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Newsletter for MPOs

HAMPTON ROADS MPO USES GPS/GIS TO PERFORM TRAVEL TIME STUDY

The Hampton Roads Planning District Commission (HRPDC), the MPO for the Hampton Roads metropolitan area, recently conducted the first comprehensive travel time study in the region to use global positioning system (GPS) technology for data collection and geographic information system (GIS) technology for data analysis. Although the MPO has conducted travel time studies since the early 1980's, previous studies were conducted using a computer-equipped vehicle and a calibrated distance-measuring instrument.

GPS Data Logger equipment used for travel time study

Travel time data was collected on more than 1,100 miles of roadway, including all of the thoroughfares that make up the Congestion Management System for Hampton Roads. To facilitate data collection, the roadway network was first divided into more than 300 segments of varying lengths. These travel time "run segments" were identified in the MPO's GIS map. Data was collected using a vehicle equipped with a GPS receiver. The driver attempted to pass roughly the same number of vehicles that passed him, and was not allowed to exceed the posted speed limit on any road. A hand-held data logger collected position, time, and speed data once every second during each data collection run. One data collection run was made in each direction during the morning and afternoon peak hours for each segment.

The GPS unit provided real-time differential correction for the position of the vehicle on the earth. The unit was comprised of a GPS receiver, an external antenna, and the data logger, which stored the collected GPS data so it was not necessary to have a separate computer in the vehicle. During the run there was no need for the driver to handle the data logger, allowing him to focus solely on driving.

Upon returning to the office, the driver downloaded data from the data logger to the HRPDC computer network. The data was then processed and joined to the HRPDC transportation GIS using a customized ArcView application.

Continued on page 2

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HAMPTON ROADS MPO USES GPS/GIS TO PERFORM TRAVEL TIME STUDY

Continued FROM page 1

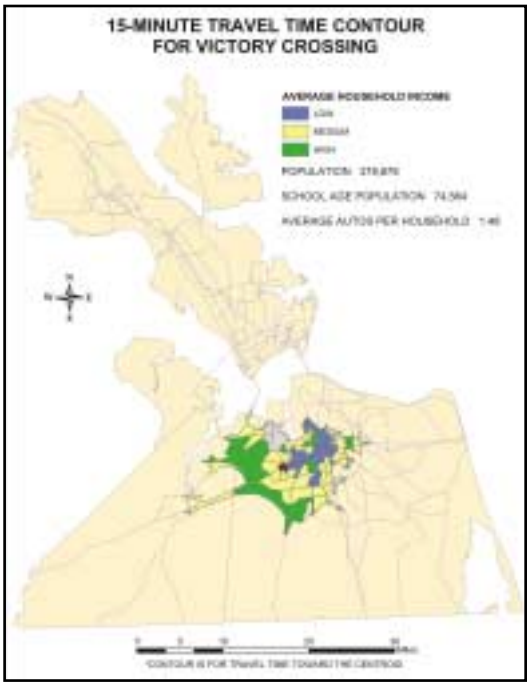
Travel Time Contour Maps

HRPDC is using the data as a means to assess the performance of the area's transportation system. One useful way to view travel time data is in the form of a travel time contour map. To construct a contour, a point of interest, or centroid, is selected and travel time is summed in all directions to or from that point. The contours in earlier studies were hand calculated and hand drawn. Those developed in this study were generated with the help of the HRPDC Transportation GIS and ArcView application, drastically reducing the time required to produce a contour. Ten and twenty-minute "away from the centroid" contours were produced for twelve activity centers using peak hour data.

A 20-minute travel time contour map showing the power of using GIS for this type of work.

Comparisons were made between the contour maps for each activity center created in 1995 and those created under this new study. This allowed planners to see how travel time has changed for each site. Maps depicted improvements or degradation in travel time with a color system for each area.

The data allow HRPDC to get a handle on the many causes for changes in travel times and average speeds from one study year to another. Changes can occur due to improvements to the transportation system, degradation of sections of the network, capacity expansion, improved signal coordination, and changes in traffic patterns and number of vehicles on the road.



HRPDC is also using travel time contours for demographic analysis.

Conclusions

HRPDC concluded several things from the analysis, including that:

- 64% of the sample of point-to-point trips in the study exhibited worse travel time in 2000 than in 1995;
- 20% of the sample point-to-point trips showed better travel time in 2000;
- most of the significant improvements shown in travel time could be attributed, in part, to major transportation improvement projects; and
- travel time contour data, coupled with demographic or socioeconomic, provide a powerful tool for economic development or facilities location.

Among the benefits of collecting travel time data with a GPS-equipped vehicle are simple and trouble-free data collection, an easy interface for linking the data to the GIS, and efficiency in terms of time and manpower. Limitations include inability to collect data inside tunnels and under dense foliage. In the latter case, runs have to be made in the fall or winter months after leaves have fallen.

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Washington, DC MPO Signal Optimization Plan Reduces Delay and Improves Air Quality

The Transportation Planning Board in the Washington, DC metropolitan area recently approved an area-wide traffic signal optimization program that will reduce travel delay and help clean up the air. The effort began with a proposal developed and publicized by a regional business group in early 2002, and led to the development of a multi-jurisdictional approach to coordinate signal planning across state and local boundaries.

The DC metropolitan area is home to almost 4.5 million people; more than 100 million vehicle miles of travel occur daily on the roadways. It also has some of the highest congestion levels in the country. Planning is made more challenging because the area encompasses the District of Columbia, the Commonwealth of Virginia, the state of Maryland, and several local governments.

A Management & Operations Approach

In 2001, the MPO Board elevated the priority of a management and operations approach to improving mobility in the metropolitan area. An existing ITS task force was reorganized and renamed the Management, Operations, and Intelligent Transportation Systems (M&O/ITS) Task Force to reflect a broader emphasis on integrated management and operations rather than simply focusing on the application of technologies to improve transportation. With that, the M&O/ITS Task Force set out to coordinate efforts to get maximum use out of the transportation system that is already built. The role of the Task Force is not to supplant or centralize M&O, but to act as a facilitator for improved coordination between jurisdictions.

One of the Task Force's efforts was to begin a pilot project to look at optimizing traffic signals on two separate arterial corridors that cross jurisdictional boundaries. As drivers travel these two corridors they encounter traffic signals that are independently controlled by the state DOTs, cities, and counties, depending on what segment they driving. The state DOTs hired consultants to examine the pilot corridors and conduct traffic studies, observations, and vehicle test runs. After these data were analyzed, signals were optimized along the corridors and new measurements were taken.

The results were positive. The Maryland State Highway Administration estimated that benefits along one of the corridors included 950,000 vehicle-hours of delay saved annually; 320,000 gallons of fuel saved; a 5.5 percent reduction in hydrocarbon emissions; and a 0.5 percent reduction in nitrogen dioxide (NOx) emissions. Pre-optimization vehicle speed averaged 8.3 miles per hour (mph). Post-optimization speed increased 62 percent to 13.5 mph. *With vehicle-hours of delay valued at $10 per hour, the net benefit of this project came to an estimated $19 million over two years, while the project's cost was $100,000.* Results along the Northern Virginia pilot corridor, however, were inconclusive, due to marked traffic pattern changes in the vicinity of the Pentagon in the immediate wake of the September 11 terrorist attacks. This effort will be revisited in the future.

These benefits are consistent with national signal optimization studies, which show cost savings as much as 80 times greater than the costs of the improvements. Optimization can also improve vehicle and pedestrian safety, and enhance the schedule reliability of transit buses. The emission reductions are important because the Washington, DC metro area is an ozone nonattainment region.

The MPO Board, acting on these positive results, approved a resolution calling for development of funding strategies for signal optimization across the metropolitan area. The resolution also stated that signals should be re-optimized every three years on average. This reflects the fact that traffic patterns and volumes change over time. The Board assigned the M&O/ITS Task Force the responsibility to develop a detailed program to ensure that the optimization concept is accomplished.

MPO staff undertook a metro-wide analysis of signals and found that more than 2,000 of the region's roughly 4,500 signalized intersections were already optimized. Approximately 2,000 additional signals would benefit from optimization. Estimated

costs for optimizing these additional signals would be approximately $10.3 million in the first three years and $2.3 million in each subsequent year. The emissions benefits of such an optimization program were also put forth to help the MPO achieve a finding of air quality conformity. The potential air quality benefits were critical in the decision to adopt the program.

Ultimately, the Board voted unanimously to optimize 856 signals at a cost of $3 million during the years 2003 to 2005. The jurisdictions comprising the MPO Board committed to this initial effort. Advocates for the initiative had requested that the Board approve a pooled regional fund that would be dedicated to the effort. For the current effort, however, separate, multiple funding sources and contracting mechanisms are to be employed. Advocates also hope to persuade the Board to accomplish more after the initial wave of optimization is completed.

A Cost Effective Measure

The optimization program will reduce delay along major corridors by a significant amount at a relatively small cost. MPO staff estimate that optimization will cost approximately $3,500 per intersection, excluding any hardware costs that may be incurred. In addition, calculations performed by MPO staff show that optimizing the signals will result in NOx emission reductions of about 0.18 tons per day, and at a much lower cost than many other emission reduction measures the MPO is implementing.

Andrew Meese, of the MPO staff, noted the influence of the Greater Washington Board of Trade, a group representing business in the metropolitan area, in the development and approval of the measure. The Board of Trade seized upon the idea during a conference held earlier in the year, and actively promoted the concept to elected officials and others on the MPO Board. Also instrumental is the effort undertaken by the MPO staff. Meese said this case provides a good example of how an MPO can address a transportation problem in the M&O realm rather than in terms of the LRP process, and positively effect mobility.

For more information, contact Andrew Meese at (202) 962-3789 or ameese@mwcog.org.

TRANSPORTATION PERFORMANCE MEASURES AND DATA

This article is excerpted from white papers written by Michael Meyer, Ph.D., P.E. and Richard Schuman. The complete white papers can be found on the Internet at http://www.ops.fhwa.dot.gov/nat_dialogue.htm.

The performance of our nation's transportation system affects our lives on a daily basis. Management and operations (M&O) for transportation systems focus on improving this performance. The challenge to the transportation community is that M&O improvements often are not incorporated as a serious component of state and metropolitan visions for the future of our nation's transportation systems.

One step toward enhancing the performance of transportation systems is to collect data on a number of performance characteristics. Monitoring key measures enables officials to implement the best strategies to improve performance. As more transportation agencies move aggressively toward improving operations and measuring performance, the need for comprehensive, high-quality data becomes imperative.

Transportation Performance Measures

Performance measures are adopted for a number of reasons, including accountability, efficiency, and improved communication. For the past ten years, focus on "serving the customer" has increased, and therefore measurement of performance has shifted to a customer orientation. What do system users want? In order of preference, the following performance measures seem to be most important to users:

- System reliability
- "Reasonable" travel time or speed

Continued on page 5

TRANSPORTATION PERFORMANCE MEASURES AND DATA

Continued FROM page 4

- Safety
- Average time of delay at top bottleneck points or average daily hours of travel
- Traveler costs
- Physical condition of the transportation system
- Customer satisfaction with agency performance

If performance measures are institutionalized throughout the decision-making structure, the M&O strategies that improve system performance could very well surface as top priorities for transportation agencies.

Data Users and Their Needs

Several areas of the country are moving from "data poor" to "data rich." If collected and used properly, data will empower the system owners, operators, and users, all of whom have varying data needs:

- Highway operators need data to support traffic control, management of crash incidents, preparation for weather-related hazards, and similar road management functions.
- Transit operators can use data from automatic vehicle location and automated passenger counting systems to improve service.
- The traveling public needs data to make informed route and trip time decisions.
- Freight carriers and shippers need data to help reduce costs, increase revenues, and enhance overall customer satisfaction.

Recent Data Collection Efforts

Efforts are underway to translate the needs of the various stakeholders into a single set of data requirements. The focus must shift to establishing complete, ubiquitous systems for data collectionæa national surface transportation *infostructure*. This *infostructure* could be defined as "the information infrastructure used to measure the performance of a physical infrastructure."

A recent analysis of the Metropolitan ITS Deployment Tracking Database indicates that 70 of the 78 largest metropolitan areas are gathering at least some information on traffic flow and incidents, or transit vehicle location, but only a handful of areas collect data over a large portion of their region. By 2005, more areas expect to have data collection systems in place, though most of these systems will still cover only a small part of their transportation systems. A conclusion to be drawn is that ubiquitous data collection is unlikely to occur unless additional efforts are undertaken, especially in smaller cities and rural areas.

Benefits of Data Collection

Wise use of the information generated by transportation data collection systems can yield significant benefits, as illustrated by the following examples:

- Adaptive traffic signal control has been shown to reduce vehicle delays by a range of 14 to 44 percent and reduce vehicle stops by 10 to 41 percent.
- Freeway ramp metering has been shown to increase freeway speeds by 8 to 60 percent and reduce crashes by 15 to 50 percent.
- Transit fleet management using automatic vehicle location has improved on-time bus performance by a range of 9 to 23 percent and enabled fleet size to be reduced by 4 to 9 percent.
- Weather management data has led to a reduction in the use of road salt ranging from 20 to 30 percent and a reduction in crashes ranging from 10 to 15 percent.

Challenges Ahead

The industry's collective experience in developing and deploying systems for data collection highlights a number of challenges to improving transportation data.

- *Data Gap:* The data needed to support operations on a nationwide basis are lacking.
- *Data Quality:* Where data exists, data quality is often problematic.
- *Data Sharing:* Little information sharing occurs between the public and private sectors.
- *Public / Private Roles:* Until recently, public sector organizations using public resources collected most of the data. This situation is likely to change due to recent technological advances.

Addressing these challenges will help ensure that our nation expands the collection and use of comprehensive and continuous transportation data. These data, among other functions, support the development of performance measures. Collection of data and development of performance measures are vital to ensure the effective M&O of the transportation system of the future.

AMPO is a nonprofit, membership organization established in 1994 to serve the needs and interests of metropolitan planning organizations nationwide.

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OF Note

Conference Proceedings – The proceedings of the March 2002 TRB National Conference on Traffic Incident Management are available. See http://gulliver.trb.org/conferences/TIM/TIMProceedings.pdf

FHWA's Inform Website – This site provides information on how transportation needs across the U.S. are being met by low-cost technologies or simple solutions developed by local transportation professionals. See www.its.dot.gov/inform/index1.htm

ITS Integration Resource – USDOT released "Working Together to Improve Transportation," which focuses on ITS deployment and integration in 78 metropolitan areas and tracks efforts in several others. See www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13672.html

Operations Outreach CD – This USDOT resource contains presentations on congestion, security, public safety, and weather aspects of transportation operations, and can support outreach efforts at conferences, workshops and on web sites. See www.nawgits.com/fhwa/op_outreachcd_req.html

Cross-Jurisdictional Signal Coordination Case Studies – This USDOT report presents five case studies that demonstrate cross jurisdictional signal coordination is an achievable goal for any size community. See www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13613.html ◆