INRIX

Preliminary Speed Assessment

on I-405 from Bellevue to Lynnwood

Executive Summary

The comparison of pre- and post-toll conditions on two northbound and two southbound segments of I-405 between downtown Bellevue and I-5 (near Lynnwood) shows extended peak hour conditions for most segments in the peak direction of travel for those in the general purpose lanes. Additionally, these segments also show slower speeds during the peak hour in the general purpose lanes. Though one of the segments studied shows a reduction in the duration of the peak hour, slower speeds were still observed in the peak hour in the non-peak directions. The analysis also shows greater variability in peak hour speeds in the post-toll condition, especially for the 50^{th}- and 85^{th}-percentile speeds. As such, this analysis suggests that post-toll speed improvements on I-405 are isolated to vehicles that already experience the least peak hour congestion (i.e., those driving in the HOV/HOT lanes), while post-toll speeds in the general purpose lanes have generally gotten worse for the majority of drivers.

Background

High occupancy express toll (henceforth "HOT") lanes have been in effect on I-405 since September 27, 2015. I-405 is the primary north-south freeway serving Bellevue and the eastside communities, the purpose of this analysis is to present observable changes induced by tolling the Bellevue-Lynnwood corridor[1].

I-405 is located along the eastern length of Lake Washington, and meets I-5 at its northern and southern terminus. In the pre-toll condition, the 30-mile facility generally operated with a single, 2-person HOV lane and varies between three to four general purpose lanes. The 17-mile corridor at, and north of Bellevue comprises the tolled corridor (henceforth "the study area") operated with one HOV and three general purpose lanes under pre-toll conditions. With implementation of the HOT lanes, the I-405 corridor saw the addition of a second HOV lane from Bellevue northward into Woodinville.

TABLE 1
I-405 Lane Configuration

	Renton		At Bellevue/Kirkland		Bothell	
	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Pre-toll lanes	3	1 HOV	3 or 4	1 HOV	3	1 HOV
Post-toll lanes	3	1 HOV	3 or 4	2 HOT	3	1 HOT

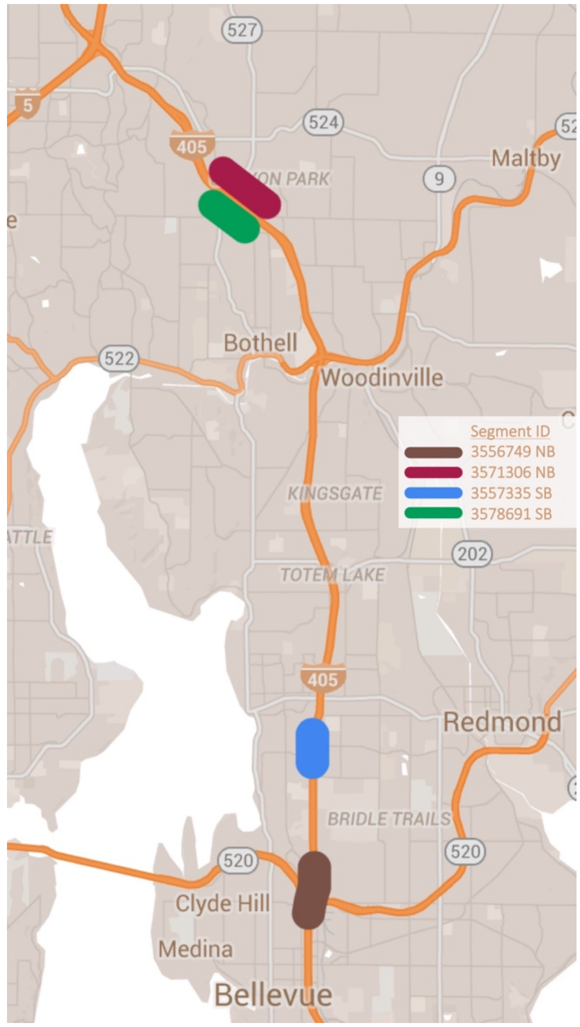
Notes: GP = general purpose lanes, HOV = 2+ persons carpool, HOT = 3+ carpool or tolled for all single and double occupancy

At the moment, this analysis examines four segments on the I-405 and has not investigated any secondary effects on arterials or other roadways that have the potential to receive diverted traffic resulting from tolling I-405. The report does not include the impact on total travel time or the entire experience of speeds along the routes.

[1] For additional information around tolling efforts on 405 and/or the greater regional plan, please visit WSDOT's site at: http://www.wsdot.wa.gov

Data

As shown in the figure to the right, this analysis considers two northbound segments (3556749 and 3571306), as well as two southbound segments (3557335 and 3578691). These segments were chosen as they represent locations of known peak hour congestion in the pre-toll condition, and are located near the SR527 and SR520 interchanges and near NE 68th Street in Kirkland.



Map showing the approximate location of the segments discussed in this study.

The analysis uses probe-based, speed profile data from INRIX for October 2014 to establish pre-toll conditions, and data for October 2015 to establish post-toll conditions. This time period was selected such as to negate any seasonal travel pattern variations. Likewise, the analysis focuses on the typical Wednesday, as this is believed to represent the typical commuting patterns.

The speed profile data set is a monthly aggregate of statistical speed distributions[2] for each individual roadway segment. This data set provides unique statistical speed distributions for each quarter-hour of each day in the week, totaling 672 unique profile reports throughout the week. As an example, the 50th percentile profile represents the median segment speed over the course of the time period, and denotes the speed at which half of all vehicles are traveling slower than that speed.

This data set was chosen as it enables the analysis of the corridor by different speed populations, and lends itself to providing insight regarding if and who benefits from implementation of the HOT lanes by focusing on the 15th, 50th and 85th percentile speed distributions.

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[2] INRIX statistical parameters provided for each time bin include the average speed, standard deviation, the 1st, 5th, 10th, 15th, 20th, 25th, 30th, 40th, 50th, 60th, 70th, 80th, 85th, 90th, 95th and 99th percentiles of speed values, and the 10, 20, 30, 40, 50, 60, 70, 80 and 90 MPH “failure rates,” or the percentage of data points that fall below the specific speed threshold for the given segment and time.

Methodology

This analysis is designed to identify speed changes by comparing the daily speed distributions for October 2014 to October 2015 for each speed profile. The speed profiles were assembled for the 15th, 50th and 85th percentile speeds where the 15th percentile profile represents the slowest 15 percent of speed on a given segment, the 50th percentile represents the median speeds for a given segment, and the 85th percentile profile represents the fastest speeds on a given segment.

Results

The table below shows the results of comparing pre- and post- toll conditions and found several recurring patterns among the four segments studied in this analysis.

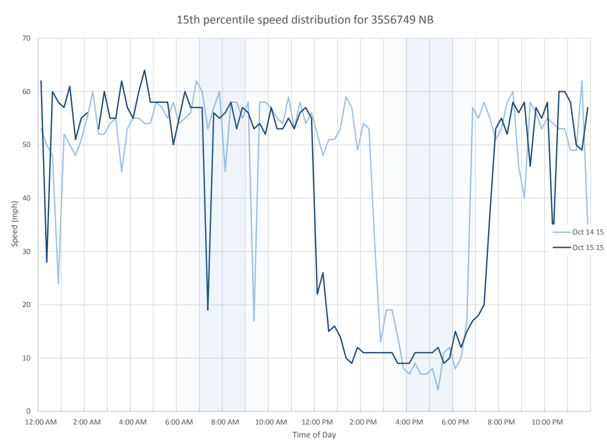
Table 2
Summary of Results: Comparison of pre- and post- tolled conditions

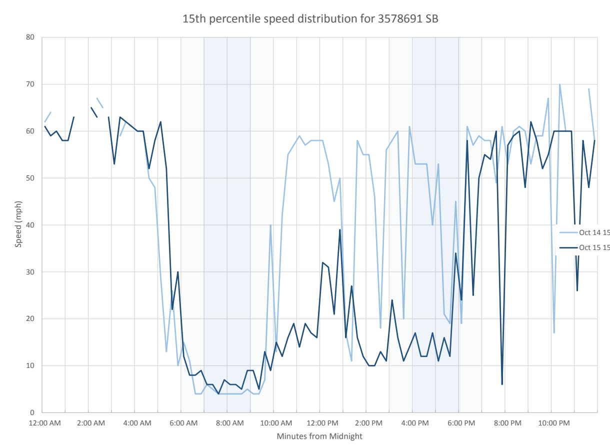
	Northbound		Southbound	
	3556749	3571306	3557335	3578691
	At SR 520	At SR 527	At NE 68th St	At SR 527
Reduced speeds in the non-peak direction			x	x
Reduced speeds in the peak direction			x	
Extended peak hour duration	x	x		x
Reduced peak hour duration			x	
Speed improvement for the 50th and 85th percentile speed populations	x	x	x	x

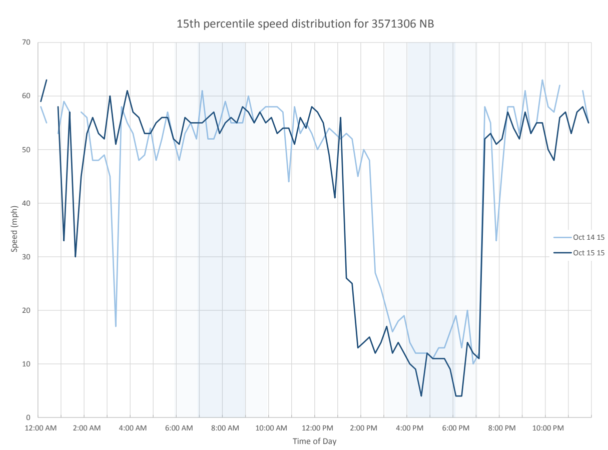
As discussed in more detail in the following section these results are detectable for all four segments albeit to varying degree depending on the speed population.

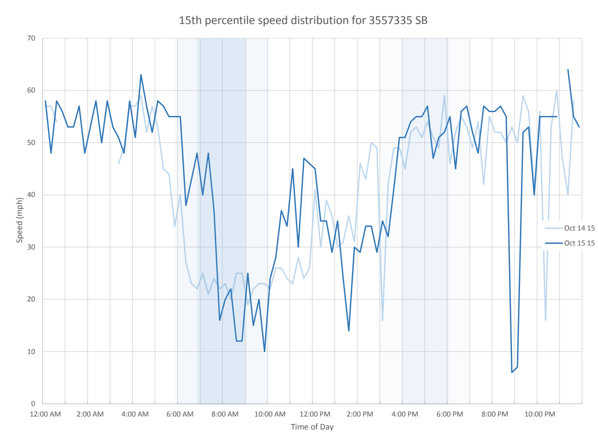
Slow Speed Populations: the 15th percentile profile

Below are the 15th percentile profiles for the four segments included in this analysis. As shown in the charts below, the slow speed population experiences extended peak hour conditions, as evident by the broader peaks. As an example, in segment 3556749, the peak period grew from approximately 250 minute to 475 minutes, an increase of 225 minutes or a 190% of the original period. Additionally, speed reductions in the non-peak direction also develop in the post-toll conditions in the southbound direction. Though segment 3557335 shows a shorter peak hour period in the post-toll condition, it should be noted that the data suggests a speed reduction of almost 10 miles per hour.



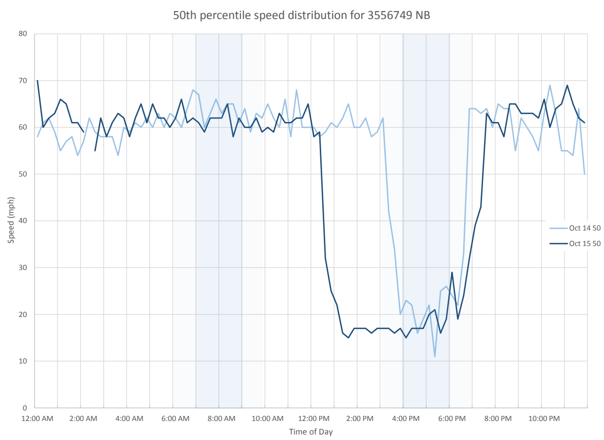


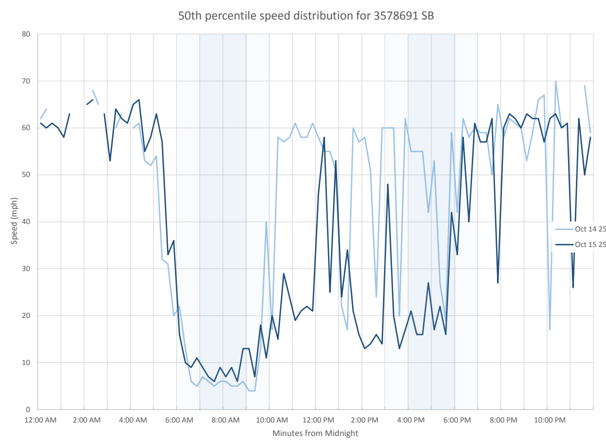


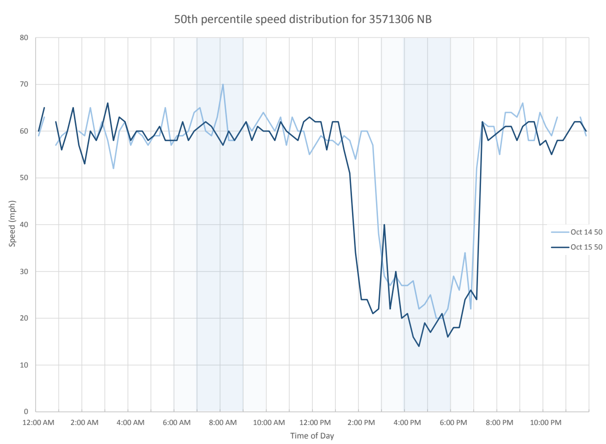


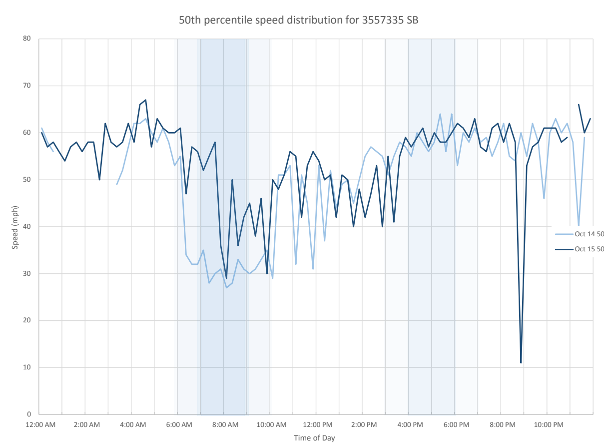
<u>Median Speed Populations: the 50th percentile profile</u>

Below are the 50th percentile profiles for the four segments included in this analysis. As shown in the charts below, the median speed population shows extended peak hour conditions in the northbound direction. However, speed improvements, as evident by the spikes on the southbound charts, show temporary improvements of up to 40 miles per hour in the post-toll condition.



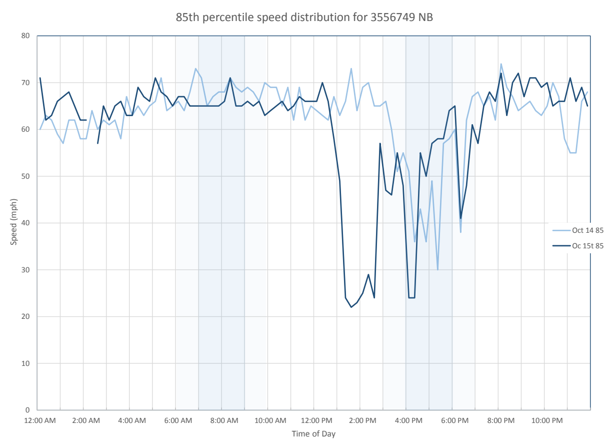


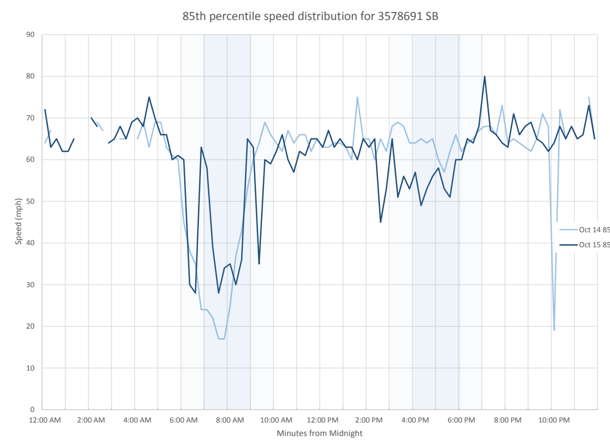


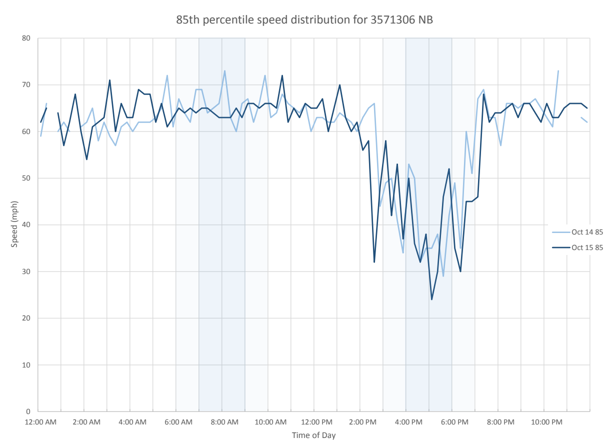


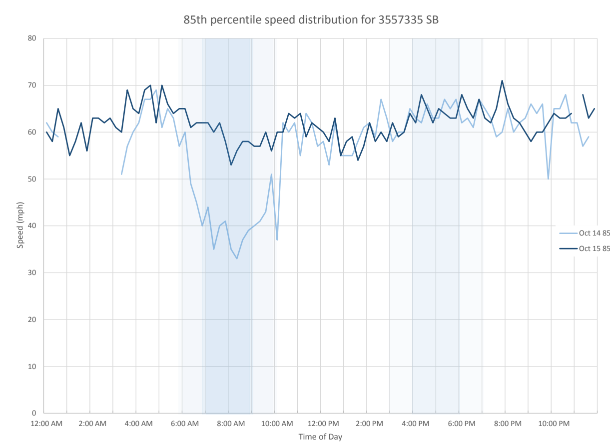
Fast Speed Populations: the 85th percentile profile

Below are the 85th percentile profiles for the four segments included in this analysis. As shown in the charts below, the speed population that experiences the least amount of congestion also shows the greatest temporary speed improvements, as evident by the spikes in both the northbound and southbound charts under the post-toll condition.









Conclusions & Recommendations

The results of this preliminary analysis shows extended peak hour conditions for most segments in the peak direction of travel for those in the general purpose lanes. Additionally, these segments also show slower speeds during the peak hour in the general purpose lanes. The analysis also shows greater variability in peak hour speeds in the post-toll condition, especially for the 50th- and 85th-percentile speeds. As such, this analysis suggests that post-toll speed improvements on I-405 are isolated to vehicles that already experience the least peak hour congestion (i.e., those driving in the HOV/HOT lanes), while post-toll speeds in the general purpose lanes have generally degraded for the majority of drivers.

As mentioned above, this is a preliminary analysis, and additional scrutiny is needed to fully assess the effect of tolling the study area. Though this initial speed-based analysis shows limited benefits to the conditions experienced by a system user, it has not considered reliability, throughput, or travel time implications that would be observed though a different data set.

As such, the following additional analyses are recommended:

- Further speed-based analysis focused on a corridor-wide understanding of the systemic impact of tolling along the length of the study area.
- Additional volume based studies to elucidate the throughput of the system.
- Additional reliability studies to understand the overall corridor performance as well as the impact tolling has had on other roadways within the system.

Source Data

INRIX will make available the source data used in this report for further third-party analysis. To obtain source data please email inrixitrafficushelp@inrix.com. For all press inquiries, please email Mark.Burfeind@inrix.com.

About INRIX

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