

An Application for Measuring Vehicle Travel by Visitors

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ABSTRACT

This paper develops a simple approach to estimating annual vehicle travel by visitors to individual states. Domestic and foreign visitors are considered separately. The approach uses local or national surveys for domestic visitors but federal surveys for foreign visitors. The approach is applied to Florida for the 15-year period from 1984 through 1998. Visitors accounted for about 9.8% to 12.7% of all vehicle travel in the state during this period. Variations over time result from changes in the number of visitors and their characteristics such as the length of stay and party size.

INTRODUCTION

Understanding visitor travel trends is important for predicting future demands for transportation. Visitor travel has different temporal and geographic distributions, and its growth pattern may differ from resident or freight travel. These differences are relevant to a discussion of how to fund transportation infrastructure and service investments such as equity issues. A good understanding of visitor travel has implications for safety, traveler security, signage, and other aspects of how transportation facilities are designed and operated.

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One motivation for this paper is that visitor travel is often not considered in the transportation planning processes in this country. In recent years, freight has increasingly been incorporated into planning, despite the fact that it may actually account for a smaller proportion of total vehicle-miles of travel. Between 1994 and 1998, heavy trucks accounted for 7.3% to 8.2% of all vehicle travel on freeways and arterials in Florida (CUTR 2001b). The most recent study on tourism travel is a National Cooperative Highway Research Program project that examines the extent of cooperation between state departments of transportation and state travel offices (Frechtling et al. 1998).

Our research was also motivated by a desire to put the seemingly large numbers of visitors into perspective. For example, the estimated annual number of visits to Florida by nonstate residents increased from 29.9 million in 1984 to 52.7 million in 1998 (CUTR 2001a), a 76% increase during this 15-year period. This tremendous increase in the number of visitors is often cited as contributing to transportation problems in Florida. At face value, one might quickly conclude that tourists must play a large role in the state's transportation problems. After all, Florida's population was no more than 15 million in 1998 and its increase since 1984 has been about half as fast as that of its visitors (from 10.9 million to 14.9 million) (BEBR 1985–1999).

Finally, our research is motivated by a desire to understand the potential negative impacts of visitors. While tourism may have many positive impacts on local economic development, tourism can also result in many negative impacts on the environment of the host areas. One of these negative impacts is air pollution from automobile emissions. Information on how much visitors drive contributes to our understanding of the potential costs of tourism on the local environment. Local decisionmakers tend to focus on and emphasize the positive impacts but ignore the negative ones.

This paper is divided into three sections: details of the method being proposed for estimating vehicle travel by visitors; application of this method to Florida, including data sources used, and results, and the applicability of the proposed approach to other states; and conclusions.

METHODS

The proposed approach measures annual vehicle travel by visitors by their origin and mode of entry. The estimations take advantage of annual surveys of domestic visitors as they leave the state after a visit and federal surveys of international travelers to individual states.

Visitors are those persons who travel to Florida for business or pleasure and stay at least one night but no more than a certain number of nights. By origin, domestic visitors are people who come from Canada or other U.S. states, while foreign visitors are all other visitors. Mode of entry includes those who come by car, air, or other public modes (e.g., intercity bus). The approach used here also separately considers vehicle travel by visitors at their destinations and on their way to and from the borders. Taking these factors into account, three types of visitors are considered: domestic air visitors, domestic auto visitors, and foreign air visitors. Domestic visitors who come by other public modes as well as foreign auto visitors are not considered separately because data are not readily available for them. According to the 1995 American Travel Survey, auto and air account for 97.7% of all visitors and intercity bus accounts for 1.6% (USDOT BTS 1997b).

Domestic Air Visitors

For domestic air visitors, we used data on four of their travel characteristics and an estimate of their total numbers. Characteristics include the length of stay at major destinations (L), party size (S), the share traveling by car once they reached Florida (C), and the average amount of daily driving per party (D). For ease of reference, we use N to represent the annual number of domestic air visitors. The estimation for any given year is done in four steps:

1. Estimate the number of visitors who travel by car at their destinations, which is given by $C*N$.
2. Estimate the number of parties among the visitors who travel by car around their destinations, given by $(C*N)/S$. This number also represents the number of cars these domestic air visitors drive while they are in the state.
3. Estimate the average amount each vehicle is driven. This is given by $L*D$.

4. Put these different pieces together to yield the annual amount of driving by domestic air visitors in Florida: $(L * D) / [(C * N) / S]$.

This method may slightly underestimate vehicle travel in the state by domestic air visitors, because those visitors who drive to a bordering state on their way out are excluded in this measurement.

Domestic Auto Visitors

For domestic auto visitors, their driving on the state's highways consists of two components. One component is driving at their destinations. All domestic auto visitors are assumed to travel by car at their destinations, that is, $C = 1$. The same procedure used to measure this component is used for those who come by air.

The second component of those who come by car is driving done on their way from the state's border to their destinations and back to the border. This component is the product of the total number of these cars by the average distance between their destinations and the border. This average distance may change from year to year because of changes in destinations chosen by these visitors.

Foreign Visitors

The methodology used for domestic air visitors is also applied to foreign visitors. The underlying assumption is that foreign visitors to the state typically both arrive and leave the state by air. This assumption may lead to underestimating the amount of driving by foreign visitors for at least two reasons. First, some foreign visitors may enter the United States by air through another state and then drive to Florida. Second, just as in the case for domestic air visitors, some of them may drive to other states and leave from there.

Comparison to State Total Travel

Once annual driving by each of these three groups is estimated, the total is then compared with the total amount of driving in the state. The total amount of driving in the state reflects all vehicle travel in the state on public roads, including those by visitors, residents, and freight. While a better comparison might be the total amount of passenger driving in the state, data may not be available to separate passenger and freight travel.

APPLICATION

We applied the simple approach proposed above to Florida for the period from 1984 through 1998. The data sources are presented first, followed by the results and discussion of how the same approach can be applied to other states.

Data Sources

For domestic visitors, data on L , S , C , and N are from the annual *Florida Visitor Study* (Florida DOC 1984–1995; Florida FTIMC 1996–1998). This document compiles data on the characteristics of Florida's domestic visitors and estimates aggregate statistics on the tourism industry in Florida. From 1984 to 1996, it was based on an annual survey that involved personal interviews of visitors as they completed their stay and left the state. It was published by the Tourism Division of the Florida Department of Commerce before 1996 and has been published by the Florida Tourism Industry Marketing Corporation since then. Both groups used the same survey methodology consistently. Since 1996, however, this document has been based on the *DIRECTIONS Travel Intelligence System* (DKS&A 2000). This system is a syndicated database that tracks traveler behavior in the United States, based on annual surveys of 540,000 traveling households.

For foreign visitors, data on L and S are available from the annual *Profile of Overseas Travelers to the U.S.* (USDOC ITA 1998), which is based on the monthly *Survey of International Air Travelers*. Unfortunately, data from earlier years were not available for this paper. As a result, 1998 survey data on the length of stay and party size for foreign visitors were used for the entire estimation period. While the survey asked what modes the respondents used while visiting the United States, the questions allow multiple modes to be chosen in the answer. Because of this, the data were unusable for our study. Instead, we assumed that C , the portion of visitors who travel at their destinations in Florida by car, is the same for foreign visitors as it is for domestic air visitors. This assumption may overestimate vehicle driving by foreign visitors if they are actually less likely to drive than domestic air visitors.

For foreign visitors, data on N are available from the annual *Overseas Visitors to Select U.S. States*

and Territories (USDOC ITA 1996–1995 and 1998–1997). The data are derived from the INS I-94 form that all noncitizens must complete to enter the United States. The basis of the derivation is the first intended address by these visitors. Because these visitors may visit more than one state, a direct estimate from the I-94 form will understate the total number of international travelers that visited any given state. This underestimate can be accounted for by using the monthly survey of international travelers.¹ Our data on the number of foreign visitors to Florida came from the abovementioned document for the years after 1994.

For the period before 1995, data on the annual number of foreign visitors from the *Florida Visitor Study* were adjusted to reflect differences between these series. The series in the *Florida Visitor Study* shows the direct count from form INS I-94 and underestimates the total number of foreign visitors to Florida. The numbers before 1995 were adjusted up by a factor that is the ratio of the 1995 number (5.345 million) from *Overseas Visitors to Select U.S. States and Territories* to the 1995 number (4.162 million) from the *Florida Visitor Study*. The resulting adjustment factor is 1.284.

We did not have data to get a direct estimate of D (average daily driving per party) for any of the three visitor types, and the annual surveys do not contain any information on how much a party of visitors drove at their destinations. As a result, the estimation relied on assumed values for D . We believe that the average daily driving by Florida resident households provides a good point estimate for D . Most domestic visitors come to Florida either for social (visiting relatives or friends) or recreational purposes. While both a typical household and a visitor party would need travel for basic life maintenance activities (shopping, eating), work-related driving by a typical household is replaced by visitors driving for social and recreational activities. The orientation of activities to lodging provides additional confidence as evidenced by accommodations adjacent to theme parks and beach areas throughout Florida. We estimated average daily driving by Florida resident households with data from the Nationwide Personal Transportation Survey (NPTS), which provides data

¹More details about these are available from the source. See references.

for daily travel of Americans in this country (USDOT FHWA BTS 2003). The NPTS was conducted five times: 1969, 1977, 1983, 1990, and 1995. Using the NPTS Table Wizard, we got an estimate of about 52.65 daily vehicle-miles per Florida household for 1995 (USDOT BTS 1997a).

In addition to an estimate of the amount of daily driving by Florida households for a single year, we also needed to know how the amount of daily driving by each domestic party may have changed over time. For this, we examined the growth in the daily amount of driving for social and recreational purposes between 1983 and 1995 at the national level. National statistics were used here because data specific to Florida were unavailable for 1983. We found that the daily amount of per capita driving for social and recreational purposes grew at about 2.52% annually from 1983 to 1995 at the national level. Applying this growth rate to our 1995 estimate of D , we got a growth pattern for D from 1984 through 1998.

We applied the estimate of D for domestic visitors to foreign visitors simply because we did not have any other better information. It is likely that foreigners drive less while in their home countries. However, we had no information on how much less they drive as a group compared with U.S. residents. In addition, foreign visitors may drive more once in this country than they typically do at home.

We used two sets of numbers to estimate the average distance between the northern Florida border and the chosen destinations of domestic auto visitors. One set of numbers provided the distances between the border and each of the chosen destinations. These distances between city pairs were obtained using a Florida Department of Transportation's online tool (Florida DOT 2000). Because of the long border, we used three border cities to represent it: Pensacola for visitors entering the state on I-10 from the west, Jasper for those entering from I-75 in the middle, and Jacksonville for those entering on I-95 from the east. The largest city in each of the top 10 destination areas was used in the online tool to represent the area. For each destination area, the average of its distances to the three border cities was used.

The second set of numbers used is the distribution of these visitors by their chosen destinations from the annual *Florida Visitor Study*. For 1984 to 1996, the question on destination choice solicited all

destinations a respondent visited in Florida. For 1997 and 1998, however, that question was limited to the main destination of a respondent. As a result, the top 10 destinations from 1984 through 1996 typically accounted for over 90% of all visitors who came by car. For the last two years, they accounted for about 67%.

Using these two sets of numbers, the average distance between Florida's northern border and the chosen destinations was estimated for each year. From 1984 to 1996, this estimate of the average distance overstated the true value because some visitors visited more than one destination. To account for this overestimate, the distances were adjusted down by a correction factor. To obtain this factor, we calculated the percentage of all auto visitors who chose the top 10 destinations for each year. For any given year from 1984 to 1996, this factor was calculated as the ratio of the total percentage in that year to the total percentage in 1998.

For the annual amount of vehicle-miles traveled (vmt) in the state, we used the data in *Highway Statistics Summary to 1995* (USDOT FHWA 1996) for data from 1984 through 1995 and the annual *High-*

way Statistics report (USDOT FHWA 1996–1998) for the other years.

RESULTS

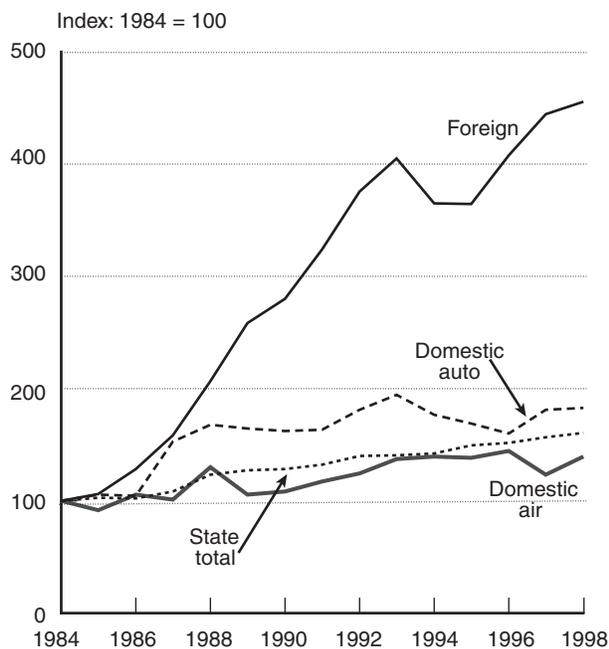
Table 1 summarizes our results of the estimated amount of vmt by Florida's visitors on its highways and how this amount compares with the state's total vmt from 1984 through 1998. The annual vmt by Florida's visitors increased 86% from 8.4 billion in 1984 to 15.7 billion in 1998. Relative to total state vmt, these vehicle-miles accounted for about 9.8% at the beginning of this period and reached 12.7% in the early 1990s. Their share later declined to about 10.9% of the state total.

Among the three visitor types, the annual amount of driving by foreign visitors grew the most (figure 1). From 1984 to 1998, total vmt in the state grew by 61%. For the same period, driving by domestic air visitors grew by 40% and driving by domestic auto visitors grew by 83%. However, driving by foreign visitors grew 356%. These differences in relative growth are also reflected in the differences in the share of total state vmt contributed by visitor type as shown in table 1.

TABLE 1 Vehicle Travel by Florida's Visitors and Share of State Total

Year	Vehicle-miles traveled (millions)				As a percentage of state total			
	Domestic air	Domestic auto	Foreign	All visitors	Domestic air	Domestic auto	Foreign	All visitors
1984	2,699	5,184	524	8,406	3.2%	6.1%	0.6%	9.8%
1985	2,487	5,487	557	8,531	2.8%	5.8%	0.6%	9.2%
1986	2,853	5,435	675	8,963	3.3%	5.7%	0.8%	9.7%
1987	2,738	7,922	831	11,491	2.9%	7.8%	0.9%	11.7%
1988	3,514	8,707	1,084	13,306	3.3%	7.7%	1.0%	12.1%
1989	2,859	8,527	1,354	12,740	2.6%	7.3%	1.2%	11.2%
1990	2,929	8,415	1,469	12,813	2.7%	7.1%	1.3%	11.1%
1991	3,173	8,478	1,698	13,349	2.8%	6.9%	1.5%	11.2%
1992	3,370	9,407	1,968	14,744	2.8%	7.3%	1.6%	11.8%
1993	3,717	10,100	2,123	15,941	3.1%	7.8%	1.8%	12.7%
1994	3,775	9,186	1,913	14,874	3.1%	7.1%	1.6%	11.7%
1995	3,736	8,766	1,912	14,413	2.9%	6.4%	1.5%	10.8%
1996	3,912	8,309	2,138	14,359	3.0%	6.0%	1.6%	10.6%
1997	3,329	9,396	2,331	15,056	2.5%	6.5%	1.7%	10.7%
1998	3,775	9,489	2,387	15,652	2.7%	6.4%	1.7%	10.9%

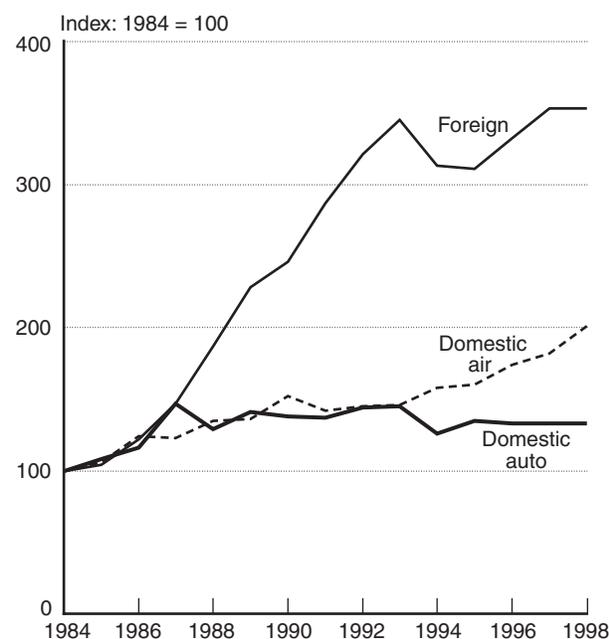
FIGURE 1 Growth in Vehicle-Miles Traveled: State Total and Visitor Types



Much of the differential growth trend in vmt between domestic and foreign visitors results from the differential growth trends in their numbers. From 1984 to 1998, the number of foreign visitors grew by 253%, compared with 33% for domestic auto and 101% for domestic air visitors (figure 2).

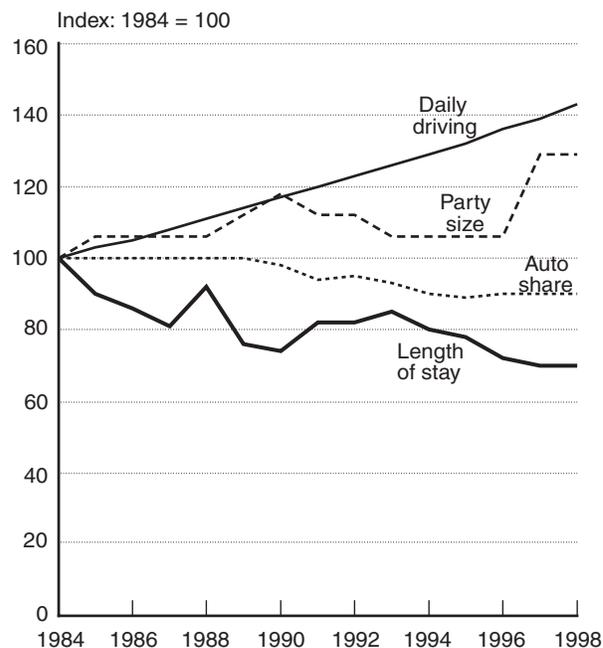
However, increases in the number of visitors by visitor type do not fully account for the differences in

FIGURE 2 Growth in Number of Visitors by Visitor Type



the amount of driving by visitor type. For example, while the number of domestic air visitors grew by 101%, the amount they drove only rose 40%. On the other hand, the number of domestic auto visitors grew by only 33%, while their vmt rose 83%. In addition, the number of foreign visitors grew by 253%, compared to a 356% increase in their vmt. The additional differences in driving by the visitor types reflect a variety of factors that determine how much they drive. These include the length of stay, party size, share traveling by car at their destinations, and the average amount of daily driving per party. Figures 3 through 5 show the changes in these parameters for domestic air visitors, domestic auto visitors, and foreign visitors, respectively.

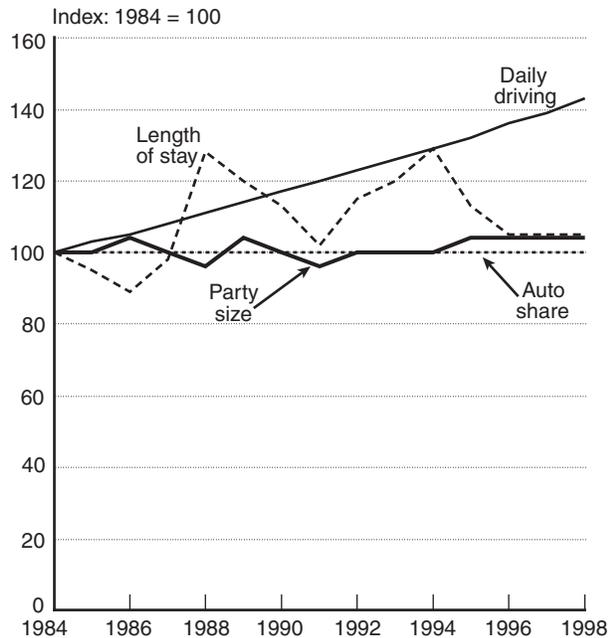
FIGURE 3 Changes in Determinants of Annual Driving by Domestic Air Visitors



Changes in other factors explain the slower growth in driving for domestic air visitors in comparison with the number of visitors. From 1984 to 1998, the length of stays decreased by 30%, the share of domestic air visitors traveling by car at their destinations decreased by about 10% and the number of people per party increased by about 30%.

Domestic auto visitors data, in contrast to domestic air visitors, show that the growth in their driving is greater than the number of visitors. On the negative side, the number of people per party slightly

FIGURE 4 Changes in Determinants of Annual Driving by Domestic Auto Visitors



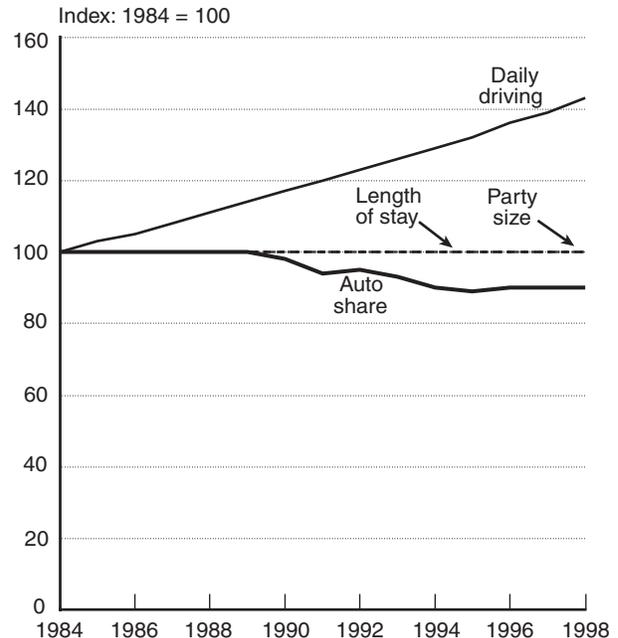
increased by about 4%. On the positive side, however, not only did the assumed growth in daily driving reinforce the growth in the number of visitors, but the length of stays also increased slightly by 5%.

Driving by foreign visitors also grew faster than the number of these visitors. Even though the share of these visitors traveling by car at their destinations decreased, the assumed growth in daily driving overcompensated for that decrease. In addition, we assumed, due to lack of data, that both the length of stays and the number of people per party of visitors remained the same.

Applicability to Other States

The proposed approach may offer some guidance to other states attempting to measure vehicle travel by visitors. Applicability would be governed mainly by two issues. First, the proposed approach to measuring vehicle travel by visitors to a single state does not take into account through travel. Excluding through travel was intentional, because people who travel through a state are technically not visitors to that state. However, through travelers use infrastructure and hence are of interest to planners. While there is little through travel in Florida because of its geography, many states have a lot of this traffic and, thus, would find this far more relevant.

FIGURE 5 Changes in Determinants of Annual Driving by Foreign Visitors



Note: Both length of stay and party size equal 100.

The other issue is the availability of similar data sources in other states. Our approach relies primarily on two datasets. One dataset has information on the annual number of foreign visitors and their characteristics, using federal data for estimating their driving. Since the federal data are available for every state, this approach is applicable to other states for measuring vehicle travel by foreign visitors.

The other dataset has information on the annual number of domestic visitors by entry mode and characteristics. The data on domestic visitors may come from different sources. The Florida application used two sources. One is an annual survey of these visitors as they complete their stay and leave Florida. This survey is specific to Florida. It is possible, however, that some other states have similar surveys. The other data source is the *DIRECTIONS Travel Intelligence System* mentioned earlier. This system is a syndicated database that tracks travel behavior for the entire country and is based on annual surveys of 540,000 traveling households. Most states can get the data needed for the proposed approach by using the subsample for their states.

In addition to those state-specific annual surveys or the *DIRECTIONS Travel Intelligence System*, individual states can also use the 2001 *National*

Household Travel Survey (NHTS) (USDOT FHWA BTS 2003). The 2001 NHTS was designed to include both local and long-distance travel. For each destination state, the survey data contain all the necessary information for applying the proposed approach. Specific information items from the survey include destination cities, group size, modes to and from destinations, modes used at destinations, duration of stay to be derived from information on departure and return dates, and the total number of visitors. One advantage of the 2001 NHTS is that it also gives information on the origin states of visitors. This information can potentially be used to determine where visitors may enter a destination state, which is particularly important if there are many bordering states and entering routes. Another advantage of the 2001 NHTS is that it provides a consistent source of data for all states. One interesting exercise would be to apply the proposed approach to individual states with the 2001 NHTS to measure vehicle travel by domestic visitors.

CONCLUSION

This paper proposes a simple approach to estimating vehicle travel by visitors to individual states and applies it to Florida for the 15-year period from 1984 through 1998. Our findings for this period show a trend toward slower growth in driving by domestic visitors entering Florida by air and higher growth in driving for those visitors entering by auto and for foreign visitors. Changes in other factors—number of visitors entering the state, their length of stay, and the number of people traveling together in a party— affect these trends. The proportion of vehicle travel by visitors to a state can be significant and may exceed that by freight trucks. Proportions appear to be relatively stable over time with some variations depending on not only changes in the number of visitors but also changes in their characteristics. Estimates of vehicle travel by visitors are likely to be conservative, because several components of vehicle travel by visitors are omitted due to lack of data.

This approach is applicable to individual states that have access to information on domestic and foreign visitors, such as the number of visitors, their distribution among major destinations, average length

of stay, average party size, and the proportion traveling at their destinations by car.

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