EXHIBIT NO. 124

November 19, 2017

Sammamish Segment 2B Hearing Examiner Testimony

Outline

INTRODUCTION SLIDE

My presentation will be brief, probably only around 40 minutes. Please stop me with any questions.

First, I want to briefly describe my background which is summarized in my CV (Exhibit 01 ___). I am a registered Civil Engineer in Washington. I have worked for Fehr & Peers, a national transportation planning and engineering firm, for over 10 years and am currently located in our Denver, Colorado office. My professional experience includes the planning and design of on-street bikeways, trails and walkways. My recent project experience includes the design of protected bike lanes in Denver, as well as the development of Denver Moves Pedestrians and Trails, the city's long-range plan for trails which included the development of design guidelines for new trails. Lastly, I have spent much of my career as an instructor to graduate students and other professionals. Last fall I was an Adjunct Lecturer of Pedestrian and Bicycle Planning through the Masters of Urban Planning Program at the University of Colorado, Denver. I am also an instructor of Complete Streets through a continuing education program at the University of California, Berkeley and also through the National Complete Streets Coalition. Complete Streets is an approach to transportation network planning and design that recognizes that we should plan and design for all modes of transportation and for all ages and abilities.

My presentation will make 5 key points focused in 3 areas: first, user volume forecasts for the trail; second, the AASHTO Guide for the Development of Bicycle Facilities (or AASHTO Bike Guide for short); and third, context-sensitive design. For each key point I will provide supporting evidence.

USER VOLUME FORECASTS – Slide 2

Starting with the user volume forecasts, my first key point is that there are still aspects of the user volume forecasts that defy engineering judgment and that do not conform to accepted guidelines.

USER VOLUME FORECASTS – Slide 3

At least three iterations of user volume forecasts have been produced through the history of this project. Most recently, the County provided an amended East Lake Sammamish Trail Demand Analyses memo on November 16, 2017 (Exhibit 02 ___). That memo includes this table. This table shows various user volume forecasts at two different locations on the East Lake Sammamish Trail: at Inglewood Hill Road and at 190th Place SE. For each location 2017, 2030 and 2040 user volume forecasts are provided. The year and location are shown in the left-most highlighted column. The highest annual hourly volume is shown in the middle highlighted column and the 30th highest hourly volume is shown in the right-most highlighted column. Neither the highest annual hourly volume nor the 30th highest hourly volume change between 2017 and 2040.

USER VOLUME FORECASTS – Slide 4

This is despite population forecasts from the Puget Sound Regional Council that show the region growing from 4.2 million residents to 4.9 million residents from 2020 to 2040, a 17 percent increase (Exhibit 03 ___). This lack of sensitivity to population change is primarily due to the variables selected for the Direct Demand Model which do not conform to accepted guidelines, namely National Cooperative Highway Research Program (NCHRP for short) Report 770, the same guidelines cited in Mr. Schultheiss' testimony. Colleagues of mine at Fehr & Peers contributed to this report, including the section on Direct Demand Models.

USER VOLUME FORECASTS – Slide 5

The County's forecasts relied on a Direct Demand Model. This is the definition of a Direct Demand Model according to NCHRP 770 (Exhibit 04 ___).

Their structure is to explain observed levels of bicycle or pedestrian activity on facilities (links) or at intersections (points) as recorded through counts, using a range of factors that describe local context. This is usually done using regression modeling techniques, with the calibrated models then applied back on all or a subset of the sampled system of intersections or links to assess their accuracy in replicating choices.

In simple words, Direct Demand Models are regression equations, where the regression is a correlation between observed count data and data that describes the local context.

USER VOLUME FORECASTS – Slide 6

These are the context variables often used in Direct Demand Models according to NCHRP 770. These variables include population or employment densities, population or employment activity levels within a nominal buffer distance, land use mix, characteristics of the facility, interaction with vehicle traffic, transit availability and major generators.

USER VOLUME FORECASTS – Slide 7

These are the same variables from NCHRP 770 with some in red if they were included in the County's highest annual hourly volume model as described in the East Lake Sammamish Trail Demand Analyses memo dated June 20, 2017 (Exhibit 05 ___). The model used three variables: First, Demographic Characteristics of the Catchment Area, which was presumably applied as a percentage rather than a population number since the forecasts don't change from 2017 to 2040. This is problematic because people create trail use, not a percentage of people. Second, the Trail Experience variable which is most consistent with the Characteristics of the Facility variable from NCHRP 770. And third, "Miles of Trail in the Catchment Area" which does not specifically align with any variables often used according to NCHRP 770.

The model omits several variables often used according to NCHRP 770. This is explained in the amended East Lake Sammamish Trail Demand Analyses memo dated November 16, 2017 (Exhibit 02 ___).

Population in the trail catchment area was not found to be a significant predictor of that particular aggregation of trail volumes. [ed. – referring to the highest annual hourly volumes] *This is not to say that population density does not influence peak hour trail volumes, but that with the sample of data available at the time that the modeling was conducted, other variables were more predictive of peak hour volumes.*

Basically, this suggests that the modelers were unable to draw a strong correlation between the observed highest annual hourly count data and variables often used according to NCHRP 770. The modelers therefore relied on the best-correlated variables, omitting variables with a logical causal relationship. This demonstrates a common issue in statistics: correlation without causation.

The East Lake Sammamish Trail Demand Analyses memo dated November 16, 2017 goes on to say this:

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 worse overly conservative. Likewise, the fact that the forecast volumes do not take into account improvements in bicycle network connectivity, and the light rail extension to Downtown Redmond, despite these being known strong predictors of bicyclist and pedestrian activity, again makes all of the forecast values more conservative.

This statement is inconsistent with how Direct Demand Models work and the County's statements regarding the model's development in two ways.

Again, Direct Demand Models are regression equations, where the regression is a correlation between observed count data and data that describes the local context. The observed count data reflects a variety of trip purposes (people biking to work, people biking to transit, people biking to school, people recreating, etc.). Forecasts from direct demand models therefore inherently reflect the variety of trip purposes captured by the observed count data, such as people biking to transit.

USER VOLUME FORECASTS – Slide 8

Also, including additional variables (such as population, bicycle network connectivity and transit access) in the regression does not automatically increase forecasts.

Shown in blue are two sample regression equations. One with three variables, on the top, similar to the County's model. And another with four variables, on the bottom, in this case where population is added as the forth variable which the County did not do. Each regression equation has the same basic algebraic structure: the forecast equals the natural exponential function (that's e raised to the power of) of the sum of each variable multiplied by its coefficient. Regression establishes the coefficients. That coefficient is multiplied by the variable value at the forecast location. For example, in the bottom equation, the coefficient developed through regression, D, on the right, is multiplied by the population within ½ mile of the trail, so-on-and-so-forth for each of the coefficients and variables.

It is important to note that every time a new variable is added to the regression, the coefficients for the other variables change. In this example, in the regression equation with three variables, on top, those three variables have coefficients X, Y and Z. When you add a new variable, such as population, as shown in the regression equation with four variables, on the bottom, the coefficients for the already-tested variables change. In this case, X is not necessarily equal to A, Y is not necessarily equal to B, and Z is not necessarily equal to C. For these reasons, it is inaccurate to suggest that including population, bicycle network connectivity and transit access variables would automatically increase the user volume forecasts. It's just as likely that the 2040 user volume forecast may be similar to what was already-predicted whereas the 2017 and 2030 user volume forecasts may be reduced.

USER VOLUME FORECASTS – Slide 9

My next key point is this: Even if we accept the user volume forecasts as-is, the 30th highest hourly volume forecasts are right at the 300 users per hour threshold. Not two- or three-times the threshold, but exactly at the threshold.

USER VOLUME FORECASTS – Slide 10

In the County's testimony, it was suggested that the 30th highest hourly volume is an appropriate design volume. I agree with this suggestion and this suggestion is consistent with other guidance from AASHTO, in this case A Policy on Geometric Design of Highways and Streets (the AASHTO Green Book for short), which states (Exhibit 06 ___):

It is recommended that the hourly traffic volume that should generally be used in design is the 30th highest hourly volume.

USER VOLUME FORECASTS – Slide 11

Again, here is the same table from the amended East Lake Sammamish Trail Demand Analyses memo from November 16, 2017 (Exhibit 02 ___), which shows user volume forecasts at Inglewood Hill Road and 190th Place SE in 2017, 2030 and 2040. The 30th highest hourly volume is shown in the right-most highlighted column.

The County's consultant used the relationship between the highest annual hourly volume and the 30th highest hourly volume at observed trail count locations to estimate the 30th highest hourly volume on the East Lake Sammamish Trail Segment 2B. They found that the 30th highest hourly volume is 300 users per hour at 190th Place SE (an approximate mid-point of Segment 2B). This is exactly the recommended threshold for trail widening in the AASHTO Bike Guide. In all of the County's previous analysis through June 20, 2017, this location had been identified as the location representative of Segment 2B.

The 340 users per hour forecast near Inglewood Road (at the north end of Segment 2B) is obviously higher than the 300 users per hour, but it is in the ballpark of the 300 users per hour number and I will address this separately when I discuss the AASHTO Bike Guide and context-sensitive design. What is important to recognize is that neither of these numbers are close to the 600-700 users per hour numbers, the highest annual hourly volume shown in the middle highlighted column, previously used by the County to suggest that trail widening is necessary

AASHTO Bike Guide – Slide 12

Key point: The AASHTO Bike Guide uses specific language to make it clear when the guidelines are flexible and inflexible.

AASHTO Bike Guide – Slide 13

From Mr. Schultheiss' testimony, it could be concluded that he was the only contributing author to the AASHTO Bike Guide. I know that he was a contributing author on behalf of the project team, which is admirable. However, it is important to recognize that the AASHTO Bike Guide is written through a committee process. This committee process includes a panel of experts through the National Cooperative Highway Research Program process (again, NCHRP for short). Professionals representing many organizations review and comment on the language included in this guide. The guide is developed this way to ensure a high degree of consensus in the guide's recommendations. On the right, this slide shows the NCHRP Panel of 12 people that oversaw the AASHTO Bike Guide's development (Exhibit 07 ___). This slide is from an August 10, 2012 Webinar sponsored by the Pedestrian and Bicycle Information Center, an FHWA-sponsored research center at the University of North Carolina. That Webinar was entitled AASHTO Bike Guide: Overview of Revised *AASHTO Guide for the Development of Bicycle Facilities*. I'll also point out that Matthew Ridgway, a member of the Project Team in the left column, is a Principal at my firm, Fehr & Peers.

AASHTO Bike Guide – Slide 14

Jennifer Toole, the Principal Investigator for the AASHTO Bike Guide and the founder and President of Toole Design Group, Mr. Schultheiss' employer, delivered much of this webinar including the introductory slides. In this Webinar, Ms. Toole states that:

"...we launched the preparation of the content of the 4th edition. And that was overseen by a panel of experts..." Here, she is referring to the AASHTO Bike Guide.

"Folks from all over the United States were involved, from all different kinds of backgrounds."

Simply stated, the words in the AASHTO Bike Guide are chosen for a reason and those words matter. Those words are chosen by a panel of experts so that the AASHTO Bike Guide can be clearly applied by professionals throughout the United States. The panel of experts do not write the AASHTO Bike Guide in a way such that its participating authors are required to opine as to how the Guide's language was intended to apply when otherwise un-written in the Guide.

AASHTO Bike Guide – Slide 15

I understand that Mr. Schultheiss' testimony suggested that because AASHTO design guidelines are adopted by the City of Sammamish as standards, there is less flexibility in applying these guidelines. This is not true.

In that same Webinar, Ms. Toole also explains that the Guide is written as a set of guidelines and that those guidelines provide flexibility. She states:

"I do want to point out that it is a guideline. It is not a standard. And that's, I think, a very important thing to understand. The Bike Guide does not use words like shall or must; it uses words like should or may. And so, there is a lot of flexibility in the design guidance it provides."

So, if a city adopts these guidelines as their standard, as Sammamish has done, they also inherently adopt the flexibility provided within those guidelines as their standard.

AASHTO Bike Guide – Slide 16

Key point: based on the user volume forecasts and the flexibility provided by the AASHTO Bike Guide's language, it is consistent with the AASHTO Bike Guide to build a 12-foot paved trail where physical constraints do not exist. However, it is also consistent with the AASHTO Bike Guide to build a narrower trail where physical constraints do exist.

AASHTO Bike Guide – Slide 17

Again, the words in the AASHTO Bike Guide are chosen for a reason and these words matter. These words are chosen by a panel of experts so that the AASHTO Bike Guide can be clearly applied by professionals throughout the United States. And, these words are chosen carefully to make it clear what level of flexibility is available to designers. Here is what the AASHTO Bike Guide says about trail width (my own emphasis added); AASHTO Bike Guide Chapter 5 was included as Exhibit XX ___ by the County and this is on Page 5-3:

*The minimum paved width for a two-directional shared use path **is** 10 ft* – this is a relatively inflexible statement. With no more information about a trail's user volume, user profile or physical constraints, a 10 ft trail is consistent with the AASHTO Bike Guide.

*A path width of 8 ft **may be used** for a short distance due to a physical constraint such as an environmental feature, bridge abutment, utility structure, fence, and such* – this is a flexible statement. It is up to the designers to determine what qualifies as a short distance or as a physical constraint, and the list of physical constraints is left open-ended with the words "and such". A trail width of 8 ft is consistent with the AASHTO Bike Guide in these circumstances, independent of its volume.

*Wider pathways, 11 to 14 ft **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)* – this is a flexible statement. Wider trails are recommended in this situation; however, this recommendation does not supersede the other guidance for trail width. It does not mean that trail widths of less than 11-feet in these circumstances are inconsistent with the Guide. The Guide's panel of experts could have decided to make an inflexible statement such as "The minimum paved width for a two-directional shared use path with high user volumes ***is*** 12-feet", but they did not.

This language is included this way so that a narrower trail can be built where physical constraints exist and still be consistent with AASHTO guidelines, a point made in Mr. Schultheiss' testimony that I agree with.

AASHTO Bike Guide – Slide 18

Again, the words in the AASHTO Bike Guide are selected by a panel of experts for a reason and those words matter. Based on his testimony, Mr. Schultheiss and I both agree that a narrower trail is justified when physical constraints exist, independent of its volume. However, where we disagree is on the definition of physical constraints. In his testimony, Mr. Schultheiss suggested that the intended interpretation of physical constraints is those that are: really challenging to move, really expensive, a property line that you can't purchase the land and a wetland with no way to mitigate. The Guide and its panel of experts could have decided to say these things, however, they chose to say none of these things. Instead, the Guide states:

A path width of 8 ft may be used for a short distance due to a physical constraint such as an environmental feature, bridge abutment, utility structure, fence, and such.

This leaves it to design professions to judge for themselves through a context-sensitive design process what constitutes a physical constraint.

AASHTO Bike Guide – Slide 19

They did not provide such specificity regarding physical constraints to leave room for flexibility. A reason for this is explained in the Introduction to the AASHTO Bike Guide (Exhibit 08 ___). The Guide states:

Sufficient flexibility is permitted to encourage designs that are sensitive to local context and to incorporate the needs of bicyclists, pedestrians, and motorists.

So, that flexibility is provided so that we, as professionals, can design in a way that is sensitive to local context. Context is a broad term, but certainly includes aspects of the environment and property. The Guide goes on to say:

However, in some sections of the guide, suggested minimum dimensions are provided. These are recommended only where further deviation from desirable values could increase crash frequency or severity.

So, we must take seriously the interpretation and application of minimum dimensions as written within the Guide. The amount of flexibility given by the Guide's language is an indication of how much deviating from desirable values is likely to result in safety issues. That's why it's relatively inflexible in regards to 10-foot widths (with the exception for 8-foot widths in short distances), but is more flexible when it *recommends* wider trails when user volumes are high.

Context-sensitive Design – Slide 20

Which brings me to my last key point: A context-sensitive design process would conclude that the trail can be narrowed without causing disproportionate safety effects. Additionally, accepted guidelines support widening only selected trail segments and widening in 1-foot rather than 2-foot increments.

Context-sensitive Design – Slide 21

First, it's helpful to provide a definition for context-sensitive design. In this case, I will rely on a definition of context-sensitive solutions, effectively the same thing, from the Washington Department of Transportation (Exhibit 09 ___). In a Secretary's Executive Order, they define context-sensitive solutions as follows.

Its essence is that a proposed transportation project must be planned not only for its physical aspects as a facility serving specific transportation objectives, but also for its effects on the aesthetic, social, economic, and environmental values, needs, constraints, and opportunities in a larger community setting.

Again, in its introduction, the AASHTO Bike Guide states that *sufficient flexibility is permitted to encourage designs that are sensitive to local context.*

Context-sensitive Design – Slide 22

I understand that Mr. Schultheiss' testimony took the position that a statement I made is not an engineering opinion because it cannot be verified with data or analysis. This statement is from my September 25, 2017 letter which reviewed the trail demand analyses and the trail width.

As engineers, we strive to design facilities to meet guidelines whenever possible. However, it frequently occurs that meeting all desirable guidelines comes at a great cost and results in other impacts including to private property, environmental resources or other resources. When this occurs, we make case-by-case decisions whereby we weigh the costs (dollars, property, environment, etc.) against the risks (safety, level of service, etc.).

This may not be an opinion that can be verified with data or analysis. But, if you speak with a number of reasonable, experienced engineers, you will hear that this is an inherent part of a context-sensitive design process and that this is a reality to applying flexible design guidelines within an imperfect world full of constraints. They would probably add a few important details. First, we often do this through an alternatives analysis process so we can understand the relative costs and risks. Second, engineers do not make these decisions in a vacuum. Instead, we work with other experts to understand costs and risks to other resources such as the environment and property. Third, safety is paramount in all of the decisions that we make. When I say paramount, I mean that we do not make any engineering decisions without first considering the safety effects of that decision. As engineers, applying flexible design guidelines within an imperfect world full of constraints often means that marginally less safe options are chosen so as to not create disproportionate impacts to other resources. However, we obviously design to avoid instances where by not impacting those resources we will create a disproportionately negative safety effect.

Context-sensitive Design – Slide 23

As a part of this context-sensitive design process, it is helpful to estimate trail Level of Service to inform whether or not narrowing the trail is creating disproportionately negative safety effects. For this analysis, I'm using the Shared-use Path Level of Service Calculator referenced by the AASHTO Bike Guide and by Mr. Schultheiss in his testimony.

I agree with Mr. Schultheiss' testimony that this Calculator is an appropriate resource. This Calculator uses six levels of service categories and the letters A through F to represent them, from best to worst. However, Mr. Schultheiss omitted several important details in the Shared-use Path Level of Service Calculator that are important to point out. The Shared-use Path Level of Service Calculator user's guide (Exhibit 10 ____) states the following in describing its methodology:

- *Maintaining an optimum speed (for the bicyclist) is a key criterion.*
- *Service measures are primarily related to freedom to maneuver. These include meetings, active passes, delayed passes, and the perceived ability to pass.*
- *Safety is not included in the set of measures that establish service levels.*

To be clear, the methodology does not measure safety itself. It primarily measures bicyclist speed and freedom to maneuver, which is represented by the percentage of delayed passings that bicyclists experience on a trail segment. For example, if you were riding your bike on a trail and wanted to pass a slower bicyclist but had to slow down and wait because of oncoming users and limited space, you are experiencing a delayed passing.

It is reasonable to suggest that bicyclist freedom to maneuver is a proxy for certain safety issues. However, there is no commonly accepted threshold for how much change in bicyclist freedom to maneuver constitutes a substantial safety effect; that is subject to engineering judgment.

Context-sensitive Design – Slide 24

The Shared-use Path Level of Service Calculator user's guide also provides guidance for how to interpret Level of Service grades.

LOS A: Excellent. Trail has optimum conditions for individual bicyclists...

LOS C: Fair. Trail has at least minimum width to meet current demand...

LOS D: Poor. Trail is nearing its functional capacity.

LOS E: Very Poor. ...the trail has reached its functional capacity.

LOS F: Failing. Trail significantly diminishes the experience for at least one, and most likely for all user groups.

Note that LOS D is described as a trail nearing its functional capacity and LOS E is a trail at its functional capacity. It is not until LOS F that the trail is failing.

Context-sensitive Design – Slide 25

It is critical to understand how the 300 users/hour threshold identified in the AASHTO Bike Guide relates to trail Level of Service. To better understand this relationship, I ran some calculations using the Calculator available from FHWA's Web site. Here are three scenarios that help us define the relationship between user volumes and Level of Service.

In this table, I state my assumptions regarding trail width and user volume in the second column. The third column shows the percent of delayed passings experienced by bicyclists on this trail. The forth column shows the resulting Level of Service. Each of the trails on this slide are 10-feet wide.

The first trail has 190 users per hour. This results in Level of Service C, and 66 percent delayed passings. This is the threshold between LOS C and LOS D, which means that adding user volume to this trail will change the LOS from LOS C to LOS D.

The second trail has 310 users per hour. This results in Level of Service D, and 82 percent delayed passings. This is the threshold between LOS D and LOS E.

The third trail has 320 users per hour. This results in Level of Service E, and 83 percent delayed passings. This shows that we have passed the threshold from LOS D to LOS E.

This analysis shows that the 300 users/hour recommended in the AASHTO Bike Guide corresponds approximately to the threshold between LOS D and LOS E.

I want to be clear that the 300 users per hour number in the AASHTO Bike Guide is an approximation based on the threshold between LOS D and LOS E. It reality, change to trail LOS occurs incrementally as user volumes increase. It's not as if a trail operating fine at 299 users per hour turns into a safety hazard at 300 users per hour. In reality, a trail at the threshold between LOS D and LOS E is near or at its capacity and marginal volume increases result in a commensurate change to trail Level of Service.

Context-sensitive Design – Slide 26

Mr. Schultheiss indicated in his testimony that the AASHTO Bike Guide recommends designing to LOS C. That is not correct. The AASHTO Bike Guide does not make a recommendation for design Level of Service for trails. I believe Mr. Schultheiss was thinking of this statement from the Shared-use Path Level of Service Calculator user's guide which states:

In general, grades A-C can be considered acceptable levels of service and D-F can be considered degraded levels of service.

Each political jurisdiction and trail managing agency certainly has latitude to adopt different policies covering acceptable levels of service for trails within their own communities.

Again, as I just showed, the 300 users per hour number corresponds to the threshold between LOS D and LOS E, not a LOS C. And, the Shared-use Path Level of Service Calculator user's guide makes it clear that design Level of Service is a local policy decision, not something mandated by AASHTO.

Context-sensitive Design – Slide 27

Let me now address the proposed East Lake Sammamish Trail and specifically whether a change in bicyclist freedom to maneuver constitutes a substantial safety effect that justifies disproportionately impacting other resources.

This table is arranged just like the previous table, the second column includes my assumptions regarding trail width and user volume, the third column shows the percent of delayed passings experienced by bicyclists and the forth column shows the resulting Level of Service. Again, each of the trails on this slide are 10-feet wide.

The first trail has 260 users per hour. This results in Level of Service D, and 80 percent delayed passings. This is the threshold between LOS D and LOS E. This is different from my previous slide because I'm now assuming a mode split for the East Lake Sammamish Trail based on the forecasts provided by the County that is different from the default mode split.

The second trail has 300 users per hour, the same user volume forecast as the East Lake Sammamish Trail Segment 2B. This results in Level of Service E, and 84 percent delayed passings.

The third trail has 340 users per hour, the same user volume forecast as the East Lake Sammaish Trail at Inglewood Hill Road. This results in Level of Service E, and 87 percent delayed passings.

So, at its forecasted user volumes of 300 to 340 users per hour, a 10-foot trail would add to delayed passings by 4 to 7 percentage points over a trail at the threshold between LOS D and LOS E. This is a marginal effect and it is not reasonable to suggest that disproportionate safety effects will result from this change; therefore, this justifies the AASHTO Bike Guide's language that the minimum width for a two-directional shared use trail is 10-feet.

Context-sensitive Design – Slide 28

I also analyzed an 8-foot trail at 300 users per hour. That resulted in a Level of Service F, suggesting that a trail with 300 to 340 users per hour will result in an effect that is more than marginal. This justifies the AASHTO Bike Guide's language that an 8-foot trail only be used for a short distance.

Context-sensitive Design – Slide 29

In the interest of full disclosure, I also analyzed an 11-foot and a 12-foot trail at 300 users per hour. Both resulted in LOS C and 35 percent delayed passings. However, the Shared-use Path Level of Service Calculator user's guide is clear that each jurisdiction has latitude to adopt difference policies covering acceptable levels of service for trails. Note that there is no effect to delayed passings of an 11-foot trail compared to a 12-foot trail.

Context-sensitive Design – Slide 30

The Shared-use Path Level of Service Calculator user's guide further explains how trail width can be varied on selected segments to improve LOS for trail users, and supports thinking about wider trails in 1-foot rather than 2-foot increments to contain costs and minimize environmental impacts. It states:

During design of new trails and widening of existing trails, designers may want to consider varying the trail width to achieve LOS goals in key locations but not overbuild in other locations. Adding width to improve LOS is valuable to trail users, even if it is provided only on selected segments.

When considering wider trails, designers and decision makers may want to think in 1-ft, rather than 2-ft increments. Typical practice has been to consider widths in 2-ft increments. Using this approach may miss opportunities to provide measurable increases in LOS while at the same time containing costs and minimizing environmental impacts.

So, not only are 10-ft and 8-ft trails consistent with the AASHTO Bike Guide, but their existence intermittently on the East Lake Sammamish Trail with an 11-foot or 12-foot trail between them would not result in as much of a degraded condition as if the trail were 10-feet or 8-feet for its entire length.

Context-sensitive Design – Slide 31

This figure shows how it's likely to feel if you're actually biking along the East Lake Sammamish Trail. This figure shows 11- and 12-foot wide trail segments in green, 10-foot wide segments in purple and 8-foot wide segments in orange. If you were biking from left to right, you would start on Segment A (an 11- or 12-foot wide segment), experiencing a facility with relatively high freedom to maneuver and you would generally be able to pass. When you get to Segment B (a 10-foot wide segment), you will most likely have to wait to pass. But, once you get onto Segment C (an 11- or 12-foot wide segment), you would again have relatively high freedom to maneuver, so-on-and-so-forth for Segments D and E. A reminder that you would experience these conditions during the 30th highest hourly volume, probably the busiest hour of a day, while during the other 23 hours of that day you would have higher freedom to maneuver.

This is how intermittent 10-foot and 8-foot segments of the East Lake Sammamish Trail with an 11-foot or 12-foot trail between them would not result in as much of a degraded condition as if the trail were 10-feet or 8-feet for its entire length.

It's also worth pointing out that the time that a bicyclist has to wait to pass depends on the length of the trail segment. At 12.8 miles per hour, an average bicyclist's speed according to the Shared-use Path Level of Service Calculator user's guide, and within the range identified by the AASHTO Bike Guide, a bicyclist would cover a 100-foot trail segment in 5 seconds and a 500-foot trail segment in 26 seconds.

In Summary – Slide 32

In summary, I will restate my key points:

There are still aspects of the user volume forecasts that defy engineering judgment and that do not conform to accepted guidelines.

In Summary – Slide 33

Even if we accept the user volume forecasts as-is, the 30th highest hourly volume forecasts are right at the 300 users per hour threshold. Not two- or three-times the threshold, but exactly at the threshold.

In Summary – Slide 34

The AASHTO Bike Guide uses specific language to make it clear when the guidelines are flexible and inflexible.

In Summary – Slide 35

Based on the user volume forecasts and the flexibility provided by the AASHTO Bike Guide's language, it is consistent with the AASHTO Bike Guide to build a 12-foot paved trail where physical constraints do not exist. However, it is also consistent with the AASHTO Bike Guide to build a narrower trail where physical constraints do exist.

In Summary – Slide 36

A context-sensitive design process would conclude that the trail can be narrowed without causing disproportionate safety effects. Additionally, accepted guidelines support widening only selected trail segments and widening in 1-foot rather than 2-foot increments.

Conclusion – Slide 37

In consideration of my key points, these are my conclusions and my recommendations to the City:

Where physical constraints do not exist, a 12-foot trail is desirable given the forecasted user volumes and mode split. This is consistent with the AASHTO Bike Guide. However, it is not consistent with the AASHTO Bike Guide to suggest that narrower trail widths are unallowable.

So, where physical constraints do exist:

An 11-foot trail is consistent with the AASHTO Bike Guide and has nearly no effect to trail LOS compared to a 12-foot trail. It is not reasonable to cause disproportionate impacts to other resources if they can be avoided with an 11-foot trail.

A 10-foot trail is consistent with the AASHTO Bike Guide and has a marginal effect to trail LOS. This should be considered the minimum trail width for long distances of the trail.

An 8-foot trail is consistent with the AASHTO Bike Guide but has a more than marginal effect to trail LOS. Therefore, this should only be applied for short distances.

Lastly, accepted guidance suggests that trail widening only on selected segments is valuable to trail users, further supporting intermittent 10-foot and 8-foot trail segments with 11- or 12-foot segments between them.