



# TRANSPORTATION RESEARCH SYNTHESIS

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## Estimating Non-Automobile Mode Share

*The purpose of this TRS is to serve as a synthesis of pertinent completed research to be used for further study and evaluation by MnDOT. This TRS does not represent the conclusions of either the University of Minnesota or MnDOT.*

### **Abstract**

Legislatively revised statewide transportation goals were adopted in 2010. Among the revisions are requirements to foster an increase in the percentage of all trips made either by transit, bicycling, or walking. While periodic data is gathered regarding journey-to-work trips, comprehensive reporting about all travel is limited and periodic data has reliability issues. This research reports on whether and how other states gather and analyze data or estimate mode share for travel statewide. This research found that many states do not provide information on current bicycle and pedestrian mode share. Those states that do report this information, report either Census data or from their own travel behavior inventories if they are at all current. Some states narrow their responsibility and performance reporting only to state-owned infrastructure, typically interregional trails and pedestrian facilities along highways. Still other DOT's de-evolve responsibility for this issue to Metropolitan Planning Organizations (MPO's), as urban areas typically have the most bicycle and pedestrian-accessible locations. MPO's also have the more control over the development of bike and pedestrian-accessible locations. Delaware stands out as unusual in that it has integrated land use planning with transportation planning. In this way, it does not report directly on bicycle and pedestrian mode information but on land use issues which are determinants of bicycle and pedestrian mode share. It also provides alternatives which could affect bicycle and pedestrian mode share.

### **Introduction**

As population and travel grows and funding for highway expansion wanes, there is an increasing interest in shifting more people from automobiles to other modes of travel. The more trips taken on other modes, the fewer trips taken on an increasingly overburdened roadway system.

Legislatively revised statewide transportation goals were adopted in 2010. Among the revisions are requirements for Mn/DOT to foster an increase in the percentage of trips made by modes other than automobiles.

While this seems like a straightforward directive, measuring progress is quite difficult in the real world. Alternatives to automobile travel include three basic options: public transit, walking and biking. Transit usage is easy to estimate because actual ridership figures can be obtained from transit providers. In fact, it is one of the easiest modes to measure usage because of this.

Estimating walking and biking, on the other hand, is much more difficult. Automobile traffic occurs on roads and counting traffic can be done easily with tube counters and similar measuring tools. Walking and biking can occur anywhere, making it

impossible to locate measuring devices to comprehensively measure walking and biking travel. Also, devices like tube counters do not exist for walking and biking. Because of this, directly measuring walking and bicycling comprehensively is, for all intents and purposes, impossible.

It is possible to gather information by surveying travelers. One way of gathering information is through work by the Census Bureau. Through 2000, the Census Bureau collected journey-to-work information on its Census Long Form. These questions asked how individuals got to work and provided one way of gaining information on travel. The long form, however, has been replaced with the American Community Survey (ACS), which obtains data on a continuous basis but samples many fewer people. The ACS surveys about 1% of the population in any one year. This is a particularly small sample size with a relatively high sampling bias for questions with small numbers of responses. So researchers typically combine multiple years of data to improve data quality. This, however, can obscure trends.

A second shortcoming of Census data is that it is only for work-related trips. Typically work-related trips account for only about fifteen percent of all travel and journey-to-work includes about half of that figure (National Household Travel Survey, 2009)<sup>1</sup>. Because of this, the Census information is very limited in what it tells us about travel overall and about walking and biking trends in particular.

A better approach is to sample people directly about their travel through a travel behavior inventory or TBI (also called "household survey" or "travel survey"). A TBI is a direct sampling of population to determine its travel characteristics. Typically, a travel diary is given to a family and they are asked to record their travel for a day or two days. This includes questions like mode, trip purpose, trip distance, destination, and whether they traveled alone or with another individual. Recently, GPS-enable devices have been used to replace the travel diaries.

TBI's are done at many different geographies. The "National Household Travel Survey" (NHTS) is a national travel behavior inventory conducted by the Federal Highway Administration. It has been conducted in 1969, 1977, 1983, 1990, 1995, 2001 and 2009. Other states, such as Oregon (<http://www.oregon.gov/ODOT/TD/TPAU/Survey.shtml>), California (<http://www.dot.ca.gov/hq/tsip/tab/travelsurvey.html>), Georgia (<http://www.improvegeorgiatravel.com>), Nebraska (<http://www.dor.state.ne.us/lrtp/vision2032>), and many other states have done their own TBI. Many regions have conducted travel behavior inventories, including Washington, D.C. (<http://www.mwcog.org/transportation/activities/hts/>), Atlanta (<http://www.atlantaregional.com/transportation/travel-demand-model/household-travel-survey>), Chicago (<http://www.cmap.illinois.gov/travel-tracker-survey>). The Metropolitan Council has done a TBI for the Twin Cities region, with a data series going back to 1949.

The difficulty with TBI's is that they are very expensive. The Florida Department of Transportation says, "Travel surveys are expensive, labor intensive, complex, and time-consuming."<sup>2</sup> It is very costly to get a statistically valid sample size. The national NHTS, for example, included only 150,147 households<sup>3</sup>, only .05% percent of the population of the United States. The Twin Cities Travel Behavior Inventory, conducted in 2010, cost over \$2 million and included only 1% of the Twin Cities population. Because of this, typically these surveys are only done every ten years or so. This makes tracking trends and measuring success in inciting mode shifts difficult.

Another problem with measuring pedestrian and bicycle travel is that it comprises such a small percentage of travel overall that there can be significant unreliability in surveys. There are two types of errors in surveys: "sampling error" and "non-sampling error". A survey is nothing more than a sample of a much larger population and there can be variation in how accurately that particular sample represents the overall population. The question of how accurately our sample represents the overall sample is called "sampling error." Sampling error is measured through confidence levels and margin of error. For example, the National Household Travel Survey reported that walking comprised 3% of all work trips.<sup>4</sup> Statistics tell us that we can say with 95% confidence that (given the sample size) that the actual figure is within plus or minus 12% of this figure. A possible range of 25%, however, makes it hard to know in actuality whether the number of people walking to or from work is truly increasing or decreasing despite the figure derived from the survey. (It should also be noted that bicycle travel was considered so insignificant in the National Household Travel Survey that it was not even reported separately.)

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<sup>1</sup> National Household Travel Survey. (2009). Federal Highway Administration. Available from the World Wide Web at: <http://nhts.ornl.gov/2009/pub/stt.pdf>

<sup>2</sup> Florida Department of Transportation, 2011. Retrieved from the World Wide Web, June 28, 2011 from <http://www.fsutmonline.net/Floridatravelsurveys/index.htm>

<sup>3</sup> National Household Travel Survey. (2009). Federal Highway Administration. Available from the World Wide Web at: <http://nhts.ornl.gov/2009/pub/stt.pdf>

<sup>4</sup> Ibid.

This can be corrected for to some extent by oversampling. Oversampling is when you survey more people that might respond to low response questions in order to get a more robust figure. This, however, adds cost to better understand a very small percentage of travelers. Typically because walking and biking are such small percentages of overall travel, state-wide TBI's do not do this. Regional TBI's often will however, because their data is used to calibrate travel demand models that forecast transit ridership to receive federal transportation money.

Another problem with small numbers of respondents is non-sampling error. Non-sampling error can be thought of as the results of the practical problems with doing surveys. Examples include issues like the inability of respondents to remember information, deliberate inaccurate reporting (say people wanted to give more importance to walking so they report walking when they really did not walk), different interpretation of questions, language barriers, etc. A major source of non-sampling error is the failure to represent all sample households and all persons within sample households (known as under-coverage). Generally in the U.S., under-coverage is larger for African-Americans and other minority races than for Caucasians, for poor people more so than wealthy persons and for Hispanic persons more so than non-Hispanic persons. This is significant for understanding trends in walking and biking as these groups have traditionally had lower rates of automobile ownership and higher rates of alternative modes of transportation. There is no way of knowing the extent of non-sampling error or even estimating it. To the degree it can be corrected for, it can be managed through careful survey techniques. The Transportation Research Board has an active project to detail the best practices in estimating bike and walk travel (NCHRP 08-78) but this work will not be completed until April 2012.

A last problem with measuring walking and bicycling modes is that they are really an urban concept and urban phenomena. Say a cattle rancher walks out of his house and to his barn to feed his cattle. Has he taken a trip? If he then walks out to his pasture to check his windmill, has he taken a trip? If he hops on a four wheeler to get to the windmill, has he taken a trip?

Walking and biking modes assume that there are destinations that are reachable by walking or biking. This is something that simply isn't true in most rural areas. In discussions with a transportation planner from North Dakota, she stated that they really didn't have a bicycle or walk mode share because the vast majority of the population were not living in walkable environments. Because of this, it made no sense for them to track this information. This dilemma faces all the states that have a significant number of persons who live in rural areas or small towns.

So if it is impossible to directly measure walking and bicycling travel comprehensively and census data is incomplete and state-wide travel surveys are done infrequently and state surveys provide ambiguous data, what alternatives do states have to estimate mode share? And how to states deal with these questions in their long-term planning? These questions are the focus of this research.

## **Study Method**

Two approaches were used to answer these questions. First, DOT's from all 50 states were surveyed via email to ask directly how they handle this issue. Individuals from each DOT were asked:

I am trying to find out how other states analyze data and estimate mode share for travel statewide for their long-range plans. Specifically, in Minnesota, our Legislature has mandated that we increase bike/ped mode share. Yet we realize that we struggle to estimate what mode share is today, which makes it difficult to know if our mode share is changing. This can be a difficult question and I am wondering how other states approach this issue.

This survey was conducted in June 2011. Only ten DOT's ultimately responded despite repeated attempts. Respondents include: Arizona, Florida, Georgia, Iowa, Michigan, Nebraska, Oregon, North Dakota, Texas and Vermont.

In discussions with various respondents, the reasons for the low response rate became apparent. In some states, especially those with large non-urban populations, pedestrian and bicycle travel are such small components of travel that they simply do not include them in their long-range forecasting or give them much visibility in state-wide transportation planning. Brad Zumwalt from Nebraska stated, "I am not sure that we truly estimated mode share for our LRTP... Our mode share, other than automobile, is less than 10% so we really don't have a need to be too exact."

For states with larger urban populations, there is recognition that bicycling and pedestrian travel is an issue to be addressed. But, as noted in the Introduction, there is not a good way of measuring this travel so many states do not try. Keith Killough from Arizona responded, "Even at the regional level undertaken by metropolitan planning and transit organizations, quantitative mode split analysis for bicycles and pedestrians is more art than science for a variety of reasons -- most of which involve the scarcity of data. I say this from my perspective of having performed or having been responsible for bicycle planning in Washington, D.C. and Los Angeles."

Janie Temple from Texas noted their draft long-range plan stated that there are no reliable methods for forecasting bicycle and pedestrian usage at the state level. There was political pressure to include this information, however. So they included the following language, which essentially passed the requirement for collecting data to the local units of government:

Goals for optimal levels of bicycle and pedestrian mode share may be determined using data and methods developed from communities that made significant investment and have seen significant increases in bicycle and pedestrian mode share. This may allow a more detailed evaluation of future funding needs.

Because of this low response rate, the long-range plans of all the states that did not respond to the original study were reviewed to see how they approached this issue. This meant that 39 long-range plans were reviewed. (Minnesota was excluded.) These included the following states: Alabama, Alaska, Arkansas, California, Colorado, Connecticut, Delaware, Hawaii, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Mississippi, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

### **How Do States Report Bike and Pedestrian Mode Share in Their Long-Range Transportation Plans?**

With this research, it became apparent that there are five major ways that states are dealing with the dilemma of not being able to accurately measure pedestrian and bicycle travel in their long-range plans:

- 1) They include TBI and Census data, despite its shortcomings.
- 2) They do not include biking and pedestrian mode share information because it is not significant enough to have an impact on state-wide planning.
- 3) They narrow their responsibility only to state facilities – i.e. state trails and trails built along state highways. They collect usage data on this system but do not forecast utilization throughout the whole state. “State trails” can include regional trails that are managed by a department of natural resources or park department and not just facilities directly under DOT control. Typically this reporting is confined to interregional trail usage.
- 4) They de-evolve this issue to MPO’s and other regional planning entities. Because biking and walking require origins and destinations close enough together to be reached by biking or walking, many states do not see this as a state issue. This mode is really dependent upon the land use choices and thus a local issue.
- 5) They include land use planning in transportation planning and report, not on mode split information, but on land use information that is linked to bicycle and pedestrian mode share.

Note that none of these alternatives are exclusive. States often take multiple approaches.

The information below provides examples of these different approaches.

#### **Report TBI’s and Census Data**

One approach is to report either Census data or state travel behavior inventory information. Typically this includes Census Journey-to-Work data and travel behavior inventory information only if it is relatively recent. Because TBI’s are done so infrequently, often this data is not included in long-range plans. It should be noted that these are the only two sources of actual mode split information that was found through this research.

- Mississippi includes Census data for walking and biking in its long-range plan. They note that based on Census data, they estimate that 1.78% of Mississippians walk to work and 0.16% bicycle to work, reflecting why these modes get little attention. This report can be seen at:  
<http://www.multiplan2035.com/PDF/MULTIPLAN%202035%20Final%20Report.pdf>
- Alaska includes Census data in its long-range plan. The plan also notes that “Alaska is unique in that depending on the local ordinances and season, snowmobiles and all-terrain vehicles are a regular form of transportation” which results in higher than the national average. This report can be seen at:  
<http://dot.alaska.gov/stwdplng/areaplans/lrtpp/documents/SWLRTPPfinal022908-v2.pdf>
- Montana reports Census Journey-to-Work data state-wide.  
<http://www.mdt.mt.gov/publications/brochures.shtml#tranplan21>

- New York reports Census Journey-to-Work data. <https://www.nysdot.gov/portal/page/portal/main/transportation-plan/repository/masterplan-111406.pdf>
- Wisconsin reports National Household Travel Survey data. <http://www.dot.wisconsin.gov/projects/state/docs/2030-chapter3.pdf>
- Florida reports its own TBI data from the “Travel Demand and Travel Behavior Trends.” <http://www.dot.state.fl.us/planning/trends/tc-report/behavior092308.pdf>
- Vermont reports its own TBI data. <http://www.aot.state.vt.us/planning/Documents/Planning/VTBPPP2-10-08Final.pdf>
- Oregon reports its own TBI data. <http://www.oregon.gov/ODOT/TD/TPAU/Survey.shtml>

### **Do Not Include Biking and Pedestrian Mode Split Information**

Quite a number of states do not report any bicycle or pedestrian mode split. Some of the states that do not report this information include:

- Maine: <http://www.maine.gov/mdot/connectingmaine/documents/pdf/ExecutiveSummary.pdf>
- Missouri: <http://www.modot.mo.gov/pdf/plansandprojects/lrtd-web.pdf>
- Indiana: <http://www.in.gov/indot/div/pubs/LRPMain03291>
- Kentucky: <http://transportation.ky.gov/planning/stp/2006/Statewide%20Plan.pdf> 1-2.pdf
- Kansas: <http://www.ksdot.org/lrtp2008/>
- Arkansas: [http://www.arkansashighways.com/stip/Final\\_2007\\_Statewide\\_LongRange\\_Plan.pdf](http://www.arkansashighways.com/stip/Final_2007_Statewide_LongRange_Plan.pdf)
- Colorado: [http://www.coloradodot.info/programs/statewide-planning/documents/2035PlanAmendmentMay2011\\_Final.pdf](http://www.coloradodot.info/programs/statewide-planning/documents/2035PlanAmendmentMay2011_Final.pdf)
- North Dakota: <http://www.dot.nd.gov/public/transaction.htm>
- Nevada: [http://www.nevadadot.com/uploadedFiles/NevPlan\\_StatewideTransPlan.pdf](http://www.nevadadot.com/uploadedFiles/NevPlan_StatewideTransPlan.pdf)
- New Jersey: New Jersey has a separate plan biking and pedestrian activities but does not address mode split issues. It does assign responsibility for performance measures to the DOT but does not describe them. <http://www.bikemap.com/RBA/NJBikePed.pdf>
- Arizona: [http://www.whatmovesyouarizona.gov/your\\_home.asp](http://www.whatmovesyouarizona.gov/your_home.asp)
- Vermont: <http://www.aot.state.vt.us/planning/LRTBP.htm> or <http://www.aot.state.vt.us/planning/Documents/Planning/VTBPPP2-10-08Final.pdf>
- Texas: [http://www.txdot.gov/public\\_involvement/transportation\\_plan/default.htm](http://www.txdot.gov/public_involvement/transportation_plan/default.htm)
- Michigan: Has a 53 page report on walking and biking but does not include mode share or overall walking and biking information. [http://www.michigan.gov/documents/mdot/MDOT\\_SLRP\\_techrept\\_NM\\_178144\\_7.pdf](http://www.michigan.gov/documents/mdot/MDOT_SLRP_techrept_NM_178144_7.pdf)

### **Narrow their responsibility only to state facilities**

A number of states focus only on the infrastructure that they provide and not on the broader question of mode split throughout the whole transportation system. Typically this is estimates of the number of users of specific facilities, usually interregional trails and trails that have been built along roads. Examples include:

- Alabama has a separate bicycle/pedestrian infrastructure plan. This planning does not extend beyond ALDOT’s infrastructure, however. A link to this study is: <http://www.dot.state.al.us/moweb/doc/DRAFTBicyclePedestrianPlan10222009.pdf>
- Indiana includes the trails, greenways, and bicycle paths in their long-range plan. This can be seen at: <http://www.in.gov/indot/div/pubs/LRPMain032911-2.pdf>
- Kansas provides information on potential state interregional corridors but does not provide current performance information. <http://www.ksdot.org/lrtp2008/>

- Alaska identifies investments in trails, although this is primarily for recreational trips.  
<http://dot.alaska.gov/stwdplng/areaplans/lrtpp/documents/SWLRTPPfinal022908-v2.pdf>

### **De-evolve this Issue to MPO's and other Regional Planning Entities**

There is a question of whether bicycle and pedestrian mode share should even be a state issue. Walking and biking depend on destinations that are close enough to be reached by those modes. In addition, land use questions are typically outside of the purview of state DOT's. Land use and development choices are typically handled by local units of government, and thus the availability of bikeable and walkable alternatives. Also, the need to shift people off congested roadways to other modes is a regional, not state issue. Because of this, many DOT's defer to MPO's for reporting on walking and biking modes.

- Mississippi notes in its long-range plans that it supports completion of MPO bicycle/pedestrian networks.  
<http://www.multiplan2035.com/PDF/MULTIPLAN%202035%20Final%20Report.pdf>
- California also looks to local units to provide bicycle and pedestrian infrastructure. :  
[http://www.dot.ca.gov/hq/tpp/index\\_files/ctp\\_2030\\_oct\\_2007.pdf](http://www.dot.ca.gov/hq/tpp/index_files/ctp_2030_oct_2007.pdf)
- Louisiana notes that "In Louisiana, bicycle and pedestrian concerns are treated mainly as local issues" (page 5-38).  
<http://www.dotd.la.gov/study/pdf/08%20Chapter%205%20-%20Existing%20Conditions.pdf>
- Alaska looks to local units of government develop pedestrian and bicycle facilities. "ADOT&PF is supportive of various communities initiatives to develop bicycle and pedestrian facilities."(Page 53) Read more at:  
<http://dot.alaska.gov/stwdplng/areaplans/lrtpp/documents/SWLRTPPfinal022908-v2.pdf>
- Arkansas requires MPO's to address bike and pedestrian needs in their long-range plans.  
[http://www.arkansashighways.com/stip/Final\\_2007\\_Statewide\\_LongRange\\_Plan.pdf](http://www.arkansashighways.com/stip/Final_2007_Statewide_LongRange_Plan.pdf)
- Montana divides bike and pedestrian facilities into recreation (which are a state responsibility) and urban (which are an MPO responsibility). It provides information on the state trails.  
<http://www.mdt.mt.gov/publications/docs/brochures/tranplan21/bikeped.pdf>
- Nevada recognizes that pedestrian issues are local. They talk specifically about the Las Vegas strip as a place where local government is responsible for planning and monitoring performance.  
[http://www.nevadadot.com/uploadedFiles/NevPlan\\_StatewideTransPlan.pdf](http://www.nevadadot.com/uploadedFiles/NevPlan_StatewideTransPlan.pdf)

### **Integrate Land Use Planning and Transportation Planning**

Of all the states reviewed, Delaware requires special note. They are the only state to have attempted to integrate land use planning and transportation planning. This is critical because one of the biggest determinants of bicycle and pedestrian mode share is the availability of destinations that can be reached with these modes. Although they do not report mode split, they do attempt to report information on land use, which directly affects mode split. Their planning looks at specific land use changes that could be implemented that would affect the level of pedestrian and biking travel. They also identify the percentage of travel by pedestrian and bicycle modes as a performance measures for the future but do not explain how this will be achieved. This plan can be accessed here: [http://deldot.gov/information/pubs\\_forms/delrtp/delrtp\\_102510.pdf](http://deldot.gov/information/pubs_forms/delrtp/delrtp_102510.pdf).

### **Literature Review**

This research paper focuses specifically on the issues of estimating pedestrian and bicycle travel at the state level. There is virtually no literature that looks at this question. Most research that has looked at estimating pedestrian and bicycle travel has looked at either travel within a narrow geographic area (a corridor, a central business district or street, for example) or at forecasting into the future. Both of these questions can provide some information on estimating issues today.

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