Using New Data Sources to Meet MAP-21 Requirements for Performance-Based Planning: The National Capital Region's Experience in Monitoring Congestion and Reliability (#13-0183)

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OBJECTIVES

- Develop a framework to facilitate the selection of highway congestion and reliability performance measures;
- Share the National Capital Region (NCR) MPO's experience and lessons of using new data sources to monitor congestion and reliability.

NEW DATA SOURCES

The private sector probe-based speed/travel time data are among the new sources for pubic agencies to monitor highway performance and can be used to fulfill MAP-21 requirements.

Common Characteristics

- Unprecedented coverage enabled by "crowd-sourcing" data collection (e.g., portable GPS devices and smart phones);
- Unprecedented granularity enabled by detailed location referencing (e.g., TMC definitions, Open location referencing) and continuous monitoring.

Issues and Uncertainties

- **Cost factor:** large-scale/national-scale procurement of such data is unprecedented, and cost and funding source questions would need to be addressed;
- **Quality assurance:** an independent data quality assurance program or practice needs to be established to ensure the authenticity of data and fairness among different regions;
- **Standardized data elements:** such as central tendency and variation of speed (or travel time), roadway segmentation, time period of analysis, and volume data integration;
- **Standardized data processing:** the same definition of a performance measure with the same data could result in very different values depending on the data manipulation processes (as demonstrated in paper #13-4242).

GAME CHANGER

The NCR MPO was one of the earliest users of the private sector traffic data and has applied the data in a number of planning activities. To a significant extent, the data has been *acting as a "game changer" in the MPO's planning programs and processes*, and it will undoubtedly help to support the MPO to *meet the MAP-21 requirements* on reporting congestion and reliability of the highway system.

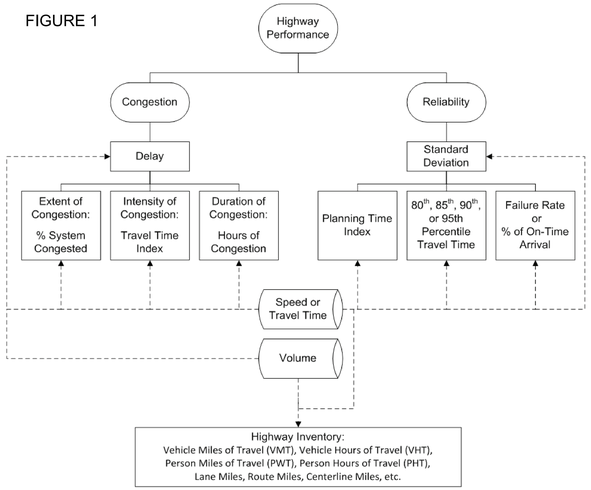
Applications of the Data

- **Congestion Management Process (CMP):** much enhanced congestion and reliability analysis, newly created dashboard-style quarterly congestion report;
- **Congestion monitoring and analysis (arterials):** moving from traditional travel time studies carried out by floating cars to a private sector probe data-based approach for the arterial monitoring program;
- **Regional Transportation Priorities Plan:** it is anticipated that the Plan will adopt the new data-based congestion and reliability measures;
- **Planning for operations:** enabled after-the-fact analysis of incidents such as snow storms, earthquakes, and hurricanes;
- **Travel demand modeling:** data are ready for model validations and future advanced models development that could take into account more details of travelers' activities and uncertainties in both supply and demand on the highway network;
- **Regional bus planning:** new data provided 24-hour congestion and reliability measures for identified bus hot spots where traditionally only peak period volumes and level of service (LOS) information were available;
- **Supporting member jurisdiction/agency studies:** increased the MPO's ability to support member jurisdictions' planning efforts.

HIERARCHICAL PERFORMANCE MEASURES

Hierarchical Framework

FIGURE 1



Delay: our single most important overarching congestion measure . The intensity, duration, and extent (or location) of congestion, in both recurring and nonrecurring forms, *all contribute to traveler delays*. The concept of delay is *easy to communicate* to a wide range of audiences, can be used by *other modes such as transit*, and can be converted to a *monetary value* in benefit-cost analysis. Moreover, delay can also go *beyond traffic congestion* to capture traffic slowdowns caused by certain adverse weather conditions and incidents in which congestion may not be observed.

Standard Deviation of Travel Times (or Speeds): our overarching reliability measure. This measure should *not* be overlooked; it is the most fundamental reliability measure, can be used in modeling and benefit-cost analysis, suitable as a background measure for technical audience.

Speed-Volume Integration

The private sector probe-based speed data has to be integrated with appropriate volume data to obtain Delay. This has been done on an ad hoc basis for the freeways in the Washington region using 5-minute speed and 5-minute volume data. Both temporal and spatial relationships between the two data have to be appropriately established before data integration.

Examples of Performance Measures

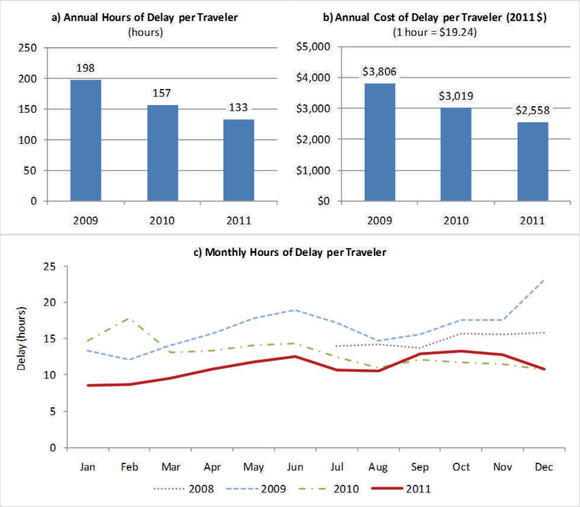


FIGURE 2: Freeway traveler delays in the Washington region.

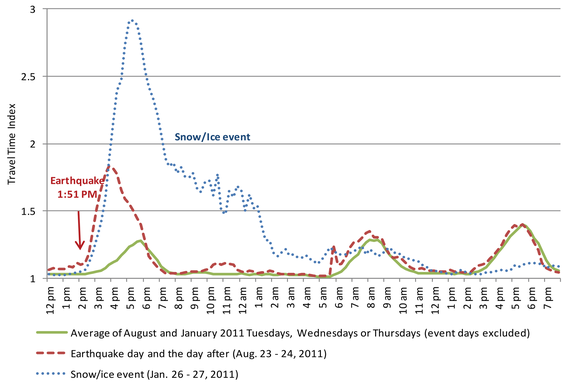


FIGURE 3: Traffic impacts of snow/ice event and earthquake.

LESSONS LEARNED AND FUTURE THOUGHTS

The development of the new data-based performance measures has evolved in the past several years in the Washington region, and it will continue to evolve in the future. The following lessons are worth noting for transportation professionals and will help to pave the path forward in developing high quality performance measures to meet MAP-21 requirements:

- The private sector probe-based traffic data has greatly advanced the region's congestion and reliability monitoring efforts;
- Hierarchically structured performance measures are preferable than a menu of measures;
- No "magic" performance measure so far captures all the aspects of congestion and reliability while maintaining a high-level of public acceptance;
- Explaining travel time reliability measures to the public remains challenging;
- Obtaining delay, the key congestion measure, requires technically challenging speed-volume data integration;
- Standardized data processing practice should be established in calculating performance measures;
- Technical, professional-oriented performance measures have their places.

CONCLUSIONS

This paper demonstrates the effectiveness and potential of the private sector probe-based traffic data, which can be provided by several competitive data vendors, in making up the gaps that exist between the new MAP-21 requirements and many transportation agencies' state of practice. Furthermore, with the vast availability of the private sector probe-based traffic data, this paper identifies an opportunity to establish a standardized national congestion and reliability monitoring program, which could also be tied into the existing HPMS. To achieve this, both standardized data and commonly agreed performance measures are necessities.

This paper has proposed a hierarchical framework of performance measures that can inform and facilitate performance measure identifications. This paper could also be a reference to other transportation agencies and entities in identifying appropriate performance measures that can satisfy their specific needs. Some observations and lessons provided in this paper could be useful in future performance measures research.

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