carpools and single occupant vehicles (SOVs) that are willing to pay a toll to use the lane. The dynamic pricing strategy that manages the HOT lane demand is designed to ensure that operational flow is maintained with an average speed of 45 mph or greater, 90% of the time. The main user group that was negatively impacted by this conversion were the HOV2 two-person carpoolers, who used to be able to use the carpool lanes for free and now have to either split a toll or find a third person to join their carpool if they want to continue using the HOT lane.

A 2008 study for potential implementation of HOT lane in Atlanta found that higher income users are expected to use the facility more frequently than lower income users. However, this by itself is not an equity problem because low-income populations are generally also in favor of implementing HOT lanes because they have a need to use these lanes for specific types of trips and are willing to pay the costs to save time under certain conditions (3). In terms of equity, if traffic conditions experienced by low income populations are not worse after the conversion compared to baseline conditions, the I-85 HOT project should be in compliance with the Clinton Executive Order on environmental justice (7). This is because environmental justice regulations are designed to ensure that low income populations and other groups are not disproportionately negatively impacted by such investments.

Income of the users has been used as a metric in the evaluation of potential socio-economic aspects of transportation projects. Some studies used survey data providing individual level accuracy for a small proportion of the users (8). Some other studies used license plate data matched to household address blockgroup median income (9, 10). While the license plate studies are based on a large proportion of the users compared to surveys, they use aggregate level data (median household income in blockgroup) which albeit do not have the accuracy of individual household-level data and the comparison results are usually not significant.

This paper compares HOT and GP travelers’ income indirectly, using the value of vehicles as a surrogate. This is another way of looking at the issue in the absence of direct survey data that provides an estimate of the income of the users. A study in Tennessee found a strong positive correlation between vehicle age and average household income (county-level data were used in the study) (11). A San Francisco study also found that the cost of a vehicle is positively correlated with household income (12). Using the vehicle registration data, this study assigns vehicle value to the large license plate dataset collected from I-85 HOT corridor and use statistical analysis to compare the HOT and general purpose lanes vehicle value and fleet distribution. The analyses reported in this paper also evaluate the relationship between the amount of toll paid by HOT users and the vehicle value.

**METHODOLOGY**

A performance evaluation study of the I-85 HOV (High Occupancy Vehicle) lane to HOT (High Occupancy Toll) lane conversion project is currently being conducted by a team from Georgia Institute of Technology, School of Civil and Environmental Engineering. To assess the impacts of the HOT lane on commuters’ demographic profiles and fleet characteristics, quarterly vehicle occupancy (persons/vehicle) and license-plate data are being collected for one year before and one year after the HOT lane implementation. To date, a total of seven quarterly deployments have been conducted (starting in fall 2010 and ending in summer 2012).

Each quarter, a data collection team visits each of the five selected sites for at least two days during one week to record vehicle occupancy and license plate data in both the AM and PM peak periods. Each peak session collects data for two hours: 7am-9am during the AM-peak and 4:30pm-6:30pm during the PM-peak. Because traffic around the Atlanta area generally enters the city in the morning (predominantly commute traffic) and exits the city in the...
afternoon (a combination of commute and other traffic), the AM-peak sessions observe the southbound traffic while the PM-peak sessions observe the northbound traffic.

After data collection, the recorded video is manually processed using proprietary video processing software developed at Georgia Tech. The processed output file includes license plate characters, date, time, and site of data collection. The method of converting video files to license plate numbers is based on visual capture by undergraduate students. More detailed information on the process can be found in D’Ambrosio’s thesis (13).

Each decoded license plate is assigned a unique key identifier, and Georgia license plates (nearly a million) were matched to the motor vehicle registration database by the Georgia Tech Research Institute (GTRI), for privacy considerations. The key identifier was carefully designed to include information about the observation of the plate (site, session, period, etc.).

Approximately 80% of the plates that were processed yielded a match in the motor vehicle registration database. Some reasons for the relatively low match rate (85% is more typical) include the accidental recording of out-of-state vehicles, the difficulty of correctly interpreting license plate characters under poor lighting conditions, and a slightly out-of-date vehicle registration database. For example, license plates collected in April 2012 were matched to fourth quarter of 2011 registration data, available at the time of matching process. Moreover, a small number (less than 1%) of license plates returned incorrect vehicle information even though the license plate was transcribed correctly (14). This accuracy check has been done by watching the collected field videos. The incorrect records are assumed to be out-of-date information due to new vehicle purchases or stolen license plates. Moreover, out of state plates which accounts for 5% of the license plates were removed before matching process.

The processed results contain vehicle make, model and year, based upon vehicle registration records for the observed license plate. No personally identifiable information, such as owner name or physical address, is returned through this process.

After receiving the data, a data cleaning process removes all buses and trailers from the analysis because the values of these units would not be correlated with commuter income. A total of 21,734 vehicle type records (unique make, model, model year, and body style) correspond to the 1,336,258 license plates observed (excluding buses and trailers). These license plates were observed across all GP lanes and the managed lanes (HOV or HOT) one year before and one year after the conversion during 170 sessions of data collection (AM and PM two-hour peak periods) across five sites along the corridor (9). Figure 1 shows the corridor location and data collection sites across the corridor.
To obtain a vehicle value estimate, several online sources were evaluated. Data accuracy and convenience of use were two priorities in evaluating different data sources. Finally, TRUECar® (TRUECar, Inc.) and Kelly Blue Book (KBB) were selected (15, 16). While KBB is probably the most recognized and is deemed a reliable source, its price checking process is not as convenient as TRUECar. TRUECar was used for all vehicles except the 2012 vehicle models, because TRUECar does not provide used car price for 2012 model. KBB was used for the 2012 vehicle models. The KBB used car price, rather than the dealership or invoice price was used for 2012 models so as to reduce the potential bias toward high value cars in the dataset.

In the TRUECar price checking process, the private seller price for vehicles in good condition and standard attributes were assumed for all vehicles. Different make, model and model year combinations in the observation data yield 21,734 unique combinations. However, about 2,700 of these combinations represent 85% of the fleet. For practical reasons, the analyses proceeded with these 2,700 unique combinations. Four undergraduate students collected the data from the websites and a graduate student assessed the accuracy of the dataset.

By matching the vehicle make model year of the checked price dataset to the original license plate dataset, 85% of the observed plates were assigned a vehicle value. Because the entire price checking for this analysis was performed in the summer of 2012, it was not reasonable to use these prices for vehicles that were observed in 2010 or 2011. Therefore, this study is based on license plate data collected in spring and summer 2012 matched to the prices checked in summer 2012. Research designed to assess the change in vehicle values from the HOV lane to the HOT lane is ongoing and requires access to depreciation tables allowing the team to assign vehicle values to the vehicles at the time they were observed (i.e., 2010 and 2011).

RESULTS

HOT and GP Lanes Vehicle Value

The average vehicle value observed in each lane was calculated from the make/model/model year combinations and error bar charts were created. Figures 2(a) and 2(b) show the 95% confidence intervals around the average TrueCAR private seller price across the six lanes (the HOT lane and five GP lanes). Figure 2(b) is zoomed in, to show the significant differences. The confidence bounds around the mean can be interpreted to mean that we are 95% confident that the average vehicle value falls somewhere between the confidence bounds (but is equally likely to fall anywhere within the bounds). Hence, when confidence bounds do not overlap, we are reasonably confident that the means are different.

As expected from the literature which indicated that wealthier households are likely to use the HOT lanes more frequently, the average vehicle value in the HOT lane is higher than in the GP lanes. Surprisingly, vehicle values across the general purpose lanes show a decreasing trend from left to right (i.e., from the fast lane to the slow lane). This may be an indication that vehicles that tend to stay longer in the corridor (long commute trips) and are generally of higher value as long-distance commute vehicles are using the leftmost lane. Such a result would match with what we really see in spatial distribution of households in terms of household income, where, in Atlanta, the household income increases in moving from central district toward suburban areas up to the end of Atlanta metro area (Figure 3). However, this requires a more detailed analysis of the commutershed represented by the subfleets using each lane.
FIGURE 2(a) and 2(b): 95% Confidence Interval for Private Seller Price across Lanes (FIGURE 2(b) is a zoomed version of FIGURE 2(a)).

Figure 3 shows HOT corridor commutershed developed based on license plate data registered household addresses. Because the HOT corridor is used by commuters who work in the Atlanta central business district and live in Atlanta northeast residential areas, it is expected that people who live further from Atlanta will use the HOT lane more frequently. Since the farther residential areas are higher income areas as well (Green Block groups), the higher vehicle value in the HOT lane is expected.

FIGURE 3: HOT Corridor Commutershed Household Income.
Figure 4 shows the confidence interval for average vehicle model year across the same six lanes. The same decreasing (and significant) is observed by vehicle model year.

![Figure 4: 95% Confidence Interval for Vehicle Model Year across Lanes.](image)

Table 1(a) and table 1(b) show the detailed statistics for vehicle value and model year across the observed lanes, including the differences between HOT lane and GP lanes. Table 1(a) shows auto private seller price statistics across all the lanes while Table 1(b) aggregates general purpose lanes and adds the model year statistics as well. Because the distribution of vehicle value is similar to other monetary variables (i.e., has a long tailed distribution) the median is lower than the average value. However the difference between the medians is very close to the difference between the means.

**TABLE 1(a) and 1(b): Auto Private Seller Price and Model Year Statistics across Lanes**

<table>
<thead>
<tr>
<th>Statistics</th>
<th>HOT</th>
<th>GP1</th>
<th>GP2</th>
<th>GP3</th>
<th>GP4</th>
<th>GP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>$11,382</td>
<td>$9,752</td>
<td>$9,267</td>
<td>$8,995</td>
<td>$8,971</td>
<td>$9,018</td>
</tr>
<tr>
<td>Median</td>
<td>$10,080</td>
<td>$8,531</td>
<td>$8,041</td>
<td>$7,692</td>
<td>$7,581</td>
<td>$7,659</td>
</tr>
<tr>
<td>St Dev</td>
<td>$7,270</td>
<td>$6,352</td>
<td>$6,173</td>
<td>$6,174</td>
<td>$6,246</td>
<td>$6,311</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Statistics</th>
<th>HOT</th>
<th>GP</th>
<th>Diff</th>
<th>Diff (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Seller Price ($) (Basic Attributes, Good Condition)</td>
<td>Average</td>
<td>$11,382</td>
<td>$9,242</td>
<td>$2,140</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>$10,080</td>
<td>$7,986</td>
<td>$2,094</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>St Dev</td>
<td>$7,270</td>
<td>$6,265</td>
<td>$1,005</td>
<td>NA*</td>
</tr>
<tr>
<td>Model Year</td>
<td>Average</td>
<td>2005.75</td>
<td>2004.72</td>
<td>1.03</td>
<td>NA*</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>2006</td>
<td>2005</td>
<td>1</td>
<td>NA*</td>
</tr>
<tr>
<td></td>
<td>St Dev</td>
<td>3.781</td>
<td>4.085</td>
<td>0.304</td>
<td>NA*</td>
</tr>
<tr>
<td></td>
<td>Sample Size</td>
<td>45,295</td>
<td>288,450</td>
<td>NA*</td>
<td>NA*</td>
</tr>
</tbody>
</table>

* Not Applicable

On average, the value of vehicles using the HOT lane is approximately $2,100 (23%) higher than the value of vehicles using the GP lanes. Similarly, the average vehicle model year is about one year higher in the HOT lane than in the GP lanes. The distributions of the HOT and general purpose lanes vehicle value are illustrated in Figure 5. While both of the distributions' shapes appear similar and cover same range of values, the concentration of general purpose vehicles is more in lower value vehicles compared to HOT lane. The Mann-Whitney test reject the
hypothesis of same distribution for both HOT and GP vehicle values (sig<0.000), which is not surprising given the huge sample size. Because the distributions are not normal, independent sample nonparametric median test were performed instead of t-tests to compare central tendency of HOT versus GP lanes vehicle values. The test rejects the hypothesis of same median for HOT and GP vehicle value (sig<0.000). Because no similar study was identified in the literature, no evaluation metric was available to assess the noted difference between HOT and GP lane vehicle value.

![HOT vs GP Vehicle Value Distributions](image)

**FIGURE 5: HOT and GP (General Purpose) Lanes Vehicle Value Distributions.**

Figure 6(a) and 6(b) show the same confidence intervals illustrated in Figure 2 across different lanes, times and sites. Figure 6(b) aggregates all the GP lanes while Figure 6(a) shows each general purpose lane separately. Five data collection sites across the corridor in the order of exiting from central district are: CTR (Chamblee Tucker Rd), JCB (Jimmy Carter Blvd), BRR (Beaver Ruin Rd), PHR (Pleasant Hill Rd) and OPR (Old Peachtree Rd) and they are also illustrated in Figure 1.

The average vehicle value in GP lane increases toward the wealthier suburban areas, matching the pattern discussed before relative to the spatial distribution of the households by income (Figure 4). However, the HOT lane does not follow the same increasing value pattern. Instead, vehicle values across different sites are almost equal except for JCB which is lower significantly in the afternoon. This may be the result of the influence of non-commuting trips such as shopping which are mainly in the afternoon (9).

The same decreasing trend in vehicle value from left lane to right lane can be observed at all data collection sites except OPR and CTR. The reason may be that the I-285 interchange is located between CTR and JCB and Highway 316 is located between PHR and OPR which changes the corridor commutershed. Moreover, OPR site is almost
located at the end of Atlanta metro area and most of the commuters exit the corridor before reaching that point. Additional research will address this issue in future.

Another potential indicator of household income is the willingness to pay a toll on the HOT facility. The relationship between total toll amounts paid by each license plate in the HOT lane and vehicle value is presented in this section. During March, April and May 2012, 95,670 unique license plates (matched to the registration database) used the HOT lane. The data for this analysis comes from RFID tag reads managed by SRTA (State Road and

FIGURE 6(a) and 6(b): 95% Confidence Interval for Auto Private Vehicle Seller Price across Lanes, Time and Sites (FIGURE 6(a) aggregates all GP Lanes.).

HOT Lane Usage and Vehicle Value
Tollway Authority) linked to license plate data for observed HOT lane trips. All of the trips have been aggregated using the plate number to calculate total amount of toll paid by each unique license plate during the 90-day period. Next, using the make, model and year assigned to each license plate by registration database, about 86% of the plates were assigned vehicle values.

Figure 7 shows the scatter plot of total tolls paid over the 90 day period and the value of the vehicle paying the tolls. All vehicles using the HOT lane that did not pay a toll (i.e. 3-person carpools, emergency vehicles, etc.) were excluded from the analysis to remove any bias that they would introduce into the calculations.

Correlation coefficients between the total toll amount paid and vehicle value in both parametric and non parametric formats are presented in Table 2. Although all the correlation coefficients are positive and significant, given the very large data set, the amount of correlation does not even reach 0.05, indicating that there is poor correlation between vehicle value and total toll payment. However, it should be noted that the maximum toll that can be charged in the facility is capped and because the maximum toll does not always ensure that the lane remains in operation at 45 mph, the current results might change significantly if tolls are allowed to move upward to their natural maximum needed to control congestion.

**TABLE 2: Correlation between Total Toll Amount Paid and Vehicle Value**

<table>
<thead>
<tr>
<th></th>
<th>Pearson</th>
<th>Kenndall’s tau_b</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>0.018</td>
<td>0.030</td>
<td>0.045</td>
</tr>
<tr>
<td>Significance</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Vehicle Ranking Analysis**

As discussed earlier, the average vehicle value in HOT lane is $2,140 (23%) higher than the GP lanes. Higher vehicle values may arise from two factors: 1) higher value make/model vehicles being in the HOT lane (e.g. more sport utility vehicles), and 2) newer vehicles within a make/model being used in the HOT lanes. To assess how each
factor contributes to change in average vehicle value, vehicles in GP as well as HOT lane are aggregated by make and model pair.

More than 400 unique make/model contributions (composed of a variety of model years) were observed. However, in performing statistical comparisons, only vehicle makes and models observed more than 30 times were included in the assessment, reducing the total number of unique make/model combinations to 180. Table 3 illustrates the top 20 make/model combinations by observation frequency in the HOT lane and GP lanes, along with the average model year and average value for the make/model combination. The top 4 vehicles, Honda-Accord, Honda-Civic, Toyota-Camry and Ford-F150 retain their ranking in HOT and GP lanes. However, average model year is higher in the HOT lane (newer vehicles) leading to a higher vehicle value for the vehicles in the HOT lane compared to GP lanes.

The change in rankings for some vehicles such as Nissan-Altima or Honda-CRV is only one or two place, while some other vehicles such as the Ford-E350 or Lincoln-MKX moved more than 100 places in the ranking. The highest change in vehicle ranking belongs to Ford-E350 which is in 377th place in GP lanes and 131st place in HOT lane. While the average vehicle value didn’t change for this vehicle, the main reason for the big ranking change is the body style of the vehicle which has enough space for 12 passengers and is being used for vanpooling.

With such a large sample (180 unique make/model combinations), the observed change in rank order is likely to be significant. The significance of rank order change can be tested using the Wilcoxon signed-rank test which is a non-parametric test used when comparing two dependant samples, using the ranks of the pairs of scores formed by the matched pairs in the sample (17). The Wilcoxon signed-rank test rejects the null hypothesis that the median of differences between different vehicles rate of presence in GP versus HOT lanes equals zero at 0.046 significance level. After becoming statistically confident that there is a significant change in vehicle rank orders, the next step is to see how much of the difference in vehicle value at HOT versus GP lanes is caused by the vehicles rank order change compared to model year.

Discussed earlier, there is $2,140 difference between HOT and GP vehicle value which corresponds to 23% of GP average vehicle value. Multiplying the difference in observation percents in HOT versus GP lanes to GP vehicle values (for each vehicle make and model combination) and adding up the values, equals $882. This amount is 42% of the $2,140 which means vehicles rank order changes account for 42% of the change in vehicle value. The remaining 58% is because of one year increase in model year (on average) in HOT lane compared to general purpose lanes.

Finally, out of 23% difference in vehicle value between HOT and GP lanes 13% is because of the increase in model year and 10% is because of the change in vehicles rank orders.
TABLE 3: Rank Order of Vehicle Make and Model Usage in HOT and GP Lanes

<table>
<thead>
<tr>
<th>Rank</th>
<th>Vehicle Make</th>
<th>Vehicle Model</th>
<th>Average Model Year</th>
<th>Average Vehicle Value($)</th>
<th>Vehicle Make</th>
<th>Vehicle Model</th>
<th>Average Model Year</th>
<th>Average Vehicle Value($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOND</td>
<td>ACCORD</td>
<td>2004.6</td>
<td>9,585</td>
<td>HOND</td>
<td>ACCORD</td>
<td>2003.5</td>
<td>8,189</td>
</tr>
<tr>
<td>2</td>
<td>HOND</td>
<td>CIVIC</td>
<td>2005.0</td>
<td>8,130</td>
<td>HOND</td>
<td>CIVIC</td>
<td>2004.3</td>
<td>7,270</td>
</tr>
<tr>
<td>3</td>
<td>TOYT</td>
<td>CAMRY</td>
<td>2005.2</td>
<td>8,840</td>
<td>TOYT</td>
<td>CAMRY</td>
<td>2004.3</td>
<td>7,878</td>
</tr>
<tr>
<td>4</td>
<td>FORD</td>
<td>F150</td>
<td>2005.8</td>
<td>9,353</td>
<td>FORD</td>
<td>F150</td>
<td>2004.3</td>
<td>7,486</td>
</tr>
<tr>
<td>5</td>
<td>NISS</td>
<td>ALTIMA</td>
<td>2006.9</td>
<td>9,001</td>
<td>TOYT</td>
<td>COROLLA</td>
<td>2005.1</td>
<td>8,031</td>
</tr>
<tr>
<td>6</td>
<td>HOND</td>
<td>CR-V</td>
<td>2005.8</td>
<td>10,529</td>
<td>NISS</td>
<td>ALTIMA</td>
<td>2005.9</td>
<td>8,103</td>
</tr>
<tr>
<td>7</td>
<td>TOYT</td>
<td>COROLLA</td>
<td>2006.1</td>
<td>7,942</td>
<td>CHEV</td>
<td>SILVERADO</td>
<td>2005.0</td>
<td>8,295</td>
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<tr>
<td>8</td>
<td>INFI</td>
<td>G35</td>
<td>2005.0</td>
<td>11,236</td>
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<td>CR-V</td>
<td>2005.2</td>
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<td>9</td>
<td>FORD</td>
<td>ECONOLINE</td>
<td>2007.4</td>
<td>9,560</td>
<td>FORD</td>
<td>EXPLORER</td>
<td>2002.6</td>
<td>5,805</td>
</tr>
<tr>
<td>10</td>
<td>CHEV</td>
<td>SILVERADO</td>
<td>2005.3</td>
<td>8,421</td>
<td>FORD</td>
<td>ECONOLINE</td>
<td>2004.5</td>
<td>7,031</td>
</tr>
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<td>11</td>
<td>FORD</td>
<td>EXPLORER</td>
<td>2004.0</td>
<td>8,078</td>
<td>DODG</td>
<td>RAM</td>
<td>2004.9</td>
<td>7,734</td>
</tr>
<tr>
<td>12</td>
<td>HOND</td>
<td>ODYSSEY</td>
<td>2006.4</td>
<td>12,013</td>
<td>FORD</td>
<td>MUSTANG</td>
<td>2004.3</td>
<td>8,890</td>
</tr>
<tr>
<td>13</td>
<td>LEXS</td>
<td>RX</td>
<td>2004.6</td>
<td>15,501</td>
<td>HOND</td>
<td>ODYSSEY</td>
<td>2004.7</td>
<td>9,425</td>
</tr>
<tr>
<td>14</td>
<td>FORD</td>
<td>MUSTANG</td>
<td>2005.4</td>
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CONCLUSION

Using license plate registration data (make, model and year), this study assigns vehicle value to license plates as a surrogate value for household income. Using the method, this paper evaluated the difference in fleet composition between the HOT (High Occupancy Toll) lane and adjacent general purpose lanes on I-85 in Atlanta, GA. As was expected from review of prior studies, the analysis showed that the average vehicle value in the HOT lane is significantly higher, about $2,100 (23%), and the average vehicle model year is about one year newer, compared to general purpose lanes.

Using the HOT toll payment data for the identified license plates using the HOT lane over a three month period, this study showed positive and significant (given the large sample size) but less than 0.05 correlation between paid toll amount and vehicle value. However, it should be noted that the maximum toll that can be charged in the facility is capped and because the maximum toll does not ensure that the lane remains in operation at 45 mph, the current results may change significantly if tolls are allowed to move upward to their natural maximum needed to control congestion.
Out of 23% difference in vehicle value between HOT and GP lanes 13% is because of increase in model year and 10% is because of the change in vehicles make/model rankings. The change in make/model rankings can be because of both vehicle values (ability to pay the toll) and body style (appropriate for carpooling and vanpooling).

In conclusion, the fact that there is a difference in vehicle value between HOT and general purpose lanes doesn’t mean that only high value vehicles are using the HOT lane. Instead, it means that high value vehicles are more frequently using the HOT lane while lower value vehicles are still using the lane. Conducting household commuter surveys is expensive and time consuming, covering only a small portion of the population. The license plate methodology provided in this paper is a less expensive method that can help analysts gain some preliminary insight into the trends and should be very useful as a precursor to survey implementation.
REFERENCES


