The metrics: reloaded

Performance-based management is paramount, says Mike McGurrin as he delves into the cloudy waters of transportation metrics

The Moving Ahead for Progress in the 21st Century Act (MAP-21) became law on 6 July 2012. MAP-21 codifies the increasing emphasis on performance-based transportation management that has been building for many years. Performance-based management can be a powerful tool for guiding effective investments, but only if the metrics used are well-aligned with the desired outcomes. Paraphrasing management consultant Peter Drucker, the proper metrics will ensure that transportation agencies are doing the right thing, not just doing the thing right.

What is the goal (desired outcome) of transportation? Are we using metrics that fully capture that goal? Most transportation is what economists refer to as a "derived demand." Transportation is just a means to an end. We rarely transport people or goods just to move them, but rather to provide services, obtain work, or achieve some other primary purpose.

Improved access can be provided by reducing congestion, but it can also be provided through changes in land use, by increasing connectivity in the transportation system, or by providing substitutes for transportation, through the movement of information. Therefore, metrics that focus only on congestion and its associated costs only address a subset of the problem and of potential solutions. Mobility metrics, such as Annual Hours of Delay (AHD) used in programs such as the US Congestion Management and Air Quality (CMAQ) program, defined as travel time above a congestion threshold (defined by State DOTs and MPOs) in units of vehicle hours of delay are incomplete. Such measures focus only on delay above a travel time based on free-flow or other set value. As long as traffic moves freely, it doesn’t matter, according to these measures, how long the total trip time is, or, in fact, whether or not the trip is even necessary. Metrics such as delay, the travel time index, or buffer times all share this shortcoming (not to mention that they are focused on a single mode of travel). These metrics are well-understood and relatively easy to measure, but focusing exclusively on them can lead to misdirected and inefficient investments.

Because transportation is a derived demand, the more appropriate goal is to minimize the total time and cost associated with travel, not just those associated with congestion. There is a concept accompanied by objective, quantitative metrics that focus on this goal. This is the concept of transportation accessibility, also called access to destinations.

DEFINING ACCESSIBILITY

Accessibility is defined as the ability to reach desired goods, services, activities, and destinations. Accessibility can be improved by reducing congestion, but it can also be improved by adding additional links in transportation networks (e.g., new highway bridges or increased service on metro lines), by locating services closer to households (through land use changes) or by substituting the movement of information for the movement of people and goods (e.g., telework). Accessibility is a comprehensive outcome-focused measure that captures the effects from any of these changes.

Academics have developed numerous mathematical formulas for calculating accessibility metrics. Among the easiest to understand are cumulative opportunity metrics. Cumulative opportunity metrics simply count the number of destinations of interest within a set travel time or distance. For example, a cumulative opportunity model for jobs in a neighborhood using a 30 minute travel time threshold, simply counts the number of jobs that can be reached within a 30 minute commute from that neighborhood. The accessibility

3D heat map shows access to jobs in Washington, DC
scores for various neighborhoods can then be compared, as can, for example, accessibility by transit versus accessibility by automobile. An average can be calculated for a metropolitan region by calculating the average, weighting the accessibility for each neighborhood (or traffic analysis zone, or other small area) by the population in that neighborhood. The trend can then be tracked over time.

Comparing different regions is more difficult, because the number of jobs varies from region to region. One approach that focuses on transportation may be to normalize the metric for each region by calculating the percentage, rather than the absolute number, of jobs in the region that the average resident can reach within 30 minutes.

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BARRIERS TO IMPLEMENTATION
There is a growing awareness of the limitations of mobility metrics alone, and of accessibility as a concept, however this has yet to translate into widespread practice. If accessibility is such a useful concept, why isn’t it more widely used? There are two reasons. First, until recently, it was very difficult to collect the necessary data and conduct the analyses. Data was rarely readily available in an appropriate electronic format, and proprietary Geographic Information Systems (GIS) or transportation planning toolsets were required. Second, the metric crosses the divide between the planning and operations communities.

The rapid growth in open data (eg, for transit schedule
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information and street maps), improved traffic speed and travel time data for arterials and other streets, and new free tools, such as OpenTripPlanner Analyst, have greatly reduced the technical barriers. For example, the Brookings Institution made extensive use of transit schedule data available in the standard General Transit Feed Specification (GTFS) format for their comprehensive study of transit-based access to jobs in 100 cities across America.

The open source OpenTripPlanner project, originally developed to provide transit agencies with a tool trip planning tool for riders, has added OpenTripPlanner Analyst to support, among other things, accessibility analysis. What remains are the institutional divides.

“There is an institutional divide between transportation planning and management and land planning and management. Mobility measures still dominate discussions of system performance in transportation. Also transportation agencies feel they do not control land use, so that including it in the performance measures is not helpful, while land planning agencies feel they do not control transportation,” states Professor David Levinson, RP Braun CTS Chair in Transportation at the University of Minnesota.

However, even within the planning community, there is a large variance in the extent to which agencies are utilizing accessibility metrics in their activities. Some planning agencies have adopted these metrics. Montgomery County, Maryland, for example, includes “Mean Travel Time to Work” as a metric. The Sacramento Area Regional Council of Governments has long included accessibility as an explicit metric in their planning activities. At the same time, other planning agencies fail to make a clear distinction between mobility and accessibility.

“There is still more talk about accessibility as a goal than actual measures of accessibility, as there is still no standard practice on this,” reports Dr Susan Handy, the Director of the Sustainable Transportation Center at the University of California Davis.

A VISION FOR THE FUTURE

Performance-based management should be built around outcomes, and accessibility is one of the best available metrics for assessing how well a region’s transportation networks provide the desired outcomes. Increases in the availability of data in usable, electronic form, combined with more powerful and less expensive processing tools have significantly lowered the barriers to routine use of accessibility as a performance metric, offering hope that accessibility may become a more widely used. This shift could be accelerated by AASHTO and/or the USDOT recognizing accessibility as a key performance metric under MAP-21 and related efforts. As Professor Levinson and his colleague, Emilia Istrate have written, “A recommended federal measure would provide a benchmark for the state and local agencies, which then could develop their own accessibility metrics.”
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Looking into the future, might transportation agencies transform and expand their traditional roles? There has been a steady, albeit slow, trend to recognize the importance of multi-modal solutions. But why stop with the movement of people and goods? If the movement of information can often be an effective substitute, why not include promotion of telework and other demand reduction strategies within the purview of transportation agencies?

Ultimately, these agencies could transform into what Brendan Sloterback, a Minnesota planner and analyst, has called “Departments of Accessibility” focused on ensuring efficient access to goods and services, whether through mobility, proximity (through land use planning), or alternatives such as movement of information. It may be a pipe dream, but not long ago, it was a pipe dream that electric companies would actively encourage conservation and reduction of demand. These days, this is a standard element of the metrics and actions for regulated utilities.

Mike McGurin is a senior fellow for transportation systems at Noblis. The views and opinions expressed are the author’s own, and do not reflect Noblis’ position, strategy, or opinions.

Additional information on the University of Minnesota’s Access to Destinations research program can be found at http://www.cts.umn.edu/access-study/.

The Brookings Institution’s groundbreaking study Where the Jobs Are: Employer Access to Labor by Transit may be found at http://www.brookings.edu/research/papers/2012/07/11-transit-jobs-tomorrow.

Information on the open source tool OpenTripPlanner Analyst can be found at http://openplans.org/case-study/opentripplanner-analyst/.

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