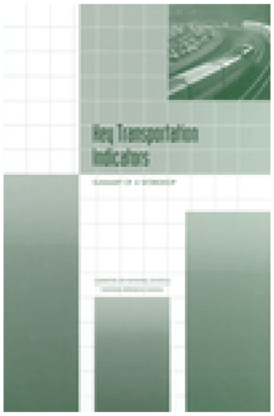

Key Transportation Indicators: Summary of a Workshop

Janet Norwood and Jamie Casey, Editors, National Research Council

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Key Transportation Indicators

SUMMARY OF A WORKSHOP

Committee on National Statistics

Janet Norwood and Jamie Casey, Editors

Division of Behavioral and Social Sciences and Education

National Research Council

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2001

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Several CNSTAT staff members also deserve special thanks. Miron Straf served as study director for this workshop. His excellent research and planning made the workshop possible. Terri Scanlan, program associate, and Carrie Muntean, research assistant, very ably assisted Dr. Straf in the planning of the workshop. Jamie Casey served as project assistant for the workshop and was responsible for all of the logistical details; subsequently, as research assistant, she was responsible for the preparation of the report. Constance Citro, senior program officer, reviewed drafts of this report and offered excellent advice and support throughout the writing and review stages. Christine McShane edited the final draft of this report and led it through publication. Eugenia Grohman, associate director for reports in the Division of Behavioral and Social Sciences and Education, led the report through the review process.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the Report Review Committee of the National Research Council. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making the published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their participation in the review of this report: Joel Horowitz, Department of Economics, Northwestern University; Robert Martinez, Norford Southern Corporation, Norfolk, Virginia; and C. Kenneth Orski, Corporation for Urban Mobility, Washington, DC.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the final draft of the report before its release. The review of this report was overseen by Thomas D. Larson, Lemont, Pennsylvania. Appointed by the National Research Council, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

John Rolph, *Chair*
Committee on National Statistics

Contents

APPENDIXES

1

Introduction

A transportation indicator is a measure of change over time in the transportation system or in its social, economic, environmental, or other effects. Two National Research Council (NRC) studies recommended, as a matter of high priority, that the Bureau of Transportation Statistics (BTS) in the U.S. Department of Transportation (USDOT) develop a consistent, easily understood, and useful set of key indicators of the transportation system. The NRC's Committee on National Statistics and its Transportation Research Board, which conducted these studies, convened a workshop on June 13, 2000.[1] The purpose of the Workshop on Transportation Indicators was to discuss issues relating to transportation indicators and provide the Bureau of Transportation Statistics with new ideas for issues to address. Most statistical agencies produce monthly, quarterly, or annual indicators in their areas. Examples are monthly reports of the Consumer Price Index (CPI) and the unemployment rate by the Bu-

[1]National Research Council. 1997. *The Bureau of Transportation Statistics: Priorities for the Future*. Panel on Statistical Programs and Practices of the Bureau of Transportation Statistics. Constance F. Citro and Janet L. Norwood, eds. Commission on Behavioral and Social Sciences and Education. Washington, DC: National Academy Press. National Research Council. 1992. *Special Report 234, Data for Decisions: Requirements for National Transportation Policy Making*. Committee for the Study of Strategic Transportation Data Needs. Washington, D.C.: Transportation Research Board.

reau of Labor Statistics; quarterly reports of gross domestic product (GDP) by the Bureau of Economic Analysis; and annual reports of poverty, high school completion and dropout rates, and births, deaths, and other vital statistics by the U.S. Census Bureau, the National Center for Education Statistics, and the National Center for Health Statistics, respectively. These indicators are important for public policy decision making. Some of them have significant effects on the economy and private-sector decisions. And, in an important sense, all of them serve to hold the government accountable to the public.

BTS is the newest federal statistical agency, established by the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) and subsequently reauthorized. The authorizing legislation charges BTS to work with other USDOT administrations, the states, and other federal officials to implement a long-term program for collecting and analyzing data on the performance of the national transportation system.

From its inception, BTS has compiled myriad indicators based on data that are regularly collected on the transportation system. These data serve many important purposes. They help to increase understanding of interactions between transportation activity and the economy, the environment, and community development and other land use. They are used to monitor changes in the performance of the transportation system, which may alert us to possible future problems. And they are useful directly in managing the transportation system. For these purposes, the data are mostly used within administrations of USDOT with responsibility over particular transportation modes, such as the Federal Highway Administration and the Federal Transit Administration and within state and local agencies, such as metropolitan planning organizations (MPOs).

But, among these many indicators, how can we select those that are most significant to public policy and to public awareness? Which of them are important measures of accountability? What indicators are most relevant to major transportation policy concerns? What indicators are most appropriate for BTS to develop in its role as a statistical agency that is concerned with broad transportation issues and all transportation modes?

This workshop considered questions such as these. Participants were also asked to think creatively about aspects of the performance of the transportation system that should be measured with indicators but are not. Are there useful, feasible indicators that are important to develop that cut across modes? Should safety indicators be based on the risk of a type of journey, or should they incorporate the transportation patterns of individuals? For some indicators, such as congestion, is it more meaningful to report them for a few major cities or metropolitan areas than to report them on a national level? Data from the 2000 census provide opportunities for developing new local indicators because of new definitions for metropolitan areas and the fact that transportation analysis zones will follow the boundaries of census geography. For new indicators, are the needed data available? If not, what conceptual and measurement problems need to be addressed?

USDOT has developed five strategic goals that are useful in identifying key policy areas for which indicators could be helpful. The five goals are in the areas of (1) safety, (2) mobility, (3) economic growth and trade, (4) human and natural environments, and (5) national security. The workshop focused on the first three areas for case studies. Separate groups of participants considered these areas in advance of the workshop and presented suggestions for key indicators with a discussion of conceptual, measurement, and data issues at the workshop. Indicators for the transportation of people, in contrast to freight, received most attention, although freight indicators were part of the scope for the third case study.

Each of the subgroups was to review the current indicators, review the available data to support them, and identify the issues associated with their use. The separate groups conferred in person, by telephone, or by email to consider indicators and address issues in their respective areas: (1) safety, including measures within and across modes; (2) mobility, including congestion, access to transportation in rural areas, and the condition of infrastructure and its maintenance required to meet future demand; and (3) economic growth, including the movement of freight.

The members of the safety subgroup were:

Kenneth L. Campbell (Chair), Transportation Research Institute, University of Michigan
Lindsay Griffin, Texas Transportation Institute
Charles A. Lave, Department of Economics, University of California, Irvine
John S. Miller, Virginia Transportation Research Council
Douglas Robertson, Highway Safety Research Center, University of North Carolina
Nathaniel Schenker, National Center for Health Statistics
BTS Liaison: Terry Klein, Bureau of Transportation Statistics

The members of the mobility subgroup were:

Michael Meyer (Chair), School of Civil and Environmental Engineering, Georgia Institute of Technology
David L. Greene, Oak Ridge National Laboratory
Randall K. Halvorson, Minnesota Department of Transportation
Timothy J. Lomax, Texas Transportation Institute
Alan E. Pisarski, consultant, Falls Church, VA
Anthony E. Smith, Department of Systems Engineering, University of Pennsylvania
Clifford H. Spiegelman, Department of Statistics, Texas A&M University
Ronald W. (Ron) Tweedie, New York State Department of Transportation
BTS Liaison: Alan F. Karr, National Institute of Statistical Sciences

The members of the economic subgroup were:

Damian Kulash (Chair), Eno Transportation Foundation, Inc.
Randall Eberts, Upjohn Institute
Francis Francois, American Association of State Highway and Transportation Officials (former executive director)
Barbara M. Fraumeni, Bureau of Economic Analysis
Richard (Dick) Mudge, Compass Services
M. Ishaq Nadiri, Department of Economics, New York University
BTS Liaison: Rolf Schmitt, Bureau of Transportation Statistics

Each group developed a preliminary set of a few key indicators, cutting across modes when appropriate and considering the appropriate level of geographic detail (national, state, or local). For example, for transportation safety, indicators included numbers of fatalities and injuries as well as fatality and injury rates by mode. For mobility, indicators included hours of delay and time and distance of commute trips. For economic growth, indicators included percentage on-time performance, average daily value of inventory in transit, value of goods damaged in transit, and cost per trip and unit of travel.

The groups prepared written statements summarizing their results for presentation and distribution at the workshop. The chair of each group presented the results and led a discussion. The groups raised issues that they identified while developing their indicators, including measurement issues (e.g., appropriate measures of exposure), data availability and timeliness, consistency across modes, and appropriate reporting frequency and gave suggestions about how these issues might be addressed.

In addition to the three subgroups, Diane Herz from the Bureau of Labor Statistics also gave a presentation at the workshop. She discussed the American Time-Use Survey as it specifically relates to transportation statistics. She presented potential transportation statistics that could be gleaned from the survey, such as the purpose of trips and the time spent traveling. Appendix A is a summary of her presentation.

2

Transportation Safety Indicators

This chapter begins with a brief review of existing measures of transportation safety and their possible use. It then summarizes the subgroup's discussion of issues associated with existing measures and ends with consideration of possible new indicators.

CURRENT MEASURES

Three main groupings illustrate the range of current safety indicators considered by the subgroup. They are counts of fatalities, injuries, and accidents; rates (counts per exposure units); and countermeasure-related measures (alcohol-related incidents, seat belt use, truck-related incidents, etc.). Measures in each of these groupings convey very different information and serve different purposes. There may be other types of measures not covered in these groups that have been overlooked.

The number of injured persons, often tabulated by the severity of the injury, is taken as the fundamental measure of transportation safety. Although other losses or disbenefits may be of interest, such as property damage or congestion delay, they are generally not considered safety measures.

Suggested Use

Several possible uses have been suggested for existing safety indicators. First, they can describe the current state of transportation safety relative to the past. This is the most straightforward use of a key indicator and usually implies a comparison over time, typically year-to-year changes. Second, safety indicators can indicate the status of countermeasure programs. In this case, the understanding is derived from the research underlying the development of the countermeasure in the first place. However, the meaning is likely to be limited to the context of the countermeasure. Such measures can be a useful report card for a particular program, but they may not have use beyond the program. Finally, safety indicators can be used to support policy decisions regarding existing and new countermeasures.

The final use, supporting policy decisions, may be problematic. Countermeasure development usually involves some detailed understanding of the relationship of the countermeasure to some safety objective, such as reducing injuries or accidents. Out of that understanding can come some key indicators. But time trends in key indicators characterizing the overall state of transportation safety are not likely to include any information that is relevant to decisions on new countermeasures or programs. In general, key indicators can tell in which directions things are headed, but they usually do not contain information on *why* the trend is up or down. Thinking that they do appears to be a common misconception with any key indicator. This theme of appropriate and inappropriate use continues through the remaining material discussing issues in the selection of key safety indicators.

Issues

Key indicators are numbers that convey information. By its nature, any indicator is necessarily an oversimplification and carries with it an inherent risk of misuse. In addition to selecting the measure, it is also necessary to document the intended meaning of the indicator. What understanding can the user expect to obtain? Four main issues were identified by the subgroup. The first issue is to identify the audience and exactly what the indicator is intended to communicate. The second issue has to do with counts versus rates. The third issue deals with data quality, and the final issue is exposure.

Purpose

Based on the group's discussions, a fundamental issue in selecting a key indicator is to identify the audience and clarify what the indicator is intended to communicate. Beyond this, the geographic scope and time period need to be defined. Can national figures support disaggregation to the state or county level? Can data systems that provide annual data also provide quarterly or monthly data? What comparisons are appropriate, and what comparisons are not? Different indicators serve different purposes. Reliability of both the current point estimate and change over time is also an important consideration. What differences are significant?

Counts Versus Rates

Another important issue is counts versus rates. The recent public discussion over truck safety featured some disagreement over whether increasing numbers of truck-related fatalities or a declining rate of fatalities per truck miles traveled correctly indicated the current trend in truck safety. Of course, both indicators were correct and taken together show that increases in travel were greater than the decrease in the risk of fatality per miles traveled. The two serve different purposes, and both are useful. Counts are a measure of prevalence and describe the magnitude or size of a problem. Comparisons are generally appropriate within or across modes. Prevalence is often a consideration (but not the only one) in allocating resources among different problem areas. Rates provide a different kind of information and imply a comparison based on the denominator selected, for example, vehicle miles traveled or per capita. The appropriate use of rates rests on the validity of the denominator for the comparison of interest. Driver age is an example for which rates have been of primary interest. But rates require exposure data, and exposure data are often difficult and expensive to collect. Some estimates have large errors. Exposure data are the topic of the final issue.

Data Quality

The third important issue is data quality. This discussion is taken entirely from remarks made at the workshop by Lindsay Griffin of the Texas Transportation Institute. His judgment is that the fatal crash data that are available for developing highway safety indicators are fairly reliable, but crash and injury data are much more suspect.

The reporting threshold for traffic crashes, which defines when a crash is severe enough to be officially reported by the states, can and does change without warning. In Texas, for example, traffic crashes stood at 414,614 in

1994; in 1996 the figure was 298,143—28 percent fewer. This 28 percent reduction in reported crashes was the result of an increase in reporting threshold. After July 1, 1995, reported crashes in Texas were defined to include only those crashes in which someone is injured and/or one or more vehicles are towed from the scene (the same definition that is used in Pennsylvania).

Police-reported injury and injury severity are also of questionable reliability—and may be changing over time. In Table 2-1, five years of Texas data are presented (1975, 1980, 1985, 1990, and 1995). For each year, the number of crashes and injuries recorded in Texas is depicted.

Clearly, less serious (C-level) injuries have come to constitute a larger percentage of motor vehicle injuries in Texas in recent years. Some of this increase may result from displacements out of the more serious injury categories, but some of this increase may result from an informal lowering of the threshold for C-level injuries.

While it is fairly easy to define a motor vehicle fatality (an injured party who succumbs to his or her injuries within 30 days of the crash), it is much more difficult to define traffic crashes and injuries. These definitions

TABLE 2-1 Traffic Crashes in Texas

Indicator	Year				
	1975	1980	1985	1990	1995
Fatalities	2.4%	2.3%	1.6%	1.2%	0.9%
A-Level Injuries	12.8%	12.5%	11.2%	9.5%	7.3%
B-Level Injuries	44.5%	44.8%	39.7%	29.3%	23.4%
C-Level Injuries	40.3%	40.4%	47.5%	60.0%	68.4%
Number Killed/Injured	142,391	190,388	234,691	265,819	337,431
Crashes[a]	468,596	432,940	455,458	381,446	351,073

NOTE: An A-level injury is a crash in which the most severe injury is nonfatal, but prevents a person from walking, driving, or performing other normal activities that he or she was capable of before the crash. A B-level injury is a crash in which the most severe injury does not incapacitate a person, but the injury is evident to witnesses at the scene of the crash. A C-level injury is a crash in which the most severe injury reported is not fatal, incapacitating, or non-incapacitating.

[a]Includes injury crashes and property damage only crashes (PDOs)

vary not only from state to state, but also across years within the same state. Despite differing definitions and the challenges of achieving consistent definitions and their consistent application, it can nonetheless be useful to track time-series data within a single jurisdiction.

Exposure

The final issue identified by the subgroup is exposure. This entire discussion is taken from remarks made at the workshop by John Miller of the Virginia Transportation Research Council. Exposure is a critical element to address in order to make safety indicators broadly understood beyond the transportation community. It appears that direct measures of harm—crashes, property damage, fatalities, injuries, injury severity, environmental consequences, and even stress on the users of the facility—are readily understood. Within the transportation community, measures of exposure—vehicle miles traveled (VMT) or millions of entering vehicles (which are vehicles that enter an intersection, merge onto a roadway, or enter a traffic circle)—have facilitated comparisons of different types of highway facilities: for example, the often-repeated comparison between interstate highways and two-lane highways, in which the rate of crashes per VMT is much lower for the former than the latter. Outside the transportation community, however, the average citizen may not have a ready handle on typical measures of exposure. Certainly one can understand the definition of VMT, but it may not necessarily be apparent how to relate an average annual number of miles put on a vehicle (e.g., 15,000 miles per year) to an average trip rate (e.g., 3.2 crashes per million VMT). In short, it seems that we need to relate measures of harm to measures of exposure, or daily events, with which users are familiar. There are several possibilities to consider:

- *Risk of harm per person per year*, which as an aggregate measure could use crashes per VMT in conjunction with numbers of VMT traveled. The value of such a measure is that it would facilitate comparisons for different geographical areas (in the short term). In the long term, it might be helpful for comparing subareas with different trip-making characteristics (e.g., people living in the central business district versus persons living in the suburbs). Recently, an editorial in a local newspaper argued that the risk of harm from crime (for people living in the central business district) was lower than the risk of harm from crashes (for people living in the suburbs).

- *Risk of harm by activity*. Comparison of an hour of driving, an hour of recreational boating, an hour of hiking outdoors, and an hour of walking in an urban area may be an indicator worth considering. The disadvantage of such an indicator is that it does not take into account the number of hours the activity is done annually: for example, one may spend 500 hours annually driving yet only 30 hours annually boating.
- *Risk of harm after removing deliberate and egregious user errors*. The Bureau of Transportation Statistics (BTS) reports that in bicycle crashes the bicyclist alone was at fault half the time, whereas in pedestrian crashes the pedestrian was at fault about a third of the time (for pedestrians 15 years and older). The extent to which the user is at fault when a crash occurs (as opposed to the extent to which the other party is at fault) gives additional information for understanding the relative safety of these two modes, especially if appropriate exposure information, such as risk of a fatal crash per year or per trip, can be included. A complicating factor is the definition of what constitutes an "egregious" error: an intoxicated bicyclist riding against traffic or a small child stepping into the street are both at fault, but one may reflect a more conscious disregard for safety than the other.

If a measure of exposure is selected to be used with an indicator, it still will not eliminate the need for the raw data. For example, if one has 10 crashes per 12,000 VMT for road A and 100 crashes per 120,000 VMT for road B, then, although the rates are identical, some will argue that road B merits attention because an improvement therein will affect more people than would be the case for road A. Thus, as a complement to presenting crashes as a measure of rate of travel, we may want to consider an indicator that reflects the number of people affected. The activity indicator suggested above is a step in this direction: the practical value would be that when deciding where to allocate resources, one can consider how many people will be affected, in addition to the relative risk by travel amount or activity type.

ADDITIONAL INDICATORS

The group suggested seven indicators that should not replace but could be collected in addition to those currently collected. One new safety indicator could be "risk per basket of trips." Several workshop participants discussed the concept of developing an identifiable set of trip types that would reflect travel on a per capita basis for a metropolitan area, using the term a "basket of trips." This trip set would be based on trip types comparable to those used in urban travel demand models for a region. Although travel demand models are constantly under revision, the current state of practice for most urban areas is still based on three trip types: home-based work, which are trips from home to work or vice versa; home-based other, which are any other kind of trips with one end at home; and nonhome based, which are trips that do not come from or go to home. For example, a basket of trips for a region could be three home-based work trips, five home-based other trips, and four nonhome-based trips over a 24-hour period. The advantage of this indicator is that it facilitates comparison between regions, where even if crash rates are identical (e.g., number of crashes per VMT), one can understand how changes in land use and the use of transportation modes affect crash risk because the number of VMT is thus affected. The disadvantage is that its unit of exposure is based on the trip type, which is known to be imperfect—but VMT is not perfect, either. Thus, three subindicators are

- number of injuries per basket of trips,
- number of fatalities per basket of trips, and
- number of noninjury crashes per basket of trips.

Looking ahead, given the initiatives with voluntary electronic vehicle monitoring information in which individuals agree to have vehicle performance data monitored for research purposes, it may be possible to derive risk per trip type for specific regions, such as risk per home-based work trip. Right now, though, that does not seem practical.

A highly correlated indicator to risk per basket of trips is risk per household. The advantage of this indicator is that it presents regional comparison data in a form that may be easier to understand. For example, not everyone may relate to number of injuries per "set of weekday trips in the Washington, D.C., area," but some will immediately recognize the meaning of the number of injuries per "household in the Washington, D.C., area." Accordingly, three subindicators are

- number of injury crashes per household,
- (if resources permit) number of noninjury crashes per household, and
- (if resources permit) number of fatal crashes per household.

Another participant noted that, in the medical field, an obvious goal of emergency response is to minimize the harm that occurs following an event. A relevant indicator is thus the probability of harm once such an event has occurred. The advantage of such an indicator is that it reflects the performance of vehicle design, medical response, and roadway design (e.g., guardrail installation) in terms of mitigating the adverse impacts of a crash. Accordingly, one subindicator is:

- probability of a serious injury or fatality given that a collision occurred.

If this indicator is divided into two indicators (one for fatality and one for serious injury), it will be necessary to consider the time definition of a fatality. Unfortunately, in some cases, the linkage between emergency department data and hospital data is not always firm, thus making it difficult to know whether a serious injury at the crash scene did or did not result in a fatality.

CRITERIA FOR SELECTING INDICATORS

Resources are limited. The subgroup suggested using the following criteria when selecting indicators:

- *The indicators should be understood by nonspecialists*. Not everyone knows how much they drive in a year, making risk per VMT somewhat harder to intuitively understand, but risk per VMT per type of household (such as an average suburban household, an average inner-city large urban household, or a small-city household), for example, may be easier to grasp.

- *The indicators should have a meaningful range between low values and high values*. Injury crashes occur often enough that different values in that indicator can be presented for different regions in a meaningful way. Fatalities, in contrast, are consistently quite low, which is good news but may render an indicator such as "fatalities per household" less meaningful.

- *The meaning of the indicators should be clear, even when computational methods are not*. It was pointed out during the workshop that not everyone understands how the Consumer Price Index is determined, but many persons in different disciplines still have a grasp for what a rise in it means. Similarly, the number of injuries per basket of trips can be meaningful, even if a person is not a transportation demand modeler per se.

- *Indicators should be developed recognizing that not everyone has the time to do the computations themselves*. Theoretically a person with an interest can place the number of injuries in the numerator and the number of households in the denominator and compute the number of injuries per household, but many groups that want a quick grasp of the data may not have time to conduct a detailed study.

- *If possible, the indicators should use exposure measures from other disciplines*. For example, other disciplines do not use "risk per vehicle mile traveled," but they do use "risk per capita," which makes some of the indicators shown above more attractive. Of course, not all indicators have to meet this criterion; obviously the transportation community should continue to use risk per VMT for many situations. For a wider audience, there may be other indicators in addition to this one that provide a better picture of risk.

SUGGESTED ADDITIONAL PRACTICES

In some situations, error bars or confidence intervals can be included in a graphic for the reader to understand whether changes in indicators are significant or not. For example, regarding the seasonal variations in general aviation travel, bars giving a range of expected values (thus enabling one visually to inspect whether the difference between January 1999 and January 2000 fatalities is meaningful) would be appropriate, once such fatalities had been normalized with the appropriate exposure data.

For property damage only (PDO) crashes, BTS could usefully store the estimated dollar value of damage, in order to have a consistent set of PDO crash data, even if states have different reporting requirements. BTS relies on states and other organizations for data collection, and of course reporting requirements vary from state to state and change over time—both of these circumstances are currently beyond BTS's control. For future reference, it may be fruitful to identify reporting requirements that can reliably be expected to change and to plan for these changes. For example, in terms of motor vehicle crashes, states that use a dollar threshold for noninjury crashes (e.g., in Virginia, noninjury crashes below $1,000 damage are not reported) can be expected periodically to adjust their thresholds over time. In such an instance, by including a field for the dollar amount of property damage in BTS's internal database, one can estimate how changes in dollar thresholds will affect the number of crashes reported after considering inflation. Thus, when a set of states change their dollar thresholds, BTS will be in a position to know whether a change in the number of PDO crashes results simply from the threshold reporting change or from some other factor.

3

Mobility Indicators

DEFINITION OF MOBILITY

A basic point of departure for the development of system performance indicators is to understand the phenomenon being measured. The concept of mobility has been interpreted in a variety of ways, some inappropriately. In addition, the scale of application could have an important influence on the definition of mobility. For example, mobility at the metropolitan level might be defined differently than a mobility measure at the corridor or subarea level, which itself might be very different from mobility as perceived by an individual traveler. For purposes of this subgroup, the following working definition of mobility was used to guide the discussion:

Mobility: *Mobility refers to the time and costs required for travel. Mobility is higher when average travel times, variations in travel times, and travel costs are low. Indicators of mobility are indicators of travel times and costs and variability in travel times and costs.*

An important distinction to keep in mind (as noted by consultant Alan Pisarski) is that there are people indicators and there are system indicators. System speeds and individual travel times can in fact measure the same phenomenon but have different meanings.

PURPOSE

Mobility indicators can serve many purposes. They should provide trend information from which implications for transportation can be drawn or from which transportation policy and investment decisions are made. They can provide a basis for comparisons among metropolitan areas. They can provide the public with a sense of whether system performance is improving or getting worse. And in conjunction with intelligent transportation system strategies, they could be used on a real-time basis to inform travelers of current "mobility conditions" of the transportation system so that travel decisions can be made with full knowledge of what to expect. This subgroup concluded that for purposes of the BTS initiative, mobility indicators are best used for trend analysis and comparisons.

It seems likely that with the right selection of indicators, the public and the media would be quite interested in this information. The Texas Transportation Institute congestion index receives yearly national attention when the latest data are released. A "travel temperature" index developed at Georgia Tech, which uses travel time contours to give up-to-date information on expected travel times, received international attention because the traveling public easily understood it. Information such as this is likely to be well received by transportation system users.

There was a strong sentiment for having at least a single mobility index that could be used by local officials to assess how their metropolitan area is doing over time. We could easily provide a set of measures that provide indications on a variety of system characteristics, as well as one overall mobility index.

It was also noted that an unreliable system places greater emphasis on safety, security, and, of course, reliability. Such system performance characteristics definitely need to be part of a performance measures set, although not necessarily in a mobility index.

COMPONENTS OF MOBILITY AND OF MOBILITY INDICATORS

The above definition of mobility leads to the identification of several performance characteristics that should be included in any set of mobility indicators that reflects what is of interest to the traveling public. These characteristics include:

- "Reasonable" travel time,
- Lost time (or perception thereof),
- Reliability or degree of unexpected delay,
- Physical condition of the transportation system, and
- User travel cost.

The definition of "reasonable" deserves a great deal of discussion. One way of getting at it is to monitor the share of household expenditures that goes to transportation obtained from the Consumer Expenditure Survey of the Bureau of Labor Statistics. This measure shows that not only do people spend more on transportation with rising incomes, but they also spend an increasing share of income, thus indicating the importance of transportation to the household. This phenomenon should be captured in any indicator of mobility.

Including physical condition of the transportation system in a set of system performance indicators was considered very important for a national, state, and metropolitan-level perspective on system condition and performance. Some members of the subgroup felt that condition measures should be included in the mobility category, while others thought that they should be a separate, albeit an important, category.

Transportation system indicators would seem more compelling to users if they were actionable—that is, if a person could actually react or respond to the information being provided. Indicators that directly affect the lives of every person in a metropolitan area are most likely to be received with interest. Transportation fits into this category. It was also noted that one of the biggest complaints from the public is construction-related delay. If a measure could be developed that includes this performance characteristic, there was a sense that it could be used very effectively in developing strategies to minimize construction-related delay time.

We note that these mobility performance characteristics are important for both passenger and freight travel. For example, a recent study of travel time variability in California by the Transportation Research Board estimated a value of $12.60 per hour of standard deviation in travel time, compared with a value of travel time of $5.30 per hour for normal travel time. This indicates that travelers place a much greater value on travel time reliability.[1] A similar result was found in a study of the value of time

[1]Small, K., R. Noland, X. Chu, and D. Lewis. 1999. Valuation of travel time savings and predictability in congested conditions for highway user-cost estimation. *NCHRP Report 431.* Washington D.C: National Academy Press.

associated with travel time variability due to freeway incidents.[2] Whereas the reliability of travel time is important for passenger travel, it is probably more important for freight movement, for which delivery schedules are often related directly to financial costs. It seems important therefore to incorporate the certainty (or the uncertainty) of travel time into a performance index.

POSSIBLE MOBILITY INDICATORS

Many indicators have broad impact because they have economic implications. To the extent that such economic implications can be incorporated into mobility measures (and to some extent they are through travel time measures), they will be more relevant to citizens and local officials. The most frequently cited mobility measures fall into six major areas: congestion related (e.g., level of service, volume/capacity, and delay); trip time; amount of travel (vehicle miles traveled, vehicle hours traveled); mode share; transfer time; and transit performance. In considering these candidates and given the discussion above, the following mobility indicators are proposed as initial candidates for consideration as part of a set of national transportation indicators.

- Average daily hours of travel per person,
- Average minutes per mile,
- Average vehicle minutes of delay,
- Total passenger- and ton-miles traveled,
- Reliability factor (for example, percentage of a person's travel time that is no more than 10 percent higher than average; the particular percentage chosen would depend on the distribution of the data),
- Personal or household consumption expenditures on transportation, and
- Travel rate index, which shows how much time is added to a trip during rush hour conditions compared with free-flow conditions.

It was suggested that perhaps a better approach to measuring mobility

[2]Cohen, H. and F. Southworth. 1999. On the measurement and valuation of travel time variability due to incidents on freeways. *Journal of Transportation and Statistics*. Vol. 2, no. 2. Washington D.C: Bureau of Transportation and Statistics. Dec.

would be to develop different measures for different modes and levels of analysis, and that weights be used (perhaps based on corresponding mode-related dollars or time budget) to aggregate to a metropolitan scale. This approach would reflect typical travel market or geographic segments. With segment-specific indices, officials would be able to gauge the level of mobility by important trip purposes, population groups, and geographic locations.

GENERAL DISCUSSION

One member of this subgroup, David Greene, Oak Ridge National Laboratory, raised three issues. First, a good measure of performance reliability would be the variability of travel times for a specific trip. Second, no one knows the relationship between objective measures of transportation systems and subjective measures of these systems. Valuable research could be done to understand how the performance of the system affects the satisfaction of the customers of the system. Third, Greene noted that the mobility indicators subgroup focused mainly on travelers, not on freight. An equivalent set of measures should be developed for freight.

Randall Halvorson, Minnesota Department of Transportation, suggested that a measure of mobility must include elements of accessibility and elements of the infrastructure. Alan Pisarski also mentioned that elements of accessibility are important in a measure of mobility. An example of this type of measure is to record the percentage of travel opportunities within 20 minutes as a measure of what the transportation system offers customers. Pisarski also mentioned that it is important to have some basic system indicators. For example, how many miles of highway per square mile of land area are there? How many passenger-miles of transit service are being provided per square mile, per person? How many airline miles? To how many cities can you fly from this city nonstop?

Anthony Smith, University of Pennsylvania, suggested that a new BTS web site could be developed that would include maps of various transportation measures for different areas of the country, updated on a regular basis. Since it is difficult to identify the potential users of transportation data, this would be a useful way to make a variety of data available. Timothy Lomax, Texas Transportation Institute, noted that a "one number" approach to transportation data may also be appropriate so that more casual data users could understand the impact of transportation indicators.

A variety of perspectives were expressed on the general usefulness of indicators and most certainly on their definition. It was clear from the subgroup's interaction that such indices were considered important and likely to be of great interest to national and local leaders, as well as the public. The subgroup felt that travel time, reliability, and economic costs should be incorporated into measures of mobility.

4

Transportation Indicators of Economic Growth

RELATIONSHIP BETWEEN TRANSPORTATION AND ECONOMY

Every day, governments, businesses, and individuals make many transportation investments and decisions about the use of transportation. Location and development decisions are also heavily influenced by transportation. People often use transportation data in making these decisions. Are there any general indicators of transportation and economic growth that could be developed systematically and that would be generally helpful to all parties making transportation-related decisions?

The relationships between transportation and the economy are very complex and poorly understood. Transportation is a massive enterprise with substantial direct and indirect effects on economic productivity and economic growth. Transportation industries—the provision of transportation services, the manufacture of vehicles, and the construction of infrastructure—are major economic activities in themselves. Transportation is a cost, to a greater or lesser extent, of virtually every other good or service in the economy. Transportation is an enabler of economic activity and a facilitator of international trade. Transportation is a measure of economic activity: in many instances, it may be a leading indicator, inasmuch as physical movements precede financial transactions. Transportation is a reflection of economic activity, inasmuch as products must be moved to markets. Some of these relationships are clearly circular: transportation affects economic conditions, and economic conditions influence transportation. Furthermore, all of these relationships shift with changes in technology, economic development, geographic changes, and many other factors.

Pioneering work by Ishaq Nadiri, Randall Eberts, David Aschauer, Alicia Munnell, Dale Jorgenson, and others has contributed important understandings about these relationships, but we are far from having an accepted, comprehensive model of the key relationships and how they work. As a result, any indicator of transportation and economic growth poses difficult issues of interpretation. Any index of transportation and economic growth must reflect this context of change and uncertainty.

In making public policy, it would be very useful to know the value of an extra dollar invested in transportation. It would be useful to know where, geographically and modally, to invest that dollar. It would also be useful to be able to track the transportation sector's contribution to the gross domestic product (GDP). Consumers are probably most interested in price indexes—the price of gas, the price of cars, or the fares for different modes. Financial and business interests are interested in productivity measures.

CURRENT AND POTENTIAL ECONOMIC INDICATORS

Indexes of accessibility, impedance, bottlenecks, or congestion may have great value, and these features are closely tied to the economic impact of transportation. The economic indicators subgroup did not explore such physical measures in depth, however, although they may warrant consideration as mobility indexes. Perhaps transportation capacity utilization could be the basis of an index. Manufacturing capacity utilization has proven to be a closely watched macro indicator, and a similar measure for transportation may prove useful as well.

A good index should be simple, policy relevant, reliable, and timely. It is useful to compare several possible indexes in these respects. Table 4-1 compares these key attributes for seven indicators that the subgroup considered:

- Transportation prices (an index of the aggregate price of transportation service, possibly subdividable by mode or commodity),
- Transportation productivity (labor productivity or total-factor productivity),
- Contribution of transportation to economic growth,

TABLE 4-1 Potential Transportation Indexes

Index	Policy Relevance	Simplicit
Transportation prices (an index of the aggregate price of transportation service, possibly subdividable by mode or commodity)	• International competitiveness • Sectoral impacts	Relativel mode, co meaning considera
Transportation productivity (labor productivity or total-factor productivity)	• Efficiency • Modal efficiency	Labor pr major m compute Labor St
Contribution of transportation to economic growth (transportation sector value added relative to GDP)	• Sectoral importance • Sectoral performance	Relativel transpor key data simple fo transport
Logistics (transportation plus inventory) as a fraction of GDP	• Efficiency of overall distribution	Relativel very aggr
Full-supply-chain distribution cost relative to GDP	• Efficiency of overall distribution, sensitive to possible changes associated with e-commerce.	Complex and appl
Growth in transportation infrastructure relative to growth in the economy	• Shifts in public attention to infrastructure investment	Complex into an c
Transportation capacity utilization	• Efficiency • Adequacy of investment	Complex into an c

	Simplicity	Reliability	Timeliness
	Relatively simple for a single mode, commodity, or routing; meaningful averages will require considerable effort to develop.	Even if a definition of suitable aggregates to include in the index is determined, inclusion of quality changes may be difficult.	The supporting data could be sampled and reported in close proximity to the period of coverage.
	Labor productivity indexes for major modes are now being computed by the Bureau of Labor Statistics.	The reliability of existing labor productivity measures is diminished by noninclusion of quality changes; total-factor productivity measures are less reliable.	The data needed to compute these measures could be processed to produce an index that is timely, but this would require collection of additional data.
	Relatively simple for freight transportation, for which the key data are available. Less simple for personal transportation activity.	Freight data are probably reliable; personal consumption data are not.	Some freight data, such as data on trains, are available in a timely fashion; other freight data, such as data on trucks, are not.
	Relatively easy to compute this very aggregate index.	The components of this index are currently collected and reported in reliable data series.	This index can be reported in a timely fashion.
iated	Complex and difficult to design and apply.	Reliability will depend on the quality of component data, many of which will reflect private-sector operations and may be difficult to obtain.	Timeliness is doubtful, given complexity and introduction of new data requirements.
	Complex to define and make into an operational index.	Reliability could be a problem because good data are not currently available on some components.	Timeliness is doubtful.
	Complex to define and make into an operational index.	Aggregate index may not reflect key modal and geographic conditions.	Timeliness is doubtful.

- Logistics (transportation plus inventory) as a fraction of GDP,
- Full-supply-chain distribution cost relative to GDP,
- Growth in transportation infrastructure relative to growth in the economy, and
- Transportation capacity utilization.

Each of these indicators reflects a different aspect of transportation and the economy, and there is no clear consensus at this stage regarding the framework that should apply. At the most aggregate level—the relationship between transportation investment and economic growth—there is no agreed-on theory that can be drawn on. The production function literature has attempted to take the national income accounts, which have traditionally been modeled in terms of labor and private capital, and extend them to include public capital, such as transportation investment. Similar extensions have been done using cost function models. The results are important and suggestive of a relationship, but any particular formulation is tenuous. At less aggregate levels, such as modal productivity or prices, the audience for each indicator has its own issues and needs.

Much of the expenditure on transportation—as much as 70 percent—is for business-to-business services or goods. GDP accounts do not include business-to-business activity, so any index that relates gross transportation activity to the national economy should either net out the business-to-business portion and use GDP as the base, or, if this is not done, use gross output as the base. Otherwise, the index will exaggerate the financial importance of transportation relative to other sectors.

In considering the merits of different indexes, it is essential to begin to build a consensus about the applicable framework. Given the current state of understanding, it appears unlikely that this is possible with regard to the most fundamental issue: the relationship between transportation investment and economic growth. But governments, businesses, and people are nonetheless interested in transportation—how big it is, how productive it is, and how much they have to pay for it. In considering possible indictors relative to transportation and the economy, these specific concerns offer a possible practical first step. No index can give all audiences all the information, any more than the Consumer Price Index can address all the informational needs of buyers, retailers, and producers. To move forward in the consideration of indexes that might be of value in depicting economic aspects of transportation, the BTS will need to identify the audiences that the indicator is designed to serve and postulate indexes, like those in Table 4-1, that might serve these audiences. BTS should assess the policy relevance, difficulty, reliability, and timeliness of potential indexes, and try to anticipate the implications of publishing the index.

Relative to mobility or safety indicators, any indicator of economic performance and transportation will probably be less comprehensive in its coverage, but there appear to be enough potential valuable uses to continue the exploration.

5

General Discussion

The purpose of the Workshop on Transportation Indicators was to discuss issues relating to transportation and provide the Bureau of Transportation Statistics (BTS) with new ideas for issues to address. Throughout the workshop, a variety of interesting ideas were discussed. At the close of the workshop, all participants were asked to make one overall point that they thought was important. The following is a summary of that discussion.

David Greene commented that a national congestion measure would be an excellent indicator for BTS to develop. It should be based on direct measurement from the highway system using automated traffic data from loop detectors, which are measurement devices that lie in the roadway and record how many cars pass over that point. It is impossible to get this done quickly, but it is feasible over time. Tennessee studied four cities for 2 years, 24 hours a day, 365 days a year; the data collection and processing were essentially automated. There were many problems and statistical issues to be resolved, but these data can be used to develop national measures of congestion performance, first for major cities and for the highest-order highways, but eventually extending out to smaller areas over the years.

Ashish Sen pointed out that there is a problem with this type of data collection; it works well only for major highways. There is a lot of congestion on arterials that cannot be measured by loop detectors. This is an entirely new area for statisticians. There are data imputation problems, and there are inference problems, there are problems of modeling and inferring what is happening between the loop detectors that still need some resolution. This is a fascinating area for statistical research.

Terry Klein noted that a useful way to begin developing indicators would be to identify the specific objectives of producing the indicators. For example, should the indicator appeal to the public in an effort to change their attitudes and behaviors toward transportation issues? Or is it simply a tool for policy makers and decision makers to be kept apprised of the state of transportation? The indicators would be very different depending on which objective is used. If the objective is to target the media, the indicator would have to be fairly simple to understand.

Klein also mentioned that he liked the idea of a market basket of trips, but that there is a data collection problem in trying to ascertain trip type, in both the numerator and the denominator. Survey data would help collect some of the denominator data, and over time those data can be gathered. But in the numerator, for example, it can be difficult to figure out the purpose of the trip if it was involved in a fatal crash and only one person was in the car.

He then suggested that BTS should defer work on some of the economic growth indicators because it seems as if there are others who are working on the issue. The objective of the economic growth indicators is unclear. Is it to show the effect of transportation on stimulating economic growth or how economic growth affects transportation? Both? Neither? He observed that since a consensus cannot be reached on what the existing data actually mean, BTS should not start working on economic indicators right away.

Nathaniel Schenker stated that the Consumer Price Index and the unemployment rate are good models to follow in developing transportation indicators. They are well-established indicators, and both of these measures are broken down into many different measures, such as unemployment by age, race, region, and so on.

Douglas Robertson reiterated the importance of clearly defining an audience before beginning to develop transportation indicators. There is more than a single audience for this type of information, so it is important to group the audiences according to some criteria. And it is important that the audiences not only understand the data that they are provided with, but also that they act on those data. Consequently, newly developed indicators must have a purpose that is based on a need for the information that they provide. Many of the indicators discussed today did not have a clearly stated purpose. Consequently, Robertson would not spend any money on developing new indicators before studying current measures to see how they can be improved with regard to data quality, quantity, accuracy, reliability, and usefulness. For the short term, BTS should spend its money on ways to improve current indicators and tying current performance measures to purposes based on needs, targeted to audiences that are going to act on the information.

John Miller suggested a couple of new indicators that he thought could be quickly developed. In the area of safety, a measure of injuries per household is a good idea. This is an indicator that the public can relate to without knowing exactly how the number is computed. Also, injuries are measurable and easily understandable. The number of fatalities would be very, very small, but the number of injuries would be larger, and it is something that people can see a change in.

In the area of economic indicators, Miller thought it would be interesting to find out how the performance of the transportation system affects industry sectors. If, for example, the reliability of travel-time estimates is increased by 20 percent, what effect will that have on the book sales industry for e-commerce?

Lindsay Griffin noted that the Department of Transportation has been measuring fatalities for many years. Fatality is the most consequential form of injury, and it is also the one that can be counted most reliably. The motor vehicle death rate per 100 million vehicle miles has gone down 3.8 percent per year since the mid-1960s, when the department was formed. Now is a good time to address the measurement of injuries, which are a major problem. Currently, the injury data that are used for national measures come from the general estimate system, which is based on police-level data. This method uses a primitive injury scale, one that is highly unreliable; it is important that more reliable scales are put in place.

Kenneth Campbell stated that an indicator would be successful if a good conceptual or theoretical model backs it. He spoke specifically about traffic safety. From his point of view, the area of injury prevention has always been divided into two parts. First are crash-worthiness problems, which have to do with the probability of injury given the vehicles involved in a collision. Second is the risk of accident involvement given a certain number of miles traveled. These two match very well with fundamentally different program areas; it involves a completely different program area to prevent injury given a collision than it does to prevent collisions in the first place. Hence, it would be useful, instead of looking at the historical trend of fatalities per mile traveled, to break that down into its two logical components: the probability of fatality given collision involvement and the probability of collision versus miles traveled.

Damian Kulash noted that it is important to generate simple, cheap transportation measures in order to anchor fancier, more expensive measures. For example, in the safety area, fatalities per vehicle- or passenger-mile could be a good, easy measure. Generating a statistic once a year would be a way of focusing attention on specific groups, as such cyclists or older Americans. In the mobility area, congestion is important, but it seems that the concern of the press and the public, for good or ill, is still driven by the journey to work. So some sort of generalized cost—time plus money—of the journey to work would be a very useful indicator.

Rolf Schmitt observed that the fundamental statistics BTS can provide are annual, and eventually quarterly, estimates of total transportation activity. That means tons, value, and distance of goods moved in the United States; trips, travelers, distances traveled; and frequency and distance of vehicle movements. Those estimates underlie the general areas of the workshop: economic, safety, and mobility. Theory is needed to support that, but there is no theory that underlies passenger movement.

Barbara Fraumeni supported the use of an indicator on the contribution of transportation industries to economic growth. That statistic is available, is commonly published, and therefore it would attract attention. One of its shortcomings, however, is that it does not consider consumers. It is an important statistic because everyone can relate to GDP.

Fraumeni also mentioned the importance of productivity. Currently available productivity measures for the transportation industries are very basic, in the sense that they do not incorporate changes in quality. With BTS's prompting, a better measure of productivity could be obtained in the transportation industries.

Randall Eberts commented that it is important how BTS packages its data, that is, how the agency juxtaposes pieces of information. Whenever a government agency puts two variables together, it appears that the agency has endorsed that relationship in some way. BTS should be very careful in doing that. Also, it should try to create a CPI-type measure for transportation. No one has documented the price of transportation, and that is very valuable information. Another example is the Dow Jones industrial average. That measure does not account for every stock, and it changes over time. It is important not to shy away from a measure because it does not provide total coverage.

Alan Karr commented that indicators that facilitate comparisons are useful. If comparison is not possible, then somehow that needs to be conveyed. Indicators that include geography are very easily compared.

Clifford Spiegelman noted that it is important to consider any risks to the agency or the stakeholders that may be associated with releasing an imperfect indicator. It is important to consider quality before data are released.

Alan Pisarski suggested that BTS provide a national summarization of the fundamental services provided by transportation. For example, how many different international venues can one get to from cities A, B, and C? This activity would be done best on a national level; states and other local areas would have a very difficult time gathering this type of data.

Thomas Palmerlee acknowledged the need to continue to make the statistics understandable. To use technologies like Geographic Information Systems for visualization is really a critical issue to helping the public, and even transportation analysts, to understand those relationships.

Piyushimita Thakuriah suggested that BTS develop some type of schematic representation, perhaps beginning with indicator objectives and going down to the possible candidate indicators that were discussed today. The schematic should also note what types of data are available to calculate each of those indicators, just to get a sense of which are the feasible ones and which are not feasible.

She also noted that gathering data on safety trends across different transportation modes would be useful. That is the one safety indicator that is truly national in scope and that would attract public interest. No state or local agency has the charge to do that, and BTS is uniquely positioned to do it.

Thakuriah observed that mobility indicators are, by nature, local, because they are always relative to the local infrastructure. It is important to keep in mind that different metropolitan areas or different states will contribute to the total index in very different ways. BTS would have to figure out how to display that variability.

Miron Straf mentioned the issue of risk perception by the public. There is a large literature on it, and many agencies are concerned about how the public perceives risk. For example, there is a statistic that if you smoke a cigarette, it takes 11 minutes off your life expectancy. That grabs people. It would get the public's attention if BTS came up with statistics similar to that. For example, it might be five hours for a flight from Washington to Los Angeles, and 1 hour and 20 minutes for the cab ride to National Airport. Such a comparison would be useful.

Straf also suggested measures from the perspective of the consumer of transportation services. Relocation decisions by individuals, households, and families affect and are affected by the transportation system. He hopes that one day there will be a major national survey of households that follows them over time, long periods of time, for many of their economic decisions and choices—in particular, the changes in the use of transportation services and the choices made among them. It would be good to start with some prototypes and ideas of what measures we would like to see in such a survey.

Janet Norwood closed the workshop by noting that when developing indicators, it is important to know their audience and their purpose. Even if data are gathered and packaged on a national level, it is important to have disaggregated data available, because such data affect the ways in which people use and think about transportation. Data for individual areas are hard to come by, and, even though every state has data, the data are not always comparable. These are problems that BTS needs to work through in order to obtain interesting and useful indicators.

Appendix A

American Time-Use Survey

Diane Herz

The proposed time-use survey to be conducted by the Bureau of Labor Statistics (BLS) would draw from the retired sample from the Current Population Survey (CPS). The CPS is a monthly survey conducted by the Census Bureau. The American Time-Use Survey (ATUS) sample would be designed to be representative of the U.S. population age 16 and older. (This recommendation may be changed to 15 and older for comparability with time-use surveys in other countries.) The survey will be designed to produce quarterly estimates of the proportion of time spent in different activities for the population and separately for a set of comparison groups. Potential transportation statistics could be gleaned from this survey, such as the purpose of trips and the time spent traveling.

The time-use survey statistics team at BLS is currently determining the best way to stratify the survey sample and assign respondents to designated days for interviews. The sample is likely to be stratified by a number of household variables, possibly including number of adults in the household; presence of children; or age, education, and race/ethnicity of householder. It may not be feasible to stratify the sample by gender, due to the sample size.

The survey will be designed to generate annual estimates of a wide range of activities for an average week, weekday, and weekend day. Draft activity classification codes have been developed. They are based on the Australian classification system and are comparable with most international time-use coding schemes.

The goal of the survey is to have 24,000 completed interviews per month. Developers are assuming a 70 percent response rate. The CPS interviews about 150,000 individuals in approximately 72,000 households per year. Given that one member of each household is eligible for the proposed time-use survey and given nonresponse over the course of the CPS, the maximum sample size for the time-use survey is 72,000 per year. However, because the CPS oversamples small states and the goal of the survey is to be nationally representative, the maximum available sample size is about 54,000 per year. A subsample of these 54,000 will be drawn for the time-use survey.

The proposed strategy to gather information on an individual's time use is to use the designated day approach: each individual in the survey will be assigned a day of the week for which he or she will report activities. An attempt to interview the respondent will be made after the designated day. If the respondent cannot be reached for the designated day, the respondent will be reassigned to another designated day. In the case of Friday through Sunday, the respondent will be assigned to the subsequent Friday through Sunday. In the case of a Monday through Thursday, the respondent may be reassigned to another Monday, Tuesday, Wednesday, or Thursday. The exact assignment pattern for those in the Monday through Thursday sample has not been determined.

The period of fielding will probably be between 4 and 8 weeks and may depend on whether an individual is part of the Monday-Thursday sample or part of the other 3 (Friday, Saturday, and Sunday) samples. The distribution of samples across the days of the week has also not yet been determined; the distribution will be defined in order to minimize variances on the estimates of activities on a day, weekend day, and weekday.

The data will be collected continuously, with the samples drawn monthly. Results will be reported quarterly and annually, so that seasonal variation in time-use patterns is illuminated. The data will not be collected on major holidays.

The survey instrument will consist mainly of an activity questionnaire (the time-use diary), which will document activities done by the respondent over the preceding 24-hour period. The survey will use computer-assisted telephone interviewing and respondents will be asked to recall the timing of their activities sequentially. Respondents will also be asked where they were during the activity, whom they were with, and whether they were doing anything else at the same time, in order to record simultaneous activities. Respondents will also be asked what activities were done for pay to be able to better identify market and nonmarket activities. Publication tables will include information on activities performed as a sole activity and those done in conjunction with other activities.

In addition to the time-use component of the survey, several summary questions will be asked. The current questions in review ask respondents about passive care of children ("looking after" children), care of dependent adults, and extended absences during the previous month.

Other data on respondents will also be collected, including updated (from the CPS) household composition information, updated total family income (categories), the respondent's labor force status, the labor force status of his or her spouse or partner, updated earnings information for the respondent, and school enrollment. The current plan is to develop a public-use database to be made available for the research community (meeting confidentiality restrictions).

The average length of the interview is projected to be about 25-30 minutes. Completing the diaries is expected to take about 22 minutes of the total. This estimate is based on the pilot test results for the time-use component and on experience with the length of the CPS interview.

Because the sample members for the proposed time-use survey are also CPS sample members, the new data could be linked to the various CPS supplements. The BLS working group also considered several topical modules that could be attached to the time-use survey, such as tool use, child care, elder or adult care, working hours, division of labor within the household, household production, volunteer activities, subjective assessments of activities, and subjective questions about the experience of time.

Appendix B

Workshop Agenda and Participants

Workshop on Key Transportation Indicators
13 June 2000

Committee on National Statistics
and
Transportation Research Board

National Academy of Sciences
Georgetown Facility, 2001 Wisconsin Avenue, NW
Green Building, Room 104

Agenda

9:00 a.m.	Introduction	Janet Norwood Ashish Sen Barbara Torrey Robert Skinner Miron Straf
9:20	What do we mean by indicators and what purposes do they serve?	Janet Norwood
9:30	DOT strategic goals and objectives	Ashish Sen Miron Straf
9:45	Transportation safety indicators: Report of subgroup	Ken Campbell

10:15	Coffee break	
10:30	General discussion of safety indicators	
11:15	Transportation indicators of mobility: Report of subgroup	Michael Meyer
11:45	General discussion of mobility indicators	
12:30 p.m.	Lunch	
1:30	The Bureau of Labor Statistics survey of time use	Diane Herz
1:45	Discussion of possible uses of time use measures for transportation indicators	
2:00	Transportation indicators of economic growth: Report of subgroup	Damian Kulash
2:30	General discussion of economic indicators	
3:15	Break	
3:30	Discussion of general questions, specific issues, and needed indicators that we are not measuring	
5:00	Rapporteur's summary and closing remarks	

PARTICIPANTS

David Banks, Bureau of Transportation Statistics, U.S. Department of Transportation
Joseph Breen, Transportation Research Board, National Research Council
Paul Bugg, Office of Management and Budget
Kenneth Button, George Mason University
Kenneth L. Campbell, Survey and Analysis Division, University of Michigan Transportation Research Institute
Jamie Casey, Committee on National Statistics, National Research Council
Edward Christopher, Bureau of Transportation Statistics, U.S. Department of Transportation
Edward H. Clarke, Office of Management and Budget
Forrest Council, Highway Safety Research Center, University of North Carolina
Randall Eberts, Upjohn Institute
Wendell Fletcher, Bureau of Transportation Statistics, U.S. Department of Transportation
Francis Francois, American Association of State Highway and Transportation Officials (former executive director)
Barbara M. Fraumeni, Bureau of Economic Analysis
Steven Godwin, Transportation Research Council, National Research Council
David L. Greene, Oak Ridge National Laboratory
Lindsay Griffin, Texas Transportation Institute
Randall K. (Randy) Halvorson, Minnesota Department of Transportation
Charlie Han, Bureau of Transportation Statistics, U.S. Department of Transportation
Diane Herz, Bureau of Labor Statistics
Deborah Johnson, Bureau of Transportation Statistics, U.S. Department of Transportation
Alan F. Karr, National Institute of Statistical Sciences
Terry Klein, Bureau of Transportation Statistics, U.S. Department of Transportation
Rick Kowalewski, Bureau of Transportation Statistics, U.S. Department of Transportation
Damian Kulash, Eno Transportation Foundation, Inc.

Susan Lapham, Bureau of Transportation Statistics, U.S. Department of Transportation
Charles A. Lave, Department of Economics, University of California, Irvine
Timothy J. Lomax, Texas Transportation Institute
Christopher Mackie, Committee on National Statistics, National Research Council
Michael Meyer, School of Civil and Environmental Engineering, Georgia Institute of Technology
John S. Miller, Virginia Transportation Research Council
Richard (Dick) Mudge, Compass Services
M. Ishaq Nadiri, Department of Economics, New York University
Samuel Neill, U.S. Coast Guard
Janet L. Norwood (workshop chair), Chevy Chase, MD
Thomas M. Palmerlee, Transportation Research Board, National Research Council
Alan E. Pisarski, Consultant, Falls Church, VA
Douglas Robertson, Highway Safety Research Center, University of North Carolina
Terri Scanlan, Committee on National Statistics, National Research Council
Nathaniel Schenker, National Center for Health Statistics
Rolf Schmitt, Bureau of Transportation Statistics, U.S. Department of Transportation
Ashish Sen, Bureau of Transportation Statistics, U.S. Department of Transportation
Robert Skinner, Transportation Research Board, National Research Council
Anthony E. Smith, Department of Systems Engineering, University of Pennsylvania
Edward J. Spar, Council of Professional Associations on Federal Statistics
Clifford H. Spiegelman, Department of Statistics, Texas A&M University
Miron Straf, Division of Behavioral and Social Sciences and Education, National Research Council
Piyushimita (Vonu) Thakuriah, Urban Transportation Center, University of Illinois
Barbara Boyle Torrey, Division of Behavioral and Social Sciences and Education, National Research Council

Ronald W. (Ron) Tweedie, Highway Data Services Bureau, New York State Department of Transportation

Andrew White, Committee on National Statistics, National Research Council

Fred Laurence Williams, Federal Transit Administration, U.S. Department of Transportation

Peg Young, Bureau of Transportation Statistics, U.S. Department of Transportation