

Memorandum



To: Barbara Flemming, Senior Deputy Prosecuting Attorney

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

Date: November 30, 2017

Re: East Lake Sammamish Trail November 2017 Segment 2B Shoreline Land Use Hearing

Rebuttal to Charlie Alexander Testimony Delivered on November 20th, 2017

This memorandum is written to respond to points raised by Mr. Charles Alexander of Fehr & Peers, during his testimony during the November 20th, 2017 Segment 2B Shoreline Land Use Hearing. During testimony, he provided critiques of my engineering opinions regarding 1) the development of the trail demand model, 2) my interpretations of the AASHTO Bicycle Guide, and 3) the minimum width of the trail.

Critique of the Trail Demand Model

Mr. Alexander's criticism of the direct demand models presented in the amended East Lake Sammamish Trail (ELST) Demand Analysis memo, dated November 16, 2017, focus on the notion that the models "...do not conform to accepted guidelines, namely National Cooperative Highway Research Program (NCHRP for short) Report 770..." because the variables used to explain user volumes in the model presented with respect to ELST do not directly mirror the list of variables in NCHRP 770. In particular, Mr. Alexander notes that there is no inclusion of a population variable, and that the "miles of trail in the catchment area" variable does not directly align with any variables cited in NCHRP 770 which were cited as being commonly used.

However as noted in the NCHRP 770 Report Mr. Alexander provided as Exhibit 117 (page 56), the population is one of the variables "often used to represent context in these types of models". It is critical to note that the guidance states these variables are "often used". It does not say these variables (including populations) must be used as Mr. Alexander asserts. The NCHRP 770 report clearly states that the example models "should not be construed as transferable. Their coefficients are unique to how the models have been specified." The 6-step demand model process states it is not appropriate to use the example models (with coefficients) exactly as shown, but requires new models be developed to confirm the inputs used are reliable.

Our process for testing and evaluating variables was described in our May 19th, 2016 memorandum. It is not clear from Mr. Alexander's testimony and critique that he has reviewed this memorandum where we explain the population variable was not found to be reliable.

Thus in accordance with the NCHRP 770 guideline, we did not include population as a factor in the predictive models unless it was found to be reliable which it was for the peak weekend model. To include population in the other models as Mr. Alexander suggests, would require we not follow the direct demand model methodology.

Mr. Alexander's criticisms misrepresent the process of applied statistical modeling, and specifically the variable selection process. While we agree that there is a strong logical argument for including population densities as a variable to predict user volumes, in the process of developing these models we did not find statistical evidence

of an effect for population on the peak hour user volumes. As we have previously stated, this is not to say that there is no relationship, but simply that the data we have at hand does not strongly support that relationship. In developing statistical models, it is standard practice to omit variables on this basis. The fact that other similar models have included a particular variable while this model does not is not a reason to invalidate this model. Similarly, the fact that we defined a “miles of trail in the catchment area” variable when other modelers have not before is not a reason to reject the model. This variable is a measure of trail network connectivity, which has a logical justification for increasing trail ridership: a more complete network is inherently more useful for walking and bicycling than a disjointed network, as these connections allow users to travel on a larger system, effectively increasing the catchment area of the segment in question.

The memorandum provided on June 20, 2017 is a supplement to the May 19th, 2016 memorandum. This memorandum was requested by King County to 1) assess the implications of the new light rail stations planned for Downtown Redmond and SE Redmond, and 2) assess the peak hourly volumes of users (5 – 7k users per day) 3) revise the model to take into account new data points that were not available when the May 19th, 2016 memorandum was developed, namely the addition of four NEW permanent trail counters in addition to more recent trail counts for the eight stations included in the May 19th memorandum. Due to these changes, the demand model was revised with new regression analyses performed to confirm the variables. As the only major change to the model was updated count data, the underlying variables remained the same as the May 19th 2016 memorandum. The inclusion of four new counters resulted in a revised model predictive volume results.

The November 3, 2017 memorandum supplemented the June 20th, 2017 memorandum in response to critiques submitted by Mr. Alexander in his memorandum dated September 25, 2017. **The model was not updated, and the results did not change.**

In Mr. Alexander’s testimony on November 20th, he places particular emphasis on the fact the peak hour trail volumes are “not two- or three-times the threshold [of 300 users per hour], but exactly at the threshold.” In response to Mr. Alexander’s September 25th critique of the June 20th, 2017 demand model, implying we should not design the trail for “the peak activity levels unless design guidance or research suggests otherwise” as the peak volume predicted by the model may be an outlier, we evaluated a potential application of a “k” factor. As discussed in the November 3rd Memorandum, the application of a “k” factor to shared use path is not a standard practice – it is a roadway design practice. There is no research supporting the development of a “k” factor for shared use path design as the availability of trail counts is a relatively new occurrence in the transportation profession.

Mr. Alexander incorrectly states that the county “suggested the 30th highest hourly volume is an appropriate design volume.” That is not the County’s position. The County example of a 30th highest volume was provided to show that “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 experience¹ which shows the trail can reasonably be anticipated to operate at volumes in excess of 300 users per hour.

We estimated the “k” factor as being an average of the 12 counter data points available resulting in value of 2.04. This included a low volume trails (Green River and 520 Trails) and trails with actual unique anomaly events (I-90 Bellevue). We could have very easily relied solely upon the Redmond ELST data which is most likely to

¹ November 16th East Lake Sammamish Trail Demand Analyses – Amended Memorandum

simulate future ELST trail conditions which had a factor of 1.40. This would result in peak hour volumes of 428 (ELST 190th Place) and 500 (ELST Inglewood).

The AASHTO Bicycle Guide “Typically, widths range from 10 to 14 ft, with the wider values applicable to areas with high use and/or a wider variety of user groups.” Mr. Alexander also ignores the fact the user volume is expected to be approximately 50% pedestrians which is in excess of the 30% threshold suggested for trail widening in the AASHTO Bike Guide. The AASHTO Bicycle Guide also repeatedly states that “wider paths” are desirable to accommodate the more vulnerable pedestrians and less experience bicyclists which are likely to operate on this trail segment due to its proximity to Marymoor Park – the most popular regional park in King County.

AASHTO Bicycle Guide

Mr. Alexander is correct that the AASHTO Bike Guide is written as a “guideline.” The American Association of State Highway Transportation Officials is a non-profit organization that represents its members – the individual State Transportation Agencies. As a non-profit association, it cannot establish roadway or shared use path design standards. Guidelines become standards once they are adopted by an agency. Where the AASHTO Guide is adopted, courts interpret “should” statements in the AASHTO Guides as “shall” statements unless modified by local guidance. King County, which has jurisdiction for the trail, has adopted 12 feet as the minimum trail standard.

Minimum Width of the Trail

Mr. Alexander has asserted “A context-sensitive design process would conclude that the trail can be narrowed without causing disproportionate safety effects.” He further asserts that the trail can be vary in width between 8 and 12 feet throughout the length of the trail to avoid unspecified physical constraints. Mr. Alexander ignores in his critique and recommendation that it would be acceptable to vary the trail width repeatedly the fact this is a critical major trail link for King County Parks and Recreation connecting the Cities of Redmond, Sammamish and Issaquah. It also directly connects to a major regional park and is being designed to provide a high-quality trail experience for its users. A critical aspect of providing a high-quality experience is to design a trail that allows for sociability – namely the ability of people to walk side by side or bicycle side by side. Any experienced trail designer realizes that is how people want to experience a trail and that is how most people attempt to use a trail unless they are traveling alone. People traveling side by side take up more space, thus the potential for conflict increases as trail volumes increase. The purpose of a wider trail isn’t to necessarily allow bicyclists to operate at an “optimum speed” but to provide enough space for bicyclists to able to pass people walking without creating a safety problem or passing so close as to degrade the pedestrian experience or a collision. Figure 1 shows the AASHTO minimum operating space envelope with a representation of a 12 foot trail functioning as three lanes which is what is intended for high volume trail facilities.

Repeatedly changing the dimensions of the trail will not conform to user expectations of this trail to provide a “high quality experience” and has the potential to result in trail users being surprised by repeated instances of trail narrowing whereupon they collide with another trail user or ride off the path and potentially crash as their “lane” is removed. The trail facility should be thought of as providing “lanes of travel” for users and thus a core decision is whether this trail should function as a two-lane facility where users travel in single file, or if it can be designed as a three-lane facility where many users will have the ability to travel side by side. The minimum desirable width based on operating space is a 12-foot width. While the AASHTO Guide states an 11 foot trail can allow for 3-lane operation, it is clear that this requires the user operating space to be encroached upon or for users to ride at the very edge of the trail which could increase their risk of leaving the trail in crowded conditions. Mr. Alexander appears to be trying

to apply roadway design thinking to his assessment where lane widths may vary. Roadways are not designed however to constantly add or remove through lanes along the main alignment where consistent volumes are present as this would create safety problems.

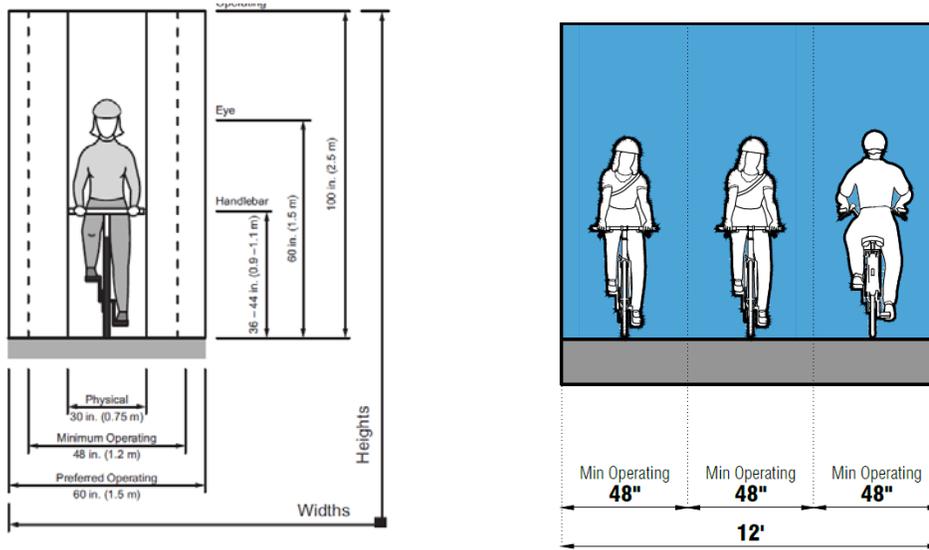


Figure 3-1. Bicyclist Operating Space

Figure 1 – AASHTO minimum bicyclist operating space compared to a three lane trail cross section.

Mr. Alexander also challenged my assertion that the AASHTO Bike Guide “recommends designing to a LOS C” when considering the SUP LOS model. This was a mis-statement on my part, but the statement was based on the reality this letter grade is implied by the written text of the Guide. As the author of this section of the AASHTO Guide, I used the same SUP LOS calculations Mr. Alexander provided as Exhibit 123 to justify the following language in the Guide:

Wider pathways, 11 to 14 ft (3.4 to 4.2 m) are recommended in locations that are anticipated to serve a high percentage of pedestrians (30 percent or more of the total pathway volume) and high user volumes (more than 300 total users in the peak hour).

A SUP LOS grade of “C” results at a volume of 300 users per hour on a trail with 30% pedestrians for an 11-foot trail as shown in Figure 3 below.

Shared Use Path Flow Analysis Tool
Trail Level of Service (LOS) Calculator
 Draft Spreadsheet Based on Federal Highway Administration Shared Use Path Study
 North Carolina State University and Toole Design Group

														Trail LOS Scale	
														LOS Score	LOS Grade
														X<4.0	A
														3.5X-4.0	B
														3.0X-3.5	C
														2.5X-3.0	D
														2.0X-2.5	E
														X-2.0	F

ROW #1

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Trail Level of Service		
			Closest 0.5 ft.	0=No Centerline	Volume	Mode Split (%)*					Score	Grade	Adj. Factor (subtract from User Percep. score)				LOS Score	LOS Grade
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	LOS Score	LOS Grade	
Example Trail	10.0	1	150.0	70.0%	30.0%	0.0%	0.0%	0.0%	100.0%	3.30	C	83.64%	113.36	0.94	0.94	2.35	2.35	E

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicyclists.

[Click Here for Default Mode Split](#)

ROW #2

Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Trail Level of Service		
			Closest 0.5 ft.	0=No Centerline	Volume	Mode Split (%)*					Score	Grade	Adj. Factor (subtract from User Percep. score)				LOS Score	LOS Grade
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	LOS Score	LOS Grade	
	11.0	1	150.0	70.0%	30.0%	0.0%	0.0%	0.0%	100.0%	3.44	C	35.33%	47.89	0.40	0.40	3.04	3.04	C

*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicyclists.

Figure 2 - Shared Use Path LOS Calculator Results for 300 Users with 30% Pedestrians

However, the East Lake Sammamish River Trail is anticipated to operate with 50% pedestrians during peak periods. This greatly reduces the LOS performance of the trail below what AASHTO Bike Guide recommends (LOS C – implied as just discussed) at a 12-foot width as shown in Figure 3 below:

Shared Use Path Flow Analysis Tool																Trail LOS Scale		
Trail Level of Service (LOS) Calculator																LOS Score	LOS Grade	
Draft Spreadsheet Based on Federal Highway Administration Shared Use Path Study																X≥4.0	A	
North Carolina State University and Toole Design Group																3.50X<4.0	B	
ROW #1																3.00X<3.5	C	
Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Trail Level of Service		
			Closest 0.5 ft.	0=No Centerline	Volume	Mode Split (%)*					Score	Grade	Adj. Factor (subtract from User Percep. score)				LOS Score	LOS Grade
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Final LOS Score	LOS Score	LOS Grade
Example Trail	11.0	1	150.0	50.0%	50.0%	0.0%	0.0%	0.0%	100.0%	3.30	C	46.47%	100.04	0.83	0.83	2.47	2.47	E
*Default mode split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicyclists.																		
Click Here for Default Mode Split																		
ROW #2																		
Segment Name	Path Width	Centerline	Volume (users per hour in 1 direction) and Mode Split							User Perception		Delayed Passings Adjustment				Trail Level of Service		
			Closest 0.5 ft.	0=No Centerline	Volume	Mode Split (%)*					Score	Grade	Adj. Factor (subtract from User Percep. score)				LOS Score	LOS Grade
Name	Width (ft)	1=Centerline	One-Way (per hour)	Adult Bicyclists	Pedestrians	Runners	In-Line Skaters	Child Bicyclists	All Modes	Score	Grade	Percent	# Per Hr	Pre Adj Fac	Fin Adj Fac	Final LOS Score	LOS Score	LOS Grade
	12.0	1	150.0	50.0%	50.0%	0.0%	0.0%	0.0%	100.0%	3.42	C	46.47%	100.04	0.83	0.83	2.59	2.59	D

Figure 3 - Shared Use Path LOS Calculator Results for 300 Users with 50% Pedestrians

Conclusion

In conclusion, Mr. Alexander has not provided any facts or data to support his position that a narrower trail is warranted. He implies the trail demand model was developed with faulty methodology by misstating that certain factors (such as population) are required. He has failed to acknowledge the fact we have addressed this issue, and in fact have stated that other factors appear to be acting as surrogates for population in some models (intersection density, college enrollment) as determined significant in the modeling. We believe it would be inappropriate use of the methodology to use population as a factor if the regression analyses does not show to be significant.

Mr. Alexander is also ignoring the fact that King County has adopted 12 feet width as the MINIMUM STANDARD, for use on a King County Trail, a value below which proper justification must be given. He has provided no such justification and has implied that it would not be harmful to the safety of trail users to operate on a trail varying between 8 and 12 feet throughout the 3.5-mile length of Segment 2B. He has not addressed the fact that 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. The complaints and conflicts would certainly suggest that safety issues will result from the construction of a trail below 12 feet in width given the projected trail volumes.