City of Bellevue

Transportation Commission Study Session

DATE: January 28, 2016

TO: Chair Lampe and Members of the Transportation Commission

FROM: Franz Loewenherz, Senior Transportation Planner, 425-452-4077
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SUBJECT: Bellevue Pedestrian and Bicycle Implementation Initiative

DIRECTION REQUESTED

	Action
X	Discussion
X	Information

Staff will provide the Transportation Commission with conceptual layouts for Bellevue's priority bicycle network corridor segments. Additional information will be shared on the proposed Rapid Implementation Program (RIP) that addresses the Task 2 deliverable in the City of Bellevue's Pedestrian and Bicycle Implementation Initiative (PBII) Scope of Work. Task 2 was introduced to the Transportation Commission at its December 10, 2015 meeting.

At its January 28 workshop, staff will invite Commissioners to review and discuss two topics — (1) travel lane width design flexibility and (2) conceptual layouts for the package of RIP candidate projects. No specific action is requested from the Commission at this time.

An additional Transportation Commission workshop is scheduled for February 25th to review the remaining corridors not addressed at the January 28th workshop. Additional topics for the February workshop include providing planning level cost estimates (both capital and operating) for the RIP proposed projects and conversing with the Commission on an engagement strategy for community input during March-April 2016. Per Council direction, the Pedestrian and Bicycle Implementation Initiative has a strategic goal of engaging the community "at the earliest stages of scope development to ensure their input is included in project design."

BACKGROUND

At your December 10 meeting, staff provided the Transportation Commission an overview of a potential Rapid Implementation Program (RIP) budget proposal to advance the City of Bellevue's Priority Bicycle Corridors (see page 92 of the 2009 Pedestrian and Bicycle Transportation Plan) with facilities that are connected, protected, and can be implemented rapidly. If realized, the city would achieve its goal established in the 2009 Plan to within ten years, implement at least two completed, connected, and integrated north-south and at least two east-west bicycle routes that connect the boundaries of the city limits.

The potential RIP budget proposal is – by virtue of its focus on early-win opportunities – targeting lower-cost on-street bicycle facility projects involving paint, signage, and delineator posts rather than more expensive off-street, raised, or curb-separated bicycle facilities. This least-cost planning approach allows flexibility and freedom to innovate, and considers incremental solutions that set the right-foundation for longer-term solutions.

At your December 10, 2015 meeting, Commissioners requested additional information on research associated with the use of narrower travel lanes than 11 feet, specifically related to roadway safety and capacity considerations (see Attachment A). Staff will expand upon this information at the January 28th Transportation Commission workshop, seeking consensus that travel lanes narrower than 11 feet are an acceptable roadway design element when considering accommodations for bicycles.

The main focus of the January 28th workshop will be to review the conceptual layouts for the many corridors where narrower travel lanes were deemed appropriate from an engineering judgement perspective in the potential RIP budget proposal. The majority of the presentation will be spent reviewing the candidate projects individually.

INFORMATION

Although the Rapid Implementation Program (RIP) proposal aims to promote separated on-street bicycle facilities there will be instances where realizing a physically separated treatment falls outside the parameters suggested in the WSDOT Design Manual (November 2015) Bicycle Facility Selection Chart (see Exhibit 1520-6a) or there may be operational or context related constraints (e.g., limited paved width). As such, the potential RIP proposal will be a combination of one of the following types of roadway bicycle facilities that, when taken together, creates a connected network:

- Separated Buffered Bike Lane (aka Protected Bike Lane) – At grade with the roadway, they include a bike lane, a buffer area, and some type of vertical feature that reduces the likelihood of encroachment into the bike lane by motor vehicles and increases user comfort. [Note: As indicated in research by the National Institute for Transportation and Communities, a bike lane separated from cars by a "2-3 foot buffer with plastic flex-posts" makes people feel more comfortable biking than anything else except a row of planters.]

- On-Street Buffered Bike Lanes – The design is effectively the same as a separated buffered bike lane without the use of vertical separators.
- Conventional On-Street Bike Lanes – At grade and adjacent to motor vehicle traffic lane and are designated by a single solid wide stripe between the motor vehicle lane and bike lane.
- Shared Lane Markings – Pavement markings (aka "sharrows") specifically used to indicate a shared lane or intersection space.
- Neighborhood Greenways – Streets with low motorized traffic volumes and speeds, designated and designed to give bicycle travel priority. Neighborhood greenways use signs, pavement markings, and speed and volume management measures to discourage through trips by motor vehicles and create safe, convenient bicycle crossings of busy arterial streets.

At your December 10 meeting, staff also shared the FHWA Separated Bike Lane Planning and Design Guide (May 2015) which highlights how jurisdictions nationwide are implementing safer and more comfortable facilities for "interested but concerned cyclists" thereby making bicycling a more widespread and mainstream means of transportation. The FHWA Guide consolidates lessons learned from practitioners and researchers "while still recognizing that our understanding of this facility type is still evolving and that there is a need for design flexibility."

RECOMMENDATION

No recommendation is brought forward at this time – for discussion only.

NEXT STEPS

An additional Transportation Commission workshop is scheduled for February 25th to review the remaining corridors not addressed at the January 28th workshop. Additional topics for the February workshop include providing planning level cost estimates (both capital and operating) for the RIP proposed projects and conversing with the Commission on an engagement strategy for community input during March-April 2016. Per Council direction, the Pedestrian and Bicycle Implementation Initiative has a strategic goal of engaging the community "at the earliest stages of scope development to ensure their input is included in project design."

ATTACHMENTS

1. Attachment A – Memo on Travel Lane Width Flexibility (January 6, 2016)

BELLEVUE PEDESTRIAN & BICYCLE IMPLEMENTATION INITIATIVE

ATTACHMENT A

DATE: January 6, 2016

TO: Members of the Transportation Commission

FROM: Franz Loewenherz, Senior Transportation Planner
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SUBJECT: December 10, 2015 Meeting Follow-up: Travel Lane Width Flexibility

PURPOSE

At your December 10, 2015 meeting, Commissioners requested additional information on research associated with the use of narrower travel lanes than 11 feet, specifically related to roadway safety and capacity considerations (see Attachment 1).

BACKGROUND

At your December 10 meeting, staff provided the Transportation Commission an overview of a potential Rapid Implementation Program (RIP) budget proposal to advance the City of Bellevue's Priority Bicycle Corridors (see page 92 of the 2009 Pedestrian and Bicycle Transportation Plan) with facilities that are connected, protected, and can be implemented rapidly. Consistent with Bellevue City Council guidance for the Pedestrian and Bicycle Implementation Initiative (PBII) scope of work, this Connected, Protected, Rapid (CPR) theme is defined as follows:

- **C**onnected: Prioritizes a connected network that "fills the gaps" in lieu of piece-meal implementation.
- **P**rotected: Promotes physically separated facilities to minimize conflicts between roadway users where possible.
- **R**apid: Identifies early-win opportunities that can be implemented quickly to advance project delivery.

The potential RIP budget proposal is – by virtue of its focus on early-win opportunities – targeting lower-cost on-street bicycle facility projects involving paint, signage, and delineator posts rather than more expensive off-street, raised, or curb-separated bicycle facilities. This least-cost planning approach allows flexibility and freedom to innovate, and considers incremental solutions that set the right-foundation for longer-term solutions.

Although the RIP proposal aims to promote separated on-street bicycle facilities there will be instances where realizing a physically separated treatment falls outside the parameters suggested in the WSDOT Design Manual (November 2015) Bicycle Facility Selection Chart (see Exhibit 1520-6a) or there may be operational or context related constraints (e.g., limited paved width). As such, the potential RIP proposal will be a combination of one of the following types of roadway bicycle facilities that, when taken together, creates a connected network:

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At your December 10 meeting, staff also shared the FHWA Separated Bike Lane Planning and Design Guide (May 2015) which highlights how jurisdictions nationwide are implementing safer and more comfortable facilities for "interested but concerned cyclists" thereby making bicycling a more widespread and mainstream means of transportation. The FHWA Guide consolidates lessons learned from practitioners and researchers "while still recognizing that our understanding of this facility type is still evolving and that there is a need for design flexibility."

INFORMATION

Like many local jurisdictions with highly developed urban areas, the City of Bellevue often finds expanding the curb-to-curb width of a roadway very expensive. Therefore, where roadway space is limited and design considerations allow, the RIP aims to implement pilot projects rapidly, by reducing lane width for motor vehicles and allocating the pavement space to cyclists.

By relying on a "design-up" approach – starting with minimal design element dimensions and increasing those values until acceptable cost-effective performance is obtained – the RIP budget proposal has the potential to create a safe and comfortable network of bicycle facilities with the most reasonable low-cost solution to meet that need. This strategy is consistent with WSDOT Design Manual guidance – Chapter 1106 – Design Element Dimensions (November 2015) which references the following example as a design-up approach: "A prioritized bicycle mobility and safety performance target may result in reducing motor vehicle lane widths in order to provide a needed bike lane width." By minimizing the scope of work for each RIP project proposal system-wide CPR needs can be optimized through individual project savings.

The WSDOT report Understanding Flexibility in Transportation Design (April 2005) documents considerations (e.g., access control, geometry, operating/posted speeds, contexts, users, design levels, design speed, facility alignment, sight distance, cross-section) affecting an engineer's decision to make roadway adjustments. While these factors are important considerations, especially along rural or high speed roadways (50+ mph), reducing lane widths on urban arterials to accommodate bicycle facilities is in keeping with best practices as outlined in the United States Government Accountability Office's report on Pedestrians and Cyclists: Cities, States, and DOT Are Implementing Actions to Improve Safety (November 2015) which states:

"According to FHWA officials, the purpose and goal of street design in the United States for decades was, in general, to move motor vehicles from their origins to their destinations as expeditiously as possible, and this design may have overlooked the needs of pedestrians and cyclists. Design efforts such as widening lanes or minimizing sharp curves may have contributed to motorist safety, but may also have contributed to declines in pedestrian and cyclist safety. Wider, straighter highways could lead to motorist speeding, which not only increases the likelihood of crashes with a pedestrian or cyclist, but also the probability that those crashes will cause death or a serious injury. More recently, however, transportation agencies are beginning to focus on ensuring that roads provide safe mobility for all travelers, not just motor vehicles. To do so, transportation agencies may install facilities specific to pedestrian and cyclist use, such as separated bike lanes, which can make road users feel safer. For example, according to FHWA's Separated Bike Lane Planning and Design Guide, since separated bike lanes are physically separated from vehicular traffic, almost all cyclists report feeling safer as a result of the separation."

As reflected in the report Accommodating Bike Lanes in Constrained Rights-of-Way, the Association of Pedestrian and Bicycle Professionals identifies the many transportation agencies nationwide already moving in this direction, utilizing design flexibility and engineered solutions to maximize multimodal benefits while minimizing costs. Narrowing lane widths reduces costs, a critical issue in times of shrinking budgets: smaller right-of-way costs, reduced costs for utility easements, reduced construction costs, reduced environmental mitigation costs. Accommodating more users in less space also addresses critical environmental issues: narrower lanes means less pavement (asphalt or concrete), less runoff, and less land consumed.

At your December 10 meeting, staff made reference to narrowing travel lanes as a relatively simple and cost-effective way to integrate bicycle users into the design and operation of the City of Bellevue's transportation system and that this approach is consistent with existing Federal guidance, including:

- In the design of urban arterials section, the AASHTO Green Book states, "lane widths may vary from 10-feet to 12-feet." AASHTO also states, "Major improvement of existing arterials can be extremely costly, particularly where additional rights-of-way need to be acquired through highly developed areas. Accordingly, it is often necessary to use design values that are less than desirable and below the design values that are used where sufficient right-of-way is available or can be acquired economically."
- In Bicycle and Pedestrian Funding, Design, and Environmental Review: Addressing Common Misconceptions (August 2015), FHWA notes that a number of common misconceptions have been raised about the use of Federal funding, street design, and the environmental review process that can cause confusion and result in project delay. According to FHWA, lanes don't have to be at least 11 feet wide on the National Highway System or at least nine feet wide on local roads; indeed: "There is no minimum lane width requirement to be eligible for Federal funding." FHWA refers to

blanket adherence to typical lane-width standards as "nominal safety," but using engineering judgment based on the particular circumstances as "substantive safety," urging engineers to practice the latter. Also: "In appropriate contexts, narrower lanes, combined with other features associated with them, can be marginally safer than wider lanes."

- In Bicycle and Pedestrian Provisions of Federal Transportation Legislation (September 2015) FHWA encourages jurisdictions: "Restriping roads, either as a stand-alone project or after a resurfacing or reconstruction project, to create striped bike lanes." And, the U.S. Department of Transportation Mayor's Challenge contains seven key strategies to improve pedestrian and bicycle safety, including Challenge Activity 5 calling for "improving existing roads and facilities to build biking and walking networks as part of regular and routine resurfacing and other maintenance programs."
- In Revision of Thirteen Controlling Criteria for Design; Notice and Request for Comment (October 2015) FHWA began accepting comments to proposed revisions that would streamline its 13 controlling criteria for design, the geometric design standards for projects on the National Highway System (NHS). When the criteria are not met, a formal exception must be obtained from the FHWA for each variance. The proposed revisions – informed by National Cooperative Highway Research Program (NCHRP) Report 783 – acknowledge that although the controlling criteria have a significant impact on safety and operations on high-speed roadways, those impacts are not seen on streets with speed limits below 50 mph. Because of this, roadways with speed limits of less than 50 mph would now have to meet only two criteria – design loading structural capacity and design speed – if the changes are implemented. These changes would make it easier for engineers to design NHS projects more attuned to local priorities; related to the lane width criteria, NCHRP Report 783 notes: "On roadways with speeds of 45 mph or less, there are often good reasons for using narrow lanes as a flexibility measure to obtain other benefits: shorter pedestrian crossing distances, inclusion of turn lanes, medians, bicycle lanes, etc."

CONCLUSION

Staff will expand upon this information at the January 28th Transportation Commission workshop, seeking consensus that travel lanes narrower than 11 feet are an acceptable roadway design element when considering accommodations for bicycles. The main focus of the January workshop will be to review the preliminary design concepts for the many corridors where narrower travel lanes were deemed appropriate from an engineering judgement perspective in the potential Rapid Implementation Program budget proposal.

An additional Transportation Commission workshop is proposed for February 25th to review the remaining corridors not addressed at the January 28th workshop. Additional topics for the February workshop include providing planning level cost estimates (both capital and operating) for the RIP proposed projects and conversing with the Commission on an engagement strategy for community input during March-April 2016. Per Council direction, the Pedestrian and Bicycle Implementation Initiative has a strategic goal of engaging the community "at the earliest stages of scope development to ensure their input is included in project design."

ATTACHMENT 1
REFERRENCES ON LANE WIDTH RESEARCH

EFFECT OF LANE WIDTH ON TRAFFIC SAFETY

National Association of City Transportation Officials (NACTO). Urban Street Design Guidelines. 2013.

Dave Berg, Transportation Director, endorsed the Urban Street Design Guidelines as a standard application for the City of Bellevue (see letter). NACTO states: "Lane widths of 10 feet are appropriate in urban areas and have a positive impact on a street's safety without impacting traffic operations."

Eric Dumbaugh and Wenhao Li. "Designing for the Safety of Pedestrians, Cyclists, and Motorists in Urban Environments." Journal of the American Planning Association. 2011.

In urban environments, crash avoidance often requires drivers to be able to brake quickly in response to another roadway user entering the right-of-way. In such conditions, design elements like wide lanes, wide shoulders, and roadside clear zones may exacerbate crash risk, since all lead to higher vehicle operating speeds.

Ingrid Potts, Douglas Harwood, and Karen Richard. "Relationship of Lane Width to Safety on Urban and Suburban Arterials." Transportation Research Board 86th Annual Meeting. 2007.

The authors state "the conventional wisdom of most highway engineers is that use of narrower lanes in the design of a roadway will result in more crashes if other design characteristics of the roadway remain unchanged. This has been demonstrated for lane widths on rural two-lane highways, but there is no definitive research on the safety effect of lane widths for urban and suburban arterials."

This comprehensive study analyzed over 3,000 roadway segments where lane widths varied from nine to thirteen feet. Over 20,000 crashes occurring on these roadway segments during a 5-year period were evaluated.

Comparing 10- to 11-foot lanes to 12-foot lanes, it found: "A safety evaluation of lane widths for arterial roadway segments found no indication, except in limited cases, that the use of narrower lanes increases crash frequencies. The lane widths in the analyses conducted were generally either not statistically significant or indicated that narrower lanes were associated with lower rather than higher crash frequencies."

Also from the conclusions: "There are situations in which use of narrower lanes may provide both benefits in traffic operations, pedestrian safety, or reduced interference with surrounding development and space for geometric features that enhance safety, such as medians or turn lanes. The analysis results indicated that narrow lanes can generally be used to obtain these benefits without compromising safety."

Elizabeth Macdonald, Rebecca Sanders and Paul Supawanich. The Effects of Transportation Corridors' Roadside Design Features on User Behavior and Safety, and Their Contributions to Health, Environmental Quality, and Community Economic Vitality: a Literature Review. University of California Transportation Center. 2008.

This literature review suggests that a strategy of reducing travel lane widths to enhance pedestrian safety can be accomplished without negatively affecting driver safety. Indeed, longer crossing distances – associated with wider travel lanes – not only pose as a pedestrian barrier but also require longer traffic signal cycle times which may have an impact on general traffic circulation.

Peter Swift. Residential Street Typology and Injury Accident Frequency. 2006

Approximately 20,000 police accident reports from the City of Longmont, Colorado (population 72,000), were reviewed and compared against five criteria for evaluating the probability that street design contributed to the accidents. The most significant relationship between injury accidents and street design was found to be with street width and curvature. As street widths widen, accidents per mile increase exponentially.

E. Hauer and Y. Mohammedshah. Safety Models for Urban Four-Lane Undivided Road Segments. Transportation Research Record. 2004.

Study of 4-lane undivided roads in Washington State. For on-road crashes on urban roads, lane width had no effect on injury crashes, while for property damage only (PDO) crashes, "The wider the lanes, the larger the frequency of PDO accidents. The relationship is weak … and is included only because of the traditional interest in this variable."

EFFECT OF LANE WIDTH ON ROADWAY CAPACITY

New York City Department of Transportation (NYCDOT). Protected Bicycle Lanes in NYC. 2014.

Since 2007, the NYCDOT has installed over 30 miles of protected bicycle lanes throughout the city, including several parking protected bicycle lanes on various avenues in Manhattan. The report contains an analysis of how some of these Manhattan routes have impacted safety, mobility, and economic vitality. Routes were chosen for inclusion if they had at least three years of "after" safety data available. NYCDOT offers findings of how rider safety were increased even while travel times for motor vehicles improved and volumes were maintained.

Highway Capacity Manual (HCM). Transportation Research Board. 2010.

In the most recent HCM (2010), based on recent research, there is no capacity reduction until lane width falls below 10 ft. Saturation flow rate at signalized intersections is constant for lane widths down to 10 ft, and falls by 4.4% for lane widths of 9.5 ft.

John Zegeer. "The Effect of Lane Width on Urban Street Capacity." Technical Memorandum published in Appendix P of "Conserve by Bicycle: Phase I Report," Florida DOT. 2007.

Studies cited in the memorandum conclude that lane width has little or no effect on motor vehicle capacity for widths between 10 and 12 ft.

K. Fitzpatrick, P. Carlson, M. Brewer, and M. Wooldridge. Design Factors That Affect Driver Speed on Suburban Streets. Transportation Research Record 1751. 2001.

A study of 55 four-lane arterial street segments in Texas to investigate what elements of the roadways affected driver speed found that wider travel lanes leads to greater driving speed on suburban arterials. On the straight sections, 10-foot lanes carried an 85th percentile speed 9.4 mph slower than 13-foot lanes.