EXHIBIT NO. 113

Memorandum

To: Barbara Flemming, Senior Deputy Prosecuting Attorney

From: Bill Schultheiss, P.E. (WA. P.E. #46108)

Date: November 16, 2017

Re: East Lake Sammamish Trail Demand Analyses - Amended

During the Substantial Development Hearing SSDDP2016-00415, hearing examiner Mr. John Galt requested clarification for a number of figures and conclusions contained in a November 3rd memorandum discussing the Trail Demand Analyses. This memorandum revises and amends the original November 3rd memorandum to respond to Mr. Galt's request for additional information and data. This includes updates to figure titles, consideration of the impact of applying a "k" factor to the predicted peak hour trail volumes. The assessment of a "k" factor required the additional of other supplemental trail count information and the insertion of the predicted trail volumes from the original trail demand analyses memorandum dated June 20th, 2017.

The November 3rd memorandum was submitted in response to a request by King County for Toole Design Group (TDG) to respond to a critique submitted by Mr. Charles Alexander of Fehr & Peers, dated September 25, 2017. Mr. Alexander's critique pertains to a demand analysis completed by TDG for King County's proposed extension of the East Lake Sammamish Trail (ELST) between the towns of Redmond and Issaquah, dated June 20, 2017. The ELST is a critical linkage in the regional King County Trail network, providing a safe transportation linkage and recreational opportunity for the growing population centers in this part of the county.

One of the key outcomes of the previously submitted demand analysis is a conclusion that, due to anticipated demand levels, the proposed trail alignment warrants an 11 to 14 foot wide path to mitigate user conflicts and to safely serve pedestrians and bicyclists per design guidance in the AASHTO Bike Guide.

Mr. Alexander's criticism focuses on four aspects of our previously submitted demand assessment, which we will respond to in the order presented in his memo.

1. **The implied precision of forecast user volumes is unreasonably high.**

We agree that it is unreasonable to expect that 23 year forecasts of hourly user volumes can accurately predict to the individual user. This is true of any forecast, and it is implicit in discussing the values as forecasts. Further, rounding the forecast values would not change the conclusion of this analysis, as the rounded values would still be in excess of recommended thresholds for a wider path alignment. The original summary table of demand model forecast values has been incorporated into this amended memorandum (Table 1). Two additional columns have been added to the table to show the peak hour forecast reduced to match the calculated trail "k" factor for the 30th highest hour of the year and a rounded results column showing values to the nearest value of 10 users.

2. **There is a discrepancy between forecasted growth in the average weekday, peak weekday, and peak weekend day traffic volumes, and no forecasted growth in the average weekend day and peak hour volumes (basically why are some future peak hour volumes projected to increase, while others are not projected to increase).**

This discrepancy is discussed in a footnote in the memo (see footnote 6, page 11). The approach taken in these traffic forecasts involved conducting a separate statistical analysis of trail volume determinants for each of the

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volume values of interest (e.g. average weekday, peak weekday, peak hour). Separate models were developed for each type of volume, with the understanding that different types of travel are likely occurring in each of these periods, and that therefore the determinants of traffic volumes might be different depending on the time period. For the volumes referenced above that do not have any predicted growth, population in the trail catchment area was not found to be a significant predictor of that particular aggregation of trail volumes. This is not to say that population density does not influence peak hour trail volumes, but that with the sample of observed data available at the time that the modeling was conducted, other variables were more predictive of peak hour volumes.

Across the models developed, higher population densities, trail connectivity (measured as mileage of trails in the surrounding area), and local street connectivity frequently emerged as significant predictors of demand. Even though individually these terms do not appear in all of the models developed, the fact that they were found to influence volume at multiple different aggregation levels suggests that they are generally strong predictors of growth in trail traffic volumes. The fact that the projected peak hour volume forecasts (which exceed 300 bicyclists per hour) do not depend explicitly on population growth makes them at worst overly conservative. Likewise, the fact that the forecast volumes do not take into account improvements in bicycle network connectivity, and the light rail extension into Downtown Redmond, despite these being known strong predictors of bicyclist and pedestrian activity, again makes all of the forecast values more conservative.

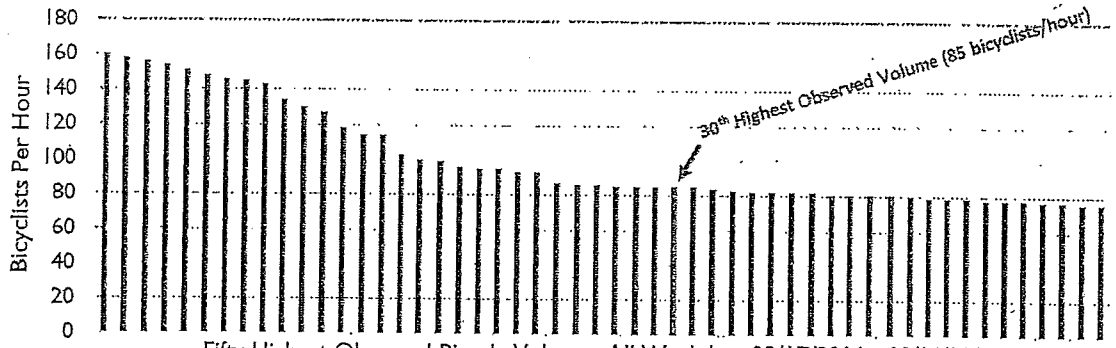
3. **It is unclear how many days can be expected to carry the peak weekday, peak weekend day, and peak hour volumes.**

To respond to this, we pulled recent continuous count data from trails in the surrounding area to assess frequency of high volume events[1]. The data pulled here represents observations taken between September 17, 2016 and September 16, 2017. The relevant trail count locations are the Sammamish River Trail (SRT) and the East Lake Sammamish Trail in Redmond. The SRT counter is located between NE 85th St. and NE 90th St., and the ELST – Redmond counter is at the south end of Redmond, just south of the Marymoor Connector Trail. It is important to note that the ELST – Redmond counts, while they are along the same alignment as the ELST trail under discussion, do not represent the total volumes that can be anticipated once the trail extension is complete due to the added connectivity that this extension will allow, making it a viable transportation corridor.

Figures 1 and 2 plots show the 50 highest hourly bicycle counts for the ELST – Redmond sites from the past year sorted separately for weekdays and weekends. These figures show the volume of bicycle traffic for the top 50 hours for the year between September 17, 2016 and September 16, 2017. These figures show the amount of bicycle traffic alone, as this is the basis for the original bicycle traffic forecasts for the ELST Segment A and B direct demand model. As can be seen, even with the incomplete trail that is currently in place, bicycle volumes exceed 100 bicyclists per hour 17 times on weekdays and over 50 times on weekends with peak volumes exceeding 140 bicyclists per hour for 16 separate hours when weekends and weekdays are combined. As the models for this corridor suggests, use of the trail is anticipated to grow as overall trail connectivity is improved. The 30th highest hourly volume is noted in each figure as a reference point.

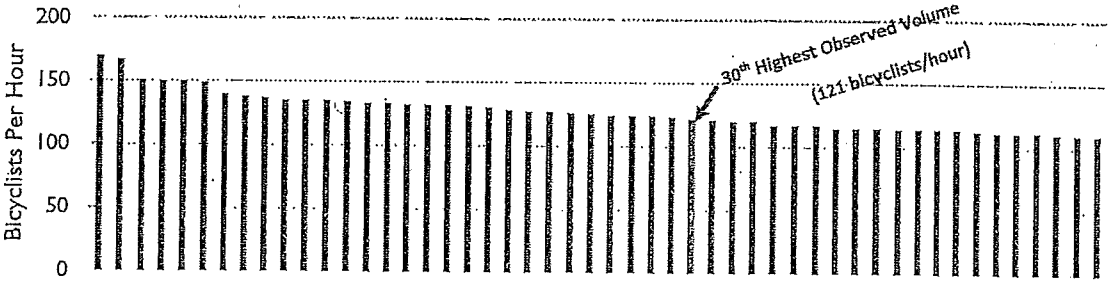
[1] Counts are from WSDOT's permanent counter program, available at wsdot.wa.gov/mapsdata/travel/bikepedcount.htm.

Figure 1: ELST Redmond Weekday Hourly Bicycle Volumes



Fifty Highest Observed Bicycle Volumes All Weekdays 09/17/2016 - 09/16/2017

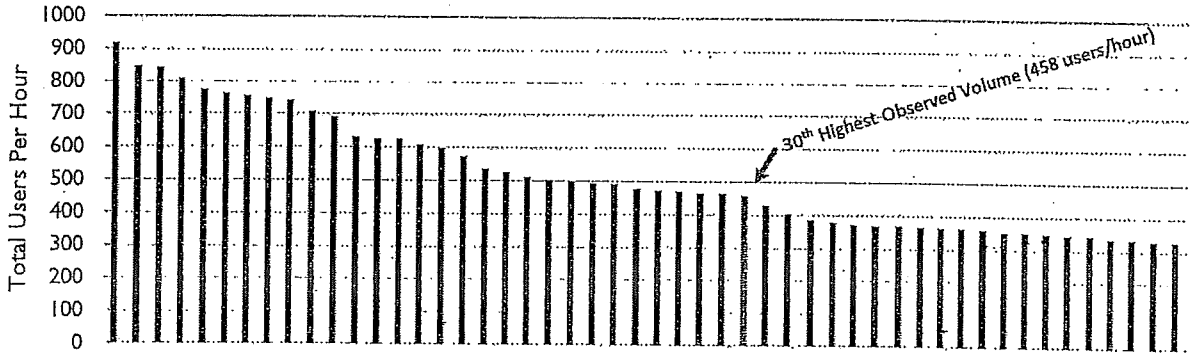
Figure 2: ELST Redmond Weekend Hourly Bicycle Volumes



Fifty Highest Observed Hourly Bicycle Volumes, All Weekend Days
09/17/2016 - 09/16/2017

The direct demand model for the ELST Segment A and B is based on estimating bicycle volumes and extrapolating to total user volumes. A mode split of 50% pedestrians and 50% bicyclists was chosen based on an evaluation of the mode split on trails within the region. Figure 3 below displays the total user volumes for the ELST Redmond location (all bicyclists and pedestrians) for the top 50 highest volume hours for the entire year between September 17, 2016 and September 16, 2017.This location experienced over 50 hours with more than 300 path users per hour despite limited trail connectivity with pedestrians consistently exceeding 50% of the trail traffic .

Figure 3: ELST Redmond Total Hourly User Volumes

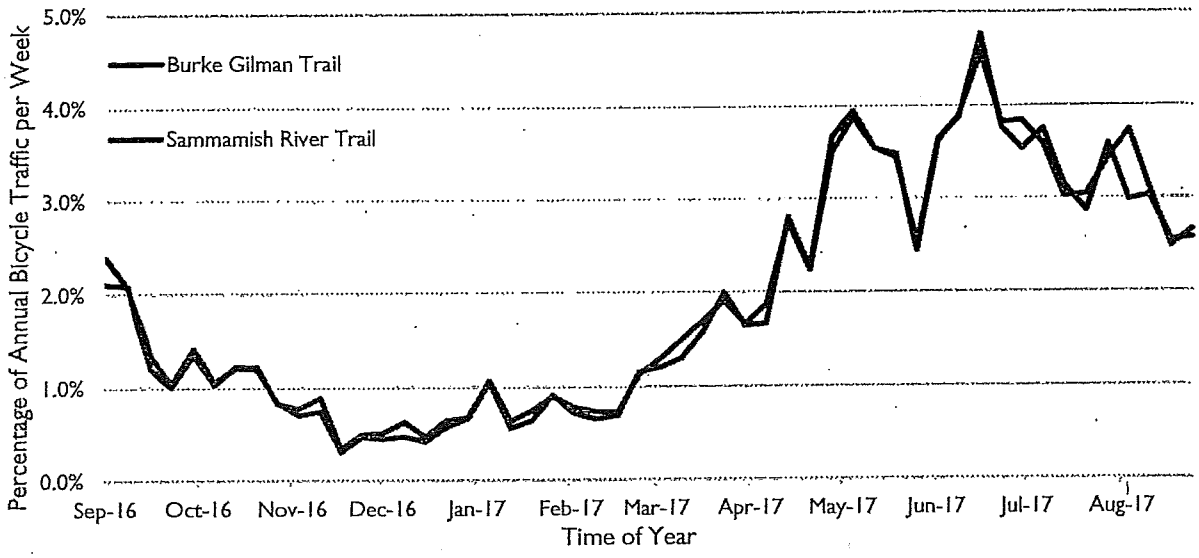


Fifty Highest Observed Hourly Total User Volumes
All Weekdays and Weekends 09/17/2016 - 09/16/2017

As these plots have shown, the newly constructed section of the ELST in Redmond is already seeing very high rates of usership, despite feeding into a gravel trail that does not serve the needs of those cyclists who are not comfortable riding on unpaved surfaces. Improving this network connectivity by completing a paved surface trail on Segments A and B in Sammamish will increase the number of cyclists on the entire ESLST, as it will enable a vital connection between Redmond, Sammamish, and Issaquah.

For another perspective on the variation of trail traffic over time, we can look to the seasonality of trail usage around King County. Figure 4 shows the weekly bicycle traffic volume on the Burke-Gilman Trail and the Sammamish River Trail as a percentage of annual traffic volume. This figure shows that while the heaviest periods of bicycle activity in the region are in the summer, the "shoulder season" extends into April and September, with activity throughout the year. As can be seen, the variability of monthly bicycle traffic relative to the annual volume of bicycle traffic on the system is relatively narrow which demonstrates that there is a relatively consistent level of bicycling activity even in winter months. Accordingly, while the design hours for this facility may be in the summer, the benefits of a higher quality user experience will extend to trail users year-round.

Figure 4: Seasonal Bicycle Traffic

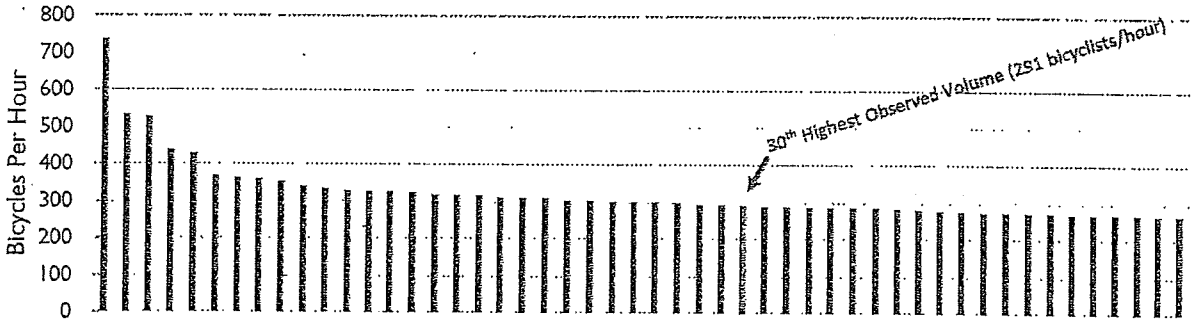


4. **Related, it is unclear whether the data underlying the models presented has been filtered to omit special event traffic volumes.**

Mr. Alexander's memo also mentions the possibility that the demand model under discussion is affected by the presence of special events in the data, citing a half-marathon in Redmond that uses the SRT as an example. This particular event would not affect the data used in the demand analysis, as the volumes being modeled are bicycle volumes, which are then extrapolated to estimate total user volumes. Looking at the SRT bicycle volumes for Summer 2017 reveals that, it is possible 2 or 3 unique events may have resulted in high peak hour volume on the existing ELST train in Redmond as shown below, there are almost 50 hours during the entire year with bicycle volumes approaching or exceeding 300 per hour. Considering that the predicted peak hour total volumes exceed 300 for the new trail

location, we can expect to see multiple hours exceeding this value.

Figure 5: SRT Hourly Bicycle Volumes



Fifty Highest Observed Hourly Bicycle Volumes
All Weekdays and Weekends, 09/17/2016 - 09/16/2017

Conclusion

In conclusion, while there are some ways that the demand estimates presented in our original memo may be slightly optimistic by using the peak hour, the degree to which they are optimistic on that front is overstated by Mr. Alexander's supposition that hours of high volumes are a rare occurrence on King County regional trails. In fact, King County trails have repeated high activity periods throughout the year, and there is no reason to expect that the complete ELST will be an exception. In addition, there are many ways that the demand estimates and forecasts that we present are conservative. Historic predictions of trail use and population growth have proven to be lower than the actual outcomes over time.

For example, the extension of light rail to Downtown Redmond will be both a major trip attractor for commuters in Sammamish and Issaquah, and will enable more Seattle residents to enjoy the recreational opportunity presented by the ELST. This increased accessibility is not accounted for in our forecasts. Further, the Cities of Sammamish, Redmond, Issaquah are actively working to improve bicycle connectivity within their communities and to the ELST. The demand model does not account for future improvements to City bicycle networks, trail demand will increase. Further, as Mr. Alexander points out, the forecasts of peak hour traffic in the original memo do not account for population growth. As population is expected to grow in the region, we can likewise expect to see growth in trail volumes and consequently in peak hour volumes.

The King County Regional Trails Plan from 1992 and the 2004 King County Regional Trail Implementation Guidelines both discussed the challenges of 10-foot-wide trails contributing to "conflicts" and "over-crowding" which generate "frequent complaints" from the public as far back as 1985. King County's vision for over 25 years is for the ELST to be a key part of its "continuous network of high-volume, safe, and pleasurable" regional trail network. This network is to function as an equivalent to the "major arterials [for car traffic] in a street plan" providing recreational and transportation "opportunities for users with differing skills." The latent demand for a high-quality trail facility is evidenced by the experience of the King County trails including the recently opened ELST in Redmond which connects to a gravel trail.

Finally, Mr. Alexander speaks to not engineering to the peak activity levels unless design guidance or research suggests otherwise. While there may not be extensive research, and there is no specific guidance on choosing an appropriate design hour for trails, it is common engineering practice to take the 30th highest hour of roadway traffic as a reasonable hour to represent typical conditions to base the design of a roadway on (AASHTO defines this value as the "k" factor). Despite the fact applying a "k" factor to trail volumes is not required, the following presents an

assessment of the demand model applying an assumed "k" factor based on regional trail demand experience. Appendix A details findings from other similar trails in the region in terms of the relationship between their peak observed hourly bicycle volume and 30th highest hour of bicycle traffic. From this sample of locations, we see an average ratio of peak hour to 30th highest hour of 2.04, which we have applied in Table 1 to the peak hour forecasts for the proposed trail alignment to approximate suggested potential 30th highest hour volume. Both points used in the trail demand model are located on the ELST (within Segment B) adjacent to the Inglewood Road and 190th Place intersections.

Table 1 – Demand Model Reported Peak Volumes for the ELST

ELST Segment B Locations	Average Weekday	Average Weekend	Peak Weekday	Peak weekend	Peak Hour	30th Peak Hour*	30th Peak Hour**	Annual
2017 Inglewood Hill Road	847	1,578	1,230	6,790	696	342	340	321,829
2025 Inglewood Hill Road	903	1,578	1,307	6,982	696	342	340	337,724
2040 Inglewood Hill Road	938	1,578	1,356	7,097	696	342	340	347,626
2017 190th Place SE	541	1,317	894	5,715	603	296	300	208,151
2025 190th Place SE	565	1,317	932	5,846	603	296	300	215,109
2040 190th Place SE	579	1,317	954	5,921	603	296	300	219,177

**This value is the estimated 30th highest peak hour of trail traffic based on an analysis of the ratio of peak hourly bicycle volume to 30th highest hourly bicycle volume from similar trails in the region (calculated in Table A.1 as 2.04).*

*** This value is a rounded value of the calculated 30th Peak Hour from the previous column to reflect the accuracy of the direct demand model.*

As can be seen in table 1, the predicted volumes for the proposed segments during the 30th highest hour are expected to approach or exceed 300 total users per hour.

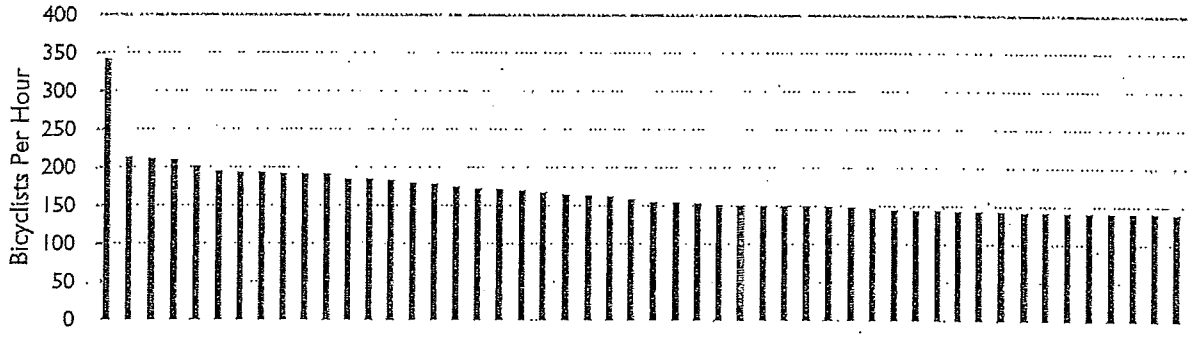
In addition to looking at the total numbers, it is worth considering that, due to Segment 2B's nature as a flat lakefront trail connected the region's largest and most popular park, we can reasonably expect that under peak conditions we can expect to see high volumes novice bicyclists using the trail. It is also important to keep in mind that the demand modeling is a conservative estimate of the future trail demand. It is one factor of many considerations for determining an appropriate trail width. The overarching goal as identified in King County Master Plans for the trail system is to develop a design that provides a high-quality experience and can handle high-volumes of traffic as a critical regional trail link.

In my engineering opinion, considering the importance of trails in the region, the regional significance of this trail, the population and workforce density near the trail, the planned extension of light rail to Redmond, the presence of significant regional parks, efforts made by the cities along the trail to be bicycle friendly, and the quality and location of the ELST; the ELST will be a high-volume trail. Accordingly, responsible engineering judgment suggests that we should err on the side of caution in planning and designing for these conditions to mitigate potential user conflicts at the times of the week when the least experienced bicyclists are most likely to be using the ELST and maintain a minimum trail width of at least 12 ft throughout the trails length.

Appendix. Additional hourly distribution plots

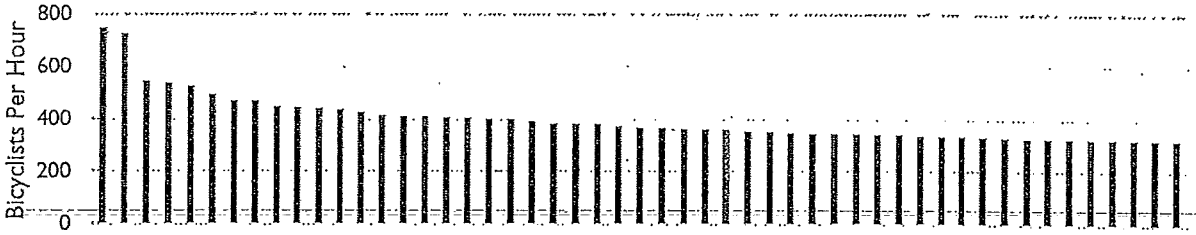
To further evaluate the potential distribution of peak traffic flows on the ELST, the following plots show total hourly volume distribution plots from continuous counters around the King County region. As above, these are all based on 1 full year of data collected between 09/17/2016 and 09/16/2017 and show the top 50 highest hours of volume of the year. These only show bicycle volumes and do not include pedestrian traffic.

Figure A.1: I-90 (Bellevue) Hourly Bicycle Volumes



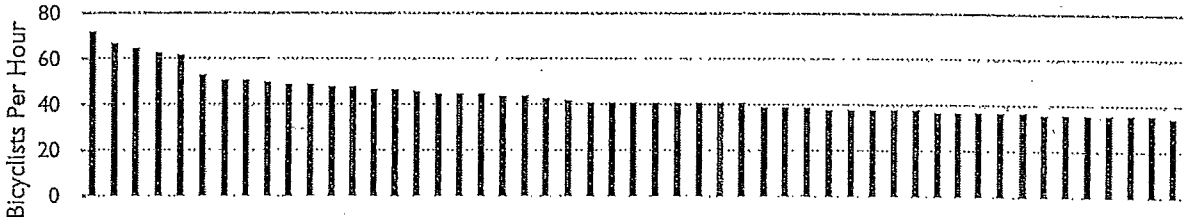
Fifty Highest Observed Bicycle User Volumes
All Weekdays and Weekends, 09/17/2016-09/16/2017

Figure A.2: Sammamish River Trail (Woodinville) Hourly Bicycle Volumes



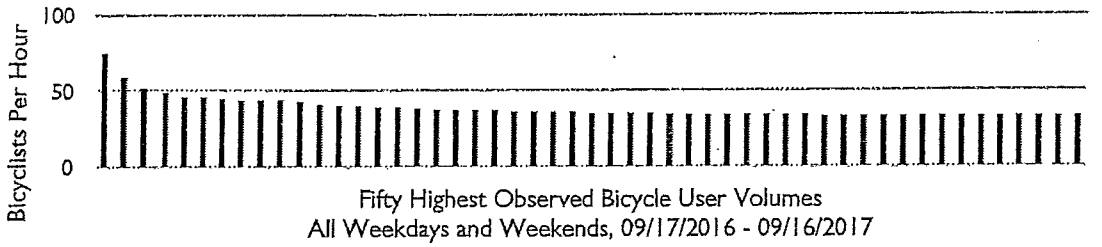
Fifty Highest Observed Bicycle User Volumes
All Weekdays and Weekends, 09/17/2016 - 09/16/2017

Figure A.3: Green River Trail (Cecil Moses Park) Hourly Bicycle Volumes



Fifty Highest Observed Bicycle User Volumes
All Weekdays and Weekends, 09/17/2016 - 09/16/2017

Figure A.4: State Route 520 Hourly Bicycle Volumes



As can be seen from these plots, the ratio of the peak hour to the 30th highest volume hour for bicyclists at these locations varies considerably. Observed values from these sample locations are shown in Table A.1.

Table A.1: Ratio of Peak Hour Bicycle Volumes to 30th Highest Hourly Bicycle Volumes

Site	Ratio of Peak Volume to 30th Highest Volume
I-90	2.27
East Lake Sammamish Trail-Redmond	1.40
Sammamish River Trail - Redmond	2.53
Sammamish River Trail – Woodinville	2.08
Green River Trail	1.76
State Route 520	2.21
Mean	*2.04*

As can be seen from these sample locations, the average peak hour is approximately double that of the 30th highest hourly bicycle volume in the King County region. Accordingly, one could adjust predicted peak hour volumes by this average factor (2.04) to approximate the potential 30th highest peak hour trail traffic on the ELST. As these trail conditions vary considerably from location to location, we could alternatively apply the peak hour ration of 1.40 at the ELST – Redmond counter, however we choose to use the mean (2.04) to apply a more conservative peaking factor.