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16. Abstract

There are several keys to developing and applying mobility measures that are technically useful and generally understandable. Travel time measures are relatively easy to comprehend, but they have not always been used because of data concerns, mandated reporting practices and other issues. Travel time and speed measures can serve many different uses, communicate to many different audiences and enhance the ability of project analysis techniques to determine the most appropriate set of policies, programs and projects for a situation.

The overriding conclusion from any investigation of mobility and reliability measures is that there is a range of uses and audiences. No single measure will satisfy all the needs, and no single measure can identify all aspects of mobility or reliability – there is no "silver bullet" measure. The problems are complex and in many cases requires more than one measure, more than a single data source and more than one analysis procedure. Mobility and reliability performance measures, when combined in a process to uncover the goals and objectives the public has for transportation systems, can provide a framework to analyze how well the land use and transportation systems serve the needs of travelers and businesses.

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Using Travel Time Measures:

Urban Area Case Studies

by
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Disclaimer

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TABLE OF CONTENTS

USING TRAVEL TIME MEASURES TO ESTIMATE MOBILITY AND RELIABILITY IN URBAN AREAS

Travel time measures and data are becoming a more important part of transportation analyses. The move toward operational and multimodal corridor improvements requires measures and data that can respond to a variety of needs and communicate to a variety of audiences. This project used metropolitan planning organizations (MPOs) as test subjects to show the benefits and challenges of using travel time data. A guidebook for using travel time measures to estimate mobility was developed and observations about the usefulness of travel time information were collected from the MPOs.

Overview—Metropolitan Planning Organization Use of Travel Time Data

This project used metropolitan planning organizations (MPOs) as test subjects to show the benefits and challenges of using travel time data. A guidebook for using travel time measures to estimate mobility was developed and observations about the usefulness of travel time information were collected from the MPOs. The Lincoln-Lancaster County MPO and the Hidalgo County MPO served as examples.

Lincoln-Lancaster County MPO

The Lincoln-Lancaster County MPO in Nebraska uses its travel time data for studies of sub-areas of the city as well as for areawide planning efforts. The analysis method, data collection and measures were developed as a joint agreement between the citizens and Lincoln-Lancaster County MPO professional staff. The staff wanted a prioritization scheme that could be used in a computerized and systematic format. Residents did not like typical roadway capacity calculations, finding them too complicated and difficult to replicate with their own resources. The information used to compile travel time studies and the resulting products fit both the communities' needs and the staff analytical needs.

Travel time measures are used to evaluate the need for more detailed study of high priority corridors. Problems are identified using a "trigger speed" of 18 mph. When collected speeds fall below this threshold, further study is used to identify the source of the problem and potential remedies. When the average speed falls below 16 mph, the corridor segment improvement alternative (approved by the public) is selected for the 6-year capital improvements program.

The travel speed information was also used in a revalidation of the planning model speeds. Maximum and minimum speeds were developed for a matrix of area types and functional road classes. The maximum speed was estimated from the average midday speeds. Most of these were close to the 1995 model speeds that had been used. Peak-period speeds were used to estimate the minimum speeds. Most of the minimum speeds in the 1995 model were found to be too high for current conditions. More information on the city and county use of travel time and speed information can be found on the Planning Department website: http://interlinc.ci.lincoln.ne.us/city/plan/

Hidalgo County MPO

While a project report from the Hidalgo County MPO in Texas was never received and some project tasks were not performed, there are several outcomes that can guide the implementation of travel time measures. The Hidalgo County MPO has been very active in collecting and using travel speed data since 1995. More than 500 miles of road have been surveyed using in-vehicle travel time data collection techniques. This represents a significant resource for decision-making and trend analysis, much more than for a typical area of this size. The database and data collection activities also represent a commitment to travel time and speed data collection that is not found in areas with populations many times the size of Hidalgo County. In a significant way, the Hidalgo County MPO provides a valuable peer resource and study site for entities interested in performing travel speed studies.

Additional information regarding the Congestion Management System can be found at the Hidalgo County MPOs website: http://www.lrgvdc.org.

Findings Regarding Data Collection

The Hidalgo County and Lincoln-Lancaster MPOs conducted travel time data collection for several years. Included in this review are some findings from their experiences.

- **Reduce the sampling rate and frequency for uncongested road sections**. Other data, such as traffic counts and number of lanes, can be used to identify road sections that are likely uncongested. These roads can be surveyed every three to five years rather than annually. If traffic growth or usage patterns change and congestion is detected, the frequency can be increased. Most areas that perform travel speed studies spend too much effort on uncongested road sections the first few years.

- **Reduce the sampling rate and frequency on minor roads**. From a transportation problem and improvement perspective, minor roads are not as significant a problem as major streets and freeways. Data collection and analysis resources could be more efficiently used by focusing on problem areas. Stratifying the road systems into areas that should be surveyed annually, those that can be surveyed every two years, and those that can be surveyed less frequently can provide the same amount of information with lower cost. Lincoln-Lancaster County MPO did this to great effect in its model update process.

- **Use the travel speed data to assist in developing local estimation procedures and in calibrating the transportation-planning model**. Travel speed estimation procedures are used both as post-processors of travel model output, and as mechanisms to allow the travel models to distribute traffic to roadways. The "target market" for improved speed estimation procedures seems to be more aligned with the post-processor function. The methods to estimate speeds from model outputs would not only improve communication abilities with the general public, they would also provide a metric for comparing no-build alternatives with additional lanes, operational improvements, land use strategies, or other capacity enhancements.

- **Recognize value of investment costs**. Travel time and speed data collection was relatively costly but provided a significantly improved data set than if estimating equations alone were used. Almost 500 miles of freeways and streets were used in the first several travel time and speed studies in Hidalgo County. This included every major road and some minor roads. The Lincoln study sampled 28 percent of the area's road miles with a basic "three runs per direction" data collection level. Important corridors were sampled with greater frequency and coverage. Interstate and major arterials represented 50 percent of the sample data collection. Both of these resulted in the ability to communicate with the public and gave a comprehensive quality to the information.

- **Collect data for relevant time periods**. Four time periods appear to be a good division of the day for the purposes of data collection. Morning peak, midday, evening peak, and after hours provides information for decisions and evaluation. This breakdown also helps connect the traveler's experience with the data sets. Atypical days or runs are noted and not included with the averages.

- **Archive data**. Use of archived data from traffic operations centers was not part of the study, but it does appear to be a significant resource for future data collection efforts. The reliability measurements provided from the automated data collection databases will add a significant amount of information and provide documentation of the improvements from several operational improvement strategies.

Data Analysis and Database Issues

Two types of data usage approaches are common—areawide or corridor analyses. The data analysis steps for each are relatively similar. The types of measures, the level of aggregation, and the database design might also vary, but many uses can be supported if an inclusive design process is used from the start. Hidalgo County's study (and other travel time studies including Corpus Christi which is discussed in a separate technical memorandum) is focused on updating its congestion management system and supporting the project funding decisions made from that. The Lincoln County work was for the similar but somewhat more detailed purpose of corridor level analyses. Some other relevant guidelines include:

- The speeds are weighted by travel amounts or road distance to get averages. If the objective is to replicate user experiences, weighting by travel distance or trips is preferable.

- Lincoln and Hidalgo County are among the cities/MPOs that use varying targets of acceptable speed according to functional class. These targets are very useful in setting targets for improvement. They do require a process to get the speeds that residents and travelers find acceptable. This approach might be incorporated into the public involvement process during the long-range plan update.

- The analyses were relatively simple. Spreadsheet or simple database programs are typically used and the datasets are not too large unless continuously collected data are used.

Measures

Researchers chose the case study sites for their experience with travel speed data and measures. Hidalgo, Corpus Christi, and Lincoln among several areas used average speed as a base measure when the study began. Even though this does not have a direct relationship with travel time, speed is easily understood. Other observations include:

- The "acceptable speed" concept applies to different types of roadway, roads in different parts of the city, and various modes of travel. Similar concepts are used in conjunction with levels-of-service; converting to speed should be relatively easy if the public and decision-makers endorse the idea.

- Lincoln uses a target speed for high-priority corridors. The target speed triggers a study of potential solutions. The follow-up study is not restricted to using car speed measures or recommending auto-only solutions. A multimodal set of solutions and measures can be employed.

- Hidalgo now uses a ratio of standard travel time to actual travel time calculated as the Congestion Index. A value of 0.74 or less is considered congested with the travel time at the speed limit representing the standard time.

- Travel speed measures are used in Lincoln for both corridor studies and areawide transportation improvement program prioritization processes. The level-of-service criteria used in several decision-making elements use travel speed as the descriptor.

Computer Modeling

The travel time surveys can be used to update the lookup tables for free-flow travel speeds. At the validation stage, travel speeds in the important corridor segments can be used to identify model accuracy. There are also a variety of other potential implementation issues:

- Travel times between locations can verify that speeds on road segments are accurate.

- Collected data can improve congested travel speed prediction methodologies.

- Travel speed estimation processes can be used to evaluate alternative projects in a shorter time than it takes to generate a new travel network model. Using both the model and field data to calculate delay will provide a context for comparisons between the two methods.

- Other computer modeling-related issues might be tested by Texas Department of Transportation for Hidalgo County's model in the future. Several suggestions were provided during the project scoping meeting between the Texas Transportation Institute and the Texas Department of Transportation's Transportation Planning Program staff.

Presentation

Most MPOs and large projects have public involvement programs that use graphics to communicate results. Travel time and speed studies can provide the basis for many excellent graphic displays. Typical presentations used in the case study cities include maps with speed ranges noted by colors placed on the streets. Some of the more detailed maps show speed values next to the streets. The following list describes potential graphics for presentations.

- Isochronal maps—"topographic" lines that show the distance away from a starting point that can be achieved after a certain travel time—are good methods of presenting information about travel to and from major activity centers.

- Travel time data can be used to support the development of accessibility maps and measures. While a difficult concept to communicate, accessibility (e.g., the number of jobs within 30 minutes of a residential area) can be presented for alternative improvement projects. Areas that gain access can be shown for a combination of projects, or for individual modal improvements.

- Speed and travel time variation during the day can illustrate the extent and duration of typical congestion. If automated data archiving is present, the day-to-day variation can be displayed and reliability statistics prepared.

Summary

The travel time and speed measures used in system evaluation and project analyses are very useful and popular with a variety of audiences. Hidalgo County MPO finds that its annual congestion report is its most popular public involvement item. The Lincoln-Lancaster MPO uses travel speed data and measures because the public understands them and can the MPO collect its own travel speed data.

We recommend that decision-makers use travel speed and time data in evaluating congestion and mobility issues. The Congestion Management Systems and Transportation Improvement Programs are likely targets for travel speed measures. The measures have proven useful in both technical and public information purposes, and we recommend that MPOs put data into audience-friendly presentations for use in public involvement and communication programs.

For More Details . . .

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