H-1 EB Piikoi On-Ramp Closure: A Comparative Analysis

March 1, 2019

EXECUTIVE SUMMARY

The State of Hawaii, Department of Transportation (HDOT) evaluated the effectiveness of closing the Piikoi Street on-ramp in the eastbound direction of the Interstate Route H-1 Freeway, during the afternoon peak period. Beginning on July 30, 2018, the Piikoi Street on-ramp to the Interstate Route H-1 Freeway was closed in the eastbound direction during the afternoon peak period (3:00 PM to 6:30 PM). As a result of the closure, HDOT's comparative analysis indicates that motorists saved almost five minutes in their freeway commute, from the Middle Street merge to Punahou Street, roughly an 18% travel time savings.

Methodology

To determine the effect on motorists' freeway travel time between the Middle Street merge and Punahou Street, a before/after analysis was completed. The "before" data used is from October 2017, when the Piikoi Street on-ramp is open. The "after" data is from October 2018, when the Piikoi on-ramp was closed.

The month of October was selected because it assumes that motorists have adjusted to the Piikoi closure, public and private schools, as well as the University of Hawaii are in session.

The first step in the evaluation was to review the volumes of traffic for the two study periods (in other words, the number of vehicles traveling the study area of the freeway being analyzed) to see if it's generally the same. Two standard deviations were deemed to be acceptable, thus a 95% confidence level was used. After checking that the volumes are comparable, then the second step was to determine the travel time. This process was repeat for multiple days; and the final step was to average the travel times to find the overall travel time increase or decrease.

Study Area

The study area is located on H-1 Freeway, between Middle Street and the Punahou off-ramp, which is approximately 4 miles in length. The Piikoi on-ramp is just before the Punahou off-ramp. As shown in Figure 1, the study area is highlighted in green. Along this segment, there are four (4) loop detectors that measure volumes; and numerous Doppler radar sensors which measure speeds between Middle Street and Punahou off-ramp.
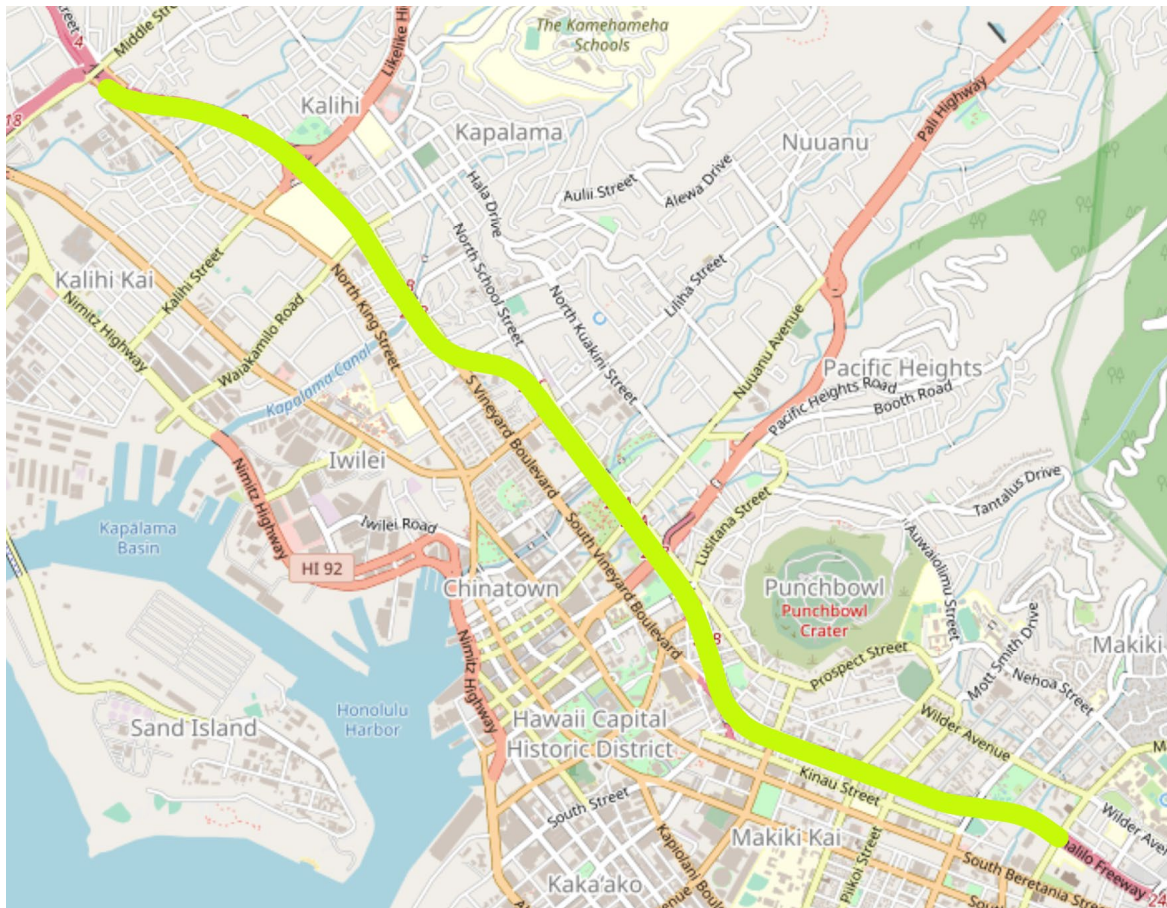

Figure 1. The Study Area: Interstate H-1, Eastbound, between Middle Street and Punahou St Off-Ramp

Data Sources

The following data sources were used for the evaluation:

- ✓ Real-Time Site Information Display, which reports traffic data (volume, speed and occupancy) collected from loop detectors every 15 minutes. The four stations in Figure 2 are used for the data collection:
    - o Station SL15LF at M.P. 19.27 at Kalihi Interchange (IC)
    - o Station SL23LF at M.P. 20.22 at Kapalama Stream Bridge
    - o Station SL71 at M.P. 21.10 near Ward Avenue
    - o Station RADAR 03 at M.P. 22.94 near Punahou Off-ramp
- ✓ Doppler radar sensors, which report travel time for the highlighted green route in Figure 1.

Figure 2. Traffic Count Stations on H-1 Fwy

Volume Comparison

Afternoon peak period volumes from 3:00 PM to 6:30 PM were collected from the stations for the following days:

- October 2017:

    October 3rd (Tuesday), October 4th (Wednesday), October 5th (Thursday)
    October 10th (Tuesday), October 11th (Wednesday), October 12th (Thursday)
    October 17th (Tuesday), October 18th (Wednesday), October 19th (Thursday)

- October 2018:

    October 2nd (Tuesday), October 3rd (Wednesday), October 4th (Thursday)
    October 9th (Tuesday), October 10th (Wednesday), October 11th (Thursday)
    October 16th (Tuesday), October 17th (Wednesday), October 18th (Thursday)

A. Kalihi IC Volume Data (SL15LF)

Station SL15LF collects data from traffic coming from Kalihi Interchange near Middle Street. The comparison of afternoon peak period volume in October is plotted in Figure 3. The average volume of the 9-day afternoon peak period is 18,884 in 2017 and 19,577 in 2018. The average afternoon peak period volume in 2018 is approximately 4% higher than it was in 2017, which is acceptable within the two standard deviations range.
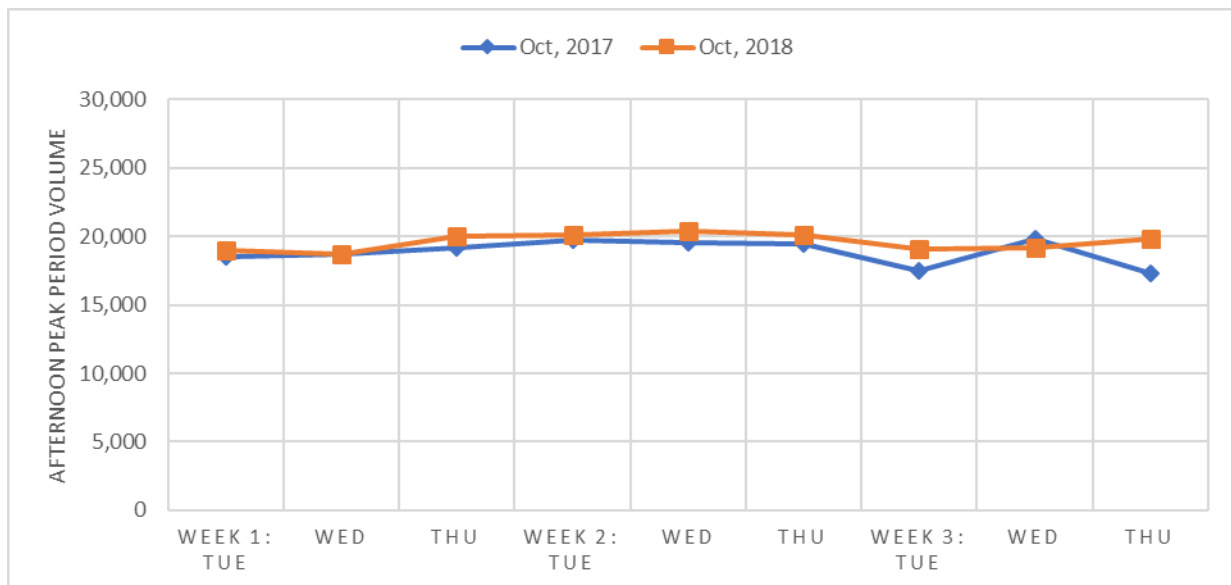

Figure 3. Comparison of Afternoon Peak Period Volume at Station SL15LF, Oct. 2017 vs. Oct. 2018

B. Kapalama Stream Bridge Volume Data (SL23LF)

The comparison of afternoon peak period volume in October is plotted in Figure 4. The average volume of the 9-day afternoon peak period is 20,263 in 2017 and 21,271 in 2018. The average peak period volume in 2018 is approximately 5% higher than it was in 2017, which is acceptable within the two standard deviations range.
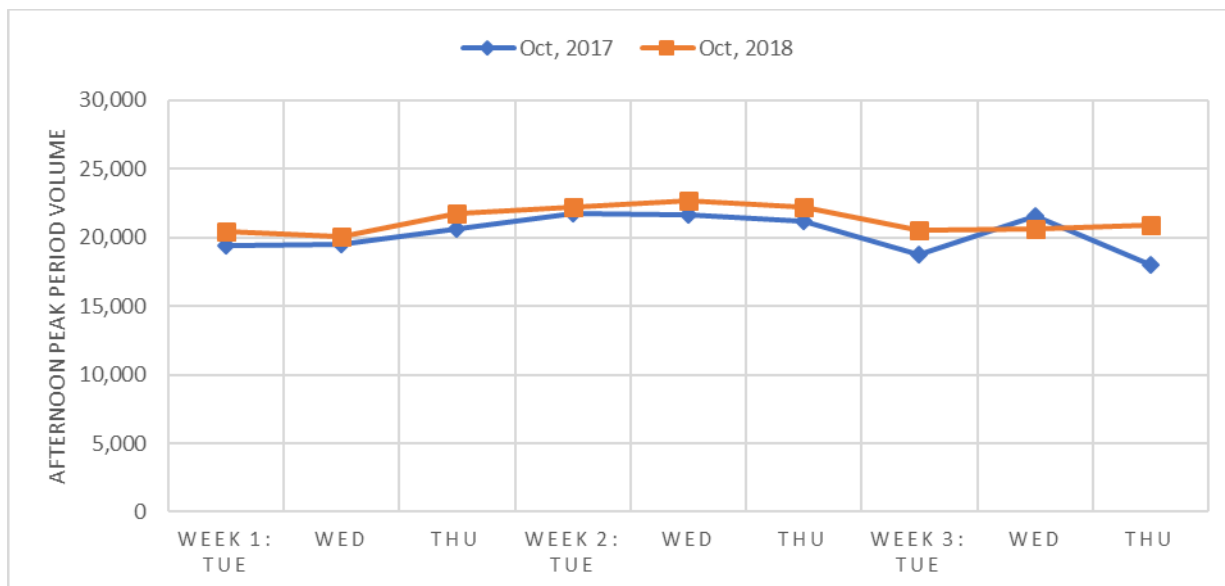
Figure 4. Comparison of Afternoon Peak Period Volume at Station SL23LF, Oct. 2017 vs. Oct. 2018

C.   Ward Avenue On-Ramp Volume Data (SL71)

Station SL71 collects data from both the mainstream traffic on H-1 and the Vineyard Blvd. on-ramp. The October afternoon peak period volume comparison is plotted in Figure 5. The average volume of the 6-day afternoon peak period is 20,064 in 2017 and 20,744 in 2018. The difference translates to approximately 3% of the afternoon peak period volume, which is acceptable within the two standard deviations range.
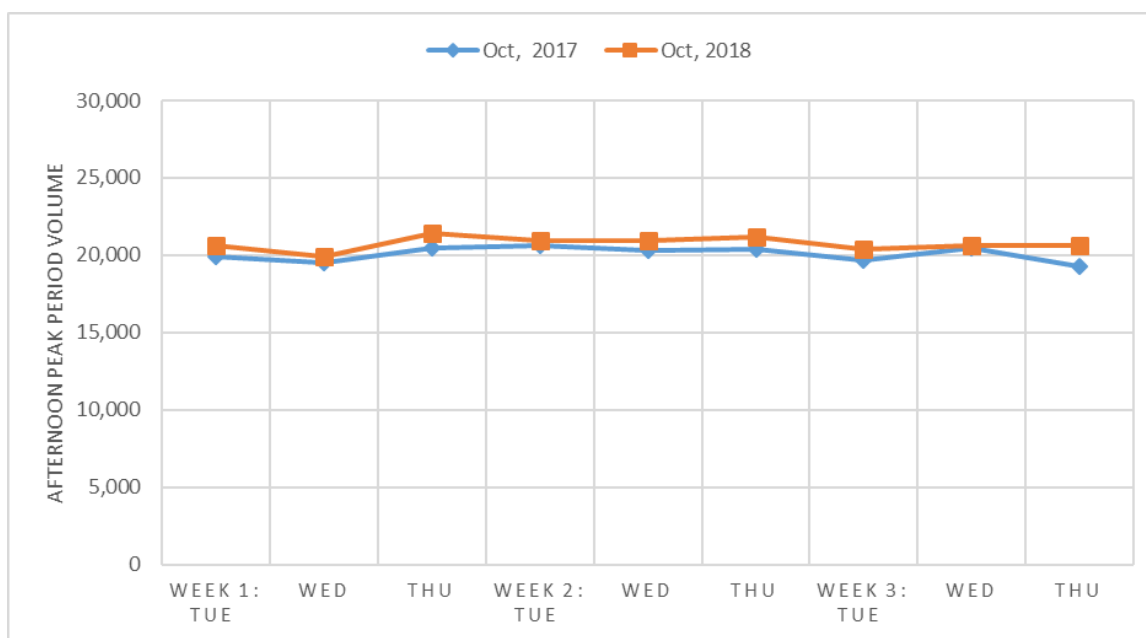

Figure 5. Comparison of Afternoon Peak Period Volume at Station SL71, Oct. 2017 vs. Oct. 2018

D. Punahou St. Off-ramp Volume Data (Radar 03)

Station Radar 03 collects H-1 eastbound data before the Punahou St off-ramp. The comparison of afternoon peak period volume in October is plotted in Figure 6. The average volume of the 9-day afternoon peak period is 22,436 in 2017 and 21,930 in 2018. The average peak period volume in 2018 is approximately 2% lower than it was in 2017, which is acceptable within the two standard deviations range.
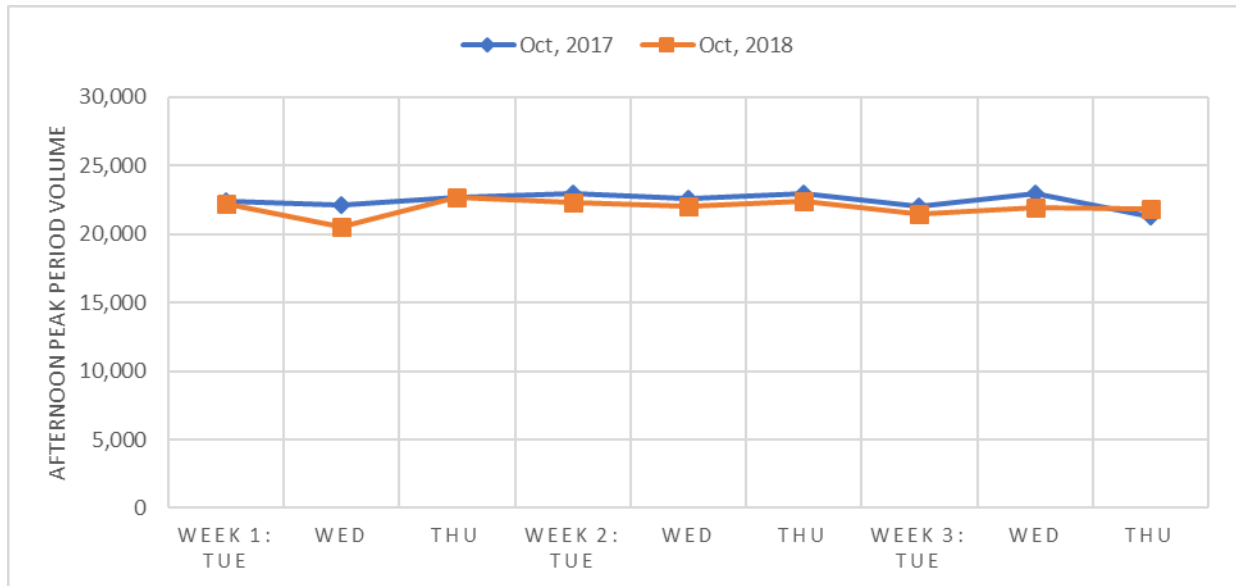

Figure 6. Comparison of Afternoon Peak Period Volume at Station Radar 03, Oct. 2017 vs. Oct. 2018

Travel Time Data

Figure 7 shows the travel time for each day and is presented in minutes (y-axis) by 15-minute intervals (x-axis). The daily afternoon peak period travel time ranges from 12 minutes to 25 minutes in October 2018; and it ranges from 16 minutes to 33 minutes in October 2017. The average travel time per vehicle is 23.2 minutes in October 2018, and 18.5 minutes in October 2017.

The travel time saved per vehicle is 4.7 minutes in 2018, which translates to 18% saving in travel time when compared to 2017.
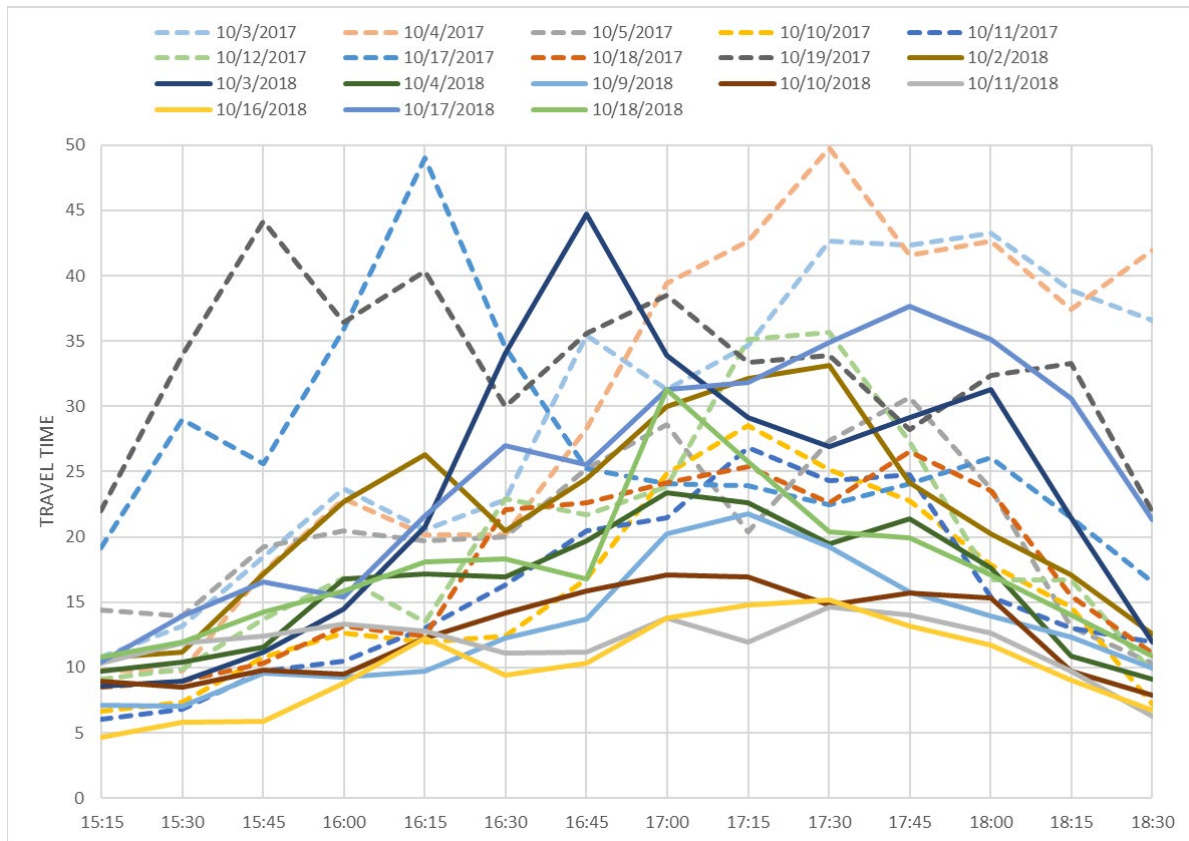

Figure 7. Comparison of Travel Time, October 2017 vs. October 2018

Summary

The following findings are drawn from this evaluation:

1. Volume: The afternoon peak period volume in 2018 in the study area has changed minimal (less than 5%) comparing to peak period volume in 2017, which is acceptable within the two standard deviations range.
2. Travel Time: The travel time in October 2018 was reduced by an average of 4.7 minutes. These results translate to roughly an 18% saving in travel time in October 2018.

The average travel time is presented in minutes (y-axis) in 15-minute intervals (x-axis). As seen in Figure 8, the dotted line represents the average travel time for nine days in October 2017. When comparing the travel time in October 2018, the solid line clearly is lower, thus representing a shorter travel time between 3:00 PM and 6:30 PM.
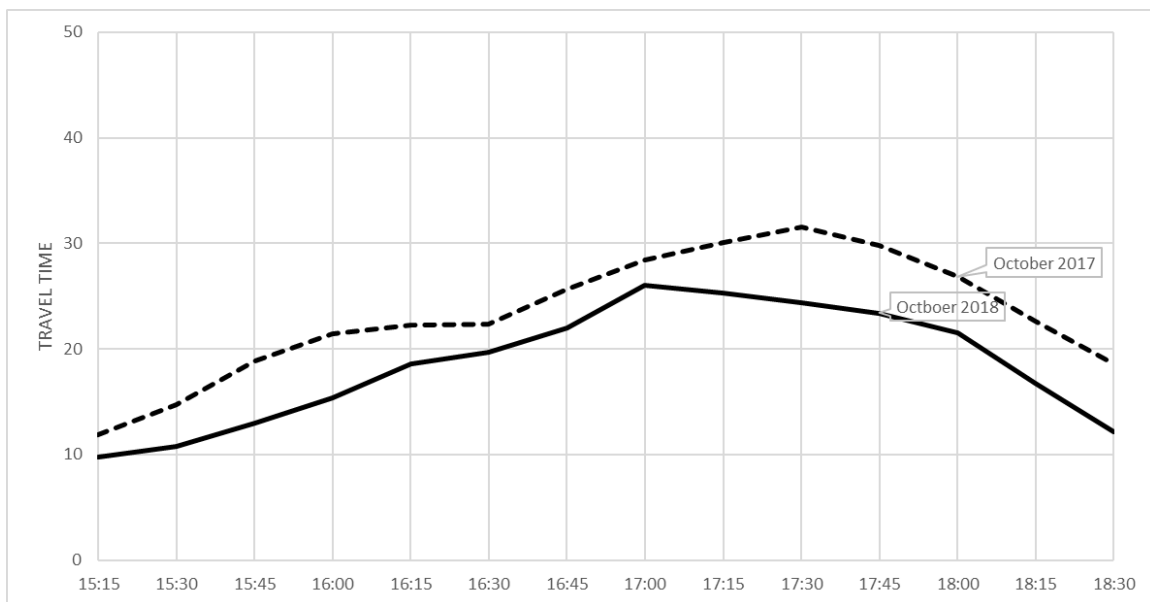

Figure 8. Comparison of Average Travel Time, October 2017 vs. October 2018