

Improved Performance Measures For Freeway Operations

Mark E. Hallenbeck

Washington State Transportation Center (TRAC)
University of Washington
Seattle, WA USA

Traditional Performance Measures

- Traditional data collected include:
 - **Volume**
 - Daily
 - Peak Hour
 - Peak Period

Improved Performance Measures

- If you are lucky, you can get at
 - **Average travel time**
 - **Average delay**

Traditional Performance Measures

- **Reported measures traditionally are:**
 - **v / c ratios**

Usually based on limited data, and a poor mechanism for showing changing conditions during the day
 - **LOS**

Hard for non-technical people to understand
Based on limited data
 - **Travel time and delay**

Often based on very limited sample, or some very imperfect calculations

Traditional Performance Measures

- **Traditional measures**
 - **Do not describe the complexity of what is happening on the roadway**
 - **Are not easily understood by most decision makers and/or the public**

Improved Performance Measures

- ITS data collection sources and modern computing power allow for greater depth of data collection
- Traditional measures are still collected, but the quantity of data is now greater
- This allows use of more accurate and descriptive performance measures

Improved Performance Measures

- Types of data collected
 - Volumes
 - Speeds
 - Lane Occupancy

Improved Performance Measures

- **Some new ITS systems allow collection of new measures**
 - **Travel times**
 - **Identification of specific vehicles**
 - **Vehicle classification**
 - **Vehicle weight**

Improved Performance Measures

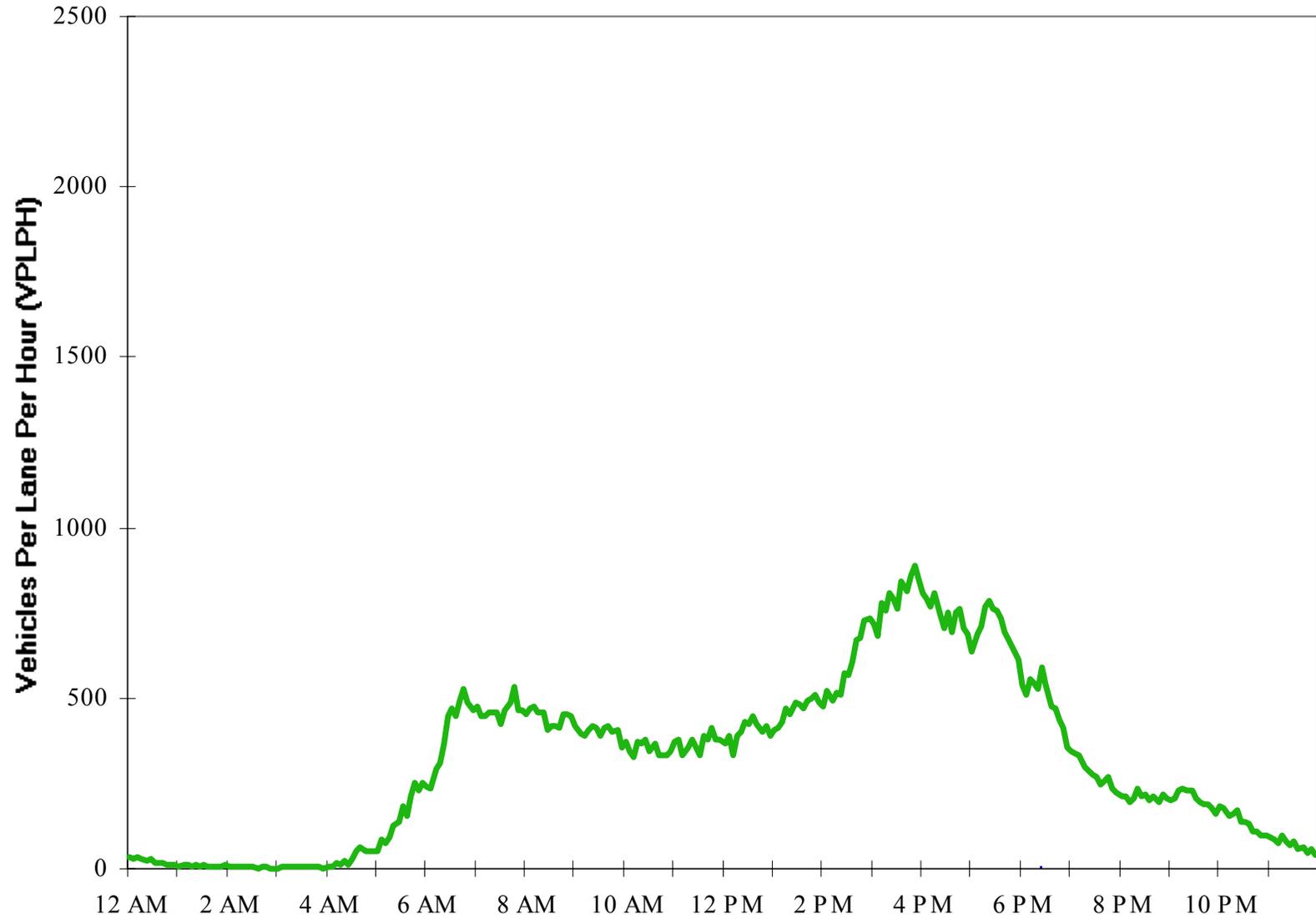
- The availability of large amounts of data and computing power allow
 - **More accurate computation of traditional measures**
 - **New variations of old measures**
 - **Calculation of new measures of performance**

Improved Performance Measures

- Changes in volume can now be visualized throughout the day

Estimated Weekday Volume (Nov 98)

I-405 NE 4th St-NB HOV NB _

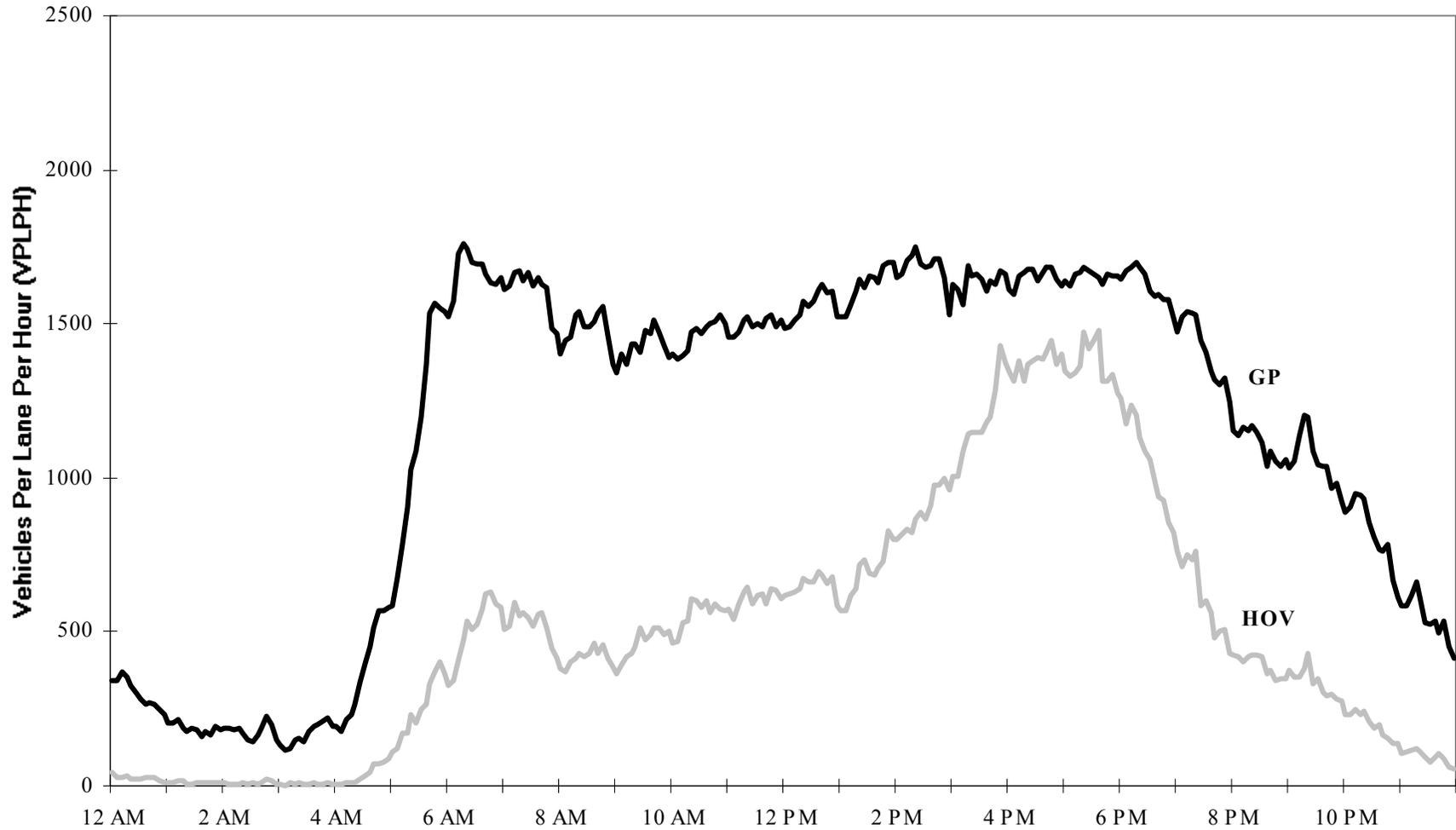


Improved Performance Measures

- This allows you to illustrate some very important trends to a general audience in non-technical terms

Estimated Weekday Volume Profile: GP and HOV Lanes (Nov 98)

I-405 NE 37th St GP SB

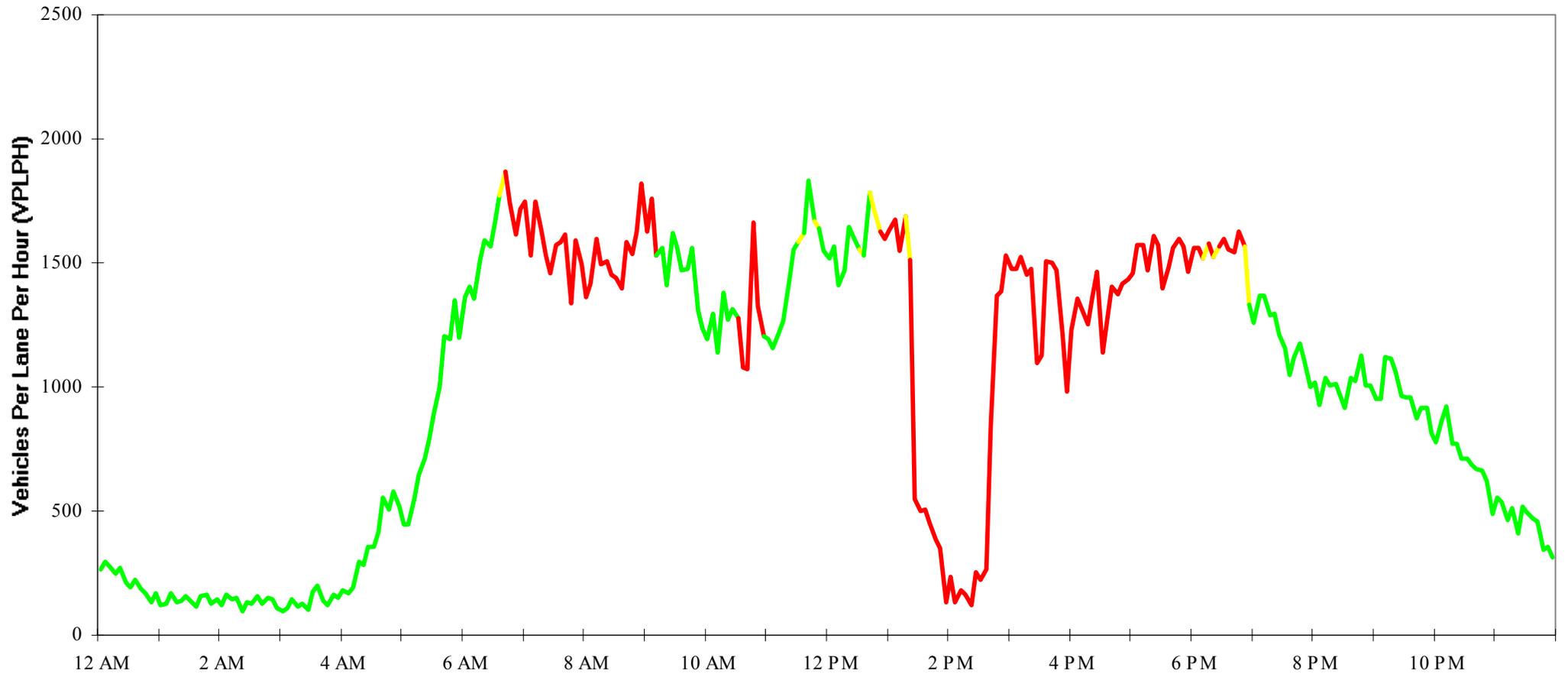


Improved Performance Measures

- But volume alone does not tell someone whether the facility is working effectively
- Color coding speed information on top of volume data yields a more descriptive picture of performance

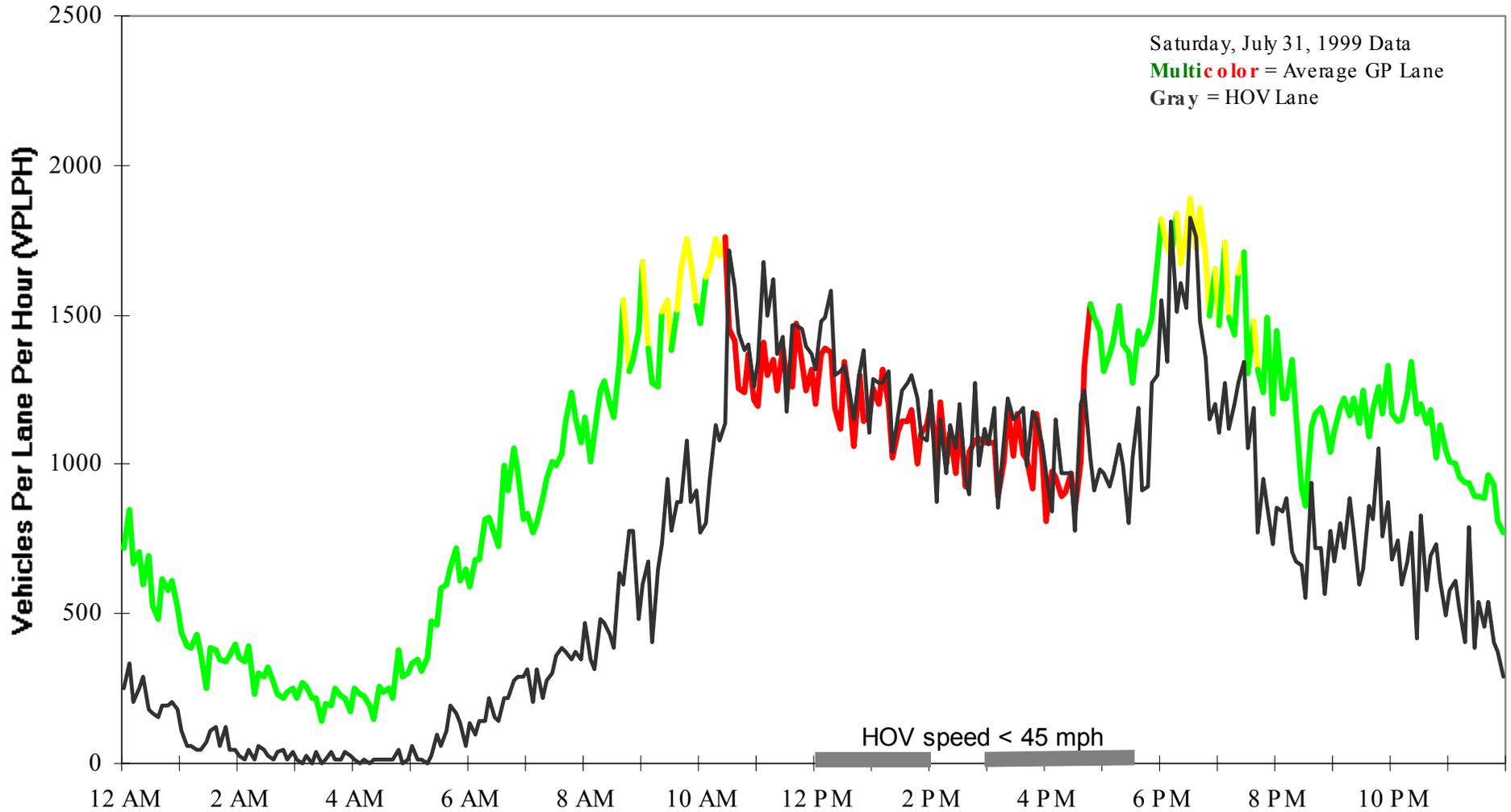
Estimated Volume and Speed Conditions (2/17/00)

I-5 NE 45th St-SB GP SB



Estimated GP and HOV Volume and Speed Conditions

I-5 S Spokane St GP NB

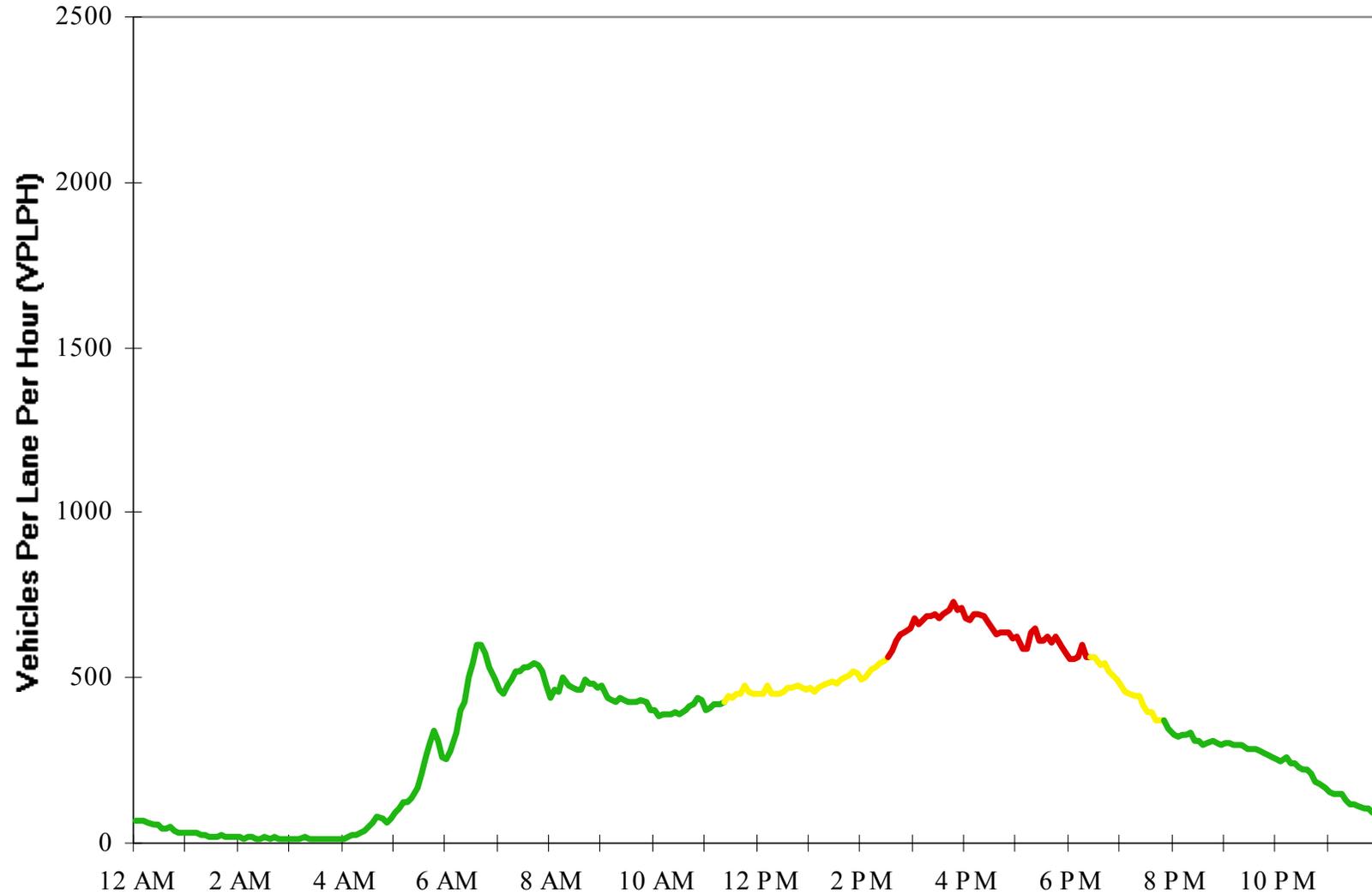


Improved Performance Measures

- Unfortunately, averaging speeds over many days often hides the fact of how often a facility is congested

Estimated Weekday Volume, Speed (1997)

I-405 NE 4th St-NB HOV NB _

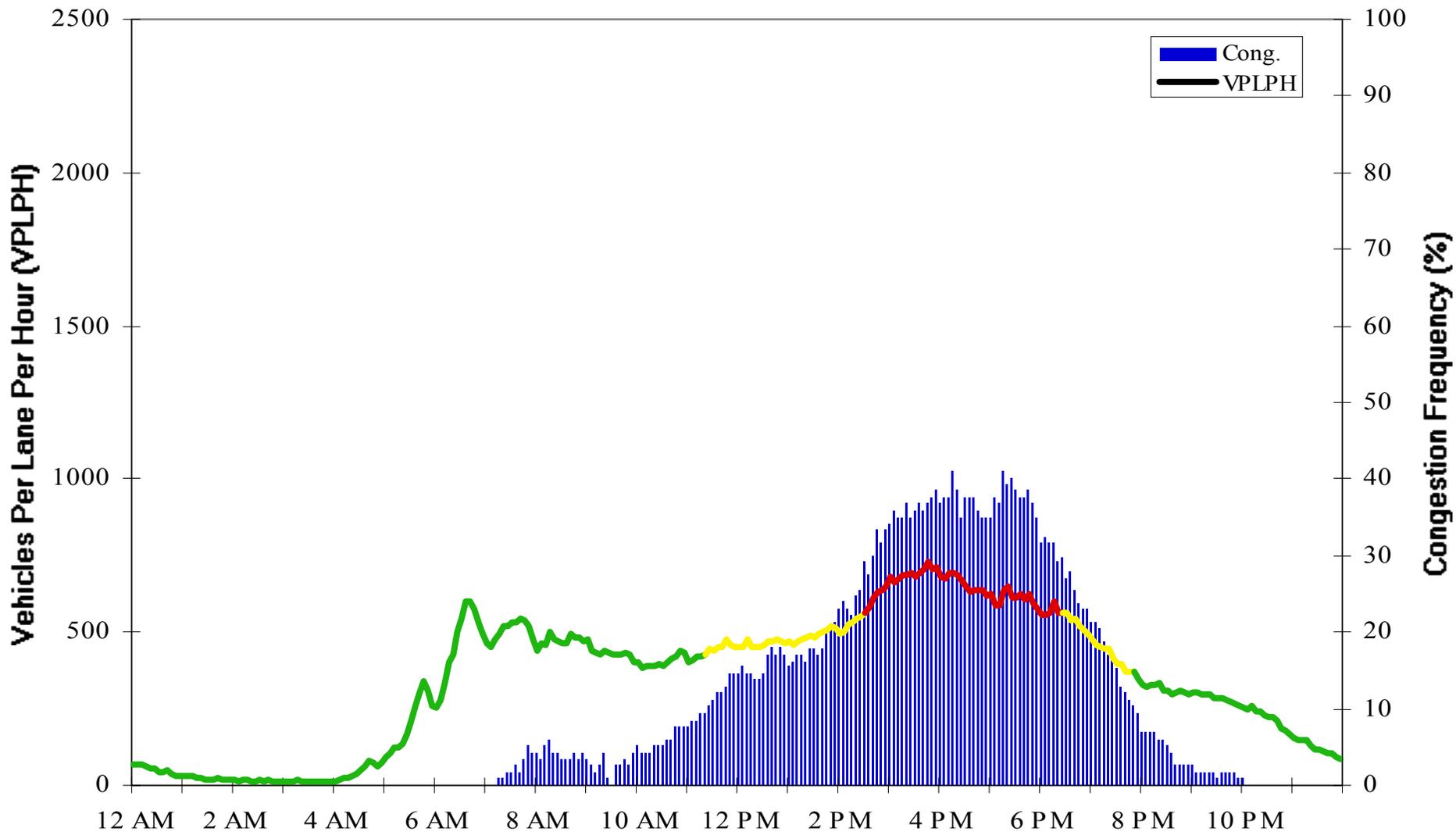


Improved Performance Measures

- We display that information based on the percentage of time a facility falls below a designated speed

Estimated Weekday Volume, Speed, and Reliability Conditions (1997)

I-405 NE 4th St-NB HOV NB _

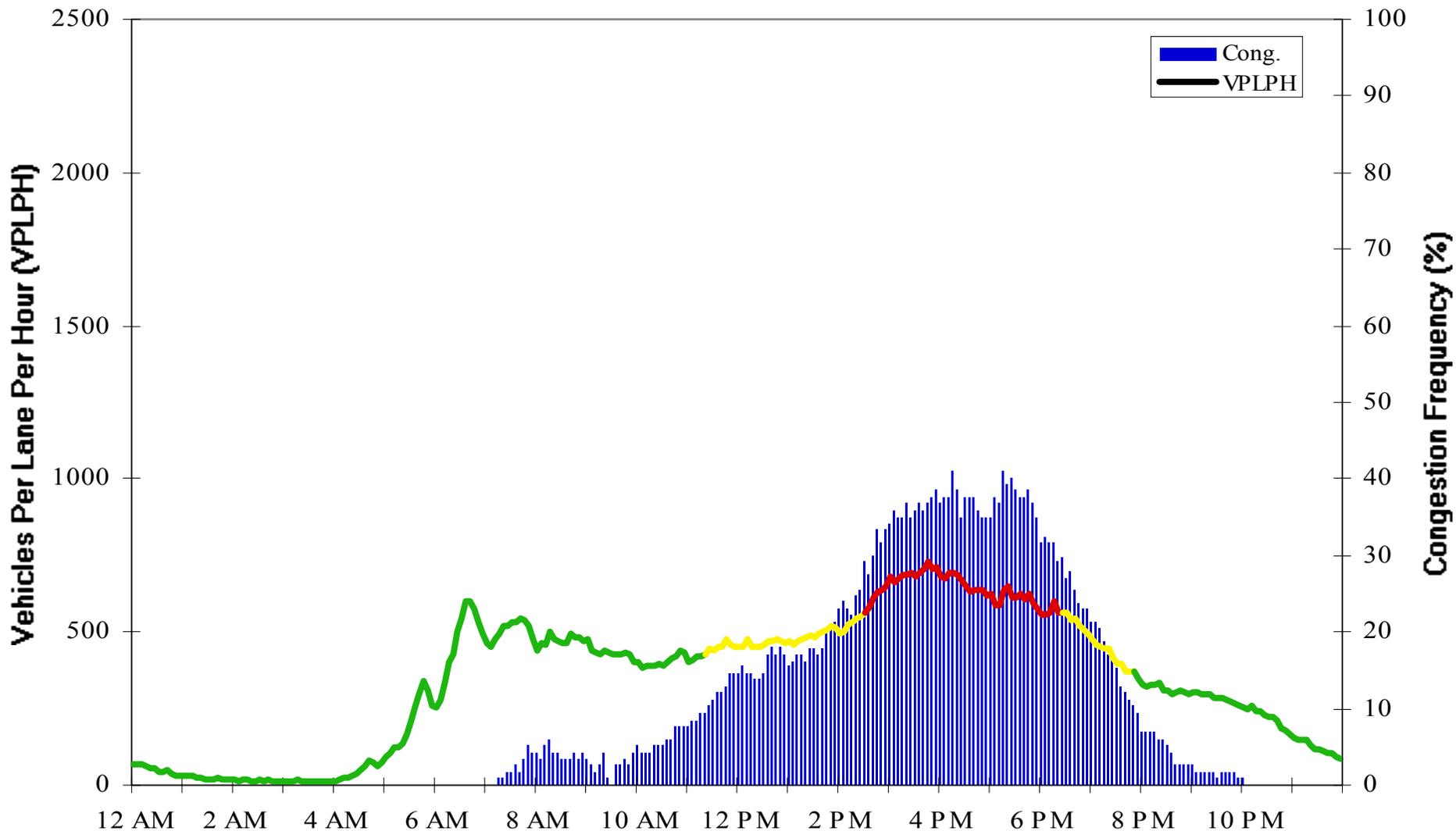


Improved Performance Measures

- This can show you what happens when a major change in freeway operations takes place
- In this case a switch from outside to inside HOV lane operation
- It also illustrates other trends

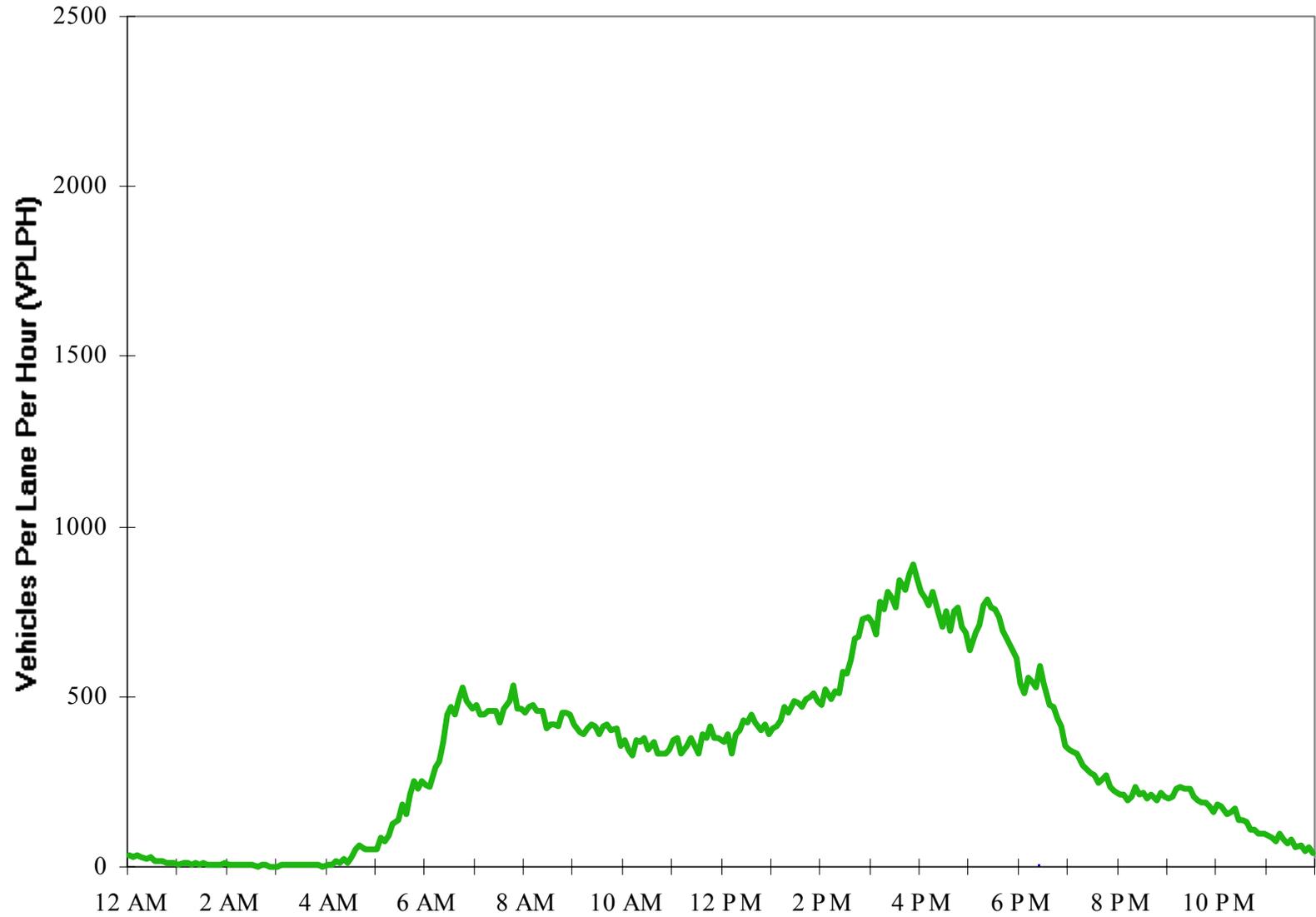
Estimated Weekday Volume, Speed, and Reliability Conditions (1997)

I-405 NE 4th St-NB HOV NB _



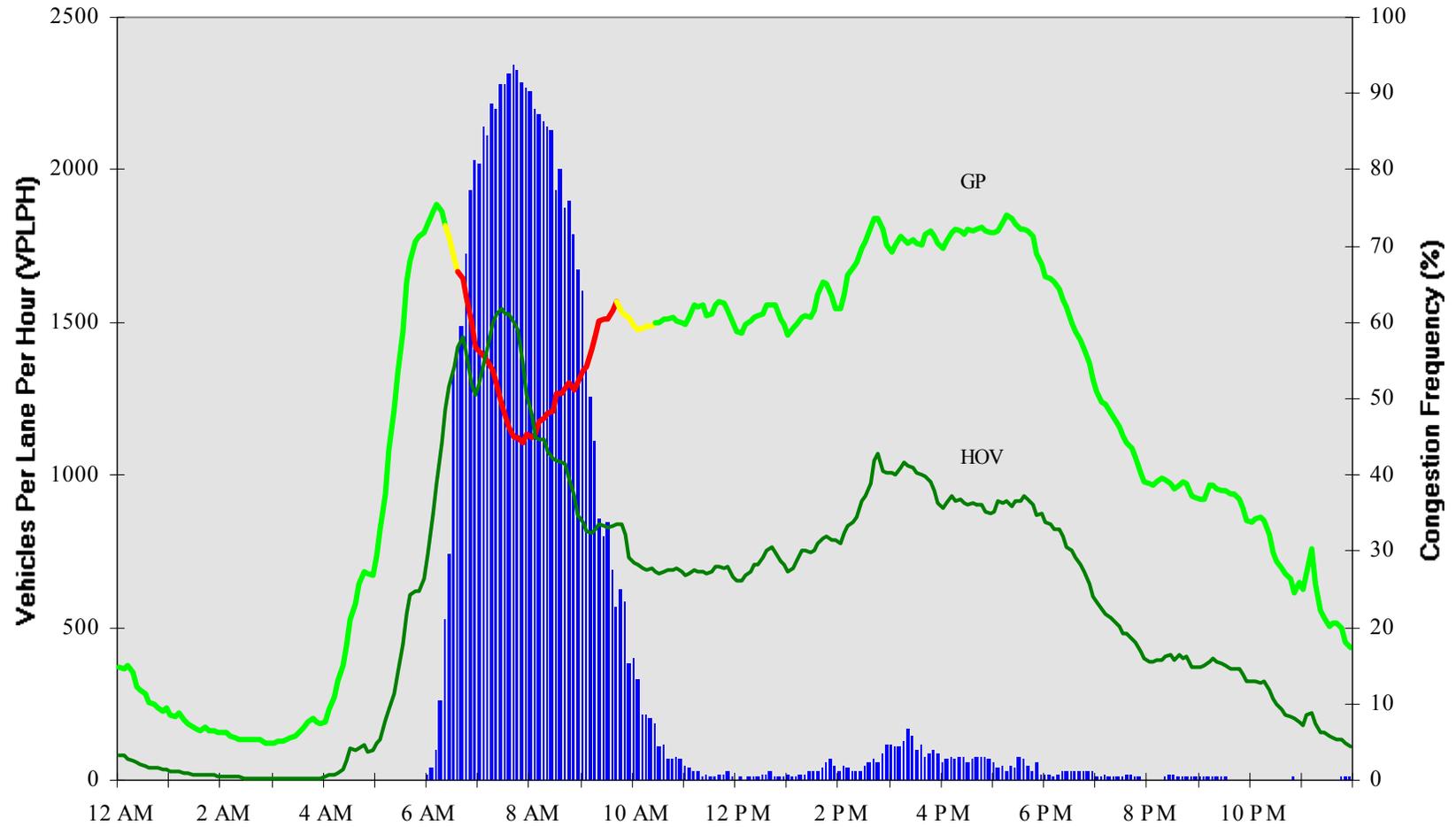
Estimated Weekday Volume (Nov 98)

I-405 NE 4th St-NB HOV NB _



Estimated Weekday Volume, Speed, and Reliability Conditions (1999)

I-405 NE 37th St GP NB

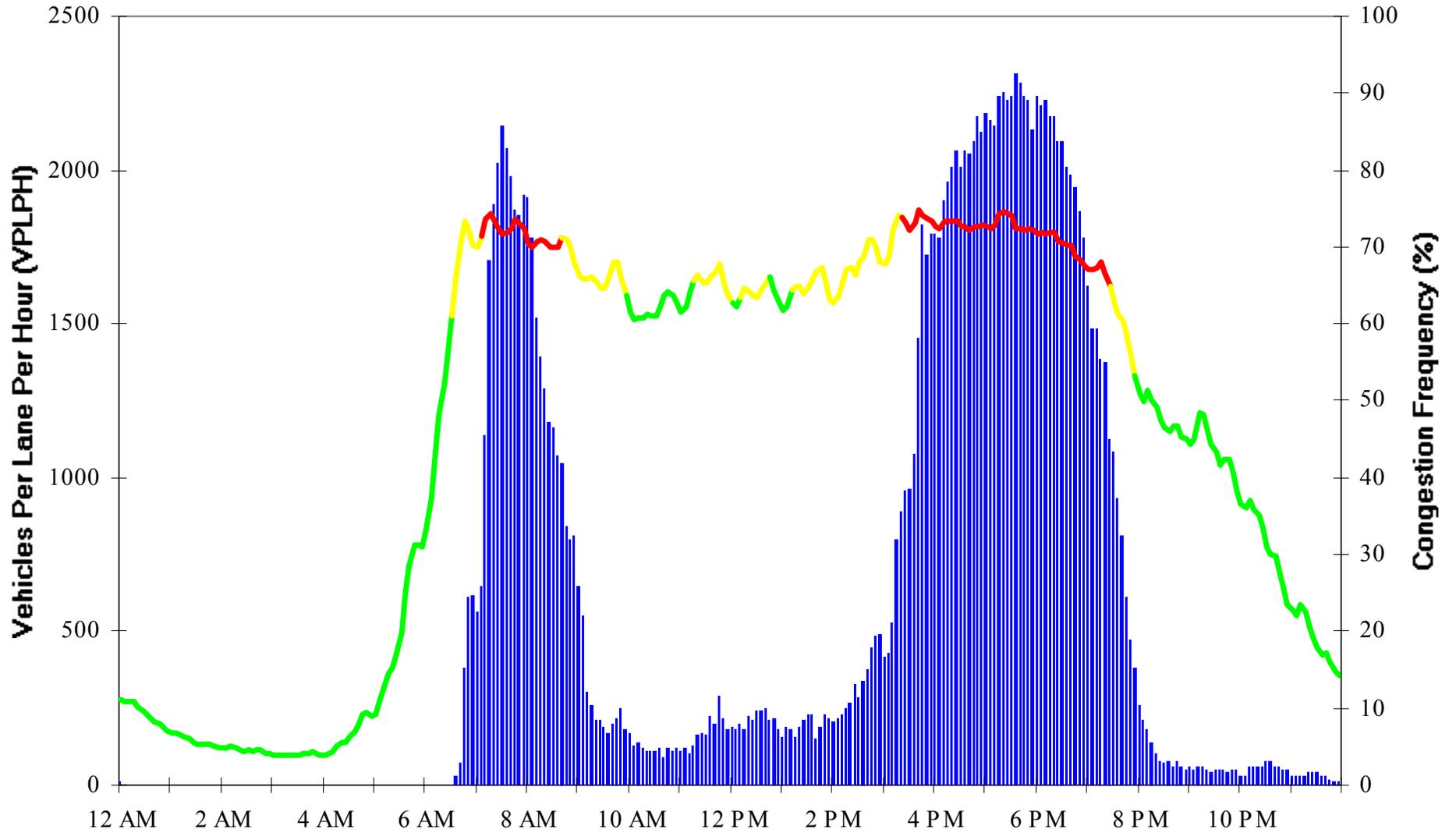


Improved Performance Measures

- But freeway performance varies significantly from location to location

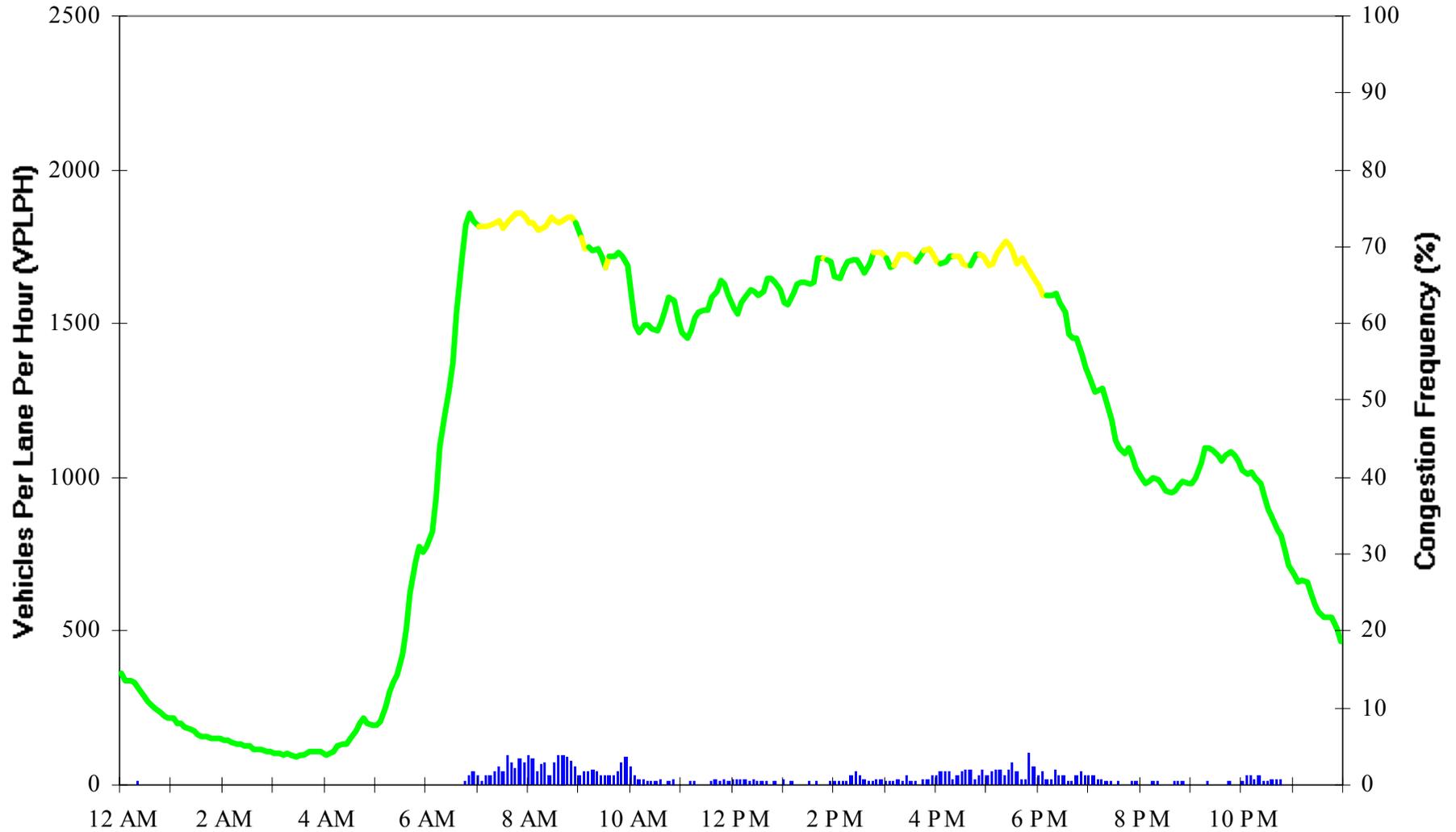
Estimated Weekday Volume, Speed, and Reliability Condition

SR-520 76th Ave NE GP WB



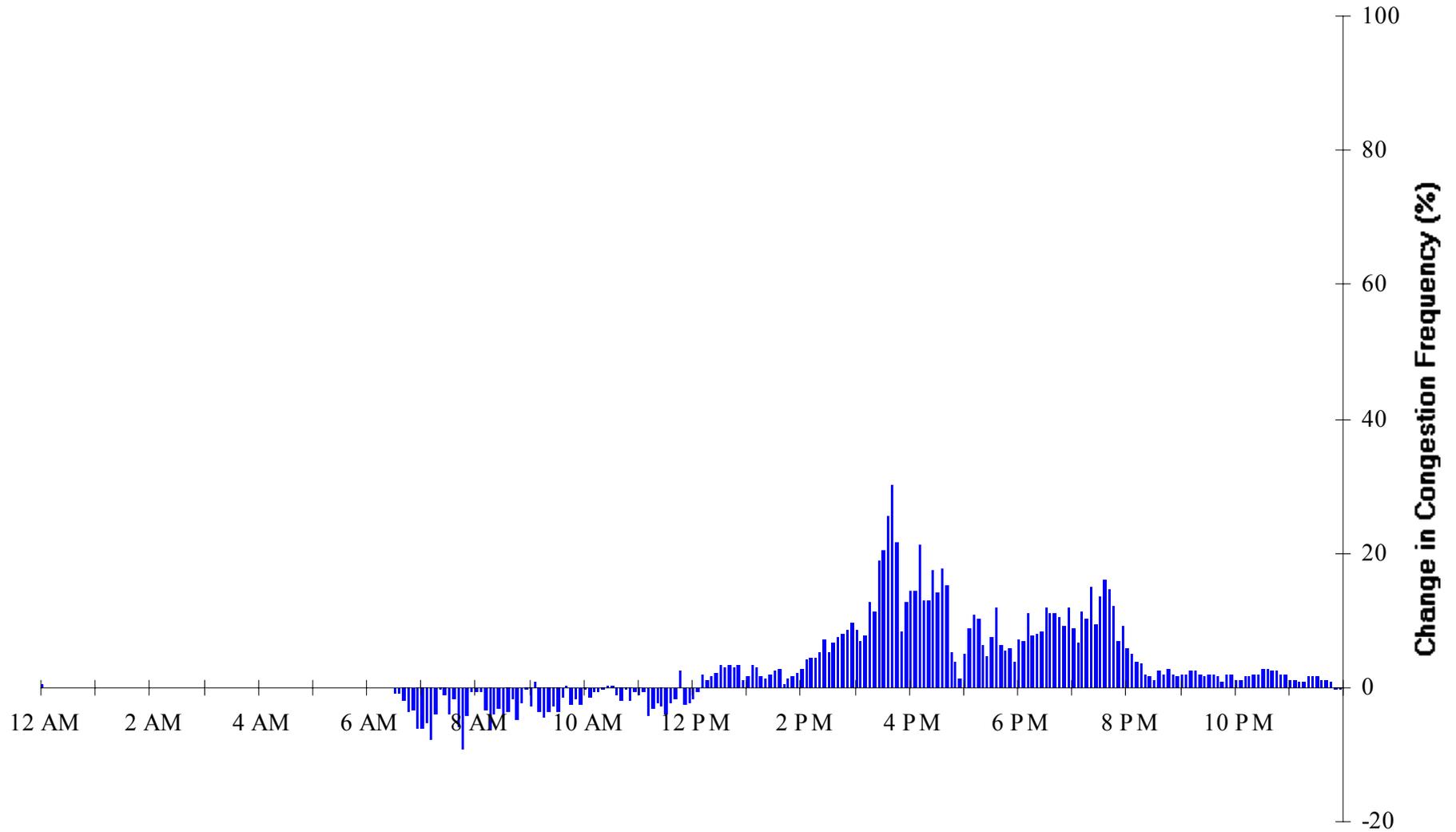
Estimated Weekday Volume, Speed, and Reliability Condition

SR-520 76th Ave NE GP EB



Estimated Change in Travel Reliability Conditions (1997 vs.

SR-520 76th Ave NE GP WB



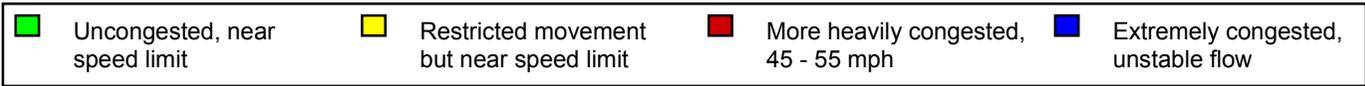
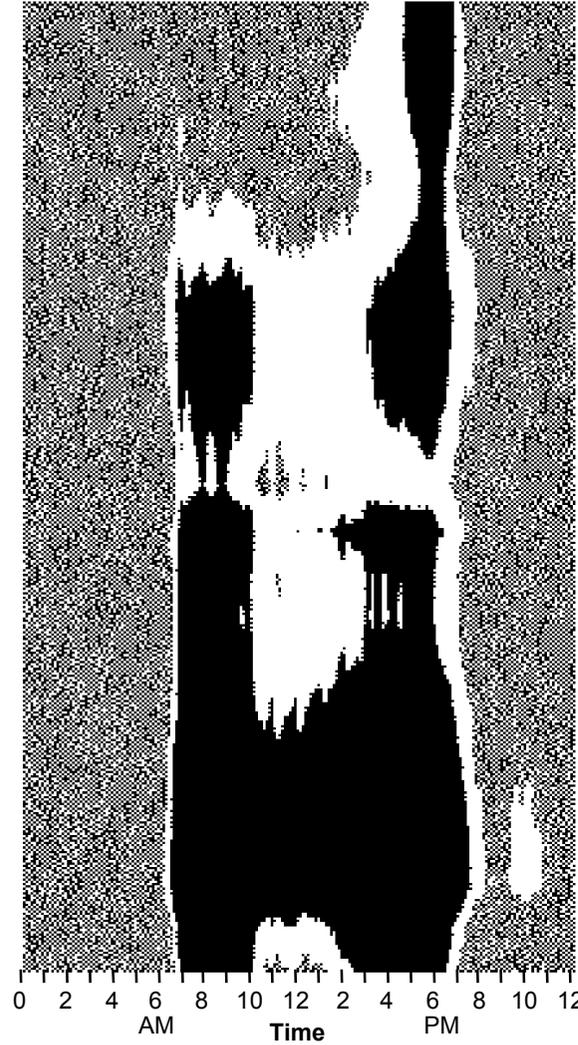
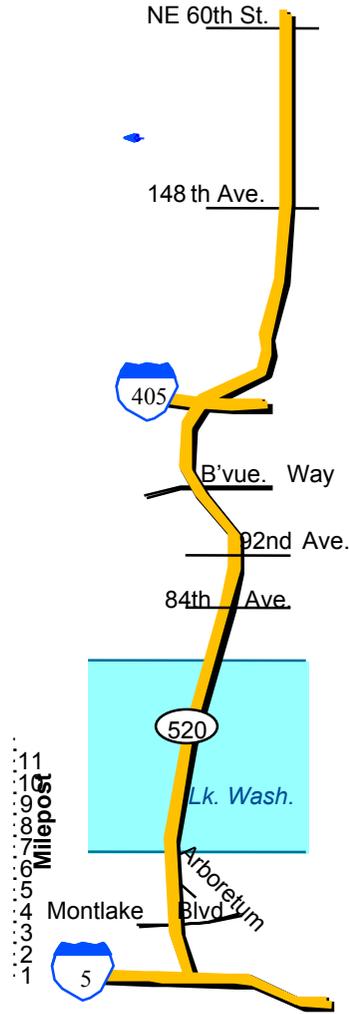
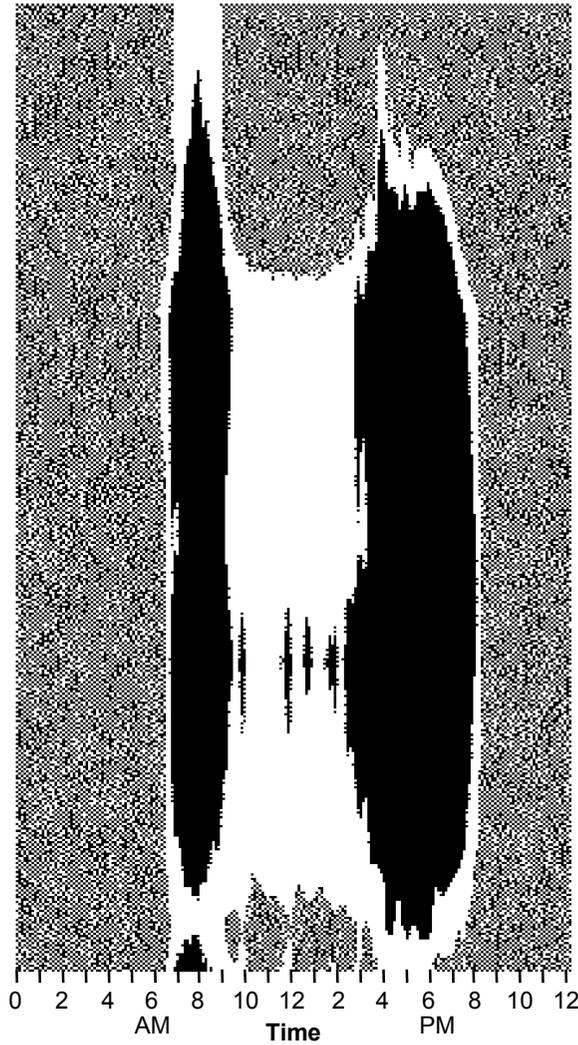
Improved Performance Measures

- This means that it is important to
 - Choose your location carefully
 - Report on multiple locations
 - Report on geographic variation
- So we developed a geographic illustration of traffic performance

SR 520 Traffic Profile General Purpose Lanes 1997 Weekday Average

West bound

East bound



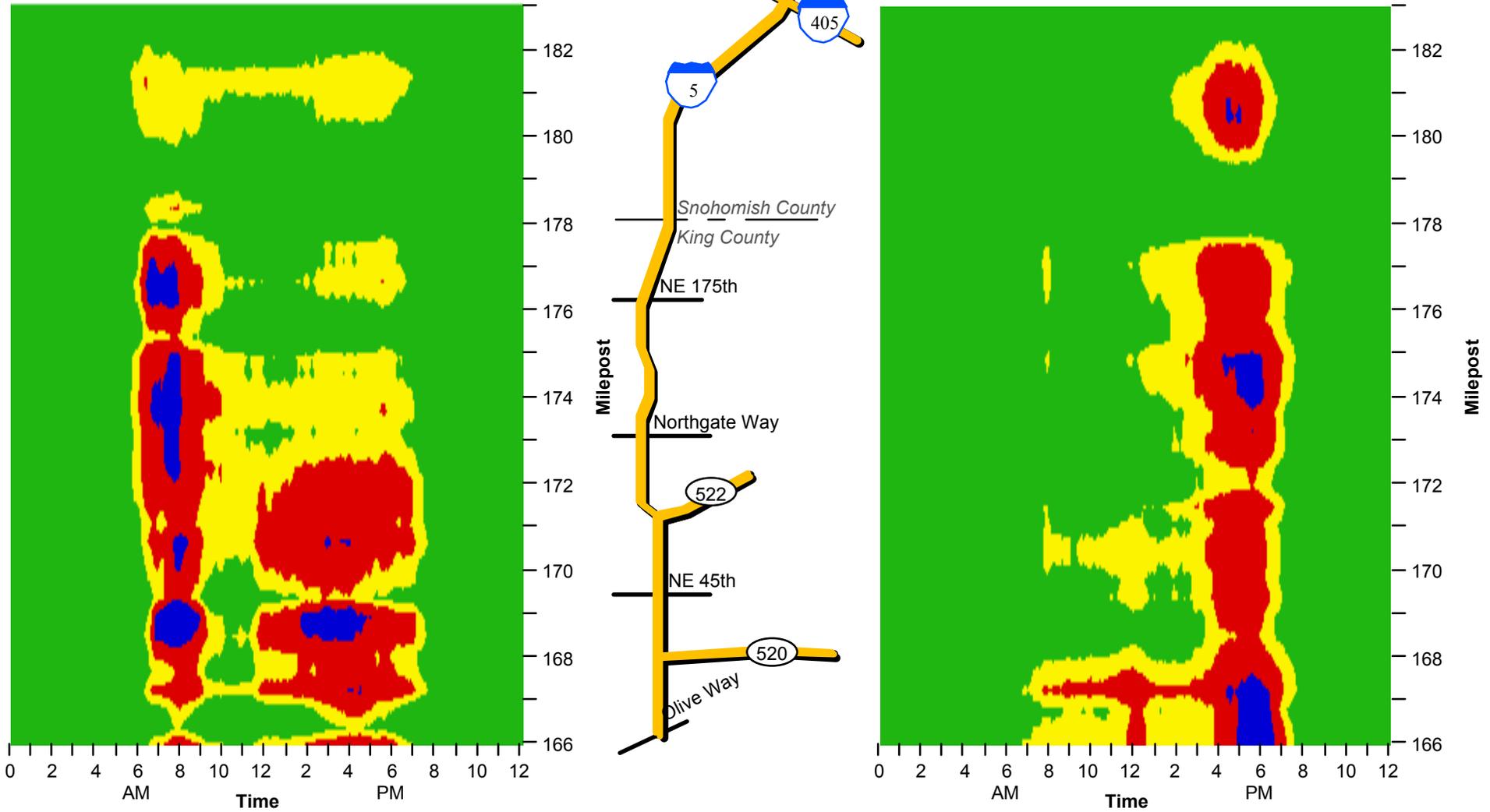
Improved Performance Measures

- Geographic illustration can be
 - Volume
 - Speed
 - Lane occupancy
 - Other

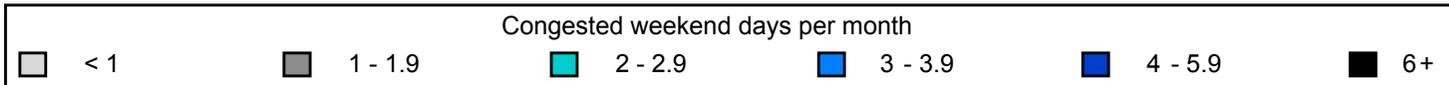
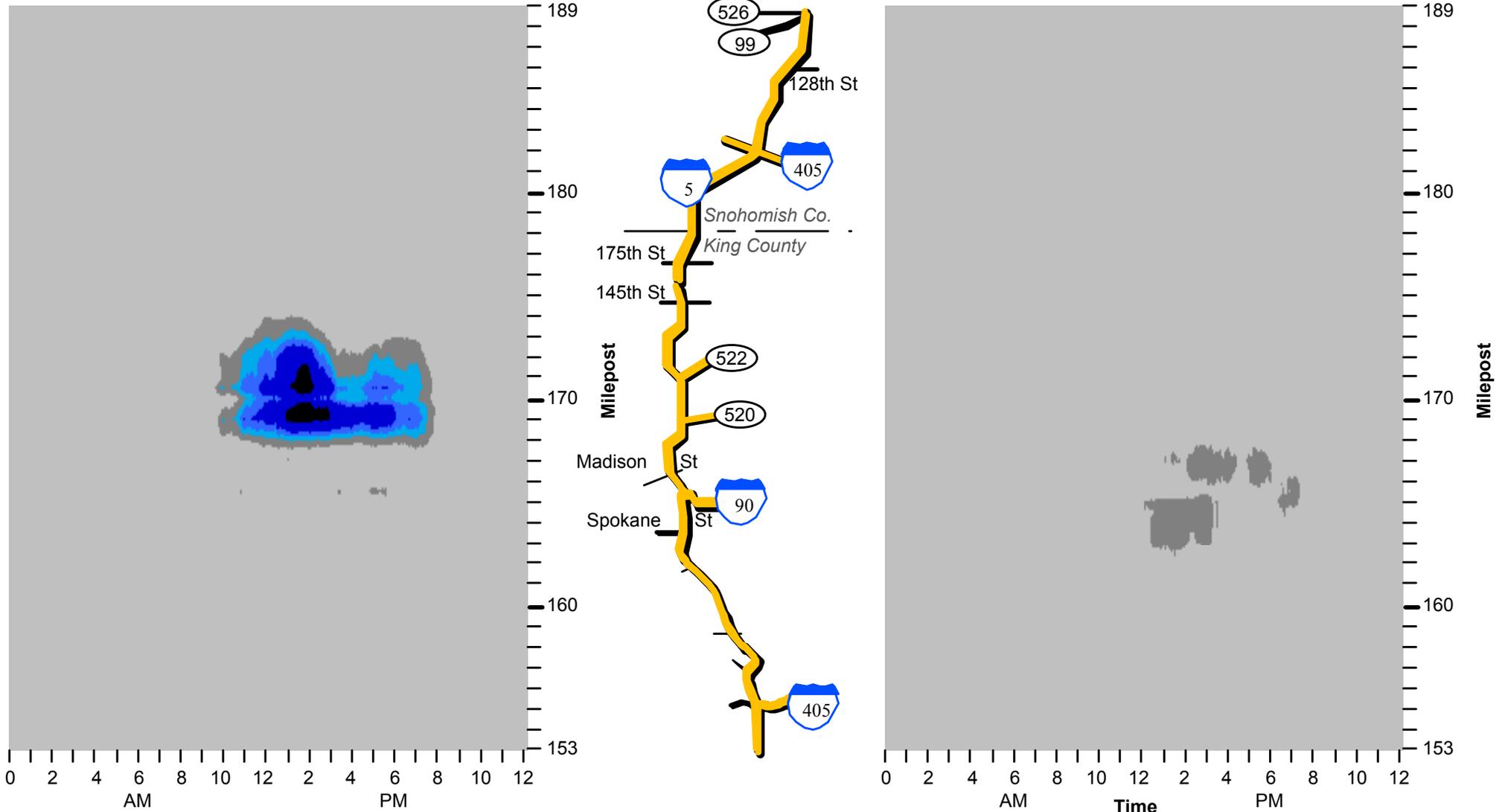
Interstate 5 North Traffic Profile General Purpose Lanes 1997 Weekday Average

Southbound

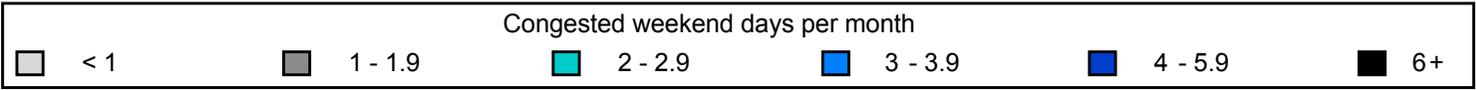
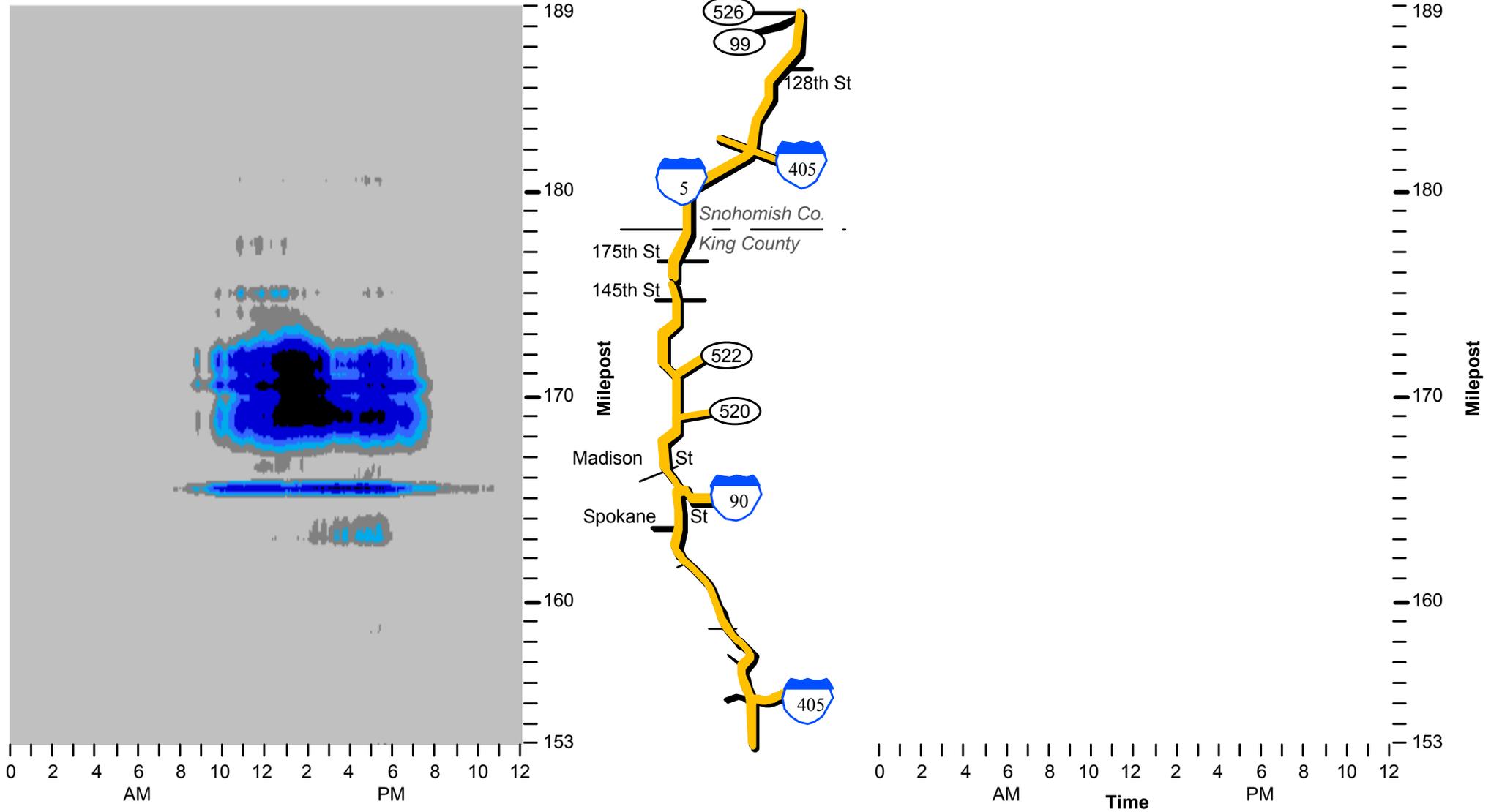
Northbound



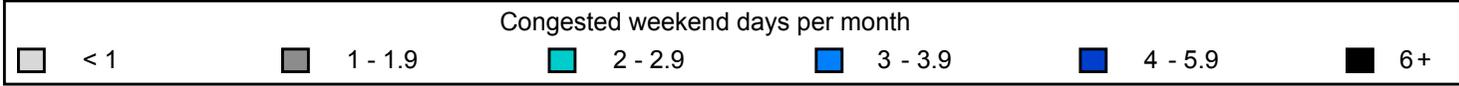
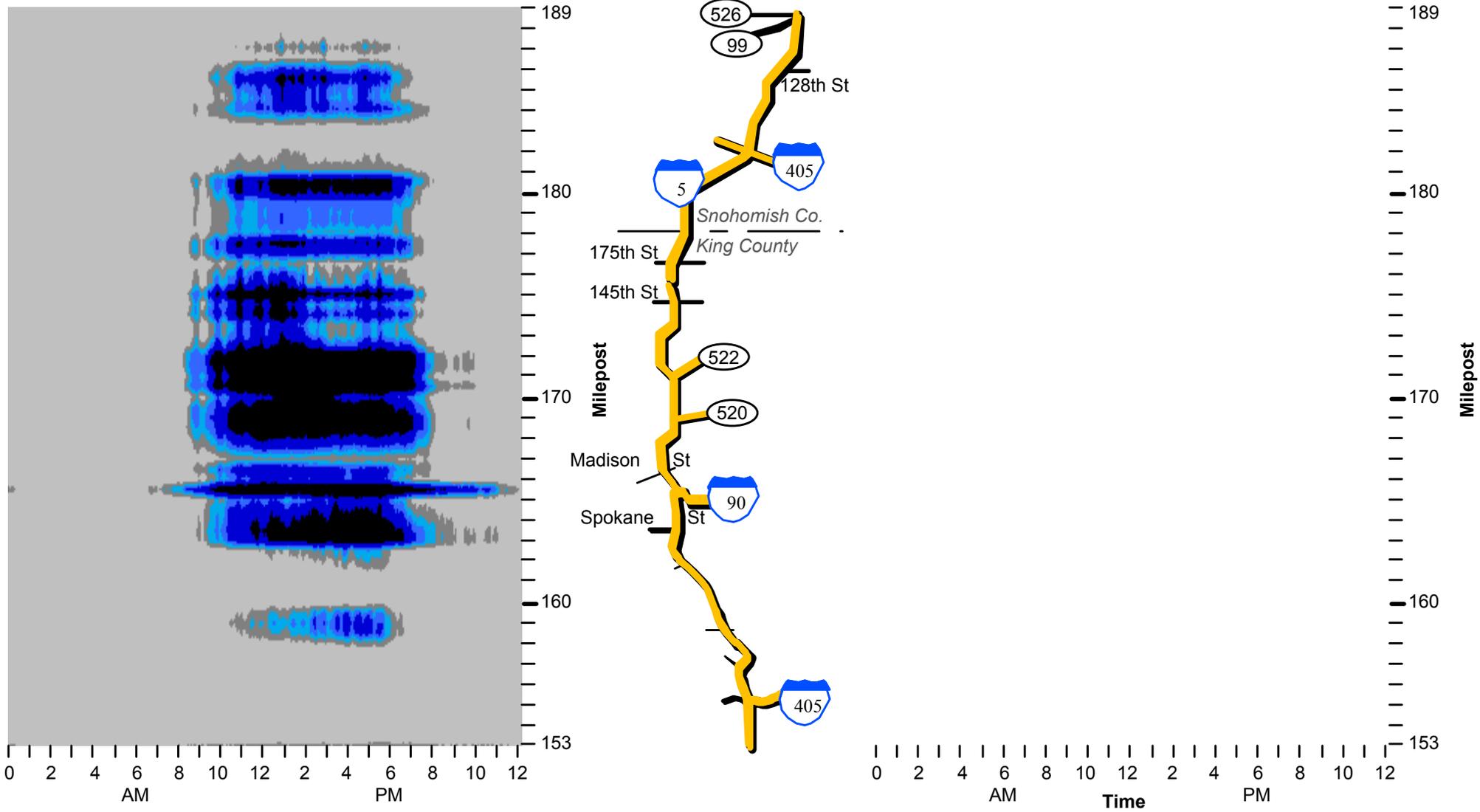
Interstate 5 LOS F Frequency General Purpose Lanes 1999 Weekend Average



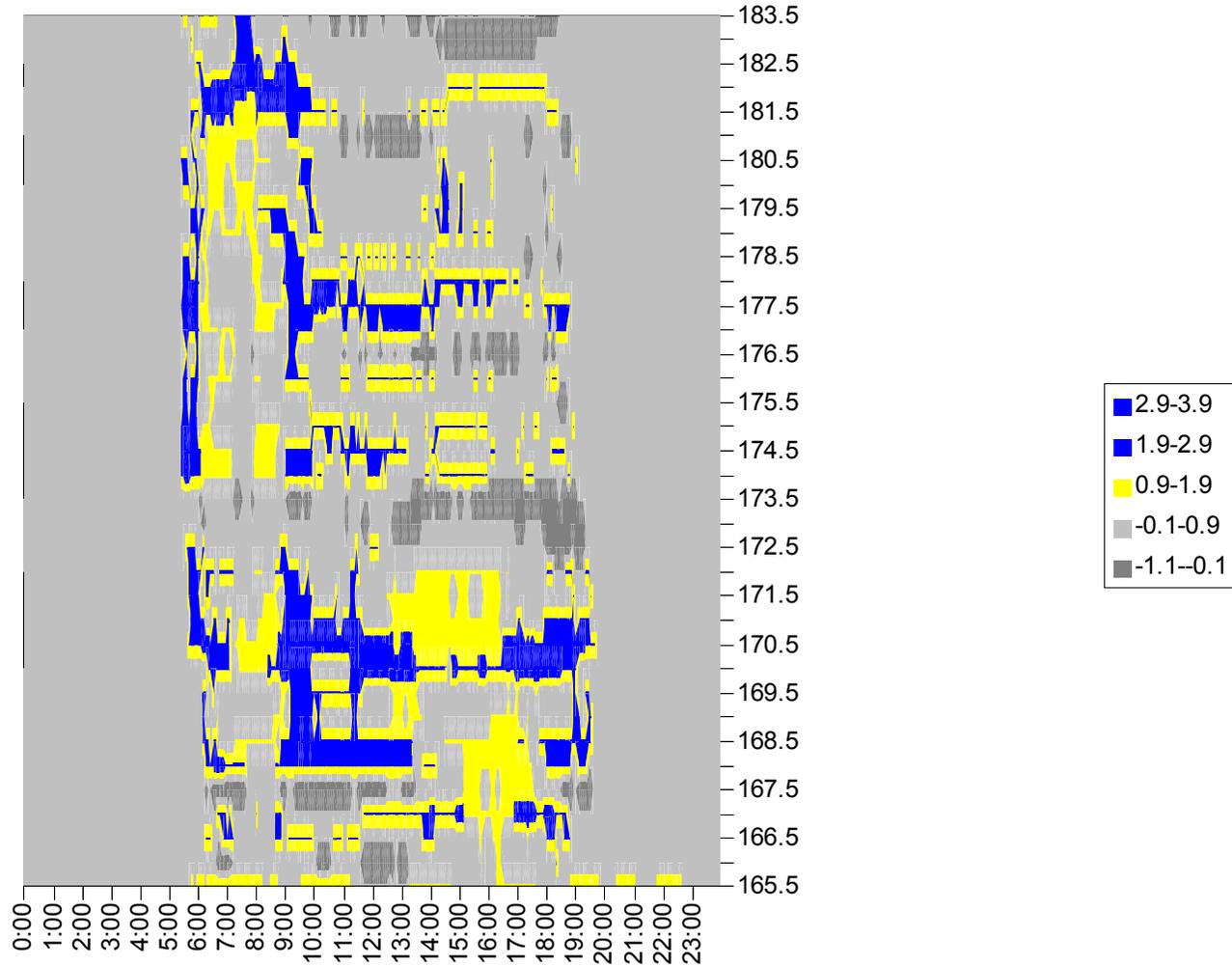
Interstate 5 LOS E Frequency General Purpose Lanes 1999 Weekend Average



Interstate 5 LOS D Frequency General Purpose Lanes 1999 Weekend Average



Change in Occupancy Percentage (1997-1999)

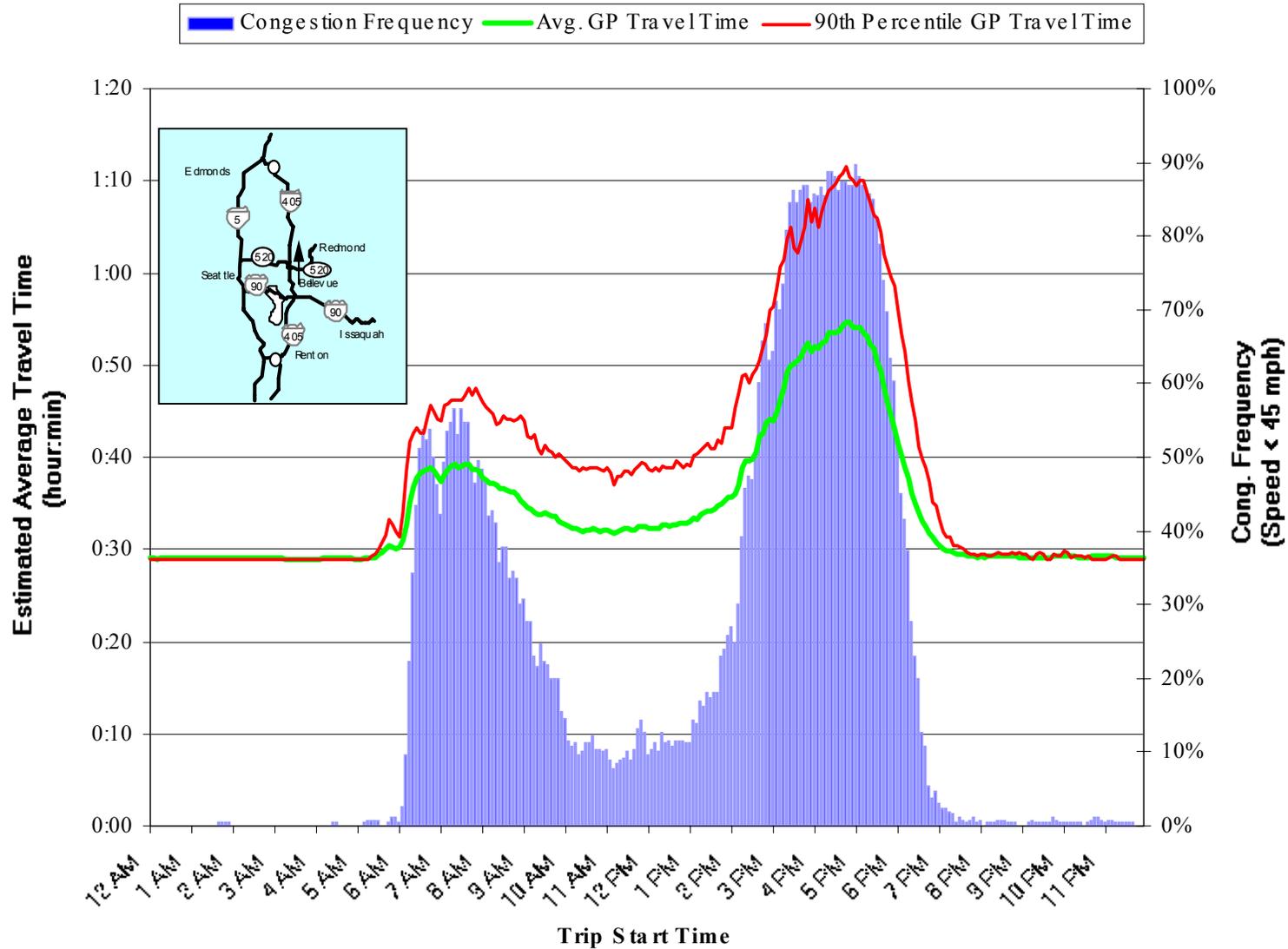


Improved Performance Measures

- The basic geographic by time of day matrix allows us to compute travel times starting every five minutes, 365 days per year
- These travel times can then be summarized

Estimated Average Weekday Travel Time (1997)

Northbound Interstate 405 GP Lanes, Tukwila to Damson Road (28.8 mi)



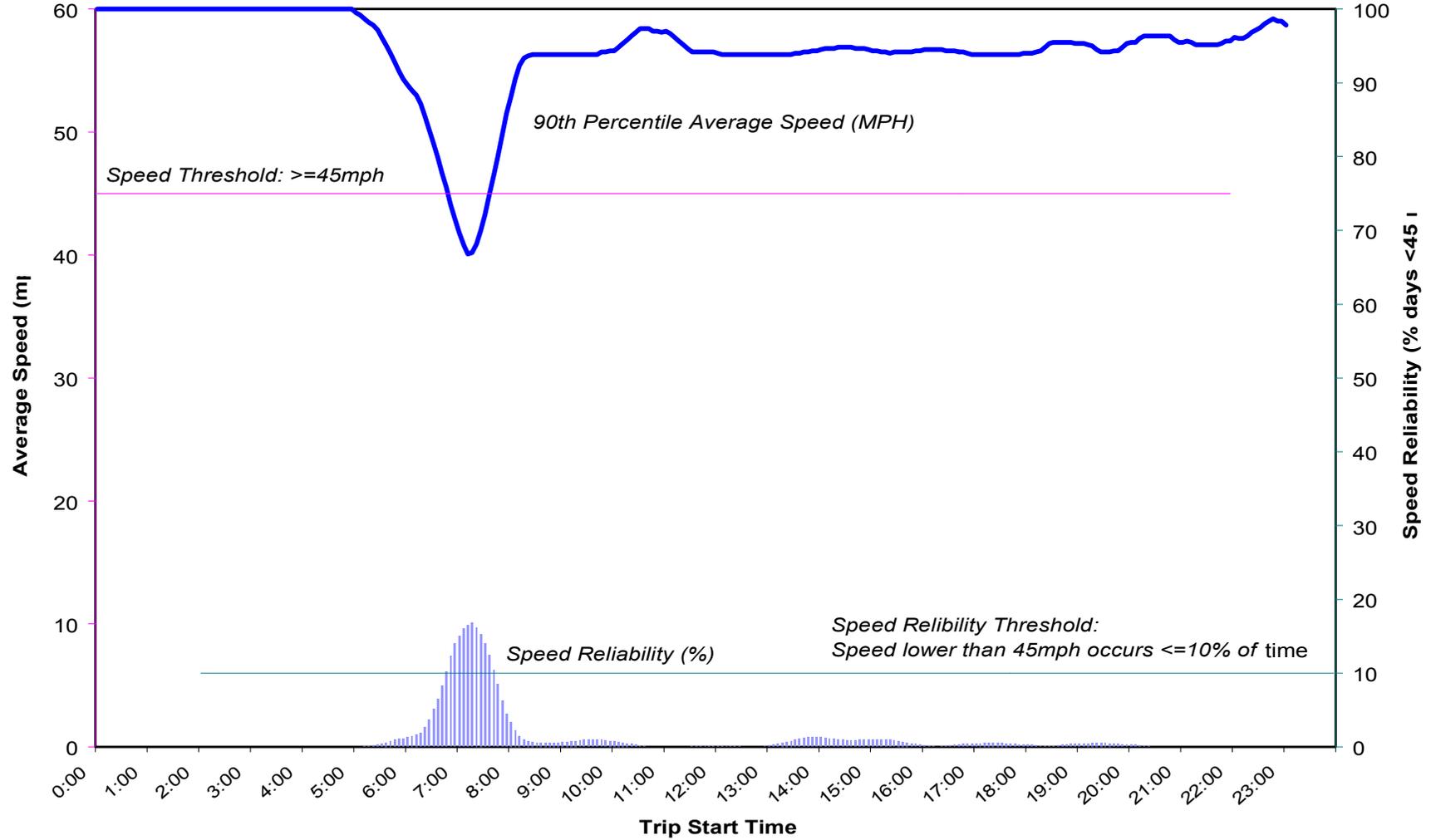
Improved Performance Measures

- **Travel time summaries include**
 - **Average travel time for a given O/D pair by time of day (every five minutes)**
 - **90th percentile travel time**
 - **Frequency with which a given average speed is not achieved**

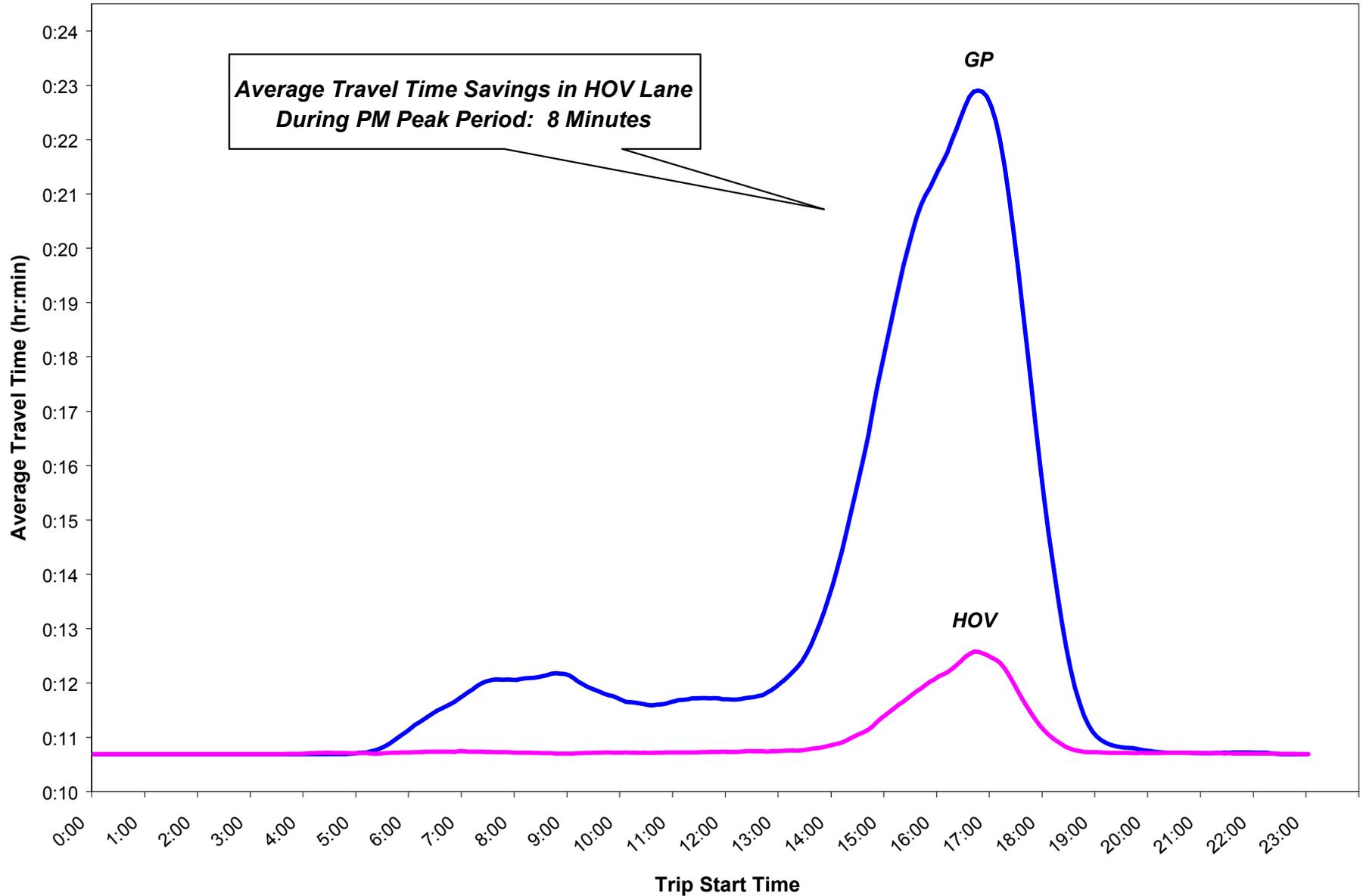
Improved Performance Measures

- Travel times can also be compared
 - Against standards
 - For HOV versus SOV

Northbound, Andover Park E to Coal Creek Pkwy (9.4 miles)



Northbound, SE 20th St to NE 160th St (10.7 miles)



Improved Performance Measures

- When truck volume and weight data become available for freeways, these same matrices (and some assumptions) can be used to compute:
 - **Truck hours of delay**
 - **Truck miles of delay**
 - **Ton-miles of delay**
 - **Value of freight delay**

Improved Performance Measures

- Each time we use our new tools to answer a question, we develop new ways to display that information
- The goal is to make that information
 - Easier to understand
 - More accurate of “real life”

Improved Performance Measures

- We are open to suggestions!
- <http://depts.washington.edu/trac/>