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## WSDOT Aggressively Leverages Transportation Operations Measures

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Over the past three years, the Washington State Department of Transportation (WSDOT) has increasingly used transportation operations indices for congestion level and travel time to both help manage its roadway network and provide quarterly "accountability reports" and real-time guidance to Washington residents. Under the leadership of Secretary of Transportation Douglas B. MacDonald and Director of Strategic Assessment Daniela Bremmer, the agency now produces a quarterly *Measures, Markers and Mileposts* report. More commonly called the *Gray Notebook*, that report helps inform the state's Transportation Commission, State Legislature, and the traveling public about the agency's progress, including progress in transportation operations.

The next *Gray Notebook* is due out at the end of August 2004. While that report is issued quarterly, some operations measures -- including those for traffic congestion and pavement and bridge conditions -- are updated on an annual basis, explains Keith Cotton, Information and Performance Analyst for WSDOT's Strategic Assessment office. Other measures, including those for worker safety and incident response and clearance, are reported each quarter.

Robin Hartsell, Project Reporting Manager for the Strategic Assessment Office, manages the publication of the *Gray Notebook*. [Note: Both Cotton and Hartsell report to Ms. Bremmer, who was away from the office during our research for this article.] Hartsell previously worked in WSDOT's Traffic Operations Section, where he helped develop a database, tracking system, and measures to help monitor incident clearance times on state highways. That system, he says, was instrumental in helping evolve the agency's

incident response program.

"In the past, if the State Patrol thought that it would take more than an hour to clear a particular incident, they would call in an incident response unit," Hartsell recalls. "We realized that this approach was very ineffective, so we increased the number of incident response units in the field and then created a roving program so that they can proactively seek incidents on our highways and really attack the peak congestion times for key commute corridors," he says.

## **Congestion Measures: Past, Present, and Future**

Cotton says that the desire to exploit benchmarks for the performance of the agency's transportation system dates back to 1999, when a Blue Ribbon Commission on Transportation recommended several benchmarks, including one for traffic congestion and one for driver delay. However, the particular benchmark that the Commission recommended for congestion was based on Highway Performance Monitoring System (HPMS) data (see the HPMS reference in the "For More Information" section below) which, Cotton says, doesn't distinguish very well between what he calls "recurrent congestion" that's due to roadway undercapacity, and "non-recurrent congestion" that's caused by transient effects, including incidents.

In December 2001, WSDOT implemented six new "congestion management principles" to help address the inadequacy of HPMS-based measures. [For more information, see [Measuring Congestion: Learning From Operational Data](#).] Those measures are:

1. Use real-time measurements (rather than computer models) whenever possible.
2. Measure congestion due to incidents as distinct from congestion due to inadequate capacity.
3. Show how reducing congestion caused by incidents improves travel time reliability.
4. Demonstrate both long-term trends and short-to-intermediate term results.
5. Communicate possible congestion fixes using an "apples-to-apples" comparison with the current situation.
6. Use plain English to describe measurements.

At about the same time, the agency, in partnership with the Washington Transportation Center (TRAC) at the University of Washington, began to look at ways to analyze its mostly loop-detector data to distinguish between recurrent congestion and non-recurrent congestion. According to a paper by Bremmer, Cotton et al at the 2004 TRB Annual Meeting, "the study concluded that it was not possible to accurately decide which travel times have been affected by incidents simply by examining individual travel times and their distribution." However, that same study proposed a temporary approach at delineating the two types of congestion, by defining "incident-related trips" as any trips that take twice as long (or more) as a "free-flow" trip on that same route.

## **A New Congestion Metric on the Horizon**

That "two-times-freeflow" metric continues to be used by WSDOT, and will be reported in the upcoming (August) version of the *Gray Notebook*. At the same time, however, WSDOT has contracted with TRAC to research more accurate ways to identify the specific impact of non-recurring events on congestion. Mark Hallenbeck, TRAC's Director and head of TRAC's research efforts in this area, says that understanding the underlying causes of recurring and non-recurring congestion is absolutely critical from an operations standpoint. "If you want to go out and improve [congestion], you have to understand what the heck is going on, and in particular what's going wrong. Then you can apply the right tools to the situation," he says.

Hallenbeck says that the key to understanding non-recurring congestion is to look at "independent variables" that can help pinpoint when actual incidents occur. He says that his research team has tried using three different data sets, including data from the 911 reporting system. "Unfortunately, the 911 data set is the worst [of the three] to use, because it's a text file. Searching it for incident locations is really tough." Conversely, the researchers found that data from WSDOT's highway service patrol was immensely useful. "They login in a real live database every time they stop to help somebody," Hallenbeck says. "So we know [incident] time, location, and -- for the most part -- severity."

The TRAC researchers then created a "median condition" as defined by speed and lane occupancy for five separate freeways and approximately 100 roadway miles. To create that "median condition," the team analyzed two months worth of data (September and October 2002) during mid-week (Tuesday, Wednesday, and Thursday) only, and removed time periods for any lane-blocking incidents verified from those independent variables. It then identified the recipe for what Hallenbeck calls the "second version" of a definition for non-recurring congestion: any time that lane occupancy is 5 or more percentage points higher than the median condition.

"Lane occupancy, for the most part, is hardly ever above 13 or 14 percent," Hallenbeck explains. "Therefore, if the median is 8, then 8 plus 5 is 13, the occupancy level above which we consider congestion due to non-recurring causes," he says. Hallenbeck calls this 5% rule a "better measure" than the older two-times-freeflow metric, but says that the two-times metric is "still quite reasonable," especially as a way to quickly and easily explain traffic conditions to the traveling public. "It's still a wonderful metric for communicating to the public about performance, but it's not necessarily a very good metric for identifying what [congestion] is due to incidents," he says.

### **Providing both Travel Times and Travel-Time Reliability Figures**

While WSDOT is making a considerable effort to identify and communicate the impacts of both recurring and non-recurring congestion, the agency also communicates other traffic-operations-related metrics in real-time to the traveling public through its extensive [Statewide Traveler Information web site](#). The agency has long shown real-time traffic conditions on its multi-colored [Puget Sound Traffic Conditions map](#), snapshots and video clips from many of the cameras located along the major freeways in the Puget Sound area, and on-line incident reports.

More recently, the agency has added additional information about travel times. "In some ways, travel times are easier for people to understand -- that a trip is going to take 37 minutes, rather than going 40 mph on this segment and 50 mph on that one," Cotton says. The [Central Puget Sound Travel Times web page](#) shows both real-time (estimated) and historical (average) travel times for different directions (and express lanes, if present) on 12 different Puget Sound routes. A historical summary of that data for the peak-period travel times will also be included in the upcoming edition of the *Gray Notebook*.

Cotton says that the agency will also summarize figures for travel time reliability -- a calculated travel time for a particular route that will meet or exceed actual travel time 95% of the time -- in the upcoming *Gray Notebook*. A relatively new online trip-planning tool, called [Calculate Your Commute](#), also uses travel-time reliability calculations to tell commuters how much time they need to allow for their trip. Here is typical advice from that tool, after selecting a particular route and starting time (8 am in this case):

If you allow **11** minutes to travel from Redmond Way exit on SR 520 to the NE 8th St. exit on I-405 in downtown Bellevue you will be on time 19 out of 20 weekdays per month.

## **Dual Purposes: Improving Operations and Being Accountable to the Public**

Clearly, WSDOT sees its transportation operations measures serving a dual role, in both helping the agency operate its roadway network as well as communicate progress -- and problems -- to its many constituents.

Hallenbeck says that his research is primarily aimed at helping WSDOT "improve the management of the system." "We're adding details into our independent variable calculation," he says. "The independent variables we're looking at include common lane-blocking incidents, weather, and special events like baseball or basketball games downtown. We're trying to calculate how much of our delay is being caused by failures or events of each of these kinds." He says that he hopes to have that analysis completed by the end of this summer, and that the payback from that analysis could be substantial.

"If we understand that incidents at particular times and locations cause particularly severe problems, we can better manage our service patrols -- how we augment them and what kind of equipment we give them," he says. "If there's an inordinate amount of delay on the freeway, an in-depth analysis might reveal that we can get a 20% improvement in performance by building two extra ramps' worth of storage. Isn't that a cheap way to gain that extra capacity?" he asks parenthetically.

Just as importantly, WSDOT is using operations measures as a way to objectively report progress -- and identify problems -- to the agency's constituents via the *Gray Notebook*. He says that the effort to identify new and useful measures is "increasing in leaps and bounds," and that his department gets

numerous calls from other states that want to learn from WSDOT's experiences. Hartsell says that the upcoming August edition of the *Gray Notebook* will include "some new looks for what we're doing with congestion." One new entry will be a discussion about the relative effectiveness of attacking choke points and bottlenecks as opposed to corridor-wide improvements. The report will likely include a summary of the issues involved, and then link on-line to a more detailed white paper authored by WSDOT's Urban Corridors Division in Seattle.

"Virtually all of this [effort] can be attributed back to Secretary MacDonald -- he's on fire for this stuff," Hartsell says. He says that the WSDOT Strategic Assessment office reviews each upcoming report in detail with the Secretary two weeks or so before it is published.

The agency also provides an anonymous on-line survey form, so that others can easily provide feedback on the accountability report or other suggestions. "Last quarter, we received between 8 and a dozen responses that were all signed 'Doug' [as in Secretary Douglas MacDonald]," Hartsell recalls. "These people were trying to add a little bit more power or influence to their suggestions, I guess."

-Jerry Werner

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### For More Information

- [WSDOT's Accountability Web Page](#)
  - [WSDOT's Gray Notebook](#)
  - [TRAC web site](#)
- [Measurement of Recurring versus Non-Recurring Congestion: Technical Report](#), Hallenbeck, M. E., Ishimaru, J. M., and Nee, J., 2003, WA.RD #568.1
- [Measurement of Recurring versus Non-Recurring Congestion: Final Report](#), Hallenbeck, M. E., Ishimaru, J. M., and Nee, J., 2003, WA.RD #568.2
- [Overview of Highway Performance Monitoring System \(HPMS\) for FHWA Field Offices](#)
- [Measuring Congestion: Learning From Operational Data](#) by Daniela Bremmer, Keith C. Cotton, Dan Cotey, Charles E. Prestrud, and Gary Westby, March 29, 2004 (second revised