

New Approaches to Measuring System Performance: Maximizing Highway System Capacity

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**Module 1: Data Collection and Analysis,
Concurrent Session: E2**

Congestion Management at WSDOT: Balanced Strategies

- **Manage Demand:** Reduce demand on the transportation system by providing citizens with options such as HOV lanes, Commute Trip Reduction programs and Traveler Information
- **Operate Efficiently:** Develop and implement strategies that maximize operational efficiency, such as ramp meters, synchronizing traffic signals, and using incident response trucks to clear traffic incidents
- **Add Capacity Strategically:** Target capital projects to improve highway capacity and relieve chokepoints that cause recurring congestion



“Operate Efficiently” Communication Challenges

- Effective communication of transportation principles, measures and results to citizens is a difficult task for DOTs:
 - Dependency on technical jargon to explain performance measures to diverse audiences.
 - Lack of narrative to explain the context for complex performance data.
 - Why does the transportation system perform a certain way?
 - Is performance improving or getting worse?
 - What is the DOT doing to improve performance?
 - Are taxpayers and decision makers getting their money’s worth?

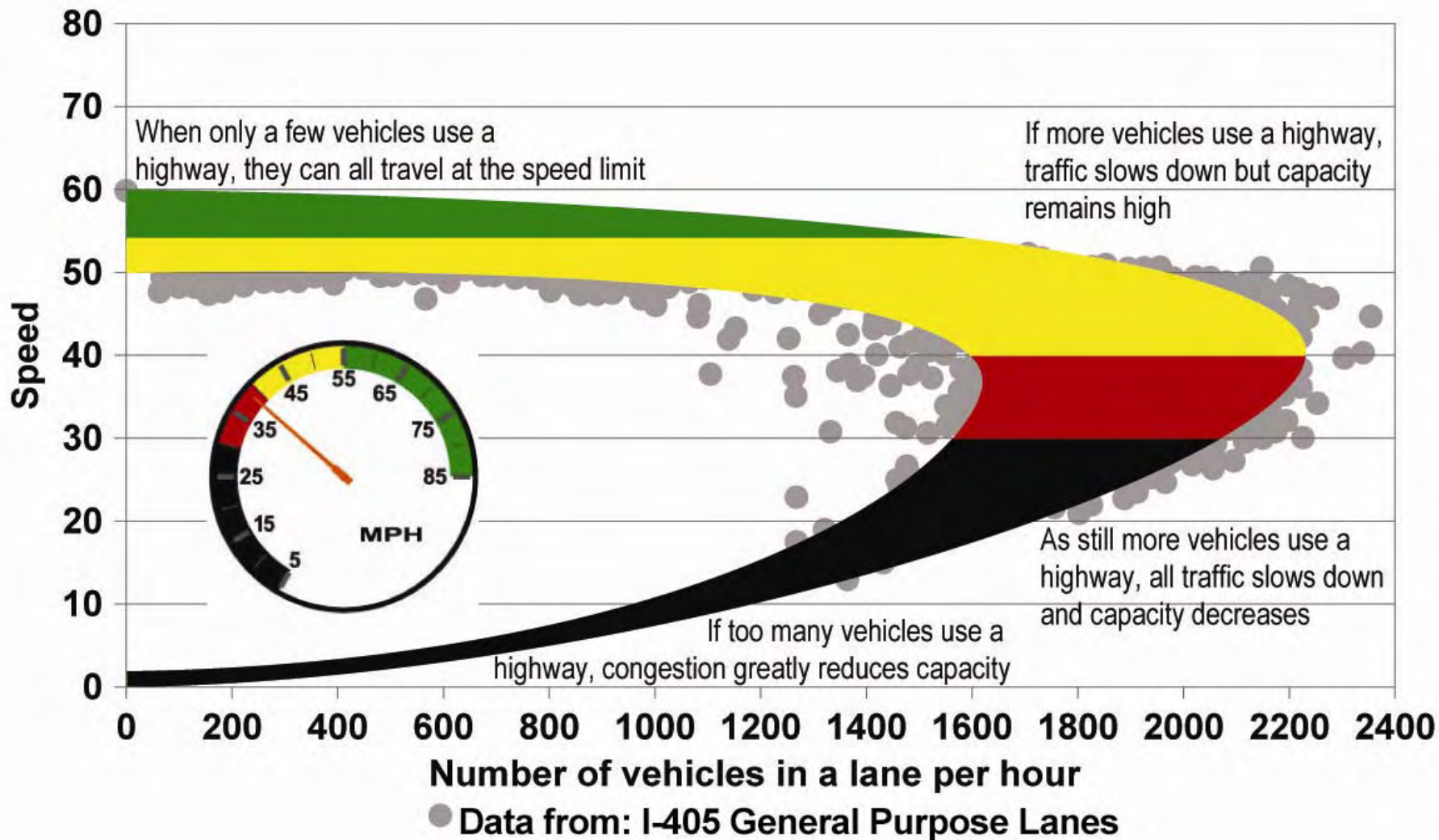


System Efficiency and Maximum Throughput

- WSDOT emphasizes system efficiency in its management of congestion on state highways; in planning (HSP) and in investment decisions.
- Maximum Throughput is the basis from which it measures system efficiency.
 - Maximum throughput is the maximum number of vehicles that can pass through an individual lane every hour, which is approximately 2000 vehicles per lane per hour (ideal capacity) on highways, and is achieved when traffic on a roadway is traveling at approximately 70%-85% of the posted speed limit.

Relating Speed and Volume:

I-405 Northbound at 24th NE, 6-11 AM Weekdays, May 2001





Congestion and Capacity

- Congestion creates a loss in throughput capacity:
Volume of traffic moves slower and fewer vehicles can pass through

Types of Congestion

- Recurrent Congestion: Regular, heavy demand –
- Non-Recurrent Congestion: Accidents, Incidents, Weather, Special Events

Example of Non-Recurrent Congestion: -Capacity Loss About to Happen- Stalled Vehicle –



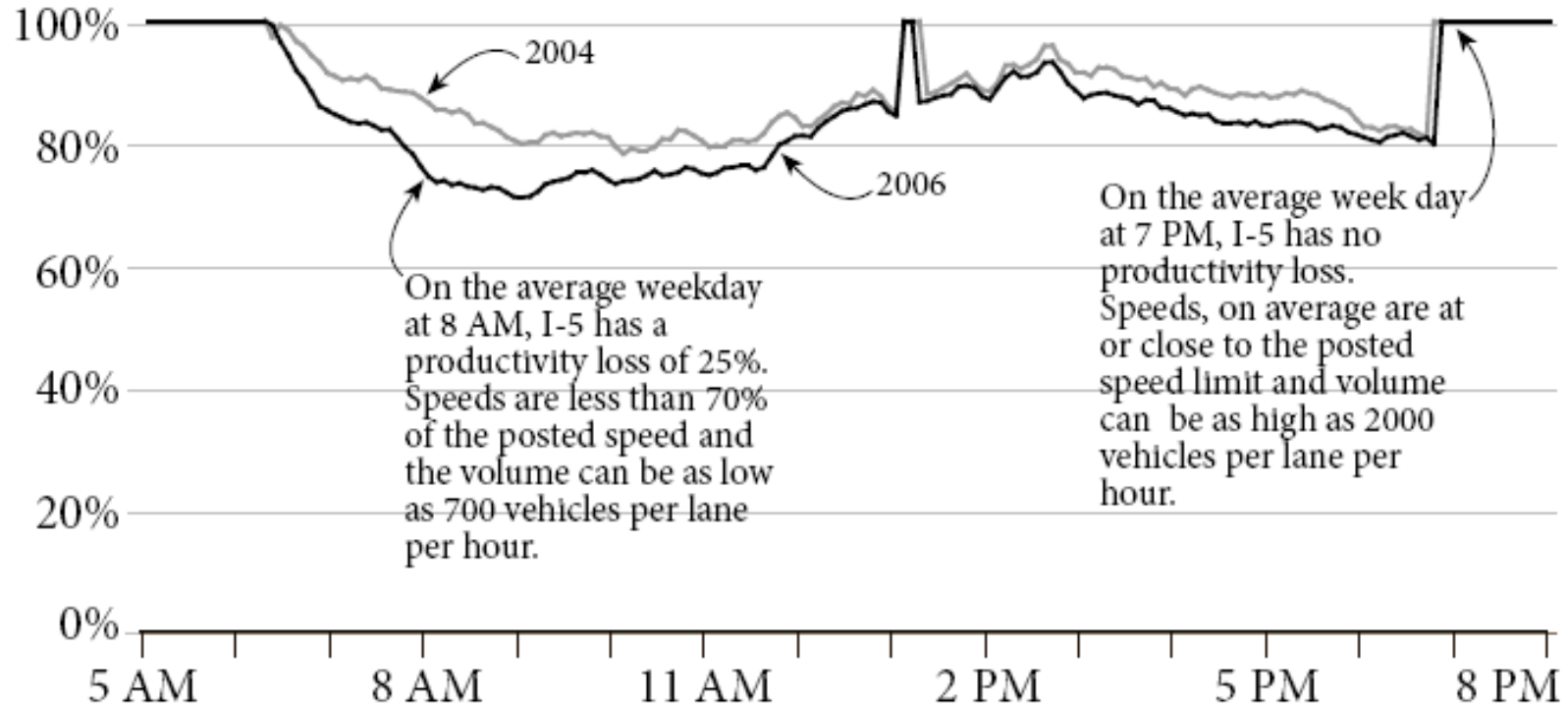


Maximum Capacity and Efficiency

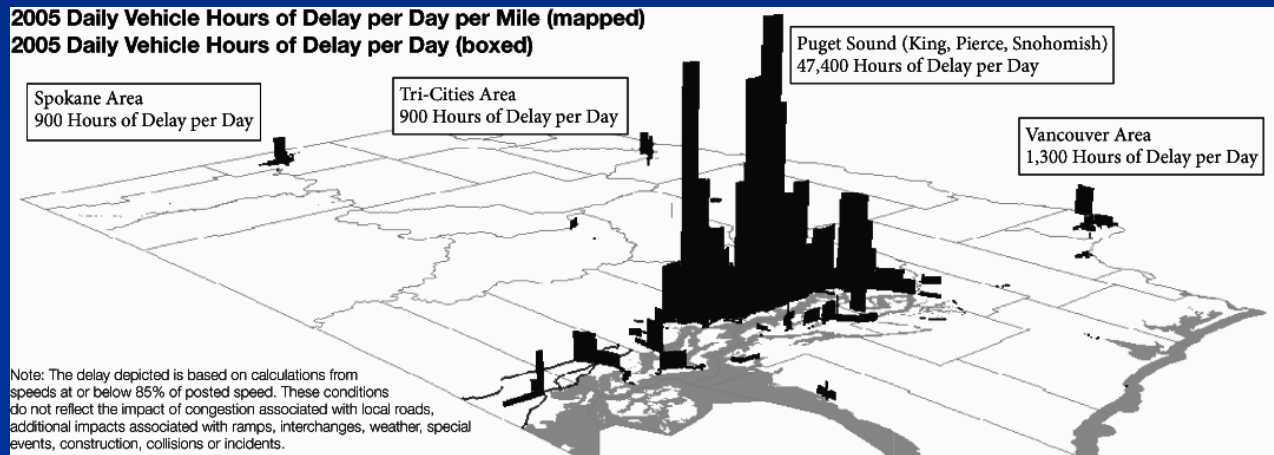
- The highway system operates at peak efficiency and capacity when vehicles travel at 70%-85% of the posted speed limit. At 60mph posted speed this means approximately 42-51 mph.
- **Ideal Capacity** : approximately 2000 vehicles per lane per hour
- **Actual (observed) Capacity** : varies, based on multiple factors (roadway geometrics, technology, weather, driving skills, bottlenecks)

Communicating the Productivity Gap

How to Read a Productivity Graph I-5 at I-90

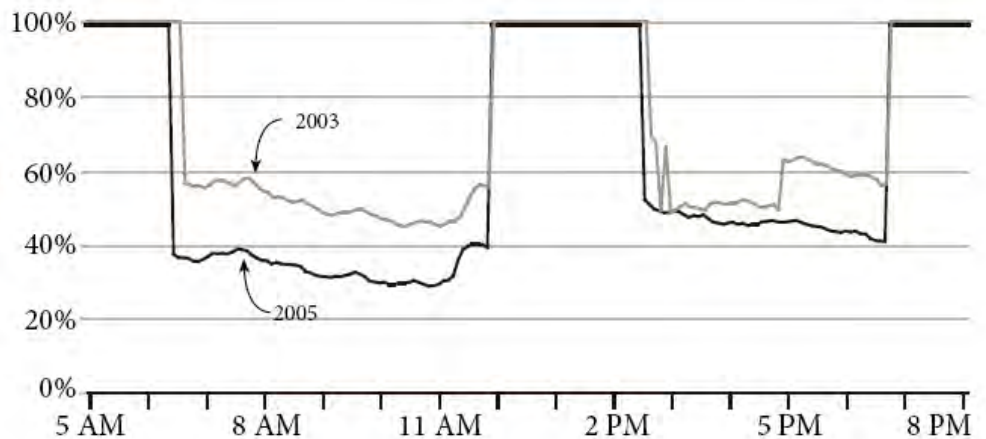


WSDOT annual congestion report explores different ways to communicate system efficiency issues and results....



...building on ideas and approaches used by our peers and colleagues in the U.S. and abroad

Percent of Lost Throughput Capacity Due to Lane or Shoulder Blocking Incidents Near the I-90 Merge in Seattle
100% equals 2,000 Vehicles Per Lane Per Hour Highway Capacity





The Difficulty of Communicating Efficiency and Maximum Throughput

- It is difficult to communicate to citizens the concept of managing the flow of traffic on highways by regulating vehicle volume and speed.
 - The public is asked to accept congestion thresholds and strategies that do not manage the system to free flow or posted speeds - a perceived standard.
 - Maintaining maximum throughput may require the deployment of operational strategies, such as variable pricing and tolling, which can become highly contentious issues with the public and media.



The Doug MacDonald Challenge

- In response to this dilemma, former WSDOT Secretary Doug MacDonald announced a contest titled “The Doug MacDonald Challenge,” to find an effective communication tool for conveying the concept of “maximum throughput” to the general public, the media and policy makers.
- Each entry could submit a 175 word submission, with an additional chart or graph to supplement the written explanation. (See <http://www.trb-pricing.org/challenge> for details).
- The contest was sponsored by TRB and TRB Congestion Pricing Committee.
- The winner would receive a \$1000 prize donated by MacDonald himself.

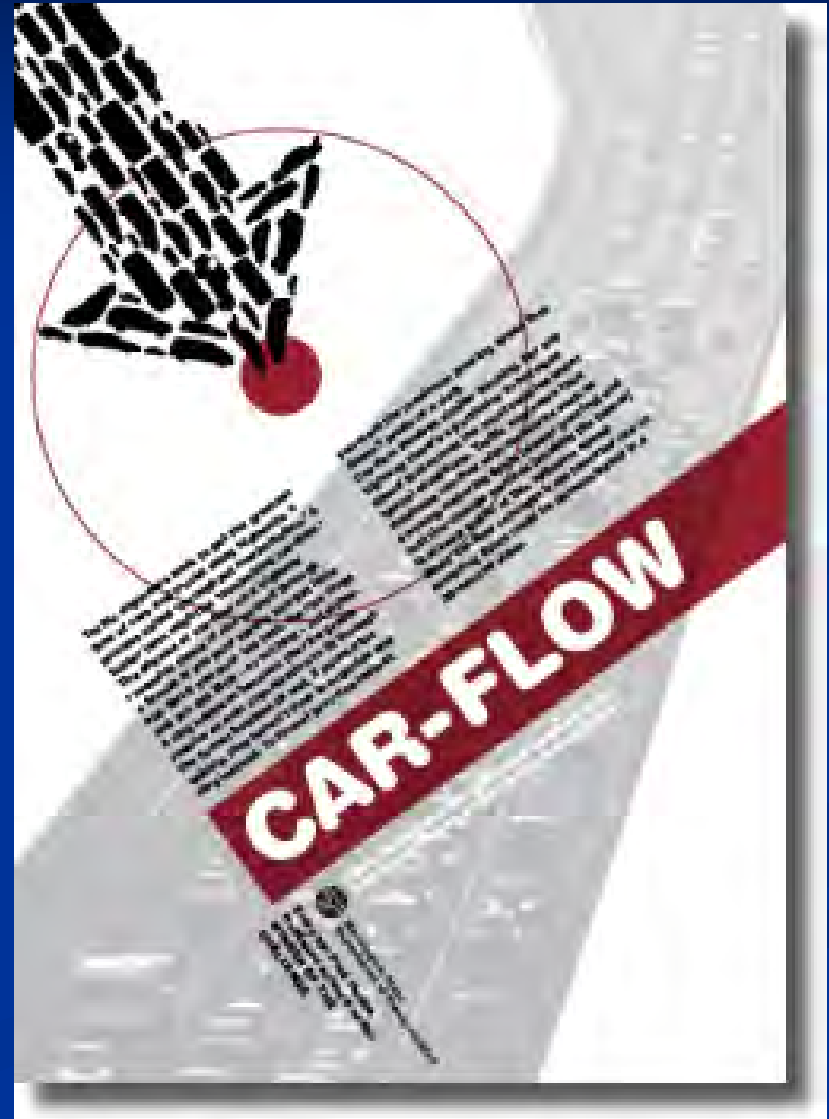
110 People Took on Doug MacDonald's Challenge...



- Finalists used a number of innovative techniques to explain maximum throughput:
 - A few entries explained the “clogging” concept through examples such as using grass clippings in a lawn mower.
 - Other entries were more theoretical, and demonstrated the physics and logic behind the concept of maximum throughput.
 - Others suggested more practical solutions for achieving maximum throughput, such as adding toll lanes adjacent to existing highways to lower the overall volume on the highway.

And the winner is...

- The winner was Paul Hasse, a freelance writer from Sammamish, WA.



The PRICE is Right

- The winning entry
 - Concept
 - Explained the concept of maximum throughput by pouring a bag of dry rice through a funnel.
 - Demonstration
 - If too much rice (vehicles) is poured into the funnel (highway system) at one time, the spout of the funnel (the highway) becomes clogged, and very little rice makes it through the spout (traffic congestion during peak periods).
 - By pouring the rice slowly through the funnel, the rice organizes itself in a more efficient manner, and flows out of the spout at a more rapid rate (up to 33% faster).





Demonstration of “The PRICE is Right”

- Video Clip of Doug MacDonald and Paul Hasse demonstrating the winning entry on Q13 News in Seattle.



Key Concepts Successfully Illustrated...

- This entry demonstrated that controlling the volume and flow of traffic through a highway system is essential to achieving maximum throughput and efficiency.

- Demonstrated to the public how WSDOT may control volumes and traffic flow through:
 - Ramp metering
 - HOV/HOT lanes
 - Variable congestion pricing/tolling
 - Variable speed limits

And the “Other” Contest...

- Soon after the contest was announced, the *Seattle Times* picked up the story, but erroneously reported that the contest was for the best idea for “relieving traffic” rather than explaining maximum throughput and efficiency.
- Before the details of the contest could be corrected, WSDOT received an impromptu opinion poll from over 250 people in the general public, providing WSDOT with a valuable resource on the public’s views and knowledge of transportation issues in Washington State.
- Some of the ideas include:
 - Eliminating HOV lanes, teaching drivers how to merge, lowering the speed limits, raising the speed limits, tolling of highways, and 16 entries suggested building more roadways.





“Challenge” Conclusions

- Don't try this at home, unless you have a funnel, a 20 lb. bag of rice, a laboratory jacket with your name monogrammed on it, and...
 - Communicating difficult to understand (maximum throughput) and politically sensitive subjects (tolling and congestion pricing) is best done in an engaging, humorous, and disarming manner.
 - Engaging a wide variety of audiences, such as engineers, planners and the general public, with a presentation is useful in implementing new and complex transportation concepts.
 - This demonstration was presented at the White House, state governor and legislators, national transportation conferences, and chamber of commerce meetings.
 - Helped in creating support for a successful proposal between City of Seattle, King County, and Puget Sound Regional Council for a multi-million dollar grant from USDOT for tolling SR 520 (Evergreen Floating Bridge). Urban Partnership Agreement



Resources and Contact Information

- WSDOT Accountability Web Site
<http://www.wsdot.wa.gov/accountability/>
- Doug MacDonald Challenge Home Page and Folio
<http://www.wsdot.wa.gov/traffic/congestion/rice/>
- WSDOT GNB Annual Congestion Report:
<http://www.wsdot.wa.gov/NR/rdonlyres/3E501E2B-6E0A-4FD9-8801-2400A9194A45/0/WSDOTCongestionReport.pdf> **2007 GNB Congestion Report pending publication -late November 2007 release**

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