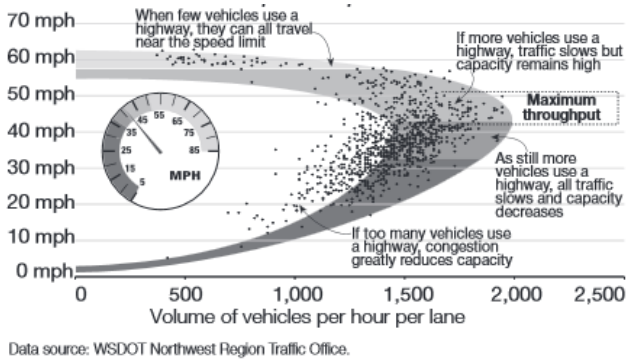
Results Washington
Goal 2: Prosperous Economy
Sub-Topic: Sustainable, Efficient Infrastructure
Indicator 3.2.b – Efficiency

***Leading Indicator 3.2.b –*** Operate strategic corridors at 90% efficiency or higher.

**Background:**

***How does WSDOT measure efficiency?*** WSDOT measures system efficiency in terms of throughput productivity. These measurements are made at 20 locations along key corridors in the Puget Sound region, and reported in the annual *Corridor Capacity Report*. WSDOT aims to provide and maintain a system that, when given a fixed capacity, maximizes productivity and efficiency, rather than a system that is free flowing but where fewer vehicles can pass through a segment during peak travel periods.

***What is throughput productivity?*** *Throughput productivity* is defined as the efficiency of a highway segment, expressed as a percentage of the maximum throughput recorded at that particular highway location. *Maximum throughput* is a dynamic metric of when highways are operating at peak efficiency. On freeways, maximum throughput is achieved when vehicles travel at speeds between 42 and 51 mph (roughly 70%-85% of a posted 60 mph speed limit). At maximum throughput speeds, highways are operating at peak efficiency because more vehicles are passing through the segment than at posted speeds. This happens because drivers at maximum throughput speeds can safely travel with a shorter distance between vehicles than they can at posted speeds. As traffic increases beyond maximum throughput, however, roads are able to carry fewer vehicles, resulting in slower speeds and a drop in efficiency.

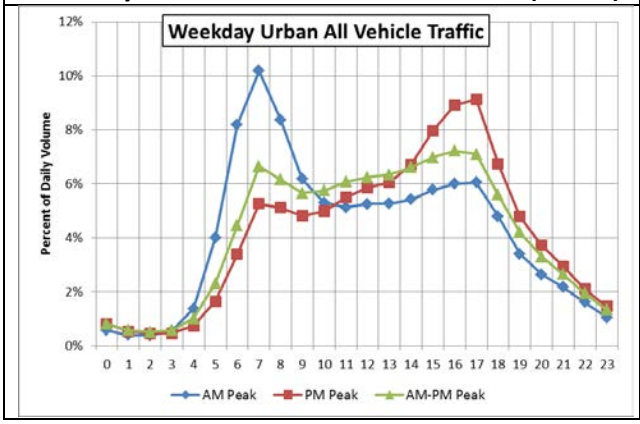


Data source: WSDOT Northwest Region Traffic Office.

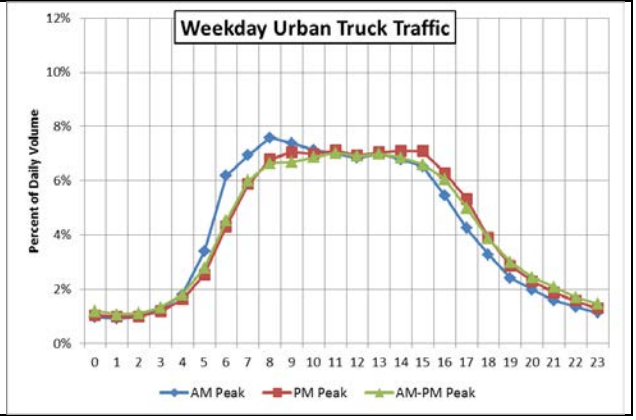
***What is the efficiency goal?*** In order to best represent the entire system's performance, WSDOT is using a throughput productivity target for Results Washington of operating corridors at 90% efficiency or higher. A 90% throughput productivity target will reflect benefits from a balanced set of strategies such as promoting transportation options (Managing Demand), operational strategies (Operating Efficiently), changes in infrastructure (Adding Capacity Strategically), and policy actions (Maintain and Keep Safe). It provides the principles for making responsible and sustainable investment decisions to sustain and enhance system performance.

***What is the timeframe of this measure?*** The timeframe that will be used for the measure will be 5:00 a.m. to 8:00 p.m., as this will incorporate the peak travel periods for commute and freight traffic. The graphs below show weekday all-vehicle and truck traffic profiles by peak patterns. The truck traffic distributions show midday peaks with a plateau between 8 a.m. and 4 p.m. while all-vehicle distributions peak around 7 a.m. and 5 p.m. The timeframe of 5 a.m. to 8 p.m. was selected to be inclusive of both commute and freight travel, as approximately 90% of all traffic volume occurs between these hours. System efficiency during nighttime hours is typically at 100%, so using an all-day timeframe would only dilute the relevant throughput productivity data.

**Weekday All-Vehicle Traffic Distributions (Urban)**




**Weekday Truck Traffic Distributions (Urban)**




*Data Source: FHWA Office of Policy Information and state DOTs, and TTI analysis*

The table below summarizes the throughput productivity data for 2010 through 2014. As mentioned above, the 5 a.m. to 8 p.m. timeframe (the second from the left column) will be the focus of this measure in order to be inclusive of commuter and freight traffic; however, throughput productivity data for various other timeframes are also included in the table for reference.

| **Throughput Productivity Averages for 2010 through 2014** | | | | |
|---|---|---|---|---|
| Year | **5 a.m. to 8 p.m.** | All-day | Morning peak (5-10 a.m.) | Afternoon peak (2-8 p.m.) |
| 2010 | **96.1%** | 97.6% | 95.8% | 95.1% |
| 2011 | **96.0%** | 97.5% | 95.6% | 95.4% |
| 2012 | **95.7%** | 97.3% | 95.8% | 94.4% |
| 2013 | **95.2%** | 97.0% | 94.9% | 94.2% |
| 2014 | **94.6%** | 96.6% | 94.3% | 93.4% |

*Data Source: WSDOT Office of Strategic Assessment and Performance Analysis*

**What does this measure mean?**

Maintaining state highway system performance for people and freight movement is important to the region's economic vitality. Commuters value efficiency across all transportation modes because it allows them to make better use of their own time, while shippers and freight carriers require an efficient system to remain competitive. By tracking throughput productivity, WSDOT can monitor and prioritize efficiency needs.

WSDOT aims to operate all strategic corridors at 90% efficiency, assuming fixed capacity. For the purpose of this measure, efficiency is conveyed in terms of a throughput productivity average that is normalized by corridor volume to provide a true reflection of system performance.

**Methodology:**

The throughput productivity measure which will be used for WSDOT's Results Washington efficiency measure is calculated as follows:

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1. Vehicle count and speed data is collected annually for 20 locations along key corridors in the central Puget Sound region from about 6,800 loop detectors embedded in the pavement throughout 235 centerline miles of state highways.
2. This real-time data is compiled to find the average vehicles per hour and average vehicle speed for each 5-minute interval (there are 288 5-minute intervals in each day) of all valid weekdays in a given calendar year (up to 261). For each of the 20 locations, this results in a dataset of the annual average weekday, split into 5-minute intervals.
3. Throughput productivity is calculated for each 5-minute interval for the annual average weekday at the 20 locations. If the average speed is less than 50 mph (the maximum throughput speed—approximately 85% of the posted speed) during that interval, then the number of vehicles per hour for that 5-minute interval (actual throughput) is divided by the maximum number of vehicles per hour recorded at that location throughout the day (maximum throughput). Each year uses its own maximum throughput data for a baseline.

$$Throughput\ Productivity = \frac{Actual\ Throughput}{Maximum\ Throughput}$$

4. Throughput productivity values for each 5-minute interval that falls within the 5 a.m. to 8 p.m. timeframe are averaged to get a single throughput productivity percentage for each commute route.
5. To arrive at the throughput productivity value for a given year, these individual productivity averages (calculated in step 4) for each location and direction (20 in total) are normalized to account for differences among corridor volumes. By weighting each corridor by vehicle count to calculate the average for each year, the final throughput productivity value is a more accurate reflection of system efficiency.

**Resources:**

For more information on system efficiency in Washington, see the following publications:

- 2015 *Corridor Capacity Report*: http://wsdot.wa.gov/publications/fulltext/graynotebook/CCR15.pdf
- 2015 *Corridor Capacity Report Appendix*: http://wsdot.wa.gov/publications/fulltext/graynotebook/CCR15_appendix.pdf
- *WSDOT's Handbook for Corridor Capacity Evaluation*: http://wsdot.wa.gov/publications/fulltext/graynotebook/CCR14_methodology.pdf