Developing a Congestion Performance Measure
Taskforce Concept Paper

Building on several research reports, position papers and conference proceedings, the Congestion Taskforce staff offers the following principles and possible approaches related to a Congestion Performance Measure for discussion by the AASHTO Standing Committee on Performance Management.

Summary

The key elements of the Congestion Performance Measure are outlined below. These are related to the desired outcomes and to other performance measure topics. Key elements for AASHTO discussion include:

- Approach – Each community should develop the measures and targets that best reflect their vision. National measures, if used, should apply to the national system, be focused on issues of national importance (e.g., freight) and recognize that improvements must also work in, and be consistent with, the desires of the local community.
- Targets – A *set* of performance targets will be necessary and should be determined locally, but the regional average congestion target may be the primary metric used in public functions.
- National target – The role for a national target congestion value may be limited to routes that serve an important national interest. Important freight travel routes, border crossings, key freight connections and urban corridors during off-peak hours are examples, but evacuation routes, national defense mobilization corridors and other network elements may also qualify.
- Measures – A set of a few performance measures appears appropriate at the regional and state summary level. This should include at least one "average congestion" measure and one "travel time reliability" measure. A single measure may be used to discuss the problems, but focused action requires several measures.
    - *Peak period travel delay per commuter* is a good regional average measure; it is easily understood and directly affected by all solutions. (Whether the term is "commuter" or "peak period traveler" the measure illustrates the extra travel time for the three-hour morning and evening peak travel periods).
    - Travel Time Index is useful at several levels of geography and could be used to compare both regional and sub-regional targets.
    - Buffer Index is an easily understood and useful measure of the variation in travel time; it is affected by a range of operations improvements.
- Peak and off-peak measures are needed – Commuter conditions are important, but freight also moves in the midday and overnight periods. It may be more important to maintain a reliable, smooth flowing transportation network when and where freight movement occurs.
- Average and reliability measures – Regular congestion problems are typically included in performance reporting, but the variation in travel time is caused by different issues and have a different set of solutions than the typical "too many cars on too little road" type of problem.
- Accountability and Transparency – Will be provided in several ways. The targets will be developed by the communities (not imposed from the outside). Each area should be responsible for identifying their progress toward targets they developed and, if no progress, the reason why they are not making progress. The development of an open process and visible and measurable

targets will provide a connection between annual project lists and ultimate goals of the chosen set of projects.

- Project priorities – Should be chosen - ***at least in part*** - according to their role in alleviating the problems identified in the performance measures. The measures should illustrate the effect of all types of strategies being used to address congestion problems – added capacity, operational improvements, demand management and land use development patterns.

THE CONCEPT & FRAMEWORK

What are we trying to measure? *If its being offered as a solution, it should show up in the measure.*
The measures should identify the congestion problems and the effect of all possible solutions. These solutions include both transportation and land use approaches. The effect of the entire range of possible solutions should be shown including, for example, adding lanes, bus routes and rail lines, improved traffic signal operations, rapid removal of crashed or stalled vehicles, access management treatments, flexible work hours, commute travel options, telecommuting, bicycle travel, pedestrian treatments and land use development patterns that reduce vehicle travel.

What are we trying to compare? *Trends and targets.*
As described in the AASHTO position paper, the measure will be used to identify a region's trend and compare current and projected levels against targets for that region. Some of the measures should also be appropriate for use at corridor and sub-regional levels.

Why are we trying to compare? *If you don't measure it, you won't do it*
The value of the congestion measure is to ensure that investment decisions appropriately target congestion problems. Changes in the amount of investment and the project and program decisions may be needed to better address critical congestion problems.

Who should set the congestion goal? *There is a role for locally developed goals **and** national goals to ensure economic competitiveness and national security.*
Each metropolitan region or state is in the best position to decide its congestion goal given the community desires, the long-range growth plans, economic status and other competing funding priorities.

- DISCUSSION POINT – National congestion level >> The federal government has a legitimate and compelling interest in maintaining the service quality on the National Highway System. Congestion that hinders national and international travel and trade is not in the national interest. A national congestion goal that focuses on the time periods of the day when commuting travel is not a substantial portion of trips (for example, outside of 6 to 9 a.m. and 4 to 7 p.m.) is appropriate. Such a goal recognizes the importance of freight movement and manufacturing industries that are not solely focused on peak-periods.

Are we trying to develop a "top 10 list" of most congested regions? *We seek consistent "measuring spoons" not "cookie-cutter" policy decisions.*
No, we are not focused on developing a top 10 list. The value of a national top 10 list pales in comparison to a congestion target that is supported by the community. Since each region prioritizes

congestion relief differently, and will choose to attack each congestion problem differently, the value is in developing a congestion target and a measurement approach, rather than crafting a national standard congestion target. A "one size of congestion fits all" regional target will invariably be an easier accomplishment for small regions or those that are not seeing population and employment growth, and an impossible target for the regions that are creating jobs at a rapid rate. Top 10 lists are good for publicity about transportation solutions and benefits, but they are not good decision-making tools.

Who is the Audience? *If you aren't sure who you are talking to, how can you know you're using the right language?*
There are many audiences, but in general there are two groups. There are many public, decision-makers, policy experts and stakeholders that form an external and diverse audience of information consumers. There are also many internal consumers of congestion information within an agency including leaders, planners, designers and operators.

What if there is no progress toward the region's self-defined congestion goal? *Use carrots, not sticks. Encourage agencies to invest in projects that are consistent with the goals they set.*
There are a number of reasons a region may not be making progress. These reasons include combinations of poor priority setting, much more growth than anticipated or underfunding of transportation. In these situations, agencies should undertake an analysis of:

1) agency spending in a few broad categories to determine if one topic area is receiving "more than its share" of the funding,
2) the mobility-related funding to determine if the set of projects that are being selected are not moving the region toward their goals, and
3) the type of projects to ensure that proper investigation of all project and program options (large and small) have been considered.

How should the differences in urban and rural congestion be handled? *Each region should decide how much congestion they wish to tolerate.*
Different targets are appropriate for urban and rural areas. There are different expectations for congestion in every region. Comparisons to irrelevant conditions (i.e., comparing rural and big city traffic problems) are not helpful and do not provide citizens with a sense their funds are being spent wisely. Most states and many large MPOs have some sort of "fair share" arrangement for returning funding to areas in relation to the taxes that were paid from that area. In most cases, therefore, rural added capacity projects do not compete for funding with metro region projects.

MEASUREMENT SPECS

Some of the congestion measures should work at several different levels of geography. *Providing measures that are "useful" for a variety of purposes will accelerate their implementation*
Providing a congestion measure that can be used at the project and corridor level will improve the chances that the measure will be adopted as a part of regular decision-making practice. It is not necessary that all of the measures satisfy the criteria. The relevant geographies include project, corridor, sub-region and region.

The measures should provide mode-neutral comparisons. *A broad and level "playing field" is needed so all modes can be compared.*
Travel time and person volume related quantities allow for cross-modal and multi-modal comparisons.
The measures should include attributes that are important to freight shippers. *The movement of goods is critical to a healthy economy and should be reflected in the measures.*
Travel time and travel time reliability are important elements in freight mode and route decisions. A measure of the cost of travel delay that recognizes the higher value of an hour of freight delay than an hour of commuter delay enhances the usefulness of the measures and connects to the concerns of shippers, manufacturers and travelers alike.

The measures should monitor congestion from the full range of congestion causes. *If you don't know the real problems, you can't develop solutions.*
There are many congestion causes (e.g., unusual demand, incidents, work zones, special events, operating system failures, weather and inadequate capacity). Some of these are more difficult to monitor or estimate than others, but the cause of the problem(s) must be diagnosed before a solution can be identified.

DESCRIBING THE MEASURES

The effect of the broad principles is that a range of measures will be needed to address the key questions. Regions may choose to highlight different measures, but a robust performance measure system should have all of the following attributes.

The congestion measure should be separate from the congestion target. *Don't confuse people with the measure when you want them to focus on what to do with the measure. Use a simple measure, a simple target and explain both.*
Bundling the measure and target into one metric (e.g., creating an index comparing the growth in congestion to the growth in jobs) will be difficult to explain. Two simple metrics will be easier to use and explain – a congestion measure that can be easily explained and a target that includes a component of population, job or economic growth.

- The alternative is bundling the measure and the target in a way that normalizes all the determining factors. As an example, one could produce a measure of congestion that would change according to job growth; the target might be "keep the measure value the same from year to year." In this case, congestion is really growing every year, but it would be growing at the same rate as the job market. (Historically, delay per peak period traveler has grown at about triple the rate of population growth). This approach is hard to describe, unnecessarily complicates the message and risks appearing as though "games are being played".

A set of congestion measures should be used. *Many problems, many solutions, many measures.*
Several measures will be needed to describe problems and the effect of solutions on the system as a whole and on specific modes or elements as needed for evaluation. The recommended national set includes:

- Travel delay – A measure of the total amount of extra time suffered by all travelers in the designated geography. This is very useful for economic and "total congestion effect" reporting.
- Travel delay per commuter – A measure of regional traffic congestion for individuals.
- Congestion Cost – The value of fuel and travel delay is an important measure for discussions with the public and a component of improvement analyses.

Other measures that provide additional information on the effect of programs or which are applicable at other geographic levels or time periods:

- Travel Time Index – A measure of the extra time that travelers must allow for an average peak period trip. A value of 1.50 says that a 20 minute off-peak trip takes 30 minutes in the peak period. *This measure is applicable to the broadest range of uses, but is not sufficient by itself.*
- Total travel time – A measure that brings in the effect of transportation improvements and denser land use patterns that may combine to create trips that take less time. This measure (in person-hours) would include vehicle, walk, bike and transit modes in one value.
- Buffer Index – A measure of travel time reliability; the percentage of extra time that should be allowed to make an important trip and arrive on time. The Buffer Index is a ratio of the travel time to accomplish the 19th worst trip out of 20 compared to the average travel time (i.e., the 95th percentile travel time). The Buffer Index is explained as 'one should allow an extra BI percent of time for important trips.'
- Economic benefits – The benefits to travelers and the economy represent the reason why solutions are pursued. There are several approaches to creating these estimates; it is important

that one approach is chosen and used. If the discussion only includes costs and does not include benefits, it will be difficult to convince the public or decision makers to invest more.

Relating the measures to important aspects for person and freight travel:

- *Extra travel time* is a drain on the economy and leads to increased frustration. Most of the measures have an "extra time" component.
- The *unreliability of travel time* has a particularly onerous effect on freight travel and just-in-time manufacturers. Late deliveries or an inefficient process caused by a poorly functioning transportation system affects competitiveness.
- *Economic measures* are particularly relevant to the general public and the business community. If parents only knew how much college cost, there would be very few students; there is a lot of discussion about the value of education.

The geography used by each region does not have to be the same.
Long-range planning models are a good source for the data because they include the effect of transportation and land-use actions. There is, however, no consistency in the area included in the travel demand models used by metropolitan planners across the country. Urbanized area data may also be useful because the area includes only the developed portion of each region, a more consistent and similar comparison than the metropolitan area boundary.

The geography should be the same from year to year
Using the same geographic area will illustrate the effect of the solutions (rather than the effect of boundary changes). If a sliding boundary is used, the capacity additions will appear much larger than they are (because existing roads will be re-designated when the boundary is moved).

The target does not have to be the same in every region, in every region of the same size, or even in all parts of a region.
Downtowns may be able to accommodate more road congestion due to the presence of a variety of modal alternatives including transit, bike and walk, and because destinations (jobs, shops, etc.) are nearby. Suburban areas and rural travelers have different alternative travel options and different congestion expectations. Each community is best positioned to balance the wide variety of interests and expectations.

OTHER MEASUREMENT ISSUES

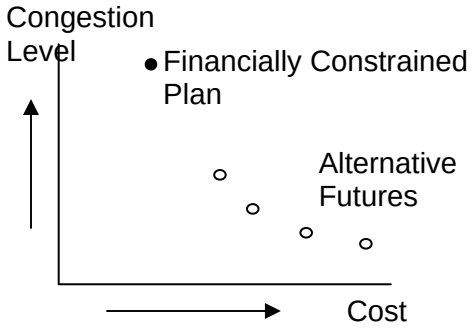
The practical effect of any move toward using performance measures will be that more before-after studies of the effect of projects, programs and policies should be conducted. All projects are evaluated in some level of detail before implementation, but very few are examined afterwards. Many are not even studied in an effort to maximize the return from the investment. In addition, it is difficult to discuss the need for additional funding or more flexibility if there are no evaluations of prior spending programs.

Studies of the effect of additional investments beyond the expected revenue (the financially constrained metropolitan transportation plan) should be developed to identify the funding needs for a range of optional congestion targets, and to identify the benefits from such investments. Scenarios might include:

- Reduce congestion
- Prevent worsening congestion
- Maintain economic competitiveness of the State
- Congestion growth matches population growth

The Exhibit below depicts one outcome of these studies; additional information on the costs and benefits of additional investment in transportation and/or the effect of alternative land use development strategies. These can be created as an extension of current planning activities that focus on producing only a financially constrained plan. Showing the reduction in congestion that comes from additional investment is one component of a program of performance management.

Displaying the Effect of Additional Investment on Congestion Levels
An Example of Performance Measurement Analysis Results



Additional analysis of several cost scenarios informs a discussion of a variety of alternative transportation investment options.

CONGESTION PERFORMANCE MEASURES
INFORMATION RESOURCES

Guide to Effective Freeway Performance Measurement: Final Report and Guidebook. Cambridge Systematics, Inc., et. al. National Cooperative Highway Research Program, Web-Only Document 97. Transportation Research Board, National Research Council, Washington, DC. 2006. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w97.pdf

Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability. Cambridge Systematics, Inc., et. al. National Cooperative Highway Research Program Report 618. Transportation Research Board, Washington, DC. 2008. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_618.pdf

Quantifying Congestion, Volume 1, Final Report, and Volume 2, User's Guide. Texas Transportation Institute, et. al. National Cooperative Highway Research Program Report 398. Transportation Research Board, Washington, DC. 1997.

The Keys to Estimating Mobility in Urban Areas: Applying Definitions and Measures That Everyone Understands. (second edition) Texas Transportation Institute, Pooled Fund Urban Transportation Performance Measure Study. College Station, TX. 2005. http://mobility.tamu.edu/resources/estimating_mobility.stm