

Issue Brief

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Better Road Congestion Measures are Needed

- Road congestion is growing worse as demand outstrips new roadway construction and other efforts to increase traffic flows.
- Better ways to measure congestion are needed to effectively address the problem.
- Actual measures of speeds and delays are key to understanding congestion.

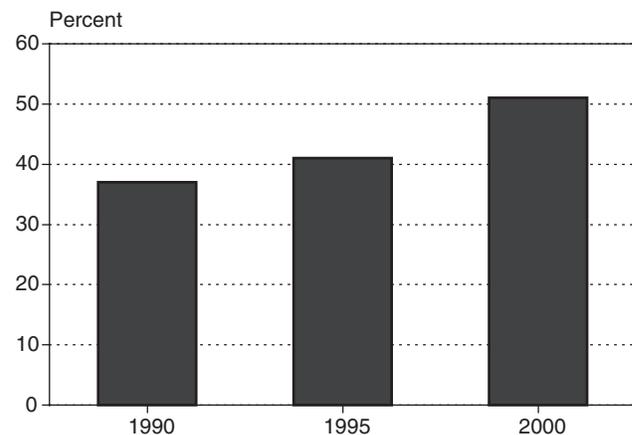
Highway congestion is an escalating economic, social, and political problem as delays on freeways and arterial streets and the costs associated with these delays steadily increase. While it is easy to observe congestion, it is very difficult to measure. Without proper data to assess the effectiveness of individual projects, there is no way to prioritize projects, choose between competing alternatives, or justify proposed funding levels. To help solve the problem, the Bureau of Transportation Statistics is examining how we measure road congestion with the goal of developing improved measurements that will lead to effective congestion-relief programs and policies at the national level.

Current estimates show congestion is a growing problem.

The Federal Highway Administration (FHWA) in its 2002 Conditions and Performance Report to Congress reported that the additional time required to make a trip during the congested peak period, compared to nonpeak times, increased from 37% in 1990 to 51% in 2000 (Figure 1).

As the numbers of vehicles and the miles those vehicles travel outstrip rates of new road construction and the identification and implementation of effective congestion relief projects, it is no surprise that congestion is getting worse. Between 1990 and 2000, vehicle-miles traveled (VMT) in the United States increased 28.2%, registered vehicles 17.3%, and VMT per driver 12.4%. During that same period, highway lane miles increased only 2.1% (Figure 2). Numerous measures have been implemented both to reduce demand (HOV lanes, increased transit alternatives, telecom-

Figure 1. Additional Peak Period Travel Time Due to Congestion



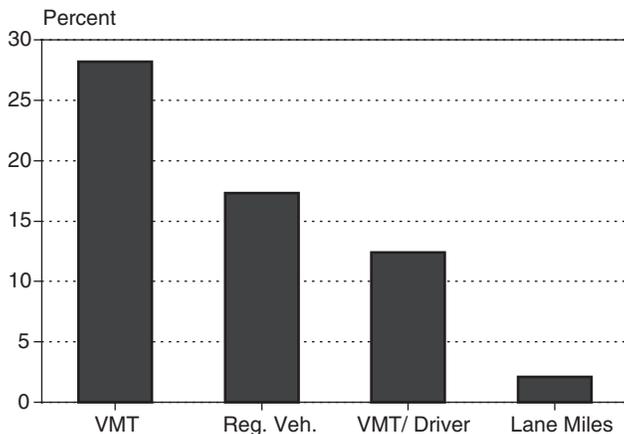
muting, etc.) and to use existing supply more efficiently (traffic management systems, reduction in incident response times, improved signal timing, etc.), but they have not been enough to close the supply and demand gap.

How should congestion be measured?

For a measure of congestion to be useful, it must provide a way to judge the effectiveness of congestion relief projects. Estimates must be sensitive to changes in the capacity and operational characteristics of the highway network that affect congestion. The procedure must be able to account for the impacts of a wide variety of congestion relief projects, whether those projects already exist or are proposed. Current efforts to measure congestion, such as the congestion indices published by the Texas Transportation Institute¹, focus on estimating direct motorist impacts, using traffic models to estimate average speeds based on traffic flows. The estimated speeds are then used to calculate motorist delay and costs associated with the congestion. Indirect impacts of congestion are not included.

A comprehensive congestion measure, and its associated costs, should cover both major dimensions of conges-

Figure 2. Selected Demand and Supply Indicators 1990–2000



tion—*direct* motorist impacts and indirect business and environmental impacts.

Direct measures of congestion, such as person-hours of delay, should be sensitive to how motorists change behavior in response to congestion. They make trips at different times, reduce the number of trips during congested conditions, use alternative transportation, and change home and work locations.

They also drive with less space between cars. This reduction in headways, the distance between vehicles, increases freeway traffic density for any given travel speed and has resulted in an increase in maximum traffic flows or capacities as reported in the Transportation Research Board's *Highway Capacity Manual*. From 1985 to 1998, estimated urban freeway capacity increased from 2,000 vehicles per hour per lane to 2,400. More vehicles can now travel on a given lane, without adversely affecting travel speeds. However, reduced headways may have adverse safety impacts, such as more crashes and increased crash severity.

The overall effect of reduced headways on congestion is not quantified by existing congestion measures, but the likely effect has been to partially offset the slowing of traffic as volume increases.

Indirect impacts are another dimension of the congestion measurement problem that affects business productivity and output and the environment. These indirect impacts have proved difficult to measure and are not included in current congestion measures. Although care must be taken in combining direct and indirect congestion impacts to avoid double counting, a promising framework to estimate the economic impacts of congestion appears in a recent study sponsored by the National Cooperative Highway Research Program.² The study developed a production function model to estimate industry congestion costs and made estimates for the Chicago and Philadelphia metropolitan areas.

Actual measures of speeds and delays are key to improving congestion estimates.

The accuracy and usefulness of many of today's congestion measures are limited because they are not actual measurements of travel speeds, but are estimates based on traffic models. One important way to improve the congestion measures is to incorporate data collected from Intelligent Transportation System (ITS) programs implemented in many urban areas across the country. A recent survey of 78 large metropolitan areas by Oak Ridge National Laboratory (ORNL) found that 53 areas collect freeway speed data and 45 collect arterial street speed data. These real-time data on traffic flows have the potential to provide very accurate measurements of average speeds and both recurring and nonrecurring delays, which can then be used to directly measure congestion.

One obstacle to using ITS data is the difficulty in converting those data into average speed and delay estimates. The data must be archived, aggregated, and passed through a quality control process. FHWA is sponsoring a project to begin this process for several urban areas. The ORNL survey found that 45 areas were archiving freeway speed data and 35 areas were archiving arterial speed data. Archived data from these areas could be used to begin incorporating ITS data into congestion measures. Another problem in using ITS data is the lack of coverage of the entire urban area. This problem can be overcome by using the ITS data on highway sections where there are measurements, and supplementing those measured speeds and delays with estimates using standard models for those sections not covered by the ITS data. This strategy has the potential to significantly increase the accuracy of existing congestion estimates.

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¹ Schrank, David and Tim Lomax, *The 2002 Urban Mobility Report*, Texas Transportation Institute, The Texas A&M University System, College St., TX, June 2002

² Weisbrod, Glen, Donald Vary, and George Treyz, *Economic Implications of Congestion*, NCHRP Report 463, Transportation Research Board, Washington, DC, 2001.