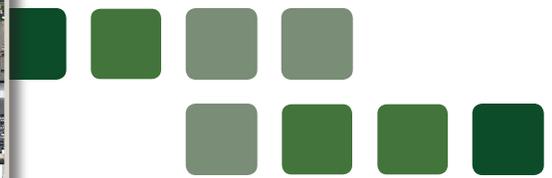




City of Burien

Transportation Master Plan



Submitted by:

FEHR PEERS

Safeco Plaza
1001 - 4th Avenue, Suite 4120
Seattle, WA 98154
(206) 576-4220

Prepared for:

City of Burien
Public Works Department
400 SW 152nd St, Suite 300
Burien, WA 98166

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Burien City Council:

Mayor Brian Bennett
Deputy Mayor Rose Clark
Councilmember Jack Block
Councilmember Joan McGilton
Councilmember Lucy Krakowiak
Councilmember Gerald Robison
Councilmember Bob Edgar

City of Burien Staff:

City Manager Mike Martin
Maiya Andrews, Public Works Director
Malissa Phok, Right-of-Way Inspector
Ramesh Davad, Development Review Engineer
Michael Lafreniere, Parks, Recreation & Cultural Services Director
Steve Roemer, Parks Manager
Scott Greenberg, Community Development Director
David Johanson, Senior Planner
Charles W. "Chip" Davis, Senior Planner, TMP Project Manager
Dori Babcock, Management Analyst

Fehr & Peers:

Donald Samdahl, Principal, TMP Project Manager
Kendra Breiland, Senior Transportation Planner
Jonathan A. Williams, Transportation Planner
Matthew Ridgway, Principal
Tiiki Rysen, Graphics Specialist

Transportation Master Plan Advisory Committee:

Brooks Stanfield
Jimmy Schultz
Rebecca Dare
Lance Heim
Larry Moormeir
Lyn White
Sue Blazak
Eric Stahlfeld
Brad Bentley
Kristi Moen
Keith Weir
Tim Riley
Julie Nelson
Mike Armstrong
Mark Benedum
Beth Quittman
Ernie Butler
Mike Woerle
Rick Jump
Tom Spohn
John Nelson
Sheryl Knowles
Christopher Ndifon
Roger Anderson
Tanya Engeset
Chestine Edgar
Dorene Carrel
Richard Schroeter
Scott Logan



1. INTRODUCTION

In the Spring of 2011, the City of Burien embarked on the creation of a new Transportation Master Plan (TMP). The TMP is a long-range plan that helps guide the City's capital investments, coordinates transportation improvements with land use plans, and creates a unified vision for the City's transportation future. This TMP will serve as the backbone to the Transportation Element of Burien's upcoming Comprehensive Plan update.

PURPOSE – TIE TO CITY VISION

In Summer 2011, the City Council adopted "Vision for Burien: Our Future. Our Choices." This vision was developed through a comprehensive community process and identifies Burien as:

"A vibrant and creative community, where the residents embrace diversity, celebrate arts and culture, promote vitality, and treasure the environment."

Accompanying the vision statement are seven core values/concepts related to community, diversity, environment, prosperity, education and youth, health and safety, and governance. It is through this lens that the City intends to conduct its everyday business. Thus, the new vision statement serves as the foundation for this TMP.

PLANNING REQUIREMENTS

Because of the overlapping boundaries of the transportation system, the City's planning effort takes place within requirements from the state, county, and regional agencies.

Figure 1 shows how Burien fits into the regional context.

State GMA Requirements

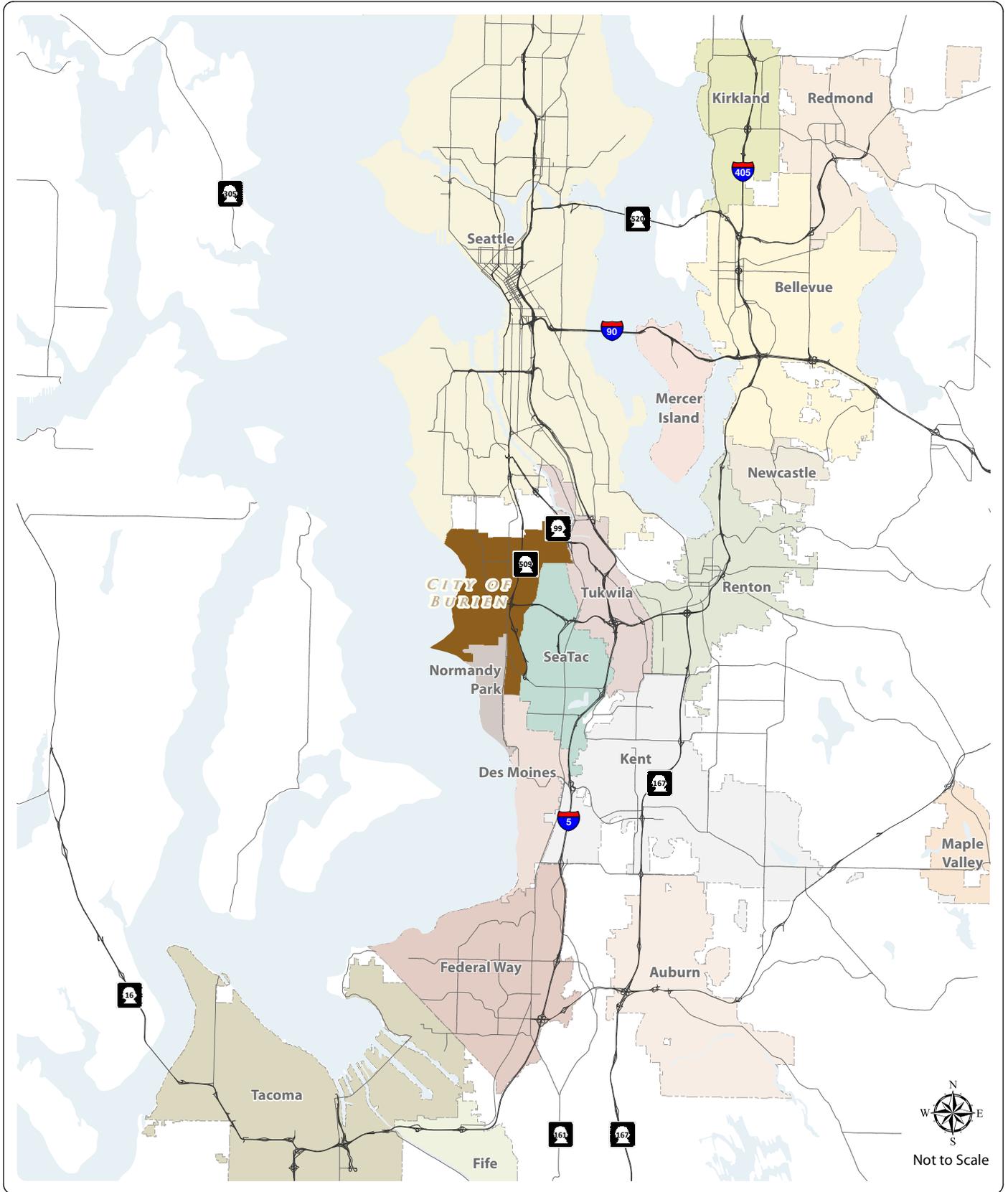
Washington's 1990 Growth Management Act (GMA) requires communities to prepare a transportation plan directly tied to the City's land use decisions and financial planning. This TMP fulfills this mandate.

Regional Plans

The Puget Sound Regional Council (PSRC), as the regional planning agency, sets policy for King, Pierce, Kitsap, and Snohomish Counties through its long-range planning document, VISION 2040, and its regional transportation plan, TRANSPORTATION 2040. VISION 2040 is the result of extensive public involvement in determining the growth pattern for counties and cities and in crafting the policy direction to manage that growth.

The continued development and support of centers is a core component of the region's growth strategy in Vision 2040. Downtown Burien is a Regional Growth Center, which serves as the focal point of cultural, civic, and economic activities and is connected to other centers by frequent and fast high-capacity transit and other transportation infrastructure.

Both regional plans state that communities and neighborhoods should have easy access to the regional system through transit, improved roadways, sidewalks, trails, and paths. This TMP is consistent with and supportive of these regional planning efforts.





HOW THE CITY USES THE TMP

The TMP is a local functional plan that will inform and support the Transportation Element of Burien's Comprehensive Plan update. The TMP is needed to guide the City's transportation investments. It is also a coordination document, ensuring that transportation decision making is coordinated with Burien's adopted Land Use Element of the Comprehensive Plan and includes the ideas formulated through the City's Visioning Process.

At its core, the TMP informs the development of the Capital Improvement Program, by identifying the types of projects that are needed to support future travel trends. The TMP also evaluates how these projects fit within the community's values and fiscal resources.

PUBLIC OUTREACH

Development of the TMP included an extensive public outreach process with the following components:

- **Transportation Master Plan Advisory Committee (TMPAC):** This group was assembled by City staff to represent a broad cross-section of the City's neighborhoods and interest groups. The TMPAC helped frame the study, bring balance to policy discussions, and build community consensus for the TMP. The TMPAC met six times over the course of the project.
- **Public Outreach Meetings:** The City hosted a number of night meetings in joint City Hall-Library complex, in which residents were encouraged to provide recommendations regarding specific

projects and areas of emphasis for the plan.

REGIONAL COORDINATION

In addition to the public outreach efforts, the City also reached out to a number of agencies at adjacent jurisdictions. These agencies included WSDOT, King County Metro, Sound Transit, and King County, as well as neighboring cities.

PLAN ORGANIZATION

This plan includes the Introduction (Chapter 1), and four additional chapters, as summarized below:

2. **Conditions and Trends:** Describes Burien's existing transportation system, including conditions for all travel modes. The chapter also discusses anticipated land use development and modifications to the regional transportation system that influence future travel trends.
3. **Multimodal Transportation System:** Introduces a layered network concept that forms the foundation of this plan to accommodate all modes of travel and creates a complete transportation network in the City. Provides details on how each travel mode would be accommodated and establishes the City's level of service metrics.
4. **Sustainable Transportation:** Conveys the City's commitment to create a sustainable transportation system, including the promotion of healthy lifestyles, respect for the environment, and fiscal responsibility.
5. **Implementing the TMP:** Evaluates the City's financial reality over the planning horizon and identifies priority criteria for project funding.



2. TRENDS AND CONDITIONS

This section provides an overview of the City’s existing transportation network. It also describes the effects of planned transportation network changes and expected land use growth in Burien.

EXISTING CONDITIONS

Burien has a fairly traditional suburban transportation system, with vehicular travel as the primary mode. The city’s street system provides a high level of mobility for vehicle traffic in town and it also connects with three state highways, State Route (SR) 509, SR 518, and SR 99/599. These highways provide high-capacity connections to other destinations and other regional automobile facilities.

Transit service in Burien is focused on the Burien Transit Center and, to a lesser extent, along Ambaum Boulevard SW. King County Metro and Sound Transit provide frequent transit service, with connections to major regional destinations.

The bicycle and pedestrian network in Burien is the least robust component of the City’s overall transportation network. Burien was incorporated in 1993 and only recently adopted a bicycle and pedestrian plan in 2004. Therefore, many areas of Burien have not yet seen strong investments in walking or biking infrastructure, such as sidewalks or paths.

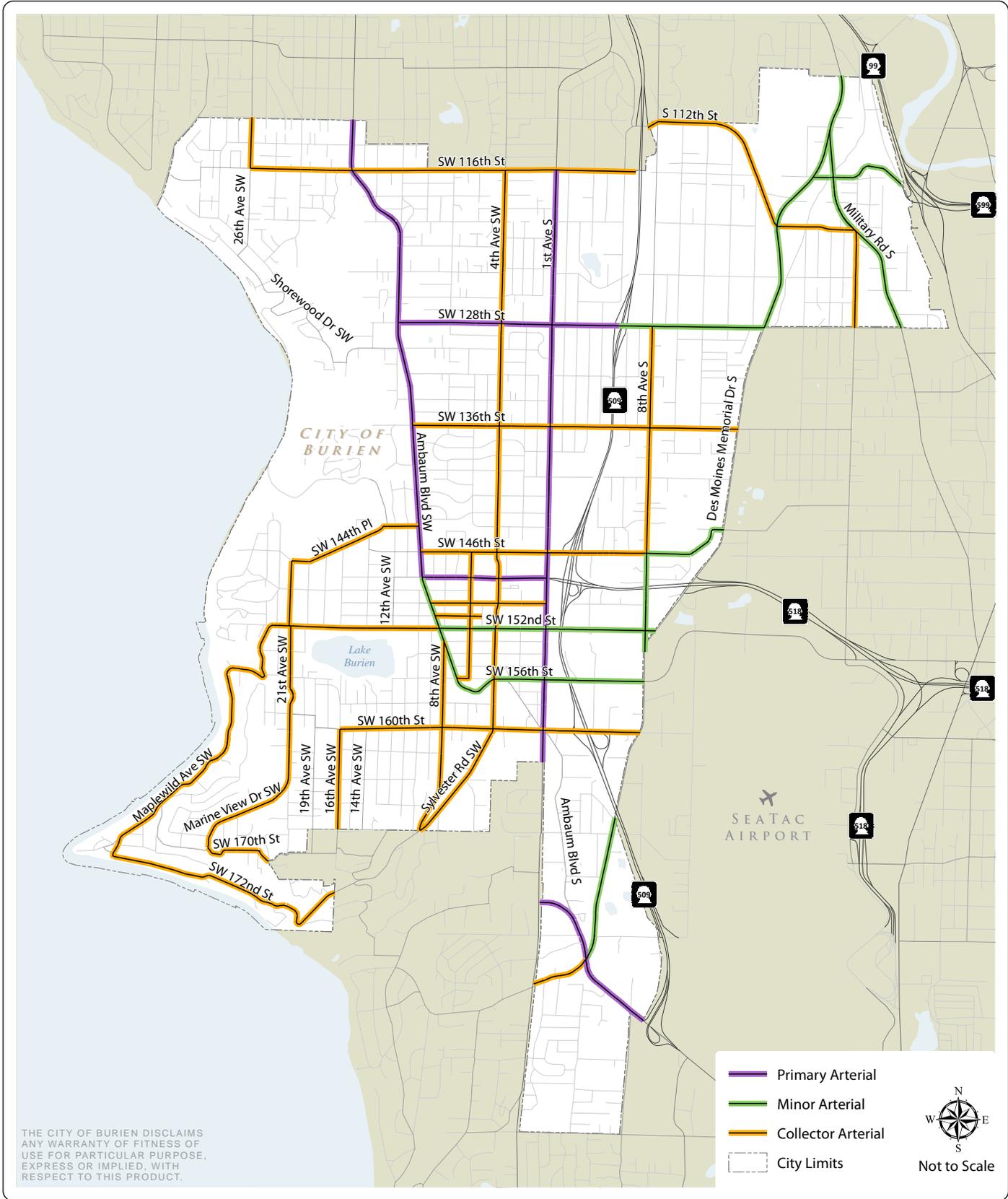
Roadway Functional Classification

The functional classification used for roadways establishes a hierarchy of roads based on the desired function. These functions, defined in **Table 1**, include accommodating vehicle travel through the area, accessing adjacent properties, or a combination of these functions. **Figure 2** details the current roadway classification in Burien.

Local streets serve as the base of the hierarchy and generally provide access to single family residential properties. The roadway hierarchy increases to include collector arterials, minor arterials, principal arterials, and freeways, which provide links to other regional facilities and destinations.

Table 1. Street Classification Types and Examples

Type	Description / Purpose	Example
Local	Primary function is to facilitate access to residential properties.	8 th Ave SW
Collector Arterial	Provide for traffic movement within a community, and have connections to minor and principal arterials. Gives higher priority on local traffic than through traffic.	4 th Ave SW
Minor Arterial	Intra-community connections that accommodate predominantly non-local, or through, traffic.	Des Moines Memorial Dr
Principal Arterial	Designed primarily for through traffic, including freight. Where possible, curb cuts are minimized to control access.	1 st Ave S
Freeway	Regional limited access highways connecting to major centers.	SR 509





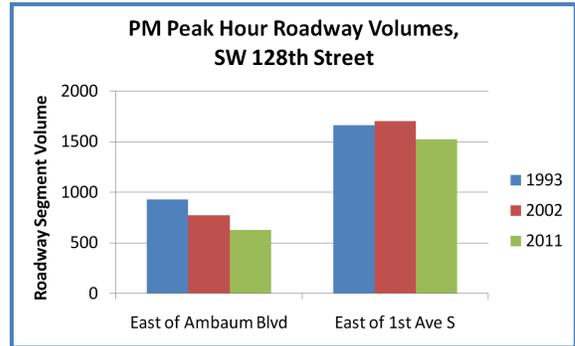
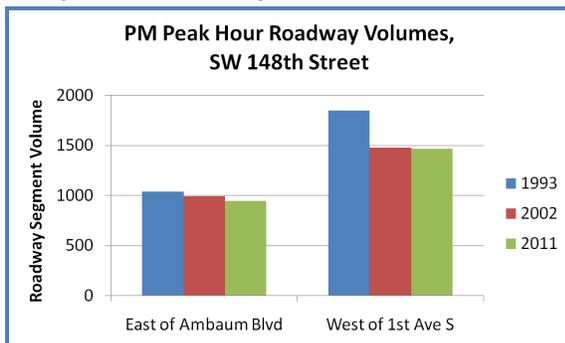
Traffic Volumes

Existing average daily traffic volumes for primary roads in Burien are shown on **Figure 3**. The highest volume segments are the primary and collector arterials (SW 128th Street, SW 146th Street, and SW 160th Street) that provide access to/from SR 509. Additionally, Ambaum Boulevard SW and 1st Avenue South carry high volumes of traffic north/south through Burien. East of SR 509, roadway volumes in the City are generally lower, with many drivers utilizing SR 518.

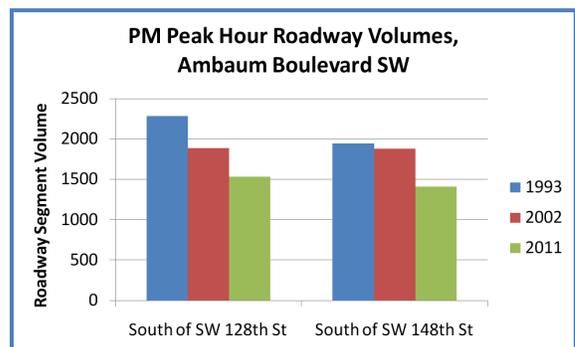
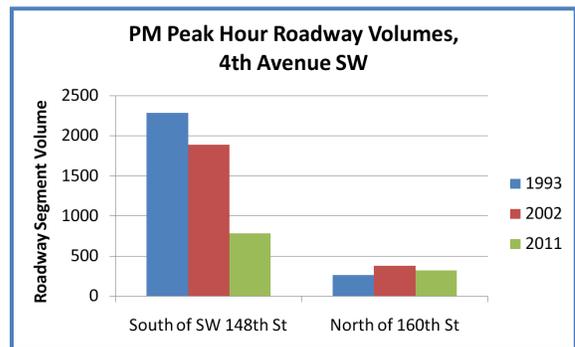
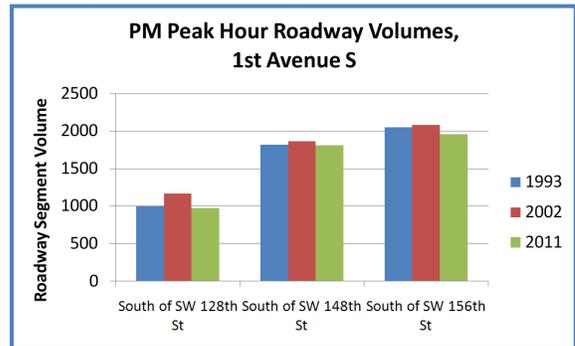
Traffic counts were obtained during the AM and PM peak periods for most major intersections in Burien. For all locations studied, the PM peak period contained higher traffic volumes, and this period was used to assess roadway conditions. The peak period for vehicle travel in Burien was found to be 4:45 PM to 5:45 PM. Traffic counts collected for this project are available electronically as **Appendix G**.

Burien has relatively uncongested roadways, as evidenced by the fact that traffic volumes have been static, or slightly decreasing, since 1993. Some example roadway segment volumes are shown in the charts below.

East/West Roadway Volumes:



North/South Roadway Volumes:





Truck Routes

Truck routes are intended to accommodate goods movement associated with commercial or industrial uses safely and efficiently within the city. The identified routes are designed to higher roadway standards to accommodate higher vehicle weights and larger turning radii.

The truck routes designated in Burien facilitate access to the major commercial activity centers within the city with an emphasis on providing connections to SR-509 and SR-518. They are defined in the Burien Municipal Code Section 10.40.060 as:

- 1st Avenue S
- SW & S 128th Street between Ambaum Boulevard S and SR-509
- Ambaum Boulevard SW between SW 128th Street and SW 148th Street
- SW 148th Street between Ambaum Boulevard SW and 1st Avenue S
- 174th Street S / S Des Moines Street between 1st Avenue S and SR-509

Trucks in excess of 10,000 pounds gross weight are prohibited on non-arterial streets, except for local deliveries.



Truck on S 160th Street at SR 509

Transit Network

King County Metro Transit (Metro) and Sound Transit provide fixed-route bus service in Burien with routes serving Downtown Seattle, West Seattle, Des Moines, Sea-Tac airport, the Tukwila International Boulevard Light Rail station, Renton, and Bellevue.

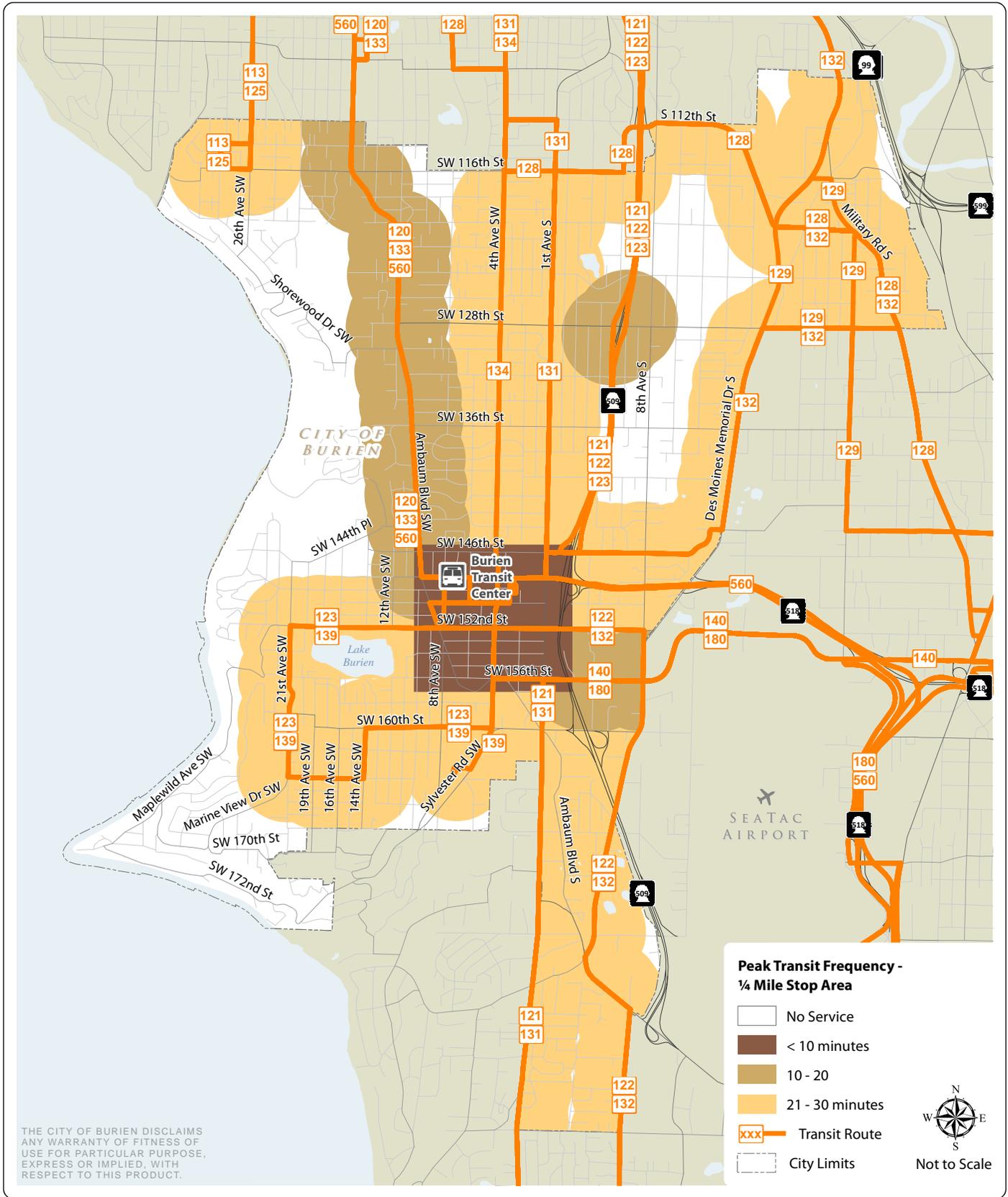
Bus service in Burien is focused on the Burien Transit Center (BTC). The BTC contains a 505 space park and ride lot. The site is also anticipated to eventually include a mixed-use transit oriented development.¹ Outside of the BTC, the most frequent service is focused on Ambaum Boulevard.

The majority of Burien residents live within a quarter mile of a transit stop. **Figure 4** provides the existing frequency of service on corridors in Burien and the areas within a quarter mile of a transit stop. Additional information on transit routes and frequency of service is provided in **Appendix B**.



Sound Transit Bus on Ambaum Boulevard SW at SW 116th Street

¹Source: King County Metro, Burien Transit Center Parking Expansion and Transit-Oriented Development Program, 2011.





Pedestrian Network

Prior to the City's incorporation in 1993, most Burien roads were constructed without sidewalks as part of unincorporated King County. Since that time, the City has developed a relatively complete network of sidewalks in downtown Burien and along major streets including Ambaum Boulevard SW, SW 152nd Street, SW 160th Street, SW 136th Street, SW 128th Street, and SW 116th Street. In total, there are about 59 miles of sidewalk along Burien's streets. **Figure 5** shows the location of existing sidewalks in Burien.

Sidewalks are absent along the north half of 1st Avenue South, on connections to arterial streets, and around many of Burien's schools.



Discontinuous Sidewalk, SW 148th Street near Ambaum Boulevard SW

Bicycle Network

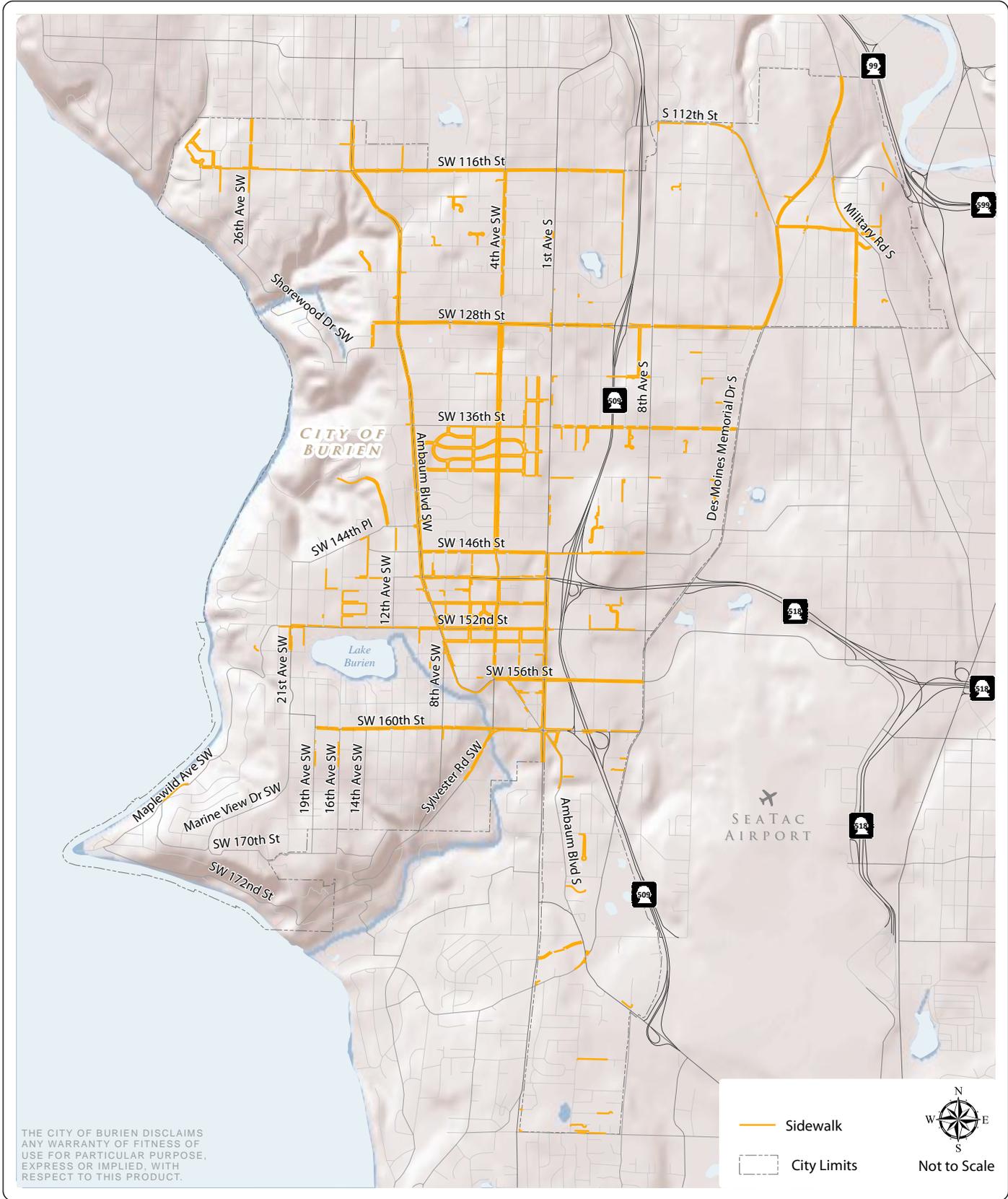
The existing bicycle network in Burien is comprised of approximately four and a half miles of striped and signed on-street bicycle lanes. These lanes, and facilities in neighboring jurisdictions, are shown on **Figure 6**.



Existing bicycle lane on SW 144th Street

The existing network of bikeways largely provides connections to bikeways in the City of SeaTac, but small segments also exist that connect to Downtown Burien. There is a lack of continuous north-south bicycle facilities and only short one east-west facility (along Ambaum Boulevard SW and SW 156th Street).

The need for more bicycle facilities was noted as part of the City's 2004 Pedestrian and Bicycle Facilities Plan. This plan made facility recommendations towards creating a more comprehensive network of bicycle routes and bikeways in Burien.



FEHR & PEERS

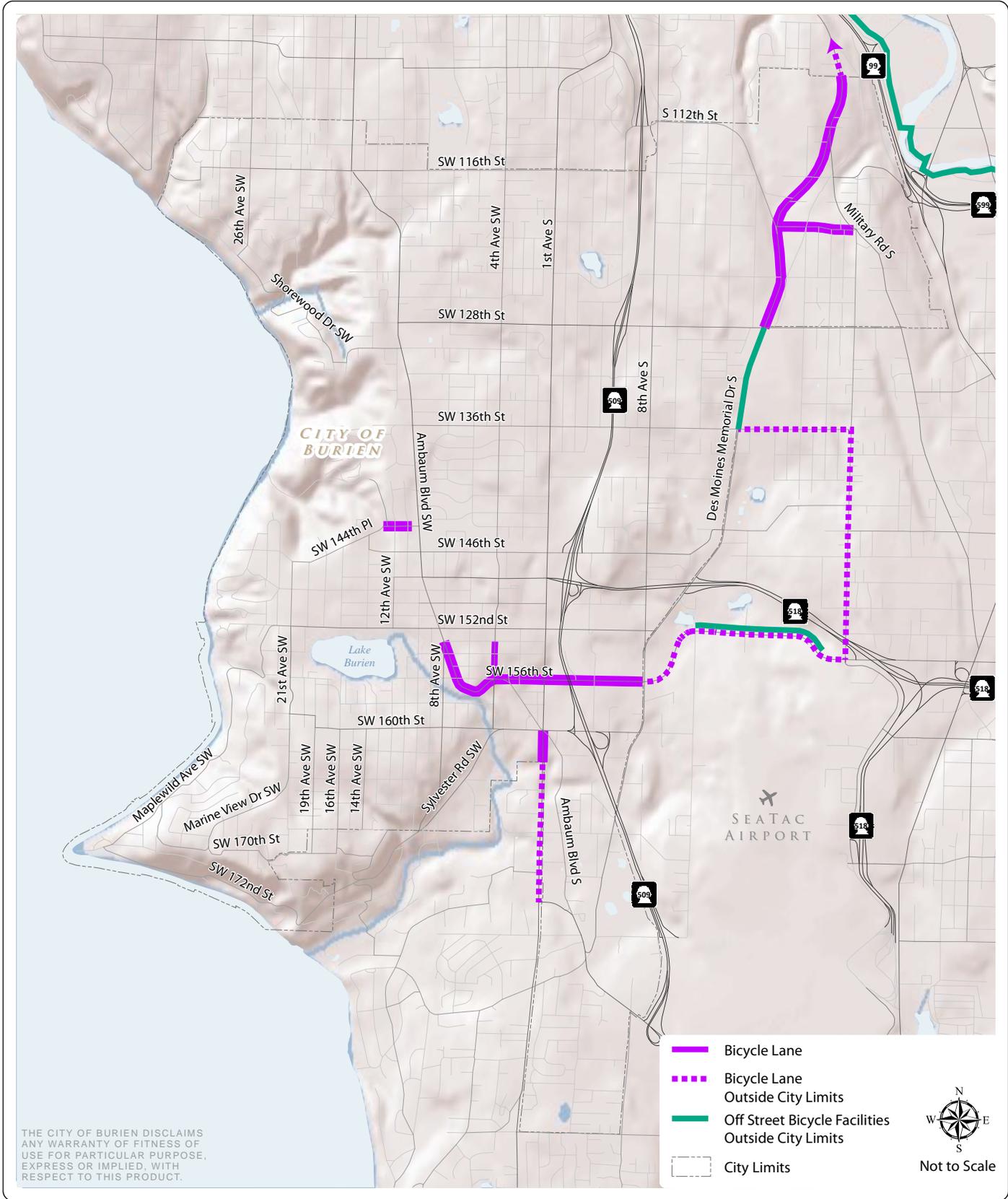
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Last Updated: January 2012

Update By: T Rysen

EXISTING SIDEWALKS

FIGURE 5





Transportation Network Safety

Statistics on motor vehicle collisions occurring in the city between 2008-2010 were reviewed. These statistics were broken out into collisions that only involved motorists and those that also involved either a bicyclist or pedestrian. Not surprisingly, the higher volume roadways contained the most collisions. Total collisions by location are shown below on **Figure 7**.

By volume, the Ambaum Boulevard SW and 1st Ave S corridors had the highest number of vehicle collisions. Along both roadways, rear end collisions were found to be the most common collision type.

Figure 8 displays all collisions that involved pedestrians or cyclists. The intersection of Ambaum Boulevard SW and SW 126th Street had the highest number of collisions that involved pedestrians/ cyclists and motorists. This intersection is in a location with multifamily housing and contains a marked crosswalk with overhead flashers. However, the design of the overhead flashers is such that they flash continually regardless of whether or not a pedestrian is present.

The Washington State department of Transportation (WSDOT) has also identified several corridors that are high accident locations, based on the number of fatal or serious collisions. These segments are identified in **Table 2**.

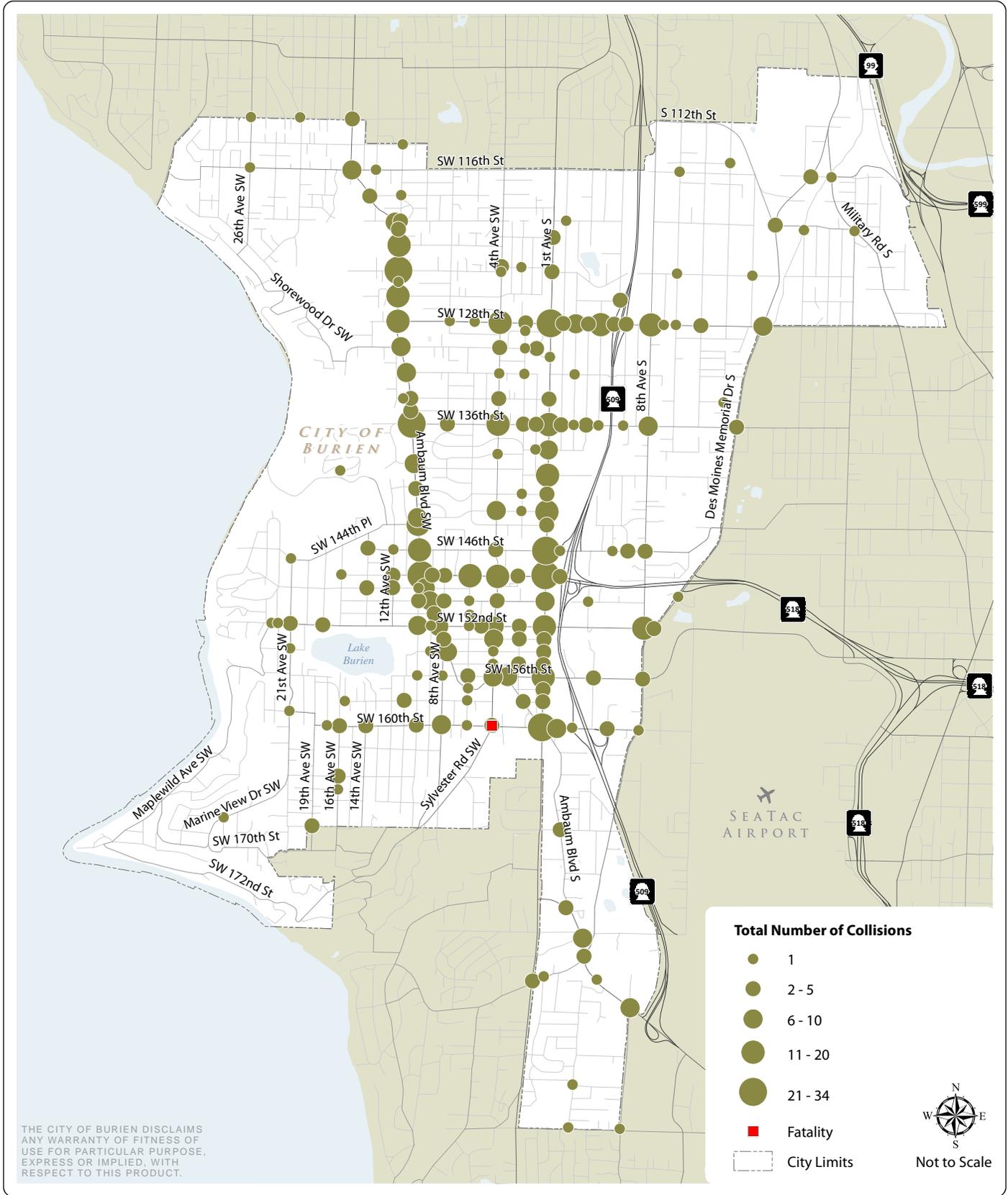
Table 2. Roadway Segments with a High Rate of Injury/Fatality Collisions

Segment	Collisions per Mile
S 128th St (Occidental Ave S to 8th Ave S)	10.6
Ambaum Blvd SW/12 th Ave SW (136th to 124th)	6.8
S 128th St (4th Ave SW in Burien to 22nd Ave S)	6.2
4th Ave SW (148th to 128th)	4.8
Ambaum/12th/188th (west of DMMD to 160th)	2.8

WSDOT, 2011



Crosswalk on Ambaum Boulevard SW at SW 126th Street



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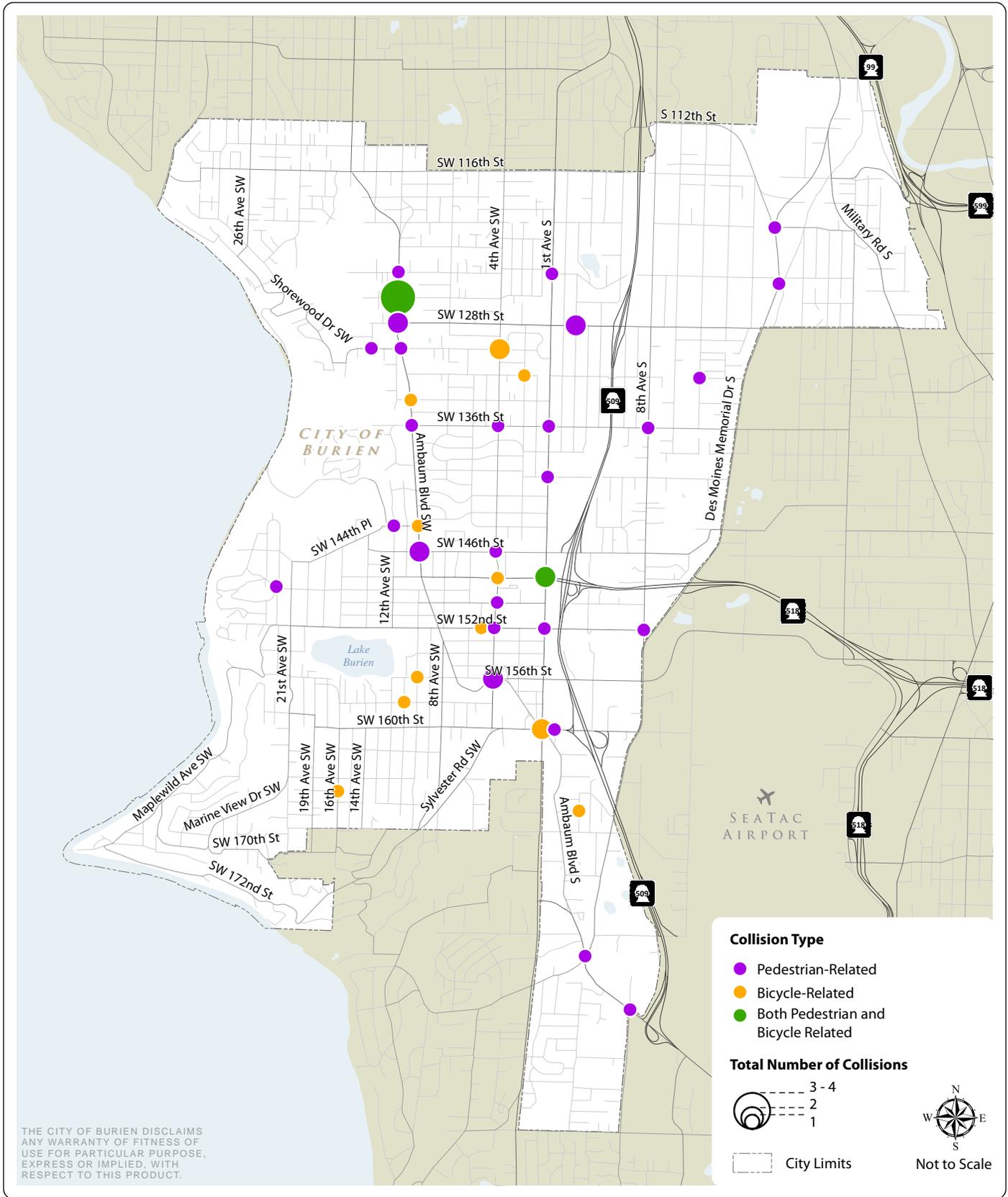
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**AUTOMOBILE COLLISIONS
(2008 - 2010)**

FIGURE 7



FEHR & PEERS

PEDESTRIAN AND BICYCLE COLLISIONS
(2008-2010)

FIGURE 8

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Last Updated: January 2012

Update By: T Rysen



Traffic Operations

Roadway traffic operations are typically assessed using intersection level of service (LOS). For stoplight-controlled intersections and 4-way stop intersections, LOS is determined to be the average delay (in seconds) that all motorists experience. For intersections with a stop sign on only one or two approaches, the delay is reported for motorists at the stop sign with the highest delay. The delay is typically reported for the busiest time of day, which is generally the PM commute hour. In Burien, the PM commute hour was identified as between 4:45 and 5:45 PM.

Burien's current roadway LOS standards vary by roadway, but are generally LOS D or better for most facilities. All intersections in Burien were found to meet current standards with the exception of the following four intersections shown in **Figure 9**:

- 8th Avenue S & S 112th Street
- SW 128th Street & 1st Avenue S
- SW 150th Street & 1st Avenue S
- S 160th Street & SR 509 NB Off-ramp

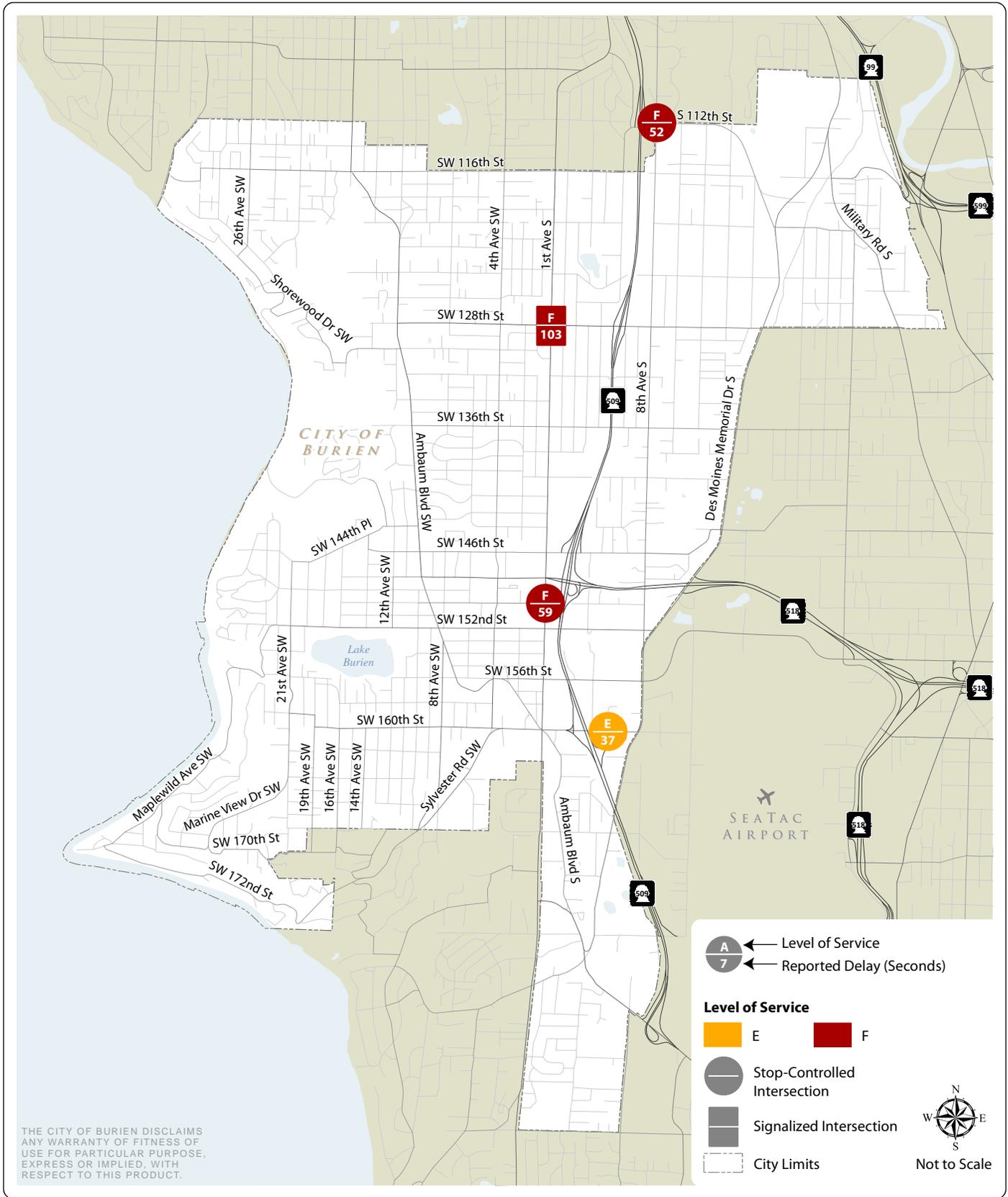
LOS results from all evaluated intersections are provided in **Appendix A** and LOS evaluation sheets are available electronically as **Appendix H**.

Vehicle Level of Service (LOS) Defined:

- A: Free-flow conditions
- B: Stable operating conditions
- C: Stable operating conditions, but the operation of individual motorists is affected by the interaction with other motorists
- D: High density of motorists, but stable flow
- E: Near-capacity operations, with speeds reduced to a low but uniform value
- F: Over capacity, with delays



Traffic Congestion on SW 148th Street at 4th Avenue SW





FUTURE TRENDS

The future transportation system in Burien is affected by growth, both at the local and regional level, and by expected changes in the transportation network. This section describes the local land use and transportation network changes that are expected to affect transportation in Burien.

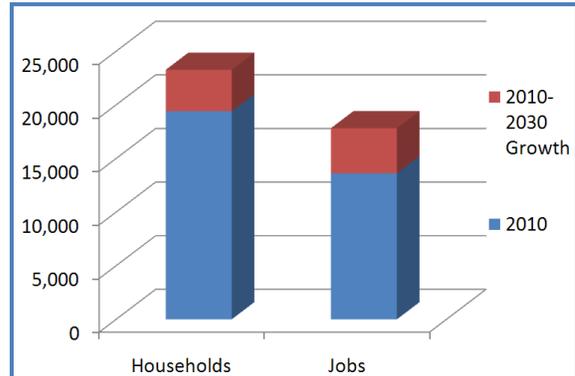
Anticipated Land Use Growth

Burien is largely a single family residential community with pockets of multifamily residential and commercial developments located in and around downtown Burien, along Ambaum Boulevard SW and along 1st Avenue South.

On April 1, 2010, the City annexed the southern portion of the North Highline area (shown on **Figure 10** as North Burien). This annexation added 14,000 new residents, bringing the total city population to around 48,000 residents (or 19,400 households).

Overall, a modest amount of growth is expected by 2030. The number of households is expected to increase from 19,400 to 23,300². This represents a total increase of 20%, or an annual increase of just less than 1%. Employment is expected to increase at a slightly higher rate of just less than 1.5% per year, from a current of 13,600 jobs in 2010 to 17,800 in 2030. **Appendix E** contains further land use information used in development of the travel demand model.

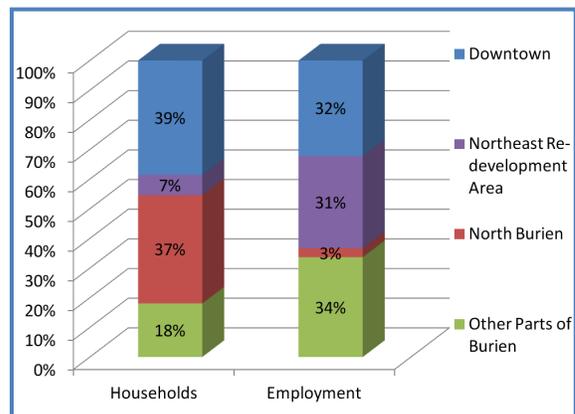
² Source: Puget Sound Regional Council and City of Burien, 2011.



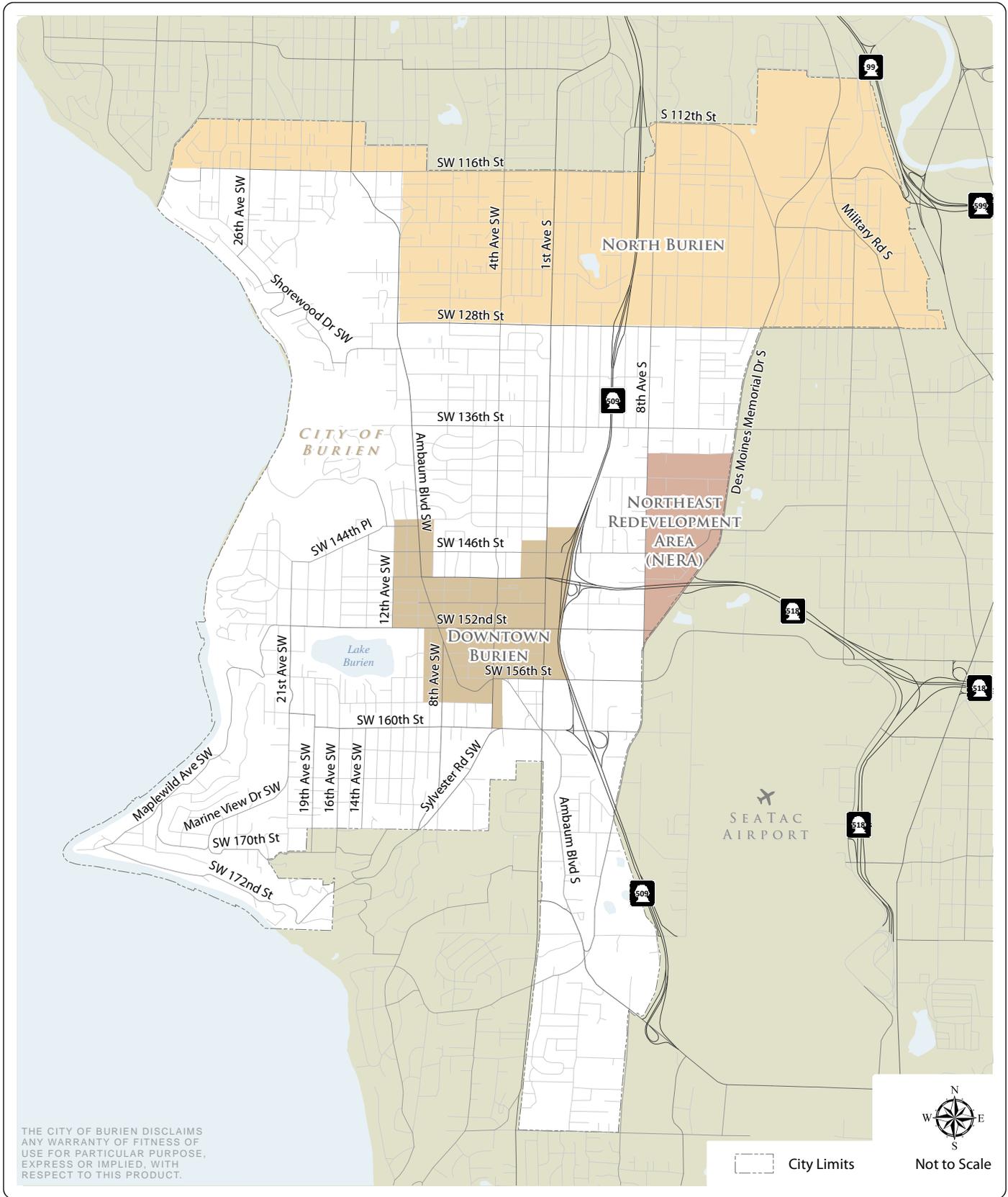
Burien 2030 Household and Employment Growth Projections

Future growth is planned in the downtown Burien core with a focus on linking this development to transit. This area is expected to absorb a significant portion of the growth in households and employment between 2010 and 2030. The number of downtown households is expected to almost double by 2030 to 3,100 households. In addition to downtown Burien, another focus area for growth is the recently annexed North Burien area.

The Northeast Redevelopment Area (NERA) will absorb much of the employment growth. The intent of NERA is to transform the area into uses compatible with operations at Sea-Tac International Airport.



Burien 2030 Growth Projections by Area





Traffic Growth

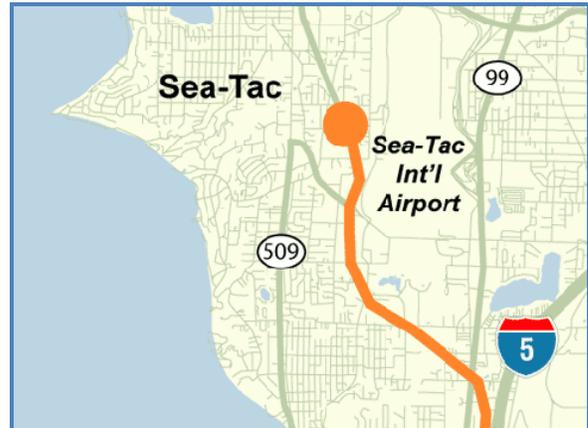
Traffic volumes in Burien have been largely flat to decreasing since 1993, as outlined in the previous discussion. To arrive at estimates of future traffic volumes, current and future land uses were incorporated into a travel demand model that also included regional growth expectations. The results of this analysis show that, as a whole, traffic is expected to increase in Burien at approximately 1% annually. This growth level would be a departure from recent trends, but provides a conservative basis for planning a roadway system that accommodates reasonably foreseeable future growth.

Since most areas of Burien anticipate little to no residential or employment growth, growth in traffic volumes will not be uniform citywide. The main roadways that are forecasted to see increases in traffic are 1st Avenue S, Ambaum Boulevard SW, 128th Street SW, and Des Moines Memorial Drive.

Changes in the Regional Roadway Network

SR 509 Extension

The most significant change in the regional roadway network will be the southern extension of SR 509 from its current terminus to I-5 south of Sea-Tac International Airport.



SR-509 Extension (WSDOT, 2011)



SR-509 Extension (WSDOT, 2003)

This project is currently unfunded and WSDOT plans to complete this project in two or three phases when funding becomes available. WSDOT completed a feasibility study in 2010 on variable tolling of the extension, and it is likely that the extension will be tolled for all users.

The extension of SR 509 has the potential to alter travel patterns in and through Burien. On the one hand it will likely decrease roadway volumes on 1st Avenue South (especially south of downtown Burien) and reduce volumes on SR 518. On the other hand, the extension will likely increase traffic on surface streets near the existing SR 509 interchanges. Due to uncertainty over

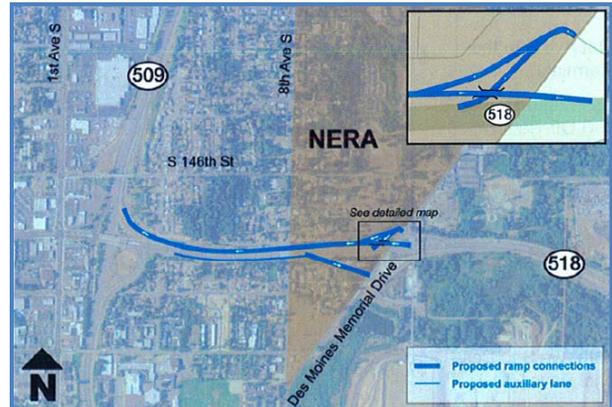


both the timeline and potential tolling (which will affect roadway volumes), the SR 509 extension was not included in the 2030 travel demand model.

SR 518 and Des Moines Memorial Drive (DMMD) Full Interchange

The current interchange at SR 518 and DMMD provides access from SR 518 heading westbound and to SR 518 heading eastbound. A proposal has been made to construct a full interchange at this location. The redevelopment of NERA is planned for just north and south of this interchange. Motorists and trucks accessing NERA from the north via SR 509 would likely utilize the ramps at 128th Street SW until the full interchange is constructed.

A 2010 report by WSDOT identified a preferred option (conceptual option #2, shown in diagram) for construction that includes a two-phase implementation plan. The first phase of this plan would construct an eastbound off-ramp to DMMD and is estimated to cost \$13.8 million. The City aims to obtain funding for, and lead, this phase of the project. A second phase would construct a westbound braided ramp from DMMD to SR 518 and a direct ramp from SR 518 westbound to SR 509 northbound. This second phase is estimated to cost \$62.4 million.³ The construction of the full interchange was assumed and included in the 2030 Travel Demand Model.



**Proposed SR 518 Ramp Alignment
(WSDOT, 2010)**

Changes in the Regional Bikeway Network

There are several local and regional planned bikeway projects planned in jurisdictions adjacent to Burien. These projects include the following:

Normandy Park

- Extension of 1st Avenue South bicycle lanes from South 174th Street to S 200th Street.

SeaTac

- Bike route along Des Moines Memorial Drive from North SeaTac Park to 16th Avenue South. This segment will also be part of the Lake to Sound Trail.
- Bike lanes on Military Road South from South 128th Street to South 150th Street.

³ Source: WSDOT, *SR 518/DMMD Final Report*, December 2010.



Regional

- Lake to Sound Trail:** This trail is a proposed 17-mile biking and walking trail linking the shoreline of Lake Washington in Renton to the shoreline of the Puget Sound in Des Moines. The trail will connect five cities (Tukwila, SeaTac, Renton, Burien and Des Moines) and four major trails (the Cedar River, Green River, Westside, and Des Moines Creek trails.) The project is a joint partnership between the cities of SeaTac, Renton, Tukwila, Burien, Des Moines and King County. This project is currently in the design and permitting phase. The section identified later in **Figure 15** will pass through southern Burien and has a planning-level cost estimate of approximately \$4 million.

Changes in the Regional Transit Network

While most transit service and infrastructure changes are largely unpredictable given uncertainties surrounding future funding, there are two significant changes planned for routes serving Burien. These are the introduction of the Rapid F line and enhancements to the existing Metro Route 120.

RapidRide F Line

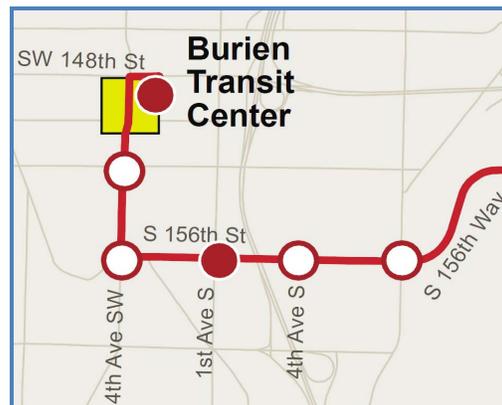
Planned for fall of 2013, this line will connect the cities of Burien, SeaTac, Tukwila and

Renton, serving the following key destinations:

- Burien Transit Center (BTC)
- Tukwila International Boulevard Link Light Rail Station
- Southcenter Mall
- Tukwila Sounder Station
- Renton Transit Center

Service to the BTC will utilize 4th Avenue SW and South 156th Street with stops planned as shown below.

While facilities are still in design for the route, improvements are planned to include Business Access and Transit Lanes (lanes for business access, transit, and right turns only) and Transit Signal Priority (additional green time at traffic signals to help buses remain on schedule).⁴



RapidRide F Line Burien Stops (King County Metro, 2011).

⁴ Source: King County Metro, RapidRide F Line Website, 2012.



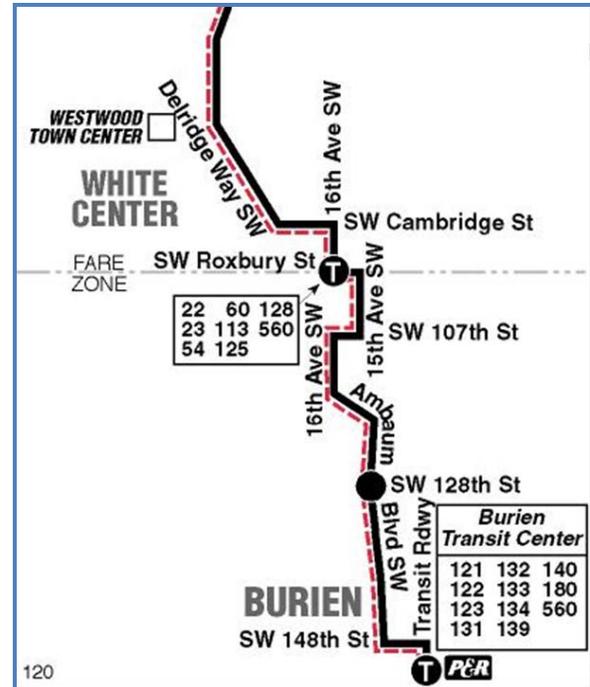
Metro Route 120 Improvements

Metro Route 120 travels on Ambaum Boulevard Southwest and provides service from the BTC to Downtown Seattle via White Center.

Improvements recommended in Burien include the following⁵:

- **Transit Signal Priority** at Ambaum Boulevard SW and SW 128th Street, SW 136th Street, SW 144th Street, SW 146th Street, and SW 148th Street. It is also recommended at SW 148th Street and 4th Avenue SW.
- **Transit Stop Relocation** for stops on Ambaum Boulevard SW at SW 132nd Street and SW 144th Street.
- **Transit Stop Consolidation** on Ambaum Boulevard at SW 122nd Street, SW 124th Street, SW 142nd Street. Consolidation is also proposed for the stop at SW 148th Street and 4th Avenue SW.

Improvements on this line received a Washington State Department of Transportation Mobility Grant, with expected enhancements to be added by summer 2013.



King County Metro Bus Route 120, Burien Portion (King County Metro, 2011).

⁵ Source: Transpo Group, Draft King County Metro 120 West Seattle Bridge to Burien Conceptual Improvements Report, October 2011.



3. MULTIMODAL TRANSPORTATION SYSTEM

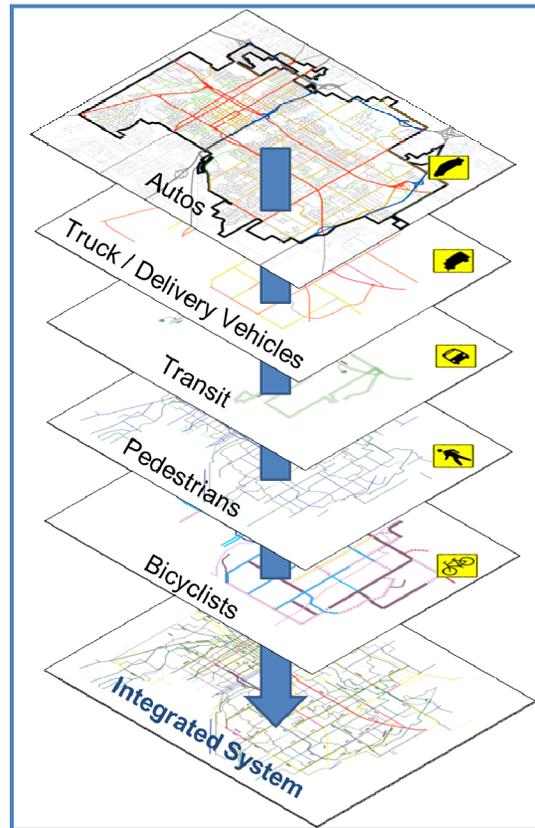
The City of Burien is committed to provide a transportation system that works for all modes - autos, trucks, buses, pedestrians, and bicycles. Since Burien is not expecting large growth in traffic volumes, the emphasis of this TMP is to create a multimodal roadway network that provides excellent mobility and connectivity throughout the city. This is accomplished through the development of a 'layered' transportation network.

INTRODUCTION TO THE LAYERED NETWORK CONCEPT

It is often a challenge for a single roadway to meet the demands and expectations of all modes at any given time. This has certainly been the case in Burien, where the city streets have been expected to concurrently serve autos, trucks, pedestrians, bicycles, and buses.

In response to this challenge, the City of Burien has adopted the concept of a 'layered' network. In a system of layered networks, individual travel modes are assigned to different segments of the overall network, in order to reduce the potential conflict inherent in trying to design all roadways for all uses. The graphic at right shows how various modal layers can be overlaid to create a logical roadway network that can realistically and safely accommodate all modes.

The following sections describe each layer of the network and the associated levels of service that the city will apply when setting priorities for modal investments throughout Burien.



Layered Network Concept
(Institute of Transportation Engineers, *Planning Urban Roadway Systems- An ITE Proposed Recommended Practice, 2011*).

AUTO/TRUCK NETWORK

Burien contains a network of roadways that serve as key conduits for freight and general vehicular mobility. Current traffic volumes, roadway classification, and freight routes



were used as a basis for developing this network of key roadways that should be prioritized to minimize delay for vehicles. These roadways provide connections to and from Downtown Burien, the Northeast Redevelopment Area (NERA), and state freeway facilities.

Layered Networks and Multimodal Level of Service

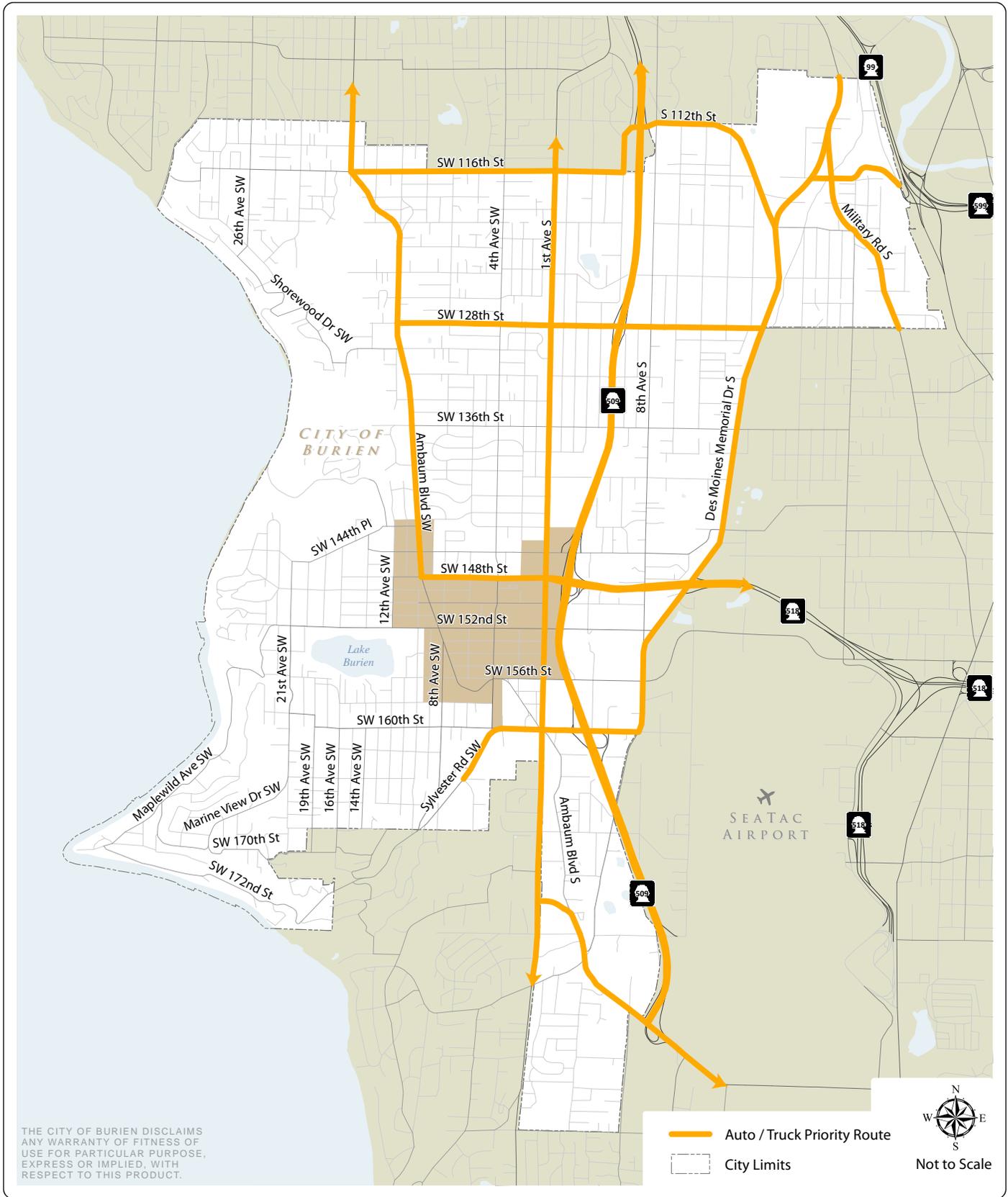
Layered networks are ideal for using multimodal level of service to address transportation performance. While traditional automotive LOS is assigned letters A-F, the non-automotive recommendations for Burien condensed these six LOS levels down to three: green, yellow, and red. Facilities receiving a green ranking meet the highest standards and recommendations for form and function, those receiving yellow are acceptable, and those receiving a red will generally need improvement(s) where funding and priority will allow.

Key Roadways

The roadways selected for inclusion as auto/truck priority were chosen due to their value in facilitating connections between Burien and the regional transportation network. It is expected that roadway improvements in Burien will be primarily aimed at maintaining uncongested flow of these roadways.

Figure 11 shows a map of the auto priority network. These routes include all of the City's currently designated truck routes and add the following priority roadway segments:

- SW 116th Street / 5th Avenue S between Ambaum Boulevard SW and SR 509. This east-west route links 1st Avenue S and Ambaum Boulevard SW with SR 509.
- S 112th Street / Glendale Way S. This is a continuation of the previous east-west route and connects SR 509 with Des Moines Memorial Drive.
- Des Moines Memorial Drive between S 160th Street and north city limits. This north-south alignment supports additional growth in the NERA and land uses in the City's potential annexation areas.
- Military Rd S and S 116th Street. These roadways connect northeast Burien with SR 99.
- SW 128th Street from SR 509 to Des Moines Memorial Drive. This is a continuation of an existing truck route (SW 128th Street from Ambaum Boulevard SW to SR 509) and provides an additional link between NERA and SR 509.
- SW 160th Street / Sylvester Road SW from Highline Medical Center to Des Moines Memorial Drive. This segment carries a high volume of traffic between southwest Burien/north Normandy Park and SR 509 and connects to the Highline Medical Center.





Level of Service Standards

For Burien, the LOS standard for vehicles will be LOS D for designated vehicle priority roadways, LOS E for downtown Burien, and LOS C for all other roadway facilities.

A standard of LOS D for auto priority streets recognizes that these streets will carry a higher volume of traffic, but should maintain consistent vehicle flow. A lower standard of E is set for downtown, accepting some additional congestion while ensuring that the streets maintain a pedestrian scale. All other roadways should remain relatively congestion-free (LOS C or better).

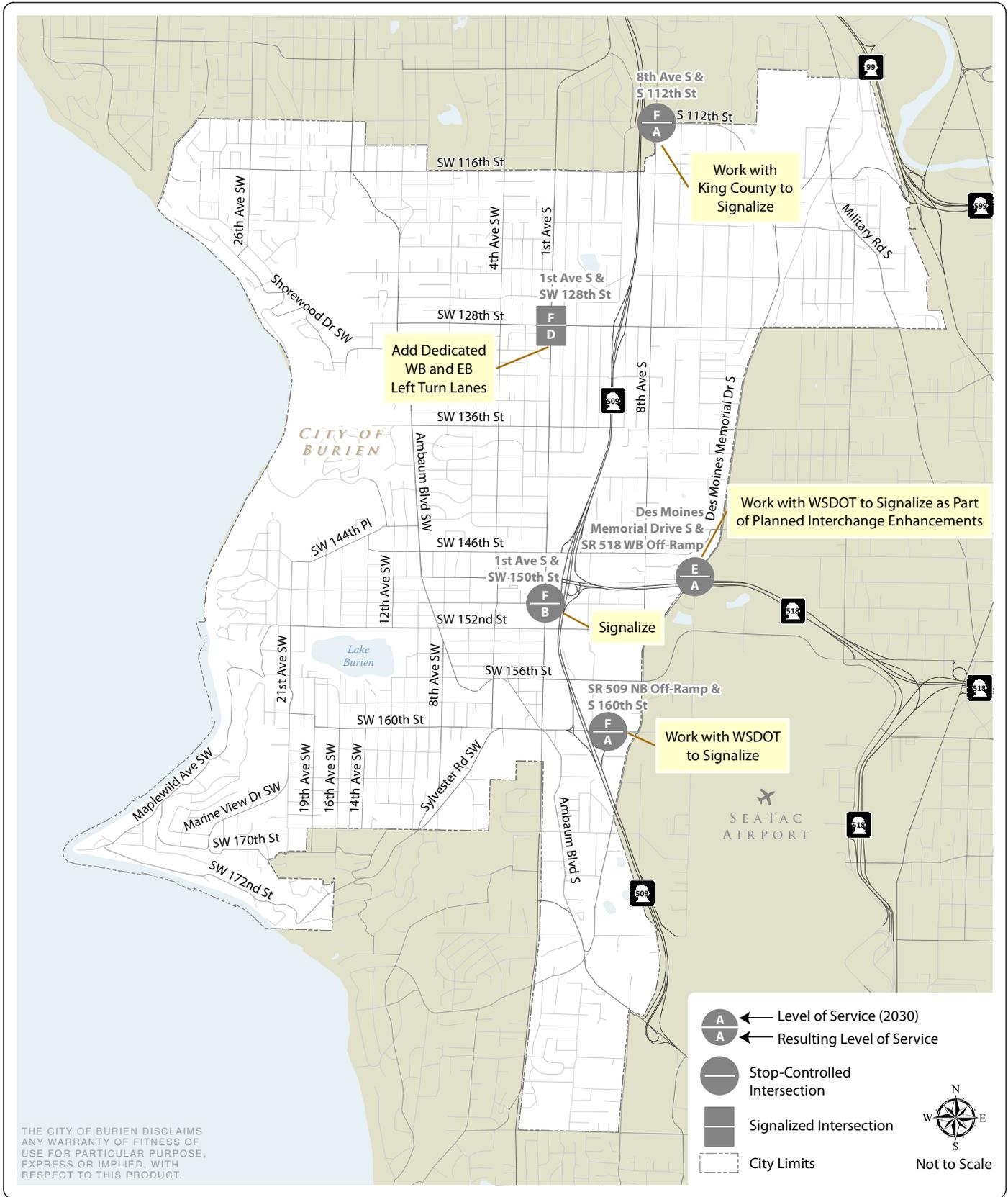
Traffic Improvement Needs

The analysis of future traffic operations considered local and regional land use growth as well as planned changes to the regional transportation system. **Figure 12** identifies intersection locations that are projected to have substandard LOS operations in the future. The figure also identifies recommended improvements to return the LOS to acceptable levels. With the exception of SR-518 WB Ramp and DMMD, all of these locations were also found to be operating deficiently today.

The recommended improvements include signaling four intersections that currently are controlled with stop signs and expanding one intersection, SW 128th Street and 1st Avenue S. The expansion will allow for an adjustment of the current traffic signal phasing (from split to concurrent) and reduce overall delay. These improvements are estimated to cost \$5 million - \$10 million.



Current configuration of S 1st Avenue and S 128th Street intersection (Google, 2012).





TRANSIT NETWORK

The transit priority network includes corridors that have a high demand for transit service and/or current high frequency of service. These corridors are detailed in **Figure 13** and include Ambaum Blvd SW, SW 156th Street, and key segments that connect to and from the Burien Transit Center. SW 156th Street is also included, since it is the expected route for the RapidRide F Line.

DMMD and 1st Avenue S south of downtown Burien were identified as potential transit priority routes. This designation stems from input from the Transportation Master Plan Advisory Committee (TMPAC), including the feedback that residents in northeast Burien would benefit from increased transit service. While these corridors currently lack frequent service, both were identified as being currently underserved by King County Metro.⁶

Level of Service Standards

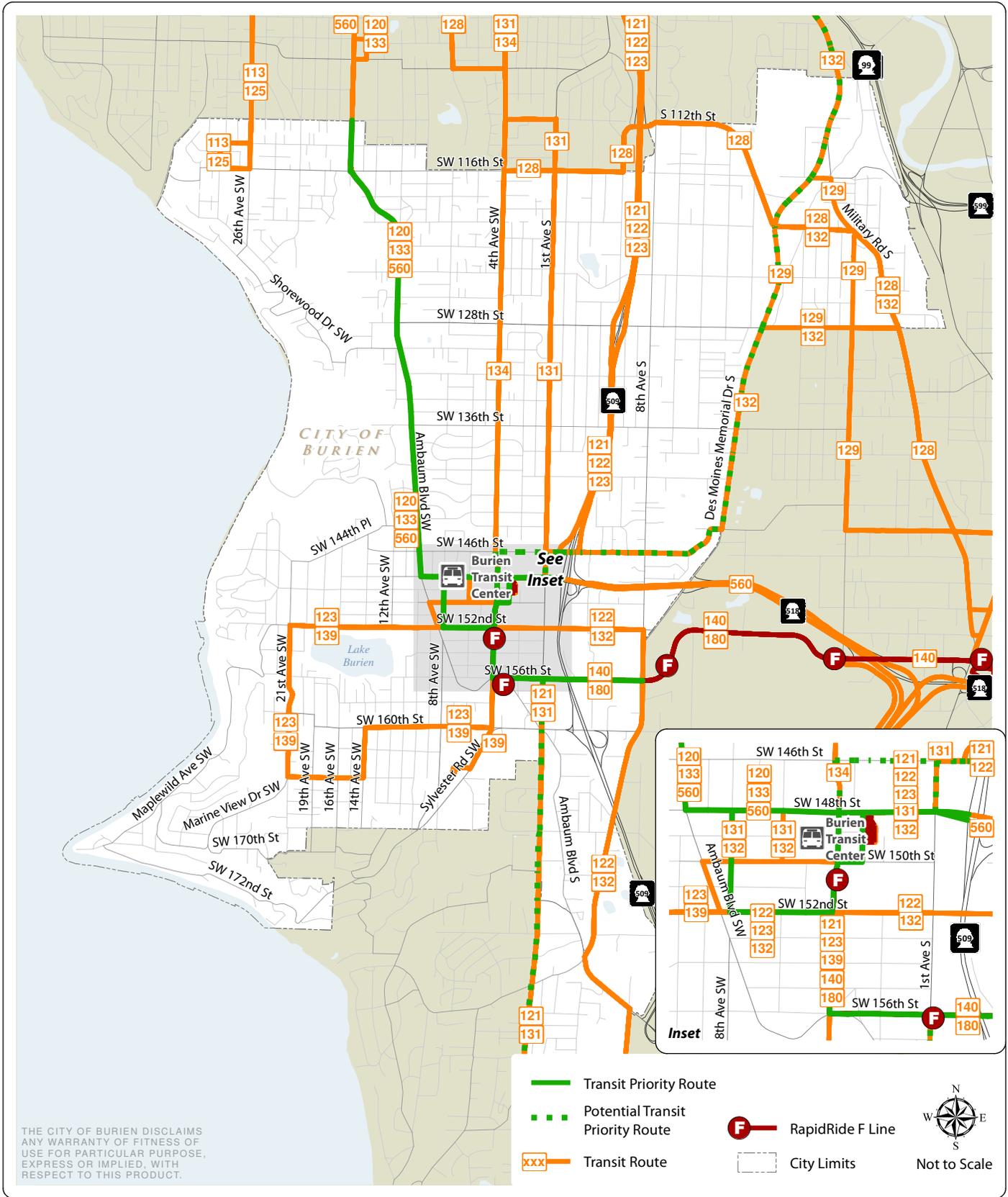
Table 3 summarizes how level of service is measured on transit priority corridors. For roadways designated as transit priority corridors, investments should be focused on achieving a green or high LOS.

In practical terms, these standards applied to Ambaum Boulevard SW would mean prioritizing shelters and benches at stops along the route, ensuring that crosswalks are located at most stops, providing sidewalks connecting to nearby households and businesses, and maintaining acceptable levels of intersection delay. Actions may also include adding Transit Signal Priority at congested intersections to improve the reliability of transit service. While detailed projects have not been identified at this time, the costs for implementing these improvements could be on the order of \$5 million.

Table 3. Transit Priority Corridor Level of Service

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

⁶Source: King County Metro, *Service Guidelines, 2011 Corridor Analysis*.





PEDESTRIAN NETWORK

Recognizing the history of Burien as an unincorporated area of King County until 1993, the pedestrian network is underdeveloped compared to present day needs. However, adding sidewalks across the city on most streets would be prohibitively expensive and incompatible with certain neighborhoods. The pedestrian priority network was developed as a means to determine where sidewalk improvements should be made and crosswalks should be added.

The following areas were designated as pedestrian priority areas by City staff and the TMPAC:

- Transit Priority Corridors
- Downtown Burien
- Pedestrian Activity Centers
 - Roads within a Quarter Mile of Schools
 - Roads within an Eighth Mile of Neighborhood Parks
 - Roads within a Quarter Mile of Food Banks

Level of Service Standards

Pedestrian LOS standards were developed separately for pedestrian priority areas and other areas of the city. As shown in **Table 4**, the emphases of the standards are completion of sidewalks on arterials and collectors and providing appropriately designed and spaced pedestrian crossings. The LOS designations are shown as green, yellow, and red. A green LOS is the preferred city standard. A yellow LOS indicates

acceptable short term conditions, while a red LOS is considered to be unacceptable.

Implementing the green LOS standards would require the installation of an additional 13-14 miles of sidewalks on collectors and arterials within the pedestrian priority areas and approximately 4 miles of sidewalks on arterials outside the pedestrian priority areas. For perspective, there are currently around 59 miles of sidewalks in Burien. The pedestrian priority streets, activity centers, and sidewalk recommendations are shown on **Figure 14**.

The crossing criteria would require installing new crosswalks at approximately 30 locations, primarily along Ambaum Boulevard NW and SW 128th Street. They also differentiate between “adequate” and “inadequate” crosswalks, as outlined in national guidelines.⁷ Further information on development of the pedestrian priority network and recommended areas for additional crosswalks are provided in **Appendix C**.

In total, these improvements are estimated to cost \$30 million - \$35 million, with some of the money allocated to specific improvements already programmed in the Transportation Improvement Program.

⁷ Zegeer, et al., *Study Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations*, Federal Highway Administration, 2005.



Table 4. Pedestrian Levels of Service

Pedestrian Priority Area LOS – Sidewalk Requirements			
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[a] or downtown	Appropriately designed crossings at existing marked crosswalks
	Crosswalks present every 600 feet	Crosswalks present
	No crosswalks present	No crossings within 600 feet

[a] Pedestrian activity areas are those areas within a quarter mile of schools, an eighth mile of neighborhood parks, or within a quarter mile of food banks.



Connection with HEAL Grant

In March 2010, Communities Putting Prevention to Work (CPPW), a national initiative to prevent chronic disease and promote community health through policies, systems and environment changes was launched. Public Health Seattle-King County (PHSKC) was one of 55 sites in the United States awarded grant funding through the Centers for Disease Control & Prevention (CDC) to address obesity and tobacco use, the leading causes of preventable death in the Puget Sound region.

While the population of greater King County is fairly healthy, people in the Highline region, which includes the City of Burien, live seven fewer years than those in other areas. The Highline region also has higher rates of obesity and diabetes and less leisure time physical activity. Burien, along with the Cities of SeaTac, Des Moines and Normandy Park applied to King County Public Health for grant funding to address the need to be more physically active and provide better access to healthy food.

In July 2010, the City of Burien was awarded a \$200,000 Healthy Eating Active Living (HEAL) grant to begin the work of assessing opportunities for increased mobility (sidewalks, safe routes to school etc.) and improved access to healthful food. As a result of grant funding, goals and policies relating to healthy eating and active living have been fully integrated into various elements of Burien's Comprehensive Plan. Burien has adopted a specific goal and policy that expresses support of planning for physical activity and healthy nutrition (Goal HC.1 and

Pol. HC 1.1). This support is reinforced by goals and policies in the Parks and Open Space element (Goal PRO.6 and Pol. PRO 6.1) and the Economic Development Element (CF.8 and Pol. CF 8.1).

Together with the HEAL grant, the Comprehensive Plan has also been amended to include goals and policies that support implementing a layered network concept with multi-modal levels of service. The revised transportation policy framework is intended to support grant objectives by reducing pollutants from transportation activities, reducing the amount of energy use through system efficiencies, and supporting improvements to the environment that facilitate the use of transit, walking and bicycling.

BICYCLE NETWORK

The 2004 City of Burien Pedestrian and Bicycle Facilities Plan laid the foundation for a citywide bicycle network. The TMP revisited the City's needs and added the newly annexed area in developing the bicycle network layer.

How does this plan compare to the 2004 Pedestrian and Bicycle Facilities Plan?

- 25 miles of bikeway recommendations were kept
- 10 miles of recommended bikeways were added (including facilities in the south North Highline Annexation Area)
- 7 miles of recommended bikeways were removed



The bicycle roadway layer designates a two-tiered network of bikeways, as shown in **Figure 15**. The first tier, designated as Neighborhood Bikeways, is designed to make primary use of low-volume residential streets. The goal for these bikeways is to create a system of facilities that accommodate cyclists of all ability levels, from bicycle commuters to families on recreational rides. These routes will be prioritized in receiving enhancements. The second tier of bike routes, General Bikeways, provide further mobility options for more experienced riders and make use of roads with higher vehicle volumes and/or steeper grades. Design elements for these routes may include sharrows, wide shoulders, or designated bike lanes.⁸ Corresponding with investments in these facilities, supporting bicycle infrastructure, including bike racks downtown and at city parks, should be provided.

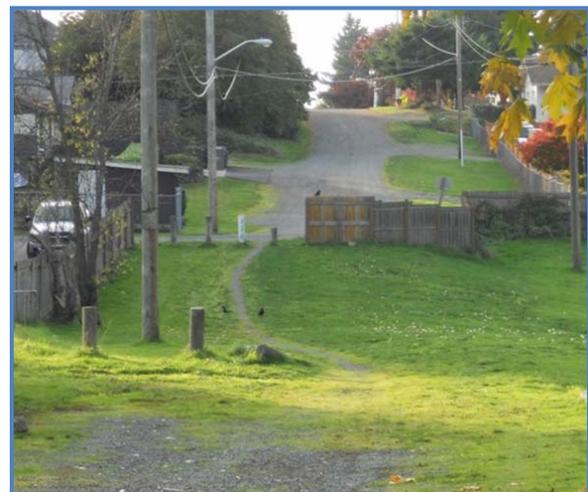
It is expected that most of the Neighborhood Bikeways will be in the form of bicycle boulevards. Bicycle boulevards are streets that are designed to give priority to non-motorized users and discourage through-traffic. Rather than allocate separate space in the street specifically for cyclists, bike boulevards communicate non-motorized preference through the roadway design, signage, and traffic calming. It is expected that these roadways will require only modest improvement, namely signage, and intersection enhancements.

⁸ Sharrows have been documented to increase bicyclist safety, and are included as an adopted item in the 2009 Manual on Uniform Traffic Control Devices (MUTCD).



Example of a Bicycle Boulevard
(www.pedbikeimages.org / Adam Fukushima)

The Neighborhood Bikeways are also designed to take advantage of so-called “paper streets” – gaps in the road network on public right-of-way that could be filled with a non-motorized path or trail. Many of these paths are currently used by pedestrians, as shown in the photo along S 132nd Street.



Informal Trail, S 132nd Street at 10th Avenue S



Other Important Facilities

In addition to bike boulevards, the network makes use of existing bike lanes on higher volume streets. The network also connects to existing bike lanes and paths in SeaTac and Normandy Park. It will also provide connections to the Lake to Sound Trail and the Duwamish River / Green River trails.

Level of Service Standards

The level of service standards for the bicycle network are different, depending if the facility is a Neighborhood Bikeway route or a General Bikeway route. As shown in **Figure 16**, volume, speed, and grade thresholds are intended to guide the determination of which bicycle facility type is most appropriate for a given roadway.

Roadway Speed, Volume and Grade

Based on the volume, speed, and grade thresholds, all components of the Neighborhood Bikeway Streets shown in Figure 15 should be in good, or green, condition as Bicycle Boulevards. For the identified General Bikeway routes, bike lanes are recommended at the following locations:

- SW 146th Street east of Ambaum Boulevard SW.
- 4th Avenue SW south of SW 146th Street
- S 112th Street/Glendale Way S.

The costs for signage and striping all planned routes and lanes is estimated at \$2 million - \$3 million, assuming that no additional right of way is needed.

Intersection Treatments and Stop Frequencies

In addition to speed, volume, and grade thresholds, LOS standards for intersection crossings and stop frequency were developed and are presented on **Table 5**.

Intersection crossings, especially for the Neighborhood Bikeway Streets, are of critical importance for safety and function. They should be designed to allow for safe crossing of busy arterials. Based on preliminary estimation, enhanced crossings will be required at ten intersections along the Neighborhood Bikeway Streets and an additional three locations along the General Bikeway routes. The cost for these intersection enhancements will vary greatly, depending on whether or not a full signal is warranted. The total costs for the intersection enhancements are estimated at \$3 million - \$6 million.

Since the Neighborhood Bikeway streets are envisioned as being the primary biking facilities, a low stop frequency is also key to their utilization. If cyclists are required to frequently stop along the route, they would be likely to choose an alternative route. The stop frequencies along the identified Bicycle Priorities streets are all currently acceptable, with the exception of the portion of 8th Avenue SW between SW 146th Street and Ambaum Boulevard SW. Stop frequency will ultimately depend on intersection design and time of day. Further information is provided in **Appendix D**.

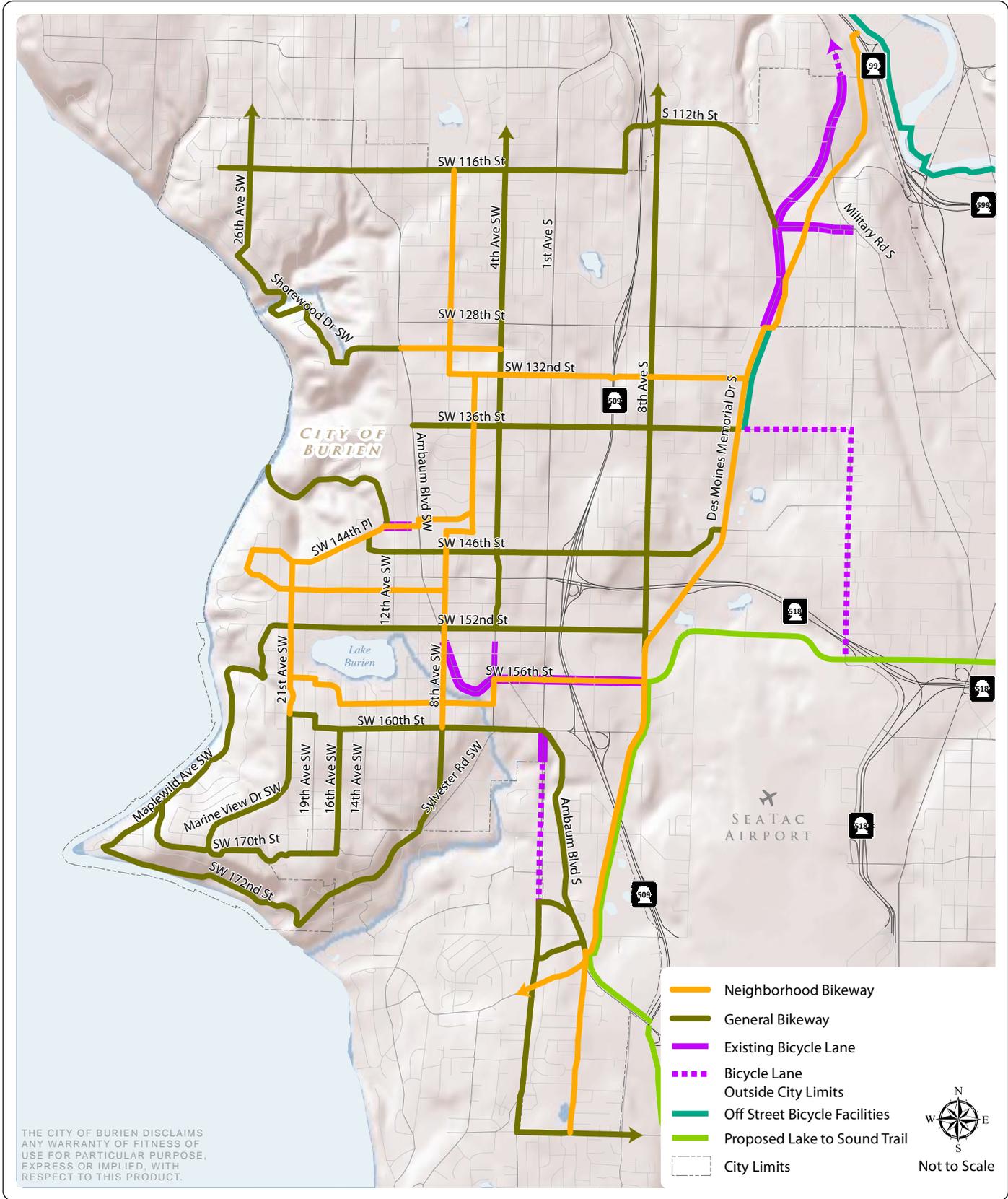




Figure 16. Bicycle Level of Service – Speed, Volume, and Grade Thresholds
Note, Speeds are posted limits.

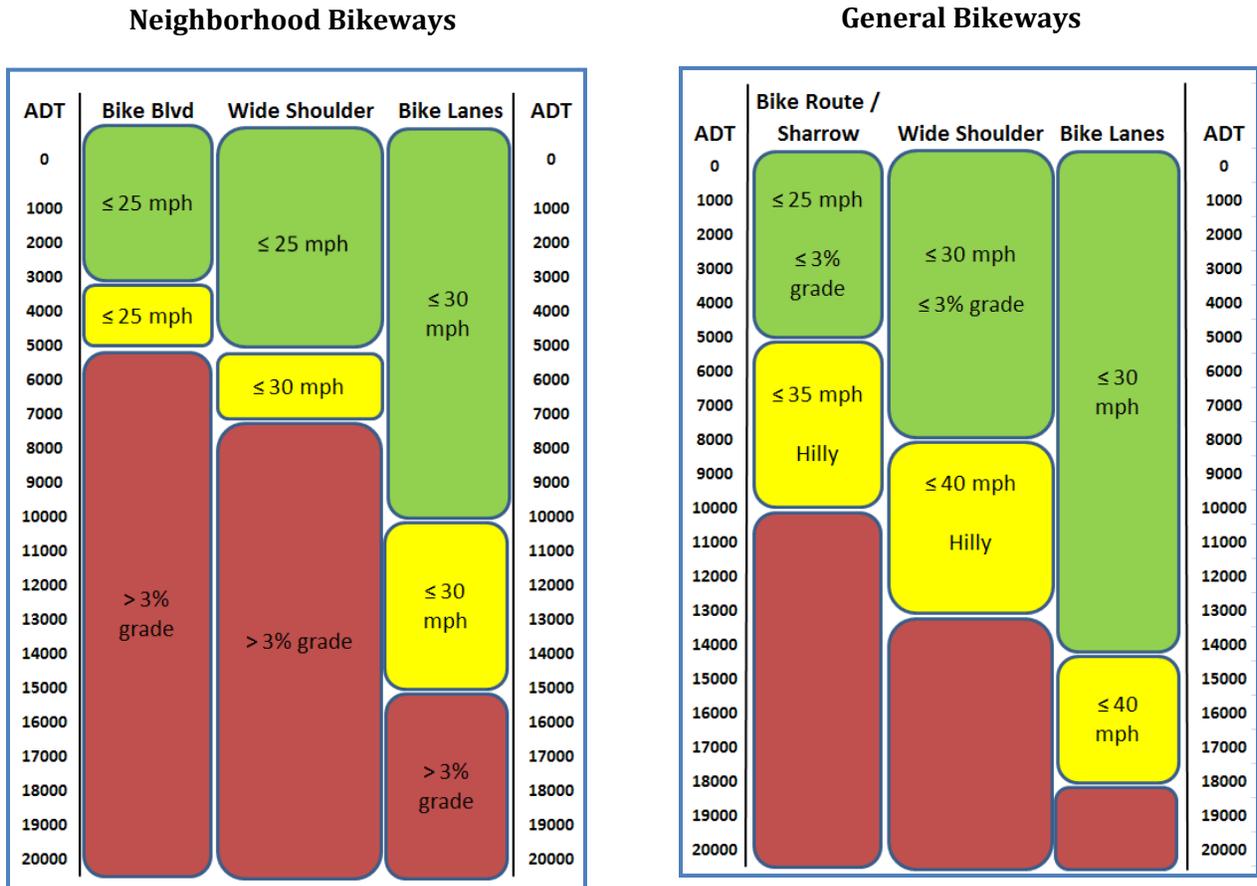


Table 5. Bicycle Intersection and Stop Frequency LOS

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



4. SUSTAINABLE TRANSPORTATION

The Burien City Council has identified sustainability as an important component of all city planning efforts. Specifically, the Burien Comprehensive Plan identifies the goal that “decision makers should have the knowledge and tools necessary to assess sustainability in their plans and decisions.” This TMP strives to create a sustainable future for Burien that can be both measured and embraced by the community.

DEFINING SUSTAINABILITY

As a part of the TMP, sustainability is assessed in three main areas:

- **Environmental** – This is defined by whether the plan promotes more environmentally conscious travel options (transit, non-motorized travel, carpooling) and envisions a transportation system that blends into the natural landscape rather than detracting from it.
- **Community** – This criterion asks whether the plan promotes healthy lifestyles, as measured by an increased ability for all residents to walk and bike, as well as travel safely through the community.
- **Financial** – This is measured by whether the plan envisions an affordable future that fits within Burien’s means and supports the community’s goals of being financially strong.

Environmental

The TMP’s focus on creating a layered transportation network that explicitly serves

all modes of travel is a key component of the City’s efforts to encourage more environmentally conscious travel options. The TMP identifies enhancements to the transportation network that will make traveling by transit, bicycle, and walking modes more efficient, pleasant, and safe.

Moreover, the transportation plan does not envision any major roadway widening projects, which are the primary types of transportation projects that detract from the natural landscape. Instead, this plan envisions a future transportation system that largely functions within the current right of way constraints.

Community

The TMP, combined with the City’s Communities Putting Prevention to Work/Healthy Eating Active Living (CPPW/HEAL) planning grant, focuses on providing a safe and enjoyable environment for walking and bicycling. The bicycle and pedestrian priority networks provide guidance for designing facilities to ensure these modes are given adequate priority to ensure safety and efficiency in travel.

Financial

The next chapter discusses implementation of the TMP and specifically how the proposed plan can be paid for. The plan was specifically designed to require reasonable capital investments, recognizing the City’s current financial position, as well as the number of other priorities that must also draw from a limited pool of resources.



5. IMPLEMENTING THE TMP

The recommended projects and programs of the TMP were developed by travel mode, as described in previous chapters. Implementing the TMP will require close coordination among the City departments, the citizens and businesses of Burien, and other agencies within the region.

In order to guide the City in implementation of the plan, priority should be assigned to assist in assembling an updated six-year TIP over the course of the coming 20 years, working toward the 2030 planning horizon. This chapter summarizes the recommended plan and documents the criteria used to prioritize the projects.

The TMP is a living document and will serve as the blueprint for transportation in Burien over the next several years. Realistically, the actions in the plan are most useful over the next three to five years, at which point a plan update will be required. Several implementation steps should be initiated over the next couple of years to determine if changes are needed, or to reaffirm a particular strategy.

OVERVIEW OF COSTS AND REVENUES

A key GMA planning requirement is the concept of fiscal restraint in transportation planning. A fiscally constrained Transportation Plan must first allow for operation and maintenance of existing facilities and then capital improvements. To develop the fiscally constrained plan, an inventory of revenues and costs was undertaken to identify funds that are likely to be available for capital construction and operations.

The proposed Transportation Master Plan for the City of Burien contains a variety of projects that will cost the city between \$56 and \$75 million over 20 years. **Table 6** summarizes the costs of the major types of transportation improvements. The TMP focuses on capital projects that will complete the layered network plan. The plan also includes ongoing pavement maintenance to ensure that the roadway network is kept in good condition.

In addition to the TMP projects identified above, the city is committed to participate in the regional and major roadway reconstruction projects identified in **Table 7**.

Table 6. Costs of Burien Transportation Master Plan (20 Years)

Project Needs*	Description	Cost Range (\$ Millions)
Auto/Truck Priority Projects	Traffic signals, intersection channelization	\$ 5-10
Pedestrian Projects	Sidewalks, crossings	\$ 30-35
Bicycle Projects	Bike boulevards, bike lanes, crossings	\$ 5-10
Transit Projects	Shelters, Transit Signal Priority, other enhancements	\$ 4-5
Pavement Maintenance	Overlay and pavement repair	\$ 12-15
TOTAL		\$ 56-75

* Does not include major regional or street reconstruction projects described in Table 7.



Table 7. Regional Roadway Reconstruction Projects[a]

Project Name	Notes	Cost Range (\$ Millions)
SR 518 Interchange at Des Moines Memorial Drive	Tied to development of the Northeast Redevelopment Area (joint WSDOT, City of Burien and City of SeaTac Project)	\$ 76
1st Avenue South Phases 3 and 4	Project boundaries are SW 116 th Street to SW 140 th Street	\$ 20
Reconstruction on several roadways to meet urban design standards [b]	Includes curb, gutter, drainage, illumination, and nonmotorized facilities	\$ 60-70
TOTAL		\$ 156-166

[a] Note that some of these projects (for example, adding sidewalks to 1st Avenue S) are a duplicate of TMP recommendations.

[b] 8th Avenue South (S 152nd St to S 128th St); 8th Avenue SW (Ambaum Blvd to Sylvester Rd SW); 4th Avenue SW (SW 148th St to SW 150th St); Des Moines Memorial Drive (S 165th St to Normandy Rd); SW 159th Street and 19th Avenue SW (SW 21st Ave to SW 160th St); South Normandy Road (1st Ave S to Des Moines Memorial Drive); S 174th Street (1st Ave S to 8th Ave S)

Combined, the city's share of the TMP and other roadway projects identified above could exceed \$200 million over the next 20 years.

It is worthwhile to note that the City of Burien has spent around \$5 million annually for transportation capital and operations. Revenues include those from general city funds, grants, bond proceeds, the Public Works trust fund, impact fees, and the new Transportation Benefit District. If the city were able to maintain this level of revenue, the City could afford around \$100 Million in transportation projects over the next 20 years. Further information on transportation revenue is contained in **Appendix F**.

The comparison of revenues to costs indicates that the city will need to carefully prioritize its projects, since not all of the transportation needs are likely to be affordable with existing revenue sources during the 20-year period. If this occurs, the City has several options:

- Increase the amount of revenue from existing sources. These could include updated impact fees, a higher vehicle license fee from the Transportation Benefit District, or creation of additional Local Improvement Districts.
- Adopt new sources of revenue (see text box).
- Lower the level of service standard, and therefore reduce the need for some transportation improvements.



What Are Potential New Revenue Sources?

- Proceeds from General Obligation Bonds
- Solid waste hauler fees for heavy vehicles
- Reciprocal impact fees with adjacent jurisdictions
- Business license fee per employee

The city can explore the feasibility and likely revenue amounts from these or other sources as the plan is implemented over the next several years.

Note that the city could also weigh changing the land use element to reduce the amount of development planned (and thus reduce the need for additional public facilities). However, in a community such as Burien that is largely built out, land use changes would not likely result in reduced facility needs.

SETTING PRIORITIES

Project prioritization is needed to help identify when best to fund and implement the projects since funding is limited. Criteria were established to help prioritize the projects and implementation based on the City’s vision and transportation goals established in the Comprehensive Plan. These criteria, not listed in any priority order, are identified in **Table 8**.

Table 8. Criteria for Project Prioritization

Criteria	Measurement
Mobility	
Multimodal Mobility	Meets multimodal level of service policies (for each mode- Auto/truck, transit, pedestrian, bicycle)
Regional Mobility	Enhances travel on major regional routes
Safety	
Traffic Safety	Reduces vehicle and/or personal collisions
Emergency Response	Reduces travel time for emergency response
Environment	
Environmental Preservation	Protects open spaces and minimizes increases to paved areas
Neighborhood Protection	Supports protection of residential areas and neighborhood streets
Preservation and Maintenance	
System Preservation	Improves physical condition of city roadways
Health	
Active Lifestyle	Promotes active movements by residents and employees
Implementation	
Funding	Level of funding commitment for project
Project Readiness	Degree the project is ready to be implemented



Using these criteria, the recommended projects will need to be evaluated and ranked based on how well each could meet the criteria. High priority projects for Burien are those that meet multiple criteria in terms of effectiveness, livability and ability to be implemented. These attributes will allow the City to take advantage of a variety of public and private funding sources to complete key projects.

MONITORING AND EVALUATION

The TMP is a long-range plan that enables the City to plan for its current and future transportation needs. Nonetheless, the transportation network is dynamic, constantly changing due to circumstances beyond the scope and influence of this plan. Hence, regular updates are necessary to ensure the plan remains current and relevant. The TMP includes the following actions to monitor and evaluate the progress of implementing the plan.

Bi-Annual Mobility Report Card

A bi-annual mobility report card will be developed to document progress towards plan implementation and to monitor the transportation system performance. The City will use this information to inform the public regarding the City's actions, and results, related to the TMP. The report card will also provide a basis for future updates of the TMP.

The report card is expected to report on the following topics:

- Land Use and Transportation Trends - These data will describe general land

use and transportation trends within Burien. Information will include:

- Current population and employment levels and growth rates,
- Summary of yearly development activity, and
- Summary of growth in traffic volumes, transit service and other trends
- Transportation Performance - These data will focus on documenting the current performance of the transportation system, by mode. Information will include:
 - Transit route ridership (from KC Metro and Sound Transit)
 - Park-and-ride lot utilization
 - Traffic volumes
 - Collisions
 - Traffic level of service (auto/truck priority corridors)
 - Pedestrian and bicycle volumes
 - Pavement Maintenance Ratings
- Project Implementation Status - These data will summarize the city's progress towards implementing the priority network improvements recommended in the TMP. Information is expected to include:
 - Auto/truck facilities constructed
 - Pedestrian facilities constructed
 - Bicycle facilities constructed
 - Miles of Pavement overlays

The report card will provide the necessary information to help the city adjust transportation priorities and to facilitate updates to the TMP every few years.



BURIEN TRANSPORTATION MASTER PLAN APPENDICES

APPENDIX A.....INTERSECTION LOS

Description of intersection LOS methodology, 2010 and 2030 LOS results

APPENDIX B.....SUPPLEMENTAL TRANSIT INFORMATION

Transit frequency table, mid-day service map, and regional service map

APPENDIX C.....SUPPLEMENTAL PEDESTRIAN INFORMATION

Location of current crosswalks, details of pedestrian activity centers, general recommendations for additional crosswalks

APPENDIX D.....SUPPLEMENTAL BICYCLE INFORMATION

Map detailing stop frequency on bicycle priority streets and potential locations of intersection/crossing enhancement needs

APPENDIX E.....TRAVEL MODEL AND LAND USE INFORMATION

Map of Burien Transportation Analysis Zones and table of 2010 and 2030 households and employment

APPENDIX F.....SUPPLEMENTAL FUNDING ANALYSIS

Tables showing current transportation revenue sources and amounts

ELECTRONIC APPENDICES:

APPENDIX G.....TRAFFIC COUNTS

AM and PM peak period intersection turning movement counts and all day traffic counts (ELECTRONIC: XLS AND PDF)

APPENDIX H.....INTERSECTION ANALYSIS SHEETS

2010 and 2030 Highway Capacity Manual (HCM) LOS Synchro output sheets (ELECTRONIC: PDF)



APPENDIX A – INTERSECTION LOS

This appendix summarizes existing and future vehicle level of service (LOS).

Intersection LOS Methodology

Level of Service (LOS) is a general measure of traffic operating conditions whereby a letter grade, from A to F, is assigned. These grades represent the perspective of drivers and are an indication of the comfort and convenience associated with driving as well as speed, travel time, traffic interruptions and freedom to maneuver.

For 4-way stop intersections and signal-controlled intersections, LOS is determined by the average delay that all motorists experience. Because motorists have different perceptions of delay in different contexts, the delay thresholds for all-way stop intersection LOS are generally lower than those of signal-controlled intersections LOS. Additionally, for intersections with a stop sign on only one or two approaches, the delay is reported for motorists at the stop sign with the highest delay. The delay is typically reported for the busiest time of day, which is generally the PM commute hour. Intersections that are LOS E or F likely perform poorly only during several hours of the day.

Complete LOS definitions for all-way stop and signal-controlled intersections are shown in **Tables A-1 and A-2**, respectively. These definitions of LOS for motorists are contained in the Highway Capacity Manual (HCM) (Transportation Research Board, 2000). The HCM methodology is the prevailing measurement standard used throughout the United States.

Table A-1. Level of Service Definitions for Stop-Controlled Intersections	
Level of Service	Average Control Delay (seconds/vehicle)
A	< 10.0
B	> 10.0 and < 15.0
C	> 15.0 and < 25.0
D	> 25.0 and < 35.0
E	> 35.0 and < 50.0
F	> 50.0
<i>Highway Capacity Manual, Transportation Research Board, 2000</i>	



Table A-2. Level of Service Definitions for Signalized Intersections, 2000 HCM Operational Methodology		
Level of Service	Average Stopped Delay per Vehicle (seconds)	Definition
A	<10	No vehicle waits longer than one red light and no approach phase is fully used.
B	>10 and <20	An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.
C	>20 and <35	Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	>35 and <55	Delays may be substantial during portions of the peak period, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	>55 and <80	Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	>80	Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.
<i>Highway Capacity Manual, Transportation Research Board, 2000</i>		

Intersection LOS for the years 2010 and 2030 was calculated with Synchro 7.0, a traffic operations software package based on HCM 2000 methodologies. The 2010 LOS/delay represents existing conditions from observed traffic volumes, while the 2030 LOS/delay comes from a forecast developed by a travel demand model, based on expected future land use. Future volumes were post-processed using the delta method. This method corrects for model inaccuracies by calibrating existing counts to existing model volumes and then adding the future year model growth.

Intersection LOS Results

The City of Burien has adopted intersection LOS standards that vary by facility. These LOS standards are summarized in **Table A-3**.



Intersection	LOS Standard
Within Urban Center boundary	E
Auto/Truck Priority Routes	D
All others	C

A summary of intersection LOS and delay for the years 2010 and 2030 is shown in Table A-4. Out of 42 intersections, only four did not meet Burien standards in 2010: S 112th St / 8th Ave S, S 160th St / 509 NB Ramp, SW 150th St / 1st Ave S, and SW 128th St / 1st Ave S. The same intersections, in addition to SR 518 off ramp / Des Moines Memorial Dr S, failed to meet standards for the 2030 forecast. These are indicated in bold in **Table A-4**.

Name	Control Type	2010 LOS/Delay	2030 LOS/Delay
S 112th St / 8th Ave S	Stop - 4 way	F / 52	F / 150+¹
SW 116th St / Ambaum Blvd SW	Signalized	A / 10	C / 31
SW 116th St / 1st Ave S	Signalized	B / 16	B / 17
S 136th St / Des Moines Memorial Dr S	Signalized	A / 6	B / 19
SW 136th St / 1st Ave S	Signalized	C / 32	D / 38
SW 148th St / 6th Ave SW	Unsignalized ²	D / 32	D / 34
SW 150th St / 6th Ave SW	Signalized	B / 19	B / 18
SW 152nd St / 6th Ave SW	Signalized	A / 8	B / 15
SW 150th St / 4th Ave SW	Signalized	D / 40	D / 39
SW 152th St / 4th Ave SW	Signalized	A / 10	B / 13
SW 152th St / 1st Ave S	Signalized	D / 36	D / 49
Ambaum Blvd SW / 4th Ave SW	Signalized	B / 11	B / 17



Table A-4. Study Intersections Level of Service for 2010 and 2030

Name	Control Type	2010 LOS/Delay	2030 LOS/Delay
SW 160th St / 4th Ave SW	Signalized	B / 15	B / 20
SW 156th St / 1st Ave S	Signalized	D / 49	D / 52
S 156th St / Des Moines Memorial Dr S	Signalized	A / 10	B / 16
S 160th St / Des Moines Memorial Dr S	Signalized	B / 11	B / 13
SR 518 on ramp / Des Moines Memorial Dr S	Signalized	B / 10	A / 10
128th St / Ambaum Blvd SW	Signalized	B / 11	B / 12
SW 160th St / 1st Ave S	Signalized	C / 22	D / 48
S 128th St / 4th Ave SW	Signalized	C / 25	D / 36
S 128th St / 8th Ave S	Signalized	B / 15	B / 18
SW 148th St / 1st Ave S	Signalized	D / 38	D / 52
SW 148th St / 509 SB Ramps	Signalized	B / 17	B / 17
SW 148th St / Ambaum Blvd SW	Signalized	C / 26	C / 28
S 128th St / 509 SB Ramps	Signalized	B / 11	A / 10
S 128th St / 509 NB Ramps	Signalized	A / 9	A / 10
S Normandy Rd / Ambaum Blvd S	Signalized	C / 31	C / 33
SR 518 off ramp / Des Moines Memorial Dr S	Stop - Only for off ramp traffic	C / 17	E / 36
SW 146th St / 1st Ave S	Signalized	C / 34	D / 41
S 160th St / 509 SB Ramp	Stop - Only for off ramp traffic	C / 20	C / 19
S 160th St / 509 NB Ramp	Stop - Off ramp and 5th Pl S	E / 37	F / 126
S 120 th St / Des Moines Way S	Signalized	A / 9	B / 10
S 128th St / Des Moines Memorial Dr S	Signalized	A / 9	A / 9
S 116th St / Des Moines Way S	Signalized	B / 13	B / 18
SW 146th St / Ambaum Blvd SW	Signalized	B / 12	B / 14



Table A-4. Study Intersections Level of Service for 2010 and 2030

Name	Control Type	2010 LOS/Delay	2030 LOS/Delay
SW 148th St / 4th Ave SW	Signalized	B / 12	B / 15
SW 152nd St / Ambaum Blvd SW	Signalized	C / 21	C / 27
SW 148th St / 509 NB Ramps	Signalized	A / 8	A / 9
SW 150th St / 1st Ave S	Stop - Two way (EB & WB)	F / 59	F / 150+ ¹
SW 128th St / 1st Ave S	Signalized	F / 103	F / 134
S 146th St / 509 SB Ramps	Stop - Only for off ramp traffic	C / 16	C / 17
SW 136th St / Ambaum Blvd SW	Signalized	A / 10	A / 10
¹ Synchro software does not accurately estimate delay above 150 seconds. ² Intersection contains a pedestrian half-signal. Highest delay is reported analyzing side-stop delay. Delay due to pedestrian signal is 2 / A in existing and 4 / A in 2030. <i>Highway Capacity Manual, Transportation Research Board, 2000</i>			



APPENDIX B – SUPPLEMENTAL TRANSIT INFORMATION

This appendix provides documentation on existing transit service in Burien.

Frequency of Service

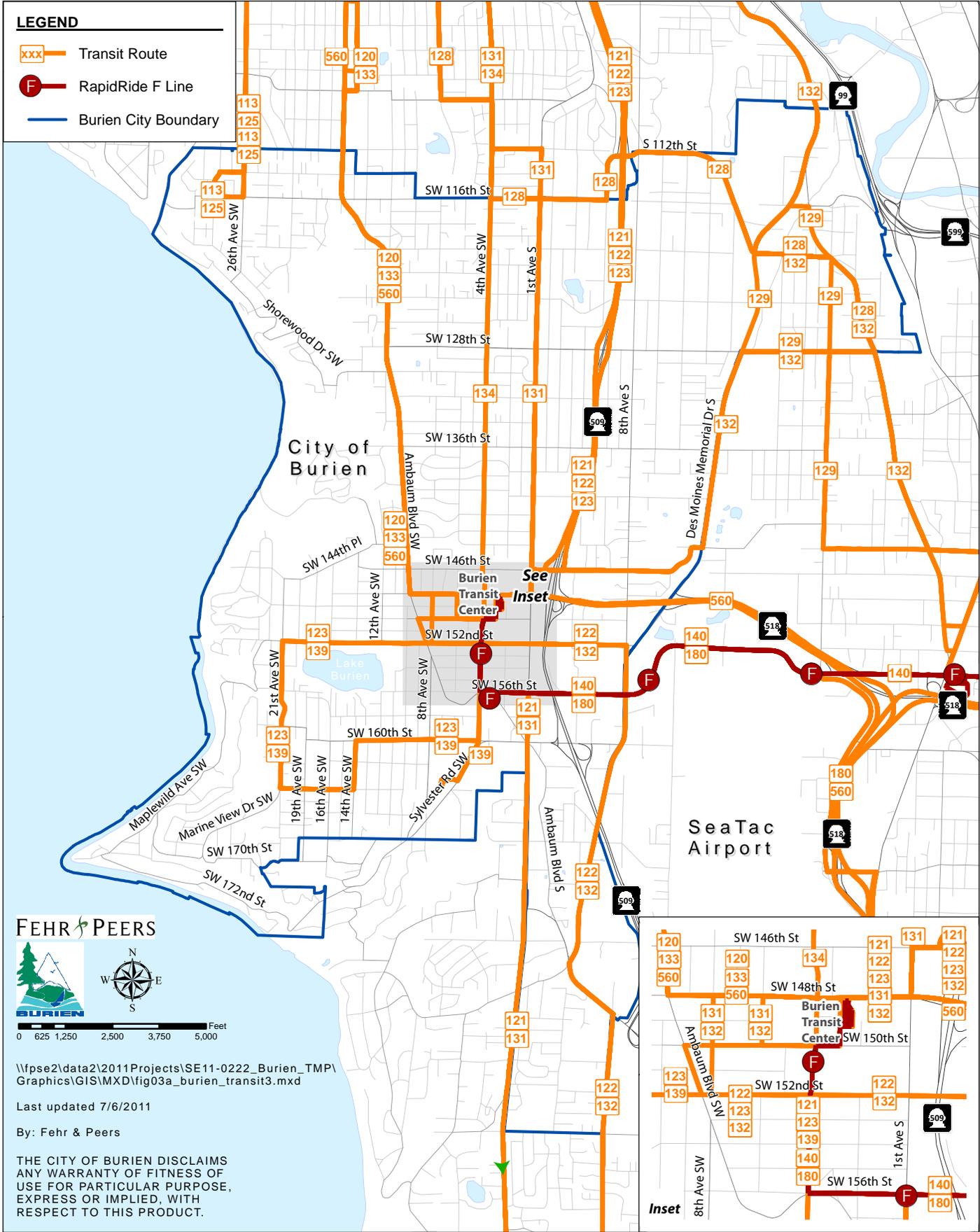
Table B-1 details the AM Peak (6:00 AM – 9:00 AM), midday, and PM Peak (3:00 PM – 6:00 PM) transit service in Burien by line number. With the exception of the Sound Transit route 560, all routes are operated by King County Metro Transit.

Table B-1. Existing Burien Transit Routes and Weekday Frequencies				
Route	Destination	AM Peak Frequency	Midday Frequency	PM Peak Frequency
113	Shorewood - Downtown Seattle	30 (NB only)	-	30 (SB Only)
120	Burien Transit Center - Downtown Seattle	15	15	15
121	Highline Community College - Downtown Seattle	15/30 (NB/SB)	-	30/15 (NB/SB)
122	Highline Community College - Downtown Seattle	20 (NB Only)	-	20 (SB Only)
123	Seahurst -Downtown Seattle	35 (NB Only)	-	35 (SB Only)
125	Shorewood - Downtown Seattle	One SB Run	30	-
128	Southcenter - Admiral District	30	30	30
129	Tukwila Station - Riverton Heights	35	-	35
131	Highline Community College - Downtown Seattle	60	60	60
132	Highline Community College - Downtown Seattle	30	60	30



Table B-1. Existing Burien Transit Routes and Weekday Frequencies				
Route	Destination	AM Peak Frequency	Midday Frequency	PM Peak Frequency
133	Burien Transit Center - University District	30 (NB only)	-	30 (SB Only)
134	Highline Community College - Downtown Seattle	45 (NB Only)	-	60 (SB Only)
139	Burien Transit Center - Gregory Heights	30	30	30
140	Burien Transit Center - Renton Transit Center	15	15	15
180	Burien - White River Station	30	30	30
560ST	Bellevue Transit Center - West Seattle Junction	30	30	30
<i>King County, 2011 and Sound Transit, 2011</i>				

Figure B1 shows a map of the existing transit routes in Burien and the alignment of the RapidRide F line. Figure B2 shows the ¼ mile stop distance and midday corridor frequency of service (Figure 4 of the report provided the peak hour corridor frequencies). Finally B3 displays a regional map of transit routes that serve Burien.



FEHR PEERS



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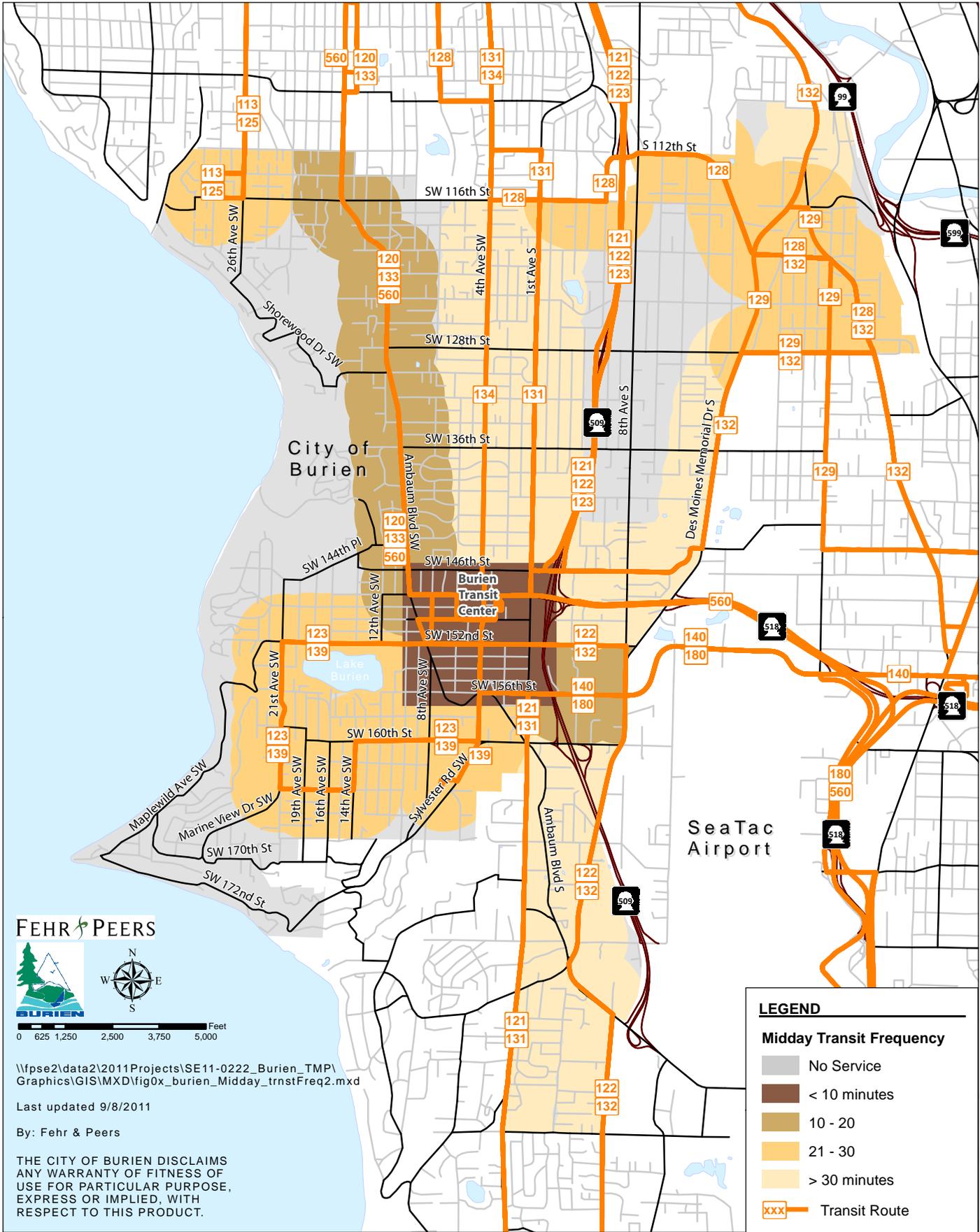
Last updated 7/6/2011

By: Fehr & Peers

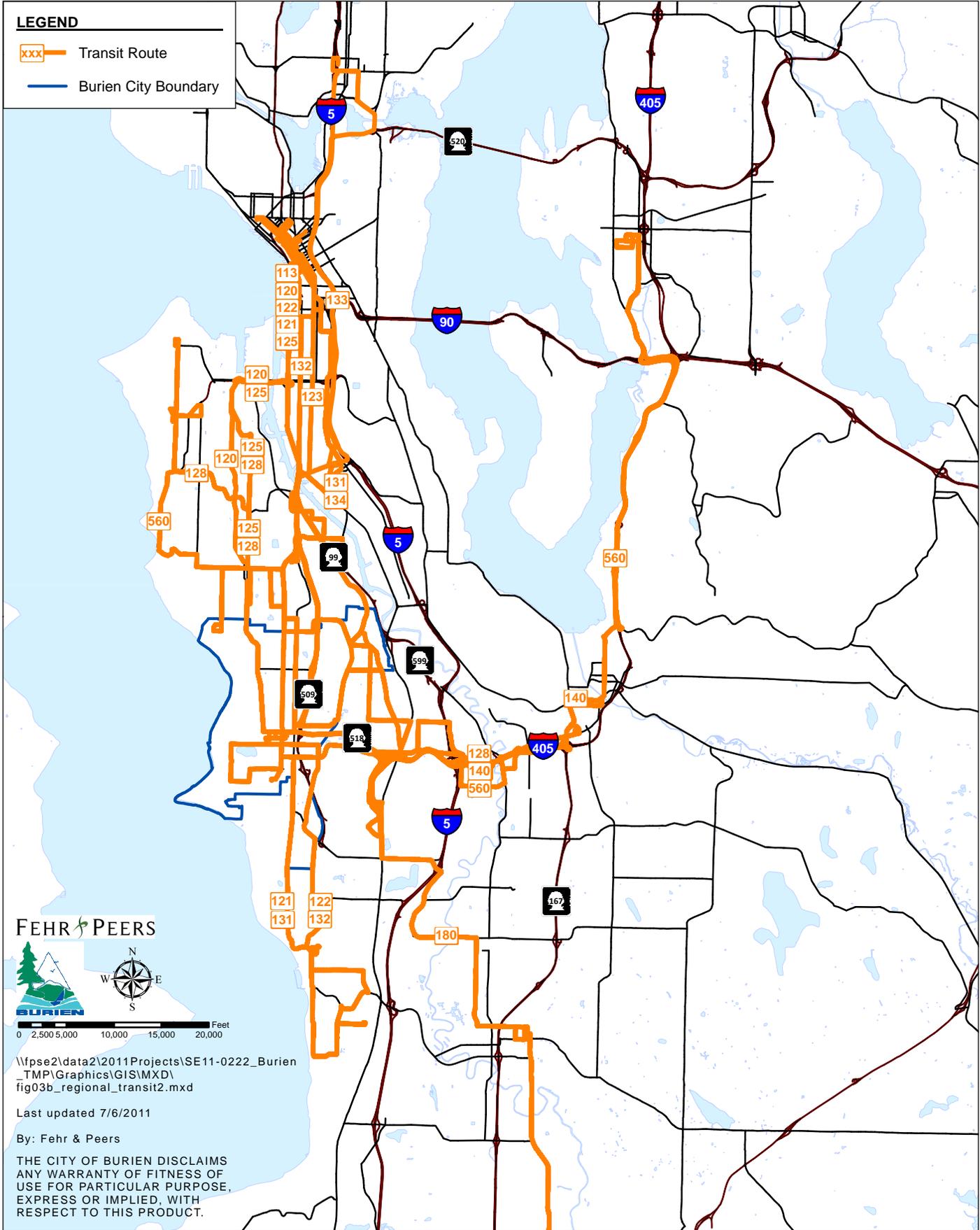
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BURIEN TRANSIT ROUTES

FIGURE B1



BURIEN MIDDAY TRANSIT FREQUENCY



REGIONAL TRANSIT ROUTES

FIGURE B3



APPENDIX C – SUPPLEMENTAL PEDESTRIAN INFORMATION

This appendix provides further information on the development of the pedestrian priority areas and identifies current sections of roadways that should be considered for additional marked crosswalks.

Pedestrian Priority Area Development

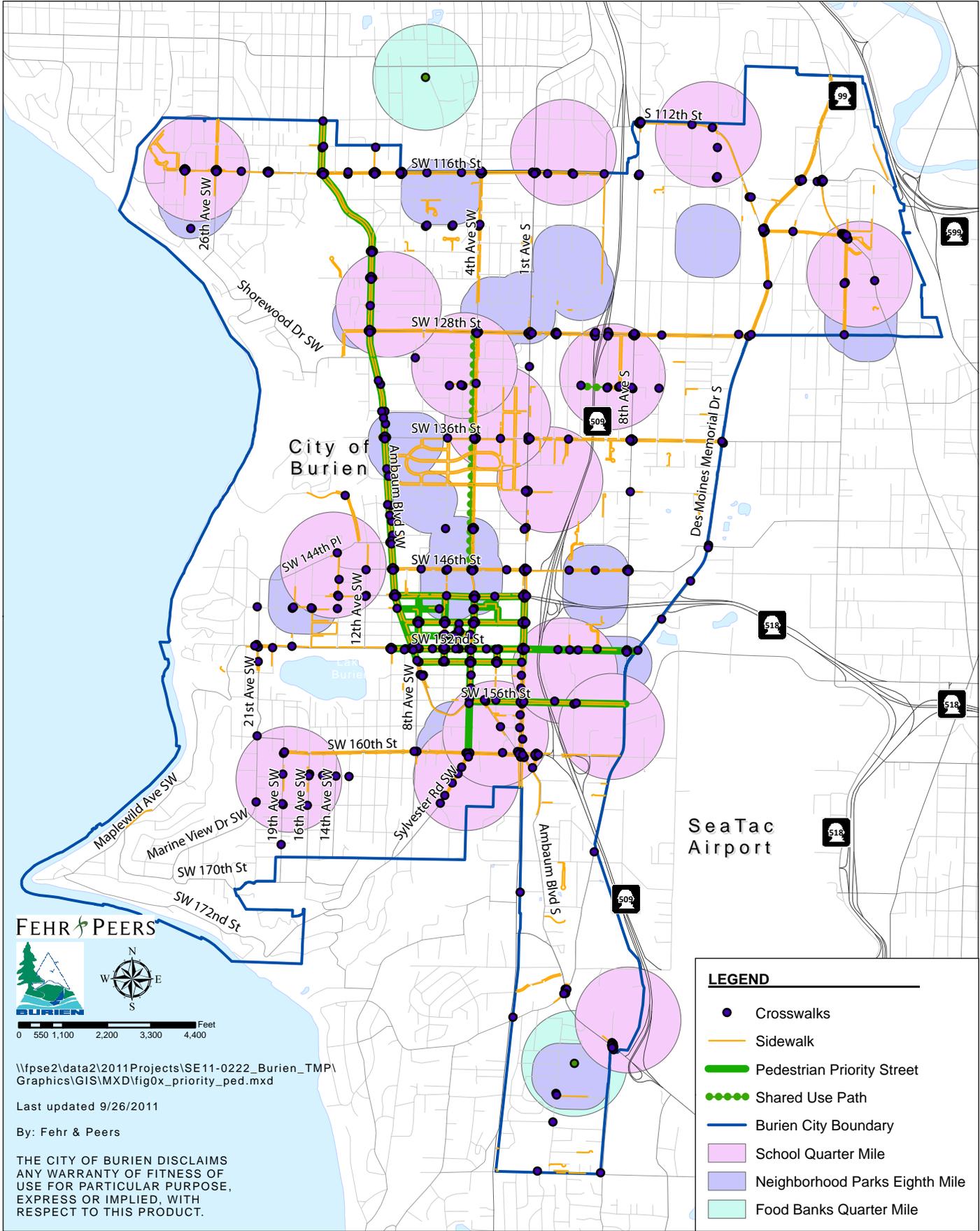
In order to identify areas to prioritize pedestrian improvements, the following areas were selected:

- Streets designated as transit priority corridors
- Streets within Downtown Burien
- Streets within 1/4 mile of schools
- Streets within 1/4 mile of food banks
- Streets within 1/8 mile of neighborhood parks

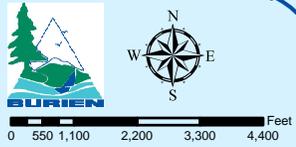
Streets along transit priority streets and in Downtown Burien expect a higher volume of pedestrians and should be a priority to ensure that sidewalk or crosswalk gaps are addressed.

For school areas, it is recognized that Safe Routes to School extend farther than 1/4 mile, and analysis of these routes in other studies may lead to further recommendations outside the 1/4 mile distance. Neighborhood parks include smaller parks in Burien where it is expected that most visitors walk to reach them.

Figure C1 on the following page identifies each of the pedestrian priority areas by type and also identifies the location of existing crosswalks in Burien.



FEHR PEERS



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Last updated 9/26/2011

By: Fehr & Peers

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LEGEND

- Crosswalks
- Sidewalk
- Pedestrian Priority Street
- Shared Use Path
- Burien City Boundary
- School Quarter Mile
- Neighborhood Parks Eighth Mile
- Food Banks Quarter Mile

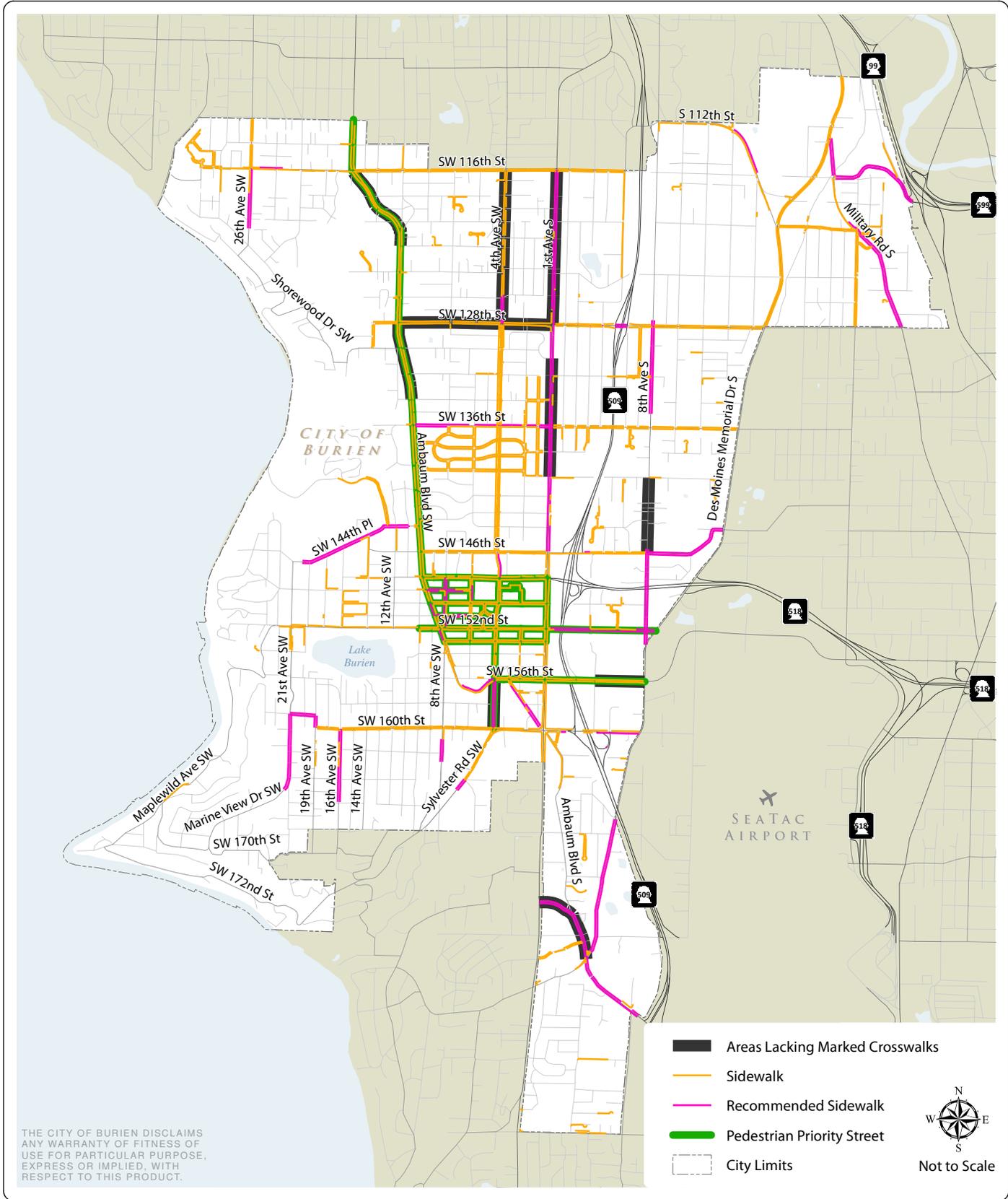
PEDESTRIAN PRIORITY STREETS



Figure 14 of the report defined the pedestrian LOS criteria and included a section to score crossings by crosswalk type and location. The appropriateness of a crosswalk type scores a crossing as being correctly designed for the roadway type, speed, and volume that is being crossed. Crossing types range from unmarked crossings (typical of low volume residential streets) to striped crosswalks, striped crosswalks enhanced with other visual indicators (signage, lights, raised elements), to a full pedestrian-actuated traffic signal. The Federal Highway Administration has published guidelines on designing appropriate crossings.¹

Figure C2 outlines general areas where marked or enhanced marked crosswalks should be added. These were developed based on crosswalk gaps on arterial and collector roadways. For most local roads, the current unmarked crosswalks are appropriate for the low volume of traffic.

¹Zegeer, et al., *Study Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations*, Federal Highway Administration, 2005.





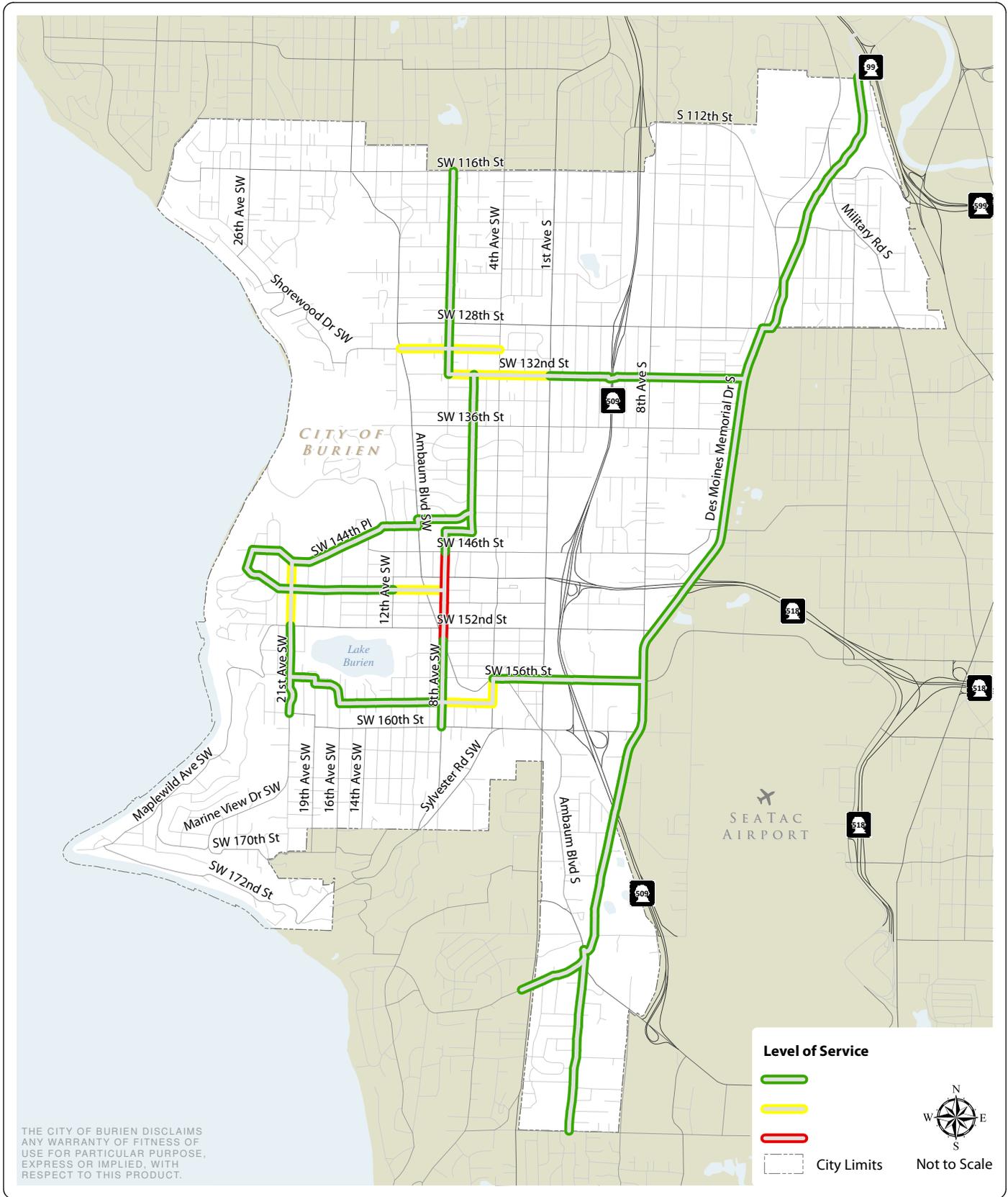
APPENDIX D – SUPPLEMENTAL BICYCLE INFORMATION

This appendix provides further information on the development of the general bikeways and Neighborhood Bikeway routes in Burien.

Stop Frequency on Neighborhood Bikeway Routes

The Neighborhood Bikeway routes are intended to create a system of facilities that accommodate cyclists of all abilities. In order for these facilities to be attractive and encourage utilization, they should be designed to minimize the frequency of required stops for cyclists. Table 4 in the report outlines the stop frequency goals for the network.

Ultimately the stop frequency will be dependent on intersection crossing design and treatment, and vary depending on time of day, signal timing, and other factors. **Figure D1** outlines the expected stop frequency on the Neighborhood Bikeway route. Areas in yellow and red should receive extra consideration during final design to minimize stop requirements on the network.



FEHR & PEERS

**NEIGHBORHOOD BIKEWAYS
STOP FREQUENCY LEVEL OF SERVICE**

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Last Updated: January 2012

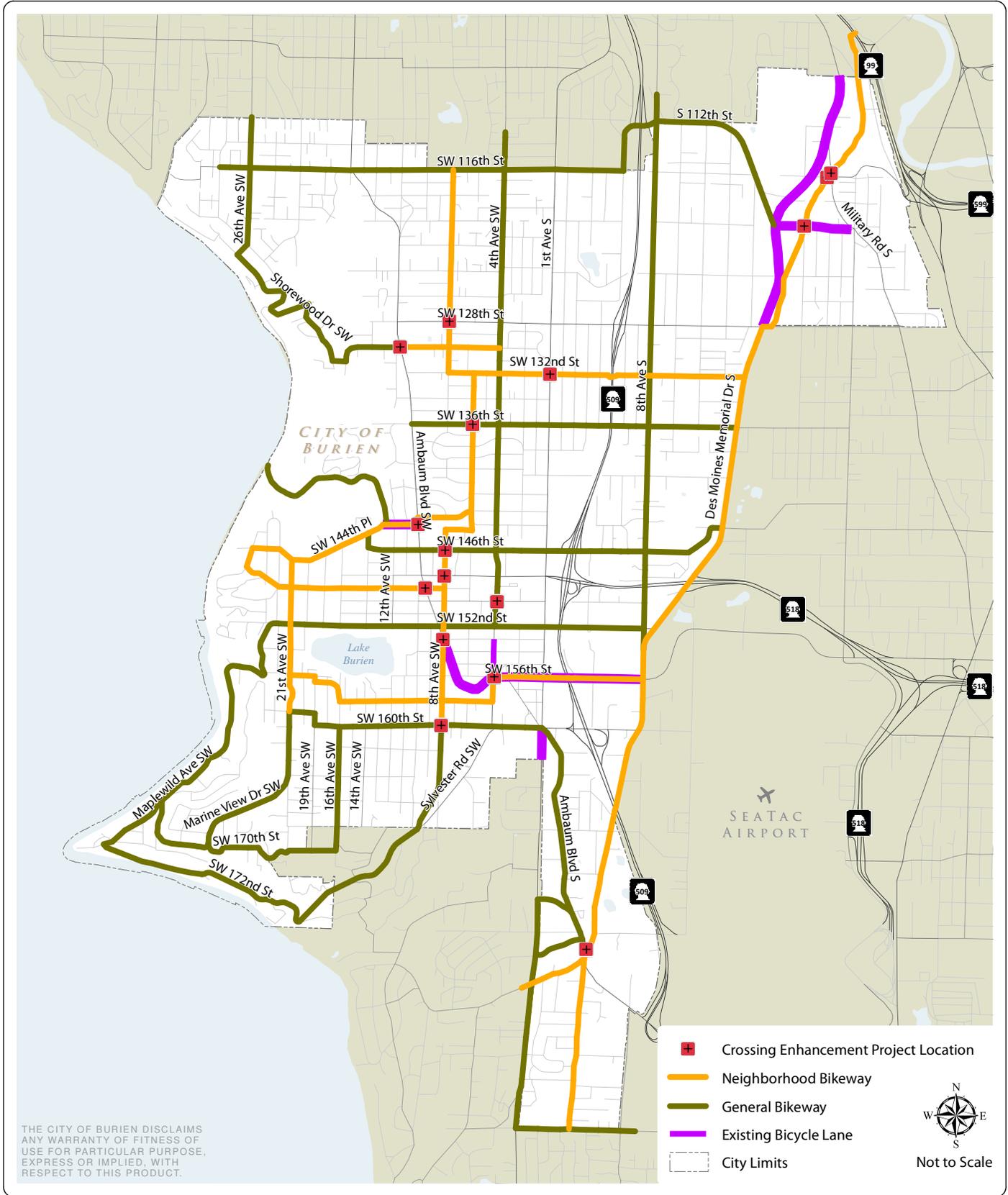
Update By: T Rysen

FIGURE D1



Intersection Enhancement Locations

Because the Neighborhood Bikeway routes (and to a lesser extent the general bikeways) make use of lower-volume residential streets, they will require improvements to allow cyclists to safely cross arterial streets or other high-volume roadways. Improved crossings will also benefit pedestrians at these locations. Crossing improvements could include installation of improved signage and lighting, medians, or bicycle/pedestrian actuated signals. Traffic volumes and speeds at each location will dictate the appropriate crossing type. **Figure D2** details locations where bicycle crossing enhancements should be considered, based on the proposed Neighborhood Bikeway and general bikeway routes.





APPENDIX E – TRAVEL MODEL AND LAND USE INFORMATION

This appendix provides details on the 2010 and 2030 household and employment information used in the travel demand model.

Land Use Information

Table E-1 details the 2010 and 2030 household and employment assumptions at the Transportation Analysis Zone (TAZ) that were used to develop the travel demand model. This data was provided by the City of Burien Planning Department.

Table E1 - Burien 2010 and 2030 Land Use				
TAZ	2010 Households	2010 Employment	2030 Households	2030 Employment
205	59	742	758	347
221	204	16	254	34
222	628	193	677	193
223	1549	88	1786	159
224	671	341	684	425
225	512	192	542	221
226	206	170	206	232
227	477	655	479	783
228	260	187	287	203
229	300	173	305	309
230	400	135	520	135
231	53	88	66	88
232	168	73	168	669
233	54	46	54	514
234	339	149	470	149
235	125	837	125	1010
236	0	32	0	32
237	0	60	0	63
238	0	95	0	95
239	0	580	0	600
240	0	73	0	105
241	1	184	1	184
242	0	129	0	129
243	24	76	154	188
244	9	81	9	117



Table E1 - Burien 2010 and 2030 Land Use				
TAZ	2010 Households	2010 Employment	2030 Households	2030 Employment
245	16	47	16	107
246	11	151	11	246
247	38	0	38	0
248	97	83	131	138
249	23	222	23	222
250	0	59	0	59
251	0	370	28	370
252	0	324	411	508
253	0	36	0	36
254	0	116	0	116
255	18	0	18	0
256	0	67	0	67
257	2	75	34	128
258	0	20	0	20
259	0	0	0	27
260	0	15	16	15
261	0	55	0	55
262	0	173	15	281
263	0	151	68	263
264	33	423	87	507
265	55	261	168	428
266	1	36	1	54
267	18	315	71	352
268	22	362	86	399
269	20	62	20	62
270	73	13	168	13
271	91	95	185	95
272	117	54	182	63
273	247	0	304	0
274	228	201	242	220
275	299	54	307	54
276	95	0	118	0
277	215	9	255	9
278	171	307	250	337
279	458	62	462	67
280	71	18	71	264



Table E1 - Burien 2010 and 2030 Land Use				
TAZ	2010 Households	2010 Employment	2030 Households	2030 Employment
281	573	103	600	384
282	409	319	440	319
283	404	134	430	134
284	182	698	190	895
285	772	227	793	227
286	23	377	23	450
287	88	313	103	331
288	529	0	563	0
289	547	5	575	5
290	161	30	181	135
291	36	0	42	0
292	361	108	365	108
293	58	0	70	17
294	0	0	0	0
295	76	5	108	5
296	40	156	40	156
299	512	135	513	140
300	446	341	461	399
323	232	1704	414	503
324	515	0	340	0
326	415	0	590	288
328	170	68	225	68
329	1282	130	1632	130
330	544	22	586	20
331	299	130	926	94
332	382	62	331	302
333	683	26	742	99
334	84	95	194	0
335	271	21	334	15
336	105	0	26	0
<i>City of Burien, 2011</i>				

Figures E1 and E2 outline the TAZ zones and Figure E3 provides a summary of the land use information by City area.



Figure E1. Burien TAZ Areas (output from Travel Demand Model)

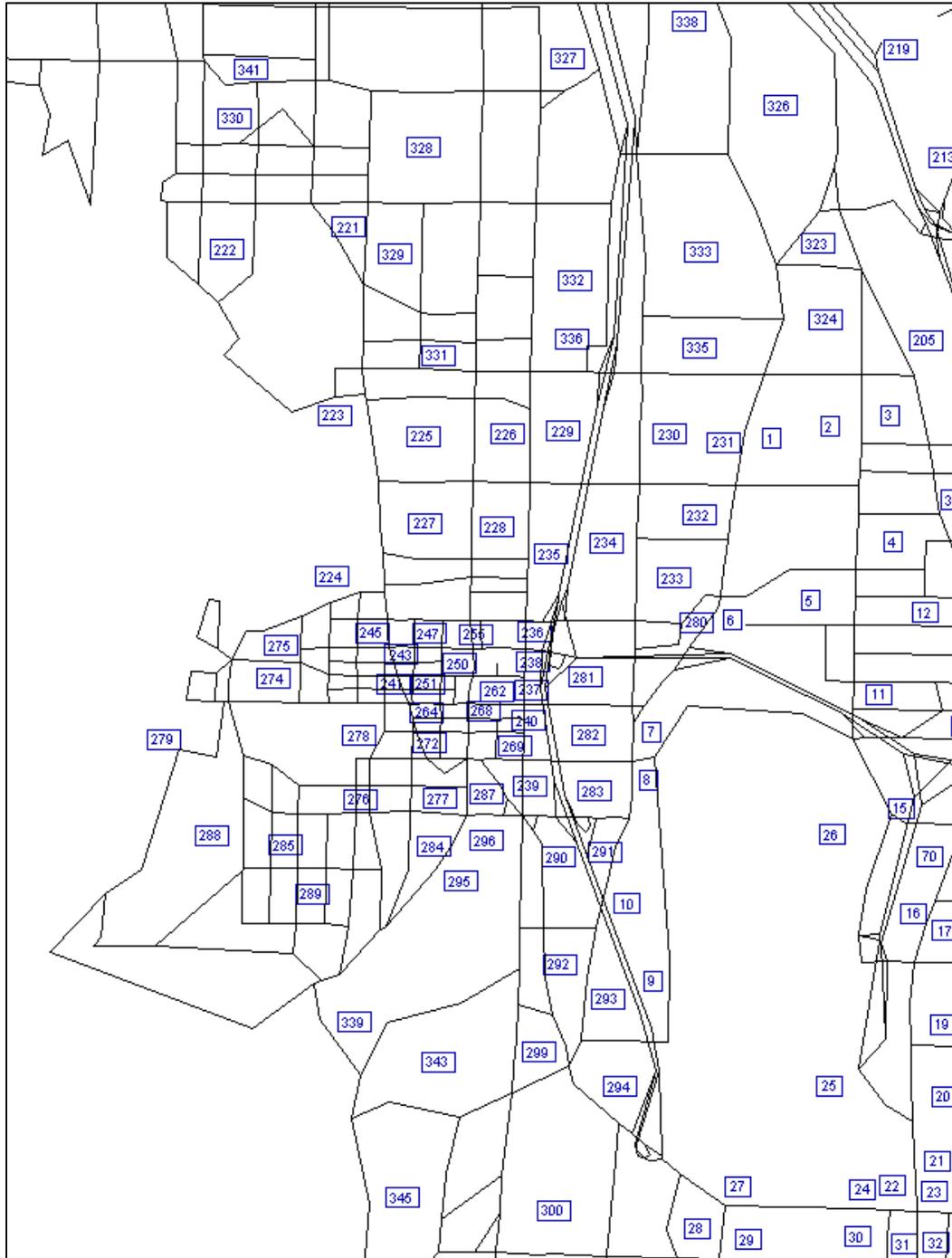




Figure E2. Burien TAZ Downtown Areas (output from Travel Demand Model)

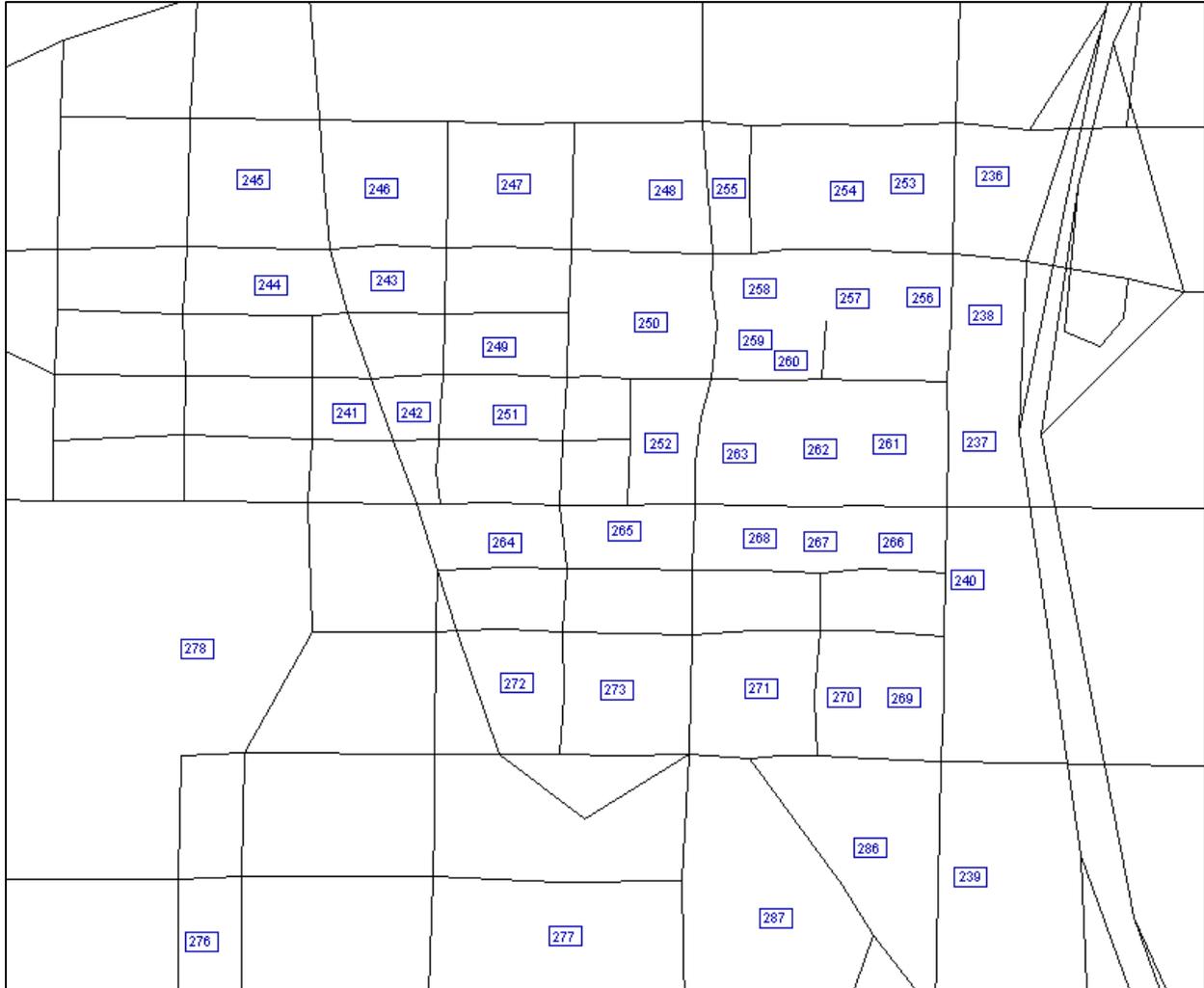
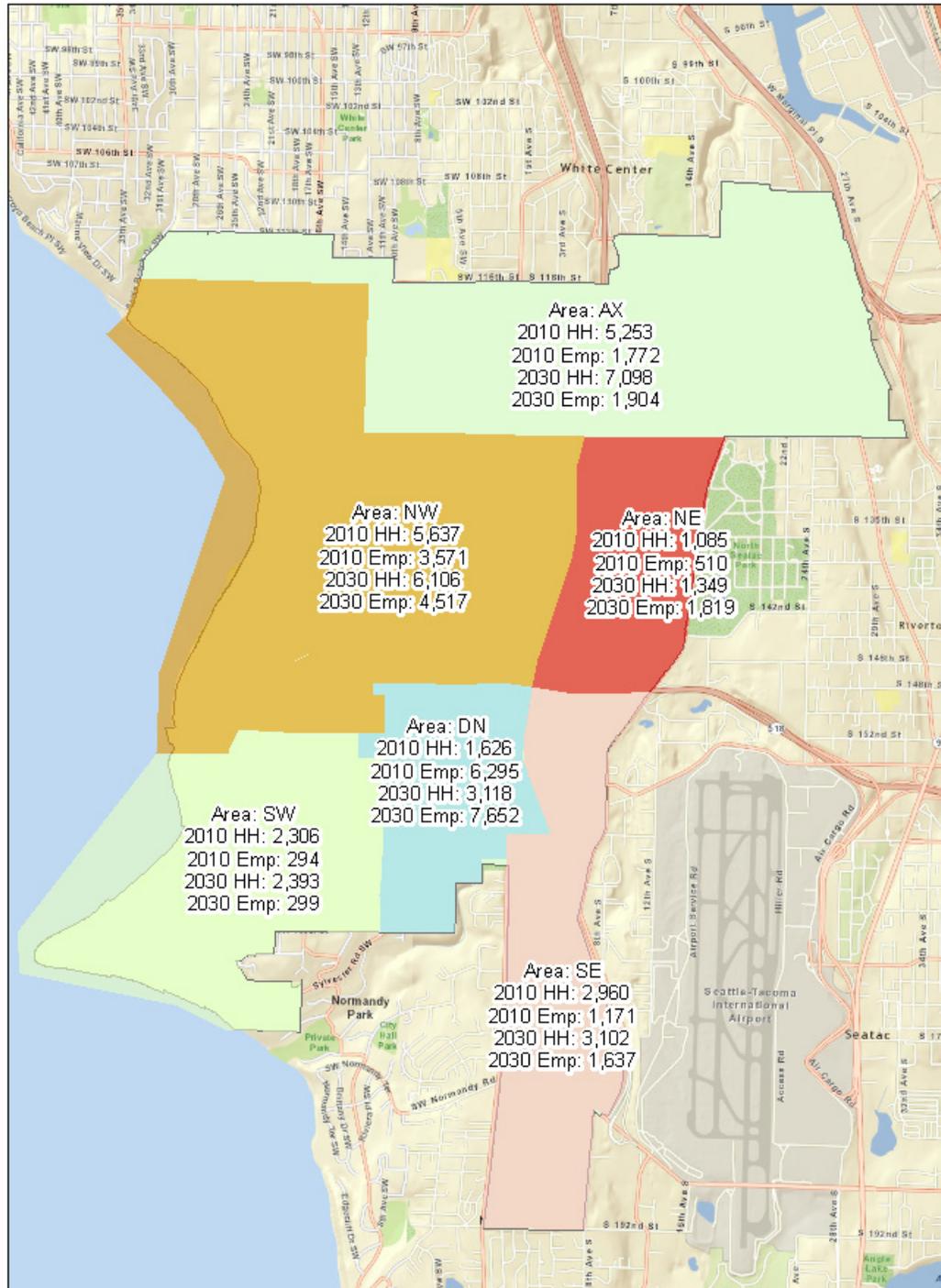




Figure E3. 2010 & 2030 Burien Land Use by District





APPENDIX F – SUPPLEMENTAL FUNDING ANALYSIS

This appendix provides further details on Burien’s history of revenues and expenditures on transportation projects. This information is intended to supplement

Table F-1 provides the history of transportation expenditures in Burien.

Table F-1. City of Burien, History of Expenditures for Transportation	
Year	Expenditures and Transfers (\$ thousands)
2004	4,537
2005	5,056
2006	7,799
2007	15,127
2008	7,198
2009	1,620
2010	2,715
Average	6,119
Average without high or low	5,367

Henderson, Young, & Co, 2012

In collecting this information, it was noted that Burien is not able to fund capital projects at this level in the current budget. The majority of these contributions occurred in 2008 and prior. **Table F-2** provides the history of Burien’s revenues by type.

Table F-2. City of Burien, History of Revenues for Transportation	
Year	2003-2012 Average (\$ thousands)
Grants	1,393
Intergovernmental	1,290
Bond Proceeds	1,086
Public Works Trust Fund	555
Utility Participation Charges	206
Mitigation and Contributions	83
Interest Income	57
Miscellaneous	4
Total	6,128

Henderson, Young, & Co, 2012