MMLOS Metrics, Standards & Guidelines

Final Report

A Recommendation of the

Bellevue Transportation Commission

City of Bellevue, WA

April 13, 2017

Level-of-Service in Bellevue
Toward a Multimodal Approach to Mobility

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introduction

from the Transportation Commission

The Bellevue Transportation Commission believes that a transportation system that accommodates all people, using all modes of travel for any trip purpose is essential to a dynamic and progressive city such as Bellevue. While one mode of travel or trip purpose is not superior to another, at any moment at any location, a specific mode of travel may be the best option for the person who is taking the trip. Therefore the city plans for and manages a multimodal transportation system.

Since the 1980s, most of the transportation planning and capital resources in Bellevue have been devoted to auto mobility. Intended changes in land use and some resulting changes in demographics are demanding that we pay greater attention to transportation facilities that support people who choose to walk, ride a bicycle or take the bus.

In the 2015 update of the Comprehensive Plan, the City Council acknowledged the expressed community interest in embracing a multimodal approach to mobility. We recommended policy in the Transportation Element, that Council approved, to establish metrics, standards and guidelines for all modes of travel.

Also, Council adopted our Vision Zero policy recommendation and a Complete Streets ordinance that create the framework for scoping, planning, designing, constructing and maintaining a transportation system that provides mobility and safety for all users, with the intent of achieving zero traffic fatalities and serious injuries by 2030.

The Transportation Commission explored national best practices and adapted what we learned to our Bellevue neighborhoods and commercial areas into our recommendation for the multimodal level-of-service metrics, standards and guidelines that we document in this report.

Our approach to mobility ensures that facilities for all modes are considered in transportation projects that the city builds and those that are required of new development. Design standards and guidelines are intended to recognize and support neighborhood land use, as well as to provide for continuity along corridors that traverse the city. We recommend design features along arterial streets that are compatible each type of neighborhood through which they pass.

For people using any travel mode, the Commission recognizes their reasonable expectation to get between Point A and Point B safely, comfortably and efficiently. Our recommendations provide the tools to help allocate space and resources to help people get around in the city!

Janice Zahn, Chair
Vic Bishop, Vice-Chair
Bellevue Transportation Commission

Approved April 13, 2017


MODEL HOMES
THERMO KING

chapter 02

executive summary

Transportation Element policy addresses level-of-service (LOS) and provides direction to achieve a multimodal approach to mobility. New LOS metrics, standards and guidelines for all modes – the Multimodal Level-of-Service (MMLOS) approach - depart from the decades-old practice of measuring only vehicles, specifically the average volume-to-capacity ratio of vehicles traveling through specified intersections at the PM peak hour. A summary of the Transportation Commission MMLOS recommendation is as follows below.

Vehicle mode

Retain existing intersection-based LOS metrics and standards, and establish a new urban corridor travel time metric. Both intersection LOS and corridor travel speed consider the context. Vehicle mobility is favored in some neighborhoods where density is low, uses are spread out, and mobility options are scarce. Conversely, where land use is dense and mixed, and where transit, walking and bicycling are viable options for many trips, vehicle LOS standards acknowledge tolerance for greater traffic congestion.

Pedestrian mode

Focus on the quality of the pedestrian environment rather on a congestion metric similar to vehicle LOS. Apply metrics, standards and guidelines to the "pedestrian network" along arterials. Pedestrian LOS standards and guidelines are based on the context; for example, people in Downtown or near a neighborhood shopping center have a reasonable expectation for a higher quality pedestrian environment than may exist along an arterial with no specific pedestrian destinations. Pedestrian utilization is a good performance metric, but is not a standard/ guideline.

Bicycle mode

Vehicle volume and speed on arterials are the significant factors that determine the type of bicycle facilities needed adjacent to vehicle travel lanes. Bicycle LOS metrics and the LOS guidelines intersect the type of facility and the expected quality of the user experience it provides – the Level of Traffic Stress (LTS). Factors that are not controlled such as topography can be addressed in the type of facility provided – i.e. a climbing bicycle lane and a downhill sharrow.

Metrics and guidelines are applied to the arterial "bicycle network" as identified in the Pedestrian and Bicycle Transportation Plan (2009), or as subsequently modified. Utilization/ridership is a good performance metric, but bicycle rider safety and comfort determine the type of facility.

Transit mode

Metrics and guidelines are established for transit rider access, transit stop/station components, and some speed and reliability factors that are under the control of the City. While there is no direct quantitative relationship between high quality components of transit access and transit ridership – ridership is an outcome – it is recognized that good transit access makes transit an equitable and attractive option for people who ride transit by necessity or by choice.

Table 1 provides an overview of the metrics, standards and guidelines that will inform the design of public investments and private-sector projects. For each mode of travel, a mobility LOS is expressed in a way that corresponds to the needs for access, comfort and safety for the users of that mode. Each mode-specific section of this document provides details for the design of projects that advance Bellevue toward a multimodal approach to mobility.

Transportation Commission Approved
April 13th 2017.

Table 1. MMLOS Summary

Mode	LOS Metric	LOS Standard	LOS Guideline
Vehicle	Volume/Capacity at Intersections	LOS C-E+, Varies by land use context	N/A
	Typical Urban Travel Speed on Arterials	N/A	Percent of posted speed limit, LOS varies by neighborhood context
Pedestrian	Sidewalk plus Landscape buffer	12-20 feet for sidewalk+landscape Varies by land use context	N/A
	Pedestrian Comfort, Access and Safety at Intersections	N/A	Crosswalk and back-of-curb design varies by land use context
Bicycle	Level of Traffic Stress on Corridors	N/A	Design to achieve LTS/LOS varies by roadway traffic speed and volume
	Level of Traffic Stress at Intersections	N/A	Maintain corridor LTS/LOS at intersections. Design components vary by context
Transit	Passenger Comfort, Access and Safety	N/A	Varies by transit stop/station typology
	Transit Travel Speed on Corridors	N/A	14 mph on Frequent Transit Network corridors between activity centers


BIKE ROUTE
I-90 TRAIL
BELLEVUE

chapter

03

MMLOS best practices

During 2013/2014, the Transportation Commission reviewed best practices in applying multimodal level-of-service for long-range transportation planning and for transportation concurrency management in Washington State and across the United States. Following the review of best practices and an evaluation of potential application options in Bellevue, the Commission unanimously approved a motion to recommend the concept of multimodal LOS in the Transportation Element policy in the 2015 Comprehensive Plan Update. Council concurred, and adopted the MMLOS policy included in Chapter 4 of this report.

A. Washington State: GMA & Concurrency

The Washington State Legislature passed the Growth Management Act (GMA) in 1990. The GMA defines transportation as a mandatory element of a jurisdiction's Comprehensive Plan. Further, the Legislature defined that a Transportation Element must include an inventory of facilities and a LOS standard for "all locally owned arterials and transit routes to judge performance of the system." A pedestrian and bicycle component is also required, however, a LOS standard is not required for those modes. As an integral part of a Transportation Element, the Legislature included the requirement of transportation concurrency, as stated below (RCW 36.70A.070):

After adoption of the comprehensive plan by jurisdictions required to plan or who choose to plan under RCW 36.70A.040, local jurisdictions must adopt and enforce ordinances which prohibit development approval if the development causes the LOS on a locally owned transportation facility to decline below the standards adopted in the Transportation Element of the comprehensive plan, unless transportation improvements or strategies to accommodate the impacts of development are made concurrent with the development.

In essence, the Transportation Element and concurrency provision are intended to require jurisdictions to identify a long-range transportation system plan that accommodates the future land use and to devise a system to ensure that the transportation system is implemented to meet community defined LOS targets. The bullets below provide more complete definitions:

- Long-range planning defines the transportation goals, policies, and desired outcomes for the transportation system given the population and employment growth forecasted in the Comprehensive Plan. Auto LOS is often used to plan the auto transportation system by establishing an auto LOS goal/standard, and determining the list of projects needed to meet that standard over time. Multimodal LOS could be used to facilitate planning for other modes.

- Regulatory concurrency is the process that jurisdictions implement to determine if a specific development would cause any transportation facilities to fall below the LOS thresholds adopted in the Comprehensive Plan.

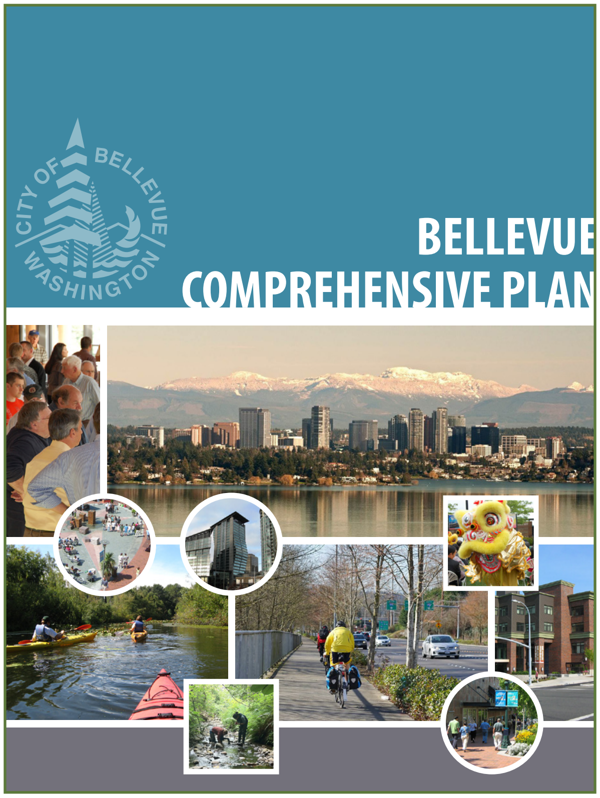
While nearly all Washington State communities have defined a multimodal long-range transportation system, very few communities have used a systematic multimodal LOS method to define what this system looks like and how the modes collectively provide for community mobility. Only a handful of communities use multimodal LOS to manage transportation concurrency.

Long-Range Planning

There is no formula to develop a Transportation Element for a Comprehensive Plan. These plans are unique for each community. However, given the requirements set forth in the GMA, the example below is typical of the steps a community would take to develop a long-range transportation plan:

1. Identify the future land use growth in the community
2. Define goals and policies related to issues such as traffic congestion, transit service, and bicycle and pedestrian mobility
3. Quantify a LOS standard for autos
4. Determine how much auto demand there will be based on the future land use
5. Identify capital projects needed to provide the roadway capacity to meet the auto LOS standard
6. Identify a network for bicycle, pedestrian, and transit travel based on community input, and planning-judgment
7. Identify a set of non-auto capital projects to implement the plans for the other modes; often, auto improvements are prioritized since the auto LOS goal must be met. Occasionally, very few non-auto projects are developed due to limited funding and an auto-oriented LOS policy.

In the absence of a LOS-based planning approach for non-auto modes, some cities develop bicycle, pedestrian, and transit networks and project lists using a qualitative approach. In this case, lines are drawn on a map to connect important destinations, or policies are defined, such as the need to build a sidewalk on at least one side of every street and to ensure that all arterials have bike lanes. This approach is typically iterative and involves substantial public input to identify destinations, travel desire lines, and policies. While this approach can be quite effective at long-term planning, it can run into difficulty as the plans are implemented, particularly when interests question the need for expanding non-auto infrastructure in absence of a clear LOS policy and standards.



Concurrency

The GMA requires multimodal Transportation Elements, but because LOS is only required to be defined for "locally owned arterials and transit routes," the law does not explicitly require concurrency planning for other modes. In practice, most jurisdictions within Washington State set concurrency standards only for autos.

Seattle is transitioning from an auto-based concurrency standard based on volume—to-capacity ratios across large screenlines to a multimodal concurrency standard based on mode share. Both the screenline and mode share concurrency standards vary across the city, reflecting a higher tolerance for congestion and a higher goal for non-SOV mode share in denser areas of the city. While mode share goals are identified in the Seattle Comprehensive Plan, the City is still working on the specific methodology to assess transportation concurrency related to the mode share standard. In essence, Seattle has quantified its vision for the transportation system, but is still working on how to achieve the vision through the concurrency regulations.

King County has a concurrency evaluation method that considers auto LOS within various "travel sheds" using average travel speeds on state routes and arterials. LOS standards vary depending on whether the travel shed is a rural area, a rural neighborhood commercial center, an urban growth area or a rural mobility area. Rural area LOS standards are skewed to higher speeds than are urban areas. In each area, 85 percent of the state routes and arterials must meet the adopted LOS standard. King County does not test individual developments; rather they assume a development proposal meets concurrency if it is located in a travel shed that meets the LOS standards cited above. This type of concurrency assessment is known as Plan Based Concurrency.

By measuring concurrency based only on auto LOS, jurisdictions tend to focus on improvements that benefit autos, potentially at the expense of pedestrians, bicycles, and transit. As the thinking of transportation planners and the expectations of the community has evolved to consider a more holistic approach to mobility, applying concurrency in a multimodal fashion has emerged as a challenge. A few examples document the best practices for assessing concurrency and long-range planning both in Washington and beyond.

Bellingham

Bellingham implemented a multimodal transportation concurrency program in 2008. The fundamental concept underlying the program is quantifying the number of person trips available (PTA) for each mode, both motorized and non-motorized modes.

The Comprehensive Plan includes LOS standards based on the PTA platform, as follows:

- Arterial Streets: LOS E which corresponds to no more than a 1.0 volume-to-capacity ratio.
- Transit: LOS F which corresponds to 1.0-1.25 riders per seat (e.g. up to 50 riders on a 40-seat bus).
- No separate LOS thresholds are identified for pedestrians, bicycles, or trails; however, they are considered in the overall PTA measure.

Based on the existing and planned transportation facilities, the City estimates the total PTA in the planning horizon year. Land use forecasts can then be tested against this transportation system to determine if the land use plans and transportation system are in line with one another. Other than determining whether future roadway and transit infrastructure meet the LOS standards, there are no explicit quantitative metrics guiding the long-range planning for the other modes. Bellingham developed the bicycle and pedestrian plans using traditional planning approaches.

Redmond

Redmond implemented a multimodal transportation concurrency program that defines LOS based on citywide person miles traveled, which are called "mobility units". The City uses supply and demand concept to describe the program: completed infrastructure projects create a "supply" of mobility units and new developments creates "demand" for mobility units. The Redmond Transportation Master Plan (TMP) lists multimodal capital projects intended to achieve the envisioned land use/transportation balance. The fundamental assumption underlying the concurrency system is that the list of projects to be constructed by the TMP's horizon year is expected to meet the demand of new development. In other words, the number of mobility units supplied by the TMP is equal to the number of mobility units that would be consumed by the planned development. Kirkland and Kenmore recently adopted similar systems.

B. National Best Practices

Highlights from Florida and San Francisco represent two approaches to multimodal level-of service.

Florida

The Florida Department of Transportation (FDOT) developed a detailed handbook for determining LOS. In addition to auto LOS – which is the typical volume to capacity ratio - the handbook addresses transit, pedestrian, and bicycle LOS.

Pedestrian LOS is based on four variables: existence of a sidewalk, lateral separation of pedestrians from motorized vehicles, motorized vehicle volumes, and motorized vehicle speeds. Bicycle LOS is based on five variables: average effective width of the outside through lane, motorized vehicle volumes, motorized vehicle speeds, heavy vehicle volumes, and pavement condition.

For transit, FDOT relies on the concept that frequency of service is the most relevant performance measure. FDOT uses the service frequency standards cited in the Transportation Research Board Transit Capacity and Quality of Service Manual.

San Francisco

The San Francisco Department of Public Health (SFDPH) developed a Bicycle Environmental Quality Index (BEQI) and a Pedestrian Environmental Quality Index (PEQI). These indices consider a wide variety of facility characteristics and quantify how well the facility is serving pedestrians or bicycles The PEQI has 30 variables such as the type of crosswalk and the traffic volume, while the BEQI has 22 variables that include also include traffic volume together with the presence of a marked bicycle facility. These scores help to prioritize capital investments. San Francisco has also tried the concept of Auto Trips Generated (ATG) in development review. This method assumes that each new auto trip creates an incremental impact to the network. The concept is aimed at balancing mobility objectives to consider the public right-of-way as a space for all modes. It is a challenge to demonstrate the nexus between ATG and the mitigation.

chapter

04

MMLOS in Bellevue

Level-of-service (LOS) metrics, standards and guidelines provide crucial information to help the community identify and evaluate transportation project design and investment decisions. Multimodal LOS will move the city toward a more comprehensive citywide multimodal transportation system.

Policy Context: Comprehensive Plan Policy Evolution

Policies in the Bellevue Comprehensive Plan articulate expectations and provide direction for action. Action may take the form of city code, budgets, or administrative implementation strategies. Policy regarding mobility has evolved, and so too have implementation strategies.

Why and how has policy evolved? The Comprehensive Plan is a "living" document that is visionary and aspirational, yet grounded in the current state of the city. Thus, mobility policies and thoughts around LOS have evolved to consider urban mobility and livability aspirations while acknowledging existing land use patterns, the transportation system network, technology advances, and the available mobility options.

Comprehensive Plan 1989

In the late 1980s, a developing awareness of the need to develop a multimodal transportation system was revealed in the Comprehensive Plan with the recognition that "the automobile is an inefficient user of urban space, both as it moves and also when parked". However, LOS D or better was recommended throughout the city "so as to minimize traffic congestion". General policy direction: Traveling on arterials should not be too inconvenient, time consuming, or unsafe.

Comprehensive Plan 1993

Urban transportation planning under the Growth Management Act took a more balanced approach to mobility with a specific goal to "Reduce auto dependency". General policy direction: Establish (vehicle) LOS standards in each area of the city in light of growth management objectives.

Comprehensive Plan 2015

Community input during the Comprehensive Plan update expressed an explicit desire to be able to get around the city without a car. Recognizing that this presents a challenge both to land use and to transportation, the Council adopted policies to improve access, safety and connectivity. General policy direction: Establish Multimodal Level-of-Service (MMLOS) measures, standards and targets. The Transportation Element Goal declares this aspiration: *To maintain and enhance a comprehensive multimodal transportation system to serve all members of the community.* And policy TR-30 provides the specific direction: *Establish multimodal level-of-service and concurrency standards and other mobility measures and targets for transportation corridors and in each area of the city in consideration of planned development patterns and mobility options.*

State Requirements for LOS

The state Growth Management Act (GMA) requires local governments to identify LOS standards for city-owned arterials and transit routes for the purposes of ensuring concurrent investment in transportation as land uses change. This is often known as "transportation concurrency." The Puget Sound Regional Council (PSRC) implements GMA requirements by reviewing and certifying local government comprehensive plans for compliance. Certification is required to receive regional- and state-allocated transportation funds.

Existing Metrics and Standards

Transportation LOS in Bellevue is defined on a policy level in the Transportation Element of the Comprehensive Plan and is codified in the Traffic Standards Code (BCC 14.10.030). Existing LOS standards for concurrency management are based on a metric that quantifies vehicle mobility through specified intersections (called "system" intersections) in terms of volume-to-capacity (v/c) ratio in the PM peak period (a two-hour period between 4-6 PM). System intersections are aggregated in Mobility Management Areas (MMAs) for which an area mobility standard (level-of-service) is established. While the v/c metric does not explicitly include a specific LOS standard for transit, bicycle or pedestrian modes, the LOS standards are established in consideration of land use and available mobility options. For instance, the LOS standard varies among MMAs from a v/c of 0.80 to 0.95 depending on land use and transportation factors.

Standards for long-range transportation planning are not formally established in policy or by code, but the common practice in Bellevue is to use a forecast average vehicle delay (in seconds) at system intersections in the PM peak hour. Delay is calculated using travel demand and traffic operational modeling to forecast intersection and area-wide LOS. Average delays at system intersections are also aggregated at the MMA level, similar to what is done for transportation concurrency management. This method of calculating intersection delay for transportation planning is generally consistent with guidance from the Transportation Research Board (TRB) on estimating the quality of vehicular traffic through intersections.

Both the concurrency and long-range planning methods explicitly consider capacity and delay only for vehicles and provide quantitative metrics and analysis for this single mode of travel. Throughout the city, and significantly in existing mixed-use urban neighborhoods such as Downtown, Crossroads and Factoria; and in evolving toward urban neighborhoods such as BelRed and Wilburton, mobility is characterized by high numbers of people who are walking, and riding transit and bicycles. However, the quantitative metrics and analysis upon which many transportation planning, design, and investment decisions are made are related to vehicle capacity and delay at intersections, which can lead to unfavorable outcomes for non-vehicle modes.

Evolving MMLOS in Bellevue

The following chapters describe the Transportation Commission's recommended MMLOS metrics, standards and guidelines to implement the mobility goals outlined in the Transportation Element of the 2015 Comprehensive Plan Update.

chapter

05

vehicle LOS

Level-of-Service

The Transportation Element recognized that "For the foreseeable future, the private auto will carry the majority of daily trips within Bellevue." Therefore it is important to serve this travel demand and to meet vehicle LOS standards. A roadway network that operates efficiently is one element of the balanced transportation system. Vehicle LOS metrics, standards and guidelines for intersections and travel corridors summarized in Table 2 will meet GMA and Traffic Standards Code requirements for concurrency management and will assist in evaluating long range planning alternatives.

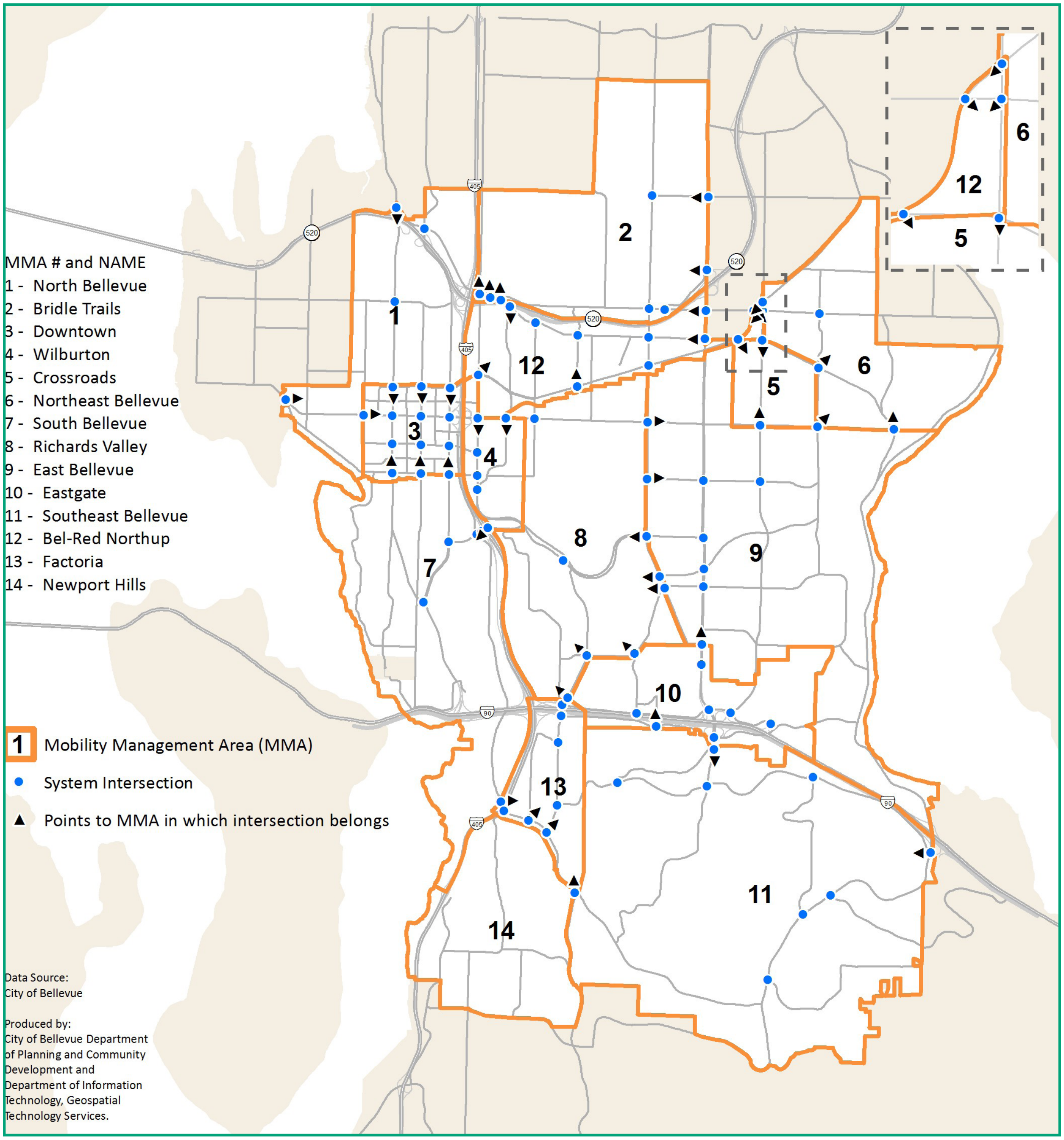
Table 2. Vehicle Level-of-Service Summary

Vehicle LOS	Metric	Where Applied	How to Apply
Concurrency	Volume/Capacity	System Intersections MMA	Standard per Traffic Standards Code
Long Range Planning	Delay	System Intersections MMA	Guideline
Corridor Analysis	% of typical urban travel time	Arterial Corridors & Segments	Guideline

Table 3. Vehicle Corridor Level-of-Service

LOS	Typical Urban Travel Time/Travel Speed on Corridors Based on 40% of the Posted Speed Limit
	Less than 90% of Typical Urban Travel Time | Faster than 1.1 times the Typical Urban Travel Speed
	90-110% of Typical Urban Travel Time | Between 1.1 and .9 times the Typical Urban Travel Speed
	110-155% of Typical Urban Travel Time | Between .9 and .75 times the Typical Urban Travel Speed
	155-200% of Typical Urban Travel Time | Between .75 and .5 times the Typical Urban Travel Speed
	More than 200% of Typical Urban Travel Time | Slower than .5 times the Typical Urban Travel Speed

Figure 1. MMA Boundaries & System Intersections



Intersections

The Transportation Commission recommends retaining the existing metrics and LOS standards that are adopted and documented in the Comprehensive Plan and the Traffic Standards Code, BCC 14.10.030. For Concurrency purposes, the existing metric is the average volume/capacity ratio at system intersections, distributed across the city in 14 Mobility Management Areas (MMAs). For long-range planning, Bellevue uses average vehicle delay at the same system intersections. Note that MMA 14 (Newport Hills) has no system intersections and thus has no LOS standard. The LOS standard varies between MMAs depending on such factors as land use intensity, neighborhood character, and available mobility options. The LOS standard average v/c ranges from 0.95 in Downtown, Factoria, and BelRed where land use is mixed and intense and mobility options are plentiful, to 0.80 in lower-density residential areas that are not as well served by transit and where separated land uses may disfavor walking or bicycling for many trips.

The existing MMA boundaries and system intersections have been slightly modified by Council ordinance over the years - most recently in the 2015 Comprehensive Plan Update - to reflect land use changes and infrastructure investments. In a subsequent phase of this MMLOS project, the Commission will examine the existing MMA boundaries and may recommend modifications to better reflect existing and planned land use, travel demand and mobility options along corridors.

Corridors

Acknowledging that people do not experience "average" intersection v/c as they travel by car throughout the city, the Transportation Commission recommends a new travel speed-based performance-based metric along arterials to assist in identifying and prioritizing congestion-relief projects.

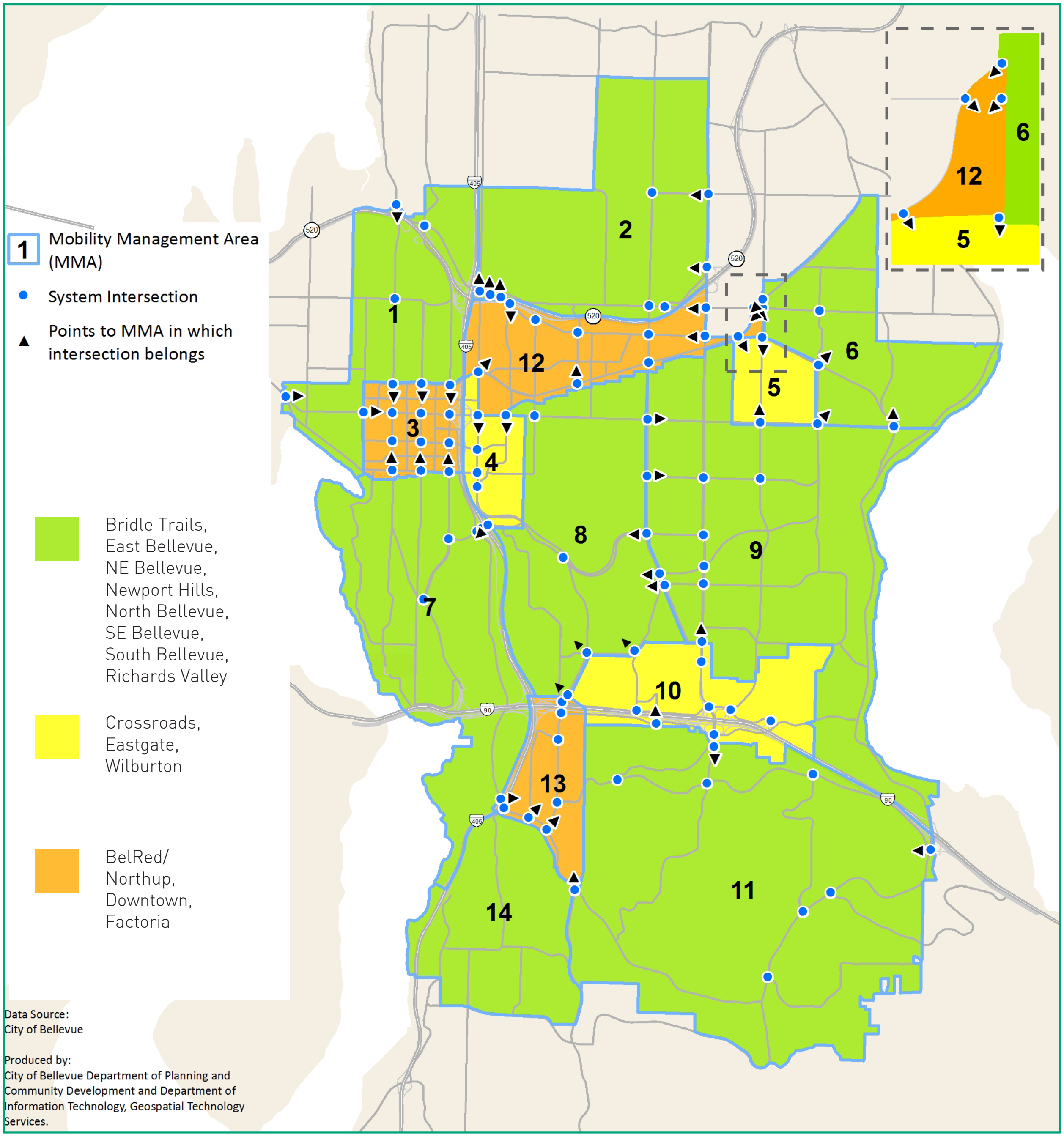
The Commission describes a "Primary Vehicle Corridor" as an arterial that connects system intersections. These corridors are a subset of the entire arterial system and they provide important vehicle connections within Bellevue and/or to regional routes for the movement of people and goods. Along a Primary Vehicle Corridor, a travel speed metric would be applied to help evaluate the existing conditions and the potential benefits of roadway congestion-relief projects.

Travel speed guidelines would apply to arterial corridors or segments, with LOS variability based on the underlying LOS Standard for MMAs (as defined in the Traffic Standards Code). For Example, Bellevue Way passes through South Bellevue, Downtown and North Bellevue, and the corridor travel speed LOS guideline would vary accordingly.

The "typical urban travel speed" metric is based on the speed it would take a person in a vehicle to travel along the subject arterial, assuming LOS C conditions for an urban arterial corridor as defined by Chapter 16 of the Highway Capacity Manual, 6th Edition. This equates to an average speed of about 40% of the posted speed limit. Note that this urban travel time metric assumes that drivers will inevitably experience some delay at traffic signals.

This approach provides a quantitative tool to evaluate vehicle LOS along an arterial corridor or segment. The typical urban travel speed guideline in Table 3 provides a general expectation of corridor traffic operations, and Figure 2 depicts the application of the guideline to Mobility Management Areas. An analysis of travel speed can be used to identify consistently congested corridors and then to evaluate and compare the effectiveness of the various design options for a congestion-relief project.

Figure 2. Recommended Corridor LOS Guidelines by MMA



chapter 06

pedestrian LOS

Level-of-Service

Dimensional standards for sidewalks and landscape buffers are adopted in the Land Use Code and in the Transportation Design Manual. With the exceptions of Downtown and BelRed where sidewalk and landscape buffer dimensions are specified by Code, these default dimensional standards are applied to arterial streets generally across the city without regard to the neighborhood context.

The Transportation Commission acknowledges that the default dimensional standards do not meet the needs and expectations of people walking (and bicycling) in the wide range of neighborhood types and land uses in the city. The frequently mentioned example of a roadway corridor that traverses many types of neighborhoods is Bellevue Way. Along this corridor the standard arterial sidewalk dimension outside of Downtown (six to eight feet, as determined by the Review Engineer) as well as street crossing opportunities (standard dimensions and accessibility) do not adequately serve locations such as the Northtowne Shopping Center where a higher quality pedestrian environment is expected. Context-specific standards are appropriate tools to help match the sidewalk infrastructure with the reasonable expectations of pedestrians.

Pedestrian LOS metrics are based in large part on the qualitative experience of the person walking; the fundamental expectations for safety, comfort and connectivity, with sidewalk design informed by the neighborhood and land use context. Citywide standards for arterial streets will continue to apply, except where the Land Use Code provides specific standards, and where, according to Table 4 below, adjacent land use intensity and related activity dictate either wider sidewalks, a wider landscape buffer, or both; plus enhanced design treatments to create safe and accessible crossings at intersections and mid-block locations. The Commission considered the anticipated pedestrian use, together with comfort, safety and access in preparing the recommended Pedestrian LOS standards/guidelines. Actual/projected utilization will be a good performance metric to assist in project prioritization and evaluation.

Sidewalk & Landscape Buffer Width

For purposes of describing the land use context, an Activity Center includes BelRed, Crossroads, Factoria, Wilburton and Eastgate. A Neighborhood Shopping Center is a location such as Northtowne, Lake Hills, Newport Hills, and other similar centers throughout the city that occupy land that is typically zoned Neighborhood Business. A Pedestrian Destination is a facility or location such as a school, park, community center, senior center, library, frequent transit network stop, or a trail crossing. The category "Elsewhere in the City" is not one of the preceding land use types, and the citywide default standards apply there. Table 5 summarizes the sidewalk and landscape buffer width standarads.

Figure 3. Default Sidewalk and Landscape Dimensions

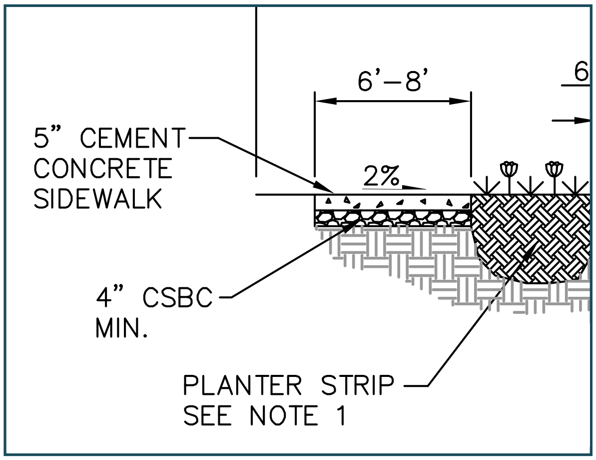


Table 4. Pedestrian Level-of-Service Summary

Pedestrian LOS	Metric	Implementation	How to Apply
Sidewalk & Landscape Buffer	Combined Width for sidewalk and landscape buffer	Frontage Improvements Capital Investment Program	Standard per Land Use Code and Transportation Design Manual
Intersection Treatment	Design Components	Frontage Improvements Capital Investment Program	Guideline
Mid-Block Crossings	Spacing of Crossings	Frontage Improvements Capital Investment Program	Guideline

Table 5. Sidewalk & Landscape Buffer Width Details

Land Use Context / Component	Downtown	Activity Center	Neighborhood Shopping Center	Pedestrian Destination	Elsewhere in the City
Sidewalk Width & Landscape Buffer Width	Downtown Land Use Code	BelRed Land Use Code or 16 ft. for other Activity Centers	13 ft. total adjacent to shopping center	13 ft. total at ped. destination or within 100 ft. of a FTN* stop	Bellevue Transportation Design Manual

Notes:

- The BelRed Land Use Code and the BelRed Corridor Plan (2012 or thereafter amended) provide dimensional standards and material guidance for local streets and arterials in the BelRed Subarea.
- *FTN = Frequent Transit Network, refer to the Bellevue Transit Master Plan

Intersection Treatment

The design of an intersection consists of various combinations of components to enable a pedestrian to cross a street. In an approach to mobility that favors motor vehicle LOS, pedestrian facilities may fall short of people's reasonable expectations for access, comfort and above all, safety. Pedestrian LOS guidelines are intended to enhance the experience of crossing the street at an intersection by using design components in the right combination to suit the location. Factors that influence an intersection design relate to the land use and urban design context and to the vehicle use of the roadway.

For instance, in a Downtown setting where the Downtown Transportation Plan calls for walking to be the easiest way to get around, design considerations to enhance the pedestrian environment be applied in the crosswalks between the curbs, in the design of the corners, and in back-of-curb amenities. Specific intersection treatment details that are applied to the various categories of land use are summarized in Table 6.

Table 6. Intersection Treatment Details

Land Use Context / Component	Downtown	Activity Center	Neighborhood Shopping Center	Pedestrian Destination	Elsewhere in the City
Signalized Intersection Treatment	Downtown Transportation Plan	BelRed Corridor Plan or Downtown Transportation Plan "Enhanced" type	Bellevue Transportation Design Manual	Bellevue Transportation Design Manual	Bellevue Transportation Design Manual

Notes:

- Downtown Transportation Plan identifies three types of intersection – Standard, Enhanced, Exceptional-that are mapped and that warrant a suite of design components to accommodate the existing or anticipated pedestrian needs for safety, comfort and access. Enhanced intersection elements could include weather protection, minor/local wayfinding, special paving treatment, wider crosswalk than standard, generous crossing time, curb bump-out, and alternative striping.
- BelRed Corridor Plan provides guidelines and standards applicable in the BelRed Subarea.
- Transportation Design Manual provides the default components and design thereof for signalized intersections not addressed by other plans or codes. Typically the minimum components will be consistent with the treatment for a "Standard" Downtown intersection. Context and engineering judgement will determine design.

Mid-Block Crossings

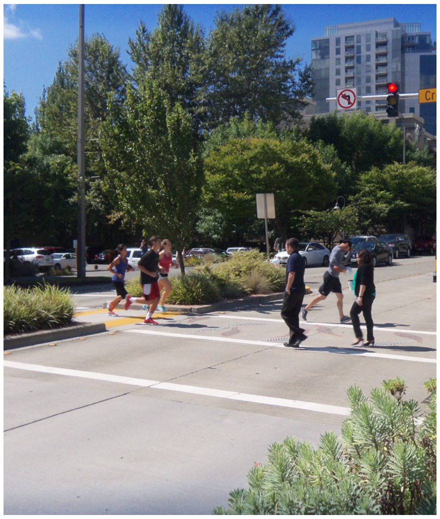
Opportunities to cross the street at mid-block locations – the crossing frequency – and the type of crossing treatment applied at any particular mid-block crossing location are largely determined by the nearby land use and the characteristics of the roadway. LOS guidelines for mid-block crossings recommend the spacing for roadway crossings to provide reasonable pedestrian access. Given the wide range of conditions at potential crossing locations, the Transportation Commission recognized that city staff are best suited to prescribe specific design treatments and details about whether the desired crossing frequency identified below can be achieved. Typical components of a mid-block crossing include crosswalk striping, a median island that may be landscaped, and some type of electronic traffic advisory such as a full signal or a flashing beacon, as shown at the bottom of Table 7.

Table 7. Mid-Block Crossings

Land Use Context / Component	Downtown	Activity Center	Neighborhood Shopping Center	Pedestrian Destination	Elsewhere in the City
Arterial Crossing Frequency	Downtown Transportation Plan (≤ 300 feet)	≤800 feet: Factoria ≤600 feet: Elsewhere	One crossing every 600 feet or less within shopping center area	Within 600 feet of primary entrance. Within 300 feet of bus stop pair on FTN	Not Applicable

Notes:

- Intersection treatment and the location and design of mid-block crossings are to be determined and approved by the Transportation Department
- FTN is the Frequent Transit Network



chapter

07

bicycle LOS

Level-of-Service

Similar to the range of factors that provide for a safe, comfortable and connected walking environment in various settings, recommended bicycle metrics and guidelines are based largely on the rider experience, not the number of riders who use a facility. This is an emerging best practice for cities that intend to enrich the environment for people who want to ride a bicycle. It is based on the experience in Portland, OR, Davis, CA, and many North American and European cities where implementation of high-quality facilities leads to safer bicycling and the outcome of higher bicycle use. The quality of the experience for a person riding a bicycle is largely determined by the speed and volume of traffic on the street, coupled with the type of bicycle facility. Bicycle LOS considers an off-street path such as the I-90 Trail, SR 520 Trail, and the planned Eastside Rail Corridor, to always meet the highest expectations for LOS. A physically separated bikeway such as the multipurpose path across I-405 on the NE 12th Street overpass is in that same category.

Table 8. Bicycle Level-of-Service Summary

Bicycle LOS	Metric	Implementation	How to Apply
Arterial Corridors	Design Components to achieve intended LOS along corridors	Frontage Improvements, Capital Investment Program	Guideline
Intersection Treatment	Design Components to achieve intended LOS at signalized intersections	Frontage Improvements, Capital Investment Program	Guideline

BICYCLE FRIENDLY COMMUNITY 2015-2019 BRONZE THE LEAGUE OF AMERICAN BICYCLISTS

Introducing Bicycle Level of Traffic Stress (LTS)

From the 2012 Mineta Transportation Institute Technical Report, Low-Stress Bicycling and Network Connectivity, authors Maaza C. Mekuria, Ph.D., P.E., PTOE, Peter G. Furth, Ph.D., and Hilary Nixon, Ph.D. propose the following:

> *"For a bicycling network to attract the widest possible segment of the population, its most fundamental attribute should be low-stress connectivity, that is, providing routes between people's origins and destinations that do not require cyclists to use links that exceed their tolerance for traffic stress, and that do not involve an undue level of detour. The objective of this study is to develop measures of low-stress connectivity that can be used to evaluate and guide bicycle network planning. We propose a set of criteria by which road segments can be classified into four levels of traffic stress (LTS). LTS 1 is suitable for children; LTS 2, based on Dutch bikeway design criteria, represents the traffic stress that most adults will tolerate; LTS 3 and LTS 4 represent greater levels of stress."*

The Transportation Commission recommends using this concept to identify the components of a bicycle facility that will provide a level of separation and protection from traffic that is expected by people who can tolerate various levels of stress while riding. Note that the individuals who are not inclined to ride a bicycle under any circumstances are not factored in this methodology. To help inform the design of bicycle facilities, the Commission recommends a classification system for Bellevue that will identify "levels of traffic stress" (LTS), for road segments as shown in Table 9.

Table 9. Bellevue Level of Traffic Stress (LTS) Categories

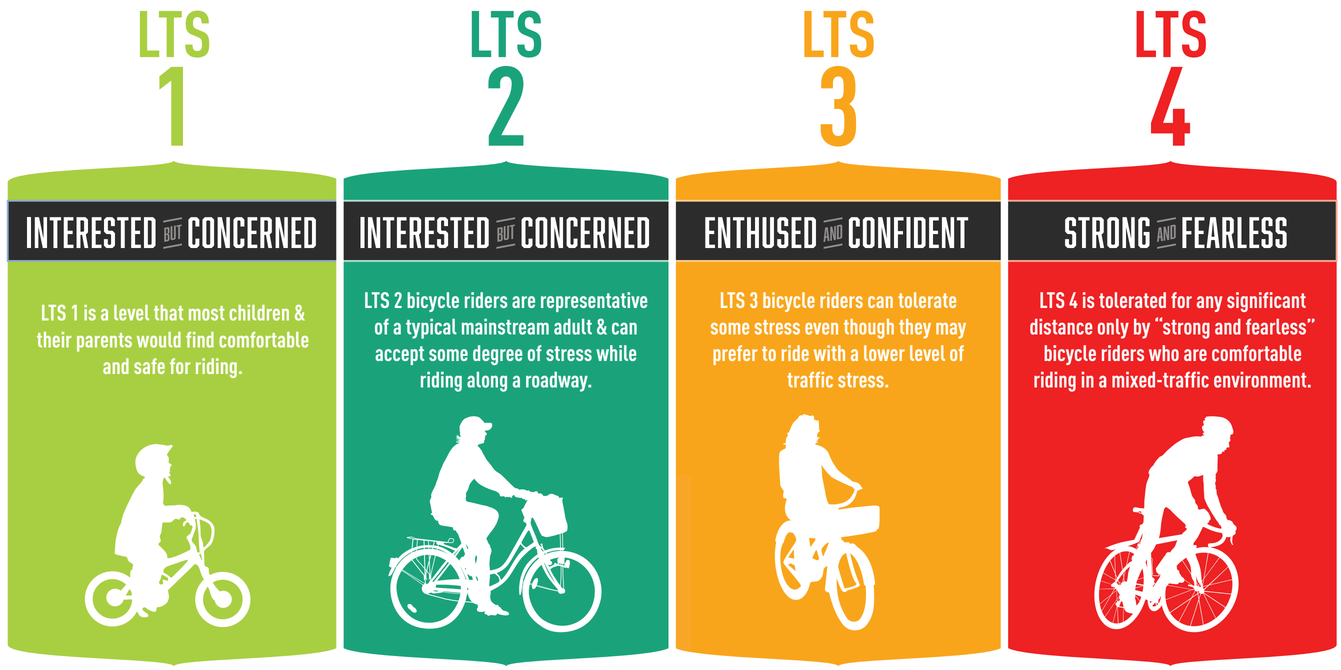


Table 10. Bicycle Level-of-Service/ Level-of Traffic Stress

Roadway Characteristics		Bicycle Facility Components: Guideline to Achieve Intended Level of Service/Level of Traffic Stress					
Speed Limit (MPH)	Arterial Traffic Volume	No Marking	Sharrow Lane Marking	Striped Bike Lane	Buffered Bike Lane (Horizontal)	Protected Bike Lane (Vertical)	Physically Separated Bikeway
</= 25	<3k	1	1	1	1	1	1
	3-7k	3	2	2	2	1	1
	>/=7k	3	3	2	2	1	1
30	<15k	3	3	2	2	1	1
	15-25k	4	4	3	3	3	1
	>/=25k	4	4	3	3	3	1
35	<25k	4	4	3	3	3	1
	>/=25k	4	4	4	3	3	1
>35	Any	4	4	4	4	3	1

Bicycle Facility Components on Roadway Corridors

In the above methodology, level-of-traffic-stress for people riding bicycles along roadway corridors is based on two key characteristics of vehicle traffic - speed and volume – together with the type of bicycle facility. For example, a low level-of-traffic-stress (LTS 1) can be achieved on a street with very low traffic speed and volume with minor improvements to bicycle facilities such as a sharrow lane marking or a striped bike lane. As the traffic speed and traffic volume increase, to provide a low LTS requires progressively more protective measures such as buffered or protected bike lanes. Conversely, a roadway with progressively higher traffic speed and/or volume will yield increasingly higher LTS if the type of bicycle facility remains constant. For any roadway type, a nearby physically separated bikeway would always yield a LTS 1.

The Bicycle LOS/LTS metrics provide guidance regarding the type of bicycle facility that would create a comfortable riding environment for various types of bicycle riders, according to Table 10. The number/color of each cell represents the approximate Bicycle LOS/LTS that may be achieved given the combination of roadway characteristics and bicycle facility components. The LTS precision indicated in the table may not be exactly what people experience while riding – the hard edges of each cell should be blurred somewhat to indicate a gradient of LTS outcomes. Various combinations may be applied to achieve the intended LOS. This table does not account for many other factors and characteristics such as slope, pavement condition, percent of heavy vehicles, etc. that may affect the LTS/LOS for a bicycle rider. These other characteristics can be addressed in the type of bicycle facility provided – for example a protected bicycle lane for an uphill climb with a corresponding downhill sharrow lane marking. It is understood that roadway characteristics, particularly traffic speed and volume are highly variable along a corridor and at various times of day. So the LTS experienced by a person riding a bicycle may also vary according to the situation.

Bicycle Corridor LOS/LTS Recommendations

In terms of Bicycle LOS/LTS guidelines, the Transportation Commission recommends achieving the following:

- **LTS 1. Priority Bicycle Corridors within Downtown and Activity Centers.** A high level of bicycle mobility for all ages and abilities is expected within areas where the City has the vision, intent and policy to promote a high-density, mixed use urban environment.
- **LTS 2. Priority Bicycle Corridors outside of Activity Centers.** A moderate level of bicycle mobility for Interested but Concerned adults would allow comfortable bicycling connections between Activity Centers and on recognized Regional routes such as the Lake Washington Loop.
- **LTS 3. Other Bicycle Network Corridors.** On arterial streets that are part of the Bicycle Network but not part of a Priority Bicycle Corridor. This network serves to connect neighborhoods with Activity Centers and with the Frequent Transit Network.
- **No LTS** standard applies on the following Exempt Bicycle Network Corridors that, due to traffic speed and/or volume, would not be a comfortable bicycling environment. No bicycle LTS standard is established for these street segments:
  - » NE 8th Street east of Bellevue Way and west of 156th Avenue NE
  - » Bel-Red Road/NE 12th Street east of Spring Boulevard NE and west of 156th Avenue NE
  - » Bellevue Way north of 112th Avenue NE (at the Y) and south of the interchange at SR 520

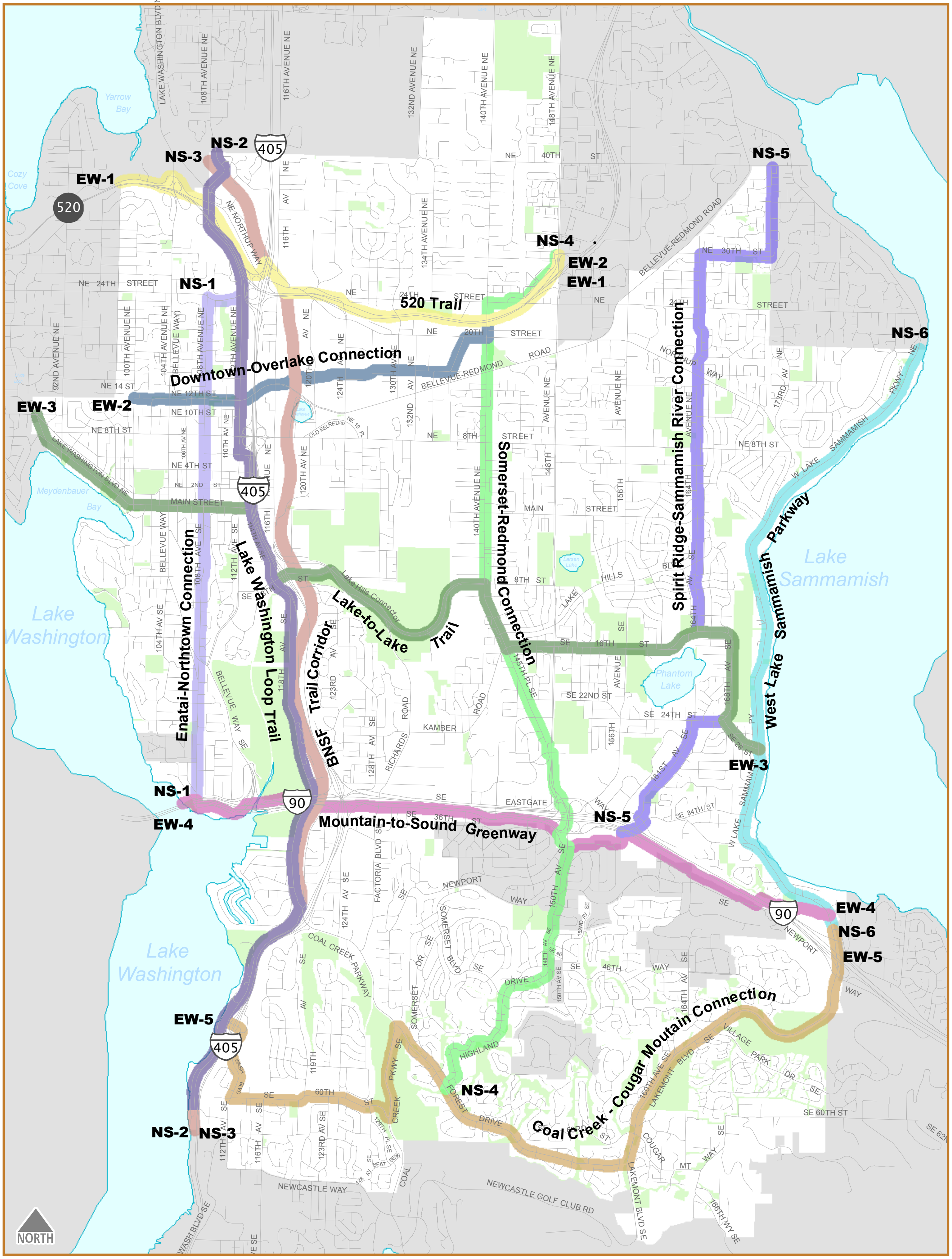
Intersections

When a bicycle facility along an arterial corridor comes to an intersecting arterial, the corridor LOS should be carried across the arterial. Otherwise the arterial intersection may become a barrier to bicycle travel to those who feel level of traffic stress is greater than they are comfortable with. The Intersection Component table (Table 11 on page 30) is a simple representation of the types of facilities that are intended to extend a bicycle corridor LOS/LTS across an intersection; these are not prescriptive solutions but rather serve as guidelines to be implemented as appropriate to the context. Select images of various treatments are included.

Bicycle Network Corridors

Applying the intended bicycle LOS to all of the bicycle corridors in the Pedestrian and Bicycle Transportation Plan (2009) yields a system that will be comfortable, safe and accessible to people who want to travel by bicycle. Figure 5 shows those corridors, and also identifies potential intersection locations where a dedicated bicycle signal may be appropriate to maintain an intended LTS 1 or LTS 2 corridor across an intersection.

Figure 4: Priority Bicycle Corridors



Source: Bellevue Pedestrian and Bicycle Transportation Plan (2009)

Table 11. Bicycle Facility Components at an Intersection

Bicycle LOS/LTS	Bike Signal	Street Crossing	Approach to Intersection	Approach to Intersection with Right Turn Lane
LOS 1	Bike Signal	Green solid or skip-stripe	Green bike box	Curb ramp to wide sidewalk, Dutch Intersection
LOS 2	Bike Signal	Skip stripe	Bike box	Green bike lane to left of turn lane
LOS 3	Green Cycle Length	Sharrow lane markings	Automatic signal actuation	Bike lane to left
LOS 4	No specific design guidleine for LTS/LOS 4			
Trail or Mid-Block Crossing	Full signal or HAWK or RRFB	Green solid or skip-stripe	N/A	N/A

Notes:

- HAWK stands for High Intensity Actvated CrossWalk beacon. A HAWK is a push-button activated signal that stops traffic to provide a protected pedestrian crossing at an otherwise unsignalized location.
- RRFB stands for Rectangular Rapidly Flashing Beacon. This beacon is actuated with a push button and the flashing lights advise drivers that a pedestrian intends to cross the street at the midblock location.

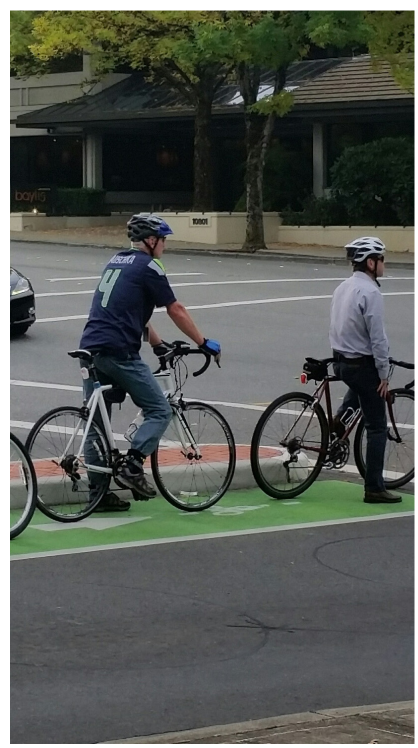
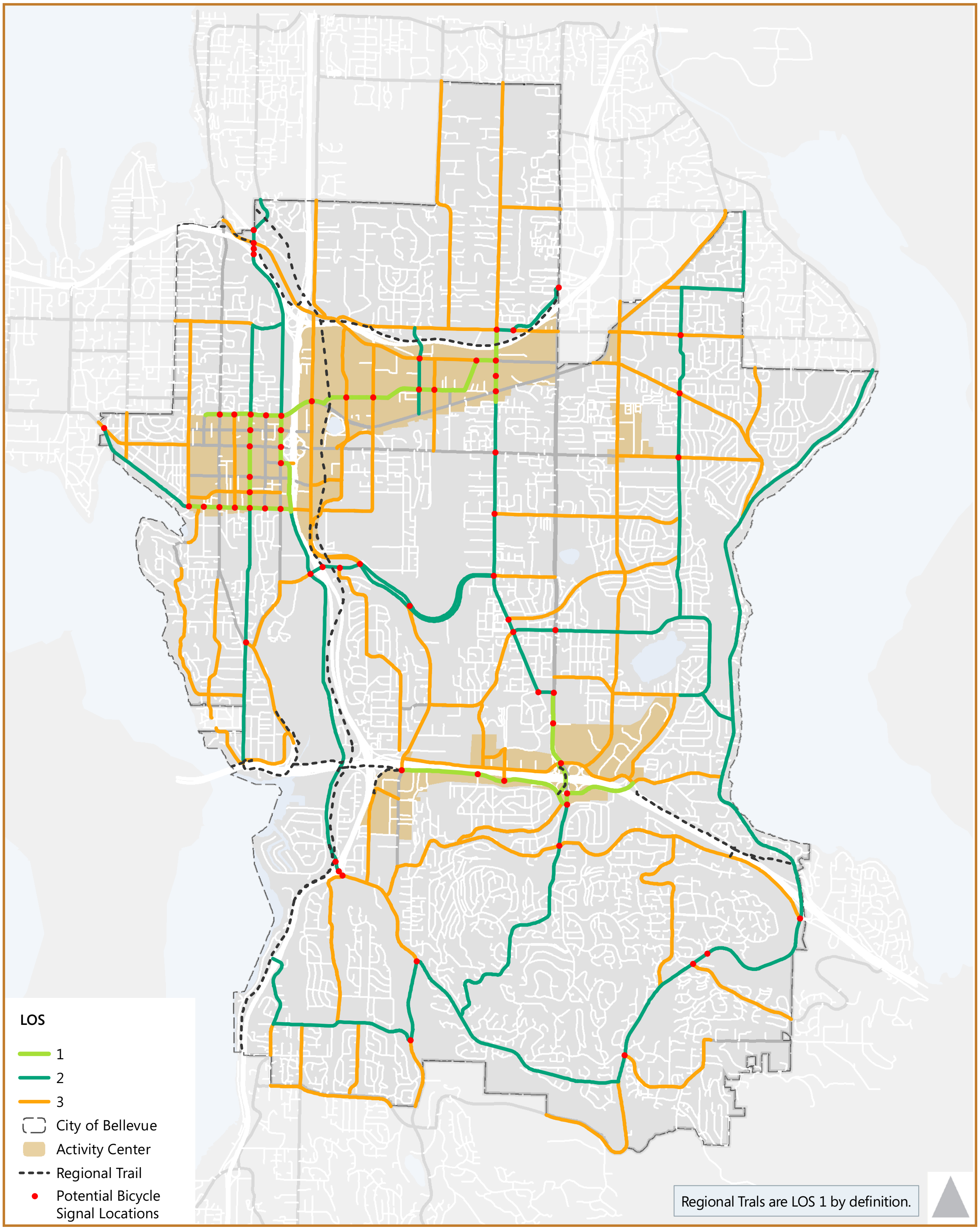


Figure 5: Intended Bicycle LOS on Bicycle Network Corridors, with Bicycle Signals at Designated Intersections



chapter

08

transit LOS

Level-of-Service

A transit agency typically measures LOS in terms of the things it controls that affect ridership such as frequency of the bus, the reliability of scheduled service, and the seat-to-passenger ratio. Since Bellevue leaves the provision of transit service to King County Metro, Sound Transit and Community Transit, the transit LOS metrics and guidelines for MMLOS are those that are largely within the city's control and are essential to creating a high quality experience for the transit rider. These are summarized in Table 12 as transit passenger access and amenities, and transit coach speed along frequent transit network routes between Activity Centers.

Table 12. Transit Level-of-Service Summary

Transit LOS	Metric	Implementation	How to Apply
Passenger Amenities	Design Components at Stops and Stations	Frontage Improvements, Capital Investment Program	Guideline
Transit Speed	Transit speed on the Frequent Transit Network between Activity Centers	Agency Partnerships, Capital Investment Program	Guideline

Passenger Comfort, Access & Information

Components of transit passenger access and amenities are documented in both the Transit Master Plan and the Downtown Transportation Plan. Components vary generally by type, design, quantity or quality based on the level of transit service that is provided at the following locations:

- **Local Transit Stop:** served by a single transit route with generally 30 or fewer boardings per weekday;
- **Primary Transit Stop:** served by one or more transit routes with service provided at a combined headway of 30 minutes or better;
- **Frequent Transit Network/RapidRide Station:** served primarily by RapidRide B and also local or regional frequent transit network routes, for example, King County Metro route #271 and #245;
- **Transit Center/Light Rail Station:** served by multiple transit routes and transit modes with a constant flow of transit vehicles and passengers throughout the day.

Bellevue may provide some basic components of transit passenger access and amenities such as a bench or shelter, or may provide enhancements such as wayfinding or bicycle parking.

Transit LOS guidelines are shown in Table 13 for transit passenger access and amenities for each type of transit stop or station.

Table 13. Transit Stop/Station Level-of-Service Guidelines

Context / Component	Local Transit Stop	Primary Transit Stop	Frequent Transit Network Stop RapidRide Stop
Weather Protection	Yes, Priority with 25+ daily boardings	Yes	Yes
Seating	Yes, Near pedestrian destinations	Yes	Yes
Paved Bus Door Passenger Zone	Yes, Zone length 25-30 feet	Yes, Zone length 40 feet	Yes, Zone length 60 feet
Wayfinding	Optional	Yes	Yes
Bicycle Parking	Optional	Yes	Yes

Notes:

- Transit stop typology defined by the Transit Master Plan and the Downtown Transportation Plan
- Building mounted weather protection and seating is preferred where building abuts the back of the sidewalk
- Passenger Landing Zone is a paved surface between the back of curb and sidewalk to facilitate passenger boarding and alighting. The precise location and dimension is to be determined in context, with the intent of providing a paved surface for passengers moving between the sidewalk and the bus. Street trees in tree wells will meet the curbside landscape buffer requirement in this zone.
- Transit Center/Light Rail Stations are not included in this table because these facilities are designed & owned by the regional transit agencies. As part of the design review process, Bellevue will ensure consistency with Transit LOS guidelines.

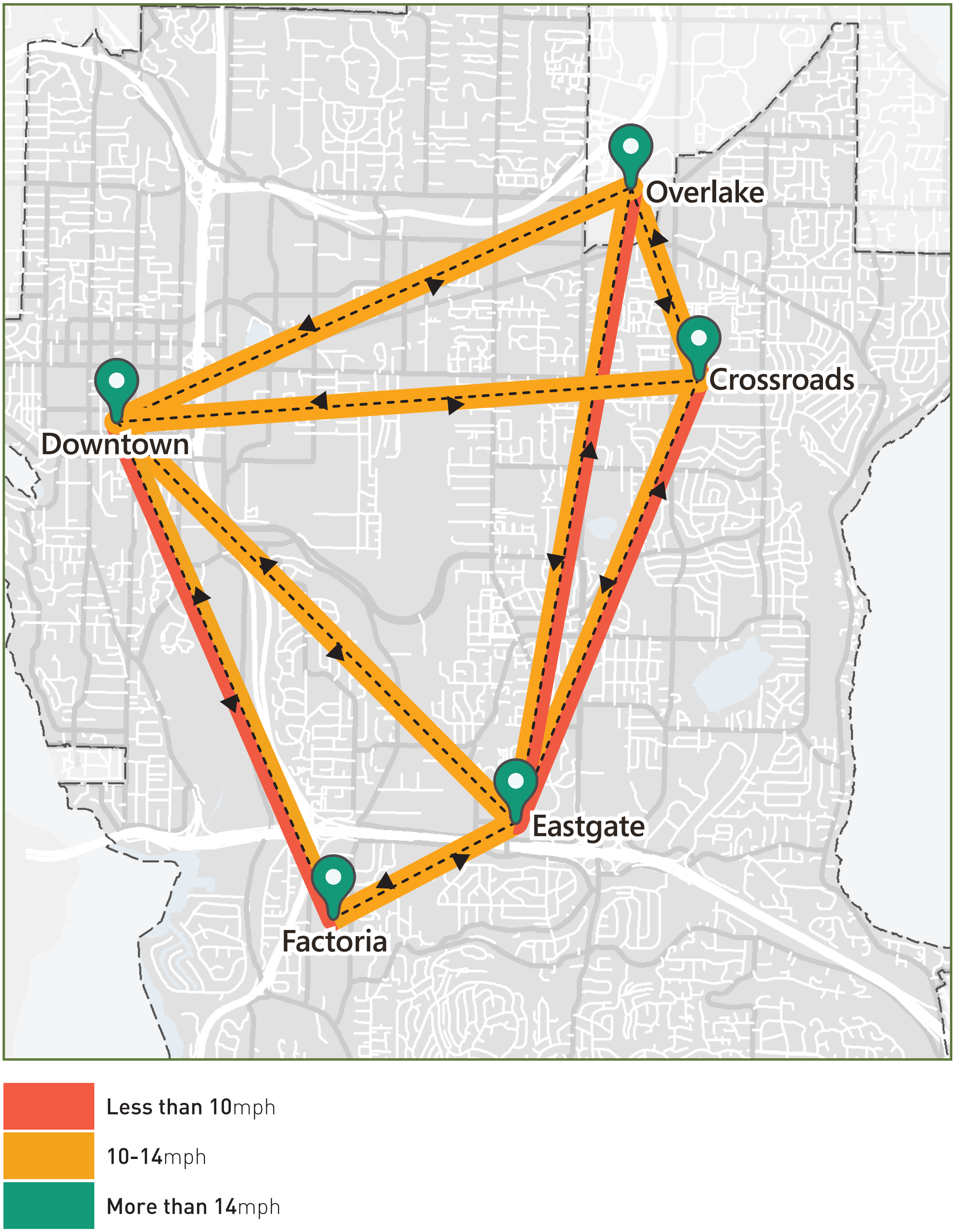
Transit Corridor Speed

For transit coach speed along corridors, the Transportation Commission recommends using a transit speed between defined Activity Centers along Frequent Transit Network corridors. Roadway conditions and traffic operations influence the speed at which a bus can travel while operating in mixed traffic. The defined Activity Centers for this metric are the same as those defined for other LOS modes; Downtown, Overlake, Crossroads, Eastgate and Factoria.

Transit speed data that is gathered by the transit agencies for coaches serving select corridors on the frequent transit network. Transit speed may be monitored to reveal trends and inform potential intervention. Intervention with the intent of increasing transit speed could be in the form of transit system signal priority investments, transit queue jump lanes, business access and transit (BAT) lanes, or other remedies and investments identified in the Transit Master Plan and the Downtown Transportation Plan. This transit speed LOS metric is based on the key routes and transit speed expectations identified in the Transit Master Plan – this standard is analogous to the goal the Washington State Department of Transportation has established to maintain a minimum acceptable speed on the regional HOV lane network for transit, carpools/ vanpools, and other HOVs.

A Transit LOS target speed of 14 miles-per hour between Activity Centers will serve as guidance to evaluate performance on the Frequent Transit Network. This guidance is derived from the Transit Master Plan. Recommended categories of "red", "yellow" and "green" describe how the observed transit speed matches up to the guidance, as shown in Figure 6. The map in Figure 6 shows the frequent transit network between Activity Centers that is color-coded to depict actual 2016 transit speed performance per the categories.

Figure 6. 2016 Transit Travel Speed Between Activity Centers



chapter

09 subsequent work

Multimodal LOS recommendations that are documented in this report include metrics, standards and guidelines for each mode. The Transportation Commission intends to follow this work with developing an approach to mobility that will deeply embed MMLOS into city decisions on the type of project to build, the priority of projects, and with what resources.

What to Build

Standards and guidelines recommended in this MMLOS report document the intended design or dimensions of a transportation facility that will meet the reasonable expectations of the community as a whole. A wide sidewalk, for instance, in an Activity Center, an LTS 2 bicycle facility on an arterial through a residential neighborhood, a bus shelter at a Frequent Transit Network stop, or a right turn lane at an intersection on a congested corridor. MMLOS can be integrated into the Transportation Design Manual to support staff with development review decisions, and it can be used in the SEPA analysis for long-range neighborhood planning projects to help the community articulate a vision.

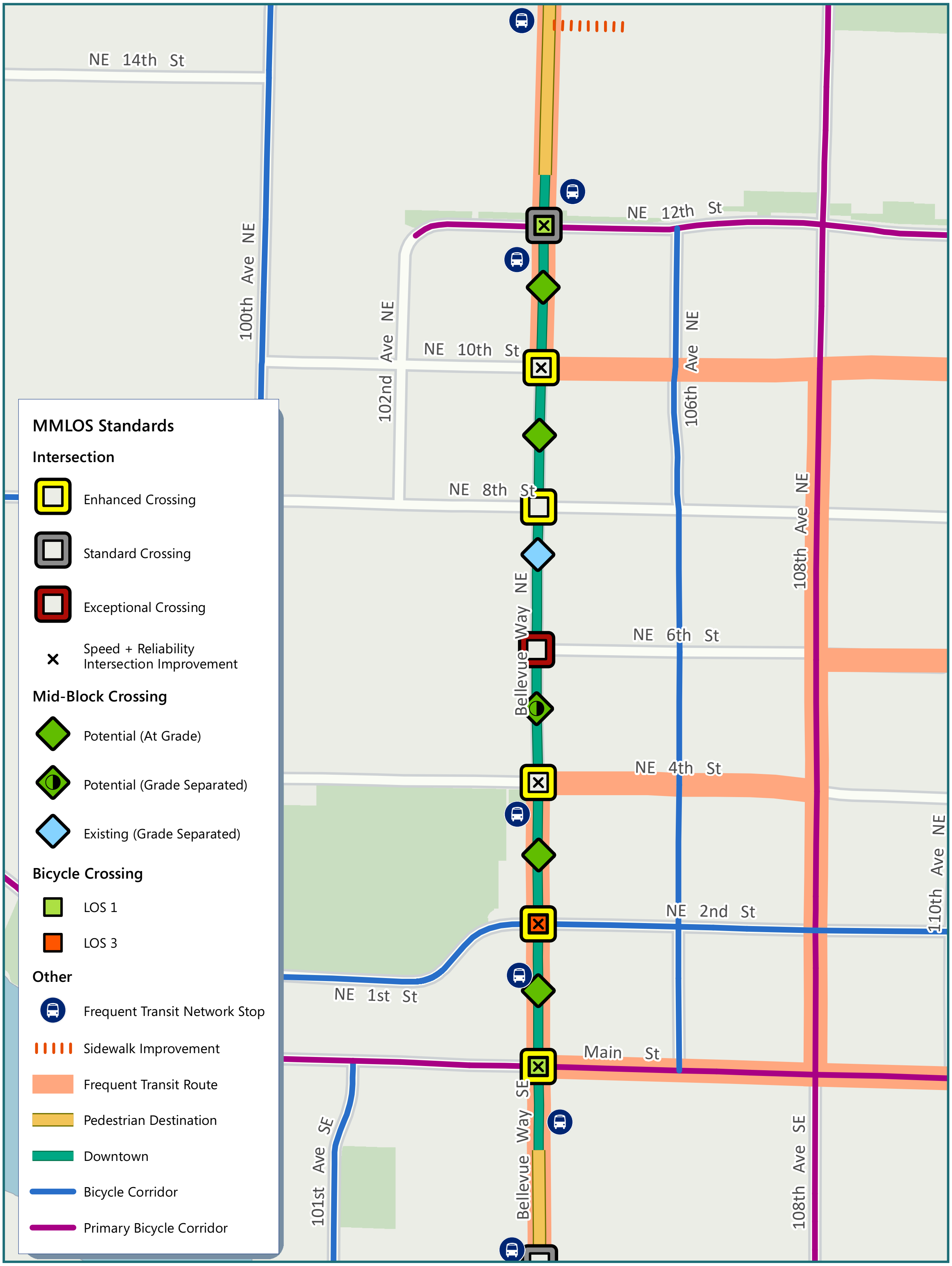
Why to Build It

The ultimate decision to build a project often begins with a deficiency –a reasonable expectation for mobility or safety is not being met by the existing infrastructure.

What Benefit & to Whom/Mode Trade-Offs

In an urban environment, there is often insufficient real estate to accommodate the ideal facility that meets everyone's needs. In Bellevue, this bears out in the Downtown urban center and in the several Activity Centers. Vehicle congestion is a reality and should be expected. Transit is sometimes caught up in that congestion. People walking and bicycling may have to share space and may experience congestion and delay. Vision Zero considers safety as a top priority, while Complete Streets seeks to ensure that all mobility options are considered. Together with the Comprehensive Plan that helps to prioritize modal priorities. MMLOS standards & guidelines may add value to the decision-making process. Figure 7 provides an example of how MMLOS can add transparency about what to build, why to build it, and the potential modal trade-offs. Figure 7 shows MMLOS applied to the Bellevue Way Corridor in Downtown, identifying the types of improvements required to meet the standards & guidelines.

Figure 7


NE 14th St
NE 12th St
NE 10th St
NE 8th St
NE 6th St
NE 4th St
NE 2nd St
NE 1st St
Main St
100th Ave NE
102nd Ave NE
106th Ave NE
108th Ave NE
110th Ave NE
Bellevue Way NE
Bellevue Way SE
101st Ave SE
108th Ave SE
MMLOS Standards
Intersection
Enhanced Crossing
Standard Crossing
Exceptional Crossing
Speed + Reliability Intersection Improvement
Mid-Block Crossing
Potential (At Grade)
Potential (Grade Separated)
Existing (Grade Separated)
Bicycle Crossing
LOS 1
LOS 3
Other
Frequent Transit Network Stop
Sidewalk Improvement
Frequent Transit Route
Pedestrian Destination
Downtown
Bicycle Corridor
Primary Bicycle Corridor

Project Prioritization: When to Build a Project

The MMLOS metrics, standards and guidelines documented in this report will help with project prioritization.

Project Implementation: With What Resources

Conditions of Development Approval

During the development review process, either for a preliminary plat that involves creating multiple new lots or for a building on a single site, the city identifies the needed infrastructure improvements immediately adjacent to the proposed project. For non-motorized facilities, the location of these improvements is interior to or on the perimeter of the site. However, people walking or riding a bicycle travel beyond the site. Further analysis will determine whether is it appropriate to consider assigning responsibility for off-site improvements to a developer, either solely or in partnership through a fee in lieu program, with other developers or with the city.

Capital Investment Program

Bellevue invests capital resources in infrastructure that supports mobility across all modes. Resources are allocated to specific capital projects and to capital programs that have objectives to meet and criteria to plan with. MMLOS may help inform the allocation of resources to achieve certain mobility outcomes.

Impact Fees

As a means for growth/development to help pay for some of the impacts to existing infrastructure or to create new capacity, the city charges an impact fee. The impact fee is based on the number of net new PM Peak Hour vehicle trips that will be added to the network. The resulting projects are always those that help create new vehicle capacity. But what about the new trips that are taken by foot, by bicycle or by transit? The current impact fee system does not directly provide any resources for non-motorized trips.

Green Metrics

Tracking local transportation system performance on a global scale will require metrics that consider the aggregate outcome of the mobility choices people make for all of the trips that they take. Considering green metrics is a way to look at the environmental outcomes of mobility choices. Such outcomes – looking through a "green lens" - may help inform investment decisions. Typical metrics that may be embedded in MMLOS analysis include:

- Mode Share. Percent of total person trips made by each mode (e.g., auto, transit, bicycle, pedestrian).
- Vehicle Miles Traveled. Aggregate and per-capita. Total miles traveled in automobiles divided by total person trips by all modes.
- Greenhouse Gas Emissions. Tons of carbon dioxide equivalent. Can also be reported on a per capita or per person trip basis.

chapter

10 acknowledgements

2017 Bellevue City Council

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2016-2017
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chapter

11

appendix

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Multimodal Policy Options *for* Long Range Planning and Transportation Concurrency

April 2014

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EXECUTIVE SUMMARY

As Bellevue has transitioned from a suburban bedroom community to a major mixed-use center, expectations about how residents and visitors travel have changed as well. With major portions of the City featuring mixed-use development, robust transit service, high pedestrian activity, and bicycle amenities, the City's sole reliance on auto level of service (LOS) as a means to plan for future transportation investment is outdated.

This report documents best practices in applying multimodal LOS for long-range transportation planning and transportation concurrency management in Washington State and nationally. Based on this research, City staff, the Transportation Commission, and Fehr & Peers recommend the following policy options be evaluated for future adoption in City codes and policies:

- Adopt a multimodal LOS policy that evaluates transportation corridors. Corridors would be defined on which modes of travel are the priority. The LOS standards of the corridors could change as they pass through different zones in the City, similar to the existing Mobility Management Areas.
- Adopt a multimodal programmatic transportation concurrency program that uses "mobility units" to measure transportation supply and demand consumed by new growth.
- Monitor progress on transportation planning overall using performance targets.

The Commission unanimously approved a motion to include the concept of multimodal LOS in the Transportation Element through the 2014 Comprehensive Plan Update. The Commission also endorsed a proposal that, with Council approval, would provide the policy direction to develop a work plan and budget to integrate multimodal metrics into the Transportation Element and the Traffic Standards Code (BCC 14.10.060).

INTRODUCTION

As a typical post-war suburban community, much of Bellevue developed in an era where the car was viewed as the primary form of transportation and a major goal of early community planners and engineers was to ensure smooth flow of traffic. Reducing traffic congestion was equated with increased safety, better mobility, and enhanced economic development. Concurrent with the rapid growth of Bellevue were advances in transportation planning and engineering. The concept of level of service, or LOS, became synonymous with reducing traffic congestion. Like almost every city across the state and country, Bellevue adopted auto-oriented LOS standards that focus on delay at intersections as the primary measure of how to plan the transportation network and manage the mobility needs of new development.

Flash forward to 2014. Bellevue has emerged as the largest city on the eastside of Lake Washington and has some of the region's largest employment centers. Downtown Bellevue is the city's fastest-growing residential neighborhood. While much of the city retains a suburban character, major portions of Bellevue feature mixed-use development, robust transit service, high pedestrian activity, and bicycle amenities. Other areas of the city are along key transit routes or major bicycle corridors that feature high numbers of non-auto users. Despite this evolution in mobility and urban form, Bellevue's method for long-range planning and transportation concurrency have remained solidly anchored to auto LOS.

This report documents best practices in applying multimodal LOS for long-range transportation planning and transportation concurrency management in Washington State and nationally. Policy options for Bellevue are also presented, along with feedback received from the Bellevue Transportation Commission about the Commission's intent to prepare and implement a multimodal level of service methodology. Lastly, policy recommendations and next steps are presented.

BACKGROUND

The concept of level of service (LOS) dates back to the 1950s when the original Highway Capacity Manual (HCM) was published by the Transportation Research Board. In simple terms, LOS is intended to describe the quality of the transportation system from a user's perspective. Thus, LOS is a qualitative description of mobility. The original LOS definition was focused on auto travel and is based on the idea that traffic congestion leads to driver delay and frustration. A completely empty road is assigned a LOS of "A" (the LOS system was set to mimic school grades), since there is nothing getting in the way of a driver and they can travel as they please. Stop-and-go traffic is assigned a LOS of "F."

In the 1960's, LOS was introduced for other modes of travel, including walking, bicycling, and transit. Initially, the LOS methods for the non-auto modes were similar to auto LOS where congestion and delay defined the LOS scores. However, outside of very dense areas, a pedestrian or bicyclist rarely feels uncomfortably crowded on a sidewalk or bike lane. Transit LOS never caught on since transit agencies tended to rely on separate measures of performance for transit planning. Given the lack of applicability in practical use, non-auto LOS methods were largely ignored for the next 50 years.

Amid recent spikes in energy prices, demographic shifts, concerns over climate change, and technological advances, both the public and the planning/engineering community have realized that providing adequate infrastructure for non-auto modes is important for a balanced community. As a result, there has been more attention focused on multimodal LOS. Recent research has provided new insight into people's travel behavior and how to meaningfully measure LOS for different modes. With this background in mind, City of Bellevue planners recognized the benefits of exploring how multimodal LOS could benefit transportation planning and concurrency management.

LEVEL OF SERVICE IN WASHINGTON STATE

The Washington State Legislature passed the Growth Management Act (GMA) in 1990. The GMA defines transportation as one of the mandatory elements of a jurisdiction's Comprehensive Plan. Further, the Legislature defined that the transportation element must include an inventory of facilities and a LOS standard for "all locally owned arterials and transit routes to judge performance of the system." A pedestrian and bicycle component is also required in the transportation element, however, no LOS standard is required for those modes. As an integral part of the transportation element, the Legislature included the concept of transportation concurrency, as stated below (RCW 36.70A.070):

> *After adoption of the comprehensive plan by jurisdictions required to plan or who choose to plan under RCW 36.70A.040, local jurisdictions must adopt and enforce ordinances which prohibit development approval if the development causes the level of service on a locally owned transportation facility to decline below the standards adopted in the transportation element of the comprehensive plan, unless transportation improvements or strategies to accommodate the impacts of development are made concurrent with the development.*

In essence, the transportation element and concurrency provision are intended to have jurisdictions identify a long-range transportation system plan that accommodates the future land use and devise a system to ensure that the transportation system is implemented to meet community defined LOS targets. The bullets below provide more complete definitions:

- **Long-range planning** defines the transportation goals, policies, and desired outcomes for the transportation system given the population and employment growth forecasted in the Comprehensive Plan. Auto LOS is often used to plan the auto transportation system by establishing an auto LOS goal/standard, and determining the list of projects needed to meet that standard over time. Multimodal LOS could be used to facilitate planning for other modes.
- **Regulatory concurrency** is the process that jurisdictions implement to determine if a specific development would cause any transportation facilities to fall below the LOS thresholds adopted in the Comprehensive Plan.

While nearly all Washington State communities have defined a multimodal long-range transportation system, very few communities have used a systematic multimodal LOS method to define what this system looks like. Only two communities use multimodal LOS to manage transportation concurrency.

WASHINGTON STATE – STATE OF THE PRACTICE

This section describes how long-range planning and regulatory concurrency is typically performed in Washington State communities. Most of the focus on this section is on regulatory concurrency since there tends to be more documentation on how communities develop and monitor regulatory concurrency programs. Following this section is a discussion of best practices in Washington State, and examples of both long-range planning and regulatory concurrency programs are highlighted.

LONG-RANGE PLANNING

There is no "cookbook" with a recipe to develop a transportation element for a Comprehensive Plan. These plans tend to be unique for each community. However, given the requirements set forth in the GMA, the example below is typical of the steps a community would take to develop a long-range transportation plan:

1. Identify the future land use growth in the community
2. Define goals and policies related to issues such as traffic congestion, transit service, and bicycle and pedestrian mobility
3. Quantify a LOS standard for autos
4. Determine how much auto demand there will be based on the future land use
5. Identify capital projects needed to provide the roadway capacity to meet the auto LOS standard
6. Identify a network for bicycle, pedestrian, and transit travel based on community input, and planning-judgment
7. Identify a set of non-auto capital projects to implement the plans for the other modes; often, auto improvements are prioritized since the auto LOS goal must be met. Occasionally, very few non-auto projects are developed due to limited funding and an auto-oriented LOS policy.

In the absence of a LOS-based planning approach for non-auto modes, some cities develop bicycle, pedestrian, and transit networks and project lists using a qualitative approach. In this case, lines are drawn on a map to connect important destinations, or policies are defined, such as the need to build a sidewalk on at least one side of every street and to ensure that all arterials have bike lanes. This approach is typically iterative and involves substantial public input to identify destinations, travel desire lines, and policies. While this approach can be quite effective at long-term planning, it can run into difficulty as the plans are implemented, particularly when interests question the need for expanding non-auto infrastructure in absence of a clear LOS policy and standards.

REGULATORY CONCURRENCY

As described above, the GMA requires multimodal transportation elements, but because LOS is only required to be defined for "locally owned arterials and transit routes," the law does not explicitly require concurrency planning for other modes. In practice, most jurisdictions within Washington State set concurrency standards only for autos—for example, this is currently the case for the Cities of Kent, Spokane, and Tacoma[1].

The City of Seattle sets LOS standards for autos (using volume-to-capacity across large screenlines)[2], but also includes mode share goals which serve to quantify the City's vision of the future transportation system. Both the screenline LOS and mode share goals vary across the city, reflecting a higher tolerance for congestion and a higher goal for non-SOV mode share in denser areas of the city.

While mode share goals are identified in the Seattle Comprehensive Plan, these goals are not explicitly tied to the assessment of concurrency. In essence, Seattle has quantified its vision for the transportation system, but has not developed a means to achieve it via the concurrency regulations.

King County has a concurrency evaluation method that considers auto LOS within various "travel sheds" using average travel speeds on state routes and arterials. LOS standards vary depending on whether the travel shed is a rural area, a rural neighborhood commercial center, an urban growth area or a rural mobility area. Rural area LOS standards are skewed to higher speeds than are urban areas. In each area, 85 percent of the state routes and arterials must meet the adopted

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[1] While there is transit in these cities, the transit is not owned or operated by the city and is therefore no transit LOS standard is defined.

[2] Seattle also defines LOS standards for transit, but they are the same as autos noting that buses travel on the same right-of-way as cars and are equally affected by congestion. Many cities use a similar justification to avoid developing a separate transit LOS standard.

LOS standard. King County does not test individual developments; rather they assume a development proposal meets concurrency if it is located in a travel shed that meets the LOS standards cited above. This type of concurrency assessment is known as *Plan Based Concurrency*.

By measuring concurrency based only on auto LOS, jurisdictions tend to focus on auto improvements, potentially at the expense of other modes including pedestrians, bicycles, and transit. As the thinking of transportation planners and the expectations of the community have evolved to consider a more holistic approach to the transportation system, applying concurrency in a multimodal fashion has emerged as a challenge. The remainder of this memorandum surveys the best practices for assessing concurrency and long-range planning both in Washington State and beyond.

City of Bellevue

The City of Bellevue's approach to long-range planning generally follows the process outlined above, although the City does maintain advanced travel models and GIS databases to streamline the identification and prioritization of future projects. Documents such as the Comprehensive Plan transportation element and Pedestrian and Bicycle Transportation Plan define specifically the City's long-range planning process; key features are summarized below.

- The City has a long-range auto LOS standard to facilitate planning of the auto network.
- The Pedestrian and Bicycle Transportation Plan was developed through the efforts of planning staff and an extensive community outreach process. The final project list was prioritized using sophisticated GIS and field data analysis techniques.
- There are no LOS standards for non-auto modes.

Bellevue is currently updating its Transit Master Plan, which outlines the City's vision for transit service and facilities. With King County Metro focusing on well-defined performance metrics to guide future service provision, the City's new Transit Master Plan has a decidedly quantitative approach. Some of the elements of the Transit Master Plan could serve as the basis of a transit LOS that can be applied for future long-range planning and potentially regulatory concurrency.

Bellevue currently has a "project-based" regulatory concurrency system that evaluates how a new development project may impact auto LOS in 14 "mobility management areas" (MMA). The MMAs allow for different LOS standards to be defined in areas of the city in consideration of land use and urban form characteristics. Auto LOS is defined using a two-hour peak period volume-to-capacity (v/c) ratio at “system" intersections. Maximum v/c ratios are defined for each MMA and, similar to King County, a certain number of intersections within each MMA are allowed to exceed the v/c ratio. In general, dense areas have both a higher v/c standard and a greater number of intersections that can exceed the v/c threshold.

Recognizing the limitations of its auto-based concurrency system, the City of Bellevue participated in a multimodal concurrency pilot project with the PSRC in 2009. That document outlined the following three steps for a multimodal concurrency management program:

> *Step 1) Evaluate multimodal concurrency in a future year. In this step, forecasted travel demand is compared with the planned capacity of the transportation system. If the analysis concludes that the transportation system is adequate, a positive concurrency finding, then the proposed development can be constructed and no further work is required.*
>
> *Step 2) If step one finds that concurrency has not been met, the analysis must determine the gap between the originally proposed future transportation system and a scenario that would meet concurrency. The gap is then translated unto units such as person trips, which allows scenario testing to be conducted.*
>
> *Step 3) Finally, strategies are designed and tested to close the gap and meet concurrency requirements.*

This report also suggests various metrics for each mode. Staff from PSRC, King County Metro, and the City of Bellevue collaborated to test this approach in Downtown Bellevue. They tested a long-term planning scenario rather than applying it as a development review case. Although it was determined that Downtown Bellevue would meet concurrency in the horizon year of 2020, the project team assumed that this was not the case so that a sample gap analysis could be completed. The team used person trips to quantify the gap and tested a variety of transit, pedestrian, bicycle, and TDM measures to close the gap.

BEST PRACTICES IN WASHINGTON STATE

Two Washington State jurisdictions have implemented multimodal concurrency programs: Bellingham and Redmond. These programs go beyond auto-centric measures so that the cities have a means to achieve their multimodal visions. The approaches used by Burien and Renton for long-range planning are also uncommon so they are summarized in this section.

City of Bellingham

The City of Bellingham implemented a multimodal transportation concurrency program in 2008. The fundamental concept underlying the program is quantifying the number of person trips available (PTA) for each mode. Metrics for each mode are shown in **Figure 1**.

Motorized	**Measurement**
Automobiles	Arterial volume-to-capacity measured during weekday p.m. peak hour based on data collected at designated concurrency measurement points in concurrency service areas
Public Transit	Seated capacity based on bus size and route frequency and ridership based on annual transit surveys measured during weekday p.m. peak hour based on data collected at designated concurrency measurement points for each concurrency service area
Non-motorized	**Measurement**
Bicycle	Credit person trips according to degree of bicycle network completeness for designated system facilities/routes for each concurrency service area
Pedestrian	Credit person trips according to degree of pedestrian network completeness for designated system facilities/routes for each concurrency service area
Trail Use	Credit person trips according to degree of trail network completeness, where trails serve a clear transportation function for a concurrency service area
Source: Bellingham Municipal Code 13.70 Multimodal Transportation Concurrency (2008)	

Figure 1. Multimodal Transportation Concurrency Measurements by Mode
Source: "Moving Beyond the Automobile: Multi-modal Transportation Planning in Bellingham, Washington, "Chris Comeau, AICP, Practicing Planner, Vol. 7, No. 3, September 2009.

Multimodal LOS in Bellingham's Comprehensive Plan

The Comprehensive Plan was revised to include LOS standards based on the PTA platform, as follows:

- Arterial Streets: LOS E which corresponds to no more than a 1.0 volume-to-capacity ratio.
- Transit: LOS F which corresponds to 1.0-1.25 riders per seat (e.g. up to 50 riders on a 40-seat bus).
- No separate LOS thresholds are identified for pedestrians, bicycles, or trails; however, they are considered in the overall PTA measure.

Based on the existing and planned transportation facilities, the City can estimate the total PTA in the planning horizon year. Land use forecasts can then be tested against this transportation system to determine if the land use plans and transportation system are in line with one another. Other than determining whether future roadway and transit infrastructure meet the LOS standards, there are no explicit quantitative metrics guiding the long-range planning for the other modes. The bicycle and pedestrian plans were developed using traditional planning approaches.

Regulatory Concurrency

The PTA concept can also be applied in a regulatory setting. Bellingham is divided into 15 "concurrency service areas," to account for the varying land use and urban form characteristics of each area. These areas are categorized into three types. Type 1 areas are urban villages with adopted master plans and generally have the highest level of pedestrian, bicycle, and transit service. Type 3 areas are less dense with few pedestrian, bicycle, and transit options and high dependence on auto travel, while the Type 2 designation is used for those transition areas that fall in the middle of the spectrum. Different weights—called "policy dials"—are applied to each mode as shown in **Figure 2**, to help direct development into the areas that the City has identified as being most appropriate for growth.

	Transportation Concurrency Service Areas		
Mode	Type 1[1]	Type 2[2]	Type 3[3]
Motorized			
Auto			
Mode weight factor[4]	0.70	0.80	0.90
Transit			
Mode weight factor[5]	1.00	1.00	0.80
Non-Motorized			
Pedestrian			
Percent threshold for minimum system complete[8]	50%	50%	50%
Person trip credit for 1% greater than minimum threshold[9]	20	20	20
Mode weight factor[6]	0.60	0.60	0.60
Bicycle			
Percent threshold for minimum system complete[8]	50%	50%	50%
Percent credit for 1% greater than threshold[9]	20	20	20
Mode weight factor[7]	0.40	0.40	0.40

1. Type 1 = Urban Village areas with adopted master plans, high-density mixed use zoning, or an active master plan process.
2. Type 2 = Medium density areas adjacent to and influenced by Urban Villages.
3. Type 3 = Lower density and auto-oriented areas near edges of City.
4. Auto mode weight factor considers the importance of roadways to a service area, relative to the availability of other mode alternatives.
5. Transit mode weight factor considers the availability/viability of the transit mode to a service area.
6. Pedestrian mode weight factor considers the importance of pedestrian facilities to a service area, relative to land use and travel patterns.
7. Bicycle mode weight factor considers the importance of bicycle facilities to a service area, relative to land use and travel patterns.
8. This is the minimum level of the planned system completed for it to be considered a viable mode alternative.
9. Person trips credited to service area based on the amount of the system completed minus the minimum threshold.

Source: Bellingham Municipal Code, Section 13.70, Table 1 (2008).

Figure 2. Multimodal Policy Dials
Source: "Moving Beyond the Automobile: Multi-modal Transportation Planning in Bellingham, Washington," Chris Comeau, AICP, *Practicing Planner*, Vol. 7, No. 3, September 2009.

The following examples illustrate how PTA are calculated by mode:

- A roadway with a 1,400 vehicle hourly capacity and a volume of 1,000 vehicles would have 600 PTA assuming an average occupancy rate of 1.5 people per vehicle.
- A location with four 40-seat buses per peak hour (160 person trip total capacity) and 100 riders would have 60 PTA.

- An area with 90% of its sidewalk or bicycle network complete would be credited with 800 PTA. An area with 40% of its sidewalk or bicycle network complete would not be credited with any PTA. To gain PTA via sidewalk or bicycle improvements, a minimum of 50% of the area's sidewalk and bicycle network must be completed.

Each year, the City of Bellingham calculates the PTA for each concurrency service area, taking into account projects with approved permits. Each new development application draws upon the PTA in the relevant area. If the development would generate more person trips than are available, the developer must contribute sufficient PTA through construction of new multimodal facilities or implement transportation demand management strategies to allow the project to go forward (these strategies reduce the PTA demanded by the development).

The pool of PTA can be increased by improving any modal facility, thereby offering flexibility to the City and developers. Another benefit of this approach is that it is based on recent observed data, providing a reliable check of current conditions. However, this also means the approach is somewhat data-intensive. In addition, there is no direct link to SEPA standards, which generally rely on traditional auto LOS thresholds to make determinations of significance.

City of Redmond

The City of Redmond implemented a multimodal transportation concurrency program in 2009. The system defines LOS based on citywide person miles traveled, which are called "mobility units" by the City. The City uses supply and demand language to describe the program: completed infrastructure projects create mobility units of supply and new developments create mobility units of demand.

The City uses this concept for both long-range planning and regulatory concurrency. The City developed a Transportation Master Plan (TMP) that lists multimodal capital projects intended to achieve the envisioned land use/transportation balance. The fundamental assumption underlying the concurrency system is that the list of projects to be constructed by the TMP's horizon year is expected to meet the demand of new development. In other words, the number of mobility units supplied by the TMP is equal to the number of mobility units that would be consumed by the planned development.

Long-Range Planning

The Redmond Comprehensive Plan includes the following policy which serves as the LOS standards for long-range planning as well as concurrency:

> *Support planned land use through the use of a citywide person-mile-of-travel-based transportation level of service standard. Redmond's transportation level of service standard is established to mean that so long as the growth of the city and the development of the city's transportation system are proportionate, work in parallel, and are consistent with the Comprehensive Plan, all concurrency management requirements are considered met.*

Concurrency is quantified as the ratio between the mobility units of supply and the mobility units of demand so a ratio of more than 1.0 indicates that the City is achieving its envisioned transportation/land use balance.

Mobility units are calculated using the City's travel demand model. First, land use growth is determined, then ITE trip-generation rates are applied to estimate vehicle trips which are subsequently converted to person trips. (Person trips for pedestrians, bicycles, and transit were estimated using the travel demand model.) Lastly, the travel demand model is used to estimate trip length which is applied to the total person trips to arrive at the person miles of travel. The resulting number of person miles traveled—or mobility units—is then allocated proportionately to each capital project in the TMP based on cost. Balance between the supply and demand of mobility units can be tracked by summing the mobility units that are supplied by completed projects and comparing that to the total mobility units that are consumed by new development.

While Redmond ultimately translates its TMP into mobility units, these units are not the basis for developing the plan itself. In terms of long-range planning, Redmond recently completed an update of the TMP with the projects in the multimodal plan being selected on the basis of how well they help to advance nine "dashboard" measures. These measures are summarized in **Figure 3** on the following page.

Redmond Dashboard Measures	
Measure	**Description**
Connectivity	Percentage of Downtown and Overlake Village development square footage with connectivity levels of "medium" or better. Connectivity is measured using route directness—the ratio of the actual pedestrian travel distance to the straight line distance between set points on the transportation network. 2030 targets are 81% of development in Downtown and 31% of development in Overlake Village
Network Completion	Proportion of the multimodal transportation system that is complete to the city's defined ultimate buildout plan. Tracked separately for auto, bicycle, pedestrian, transit, and truck networks. 2030 targets are 68% auto, 51% bicycle, 53% pedestrian, 100% transit, 76% truck.
Mode Share	Non-SOV mode share. 2030 target is 53%.
Vehicular Congestion	Average PM peak hour vehicle delay per mile on principal arterials. 2030 target is 46 seconds per mile.
Transit Ridership	Average boardings per weekday citywide. 2030 target 26,700 (based on mode share target).
Concurrency	Ratio of mobility units of supply to mobility units of demand. 2030 target is 1.0.
Safety	Number of injuries per 1,000 persons (based on daytime population). 2030 target is 1.3 injuries per 1,000 persons or less. Note that future performance for this target cannot be forecasted. The city uses this target to prioritize short-term safety projects.
Air and Water Quality	Air quality measure based on federal "attainment" status for PM 2.5. Water quality measure is based on the proportion of right of way that is equipped "basic" treatment infrastructure. 2030 air quality target is for attainment status and 2030 water quality target is for 36% of right of way to feature basic water quality treatment.
Street Preservation	Pavement condition index. 2030 target is 73.

Figure 3. Redmond Transportation Master Dashboard Performance Measures
Source: "Transportation Master Plan, pages 40-56" City of Redmond, August 2013.

Regulatory Concurrency

The regulatory concurrency process requires that the City determine the number of mobility units that would be available in the six-year timeframe that the GMA requires for transportation infrastructure to be implemented following development. To measure the available mobility units, the City employs the system completion dashboard measure in conjunction with the funding status of each project in the TMP. The City has specific guidelines to help determine which projects should be assumed to be completed within six years. For example, a fully funded project included in the CIP or the annual expenditure for a programmatic project would be included.

Each development application is evaluated to estimate the number of mobility units that would be generated using a spreadsheet tool that mirrors the more involved travel demand modeling process used for long-term planning. Redmond uses a look-up table that provides the mobility unit rates for each type of land use development, similar to an impact fee table. This demand is then compared to the level of six-year mobility unit supply to determine if the development is permissible. If insufficient mobility units are available, the development would be rejected or the developer could pay to implement a project that would supply the required amount of mobility units to maintain concurrency. The mobility unit calculation and allocation methodology is currently being updated to ensure that projects which generate higher rates of pedestrian or bicycle travel (which have lower person miles of travel than auto trips) would use proportionately fewer mobility units and since mobility units also for the basis for Redmond's transportation impact fee program, would pay lower impact fees.

As with Bellingham, this approach provides flexibility to build a project that addresses any mode. Redmond's method requires that the total mobility units be recalculated when the Comprehensive Plan is being updated rather than every year (although the six-year projection must be done more frequently). One potential problem with this approach is that more expensive projects tend to be implemented since they provide substantial mobility units; in turn, smaller projects are sometimes ignored. Also, there is no correlation to mode split goals or SEPA standards.

City of Burien

The City of Burien uses a multimodal LOS methodology in its 2012 Transportation Master Plan (TMP) to help define the projects in the City's CIP and prioritize the projects in the Transportation Improvement Plan (TIP). This approach has not yet been translated to the regulatory concurrency process. Burien continues to employ traditional auto LOS standards for regulatory concurrency review.

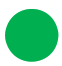
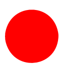
For transit, pedestrians, and bicycles, the City uses a three-tier LOS system with green denoting the highest level of service, yellow denoting an intermediate level of service, and red denoting a poor level of service. As described below, the three LOS tiers vary based on the type of transportation facility and the neighborhood context. In conjunction with the LOS system, Burien defined a "layered network," which is a system that identifies the "priority" modes on a given facility. For example, Ambaum Boulevard, which is a major north-south arterial, is defined as both a transit priority and an auto priority corridor. Ambaum is not defined as a bikeway, recognizing that cycling will not be practical for much of the public on this busy street. 4th Avenue, a parallel street located just east of Ambaum is identified as one of the City's main north/south bicycle corridors.

Burien identified corridors with high transit demand and/or high service frequency. These corridors were evaluated using the criteria shown in **Figure 4**. The TMP recognizes that the City can improve the infrastructure on which transit operates, although it has no direct control over transit service. Therefore, City investments would include projects such as bus stop amenities, crosswalks, sidewalks, intersection improvements, and transit signal priority. The City aims to achieve a green LOS for all roadways designated as transit priority corridors.

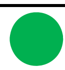
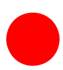
LOS	Transit Stop Amenities	Transit Travel Speeds	Pedestrian Access	Frequency of Service
(green)	High level	Minimal Roadway Delay	Sidewalks and marked crosswalks serving stops	All day service. Peak service 15 minutes or less, midday 30 minutes or less.
(yellow)	Some amenities	Moderate Roadway Delay	Sidewalks and marked crosswalks service some stops	All day service. Peak services 30o minutes or less, midday service 60 minutes or less.
(red)	Little or no amenities	Congested Roadway	General lack of sidewalks and marked crosswalks	Low level of service.

Figure 4. Transit Corridor LOS
Source: Burien Transportation Master Plan, 2012.

Burien's criteria for the pedestrian network are shown in **Figure 5**. The City designates areas as being either pedestrian priority areas or pedestrian non-priority areas. This system recognizes that investment should first be focused in areas such as downtown or near schools, rather than outlying residential areas.

LOS	Along Transit Priority Corridors	Pedestrian Activity Centers	Downtown Burien
	Sidewalk and buffer	Arterial/Collector – Sidewalk on Both Sides	Meets Downtown Standards
	Sidewalk	Wide Shoulder	Sub-standard Sidewalk
	No Sidewalk	Congested Roadway	No Sidewalk

Pedestrian Non-Priority Area LOS – Sidewalk Requirements

LOS	Other Roadway Segments
	Arterial – Sidewalk on Both Sides
	Arterial – Sidewalk on One Side
	Arterial – No Sidewalk

Crossing Requirements

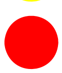
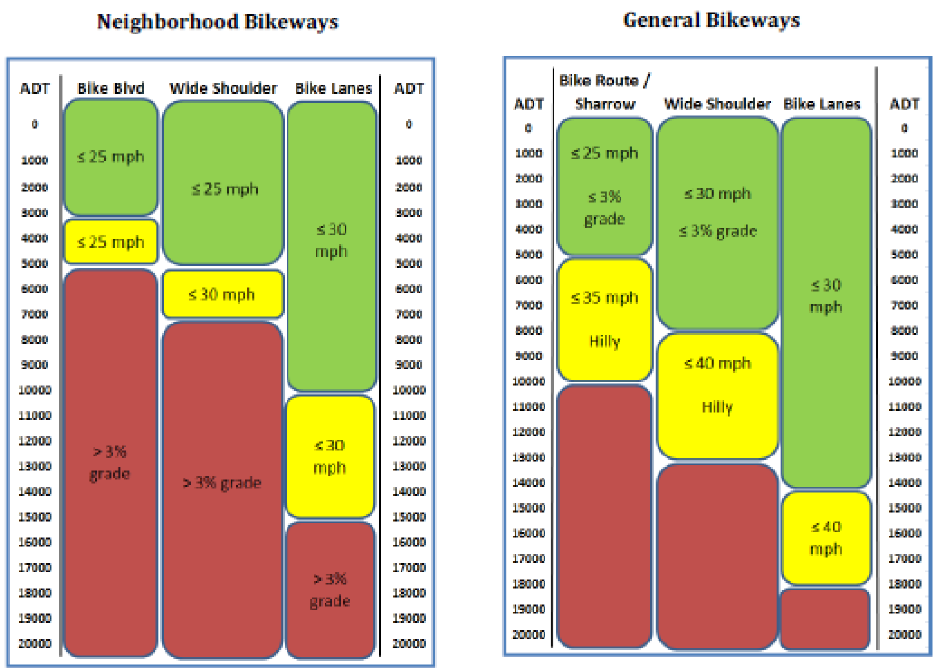
LOS	Pedestrian Priority Areas	Other Areas
	Appropriately designed crossing every 300 feet in pedestrian activity area(s) or downtown	Appropriately designed crossings at existing marked crosswalks
	Crosswalks present every 600 feet	Crosswalks present
	No crosswalks present	No crossings within 600 feet

Figure 5. Pedestrian LOS
Source: Burien Transportation Master Plan, 2012.

Bicycle facilities are also categorized into two tiers: neighborhood bikeways, which are designed to accommodate bicyclists of all abilities on low volume, low speed residential streets, and general bikeways which are designed for more confident riders who are comfortable using roadways with higher volumes and speeds. **Figure 6** summarizes the bicycle LOS from the Burien plan.



Crossing Requirements

LOS	Unsignalized Intersections	Stop Frequency (Neighborhood Bikeways Only)
🟢	Adequate crossing of arterial or collectors along bikeways.	< One stop per 1/4 mile
🟡	Marked but insufficient crossing of arterial or collector along bikeway	Stops spaced at 1/8 to 1/4 mile
🔴	No marked/controlled crossings of arterial or collector along bikeway	> One stop per 1/8 mile

Figure 6. Bicycle LOS
Source: Burien Transportation Master Plan, 2012.

Burien uses traditional (Highway Capacity Manual (HCM) intersection LOS for autos. Again, roadways are categorized differently to account for their desired character. For example, downtown Burien has a lower LOS threshold than other areas because the City wants to maintain the walkability of the area – this eliminates projects such as roadway widening from consideration.

Burien's Comprehensive Plan includes the following language:

> *The City adopts the following Level-of-Service standards for vehicles: LOS standard D for designated vehicle priority roadways; LOS standard E for downtown Burien streets; and LOS C for all other roadway facilities and services.*
>
> *The City will pursue the following actions along designated transit priority roadways: provide high level of transit stop amenities, maintain adequate vehicle LOS, provide sidewalks and marked crosswalks at all major transit stops, and encourage transit agencies to provide all day service with minimum 15-minute peak/30-minute midday bus frequencies.*
>
> *The City will pursue the following actions within designated pedestrian priority areas: provide sidewalks and/or wide shoulders on both sides of all arterial and collector routes and provide adequate street crossings within 300 feet of identified activity areas. For other areas of the city, provide sidewalks and/or wide shoulders on all arterial routes and adequate crossings at existing or planned marked crosswalks.*
>
> *The City will pursue the following actions for designated bicycle priority streets: provide high-level bicycle treatments on roadway segments considering traffic volumes and speeds, adequate intersection treatments, and undertake actions to minimize stop frequency for bicycles along these routes. For other streets with bikeways, provide appropriate bicycle treatments considering traffic volumes and speeds on designated streets, and adequate intersection treatments.*

This approach requires minimal data collection and uses simple analysis with context sensitive LOS definitions. However, there is no regulatory concurrency component, there is potential for modal conflict, and some of the measures are subjective.

City of Renton

The City of Renton uses an uncommon measure for their regulatory concurrency evaluation. Using the Renton travel demand model, the City estimates the distance that can be traveled in 30 minutes from the center of the City. This is done for a single occupant vehicle, a high occupancy vehicle, and a transit vehicle. Then, an index is determined by calculating the sum of the HOV and SOV distances and twice the transit distance. This analysis is updated periodically to set the standard for future evaluation. For instance, the 2002 index was determined to be 42 (16.6 miles for SOV plus 18.7 miles for HOV plus 2 x 3.4 miles for transit), which then serves as the standard for the 2022 horizon year.

This citywide standard is applied as part of a plan-based concurrency program to determine whether future development may impact mobility in Renton. This approach is inherently multimodal since projects that generate fewer auto trips will have less of an impact on the travel distance index. One downside compared to Redmond or Bellingham's concurrency program is that non-auto improvements do not directly improve the index. However, transit speed improvements are given more weight than auto improvements, providing incentive to increase the mobility of transit, with particularly high value to transit operating in dedicated right-of-way.

While Renton uses this travel distance methodology for regulatory concurrency, it is unclear if the City uses this measure to inform the long-range transportation plan.

NATIONAL BEST PRACTICES

This chapter summarizes the best multimodal planning practices from around the country.

Florida Department of Transportation

Florida and Washington are the only states with a concurrency requirement. The Florida Department of Transportation (FDOT) has developed a detailed handbook for determining level of service. In addition to auto LOS, the handbook addresses transit, pedestrian, and bicycle LOS. FDOT has also developed a software program to streamline the LOS calculation.

Pedestrian and bicycle LOS are calculated using a regression model. Pedestrian LOS is based on four variables: existence of a sidewalk, lateral separation of pedestrians from motorized vehicles, motorized vehicle volumes, and motorized vehicle speeds. Bicycle LOS is based on the following five variables: average effective width of the outside through lane, motorized vehicle volumes, motorized vehicle speeds, heavy vehicle volumes, and pavement condition. Note that while the bicycle LOS is not applicable to off-street facilities, the pedestrian model may be applied to shared use paths within 100 feet of the roadway.

These models were originally designed for operational purposes, but FDOT has made some assumptions to simplify the methodology for planning level evaluation by giving a discrete number of choices with default values for some variables. For example, the software includes three choices for outside lane width (wide, typical, or narrow) with default values. For pedestrian and bicycle analysis, FDOT weights segments based on their length and the severity of their scores, which significantly penalizes poorly operating segments.

For transit, FDOT relies on the concept that frequency of service is the most relevant performance measure. FDOT uses the service

Service Frequency LOS Thresholds

Level of Service	Adjusted Service Frequency (Vehicles/hour)	Headway (minutes)	Comments
A	>6.0	<10	Passengers don't need schedules
B	4.01 to 6.0	10 to 14	Frequent service, passengers consult schedules
C	3.0 to 4.0	15 to 20	Maximum desirable time to wait if transit vehicle missed
D	2.0 to 2.99	21 to 30	Service unattractive to choice riders
E	1.0 to 1.99	31 to 60	Service available during hour
F	<1.0	>60	Service unattractive to all riders

Figure 7. FDOT Transit LOS

Source: Quality/Level of Service Handbook, FDOT, 2009.

frequency standards cited in the Transportation Research Board's Transit Capacity and Quality of Service Manual, as shown in **Figure 7** on the prior page. FDOT also created "Generalized Tables" that may be used for generalized planning of facilities, rather than focusing on the segment level.

City of Destin

The City of Destin uses FDOT's ARTPLAN software to evaluate multimodal LOS within a designated Multimodal Transportation District (MMTD). In 2006, Destin was the first jurisdiction in Florida to adopt a MMTD and several other cities have since followed suit. Destin codified both short-term and long-term multimodal LOS standards within their Comprehensive Plan. **Figure 8** below summarizes the ARTPLAN LOS standards for major collector roads.

	BICYCLE	PED	BUS
Adopted (2006)	C	E	F
Adopted (2011)	B	C	E
Adopted (2020)	B	B	C

Figure 8. Destin LOS Targets by Year
Source: Quality/Level of Service Handbook, FDOT, 2009.

Within the MMTD, the City requires proposed developments to meet two conditions to be considered in compliance with the concurrency standard. First, the development must follow certain urban form and multimodal facility design standards. Second, the development must offset its traffic impact through multimodal improvements. The traffic impact of a project is determined by entering project vehicle trip generation into a spreadsheet. Multimodal improvements to offset the impact can be selected from a checklist. The number of impact mitigation points must equal or exceed the calculated impact. Mitigation projects include on-site, frontage improvements, and off-site improvements. Examples include development of pedestrian oriented buildings (adjacent to the sidewalk), constructing on-site sidewalks to connect uses, constructing off-site sidewalks/bicycle facilities, or providing less than the maximum allowed parking.

San Francisco, California

The State of California has no concurrency requirement. Therefore, jurisdictions have been moving toward using other means to achieve the goals of a concurrency program, namely, the

California Environmental Quality Act (CEQA) impact disclosure requirements and impact fee programs.

The San Francisco Department of Public Health (SFDPH) developed a Bicycle Environmental Quality Index (BEQI) and a Pedestrian Environmental Quality Index (PEQI). These indices consider a wide variety of facility characteristics and quantify how well the facility is serving pedestrians or bicycles. These scores can help jurisdictions to prioritize capital investments.

The PEQI and BEQI were developed using a survey of available research on how different roadway environments affect pedestrians and bicyclists. Both the PEQI and the BEQI use a field observation in conjunction with other data to determine an overall score for the facility. The PEQI has a total of 30 variables while the BEQI has 22, as shown in **Figures 9** and **10** below.

INTERSECTION	***STREET SEGMENT***			
Intersection Safety	**Traffic**	**Street Design**	**Land Use**	**Perceived Safety**
Crosswalk	Number of lanes	Sidewalk width	Storefronts/retail use	Illegal graffiti
Ladder crosswalk	Two-way traffic	Sidewalk impediments	Public art/historical sites	Litter
Pedestrian signal	Vehicle speed limit	Sidewalk obstructions		Pedestrian scale lighting
Traffic signal	Traffic volume	Presence of curb		Construction sites
Crossing speed	Traffic calming features	Driveway cuts		Abandoned buildings
Crosswalk scramble		Trees		
No turn on red signs		Planters/gardens		
Traffic calming features		Public seating		
Additional signs for pedestrians		Presence of buffer		

Figure 9. PEQI Scoring Elements
Source: Pedestrian Environmental Quality Index (PEQI) Draft Methods Report v 1.1, 2008.

INTERSECTION	STREET SEGMENT			
Intersection Safety	**Vehicle Traffic**	**Street Design**	**Safety**	**Land Use**
Left Turn Bicycle Lane	Number of Vehicle Lanes	Presence of a Marked Area for Bicycle Traffic	Bicycle/Pedestrian Scale Lighting	Line of Sight
Dashed Intersection Bicycle Lane	Vehicle Speed	Width of Bike Lane	Presence of Bicycle Lane Signs	Bicycle Parking
No Turn on Red Sign(s)	Traffic Calming Features	Bicycle Lane Markings		Retail Use
	Parallel Parking Adjacent to Bicycle Lane/Route	Trees		
	Traffic Volume	Connectivity of Bicycle Lanes		
	Percentage of Heavy Vehicle	Pavement Type/Condition		
		Driveway Cuts		
		Street Slope		

Figure 10. BEQI Scoring Elements
Source: Bicycle Environmental Quality Index (BEQI) Draft Report, 2009.

Most of the data is collected by observation at an intersection or street segment, using a two-page survey with simple questions. Other data is also required, including traffic volumes, grade, and heavy vehicle percentage. SFDPH created a Microsoft Access database that takes the data from the field and other sources to calculate the overall score using varying weights for each indicator. The final score ranges from zero to 100, with 100 denoting the highest quality facilities.

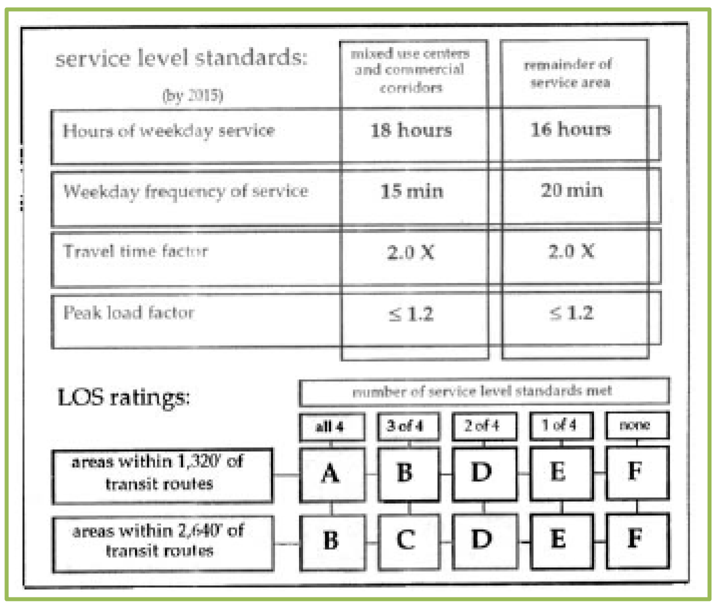
San Francisco has also tried to use the concept of Auto Trips Generated (ATG) in development review. This method assumes that each new auto trip is an incremental impact to the network. The concept is aimed at balancing objectives to consider the public right-of-way as a space for all modes rather than strictly as a vehicle facility. However, the City ran into challenges demonstrating the nexus to the mitigation it proposed and is now reconsidering if there is another way to achieve the goal.

Fort Collins, Colorado

The City of Fort Collins has developed a multimodal LOS system that essentially functions as a concurrency management system.. These standards are used for long-term planning as well as part of the development review process (which is similar to regulatory concurrency).

Transit LOS is based on four factors: hours of weekday service, weekday frequency of service, travel time factor (the ratio of transit travel time to auto travel time), and peak load factor (the ratio of passengers to seats). The City establishes two sets of thresholds depending on the area in question. Mixed use centers and commercial corridors have more stringent thresholds (e.g., more hours of weekday service and higher frequency.) than outlying areas. The number of conditions met and the distance to the transit route determine which LOS grade is achieved as shown in **Figure 11**.

Fort Collins sets thresholds for five distinct typologies for pedestrian LOS. Each measure has a different standard, rather than aggregating the measures into a single standard. Pedestrian LOS is based on five standards as described below and summarized in **Figure 12**:



service level standards: (by 2015)	mixed use centers and commercial corridors	remainder of service area
Hours of weekday service	18 hours	16 hours
Weekday frequency of service	15 min	20 min
Travel time factor	2.0 X	2.0 X
Peak load factor	≤ 1.2	≤ 1.2

LOS ratings:

	number of service level standards met				
	all 4	3 of 4	2 of 4	1 of 4	none
areas within 1,320' of transit routes	A	B	D	E	F
areas within 2,640' of transit routes	B	C	D	E	F

Figure 11. Ft. Collins Transit LOS
Source: Fort Collins Multimodal Transportation Level of Service Manual, 2002

- Directness – defined as the ratio of actual walking distance via sidewalks or pathways to minimum walking district as measured on the street grid. Continuous sidewalks along the grid system represents the ideal condition; LOS A is defined as having a ratio less than 1.2 while LOS F is defined as having a ratio greater than 2.

- Continuity – qualitative measure. For example, LOS C is defined as "continuous stretches of sidewalks which may have variable widths, with and without landscaped parkways."
- Street crossings – Four types of crossings are defined (signals, unsignalized crossing the major street, unsignalized crossing the minor street, and mid-block major street crossing), each with a defined LOS threshold. For example, LOS A on a signalized crossing is defined as "three or fewer lanes to cross; signal has clear vehicular and pedestrian indications; well-marked crosswalks; good lighting levels; standard curb ramps; automatic pedestrian signal phase; amenities, signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; and drivers and pedestrians have unobstructed views of each other."

Pedestrian Level of Service by Location Area Type

factors / area type	directness	continuity	street crossings	visual interest & amenities	security
pedestrian district	A	A	B	A	A
activity center/corridor	B	B	B	B	B
transit corridor	B	B	B	C	B
school walk area	B	B	B	C	B
other	C	C	C	C	C

Figure 12. Ft. Collins Pedestrian LOS
Source: Fort Collins Multimodal Transportation Level of Service Manual, 2002.

- Visual Interest and Amenity – qualitative measure. For example, LOS B is defined as "generous sidewalks, visual clarity, some street furniture and landscaping, and no blank street walls."
- Security – qualitative measure. For example, LOS A is defined as "sense of security enhanced by presence of other people using sidewalks and overlooking them from adjacent buildings. Good lighting and clear sight lines."

Bicycle LOS is based on the concept of connectivity to bike facilities, as shown in **Figure 13**. Again, areas have different LOS standards based on their character.

connectivity required for levels of service:

A	directly connected to both North-South and East-West on-street lanes
B	directly connected to both North-South and East-West corridors at least one of which is a set of on-street lanes
C	directly connected to either a North-South or an East-West corridor which is a set of on-street lanes
D	directly connected to either a North-South or an East-West corridor which is an off-street path
E	indirectly connected via an on-street unstriped route along a low volume local street to one or more of the above within 1/4 mile
F	no direct or indirect connections to either North-South or East-West corridors

minimum LOS

base city-wide minimum level:	C
public school sites:	A
recreation sites:	B
community/neighborhood commercial centers:	B

Figure 13. Ft. Collins Bicycle LOS
Source: Fort Collins Multimodal Transportation Level of Service Manual, 2002

Auto LOS is defined using volume-to-capacity ratios with standards varying based on the functional classification of the roadway and the type of neighborhood. **Figure 14** summarizes the auto LOS methodology.

	land use (from structure plan)			
		Other Corridors Within:		
roadway functional classification	Commercial Corridors	Mixed Use Districts	Low Density Mixed Residential	All Other Areas
Major Arterial	E	E*	D	D
Arterial	E	E*	D	D
Minor Arterial	E	E*	C	D
Collector	D	D*	C	D
Connector		C*	B	C

* Corridors within mixed use districts may fall below the LOS level indicated. In such cases, the City will provide for mitigation of congestion through alternatives to motor vehicle travel.

Figure 14. Ft. Collins Auto LOS
Source: Fort Collins Multimodal Transportation Level of Service Manual, 2002.

Fullerton, California

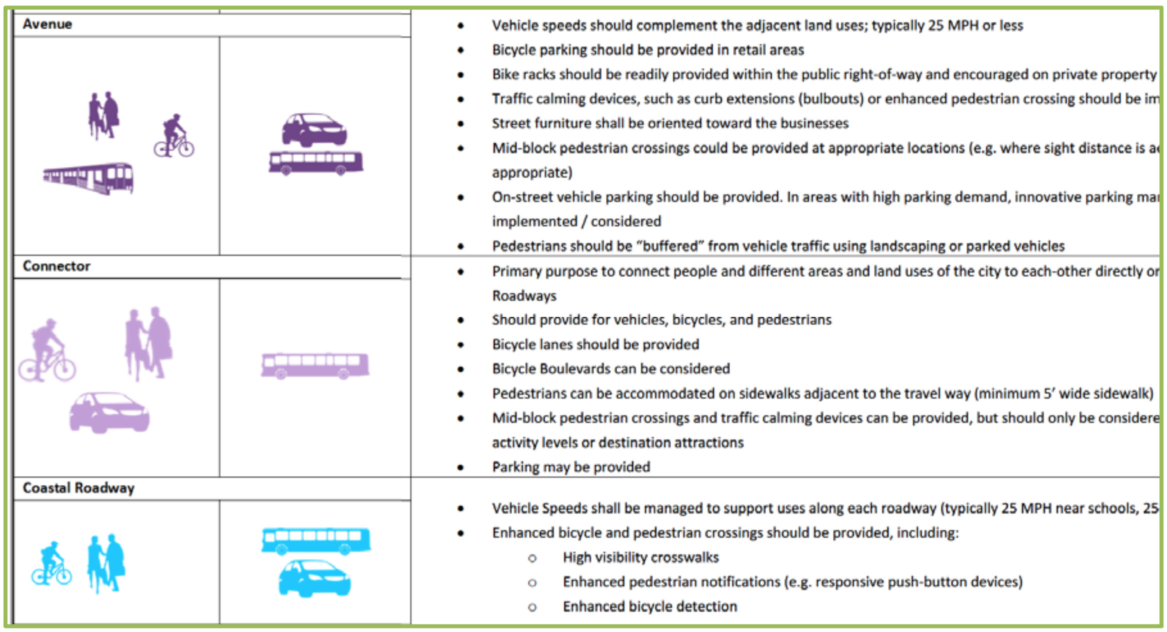
The City of Fullerton, California recently completed an update to their General Plan (currently pending approval by the City Council) that includes a multimodal LOS requirement to evaluate project impacts during the California Environmental Quality Act (CEQA) process. The City is using the Fort Collins methodology for pedestrians, bicycles, and transit and the traditional HCM intersection delay methodology for autos. The City identifies a single threshold, but the standard is applied to whichever mode has been designated as the prioritized mode on a given corridor. This modal prioritization is based on a layered network that was developed as part of the City's General Plan update. A significant impact would be identified if the project would:

> *Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit as defined below:*
>
> - *Degrades levels of service for prioritized modes from an acceptable LOS D or better to LOS E, or F; or*
> - *Increases use of a facility operating at an unacceptable LOS.*
>
> *For non-prioritized modes within the City, LOS F shall be considered an acceptable operating level. For Caltrans' facilities or facilities outside the City of Fullerton, the respective guidelines and thresholds shall apply of the operator of the study facility, if available. If not available, the City of Fullerton methodology shall apply.*

Fullerton's approach is similar to the project-based regulatory concurrency program in Washington State. In Fullerton, all projects or actions that would require a discretionary action by the City Council would trigger the CEQA review. If a project impacts multimodal LOS, the project must mitigate the impact to a less-than-significant level, which could require the construction of multimodal improvements. One potential drawback to this method is that it can be difficult to demonstrate that a project increases the use of a facility operating at an unacceptable LOS, particularly for walking and cycling on facilities located away from the immediate vicinity of the project. Proportionally allocating costs (which is a requirement of any mitigation program) may also be difficult in the absence of a travel model that can predict the pedestrian and bicycle usage of a facility.

Carlsbad

The City of Carlsbad, California has developed a multimodal LOS methodology to guide development of their long-range transportation plan. Carlsbad has intentions to adapt the multimodal LOS method into a multimodal transportation impact fee program in the near future to streamline development review. As with other communities that have adopted multimodal LOS, Carlsbad has identified a layered network with priorities assigned to different modes. Below is a figure highlighting some of the transportation network typologies.



Avenue		• Vehicle speeds should complement the adjacent land uses; typically 25 MPH or less • Bicycle parking should be provided in retail areas • Bike racks should be readily provided within the public right-of-way and encouraged on private property • Traffic calming devices, such as curb extensions (bulbouts) or enhanced pedestrian crossing should be im • Street furniture shall be oriented toward the businesses • Mid-block pedestrian crossings could be provided at appropriate locations (e.g. where sight distance is a appropriate) • On-street vehicle parking should be provided. In areas with high parking demand, innovative parking ma implemented / considered • Pedestrians should be "buffered" from vehicle traffic using landscaping or parked vehicles
Connector		• Primary purpose to connect people and different areas and land uses of the city to each-other directly or Roadways • Should provide for vehicles, bicycles, and pedestrians • Bicycle lanes should be provided • Bicycle Boulevards can be considered • Pedestrians can be accommodated on sidewalks adjacent to the travel way (minimum 5' wide sidewalk) • Mid-block pedestrian crossings and traffic calming devices can be provided, but should only be considere activity levels or destination attractions • Parking may be provided

Coastal Roadway		• Vehicle Speeds shall be managed to support uses along each roadway (typically 25 MPH near schools, 25
		• Enhanced bicycle and pedestrian crossings should be provided, including:
		  ○ High visibility crosswalks
		  ○ Enhanced pedestrian notifications (e.g. responsive push-button devices)
		  ○ Enhanced bicycle detection

Figure 15. Carlsbad Livable Streets-Modal Priorities
Source: Carlsbad General Plan Update, City of Carlsbad 2013.

As shown in **Figure 15**, different street typologies have different modal priorities. The symbols in the left column represent the prioritized modes, while the symbols in the right column represent modes that are accommodated, but not prioritized. Note that Coastal Roadways, which are right-of-way constrained streets along the coast, prioritize pedestrian and bicycle travel, while accommodating cars and transit. Carlsbad's General Plan identifies a LOS standard of D for all prioritized modes and some minimum design criteria are also specified. The ultimate transportation network in the General Plan was developed to meet the LOS D standard for the prioritized modes and potential project impacts are assessed against the multimodal LOS thresholds.

Auto LOS is analyzed using traditional HCM intersection methods.

The pedestrian, bicycle, and transit LOS methodology is similar to ARTPLAN from FDOT or the 2010 HCM methods in that LOS is based on a points system for each facility. The total points, which will range from 0 to 10, correspond to traditional LOS letter grades, as shown in **Figure 16**, below. However, unlike ARTPLAN or the 2010 HCM, the points system is highly customized to Carlsbad and issues such as high traffic speeds or volumes do not degrade pedestrian or bicycle LOS[3].

MMLOS Point System and LOS Rating	
Point Score	**LOS**
9.0-10	A
8.0-8.99	B
7.0-7.99	C
6.0-6.99	D
5.0-5.99	E
0-4.99	F

Figure 16. Carlsbad MMLOS Scoring Thresholds
Source: Carlsbad General Plan Update, City of Carlsbad 2013.

The pedestrian level of service criteria and point system for a pedestrian prioritized street are outlined below:

- Number of lanes (including travel lanes and turn lanes) at a pedestrian crossing
  - 4 points for roads with two lanes or fewer; or
  - 3 points for roads with three lanes; or
  - 2 points for roads with four lanes; or
  - 1 point for roads with five lanes; or
  - 0 points for roads with more than five lanes
- Crossing Quality
  - 0.5 points for presence of a pedestrian refuge

[3] A major criticism of ARTPLAN or the 2010 HCM multimodal LOS method is that pedestrian and bicycle LOS is heavily influenced by traffic conditions on the adjacent road. While traffic speeds and volumes are important considerations, for major roads, traffic volumes can dominate the calculation, making it impossible to improve pedestrian or bicycle LOS. A road like NE 8th Street or Bellevue Way, even with wide tree-lined sidewalks and good adjacent urban form would end up scoring poorly with this method.

- 0.5 points for well-marked crossways and mid-block crossings at safe and convenient locations
    - 0.5 points signing, striping, sidewalks, and other elements that suggest the presence of a pedestrian crossing
    - 0.5 points for Rectangular Rapid Flashing Beacons at an uncontrolled crossing
    - 0.5 points for drivers and pedestrian having unobstructed views of each other
    - 0.5 points for posted speeds of 25 miles per hour or less
    - 0.25 points for posted speeds of 30 miles per hour or less
- Other Elements
    - 1 point for active building frontages
    - 0.5 for pedestrian lighting at night
    - 0.5 points for street trees and/or quality street furniture facing the land uses
    - 0.5 points for twinkle lights in trees along the corridor
    - 0.5 points for sidewalks that are at least ten feet adjacent to retail, at least six feet adjacent to residential uses, or at least eight feet everywhere else
    - 0.5 points for a sense of security by the presence of other people and clear sight lines
    - 0.5 points for on-street parking and/or landscaping as a "buffer" from vehicle traffic and pedestrian walkway.

The bicycle level of service criteria and point system for bicycle oriented streets are outlined below:

- Type of bicycle facility
    - 6 points for multiple bicycle facilities (e.g. a bike path and bike lanes or something similar) along the corridor; or
    - 5 points for a Class I facility (off-street path) or a Class II facility (on-street bicycle lanes) with a bicycle buffer (e.g. striped median buffering the bicycles from the vehicles either on the right side or left side of the bike lane depending on if parallel parking exists); or
    - 4 points for a Class II facility that incorporates a painted lane that is at least 6 feet wide and signage or a Class III facility (bike route designated by signage only) that incorporates sharrows; or
    - 3 points for Class II bike lanes that are under 6 feet wide or a Class III facility
- Connectivity – 0.5 points if it is directly connected to bicycle facilities in all four directions

at intersections

- Amenities
    - 0.5 points if bicycle racks are provided along roadway segment corridor
    - 0.5 points if signage is provided
    - 0.5 points for bike-friendly intersections (e.g. bicycles are not trapped by right-turn lanes, there is space for bicycles to bypass the vehicle queue, etc.)
    - 0.5 points for enhanced bicycle detection or video detection at an intersection
- Other Elements
    - 0.5 points for posted speed limits of 25 miles per hour or less
    - 0.25 points for posted speed limits of 30 miles per hour or less

0.5 points for good pavement conditions

- Adjacent Vehicle Parking
    - 1.5 points for no parking along the street; or
- 1 point for backed-in angled parking; or 0.5 points for parallel parking

The transit level of service criteria and point system for a transit prioritized street are outlined below:

- Right of Way
    - 0.5 points for dedicated right of way for transit only
- Service
    - 1.5 points for at least 15 minute headways during the peak hours
    - 1 point for at least 30 minute headways during the peak hours
    - 0.5 for at least 60 minute headways during the peak hours
    - 1.5 points for good on-time performance
    - 1.5 points if the route provides for a single transfer to reach of the Coaster stations
- Visual Interest, adjacent land use and Amenity
    - 0.5 points for covered bus stops
    - 0.5 points for a bench
    - 0.5 points for a well-lit stop that provides a sense of security
- Other Elements
    - 0.5 points for a corridor that has transit preemption to reduce delays
    - 0.5 points for routes that have available seats on the bus
    - 0.5 points for the availability to directly access multiple routes (e.g. the stop

serves more than one bus route)

- 1 point for bike parking availability at the bus stop
- 1 point for buses that provide on-board bike racks

Carlsbad's system combines standard and well-understood auto LOS methods with customized LOS methods for the other modes. The key for this system is the layered network and prioritized mode concept, which addresses potential issues where improving the LOS of one mode compromises the LOS of another. While this framework has proven useful for long-range planning, it is relatively untested for development review. Translating this type of program into a Washington-style regulatory concurrency program would also require some additional thought; but systems like Redmond's and Bellingham's could work with this general framework.

MULTIMODAL LOS POLICY OPTIONS FOR BELLEVUE

As discussed in the prior chapter, there are a variety of multimodal LOS applications both in Washington and nationally. However, based on the research conducted for this project and reaction from Bellevue Transportation Commission members, there are no "turnkey" approaches that can be directly implemented in the City. Any multimodal LOS application in Bellevue would require further refinement to account for the unique characteristics of the city and to integrate into existing city tools like the travel demand forecasting model. This chapter presents a variety of customized policy options the City of Bellevue could consider for long-range planning and transportation concurrency management.

REVISE THE MOBILITY MANAGEMENT AREA STRUCTURE

Bellevue established the Traffic Standards Code in 1989, in response to citizen concerns about rapid growth and increasing traffic congestion. In 1993, Mobility Management Areas (MMAs) were established in recognition that different areas of the City had different land use contexts, different transportation options, and different traffic congestion expectations. The original MMA boundaries were set to generally align with the impact fee boundaries at the time. With some minor revisions, the Traffic Standards Code and the MMAs have remained intact, while many parts of the City have experienced dramatic land use and transportation network transformations.

This policy option would revise and simplify the MMA boundaries to separate traditional suburban areas from mixed-use/transit-oriented areas. Within the traditional suburban areas, which are generally built-out, the current auto-oriented intersection-based LOS standard could remain; however, aspirational LOS targets for other modes (transit, walk, bike) could be incorporated to track progress on building out infrastructure for these other modes. Within the mixed-use/transit-oriented areas, alternative LOS methods, including area-wide measures or corridor-based measures, may be appropriate. For example, in downtown Bellevue/Wilburton, an overall level of traffic delay could be established (as opposed to the current intersection-based approach). Similarly, a target for transit throughput or level of system completion for pedestrian infrastructure (sidewalk/trail/midblock crossings) could be established to ensure "abundant access" for travelers. **Figure 17** on the following page presents an example of what a revised MMA structure could look like.

Implications:

- o Similar structure to current system
- o Could function well for both long-range planning and concurrency management
- o Recognizes that autos are the dominant form of travel in the suburban areas of the city
- o Larger MMAs allow for more continuity along important travel corridors for both autos and transit
- o Explicitly accounts for non-auto infrastructure investments, focusing on completing the system for other modes of travel
- o More transparency for multimodal investments, particularly in mixed-use/transit-oriented areas of the city
- o Additional work would be needed to precisely define the multimodal LOS methodology
- o The City would need to modify the BKR model to calculate the new multimodal LOS results

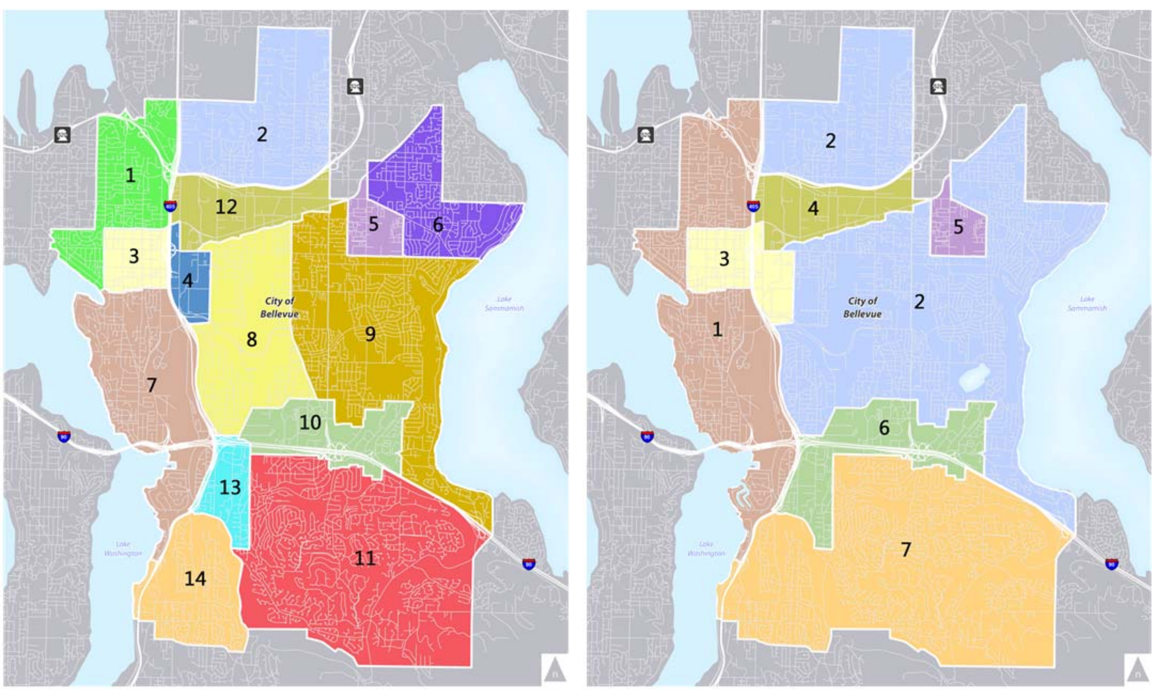


Figure 17. Current MMAs (left); Potential Revised MMAs (right)
Source: Fehr & Peers, 2014

CORRIDOR APPROACH

In the corridor approach, the primary function of the roadway/transportation corridor is the basis for establishing and monitoring level of service standards, as opposed to the MMA which relates mobility to a geographic area. A layered network (each layer representing a mode) would be defined based on plans like the Downtown Transportation Plan and the city's modal plans. For each facility type, a multimodal LOS method and standard would be defined. This standard would incorporate both design features and operational characteristics.

For instance, along a transit priority corridor, design standards could include the provision of transit signal priority, queue jumps at major intersections, and high quality pedestrian facilities to access the transit stops. From an operations perspective, transit LOS-focused metrics could include transit speed and reliability and/or person throughput. Similarly, along a corridor with a primary function of moving vehicles, design features could include right-turn pockets or dual-left turns at intersections, median access control, and sidewalks. Operations could be evaluated using volume/capacity or corridor travel time methods.

For each corridor, the LOS would also measure the functional adequacy of the relevant non-primary modes. For example, on an auto-oriented corridor, the LOS would measure traffic delay, but could also incorporate the need to provide adequate sidewalks, bike lanes and crossing opportunities. Multiple modes could be considered for a corridor—for example bikes and transit on 108th Ave NE in downtown or transit and autos on NE 8th Street.

The concept of an "ultimate facility" also fits well within this framework. When a street is built out to the maximum extent identified in the standards, it could be defined as an ultimate facility with no additional right-of-way used to improve the LOS. In this case, only operational strategies, such as signal coordination, transit signal priority, rechannelization, and other means would be used to optimize performance. Ultimate facilities recognize limitations with right-of-way and impacts to other modes once a facility reaches a given size.

MMAs would not be included in this approach, although it is possible to combine elements of a corridor and a zone-based approach. For example, various corridors could be defined throughout the city, while downtown Bellevue could be retained as a network of streets. **Figure 18** provides examples of a layered network of transportation corridors in a portion of Bellevue.

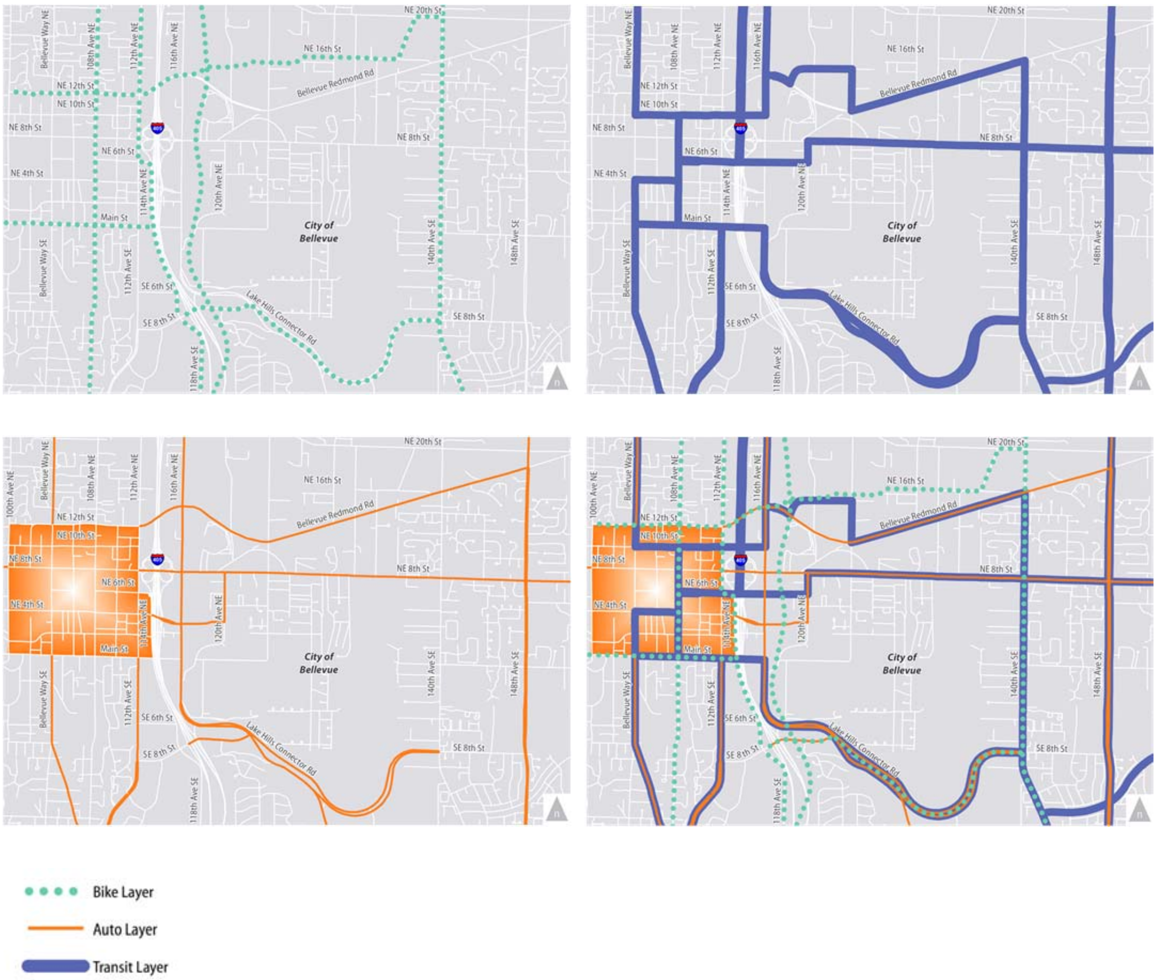


Figure 18. From Top Left to Right: Bike, Transit, Auto, and Combined Corridor Network
Source: Fehr & Peers, 2014

Implications:

- Significant departure from current system
- Could function well for both long-range planning and concurrency management
- Defines the functional design of every transportation facility that is included in the system
- Explicitly recognizes non-auto modes for design and operational consideration
- Includes flexibility to vary the LOS standard in different parts of the City
- Corridor focus works well for transit and key auto routes
- Would require the establishment of design standards for roadways, intersections, and pedestrian/bikeways across the entire city
- Would require some enhancements to the BKR travel model to implement

- Would require that all modal, neighborhood, and other transportation plans be overlaid to identify synergies or conflicts
- May require additional policy direction or research to rectify conflicts between modes in areas with limited right-of-way

MOBILITY UNITS

This approach is based on existing multimodal concurrency programs in Redmond and Bellingham, and could be a good option for concurrency management. In this approach, LOS is “simplified” into a single numerical value defined by “mobility units.” A mobility unit measures the amount of access transportation infrastructure provides within an area.

While mobility units can be defined for an entire city, in Bellevue they might best be defined for different areas. This approach would require that the “value” of mobility units be established in different areas of the city. For example, given the dense mix and diverse land uses in downtown Bellevue, pedestrian infrastructure would have more value than it would in East Bellevue, where auto and potentially bicycle infrastructure would have higher values. Additionally, analysis would be needed to determine the transportation infrastructure projects that would contribute mobility units. For example, a sidewalk in Bel-Red or downtown may be contribute mobility units to the system since they substantially aid access for businesses, services, transit and residents; however, a neighborhood sidewalk, while important for local access, may not contribute any mobility units to the system. The types of transportation infrastructure projects that contribute mobility units could vary across the City.

The mobility unit LOS standards would be defined by the amount of infrastructure that is programmed to be built at a certain time horizon, based upon the City’s modal plans. This method would increase accountability, since the City would identify when it plans to complete certain infrastructure projects for the various modes. Since the mobility unit concept is geared toward concurrency management, it could be paired with one of the other methods in this memo for long-term planning.

Implications:

- Significant departure from current system
- This system is very well suited for a concurrency management system but not as a stand-alone planning tool. It could be combined with one of the other options in this memo for long-range planning

- Would require research to determine how mobility units are calculated for different parts of the City
- This method may require substantial work on the BKR model for evaluation since pedestrian and bicycle travel are important components
- A concurrency system based on mobility units would be much simpler and less costly to administer than the current system (once the initial setup has been completed)
- This system provides substantial flexibility for City staff and commission/council members to identify potential projects that would improve LOS
- This system dovetails with the other approaches in the document when they are used for long-range planning
- This system recognizes that different parts of the city have different mobility needs

TARGET-BASED

This is an "outcome" oriented approach where reasonable mobility targets are identified and projects are matched to meet the targets. In this sense, the targets are similar to LOS standards.

As an example, targets could be set for mode share, greenhouse gas (GHG) emissions, or the number of jobs within a 20 minute transit commute. This option has the advantage of being closely tied to overall Comprehensive Plan transportation goals, but this would require substantial coordination with other elements of the Comprehensive Plan.

Depending on the targets that are set, the definition of and prioritization of projects can be less straightforward than other options identified earlier. For example, mode share goals could be reached through a variety of projects and programs. Examples include capital projects like more pedestrian infrastructure or transit speed and reliability investments. Programs and policies could be equally effective at meeting the targets—examples include revised parking codes, mandatory participation in commute trip reduction programs, or a requirement to de-couple parking costs from rent. The target-based approach is used by other jurisdictions to monitor progress on a Comprehensive Plan, but it is rare for the targets to remain fixed (often, if a target is not being met, it is simply 'kicked down the road'). For concurrency purposes, this option would likely need to be combined with either a traditional LOS evaluation, or one of the options defined earlier since these targets may not adequately meet the concurrency requirement of demonstrating how additional transportation capacity is being added to meet demand for travel from new growth.

Implications:

- o Significant departure from current system
- o Would require substantial coordination with other Comprehensive Plan elements (e.g. land use, capital facilities) and other plans/policies to ensure consistency and commitment to reach shared goals
- o Very transparent link to long-term visions and goals for the city
- o Flexibility to set different targets for different portions of the city
- o High degree of accountability; straightforward to monitor progress
- o May require substantial research and policy direction to establish targets
- o Well suited for long-term planning, but would likely need a complementary concurrency methodology (e.g., one of the other approaches mentioned in this memo)
- o May require substantial investments in BKR travel model to forecast outcomes
- o Project prioritization may be less clear than other methods
- o Could be used as a monitoring framework coupled to alternative long-range planning and concurrency methodologies

SUMMARY OF HOW POLICY OPTIONS CAN BE USED FOR LONG-RANGE PLANNING AND CONCURRENCY MANAGEMENT

As described earlier in this document, multimodal LOS for long-range planning and concurrency management are distinctly different and need not use the same methodology. Below is a table summarizing how the policy options are suited for use in long-range planning and concurrency:

Application	***Refine MMAs***	***Corridor Approach***	***Mobility Units***	***Target-Based***
Long-Range Planning	Very Well suited	Very Well suited	Not recommended; combine with another approach	Well suited
Concurrency Management	Well suited	Well suited	Very Well suited	Not recommended; combine with another approach

As noted above, the options to refine MMAs and the corridor approach are well suited for both long-range planning and concurrency management. The mobility unit approach is not as well suited for long-range planning and the target-based approach is not a good fit for concurrency management.

Any of these approaches could be mixed and applied for different purposes. For example, the refined MMAs could be used for long-range planning along with the mobility unit approach for concurrency management. The target-based option could be used to monitor performance and inform whether the long-range planning or concurrency standards need to be adjusted.

TRANSPORTATION COMMISSION DISCUSSION

The Bellevue Transportation Commission has been actively engaged in the discussion of how multimodal LOS could be integrated into future transportation planning in the City. This chapter summarizes the Commission's views and recommendations for future steps.

Meeting #1: December 12, 2013

At the initial meeting with City staff and consultants, the Commissioners discussed whether there was any need to update the City's LOS policies. Commissioners observed that the City is moving toward multimodal metrics, but not in a comprehensive or transparent manner. The consultants explained that Bellevue's existing practice of defining different auto LOS standards for each of the City's mobility management areas implicitly accounts for mobility options and the density/diversity of land uses by specifying different auto LOS standards for each MMA. While the current system reflects some land use context, it does not clearly account for all modes of travel.

In long-range planning and project prioritization for the CIP, several Commissioners noted that clear metrics for all modes would be helpful, as long as the system remained relatively simple. Several Commissioners noted that through the adoption of multimodal transportation plans, it is only natural to develop multimodal LOS methods to support long-range planning, project prioritization, and transportation concurrency. Others stressed that community expectations for traffic congestion should be related to the type of neighborhood—commercial area versus residential neighborhood—and that retaining a vehicular LOS measure is appropriate for many arterial roadways in the city

In a unanimous vote following a robust discussion, the Commission endorsed the development of a multimodal policy framework and a methodology for measuring LOS and calculating concurrency.

Meeting #2: January 9, 2013

In a second meeting with the Commissioners, City staff and the consultants presented the LOS policy options discussed in this report. Most of the discussion focused on the first two options, the revised MMA and corridor-based LOS approaches.

Among the major comments were the following:

- *The City's modal plans align well with the corridor approach, particularly for transit service.*
- *The refined MMA approach allows flexible LOS standards, which could also be applied to corridors.*
- *It might be difficult to prioritize the investments in the modal plans and establish LOS standards in the absence of a coordinated transportation master plan for all modes*
- *The refined MMA approach provides a visible link between land use and LOS*

Following the discussion, the chair of the Commission asked City staff and the consultants for recommendations. After some discussion, there was growing support for the corridor LOS approach combined with some elements from the revised MMA approach for use in long-range planning. The mobility unit approach was recommended for transportation concurrency management and targets were suggested as a way to track progress.

The Commission unanimously approved a motion to include the concept of multimodal LOS in the Transportation Element through the 2014 Comprehensive Plan Update. The Commission also endorsed a proposal that, with Council approval, would provide the policy direction to develop a work plan and budget to integrate multimodal metrics into the Transportation Element and the Traffic Standards Code (BCC 14.10.060).

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