City of West Linn

Memorandum

Date: February 27, 2015

To: West Linn Planning Commission

From: Zach Pelz AICP, Associate Planner

Subject: Materials for March 4, 2015, discussion regarding West Linn Transportation System Plan Update

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The purpose of this memorandum is to introduce the documents that will be the subject of our Transportation System Plan (TSP) review and discussion on March 4, 2015, and to provide direction on what feedback we'd like from the Planning Commission at this meeting.

At our meeting on March 4th, staff will provide a summary of the following attached memoranda prepared for the TSP Update:

1. Draft Technical Memorandum No. 6: Safe Routes to Schools;
2. Draft Technical Memorandum No. 7: Needs Analysis;
3. Draft Technical Memorandum No. 8: 10th Street Interchange Area Analysis; and
4. Draft Technical Memorandum No. 9: Regulatory Solutions.

Draft Technical Memorandum 6 provides an analysis of safety and operational characteristics near the five primary schools in West Linn to recommend solutions to improve safety for students walking and bicycling to these schools. *Staff would like feedback from the Planning Commission as to whether additional issues should be considered as part of the analysis and whether additional projects and programs are warranted*.

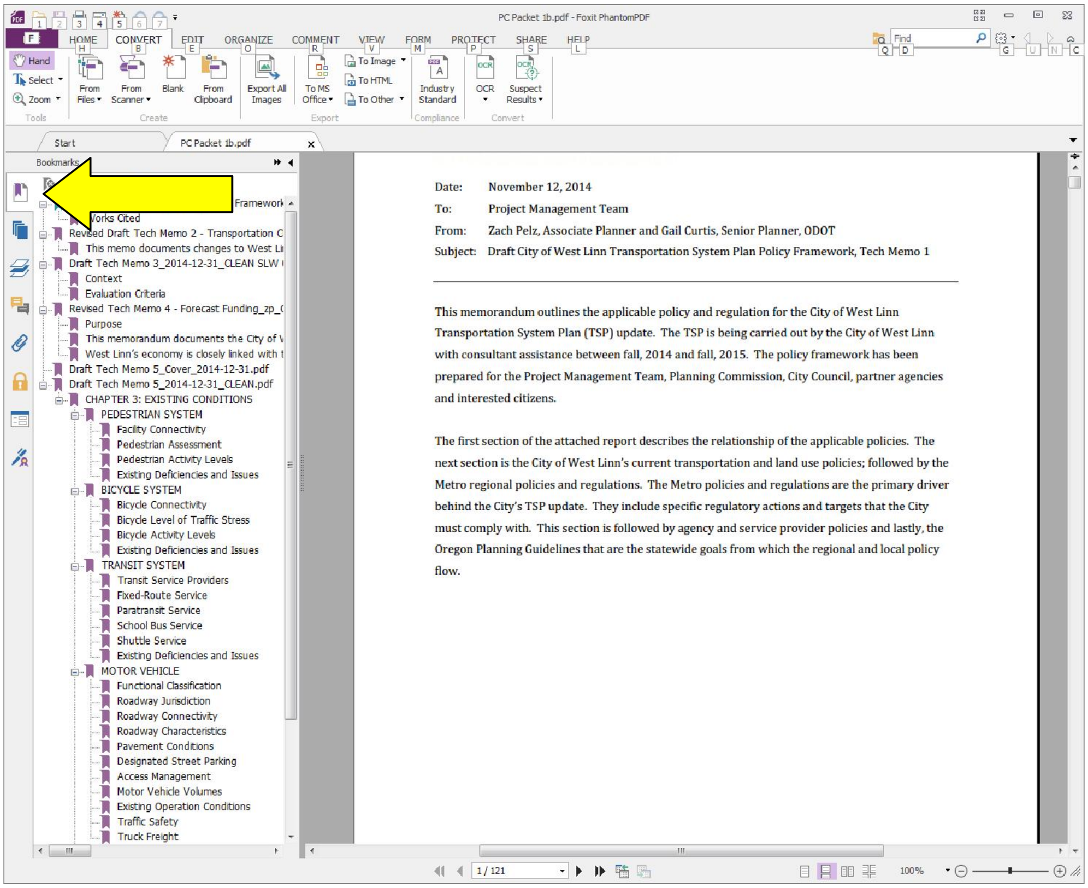
Draft Technical Memorandum 7 provides an analysis of the transportation needs in West Linn based on existing conditions and future population and employment trends. This document is provided for informational purposes only and *your feedback is not requested on this document*.

Draft Technical Memorandum 8 provides an analysis of the 10th Street Area Interchange, with improvement alternatives, in light of projected traffic volumes and funding availability. *This document is for information purposes only; your feedback is not requested on this document.*

Draft Technical Memorandum 9 provides an analysis of existing deficiencies within adopted West Linn plans relative to policy requirements contained in the Regional Transportation Functional Plan (implementing arm of the Regional Transportation Plan). *Staff would like feedback from the Planning Commission regarding the recommendations suggested in this memo to achieve compliance with Regional objectives*.

The attached memos are fully bookmarked and allow for convenient navigation between documents from your electronic device. To use the bookmarks in your .pdf document, simply click the bookmark icon shown to the left of the arrow in Image 1, below.

Image 1 Bookmarked Attachments



CITY OF West Linn

Date: February 27, 2015

To: West Linn Planning Commission; TSP Citizen Advisory Committee

From: Zach Pelz, City of West Linn

Subject: Draft Technical Memorandum No. 6: Safe Routes to Schools Update

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Background

As part of the City's efforts to promote walking and bicycling as safe and attractive means of transportation, this TSP Update plans to formalize the City's desire to improve safe routes to local schools. Safe Routes to Schools (SRTS) is a collaborative program between schools and local agencies that combines ongoing educational and outreach efforts with pedestrian and bicycle infrastructure improvements along routes used by school children to make walking and bicycling safer and to remove motor vehicles and reduce congestion from the morning commute.

Oregon school districts are not required to provide bus service for elementary school students that reside within one-mile of their school, and for secondary school students that live within one-and-one-half mile of their school (ORS 327.043). An SRTS program is important to the City of West Linn and benefits the City's transportation systems as it provides a key opportunity to improve public health, improve pedestrian and bicycle safety, and to improve the performance of its transportation systems.

SRTS can promote healthy lifestyles. Since 1970, childhood obesity in the United States has tripled; today, more than one-third of youth are either overweight or obese[1]. While the causes of childhood and adult obesity can be attributed to many factors, the City plays a part in the health of its residents through its authority to govern the development of land and the arrangement of uses upon land.

West Linn, like many suburban communities in the United States, is characterized by segregated and homogenous land use districts. Residential land uses in particular, exist as relatively large districts that are separate from commercial and employment uses, with a very limited mix of these different types of uses. This form of development typically results in a reliance on private automobiles for nearly all trip purposes because the distance between home and work,

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[1] Safe Routes to School National Partnership, 2015 (http://saferoutespartnership.org/sites/default/files/pdf/Lib_of_Res/Addressing-Childhood-Obesity-Through-Shared-Recreational-Facilities.pdf)

entertainment and cultural venues, and shopping, is typically too far to reasonably accomplish on foot or by bicycle. This reliance on the automobile subsequently reduces opportunities for physical activity which is increasingly linked to rising rates of obesity among children and adults in the U.S.

An SRTS program can also improve safety for pedestrians and bicyclists. A comprehensive SRTS program is designed around the five E's:

- Education: teaching children and families about the range of transportation choices, instructing them in important lifelong bicycling and walking safety skills, including road sharing and safety campaigns in school neighborhoods;
- Enforcement: partnering with local law enforcement to ensure that traffic laws are obeyed in the vicinity of schools for all road users and enhancing enforcement such as crossing guard programs and student safety patrols;
- Engineering: creating operational and physical improvements to the infrastructure surrounding schools that reduces speed and potential conflicts with motor vehicle traffic and makes walking and bicycling trips safer and more convenient;
- Encouragement: using events and activities to promote walking and bicycling and to generate enthusiasm for the program with students, parents, staff and the surrounding community; and,
- Evaluation: monitoring and documenting outcomes, attitudes and trends through the collection of data before and after activities and projects so modifications can be made if needed.

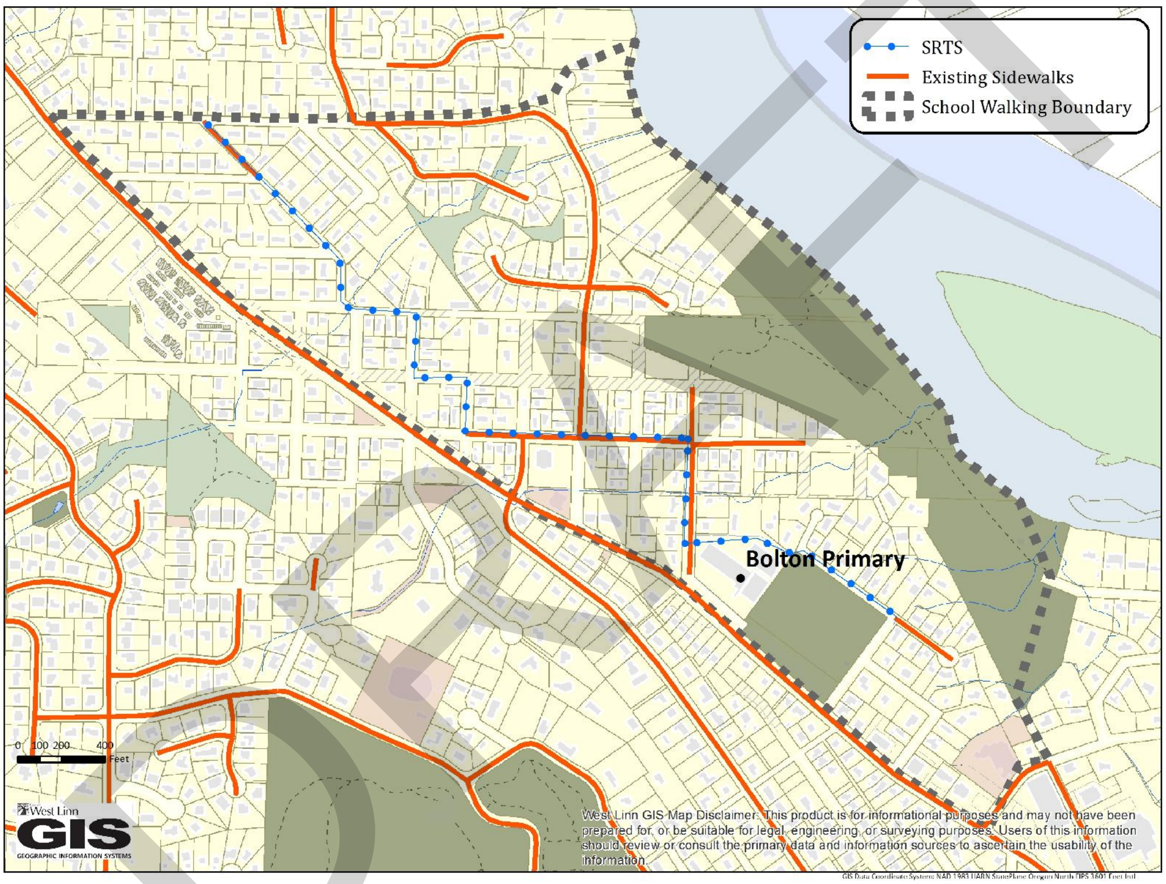
Unsafe road conditions and lack of parent confidence in their children's ability to safety navigate and understand the transportation system is an important barrier preventing many children from walking and bicycling in West Linn. Better enforcement, pedestrian and bicycle safety education built into classroom curricula, and safer infrastructure, can improve safety and encourage more children to walk and bike.

SRTS can also improve the performance of the City's motor-vehicle network. According to the Safe Routes to School National Partnership, between 20 and 30 percent of the morning rush hour traffic can be attributed to parents driving their children to school. Encouraging more kids to walk and bike to school through an SRTS program has the ability to eliminate a significant number of vehicles from the morning commute, reduce congestion and improve the performance and safety of local roadways.

Existing Conditions

The West Linn-Wilsonville School District (WLWV) operates five primary, one middle, one high, and one charter school in West Linn. WLWV has developed safe routes to each of its five primary schools in West Linn. WLWV has not developed SRTS for the charter, middle or high schools in West Linn. This evaluation of existing conditions is constrained to the five primary schools in West Linn and focuses on the presence of sidewalks and street lighting in relation to identified SRTS. This analysis is intended to identify needed safety improvements along SRTS as part of the TSP's overall project development and prioritization.

Figure 1 Bolton Primary Safe Route and Existing Sidewalks



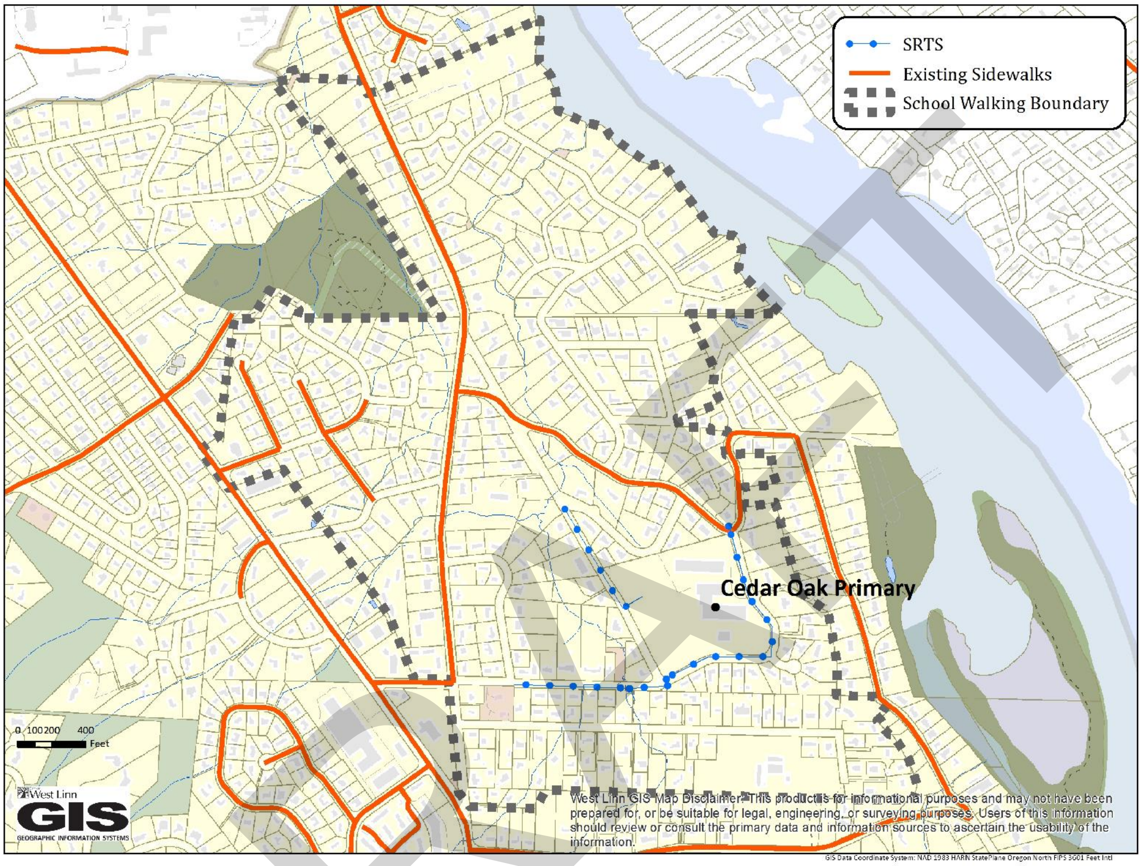
Source Metro RLIS, 2105 (sidewalks); West Linn GIS, 2015

<u>Bolton Primary.</u> Bolton Primary School is located in the southeast corner of West Linn, immediately adjacent Highway 43 (Willamette Drive) and Hammerle Park. Highway 43 carries nearly 21,000 vehicle trips near Bolton Primary School daily.

The map in Figure 1 above, shows sidewalks, the SRTS, and the boundary delineating where bus service is not provided to students attending Bolton Primary. The Safe Route identified by WLWV runs northwest to southeast beginning on Lowrey Drive at Dillow Drive. From here the route serpentines along a number of under-improved local streets until the route reaches Bolton Primary.

As shown in Figure 1, more than two-thirds of this route occurs along streets without sidewalks. Appendix A illustrates that street lights exist along the full extent of the SRTS with an average spacing of 200-feet.

Figure 2 Cedar Oak Safe Routes

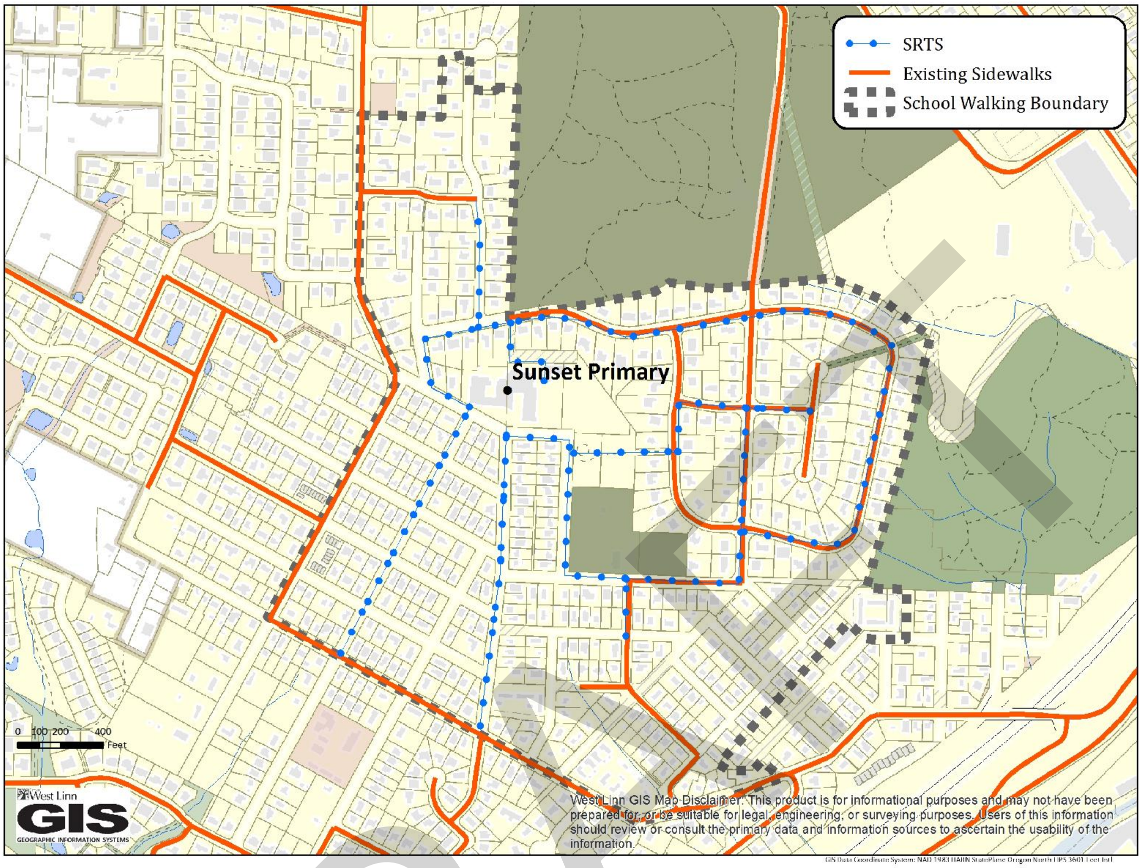


Source Metro RLIS, 2105 (sidewalks); West Linn GIS, 2015

Cedar Oak Primary. Cedar Oak Primary School is located near the north end of West Linn, east of Highway 43 and north of Mary S. Young State Park. Single-family residential development surrounds the area immediately adjacent the school, with a small-scale strip commercial development approximately one-third of a mile west along Highway 43.

The map in Figure 2 above shows sidewalks, the SRTS, and the boundary delineating where bus service is not provided to students attending Cedar Oak Primary. The Safe Route identified by WLWV runs along Cedar Oak Drive, from Old River Road to Elmran Drive and along a portion of Trillium Drive between Glen Terrace and Cedar Oak Drive. As illustrated in Figure 2, sidewalks are lacking along the full extent of the Cedar Oak Primary Safe Routes. Appendix A illustrates that streetlights are present along the entire SRTS with an average spacing of 400-feet on Cedar Oak Drive and 800-feet on Trillium Drive.

Figure 3 Sunset Primary Safe Routes and Existing Sidewalks



Source Metro RLIS, 2105 (sidewalks); West Linn GIS, 2015

<u>Sunset Primary</u>. Sunset Primary School is located near the geographic center of West Linn, between Wilderness Park and Sunset Park. Single-family residential development surrounds the area immediately adjacent the school.

The map in Figure 3 above shows sidewalks, the SRTS, and the boundary delineating where bus service is not provided to students attending Sunset Primary. The Safe Routes identified by WLWV pervade the residential neighborhoods on all sides of the school. Safe Routes extend nearly one-third of a mile south and east of Sunset Primary but extend less than one-sixth of a mile to the residential areas north and east. As shown in Figure 3, approximately 47 percent of the Sunset Primary Safe Routes, predominately in the newer subdivisions east of the school, include sidewalks. Appendix A illustrates that streetlights are present along most of the SRTS with an average spacing of 400-feet. Streetlights are not present along the pedestrian cut-through between Oregon City Loop and the school-owned properties north of Sunset Park.

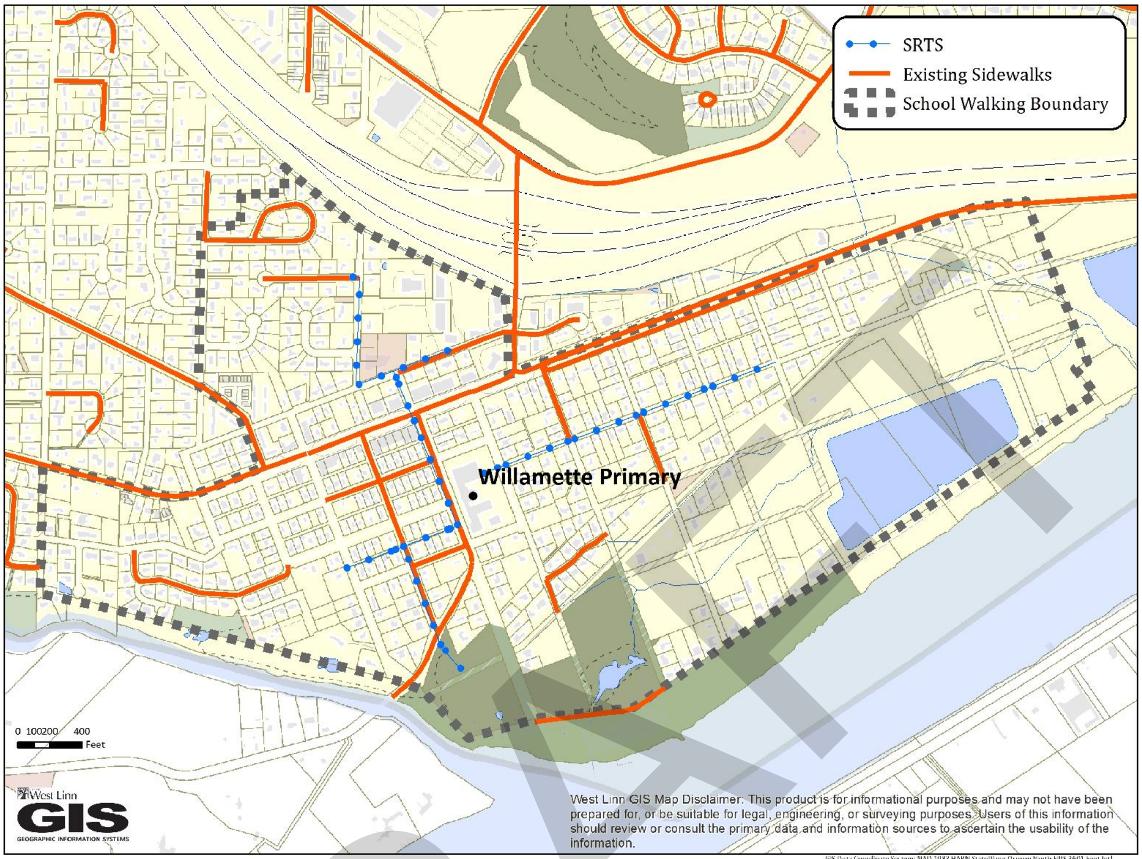
Figure 4 Trillium Creek Primary Safe Routes and Existing Sidewalks

Source Metro RLIS, 2105 (sidewalks); West Linn GIS, 2015

Trillium Creek Primary. Trillium Creek Primary School is located in northwest West Linn, adjacent Rosemont Road and Hidden Springs Road - both of which are classified as collector roadways and carry significant motor vehicle traffic throughout the day. The school is flanked by single-family residential development on all sides.

The map in Figure 4 above shows sidewalks, the SRTS, and the boundary delineating where bus service is not provided to students attending Trillium Creek Primary. The Safe Routes identified by WLWV extend more than one-third of a mile into the residential areas north and east of the school and more than one-half of one-mile into the areas south of the school. As illustrated in Figure 4, more than 95 percent of the Trillium Creek Primary Safe Routes include sidewalks. Appendix A illustrates that streetlights are present along nearly all of the SRTS with an average spacing of 400-feet. Streetlights are not present through Sunburst Park.

Figure 5 Willamette Primary Safe Routes (red lines) and Existing Sidewalks



Source Metro RLIS, 2105 (sidewalks); West Linn GIS, 2015

Willamette Primary. Willamette Primary School is located in the south end of West Linn, less than one-third of a mile south of the I-205 interchange at 10th Street. The Willamette Commercial area sits north of the school, while residential areas border the school's west, south and east sides.

The map in Figure 5 above shows sidewalks, the SRTS, and the boundary delineating where bus service is not provided to students attending Trillium Creek Primary. The Safe Routes identified by WLWV extend about one-third of a mile in all directions from the school. As illustrated in Figure 5, only about 35 percent of the Trillium Creek Primary Safe Routes include sidewalks. Appendix A illustrates that streetlights are present along most of the SRTS with an average spacing of 400-feet.

Table 1, compares the presence of sidewalks along identified SRTS at the five primary schools in West Linn.

Table 1 Comparison of Sidewalks along Safe Routes to Schools, by Distance

School Facility	Pct. of SRTS (total distance) where sidewalks are present
Bolton Primary	28
Cedar Oak Primary	0
Sunset Primary	47
Trillium Creek Primary	95
Willamette Primary	35

Findings and Recommendations

The following recommendations to improve safe routes to schools in West Linn are organized by the five E's:

<u>Education:</u> *teaching children and families about the range of transportation choices, instructing them in important lifelong bicycling and walking safety skills, including road sharing and safety campaigns in school neighborhoods.*

The City should continue to work with the School District to educate students, parents, citizens and elected and appointed officials as to the benefits of SRTS. Additionally the City should be a member of the WLWV SRTS task force to ensure effective communication between these agencies. WLWV should communicate with the City regarding changes to the SRTS maps and the City should coordinate with WLWV regarding infrastructure improvements along SRTS. The WLWV should also consider expanding curriculum programs built around safe walking and bicycling.

Another effective way the WLWV can promote SRTS is to communicate directly with elected and appointed officials, parents and other residents, through in-person meetings, flyers and other media designed to educate as to the myriad benefits of SRTS.

Finally, in addition to closer collaboration with the WLWV regarding infrastructure improvements at or near SRTS, the City should reach out directly to students for input about project development and implementation.

<u>Enforcement:</u> *partnering with local law enforcement to ensure that traffic laws are obeyed in the vicinity of schools for all road users and enhancing enforcement such as crossing guard programs and student safety patrols.*

The West Linn Police Department conducts routine patrols near area schools and should continue this practice into the future. Additionally, the WLWV SRTS task force and other stakeholder teams should develop a list of high priority areas in need of enforcement and communicate that with local law enforcement personnel. Signage, mobile speed radar trailers and other similar types of equipment should continue to be utilized around area schools and along SRTS to supplement officer patrols. Finally, the City of West Linn has established a traffic safety committee, for the purpose of reviewing traffic safety concerns presented by West Linn residents. The Traffic Safety Committee should do more to advertise this resource to local schools, SRTS task force, students and parents.

<u>Engineering:</u> *creating operational and physical improvements to the infrastructure surrounding schools that reduces speed and potential conflicts with motor vehicle traffic and makes walking and bicycling trips safer and more convenient.*

In 2013, the City of West Linn adopted its first ever Trails System Master Plan, which sought to identify funding priorities for the City's Parks and Recreation Department over the next 50 years. An important outcome of this Plan is that off-street trails are viewed not only as recreational facilities but also as facilities that can link with on-street bicycle lanes and sidewalks to create more, and more direct, transportation-related access between homes and points of interest throughout the community. Throughout the development of the Trails System Master Plan, linking off-street facilities with on-street facilities was seen as an important strategy in making efficient use of the City's transportation system and encouraging more people to walk and bicycle for transportation and recreational purposes.

During fall 2014, in anticipation of this TSP Update and the development of the City's 5-year streets Capital Improvement Program (CIP), the City of West Linn's Transportation Advisory Board, with help from City staff, prioritized the inventory of 90 on-street routes proposed in the Trails System Master Plan. The inventory of on-street routes was reviewed and evaluated based on the following seven criteria:

- <u>Safe routes:</u> is the on-street route part of an identified Safe Route to School as developed by the WLWV School District?
- <u>Walking primary</u>: is the on-street route within the walking boundary[2] for a primary school in West Linn identified by the WLWV school district?
- <u>Walking middle or high school:</u> is the on-street route within the walking boundary for a middle or high school in West Linn identified by the WLWV school district?
- <u>1/4 mile from transit:</u> is the on-street route within 1/4 mile of a transit stop?
- <u>1/4 mile from commercial:</u> is the on-street route within 1/4 mile of a commercial use in the City of West Linn?
- <u>Street collector or arterial:</u> is the on-street facility located on a roadway designated as a collector or arterial?

[2]ORS 327.043 does not obligate school districts to provide bus service to elementary school students living within 1 mile or less of their school. The walking boundary delineates the geographic area that is not served by school buses.

- One or more trail connections: does the on-street facility connect to at least one off-street facility?
- Three or more trail connections: does the on-street facility connect to at least three off-street facilities?

The TAB ranked the 90 on-street routes from high to low based on their ability to satisfy the above-mentioned criteria. More than one-third of the top ranking projects recommended for inclusion in the Streets CIP occur along SRTS identified by the WLWV school district. These routes are included in Table 2 below. The map and route number in Table 2 correspond to the *Pathway Planning Map Book* (included in Appendix B of this document), prepared for the CIP analysis described above. Because this memo focuses on SRTS, the remaining CIP recommendations are not included here.

Table 2: SRTS-related Projects Recommended for Inclusion in 5-year CIP

Map No.	Route Number	Route Name from Trails Master Plan	Location Description	Sidewalk Need[3] (as pct.)
3	**30**	Long St./Exeter St.	Long St. from Sunset Tennis Courts to Oxford St.	100
1	**33**	Cedaroak Dr./Elmran Dr.	Cedaroak Dr. northeast to 4450 Elmran Dr.	100
6	**52**	Tualatin/12th St.	Tualatin Ave. ending at Willamette Falls Dr.	50
3	**29**	Oregon City Blvd/Bonnet Dr.	Oregon City Blvd to Oxford St.	25
2	**68**	Rosemont Rd. 3	Rosemont Rd. north of Hidden Springs Rd. to Carriage Way	0
2	**36**	Santa Anita Dr.	All of Santa Anita Dr.	0
1 & 2	**32**	Hidden Springs Rd.	Hidden Springs Rd from Willamette Dr. to Rosemont Rd.	0

Table 2 reveals that more than half of the CIP recommended SRTS projects (Route Numbers 29, 68, 36 and 32) currently have sidewalks along a majority of their length. Projects in these areas are therefore likely to include safety improvements such as, enhanced crossings, improved signage, wayfinding and possibly relatively minor sidewalk infill. Where funds allow, CIP improvements

[3] Sidewalk need is that proportion of the CIP route in Table 2 where sidewalks currently do not exist along the portion that is also identified as a safe route to school, as a percent of the total distance.

near Cedar Oak Primary should include the installation of sidewalks and complementary safety enhancements along the entire length of the route.

While the extent of each of the projects recommended in the CIP are not described, it is assumed that they will consist of necessary improvements over which the City has control (sidewalks, enhanced crossings, signage, etc.). Because sidewalk infill along the entire length of SRTS at all primary schools in West Linn is not needed, Table 3 compares the relative benefit of likely improvements the City could make, as a percentage of the total length of existing sidewalks, to provide a comparison of the relative benefit of potential future investments near each of these schools.

Table 3 Relative safety benefit from CIP recommended projects near West Linn Primary Schools

School Facility	Pct. of SRTS with existing sidewalks	Pct. of SRTS recommended for CIP improvements where sidewalks currently do not exist
Cedar Oak Primary	0	60
Bolton Primary	28	0
Willamette Primary	35	0
Sunset Primary	47	5
Trillium Creek Primary	95	0

Based on the information included above, staff suggests that the TSP first consider SRTS improvements in the form of sidewalk infill and other safety enhancements (in the following order of priority), near Cedar Oak, Bolton, Willamette and Sunset Primary Schools. Staff also recommends completing gaps in the network of streetlights along SRTS - identified above as through Sunburst Park, north of Sunset Park and along Trillium Drive. Staff suggests the TSP also consider safety enhancements such as enhanced crossings, signage and wayfinding near Trillium Creek Primary.

<u>Encouragement:</u> *using events and activities to promote walking and bicycling and to generate enthusiasm for the program with students, parents, staff and the surrounding community.*

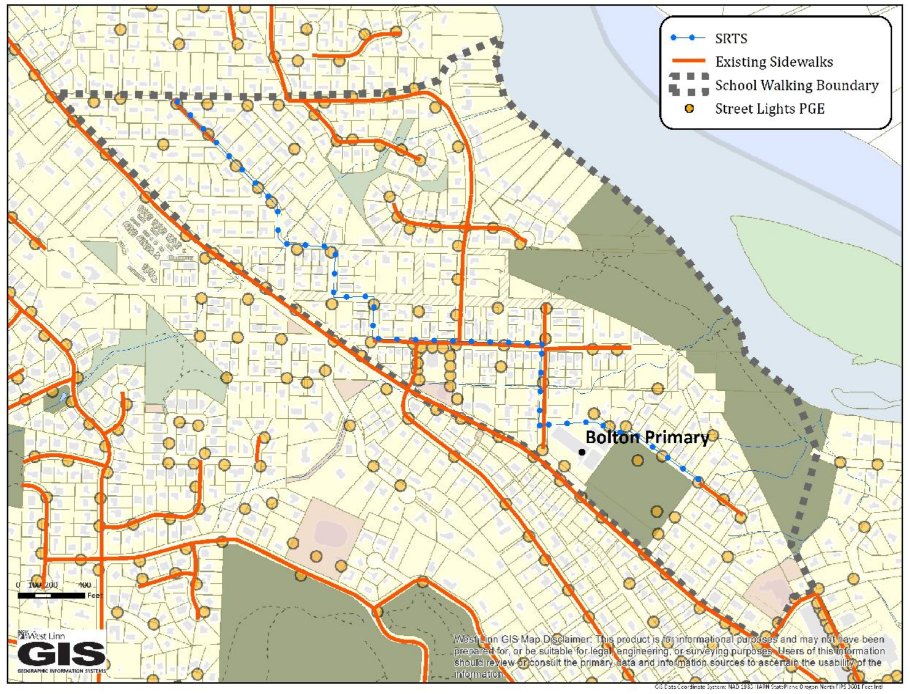
There are a number of events and activities the City and WLWV can use to promote walking and bicycling to school. In 2010 and 2011, the City of West Linn took part in the Bicycle Transportation Alliance's Bike Commute Challenge. The Bike Commute Challenge is a friendly competition among metro area employers to see who can log the highest rate of days where employees rode bike rather than drove to work during the month of September. Events like this raise awareness and encourage individuals who may otherwise choose a mode other than driving. The City and WLWV should consider developing similar events to encourage students to walk and bicycle to school.

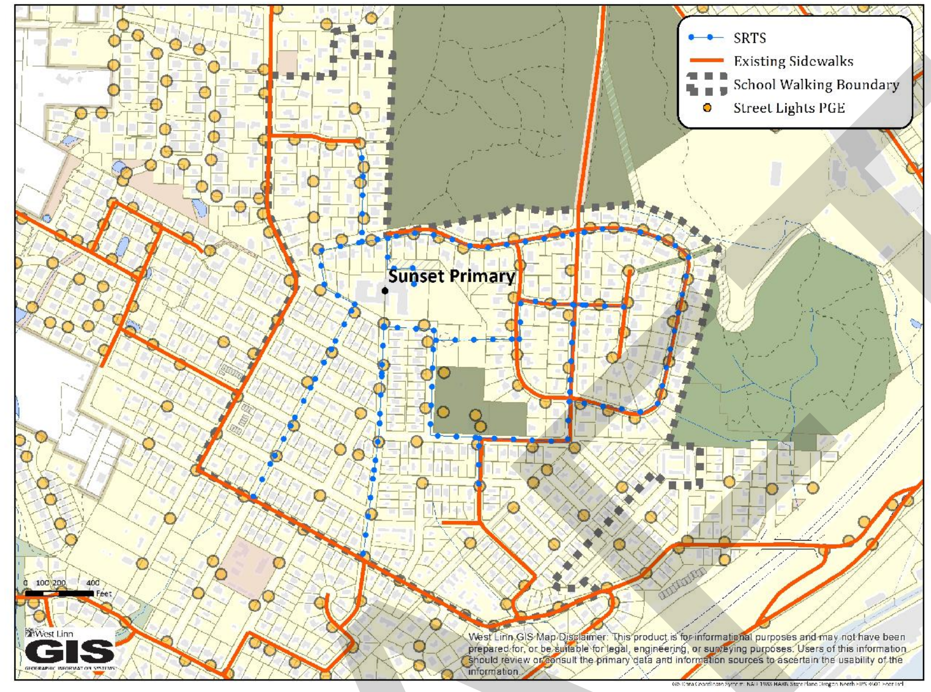
Another good way to promote walking and bicycling to school is by using what is termed a walking school bus. A walking school bus is where parents volunteer to accompany children on a walk or bike ride to school, making stops at designated locations to pick up students, similar to a traditional school bus.

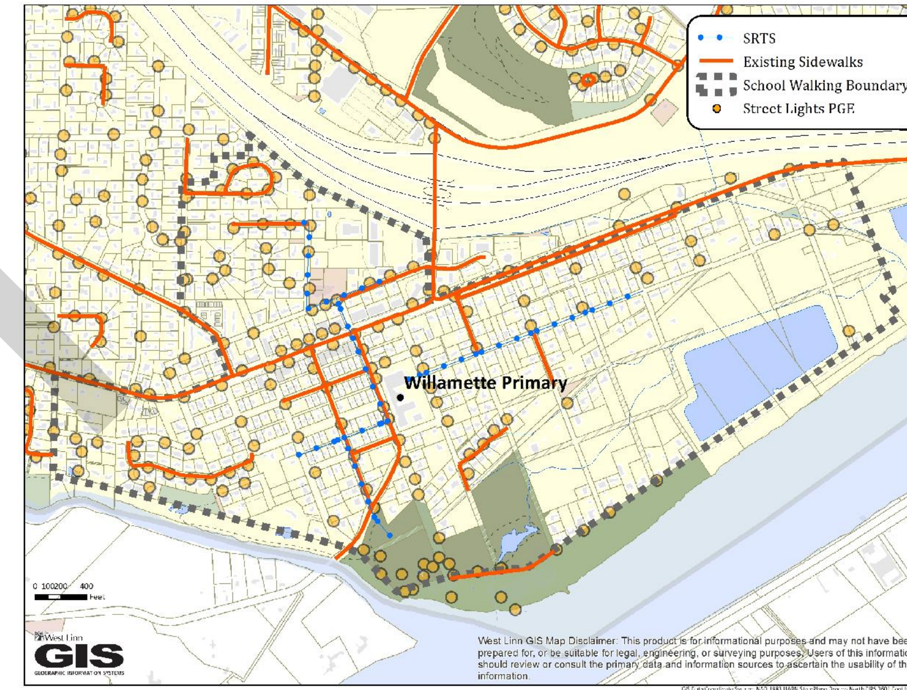
Evaluation: *monitoring and documenting outcomes, attitudes and trends through the collection of data before and after activities and projects so modifications can be made if needed.*

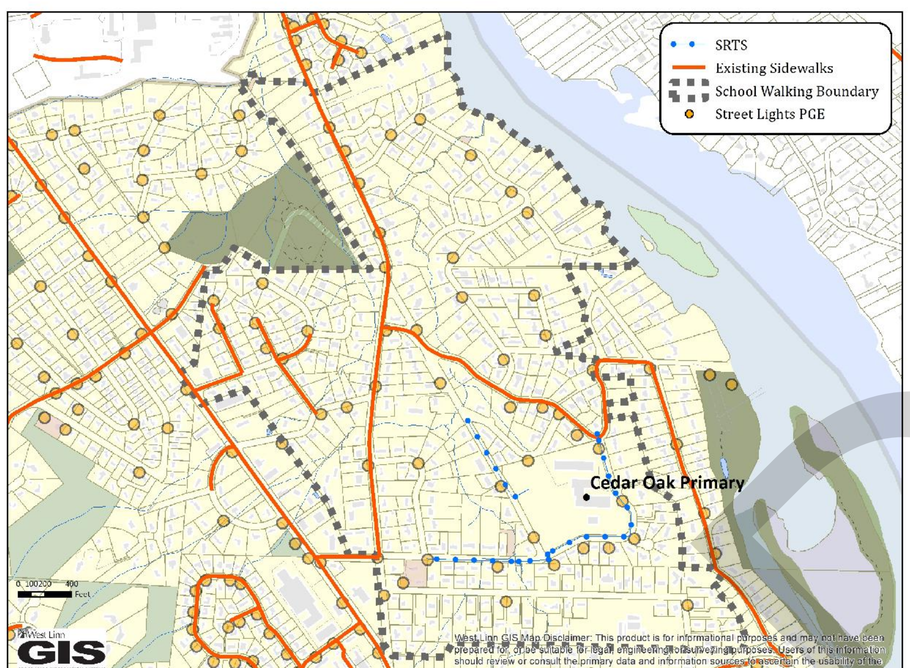
The City and WLWV should work together to collect and share data in order to better understand how students currently use the transportation system and ways it can be improved to encourage more students to safely walk and bicycle to school. The City should partner with the WLWV to collect data regarding the students that walk and bicycle to school; students that participate in walking and bicycling events; the effect of seasonal changes on walking and bicycling; and the type and location of any safety incidents involving students walking and bicycling.

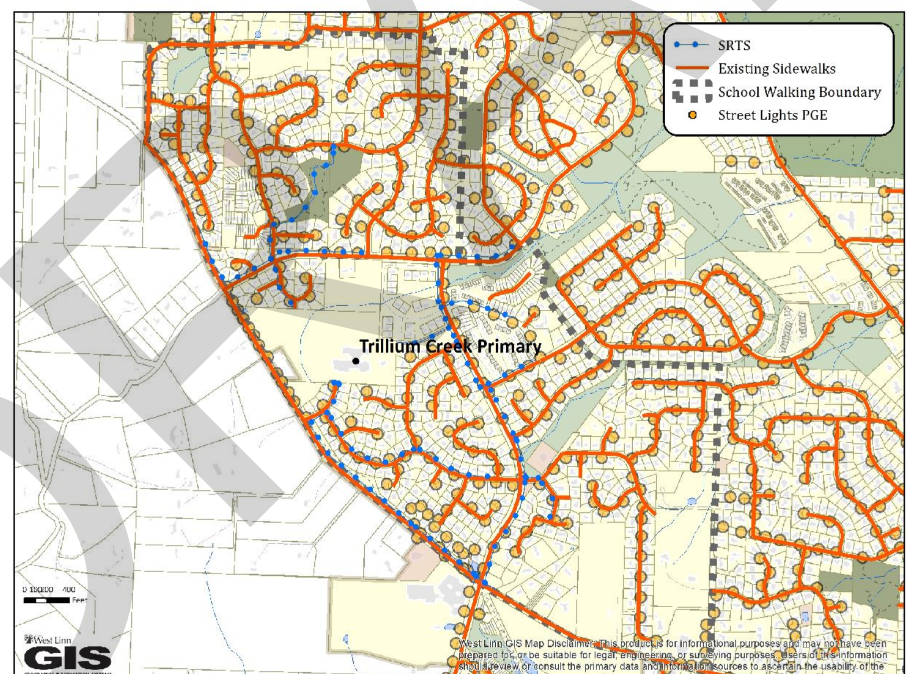
Appendix A: Lighting near Safe Routes to Schools











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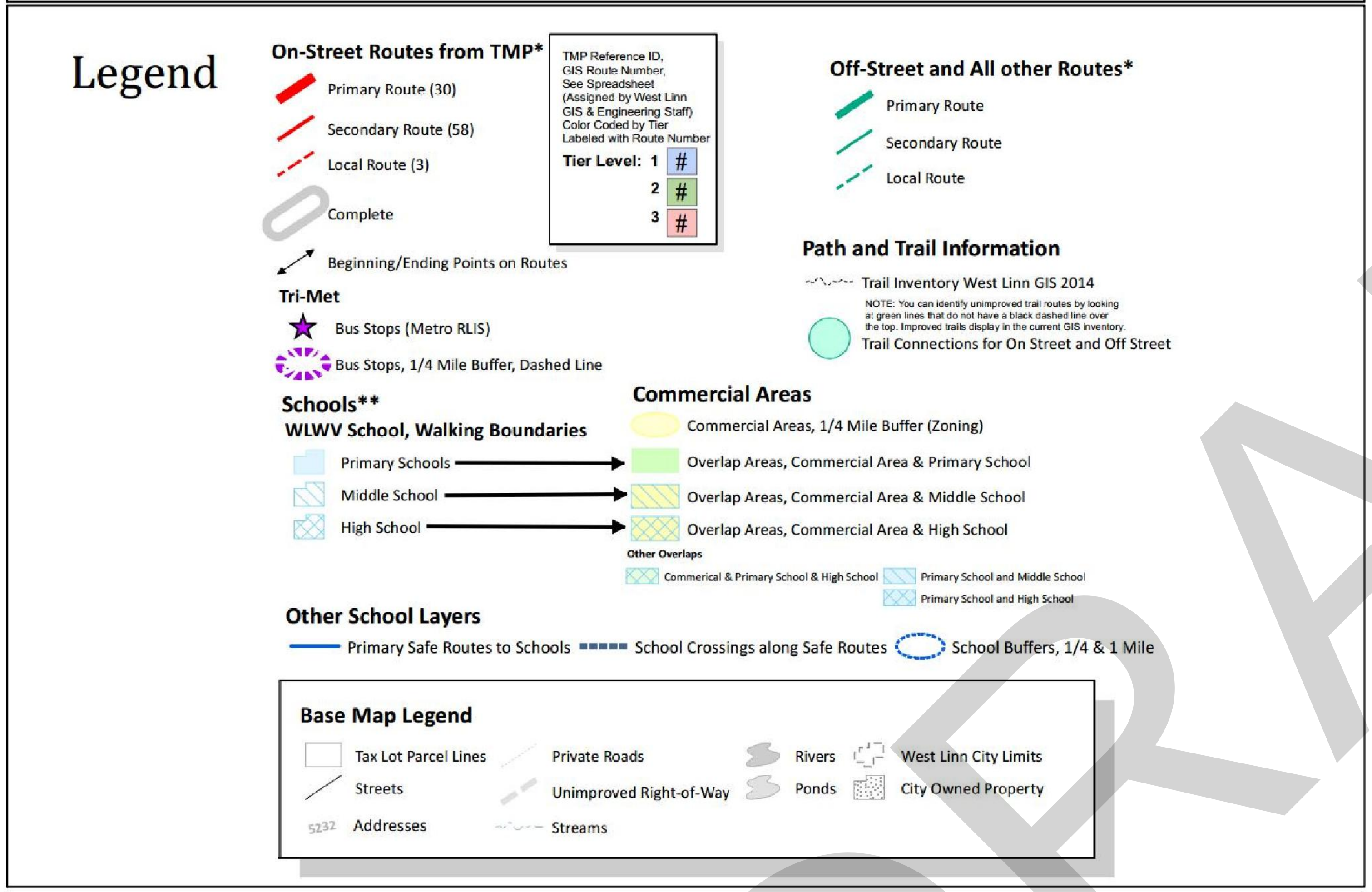
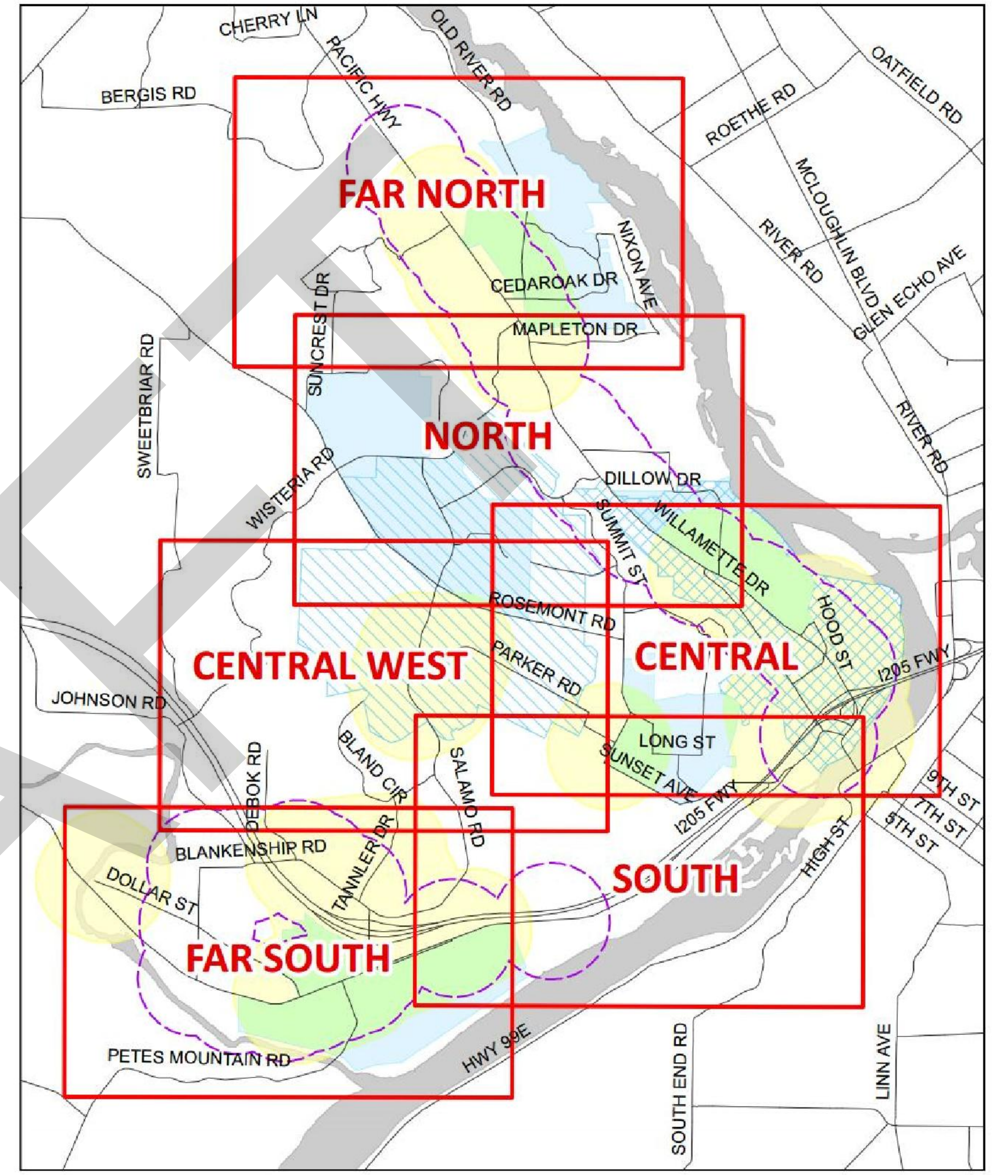
Pathway Planning Mapbook

JULY 2014





Key Map

Map 1	FAR NORTH
Map 2	NORTH
Map 3	CENTRAL
Map 4	CENTRAL WEST
Map 5	SOUTH
Map 6	FAR SOUTH

West Linn GIS
GEOGRAPHIC INFORMATION SYSTEMS

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This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Tax Lot Parcel Base Map source: Clackamas County GIS
All other map layers and map production: West Linn GIS

*West Linn 2013 Trails Master Plan (TMP) data provided by MIG.
**Boundaries and Routes from West Linn Wilsonville School District (Digitized and spatially adjusted from Google Map overlays & PDF maps)
All other map overlays provided by West Linn GIS / Public Works

MAP PUBLICATION: JULY 11, 2014 BASE MAP COURTESY OF THE CITY OF WEST LINN GIS CARTOGRAPHER: K. AHA
GIS DATA COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE OREGON NORTH FIPS 3601 FEET INTL

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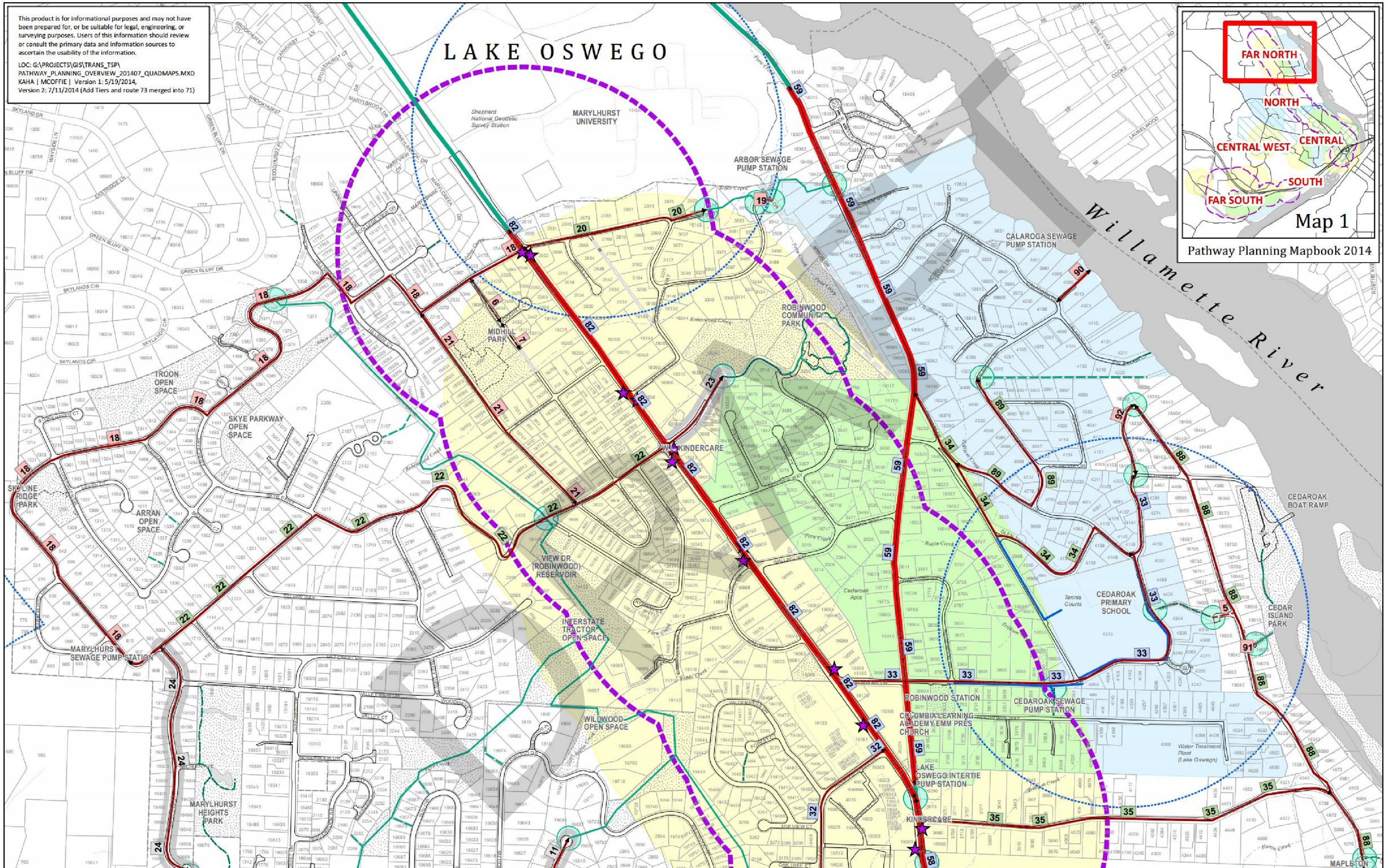
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LAKE OSWEGO
MARYLHURST UNIVERSITY
ARBOR SEWAGE PUMP STATION
CALAROGA SEWAGE PUMP STATION
Willamette River
ROBINWOOD COMMUNITY PARK
MIDHILL PARK
TROON OPEN SPACE
SKYE PARKWAY OPEN SPACE
SKYLINE RIDGE PARK
ARRAN OPEN SPACE
VIEW DR (ROBINWOOD) RESERVOIR
INTERSTATE TRACTOR OPEN SPACE
MARYLHURST SEWAGE PUMP STATION
WILDWOOD OPEN SPACE
MARYLHURST HEIGHTS PARK
KINDERCARE
CEDAROAK PRIMARY SCHOOL
CEDAROAK BOAT RAMP
CEDAR ISLAND PARK
ROBINWOOD STATION
CEDAROAK SEWAGE PUMP STATION
COLUMBIA LEARNING ACADEMY EMM PRES CHURCH
LAKE OSWEGO INTERTIE PUMP STATION
MAPLETON SEWAGE PUMP STATION
FAR NORTH
NORTH
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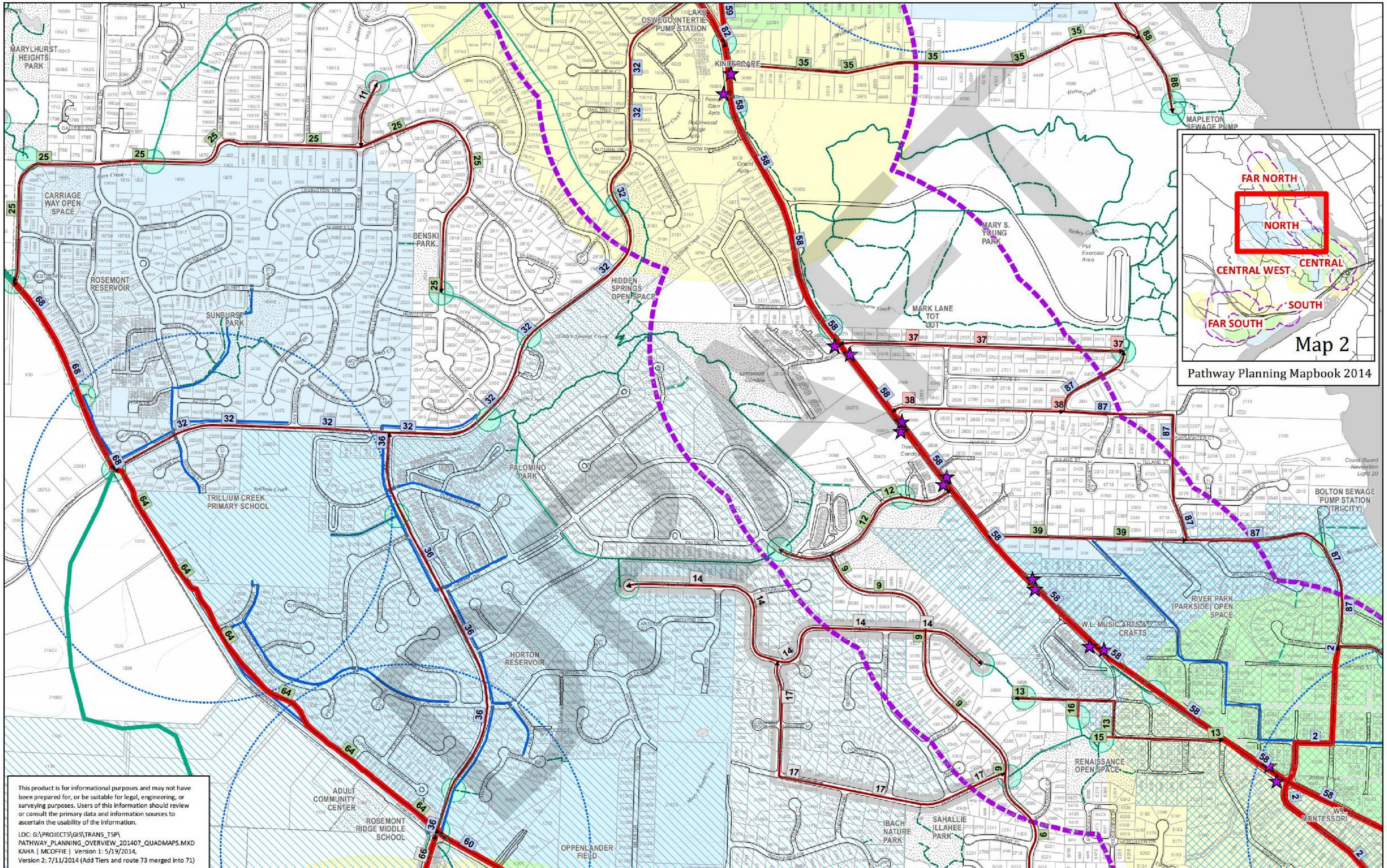
Map 1
Pathway Planning Mapbook 2014


MARYLHURST HEIGHTS PARK
CARRIAGE WAY OPEN SPACE
ROSEMONT RESERVOIR
SUNBURST PARK
BENSKI PARK
HIDDEN SPRINGS OPEN SPACE
LAKE OSWEGO INTERTIE PUMP STATION
KINDERCARE
MARY S. YOUNG PARK
Pet Exercise Area
MARK LANE TOT LOT
MAPLETON SEWAGE PUMP
PALOMINO PARK
TRILLIUM CREEK PRIMARY SCHOOL
HORTON RESERVOIR
ADULT COMMUNITY CENTER
ROSEMONT RIDGE MIDDLE SCHOOL
OPPENLANDER FIELD
IBACH NATURE PARK
SAHALLIE ILLAHEE PARK
RENAISSANCE OPEN SPACE
W.L. MUSIC ARTS AND CRAFTS
RIVER PARK (PARKSIDE) OPEN SPACE
WL MONTESSORI
BOLTON SEWAGE PUMP STATION (TRICITY)
Coast Guard Navigation Light 20
FAR NORTH
NORTH
CENTRAL
CENTRAL WEST
SOUTH
FAR SOUTH
Map 2
Pathway Planning Mapbook 2014
DRAFT
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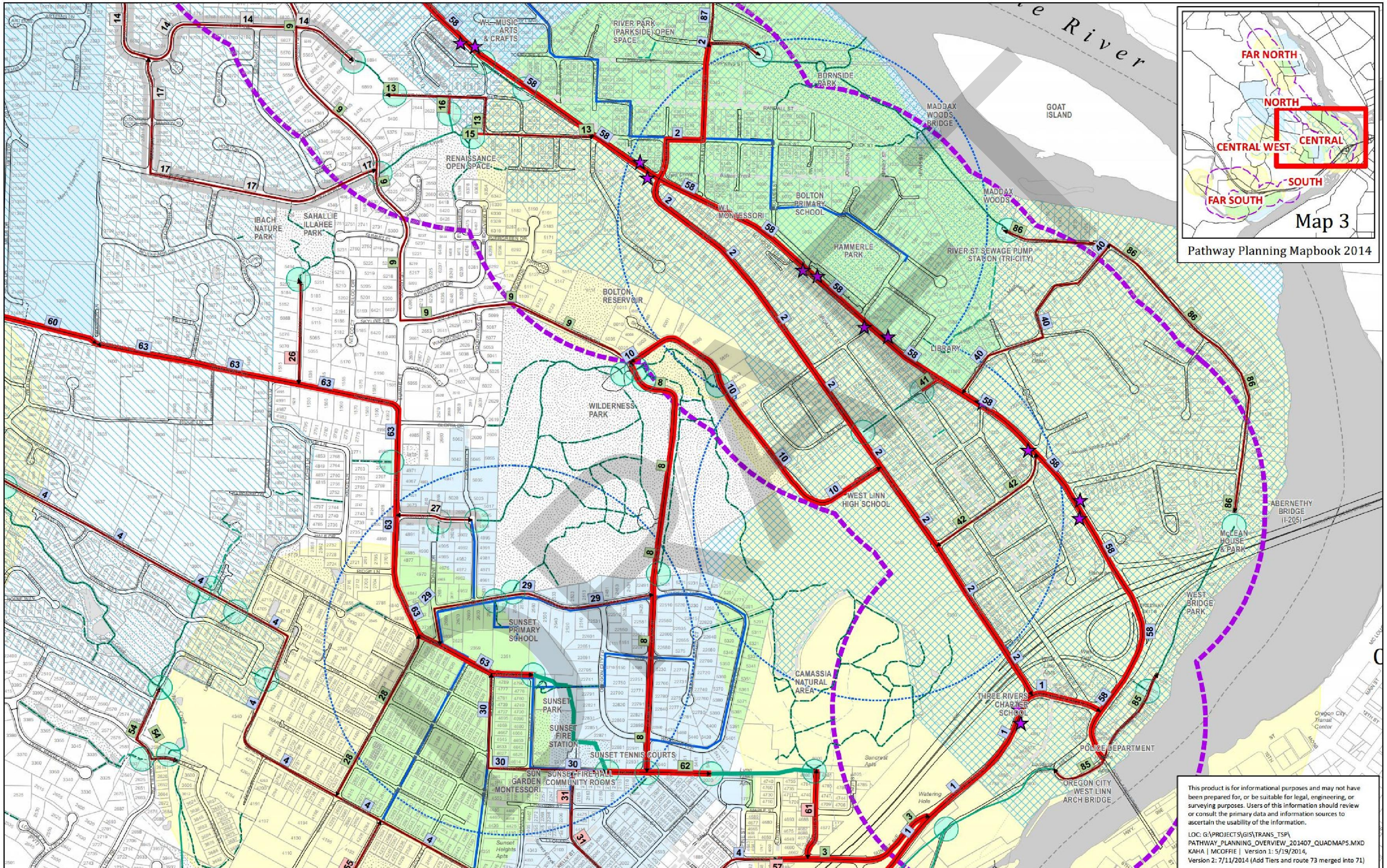
River
GOAT ISLAND
FAR NORTH
NORTH
CENTRAL
CENTRAL WEST
SOUTH
FAR SOUTH
Map 3
Pathway Planning Mapbook 2014
W-L MUSIC ARTS & CRAFTS
RIVER PARK (PARKSIDE) OPEN SPACE
BURNSIDE PARK
MADDAX WOODS BRIDGE
RENAISSANCE OPEN SPACE
IBACH NATURE PARK
SAHALLIE ILLAHEE PARK
W.L. MONTESSORI
BOLTON PRIMARY SCHOOL
HAMMERLE PARK
MADDAX WOODS
RIVER ST SEWAGE PUMP STATION (TRI-CITY)
BOLTON RESERVOIR
LIBRARY
WILDERNESS PARK
WEST LINN HIGH SCHOOL
ABERNETHY BRIDGE (I-205)
McLEAN HOUSE & PARK
WEST BRIDGE PARK
SUNSET PRIMARY SCHOOL
CAMASSIA NATURAL AREA
THREE RIVERS CHARTER SCHOOL
SUNSET PARK
SUNSET FIRE STATION
SUNSET TENNIS COURTS
SUN GARDEN MONTESSORI
SUNSET FIRE HALL COMMUNITY ROOMS
POLICE DEPARTMENT
OREGON CITY WEST LINN ARCH BRIDGE
Oregon City Transit Center
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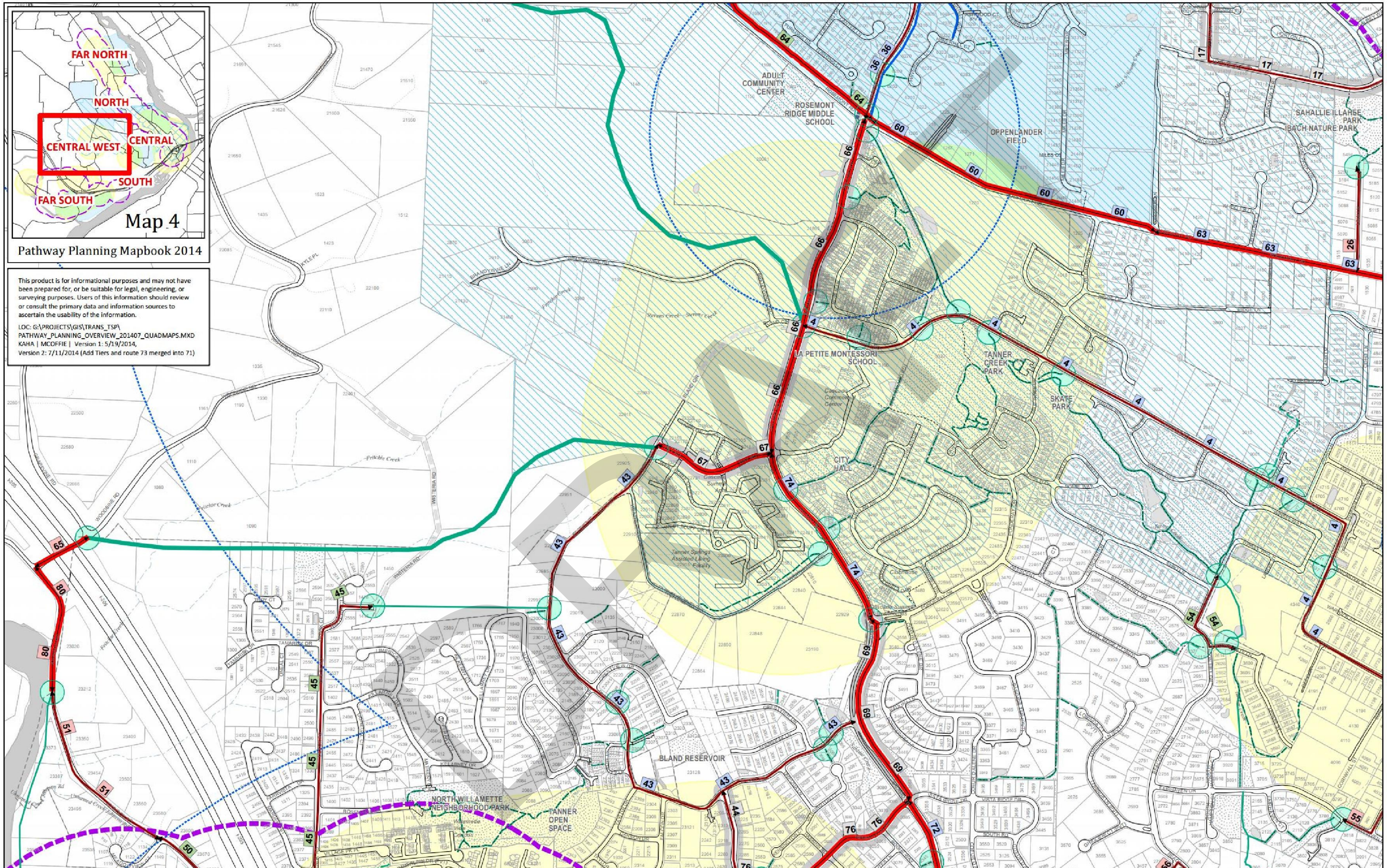
FAR NORTH
NORTH
CENTRAL
CENTRAL WEST
SOUTH
FAR SOUTH
Map 4
Pathway Planning Mapbook 2014
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KAHA | MCOFFIE | Version 1: 5/19/2014,
Version 2: 7/11/2014 (Add Tiers and route 73 merged into 71)
ADULT COMMUNITY CENTER
ROSEMONT RIDGE MIDDLE SCHOOL
OPPENLANDER FIELD
SAHALLIE ILLAHEE PARK
IBACH NATURE PARK
LA PETITE MONTESSORI SCHOOL
TANNER CREEK PARK
SKATE PARK
CITY HALL
BLAND RESERVOIR
NORTH WILLAMETTE NEIGHBORHOOD PARK
TANNER OPEN SPACE
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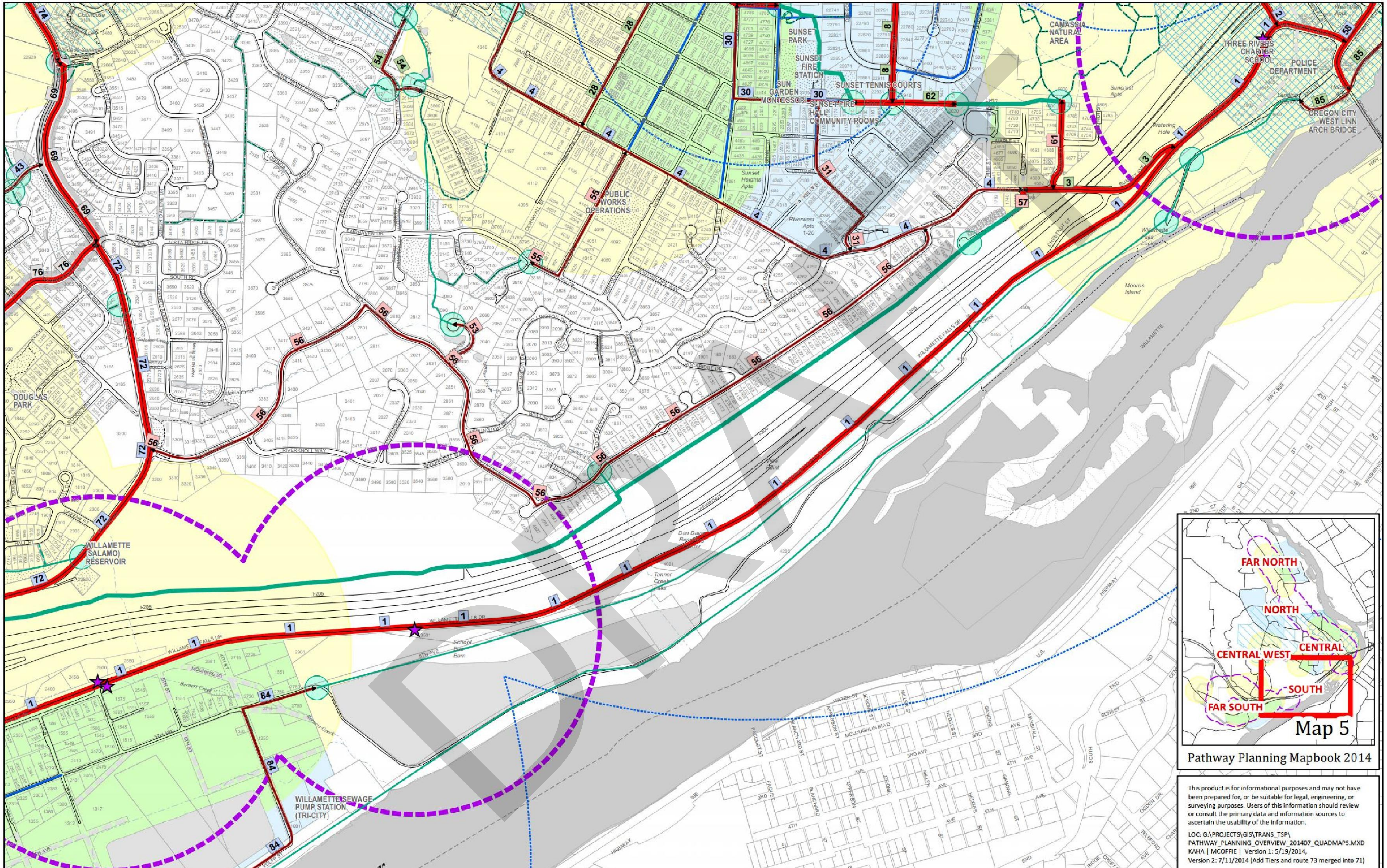
SUNSET PARK
SUNSET FIRE STATION
SUN GARDEN MONTESSORI
SUNSET TENNIS COURTS
SUNSET FIRE HALL COMMUNITY ROOMS
CAMASSIA NATURAL AREA
THREE RIVERS CHARTER SCHOOL
POLICE DEPARTMENT
OREGON CITY WEST LINN ARCH BRIDGE
PUBLIC WORKS OPERATIONS
DOUGLAS PARK
WILLAMETTE (SALAMO) RESERVOIR
WILLAMETTE SEWAGE PUMP STATION (TRI-CITY)
FAR NORTH
NORTH
CENTRAL WEST
CENTRAL
SOUTH
FAR SOUTH
Map 5
Pathway Planning Mapbook 2014
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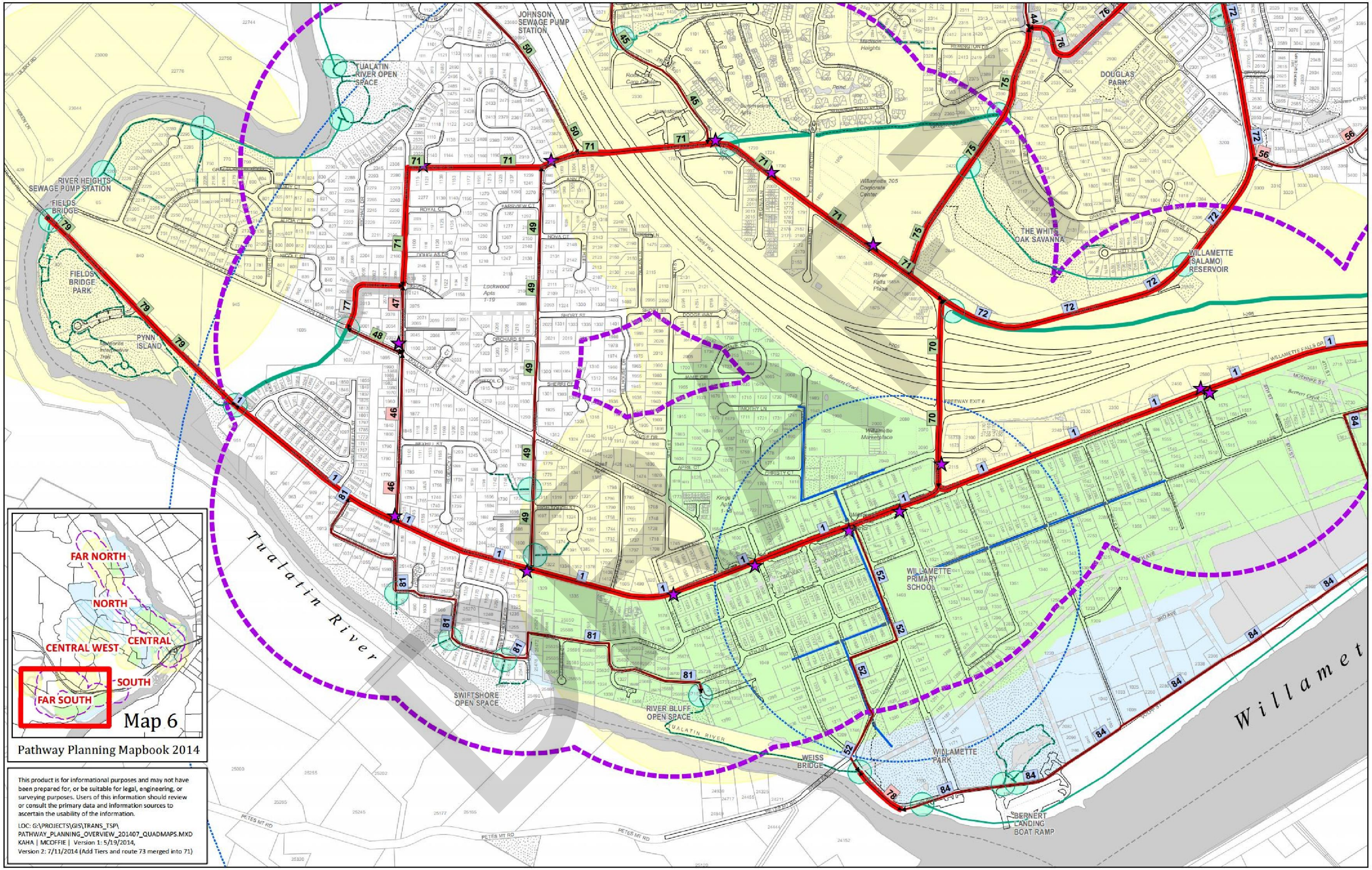
JOHNSON SEWAGE PUMP STATION
TUALATIN RIVER OPEN SPACE
RIVER HEIGHTS SEWAGE PUMP STATION
FIELDS BRIDGE
FIELDS BRIDGE PARK
PYNN ISLAND
Tualatin River
Willamette
DOUGLAS PARK
THE WHITE OAK SAVANNA
WILLAMETTE (SALAMO) RESERVOIR
FREEWAY EXIT 6
WILLAMETTE PRIMARY SCHOOL
SWIFTSHORE OPEN SPACE
RIVER BLUFF OPEN SPACE
WEISS BRIDGE
WILLAMETTE PARK
BERNERT LANDING BOAT RAMP
FAR NORTH
NORTH
CENTRAL WEST
CENTRAL
SOUTH
FAR SOUTH
Map 6
Pathway Planning Mapbook 2014
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KAHA | MCOFFIE | Version 1: 5/19/2014,
Version 2: 7/11/2014 (Add Tiers and route 73 merged into 71)

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
610 SW Alder Street, Suite 700, Portland, OR 97205 P 503.228.5230 F 503.273.8169

MEMORANDUM

Date: February 25, 2015 Project #: 17817.0

To: Zach Pelz, City of West Linn
Gail Curtis, Oregon Department of Transportation

From: Susan Wright, Matthew Bell, and Ribeka Toda, Kittelson & Associates, Inc.

Project: West Linn Transportation System Plan (TSP) Update

Subject: Draft Technical Memorandum #7: Draft Transportation System Needs

This memorandum documents the existing and future transportation system needs within the City of West Linn. The information presented in this memorandum is intended to inform the development of the West Linn Transportation System Plan (TSP) which addresses existing system needs and additional facilities that are required to serve future growth. A menu or "toolbox" of solutions to address many of these needs is included in Attachment "A". Technical Memorandum 10 will include specific solutions to address the transportation system needs identified in this memorandum.

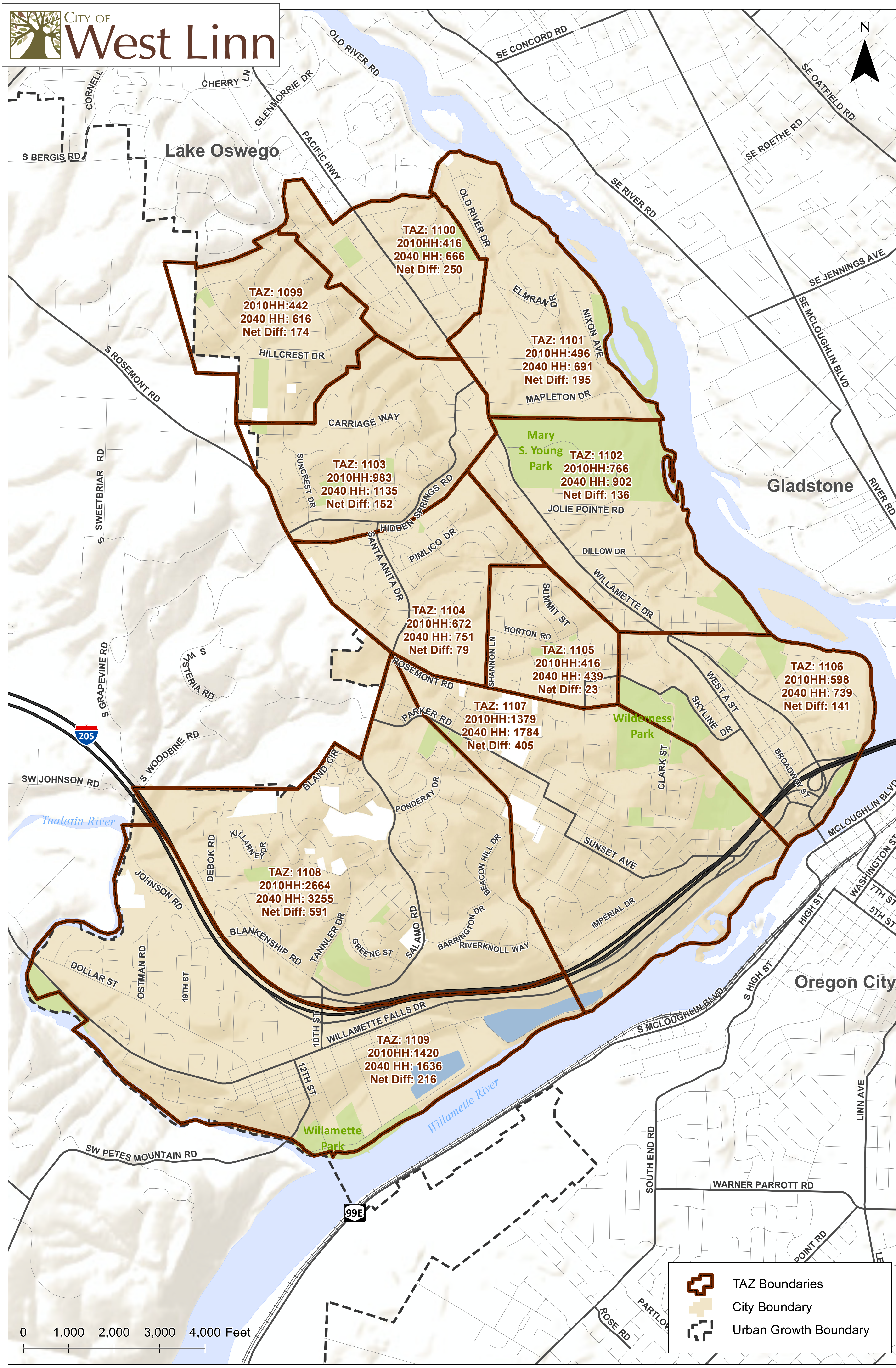
PROJECTED LAND USES

Land use plays an important role in developing a comprehensive transportation system. The amount of land that is planned to be developed, the type of land uses, and how the land uses are mixed together have a direct impact on how the transportation system will be used in the future. Understanding land use is critical to taking actions to maintain or enhance the transportation system.

Land use data for West Linn was provided by Metro. The data includes base year 2010 and forecast year 2040 population, household, and employment (retail, service, and other) estimates for West Linn by Transportation Analysis Zone (TAZ). There are 11 TAZs within West Linn. Figures 1 and 2 illustrate the TAZs and the household and employment changes expected between base year 2010 and forecast year 2040. Table 1 summarizes the TAZ data for base year 2010 and forecast year 2040 conditions. As shown in Table 1, the percent change in population and households over 30 years is anticipated to be less than 1% per year and the growth in employment is anticipated to be approximately 2 % per year.

Table 1: West Linn Land Use Summary

Land Use	2010	2040	Change	Percent Change
Population	25,458	31,471	+6,013	+23.6%
Households	10,252	12,620	+2,368	+23.1%
Employment	4,253	6,913	2,660	+62.5%



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Changes in Households by TAZ from 2010 to 2040
West Linn, Oregon

Figure
1

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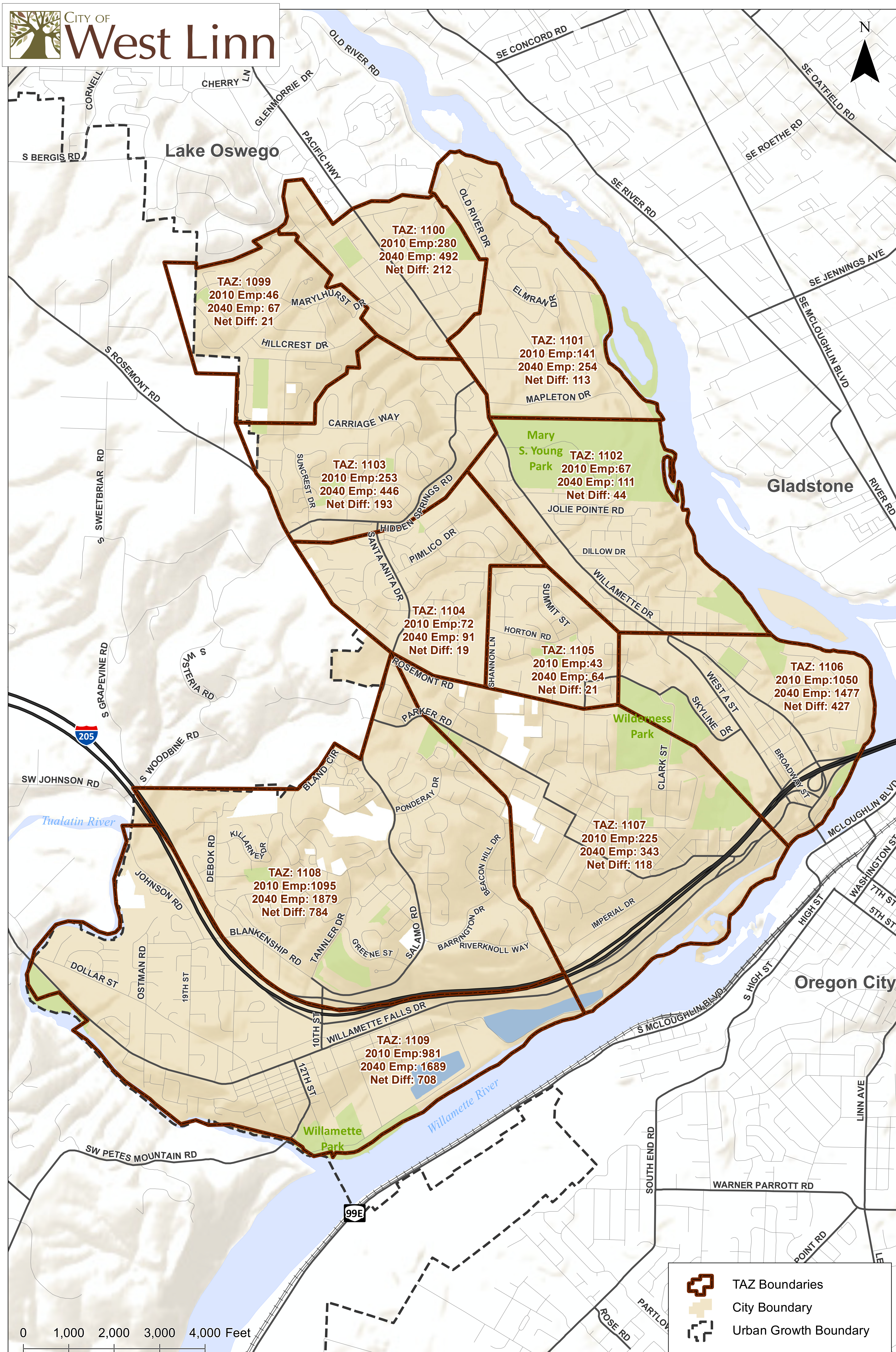
Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA



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Changes in Employment by TAZ from 2010 to 2040
West Linn, Oregon

Figure
1

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Transportation Engineering/Planning

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA

As land uses change in proportion to each other (i.e. there is a significant increase in employment relative to household growth), there will be a shift in the overall operation of the transportation system. Retail land uses generate a higher number of trips per acre of land than residential and other land uses. The location and design of retail land uses in a community can greatly affect transportation system operation. Additionally, if a community is homogeneous in land use character (i.e. all employment or all residential), the transportation system must support significant trips coming to or from the community rather than within the community. Typically, there should be a mix of residential, commercial, and employment type land uses so that some residents may work and shop locally, reducing the need for residents to travel long distances.

The data shown in Table 1 indicates that significant growth is expected in West Linn in the coming decades. The transportation system in West Linn should be monitored to make sure that land uses in the plan are balanced with transportation system capacity.

ACCESS TO ESSENTIAL DESTINATIONS

The pedestrian and bicycle systems should provide access to essential destinations in the City, such as transit centers, park and rides, bus stops, schools, parks, public facilities, and commercial centers. They should also provide access to other networks, such as Metro's Regional Pedestrian and Bicycle Networks, Metro's Regional Trails and Greenways network, and Clackamas County's Principal Active Transportation (PAT) routes as documented in the County's Active Transportation Plan (ATP).

Access to Essential Destinations

Transit Center: The Oregon City Transit Center is located across the Arch Bridge in downtown Oregon City between Mcloughlin Boulevard (99E) and Main Street on 11th Street. The Oregon City Transit Center is a major transit hub within the region serving TriMet's fixed-route bus lines 32, 33, 34, 35, 79, 99, and 154, TriMet's Lift service, and Canby Area Transit's (CAT) Orange Line. Continuous sidewalks along the Arch Bridge and through downtown Oregon City provide access to the transit center for pedestrians; however, cyclists must share the roadways with motor vehicles. TriMet's Line 35 and 154 also provide access to the Oregon City Transit Center from West Linn.

Park and Ride: The West Linn park and ride is located in the southeast corner of the Willamette Drive/Cedar Oak Drive intersection at the Emmanuel United Presbyterian Church. The park and ride is served by Line 35 with one stop along the east side of Willamette Drive north of Cedar Oak Drive and one stop along the west side of Willamette Drive approximately halfway between Cedar Oaks drive and Hidden Springs Road. Continuous sidewalks along Willamette Drive and Cedar Oaks Drive connect the park and ride with the transit and the Willamette Drive/Cedar Oak Drive intersection is signalized with pedestrian activation.

Transit Stops: The City is served by two transit lines – Line 35 along Willamette Drive and Line 154 along Willamette Falls Drive. There is limited pedestrian access to both lines as both Willamette Drive and Willamette Falls Drive have little to no sidewalks. Sidewalks are particularly important to transit facilities as most bus riders need safe and comfortable walking routes to access the bus stop. Line 35 is accessible by bicycle as there are bicycle lanes along Willamette Drive. Line 154 is not accessible by bicycle as there are bicycle lanes along a small segment of Blankenship Road only.

Schools: Providing pedestrian and bicycle access to schools can offer multimodal commute options for students. Most of the schools in West Linn have limited or significant gaps in pedestrian access. The following schools have no access by bicycle facilities:

- Cedaroak Park Primary School, along Cedar Oak Drive
- SunGarden Montessori Children's Center
- Sunset Primary School
- Three Rivers Charter School
- Willamette Primary School

Parks: There are numerous parks in West Linn. The three main parks are Mary S. Young Park, Wilderness Park, and Willamette Park.

- Mary S. Young Park: Mary S. Young Park is a 128 acre park located along the east side of Willamette Drive, between Mapleton Drive and Jolie Pointe Road. It is accessible from Willamette Drive, Mark Lane, Munger Drive, and Mapleton Drive. There is an off-street pedestrian path on the east side of Willamette Drive, but no pedestrian facilities on the west side and no crosswalk to cross Willamette Drive. There are no sidewalk connections from the south side of the park, along Mark Lane and Munger Drive or from the north side of the park along Mapleton Drive. There are bicycle lanes on both sides of Willamette Drive. There are no bicycle connections from the south side of the park, along Mark Lane and Munger Drive., or from the north side of the park along Mapleton Drive.
- Wilderness Park: Wilderness Park is a 51.4 acre park located southwest of West A Street. It has access points on Clark Street, Oregon City Boulevard, Prospect Street, and Windsor Terrace. Clark Street is a collector street that lacks sidewalks and bike lanes between skyline drive and Windsor Terrance; however, it has continuous sidewalks and bike lanes between Windsor Terrace and Long Street. Oregon City Boulevard, Prospect Street, and Windsor Terrace are local streets with limited or no sidewalks, bicycle lanes or shared-use pavement markings.
- Willamette Park: Willamette Park is a 15 acre park located at the intersection of the Tualatin River and the Willamette River at the south end of the City. It is accessible from 12th Street and Volpp Street. 12th Street has sidewalks on the west side only and Volpp has inconsistent sidewalks along both the north and south sides. There are no bicycle lanes or shared bicycle pathways on either street.

Public Facilities (library, community center, city hall): There are several public facilities in West Linn, including City Hall, the adult community center, and the library.

- City Hall: The West Linn City Hall is located at the intersection of Salamo Road and Day Road. There are sidewalks on both sides of Salamo Road and Day Road and marked crosswalks at the intersection. There are bicycle lanes on both sides of Salamo Road and no bicycle facilities along Day Road.

- Adult Community Center: The West Linn Adult Community Center is directly adjacent to Rosemont Ridge Middle School, located at the intersection of Santa Anita Drive and Rosemont Road. There are sidewalks along both sides of Rosemont Road and while there is no crosswalk directly in front of the driveway to the community center, there is a crosswalk at the intersection approximately 400 feet to the east. There are bicycle lanes along both sides of Rosemont Road and there is also an off-street multi-use path along the north side of Rosemont Road.
- Library: The West Linn Public Library is located at the intersection of Hood Street and Burns Street in the east side of the City. There are sidewalks along a portion of Burns Street but no sidewalks along Hood Street. It is also located near Willamette Drive, and while the segments of Willamette Drive near the site have sidewalks, there are no crosswalks across Willamette Drive for library patrons walking from west of Willamette Drive. Hood Street and Burns Street are local streets and have no bicycle lanes or shared pathway markings. Willamette Drive has bicycle lanes in both directions.

Commercial Centers: There are four main commercial centers in West Linn located near the Willamette Drive/I-205 interchange, the 10th Street/I-205 interchange (Willamette Historic Commercial District), the Salamo Road/Parker Road intersection, and along Willamette Drive toward the north end of the City.

- Willamette Drive/I-205 Interchange: The commercial center along Hood Street, which runs parallel to Willamette Drive, is a collection of retail and restaurants in the area enclosed by Willamette Drive, Burns Street and Garden Street.
- Willamette Historic Commercial District: The commercial area along Willamette River Drive near the 10th Street/I-205 interchange includes various restaurants and stores along both sides of Willamette River Drive, and there is a separated frontage road on both sides with parking.
- Salamo Road/Parker Road Intersection: The commercial area located in the southeast corner of the Salamo Road/Parker Road intersection includes City Hall and a shopping center.
- Willamette Drive toward the north end of City: The commercial area along Willamette Drive toward the north end of the City includes a Walmart and other retail uses and restaurants.

Access to Other Networks

Metros Regional Pedestrian Network

Metro's Regional Pedestrian Network consists of pedestrian parkways, regional pedestrian corridors, local pedestrian corridors, and regional pedestrian districts. This network includes the trails identified in the Metro Regional Trails and Greenways network. The components of the Regional Pedestrian Network are defined below:

- Pedestrian parkways are high quality and high priority routes for pedestrian activity. They are generally major urban streets that provide frequent and/or almost frequent transit service. They can also be regional trails. The following are the existing and proposed pedestrian parkways within West Linn:
  - Existing pedestrian parkways: Willamette Drive
  - Proposed pedestrian parkways: I-205 Multi-Use Path, which is also identified in the Metro Regional Trails and Greenways network
  - Regional pedestrian corridors are any major or minor arterial or regional trail that is not designated as a pedestrian parkway. The following are the existing and proposed regional pedestrian corridors within West Linn: Existing regional pedestrian corridors: Old River Drive, which is also identified as the Willamette River Greenway in the Metro Regional Trails and Greenways network, and parts of the Salamo Trail
  - Proposed regional pedestrian corridors: the Rosemont Trail, which is also identified in the Metro Regional Trails and Greenways network, and filling gaps in the Salamo Trail and the Riverside Loop Trail
- Local pedestrian corridors include any street or trail that is not a regional pedestrian corridor.
- Pedestrian Districts are areas with a concentration of transit, commercial, cultural, educational, institutional, and/or recreational destinations where pedestrian travel is intended to be attractive, comfortable and safe. Within West Linn these areas include the four main commercial centers described above.

Metros Regional Bicycle Network

Metro's Regional Bike Network consists of bicycle parkways, regional bikeways, local bikeways, and regional bicycle districts. This network includes the trails identified in the Metro Regional Trails and Greenways network. The components of the Regional Bicycle Network are defined below:

- Regional Bicycle Parkways connect to and through every urban center, many regional destinations, and to most employment and industrial areas, regional parks, and natural areas. Bicycle Parkways serve higher volumes of bicyclists and provide important connections to destinations. The following are the existing and proposed bicycle parkways within West Linn:

  - Existing bicycle parkways: Willamette Drive, Pimlico Drive, Santa Anita Drive, parts of Salamo Trail and parts of 10th Street
  - Proposed bicycle parkways: I-205 Multi-Use Trail

- Regional Bikeways provide for travel to and within the Central City, Regional Centers, and Town Centers. Regional Bikeways can be any type of facility, including multi-use paths, off-street trails, separate on-street bike lanes, and bicycle boulevards. Within West Linn these routes include the Rosemont Trail (Rosemont Road, Skyline Drive, Summit Street, Cornwall Street, Sunset Avenue) and the Willamette River Greenway trail.
  - Existing regional bikeways: Old River Drive, Willamette River Drive, Blankenship Road, parts of the Willamette River Greenway, the Rosemont Trail, and 10th Street
  - Proposed regional bikeways: Filling gaps in the Willamette River Greenway, the Salamo Trail and the Rosemont Trail
- Local Bikeways include any street or trail that is not a regional bicycle corridor.
- Bicycle Districts are areas with a concentration of transit, commercial, cultural, educational, institutional, and/or recreational destinations where bicycle travel is intended to be attractive, comfortable and safe. Within West Linn these areas include the four main commercial centers described above.

Access to the Regional Pedestrian and Bicycle Networks is mostly made on local streets, which generally provide limited facilities within West Linn. As such, there is limited access to most of the corridors identified above. Access to these corridors is critical to providing regional pedestrian and bicycle systems that serve the needs of West Linn residents.

Metro Regional Trails and Greenways Network

Metro's Regional Trails and Greenways network is the compilation of the trails that connect the parks and natural areas in the region. The trails in this network that are within West Linn are included in Metro's Regional Pedestrian and Bicycle Networks.

Clackamas County Principal Active Transportation Routes

The Clackamas County Active Transportation Plan identifies principal active transportation (PAT) routes that connect key destinations for transit, shopping and employment centers within the County. Within West Linn, Route 6a (Willamette Drive/Old River Road) has been identified as a Visionary PAT (V-PAT) Route, which means that it is a long-term project for the County. Route 6a offers a scenic route along the Willamette River south of George Rogers Park. Combined with improved facilities on Willamette Drive, this route would provide a direct connection between Lake Oswego and West Linn as well as access to employment, parks and shopping.

PEDESTRIAN SYSTEM NEEDS

Pedestrian facilities, such as sidewalks, multi-use paths and trails, marked and unmarked, signalized and unsignalized pedestrian crossings are essential elements of the City's pedestrian system. While these facilities are currently provided along many City streets, there are many more streets where these facilities are needed to improve pedestrian access to transit and essential destinations within the City, consistent with Section 3.08.130 of the RTFP. The following provides a summary of the pedestrian system needs within West Linn and is based on information provided in previous planning documents as well as a review of the transportation system.

As described below, the most common overall need is to provide a safe and interconnected system that affords the opportunity to consider the walking mode of travel, especially for trips less than one-half mile in length for residential trips, and less than one-mile for recreational trips.

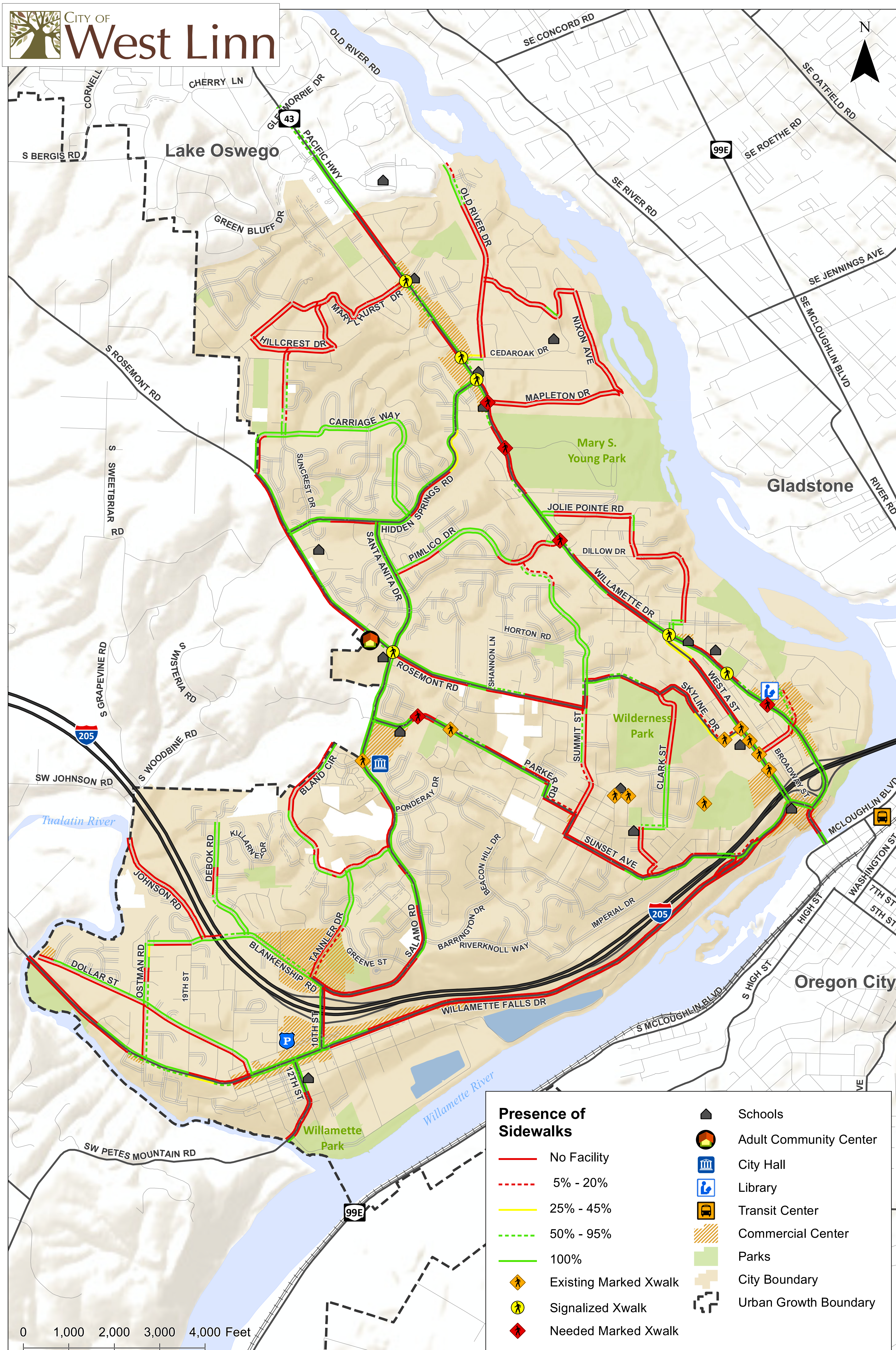
System Connectivity

A well-connected pedestrian system provides continuous sidewalks and other pedestrian facilities between essential destinations, such as residential neighborhoods, schools, parks, and retail/commercial centers. Strategies to improve pedestrian connectivity include identifying, prioritizing, and ultimately constructing new sidewalks, multi-use paths and trails, pedestrian crossings, and connections between neighborhoods. The following provides a summary of connectivity needs for the pedestrian system.

Sidewalks

Several of the arterial and collector streets within West Linn need sidewalks and other pedestrian facilities to improve connectivity. Figure 3 illustrates the gaps in the pedestrian system. As shown, there is a lack for sidewalks along both sides of Willamette Drive, Rosemont Road, Skyline Drive, Parker Road, Sunset Avenue, and many other arterials streets, as well as a lack of sidewalks along both sides of Ostman Road, Blankenship Road, Tannler Drive, Pimlico Drive, Summit Street, and many other collector streets. While the lack of sidewalks is shown along both sides of all arterial and collector streets, it may not be feasible or cost effective to construct sidewalks along both sides of all streets. Marylhurst Drive, for example, has significant grade and topography issues that may limit the ability to construct sidewalks along one or both sides of the street. Further evaluation of these streets will be provided in Technical Memorandum 10: Transportation Solutions.

Many of the sidewalk projects identified in previous the TSP and other planning documents have not been constructed, and therefore are still needed. These projects along with several additional projects identified through a review of the transportation system as well as conversations with City staff, are shown in Table 2. The pedestrian system gaps (i.e. needs) in Table 2 are based on road standards that include sidewalks on both sides of the street; however, some locations may be determined to be adequate with a pedestrian facility on one side of the roadway only.



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Pedestrian System Needs
West Linn, Oregon

Figure
3

Kittelson & Associates, Inc.
TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: USGS, ESRI, TANA, AND

Table 2: Pedestrian System Gaps

Street Name	From	To	Side	Need	SRTS – Memo 6	On-street Connection – Trails Master Plan	SRTS – Trails Master Plan
10th Street	Blankenship Road	8th Avenue	One side only	Construct new sidewalk	No	Route 70	No
19th Street	Blankenship Road	Willamette Falls Drive	Some one side only, largely both	Construct new sidewalk	No	Route 49	No
Bland Circle	Weatherhill Road	Salamo Road	Some both sides, largely one side only	Construct new sidewalk	No	Route 43	No
Bland Circle	North Limits	Tannler Drive	Some both sides, largely one side only	Fill in sidewalk gaps	No	Route 43	No
Blankenship Road	Ostman Road	19th Street	One side only	Construct new sidewalk	No	Route 71	No
Blankenship Road	Johnson Road	Debok Road	One side only	Fill in sidewalk gaps	No	Route 71	No
Blankenship Road	13th Street	10th Street	One side only	Fill in sidewalk gaps	No	Route 71	No
Carriage Way	Rosemont Road	700' north of Rosemont Road	One side only	Construct new sidewalk	No	Route 25	No
Cedaroak Drive	Old River Road	Elmran Avenue	Both sides	Construct new sidewalk	Yes	Route 33	Yes
Cornwall Street	Sunset Avenue	Oxford Street	Both sides	Construct new sidewalk	No	Route 28	No
Debok Road	100' north of Summerlinn Drive	Rosemarie Drive	One side only	Fill in sidewalk gaps	No	Route 45	No
Debok Road	Rosemarie Drive	Farvista Drive	Both sides	Construct new sidewalk	No	Route 45	No
Dillow Drive	Failing Street	Willamette Drive	Both sides	Construct new sidewalk	No	Route 2	Yes
Dollar Street	West City Limits	Willamette Falls Drive	Some one side only, largely both	Construct new sidewalk	No	No	No
Elmran Avenue	Nixon Avenue	Old River Road	Both sides	Construct new sidewalk	No	Routes 34, 89, 33, and 92	Yes (Route 33)
Exeter Street	Oxford Street	Sunset Street	Both sides	Construct new sidewalk	Yes	Route 30	Yes
Failing Street	Willamette Drive	Dillow Drive	Both sides	Construct new sidewalk	No	Route 2	Yes
Hidden Springs Road	300' east of Suncrest Drive	Santa Anita Drive	One side only	Construct new sidewalk	Yes	Route 32	Yes
Hidden Springs Road	Carriage Way	Wildwood Drive	One side only	Construct new sidewalk	No	Route 32	Yes
Hidden Springs Road	Wildwood Drive	Cottonwood Court	One side only	Fill in sidewalk gaps	No	Route 32	Yes
Hillcrest Drive	Marylhurst Drive (North)	Marylhurst Drive (South)	Both sides	Construct new sidewalk	No	No	No
Johnson Road	Woodbine Road	Blankenship Road	Both sides	Construct new sidewalk	No	Routes 50 and 51	No

Street Name	From	To	Side	Need	SRTS – Memo 6	On-street Connection – Trails Master Plan	SRTS – Trails Master Plan
Jolie Pointe Drive	Larson Avenue	Rainier Place	Both sides	Construct new sidewalk	No	Route 38	No
Larson Avenue	Dillow Drive	Tulane Street	Both sides	Construct new sidewalk	No	Route 87	No
Larson Avenue	Tulane Street	Jolie Pointe Drive	One side only	Construct new sidewalk	No	Route 87	No
Mapleton Drive	Willamette Drive	Nixon Avenue	Both sides	Construct new sidewalk	No	Route 38	No
Marylhurst Drive	Willamette Drive	Hillcrest Drive	Both sides	Construct new sidewalk	No	Route 22	No
McKillican	West A Street	Willamette Falls Drive	Both sides	Construct new sidewalk	No	Route 42	No
Nixon Avenue	Mapleton Drive	Elmran Avenue	Both sides	Construct new sidewalk	No	Route 88	No
Old River Road	Willamette Drive	Cherokee Court	Some one side only, largely both	Construct new sidewalk	No	Route 59	No
Ostman Road	Blankenship Road	Willamette Falls Drive	Both sides	Construct new sidewalk and fill gaps	No	Routes 46 and 47	No
Oxford Street	Cornwall Street	Exeter Street	Both sides	Construct new sidewalk	Yes	Route 63	No
Parker Road	Noble Lane	Sunset Avenue	Some both, largely one side only	Construct new sidewalk and fill gaps	No	Route 4	No
Pimlico Drive	Willamette Drive	Palamino Way (East)	Both sides	Construct new sidewalk	No	Route 12	No
Pimlico Drive	Santa Anita Drive	Palamino Way (West)	One side only	Construct new sidewalk	Yes	No	No
Riverview Avenue	Long Street	Sunset Avenue	Both sides	Construct new sidewalk	No	No	No
Rosemont Road	Carriage Way	Hidden Springs	One side only	Construct new sidewalk	No	Route 68	Yes
Rosemont Road	Hidden Springs Road	Santa Anita Drive	One side only	Construct new sidewalk	Yes	Route 64	No
Rosemont Road	Santa Anita Drive	Wild Rose Drive	One side only	Construct new sidewalk	No	Route 60	No
Rosemont Road	Shannon Lane	Summit Street	Both sides	Construct new sidewalk	No	Route 63	No
Salamo Drive	10th Street	Crystal Terrace Drive	Some one side only, largely both	Construct new sidewalk	No	Route 72	No
Salamo Drive	Vista Ridge Drive	Weatherhill Road	One side only	Construct new sidewalk and fill gaps	No	Routes 72, 69, and 74	No
Simpson Street	Long Street	Riverview Avenue	Both sides	Construct new sidewalk	No	Route 31	No
Skyline Drive	Summit Drive	West A Street	Some one side only, largely both	Construct new sidewalk and fill gaps	No	Routes 9 and 10	No
Summit Street	Skyline Drive	Oxford Street	Both sides	Construct new sidewalk and fill gaps	No	Routes 28 and 63	No

Street Name	From	To	Side	Need	SRTS – Memo 6	On-street Connection – Trails Master Plan	SRTS – Trails Master Plan
Summit Street	Pimlico Drive	Apollo Road	Both sides	Fill in sidewalk gaps	No	Route 9	No
Suncrest Drive	Hillcrest Drive	Carriage Way	Both sides	Construct new sidewalk and fill gaps	Yes	No	No
Sunset Avenue	Parker Road	Walnut Street	Both sides	Construct new sidewalk	No	Route 4	No
Sunset Avenue	Willamette Falls Drive	West A Street	One side only	Construct new sidewalk	No	Route 3	No
Tannler Drive	Blankenship Road	Greene St	Both sides	Construct new sidewalk and fill gaps	No	Route 75	No
Tualatin Avenue	Volpp Street	12th Street	Both sides	Construct new sidewalk	No	Route 52	Yes
West A Street	Willamette Drive	Skyline Drive	Both sides	Construct new sidewalk and fill gaps	No	Route 2	Yes
Willamette Drive	Bolton Street	Failing Street	One side only	Construct new sidewalk and fill gaps	No	Route 58	No
Willamette Drive	Buck Street	Barlow Street	Both sides	Construct new sidewalks	No	Route 58	No
Willamette Drive	Barlow Street	Pimlico Drive	One side only	Construct new sidewalk	No	Route 58	No
Willamette Drive	Mark Lane	Cedaroak Drive	Both sides	Construct new sidewalk and fill gaps	No	Routes 58 and 82	No
Willamette Drive	Cedaroak Drive	North City Limits	Some one side only, largely both	Construct new sidewalk and fill gaps	No	Route 82	No
Willamette Falls Drive	Dollar Street (West)	Dollar Street (East)	Some one side only, largely both	Construct new sidewalk and fill gaps	No	Route 1	No
Willamette Falls Drive	10th Street	West A Street	Some one side only, largely both	Construct new sidewalk	No	Route 1	No

The sidewalk projects shown in Table 2 will be evaluated based on the TSP goals, targets, and evaluation criteria, and input from City staff and local citizens, to determine the highest priority projects for the financially constrained plan. In addition to the gaps in pedestrian facilities along arterial and collector streets noted in Table 2, there are other deficiencies in sidewalk conditions, including sub-standard sidewalk widths and general poor conditions. The City is currently compiling an inventory of these sidewalk condition deficiencies, including key areas such as the sidewalks near Willamette Primary School and Bolton School.

In addition to the need related to gaps and conditions of pedestrian facilities along arterial and collector streets noted above, other pedestrian facilities, such as new pedestrian crossings, multi-use paths and trails, and neighborhood connections are identified below.

Pedestrian Crossings

Pedestrian crossings along the City's arterial and collector streets are limited to major intersections and a few key mid-block crossing locations. There are currently eight pedestrian crossings along Willamette Drive at signalized intersections that include pedestrian push buttons and pedestrian signal heads. However, there are several additional locations along Willamette Drive as well as other arterial and collector streets within the City, where marked pedestrian crossing are needed to provide connectivity as well as access to schools, parks, the library, and other essential destinations within the City. The following provides a summary of the additional crossing needs:

- Willamette Drive at Mapleton Drive
- Willamette Drive at Mary S Young Park
- Willamette Drive at Pimlico Drive
- Willamette Drive at Burns Street
- Hidden Springs Road and Carriage Way
- Parker Road at Noble Lane

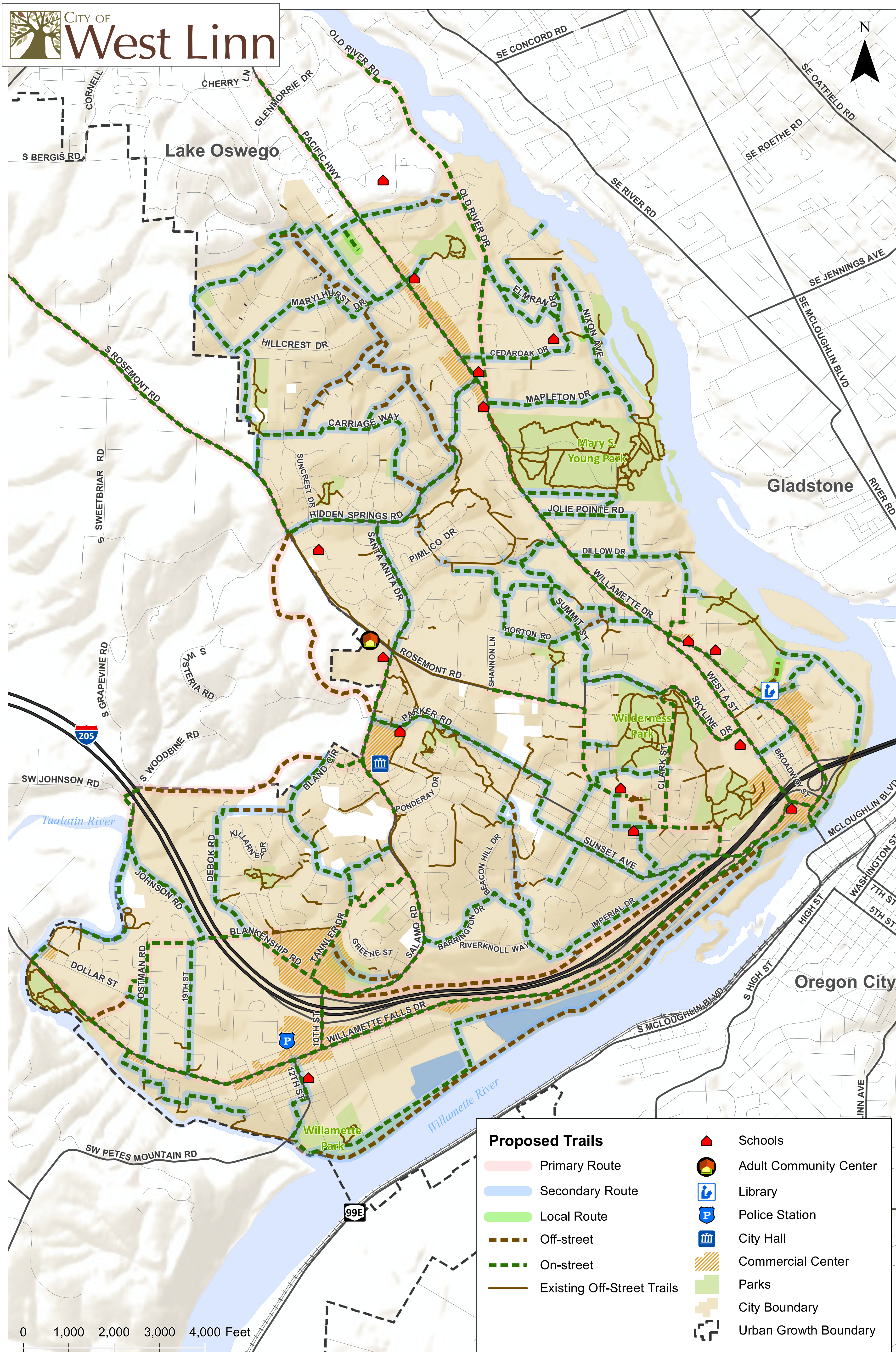
Marked pedestrian crossing at each of these locations would improve connectivity along the roadways as well as access to essential destinations. Any new pedestrian crossing located on Willamette Drive need to meet Oregon Department of Transportation (ODOT) crossing guidelines and be evaluated based on the criteria used by ODOT to ensure the crossing is warranted and safe.

Multi-Use Paths and Trails

Multi-use paths and trails are designated pathways for both bicyclists and pedestrians. There is currently a sparse network of regional and local multi-use paths in the City, shown in Figure 4, comprised of segments along Rosemont Road, Willamette Drive, Willamette Falls Drive, and within parks. Continuous multi-use paths are most comfortable for both pedestrians and bicyclists and increasing the lengths of these short segments would create a more robust network of multi-use paths and trails. The City has a Trails Master Plan that includes multi-use paths and trails as well as on-street facilities to provide connections to the trails. The on-street segments of the trails master plan should be considered in prioritizing the pedestrian system gaps.

Neighborhood Connections

Connections between cul-de-sacs and adjacent roadways can significantly reduce travel distances for pedestrians, thereby encouraging more pedestrian trips. The identification of such connections in developed areas is required in Section 660-12-045(6) of the Transportation Planning Rule (TPR) as part of a locality's development of a bicycle and pedestrian circulation plan. Appropriate improvements should provide for more direct, convenient, and safe bicycle or pedestrian travel within and between residential areas and neighborhood activity centers.



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Trails
West Linn, Oregon

Figure **4**

H:\projfile\17817 - West Linn Transportation System Plan\gis\Task_03\4 Trails Network.mxd - jsommerville - 1:03 PM 2/26/2015

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TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA

Although there are many locations in West Linn where cul-de-sac lengths are excessive and routes from local roads to collectors are not very direct, short-cuts are not always possible due to terrain or length of the necessary trail. The following identifies four possible locations for the construction of new pedestrian accessways or shortcuts:

- Wisteria Road to Bland Circle: This connection would join two residential areas, creating a circular connection from Tannler Drive to Bland Circle, to Wisteria Road, and down to Blankenship Road. A road connection was shown in the Tannler Basin Master plan at this location, to be built when development occurs. Pedestrian and bicycle access should be part of that connection. This plan advocates that the completion of the connection wait until development occurs, as the length of the needed path makes it economically infeasible for the City to pursue in advance of development.
- Sinclair Street to Holly Street: Sinclair Street dead ends in two locations. In order to walk west to Willamette Drive one must walk east to River Road and then back to Willamette Drive. A connection at this location would be a mildly sloped trail, with right-of-way needed to be dedicated along lot lines. The construction of a trail at this location would be approximately 300 feet long.
- Rosepark Drive to Rosemont Road: Rosepark Drive is a long cul-de-sac. A connection from the end of the cul-de-sac to Rosemont Road would provide shorter, more direct access for travel southeast on Rosemont Road. Right-of-way is not available for this connection and would have to be dedicated along lot lines.
- Hillcrest Court to Marylhurst Drive: A connection from Hillcrest Court to Marylhurst Drive would reduce the walking distance to Willamette Drive for residents of Hillcrest Court and other residents west of Hillcrest. There is a significant slope at this location, and right-of way is not available.

Connectivity Analysis

Technical Memorandum #5 identifies the “Excellent/Good/Fair/Poor” rating for pedestrian facilities based on the roadway characteristics. These ratings can be reviewed at a network level to identify the continuous network of “good” or “excellent” facilities and which essential destinations lack pedestrian access via a “fair” or better pedestrian facility. This analysis helps identify gaps in the pedestrian network that should be prioritized in order to create a more robust network of continuous high quality facilities. *The results of the Pedestrian Level of Traffic Stress will be presented upon receiving roadway information from the City.*

BICYCLE SYSTEM NEEDS

Bicycle facilities, such as on-street bike lanes, shared roadway pavement markings, multi-use paths and trails, bicycle crossings, bicycle parking, and wayfinding signage, are essential elements of the City’s bicycle system. While these facilities are currently provided along many City streets, there are many more streets where these facilities are needed to improve access to transit and essential destinations within the City, consistent with Section 3.08.140 of the RTFP. The following provides a summary of the bicycle system needs within West Linn and is based on information provided in previous planning documents as well as a review of the transportation system.

As described below, the most common overall need is to provide a safe and interconnected system that affords the opportunity to consider the bicycle mode of travel, especially for trips up to three miles in length. Because of the length of the trip, bicycle lanes and multi-use paths and trails both provide good accommodations for these trips. Many shorter bicycle trips can also be made on roadways with shared use pavement markings or local streets without additional accommodations for bicycles or via connections to arterials and collectors with bicycle facilities. The bicycle system needs can be categorized into two areas: Connectivity and Access. The Connectivity component creates a continuous web of on-street bicycle lanes and off-street facilities and amenities such as bicycle parking and wayfinding signs, while the Access component ensures that the bicycle network provides access to key destinations within the city, such as to transit facilities and to major bicycle generators and attractors such as schools and parks. Both of these categories are described in this section.

System Connectivity

A well-connected bicycle system provides continuous bike lanes and other bicycle facilities between essential destinations, such as residential neighborhoods, schools, parks, libraries, and retail/commercial centers. Strategies to improve bicycle connectivity include identifying, prioritizing, and ultimately constructing new on-street bicycle lanes, shared-use pavement markings, bicycle crossings, multi-use paths and trails, and bicycle parking.

On-street Bicycle Lanes

Several of the arterial and collector streets within West Linn need new on-street bike lanes and/or other bicycle facilities to improve connectivity. Figure 5 illustrates the bicycle system. As shown, there are two prominent north/south roadways that currently provide bicycle lanes in the city – Willamette Drive and Salamo Road. However, these facilities are not well connected by other facilities that could allow for travel to other areas within the city, particularly to the east and west. Also shown in Figure 5, there are no bike facilities on Rosemont Road, Skyline Drive, Sunset Avenue, and many other arterials streets, or on Ostman Road, Blankenship Road, Tannler Drive, Pimlico Drive, and many other collector streets.

While the City of West Linn street standards include bicycle lanes along both sides of arterial and select collector streets, it may not be feasible or cost effective to construct on-street bike lanes along both sides of all streets. Some streets may be suitable for bikes to share the roadway while others could have a parallel multi-use trail that could accommodate two directions of bicycle travel. Marylhurst Drive, for example, has significant grade and topography issues that may limit the ability to construct on-street bike lanes or other bicycle facilities. Further evaluation of these streets will be provided in Technical Memorandum 10: Transportation Solutions.

Bicycle System Needs
West Linn, Oregon

Figure
5

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Transportation Engineering/Planning

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA

Many of the bicycle projects identified in previous TSP's as well as other planning documents have not been constructed and are therefore still needed. These system gaps along with additional needs identified through a review of the transportation system are shown in Table 3. The gaps identified are based on the existing design standards that include bicycle lanes on all collectors and arterials.

Table 3: Bicycle System Gaps

Street Name	From	To	SRTS – Memo 6	On-street Connection – Trails Master Plan	SRTS – Trails Master Plan
10th Street	Blankenship Road	8th Avenue	No	Route 70	No
12th Street	Tualatin Avenue	Willamette Falls Drive	Yes	Route 52	Yes
Blankenship Road	Ostman Road	Debok Road	No	Route 71	No
Buck Street	Elliot Street	Failing Street	No	Route 2	Yes
Carriage Way	Rosemont Road	Suncrest Drive	No	Route 25	No
Cedar Oak Drive	Willamette Drive	Old River Drive	No	Route 33	Yes
Cornwall Street	Sunset Avenue	Oxford Street	No	Route 28	No
Debok Road	Tamarisk Drive	Margery Street	No	Route 45	No
Dillow Drive	Larson Avenue	Failing Street	No	Route 2	Yes
Elliot Street	Buck Street	Willamette Drive	No	Route 2	Yes
Elmran Drive	Old River Drive	Nixon Avenue	No	Routes 34, 89, 33, and 92	Yes (Route 33)
Failing Street	Dillow Drive	Buck Street	No	Route 2	Yes
Hidden Springs Road	Santa Anita Drive	Willamette Drive	No	Route 32	Yes
Hillcrest Drive	Marylhurst Drive (west)	Marylhurst Drive (east)	No	No	No
Hood Street	Cascade Street	Willamette Drive	No	No	No
Johnson Road	Woodbine Road	Blankenship Road	No	Routes 50 and 51	No
Jolie Point Road	Willamette Drive	Larson Avenue	No	Route 38	No
Lancaster Street	Summer Run Drive	Exeter Street	No	No	No
Larson Avenue	Jolie Pointe Road	Dillow Drive	No	Route 87	No
Mapleton Drive	Willamette Drive	Nixon Avenue	No	Route 38	No
Marylhurst Drive	Hillcrest Drive (west)	Willamette Drive	No	Route 22	No
McKillican Street	West A Street	Willamette Drive	No	Route 42	No
Nixon Avenue	Elmran Drive	Mapleton Drive	No	Route 88	No
Ostman Road	Blankenship Road	Dollar Street	No	Routes 46 and 47	No
Parker Road	Noble Lane	Dillon Lane	No	Route 4	No
Pimlico Drive	Santa Anita Drive	Willamette Drive	No	Route 12	No
Rosemont Road	Carriage Way	Hidden Springs Road	Yes	Route 68	Yes
Rosemont Road	Bay Meadows Drive	Furlong Drive	Yes	Route 64	No
Rosemont Road	Santa Anita Drive	Summit Street	No	Route 60 and 63	No
Salamo Drive	10th Street	Barrington Drive	No	Route 72	No
Santa Anita Drive	Hidden Springs Road	Rosemont Road	Yes	Route 36	Yes
Simpson Street	Long Street	Sunset Avenue	No	Route 31	No
Skyline Drive	Summit Street	West A Street	No	Routes 9 and 10	No
Summit Street	Skyline Drive	Oxford Street	No	Routes 28 and 63	No
Suncrest Drive	Hillcrest Drive	Carriage Way	No	No	No
Sunset Avenue	Cornwall Street	Willamette Falls Drive	No	Route 3	No
Tannler Drive	Blankenship Road	Bland Circle	No	Route 75	No
Tualatin Avenue	14th Street	12th Street	No	Route 52	Yes

Street Name	From	To	SRTS – Memo 6	On-street Connection – Trails Master Plan	SRTS – Trails Master Plan
Willamette Drive	I-205 southbound ramps	McLoughlin Boulevard	No	Route 58	No
Willamette Falls Drive	Dollar Street (West)	West A Street	No	Route 1	No

The bicycle network gaps shown in Table 3 will be evaluated based on the TSP goals, targets, and evaluation criteria, and input from City staff and local citizens, to determine the highest priority projects for the financially constrained plan.

Shared-Use Streets

Arterials and collectors designated to include bike facilities do not fully address bicycle travel needs in and around the city. Bicycle trips can and should be accommodated on lower traffic volume streets that offer parallel or alternative routes to collectors and arterials. Many trips occur on local streets that connect to parks, schools, and retail activity centers. There is a need for designated routes that accommodate these trips. These facilities could be considered a "shared" facility or could have a specific designation such as a "bike boulevard" where treatments area applied to the roadway to enhance the bicycle environment and/or make additional connections to bicycle destinations.

There are several low volume collector roadways where shared roadway pavement markings could be used to improve access and circulation for bicyclists, including:

- Clark Street between Skyline Drive and Windsor Terrace;
- Dollar Street between the West City Limit and Willamette Falls Drive; and,
- Old River Road between the North City Limit and Willamette Drive

Bicycle Crossings

Intersections can be potentially unsafe locations in the bicycle network, as there are more conflict points with right- and left-turning vehicles and cross street traffic. There are various configurations for right-turn lanes, and the desired configuration is to have the right-turn lane to the right of the bicycle lane, with right-turning vehicles yielding to through cyclists as they cross the bicycle lane. The following summarizes the intersections where there is a need for improvements to the crossing configurations for bicycle lanes approaching the intersection.

- Willamette Drive/I-205 ramp - Southbound Right
- Santa Anita Drive/Hidden Springs Road

Bicycle Parking

The availability of bicycle parking is an important component of a well-designed bicycle system. Lack of proper storage facilities discourages potential riders from traveling by bicycle. Bicycle racks should be located at significant activity generators including schools, parks, and commercial areas. Racks should be placed in highly-visible locations and within convenient proximity to main building entrances. Bike racks should be designed to provide two points of contact to the bicycle (e.g., so the user can lock both the wheel and the frame to the rack). Bike lockers or other storage facilities would be helpful at locations where long-term parking is expected, such as major employment centers. The attractiveness of bike parking may also be improved by providing covered parking and/or secured facilities where bicycles may be locked away. The City currently does not require bicycle parking at commercial uses or near transit tops. However, Chapter 48.150 of the West Linn Community Development Code does include provisions for bicycle facilities and parking associated with private development, including a potential reduction in vehicle parking requirements based on the provision of bicycle parking.

Connectivity Analysis

Bicyclists are a varied group of people with different skill levels, abilities, bicycling experience, and trip types. Their needs and comfort level with the City of West Linn's bicycle infrastructure vary as a result of these differences. Technical Memorandum #5 identifies the four levels of traffic stress that a bicyclist can experience on the roadway, ranging from LTS 1 (which represents little traffic stress) to LTS 4 (which represents high stress). Each LTS corresponds to a different bicyclist group, each with their own comfort levels for bicycling in the City. The City should accommodate these user types by providing adequate facilities for the majority of its users. There are multiple bicycle facility types available for the city to construct which appeal to the different user types (see Solutions section below). For instance, multi-use paths are often favored by less experienced or recreational users (LTS 1 or 2), while bike lanes on major roads tend to be used by commuters and other more experienced users (LTS 3 or 4). This analysis helps identify gaps in the bicycle network that should be prioritized in order to create a more robust network of continuous low stress facilities. The following summarizes the results of the LTS analysis for streets with LTS 3 or higher.

The results of the LTS analysis indicate that there are four street segments at LTS 3 within the City, including most of Parker Road, most of Salamo Drive, a segment of Willamette River Drive, and most of Willamette Drive. Parker Road, Salamo Drive, and Willamette Drive were identified as LTS 3 due to the 6-foot bike lane on a 35 mph roadway. In order to reduce these roadways to LTS 2 or below, the roadway speed could be reduced to 30 mph or lower, or the bike lane could be widened to 7 feet or wider. The bike lane could also be converted to a separated bike path. The segment of Willamette Falls Drive was identified as LTS 3 due to the mixed traffic conditions on a 30 mph roadway with no sharrows. In order to reduce this segment to a LTS 2 or below, the roadway speed could be reduced to 25 mph or lower, or a bike lane could be striped on the roadway.

The results of the LTS analysis also indicate that there are six street segments at LTS 4 within the City, including two segments of Rosemont Road, a segment of Parker Road, a segment of Salamo Drive, a segment of Willamette River Drive, and a segment of Willamette Drive. All of the segments with LTS 4 are mixed traffic roadways with speed limits ranging from 35 to 45 mph. In order to reduce these roadways to LTS 2 or below, the roadway speed could be lowered 5o 30 mph or lower, or a bike lane could be striped on the roadway.

TRANSIT SYSTEM NEEDS

Fixed-Routes

TriMet Lines 35 and 154 provide a basic level of transit service to West Linn. The locations of these routes are convenient for people with access to Willamette Drive and to Willamette Falls Drive, but are not located within a convenient walking distance (typically assumed to be up to one quarter-mile) for the majority of city residents such as those that live in Tanner Basin and neighborhoods along Rosemont Road.

Lines 35 and 154 both provide access to the Oregon City Transit Center. From the Oregon City Transit Center access is provided to six additional bus lines that provide connections to Milwaukie, southeast Portland, and downtown Portland as well as to the Clackamas Town Center and to Canby Transit. The MAX light rail system can be accessed in downtown Portland as well as at Clackamas Town Center to travel around the region including to Portland International Airport.

Line 35 also provides connections to the Lake Oswego Transit Center. From the Lake Oswego Transit Center access is provided to three additional bus lines that provide connections to downtown Portland, the Tigard Transit Center (which connects to the Beaverton to Wilsonville Commuter Rail line), and the Tualatin Park and Ride. To access the Tualatin City Center, Tualatin Transit Center, or Wilsonville, a transfer must be made at the Tualatin Park and Ride. Travel from West Linn to the Tualatin Transit Center requires either a 90 minute trip with one transfer in downtown Portland or a 70-80 minute trip with two transfers including Lake Oswego and one other location in either Beaverton or Tigard. More efficient services are needed to access major employment centers and transit centers in Tualatin and Wilsonville. In addition, many West Linn residents feel the City is not well served by public transit. With only one major trunk line and the access provided along Willamette Falls Drive, residents perceive that they are not able to easily move within or out of the City on public transit. Provision of service is hampered by topography and a lack of east-west routes.

Transit Stops

Amenities at transit stops, such as bus benches and bus shelters, enhance a transit system and make it more user-friendly. Steps that can make this mode as comfortable and accommodating as possible may help encourage ridership. TriMet generally limits placement of bus shelters to locations with 35 or more weekday boardings. Ridership data was obtained from TriMet that reflects the average number of boardings and alightings that occurred at each stop in West Linn in Fall 2014. Based on a review of the data, West Linn has two stops that meet this threshold, but do not currently have shelters. These stops include:

- Stop 6319: Willamette Drive & Hidden Springs Road
- Stop 6339: Willamette Drive & McKillican Road

Due to low ridership levels at other stops, the City may need to directly fund the installation of bus benches, bus shelters and other amenities.

Transit Level-of-Service Analysis

The transit level-of-service analysis was performed in accordance with the methodology described in TCRP Report 100: Transit Capacity and Quality of Service Manual (TCQSM). Of the six available measures, three were selected for this analysis as being most relevant to a long-range planning effort, including service frequency, hours of service, and service coverage. Table 4 summarizes the TCQSM measures used and the ranges of values used to determine the LOS result for each measure.

Table 4: Transit Capacity and Quality of Service Manual - Level of Service (LOS) Measures

Level of Service	Transit Capacity and Quality of Service Measures		
	Service Frequency (minutes)	Hours of Service	Service Coverage
LOS A	<10	19-24	90.0-100.0%
LOS B	10-14	17-18	80.0-89.9%
LOS C	15-20	14-16	70.0-79.9%
LOS D	21-30	12-13	60.0-69.9%
LOS E	31-60	4-11	50.0-59.9%
LOS F	>60	0-3	<50.0%

It is important to note that high LOS values, such as LOS A or B, may not reflect optimal service from the transit agency's perspective, because the market may not support those service levels. The development of agency service standards helps to bridge the gap between the kind of service passengers would ideally want and the kind of service that is reasonable to provide, given available resources.

Service Frequency

From the user's perspective, service frequency determines how many times an hour a user has access to transit service, assuming that service is provided within acceptable walking distance and at the times the user wishes to travel. Service frequency also measures the convenience of transit service to choice riders and is one component of overall transit trip time. Table 5 summarizes the transit level-of-service analysis results for service frequency.

Table 5: Service Frequency Level-of-Service Analysis – Northwest County

Provider	Routes	Peak/Off-Peak	Service Frequency	LOS
TriMet	Line 35	Peak	20-30 minutes	C-D
	Line 154	Peak	70 minutes	F

As shown, Line 35 currently operates at LOS C-D, while Line 154 operations at LOS F. At LOS C, service frequencies provide a reasonable choice of travel times, but the wait involved if a bus is missed becomes long. At LOS D, service is only available about twice per hour and requires passengers to adjust their routines to fit the transit service provided. At LOS F, service is provided frequencies greater than 1 hour, which entails creative planning or considerable wasted time on the part of passengers.

Hours of Service

Hours of service, also known as "service span," is the number of hours during the day when transit service is provided along a route, a segment of a route, or between two locations. It plays an important a role in determining the availability of transit service to potential users. If transit service is not provided at the time of day a potential passenger needs to take a trip, it does not matter where or how often transit service is provided the rest of the day. Table 6 summarizes the transit level-of-service analysis results for hours of service.

Table 6: Hours of Service Level-of-Service Analysis

Provider	Routes	Hours of Service	LOS
TriMet	Line 35[1]	19 hours	A
TriMet	Line 154[2]	12 hours	D

As shown, Line 35 currently operates at LOS A, while Lone 154 operates at LOS D. At LOS A service is available for most or all of the day. Workers who do not work traditional 8-to-5 jobs receive service and all riders are assured that they will not be stranded until the next morning if a late-evening bus is missed. At LOS D, service meets the needs of commuters who do not have to stay late and still provides service during the middle of the day for others.

Service Coverage

Service Coverage is a measure of the area within walking distance of transit service. Areas must be within 1/4-mile of a bus stop or 1/2 mile of a transit station to be considered an area served by transit. As with the other availability measures, service coverage does not provide a complete picture of transit availability by itself, but when combined with frequency and hours of service, it helps identify the number of opportunities people have to access transit from different locations. Service coverage LOS evaluates the percentage of transit-supportive areas—areas that would typically produce the majority of a system's ridership—that are served by transit.

To qualify as a transit-supportive area (TSA) one of the following thresholds must be met:

- Minimum population density of 3 households/gross acre; or
- Minimum job density of 4 employees/gross acre.

Service coverage is an all-or-nothing issue for transit riders—either service is available for a particular trip or it is not. As a result, there is no direct correlation between service coverage LOS and what a passenger would experience for a given trip. Rather, service coverage LOS reflects the number of potential trip origins and destinations available to potential passengers.

Figure 6 displays the transit level-of-service analysis results for service coverage based on population and employment estimates by Transportation Analysis Zone (TAZ) in the Metro 2010 travel demand model. Areas defined as transit supportive that have service are shown in green. Areas defined as transit supportive that are lacking service are shown in red. Areas that have transit service, but do not qualify as a TSA, are shown in orange. A majority of the areas shown in red would require additional transit routes or the development of new pathway connections to existing transit routes in order to be served.

The percentage of TSA's served in West Linn and the corresponding level of service has been identified using the Transit Level of Service (TLOS) methodology. As shown in Table 7, the percent of transit supportive areas served is less than 50 percent in terms of both households and employment areas. The corresponding LOS is F.

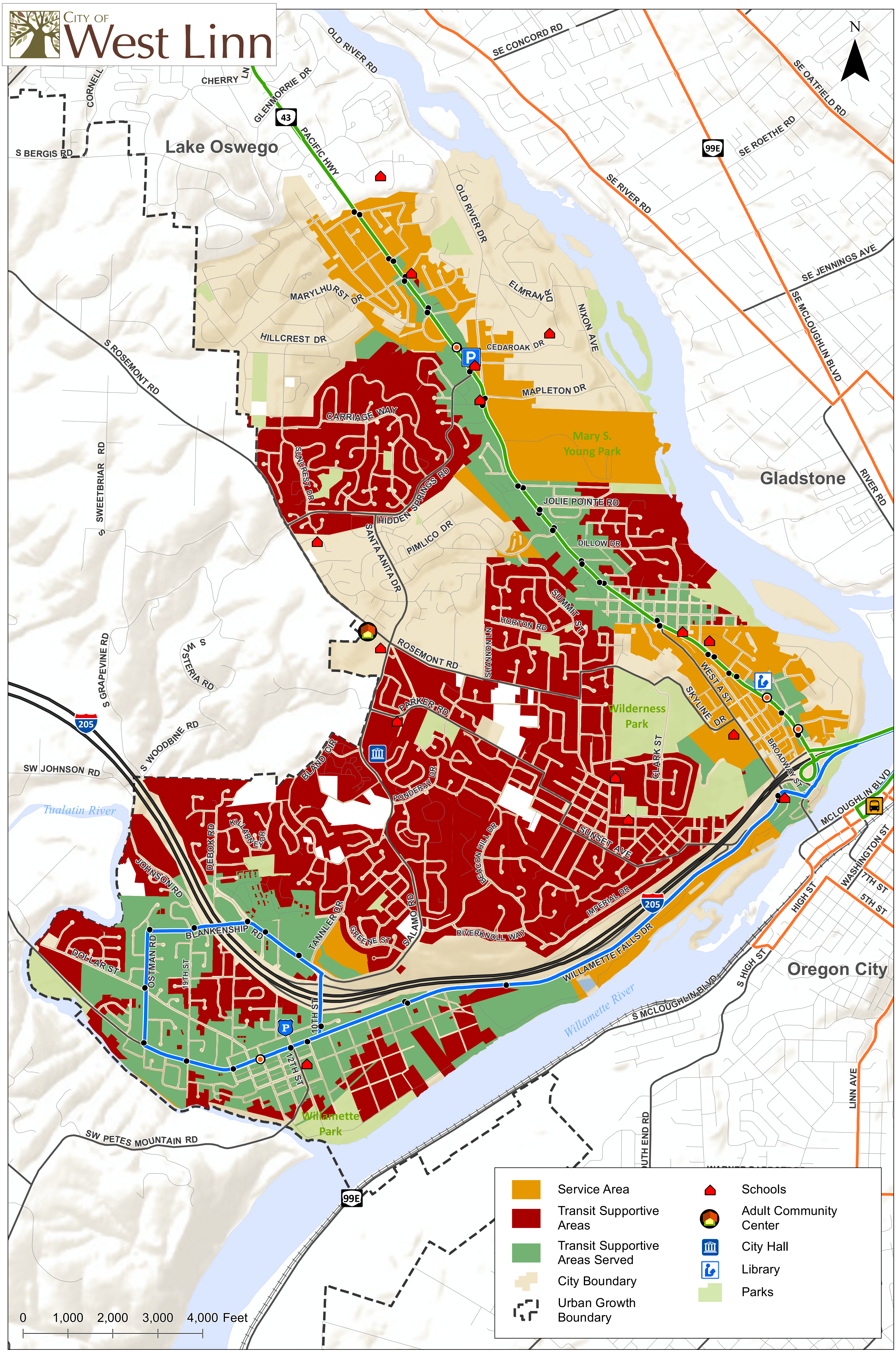
Table 7: Service Coverage Analysis

Area Type	Acres	Population	Households	Employment
Transit Supportive Area (TSA)	2,169	18,663	7,628	3,800
Transit Supportive Areas Served	643	3,995	1,628	3,171
Percent TSA Served by Transit	30%	21%	21%	83%
Level of Service	LOS F	LOS F	LOS F	LOS B
Transit Supportive Areas without service	1,526	14,668	6,000	629

As shown in Table 7, approximately 6,000 households and 629 jobs are located within areas that do not have transit service. These areas currently have a household and/or employment density that can support transit service and therefore should be included in future efforts to improve service routes and stop locations. TriMet's Southwest region Service Enhancement Plan includes changes to Line 154 to include service along Salamo Road and Hidden Springs Road.

Future Transit Service Coverage

The future transit level-of-service analysis assumes that existing service and service coverage is the same in the future. The only difference is the population and employment growth assumptions included in the 2040 regional traffic model and the resulting transit supportive areas. Figure 7 displays the transit level-of-service analysis results for service coverage. As shown, one additional transit supportive area (located north of Hidden Springs Road) is anticipated in the future. Additional service routes are needed in order to provide service to this area.



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Year 2010 Transit Supportive Areas
West Linn, Oregon

Figure
6

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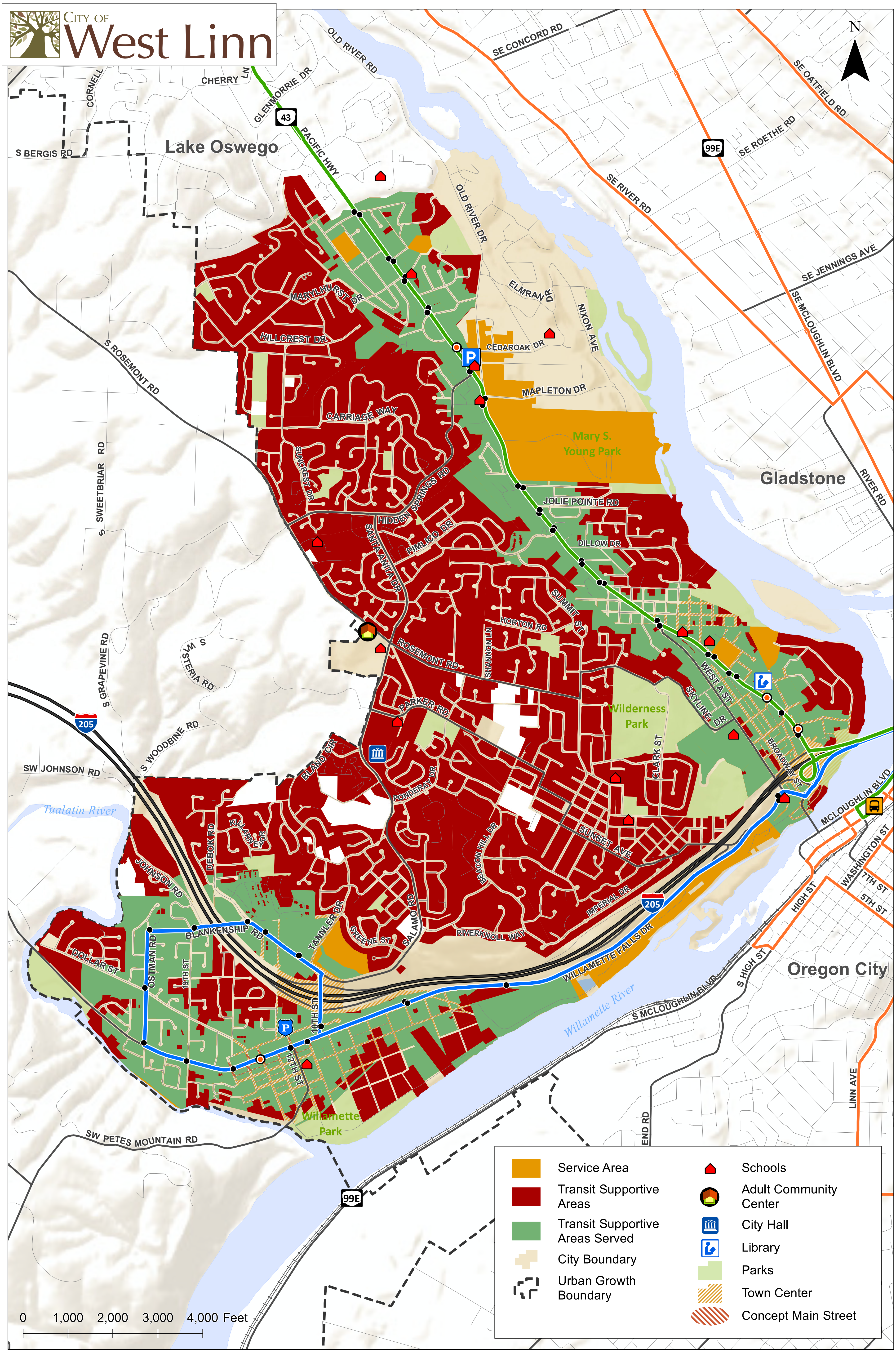
Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA



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Year 2040 Transit Suppoprtive Areas
West Linn, Oregon

Figure
7

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA

As noted above, TriMet's Southwest region Service Enhancement Plan includes changes to Line 154 to include service along Salamo Road and Hidden Springs Road. This change is proposed to eliminate Line 154's connection to the Oregon City Transit Center. Passengers on Line 154 would need to transfer to Line 35 on Willamette Drive to travel south to the Oregon City Transit Center or north to the Lake Oswego Transit Center.

Transit Investment Priorities

The Transit Investment Priorities (TIP) process guides TriMet's investments in bus and rail service. TriMet develops the TIP with input from riders, jurisdictional and community partners, and the general public. The TIP addresses short-term issues as well as the region's long-term transportation and livability goals. The TIP process helps local governments to look for ways to get the most out of TriMet's investments in transit service with their own investments in such things as sidewalks and safe street crossings, and supports their visions for the future. It also shares TriMet's planning process and future plans so that local governments can know how to take advantage of the current and future service they provide. The priorities identified in TriMet's TIP for Fiscal Year 2015 include:

- Making transit better for riders by improving current service, improving the quality of the rider experience through technology information and amenities, enhancing safety, ensuring riders' security, and improving and expanding existing services.
- Planning for the future of transit through service enhancement plans, making new community connections, improving access to transit stops, making fares affordable, and building partners for priorities identified in the region's High Capacity Transit Plan.

The Service Enhancement Plans for the Southwest region include potential changes in the fixed-route services to West Linn, including:

- New Frequent Service between Downtown Portland, Southwest Portland, Lake Oswego, West Linn, and Oregon City on Line 35-Macadam.
- Change Line 154-Willamette route to serve Salamo Road connecting the Willamette Town Center with the West Linn City Hall and the Lake Oswego Transit Center. Serve weekday peak hours only.

The potential change in service to Line 154 would improve service to the Willamette, Savanna Oak, Parker Crest, Rosemont Summit, and Hidden Springs neighborhood in West Linn as well as several essential destinations, including City Hall, the Adult Community Center, and the retail/commercial center located in the southwest corner of the Salamo Road/Parker Road intersection but would require a transfer to Line 35 to get to Oregon City. According to the hierarchy, local service expansion routes in West Linn receive the lowest priority for regional transit funds. However, local transit needs could be met through alternatives to fixed route expansion such as local shuttle services, vanpools, or the phasing of local service capital projects within the West Linn service area in partnership with TriMet.

Regional High Capacity Transit

High capacity transit is characterized by exclusive right-of-way and routes with fewer transit stops. In July 2009, Metro adopted the Regional High Capacity Transit (HCT) System Plan. The HCT Plan identifies corridors where new HCT is desired over the next 30 years and prioritizes corridors for implementation, based on a set of evaluation criteria consistent with the goals of the RTP and 2040 Concept. The location of any final HCT corridor is decided through a corridor refinement plan and/or alternatives analysis, and through a series of local and regional actions described in the plan.

The HCT plan identifies one Next Phase Regional Priority Corridor along the segment of I-205 that travels through West Linn. HCT Corridor 28 will provide service between the Clackamas Town Center, the Oregon City Transit Center, and Washington Square via I-205 and Highway 217. Other HCT Corridors within the area include two Next Phase Regional Priority Corridors in Oregon City. HCT Corridor 8 will provide service between the Clackamas Town Center and the Oregon City Transit Center via I-205 and HCT Corridor 9 will provide service between Park Avenue and the Oregon City Transit Center via McLoughlin Boulevard (OR 99E). Next Phase Regional Priority Corridors are corridors where future HCT investment may be viable if recommended planning and policy actions are implemented. The City of West Linn should work with TriMet to ensure that local transit service continues to provide access to the Oregon City Transit Center and other transit centers where HCT routes are planned.

Transportation Disadvantaged

The primary transportation disadvantaged populations in West Linn are those too old or too young to drive. Therefore, access to schools and other essential destinations should be prioritized to serve these populations. As the population continues to age, the needs of the elderly and disabled are expected to increase.

The Mary’s Wood Shuttle serves the residents of the Mary’s Woods at Marylhurst, a senior community to the north of West Linn. It is operated by Mary’s Woods at Marylhurst in partnership with TriMet Ride Connection and consists of two lines- the Green Line to Oregon City and the Blue Line to Lake Oswego. The Green Line travels through West Linn along Willamette Drive between Mary’s Woods and Oregon City, though there are no official stops aside from the occasional drop-off at key locations like supermarkets. TriMet Ride Connection may consider rerouting the service route to serve the residents of the Adult Community Center in West Linn at the intersection of Santa Anita Drive and Rosemont Road. The City of West Linn should continue to support the Clackamas County Transportation Consortium services to the elderly and ADA-eligible residents, and other services currently being provided. Also, because needs are expected to increase, West Linn should work with existing providers to assess the needs and develop ways to best meet them.

Some inexpensive ways in which the city of West Linn can assist in promoting the services currently offered to the elderly and disabled are to post notices on their public bulletin boards, and to use meetings with the public to make notices and fliers available.

MOTOR VEHICLE SYSTEM NEEDS

System Connectivity

A well-connected motor vehicle system minimizes the need for out-of-direction travel while supporting an efficient distribution of travel demand among multiple parallel roadways. The most common example of an efficient transportation network is the traditional grid system, with north-south and east-west streets spaced at generally equal distances. While most of West Linn does not have a traditional grid system, there are a number of north-south and east-west streets that provide connectivity on a regional level as well as access within West Linn. The following sections highlight the needs associated with street system connectivity within West Linn.

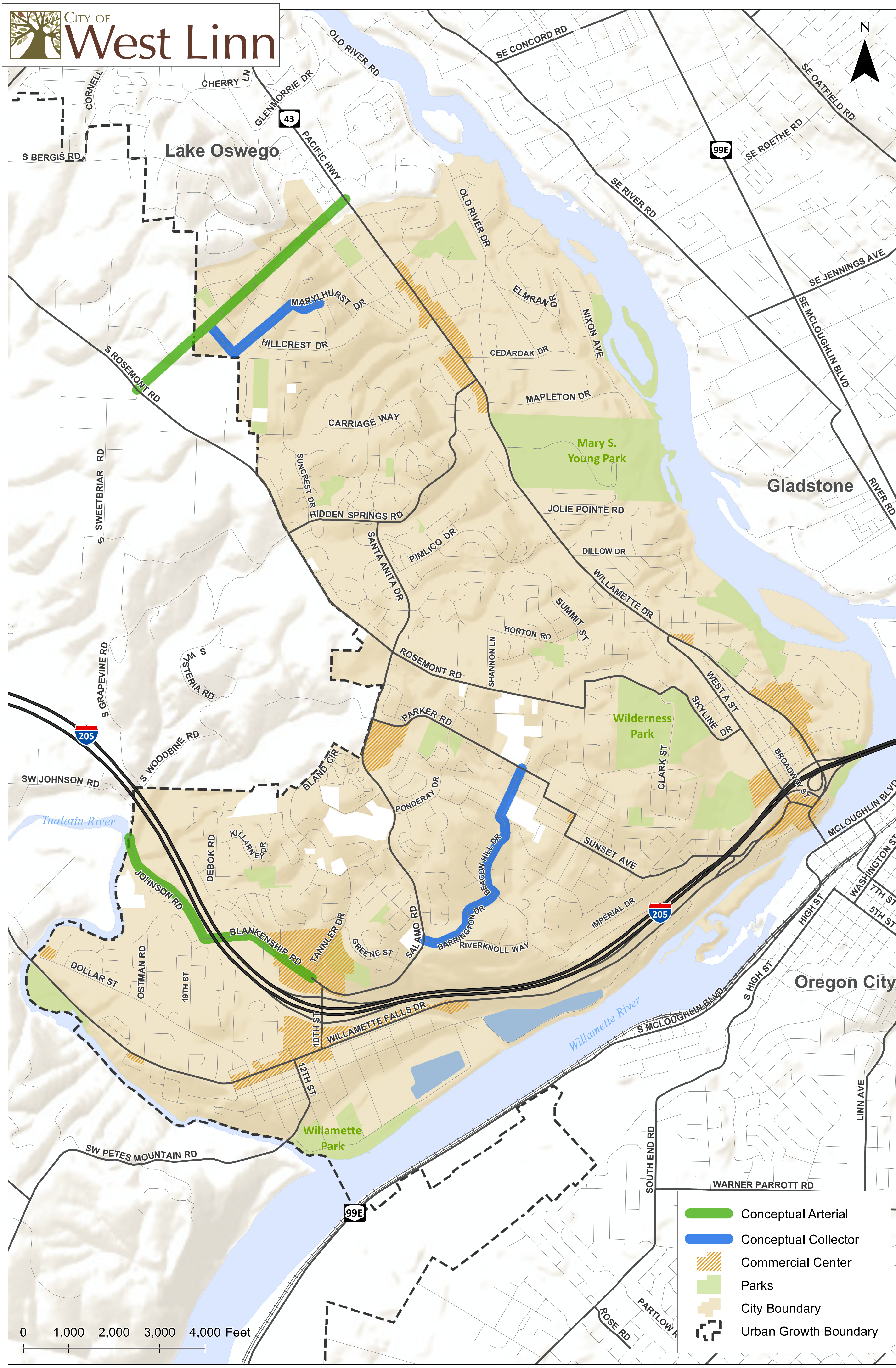
Arterial Street Connectivity

Arterial streets within West Linn consist of major arterials and minor arterials. While there are several minor arterials located throughout the City, Willamette Drive is the only major arterial. Based on the RTP, arterials are intended to provide general mobility for travel within the region as well as connect major commercial, residential, industrial, and institutional centers. Arterials are usually spaced about 1-mile apart and are designed to accommodate motor vehicle and truck traffic as well as pedestrians, bicyclists, and transit riders. Figure 8 illustrates the needs associated with the arterials street system within West Linn.

As shown in Figure 8, few of the arterials streets meet the RTP's arterial spacing guidelines. Also, there appears to be the need for an additional arterial that connects Rosemont Road to Willamette Drive approximately 1-mile north of Hidden Springs Road and an additional arterial that connects West Linn to rural Clackamas County approximately 1-mile west of Rosemont Road – this potential arterial could follow existing segments of Blankenship Road and Johnson Road as shown in Figure 8. The other potential arterial, however, would have significant right-of-way and development costs as well as impacts to existing developments and the natural environment. Given the significant constraints associated with this connection, the TSP update should focus on opportunities to improve local street connectivity as well as maximize and improve the pedestrian, bicycle, and public transportation systems along existing arterials as described below.

Collector Street Connectivity

The RTP identifies collector streets as general access streets for neighborhood circulation and as support streets for the regional transportation network. Connectivity at this level is especially important for pedestrian and bicycle trips. The RTP recommends a maximum spacing of 1/2 mile for collectors in order to encourage local traffic to use them instead of higher order facilities. Figure 8 illustrates the existing deficiencies in the collector street system.



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Arterial and Collector Street Connectivity
West Linn, Oregon

Figure
8

Kittelson & Associates, Inc.
Transportation Engineering/Planning

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: Esri, USGS, NOAA

As shown in Figure 8, few of the collector streets meet the RTP's collector spacing guidelines. Also, there appears to be the need for an additional collector that extends north from Marylhurst Drive to the new arterial connection described above – this potential connection could follow existing segments of Marylhurst Drive – and one that connects Salamo Road to Parker Road – this potential connection could follow existing segments of Barrington Drive, Beacon Hill Drive, and Beacon Hill Court. Each of these potential connections would enhance the north-south and east-west connectivity within the city and reduce reliance on the arterial street system.

Local Street Connectivity

The City of West Linn's many cul-de-sacs, steep topography, and major facilities such as Willamette Drive and I-205 limit intercity connectivity. Therefore, many intercity trips are forced to travel along the few through streets that do connect across these barriers. By providing connectivity between neighborhoods, out-of-direction travel and vehicle miles traveled (VMT) can be reduced, accessibility between various travel modes can be enhanced and traffic levels can be balanced among various streets. Additionally, public safety response time can be reduced.

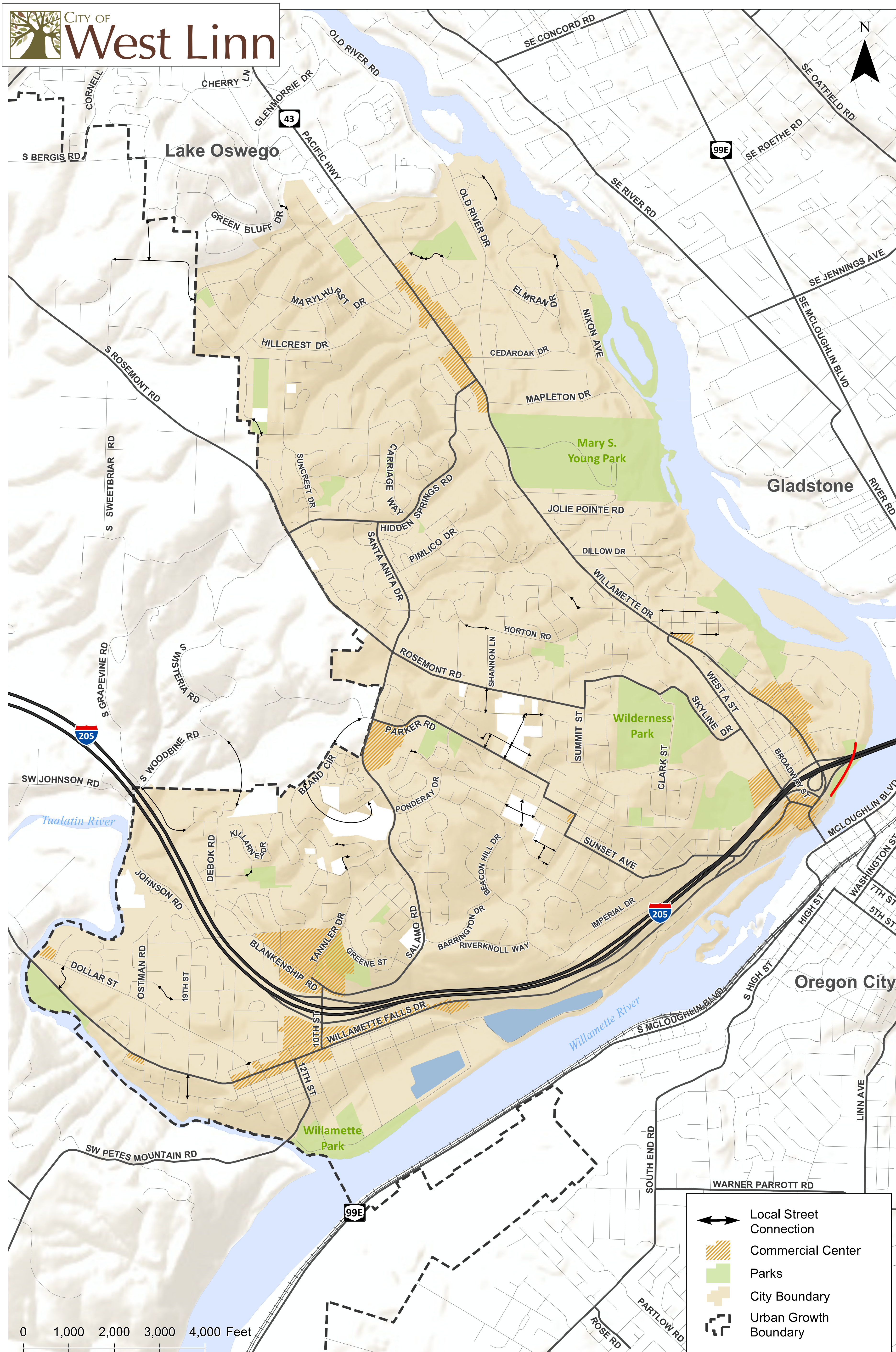
Some of the congestion on roads such as Rosemont Road, Salamo Road, and Hidden Springs Road could be improved through improved local street connectivity. Improved connectivity in the area east of Willamette Drive and in the Tanner Basin area can provide circulation to existing or future traffic signals that will result in less delay and better safety for access to the highway. Several short roadway connections will be needed within neighborhood areas to connect disjointed local streets and to reduce out-of-direction travel for vehicles, pedestrians and bicyclists.

The local street connectivity needs are shown in Figure 9. In most cases, the improvements would involve the changing of a streets functional classification from local street to neighborhood route. In limited cases, a short length of new road would be necessary for improved connectivity. The arrows on Figure 9 represent recommended connections and the general direction for the placement of the connection in existing configurations. In each case, the specific alignments and design may be modified dependent upon future development review.

The criteria for providing local connections are based on the Metro RTP requirements for new residential or mixed-use developments.

- Every 330 feet, a grid for pedestrians and bicycles (may include paved roadway or trails)
- Every 530 feet, a grid for automobiles (local street or higher classification)

The arrows shown on Figure 9 indicate local and neighborhood connections only, some of which are currently underway. Local connections for existing stub end streets, cul-de-sacs, or extended cul-de-sacs in the road network are, for the most part, not identified on this figure. Pedestrian connections from any cul-de-sac should be considered mandatory as future development and redevelopment occurs. The goal is to continue to improve connectivity for all modes of transportation.



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Local Street Connectivity
West Linn, Oregon

Figure
9

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Kittelson & Associates, Inc.
Transportation Engineering/Planning

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Data Sources: City of West Linn, Metro Data Resource Center
Terrain Sources: USGS, ESRI, TANA, AND

As new development occurs, the opportunities identified in Figure 9 should be considered to create a more efficient network consistent with the RTP guidelines. It should be noted that the primary constraint associated with each of the opportunities shown in Figure 9 is that they are located on private property and will likely only occur as part of new development.

Intersection Performance and Capacity Needs

The intersection performance and capacity needs described below are based on the analysis prepared as part of the 2008 TSP update. This section identifies study area intersection deficiencies resulting from increases in vehicle volumes as forecasted by the 2040 financially constrained Metro RTP model for the 2040 base case scenario.

Intersection Capacity Analysis

The traffic operations analysis prepared as part of the previous TSP update found that many of the study intersections did not meet or were not expected to meet their respective mobility standards under existing (2015) and/or future (2040) traffic conditions. Based on the analysis, motorists are expected to experience high levels of congestion and delay at these intersections without additional improvements to the existing transportation system. The results of the analysis are summarized in Table 8.

Traffic Signal Warrants

Traffic signal warrants were conducted as part of the 2008 TSP update for the unsignalized study intersections that were not expected to meet operational standards in the 2040 base case. The intersections that were found to meet the traffic volume warrant for signalization under existing (2015) and base case (2040) are listed in Table 9.

On arterial streets, signals should generally be spaced at least 1,000 feet apart for efficient operation, but signalizing some of the intersections that meet signal warrant would result in shorter spacing. A detailed traffic engineering evaluation must be conducted to evaluate site conditions, signal spacing, and all warrants before the installation of any traffic signal. ODOT signal design and signal phasing guidelines should be followed for all new traffic signal installations. ODOT typically requires an 8-hour warrant to be met. ODOT also requires other improvements, such as channelization to be considered prior to installing a signal.

Table 8: Weekday PM Peak Hour Intersection Level of Service

Map ID	Intersection	Existing (2015)[1]			Future Base Case (2040)[1]			Mobility Standard		
		LOS	Average Delay (Sec)	Volume/ Capacity (v/c)	LOS	Average Delay (Sec)	Volume/ Capacity (v/c)	Agency	Minimum	Standard Met?
Signalized Intersections										
2	Highway 43/Marylhurst Drive-Lazy River Drive	B	16.3	0.8	C	26.7	0.94	ODOT	v/c 0.99	Yes
4	Highway 43/Cedaroak Drive	B	10.4	0.65	B	18.3	0.82	ODOT	v/c 0.99	Yes
5	Highway 43/Hidden Springs Road	C	25	0.83	D	42.8	1	ODOT	v/c 0.99	No
8	Highway 43/West A Street	B	12.5	0.74	C	31.1	0.97	ODOT	v/c 1.1	Yes
12	Highway 43/Hood Street-McKillican Street	C	23.6	0.76	E	62.7	1.07	ODOT	v/c 1.1	Yes
13	Highway 43/I-205 SB Ramp	C	26.5	0.85	E	69.1	>1.0	ODOT	v/c 0.85	No
14	Highway 43/I-205 NB Ramp	A	8	0.3	B	10.2	0.41	ODOT	v/c 0.85	Yes
19	Salamo Road/Rosemont Road[2]								LOS D	
25	10th Street/Blankenship-Salamo Road	B	18.2	0.53	CF	21.50	0.59	ODOT	v/c 0.85	Yes
26	10th Street/I-205 SB Ramp	C	30.9	0.53	D	36.3	0.65	ODOT	v/c 0.85	Yes
27	10th Street/I-205 NB Ramp	B	13.6	0.53	B	18.6	0.63	ODOT	v/c 0.85	Yes
All-Way Stop Controlled Intersections										
20	Rosemont Road/Summit Street	A	9.2	0.37	B	12.2	0.57	City	LOS D	Yes
21	Sunset Avenue/Cornwall Street	A	7.6	0.15	A	7.8	0.16	City	LOS D	Yes
29	Willamette Falls Drive/10th Street	D	29.7	0.84	F	>80.0	>1.0	City	LOS D	No
Unsignalized Intersections										
1	Highway 43/Arbor Drive	B/F	>50.0	0.03/0.37	B/F	>50.0	0.04/>1.0	ODOT	v/c 0.99	No
3	Highway 43/Walling Way	B/E	42.2	0.04/0.21	B/F	>50.0	0.00/0.92	ODOT	v/c 0.99	Yes
6	Highway 43/Jolie Pointe Road	A/E	47.3	0.03/0.22	B/F	>50.0	0.12/>1.0	ODOT	v/c 0.99	No
7	Highway 43/Pimlico Drive	B/F	>50.0	0.16/>1.0	C/F	>50.0	0.37/>1.0	ODOT	v/c 0.99	No
9	Highway 43/Holmes Street	B/F	>50.0	0.02/0.65	B/F	>50.0	0.03/>1.0	ODOT	v/c 0.99	No
10	Highway 43/Lewis Street	B/E	40	0.01/0.15	B/F	>50.0	0.01/0.54	ODOT	v/c 0.99	Yes
11	Highway 43/Burns Street	B/F	>50.0	0.23/>1.0	D/F	>50.0	0.49/>1.0	ODOT	v/c 1.1	No
15	Highway 43/Willamette Falls Drive	A/F	>50.0	0.21/>1.0	D/F	>50.0	0.77/>1.0	ODOT	v/c 0.99	No
16	Willamette Falls Drive/Sunset Avenue	A/B	13.6	0.29/0.31	A/E	47.6	0.67/0.74	City	LOS D	No
17	Rosemont Road/Carriage Way	A/C	21.9	0.09/0.21	A/F	>50.0	0.12/0.51	City	LOS D	No
18	Rosemont Road/Hidden Springs Road	A/C	18.6	0.10/0.14	B/F	>50.0	0.07/>1.0	City	LOS D	No
22	Salamo Road/Bland Circle	A/B	38.3	0.00/0.09	A/D	34.6	0.02/0.60	City	LOS D	Yes

23	Salamo Road/Barrington Drive	A/C	15.8	0.04/0.20	A/C	21.8	0.05/0.93	City	LOS D	Yes
35	Salamo Road/Parker Road	A/C	17.0	0.05/0.13	A/F	>50.0	0.13/0.79	City	LOS D	No
24	Blankenship Road/Tannler Drive	A/F	>50.0	0.13/0.52	B/F	>50.0	0.19/>1.0	City	LOS D	No
28	10th Street/8th Avenue	A/F	>50.0	0.13/>1.0	B/F	>50.0	0.18/>1.0	ODOT	v/c 0.99	No
30	Willamette Falls Drive/12th Street	A/C	22.7	0.17/0.23	B/F	>50.0	0.44/>1.0	City	LOS D	No
31	Willamette Falls Drive/Dollar Street (East)	A/C	20.6	0.01/0.21	A/F	>50.0	0.15/0.74	City	LOS D	No
32	Willamette Falls Drive/19th Street	A/B	13.0	0.01/0.04	A/C	17.6	0.01/0.06	City	LOS D	Yes
33	Willamette Falls Drive/Ostman Road	A/C	23.6	0.03/0.06	B/F	>50.0	0.01/0.23	City	LOS D	No
34	Willamette Falls Drive/Dollar Street (West)	A/B	12.1	0.03/0.07	A/F	>50.0	0.13/0.71	City	LOS D	No

1. As described in the existing conditions memo, traffic volumes within West Linn are generally lower today than they were in 2006 and are projected to be lower in 2040 than they were projected to be 2030. Therefore, use of the existing and projected future traffic volumes from the 2008 TSP to evaluate existing (2015) and future (2040) traffic conditions is a conservative.
2. A traffic signal was recently installed at the Salamo Road/Rosemont Road intersection, and therefore the intersection operations from the 2008 TSP are no longer current.

Notes:
LOS = Level of Service
Delay = Average vehicle delay in the peak hour for entire intersection in seconds.
MOE = Measure of Effectiveness

Table 9: Signal Warrant Analysis Results

Intersection	Warrant Met for Existing (2015)[1]?	Warrant Met for Future Base Case (2040)[2]?
Willamette Drive/Arbor Drive	No	No
Willamette Drive/Jolie Pointe Road	No	No
Willamette Drive/Pimlico Drive	No	Yes
Willamette Drive/Holmes Street	No	No
Willamette Drive/Burns Street	Yes	Yes
Willamette Drive/Willamette Falls Drive	Yes	Yes
Willamette Falls Drive/Sunset Avenue/Chestnut Street	No	Yes
Rosemont Road/Carriage Way	No	No
Rosemont Road/Hidden Springs Road	No	Yes
10th Street/8th Avenue-Court	No	Yes
Willamette Falls Drive / 10th Street	Yes	Yes
Salamo Road/Parker Road	No	No
Blankenship Road/Tannler Drive	No	Yes
Willamette Falls Drive/12th Street	No	Yes
Willamette Falls Drive/Dollar Street East	No	No
Willamette Falls Drive/Ostman Road	No	No
Willamette Falls Drive/Dollar Street West	No	No

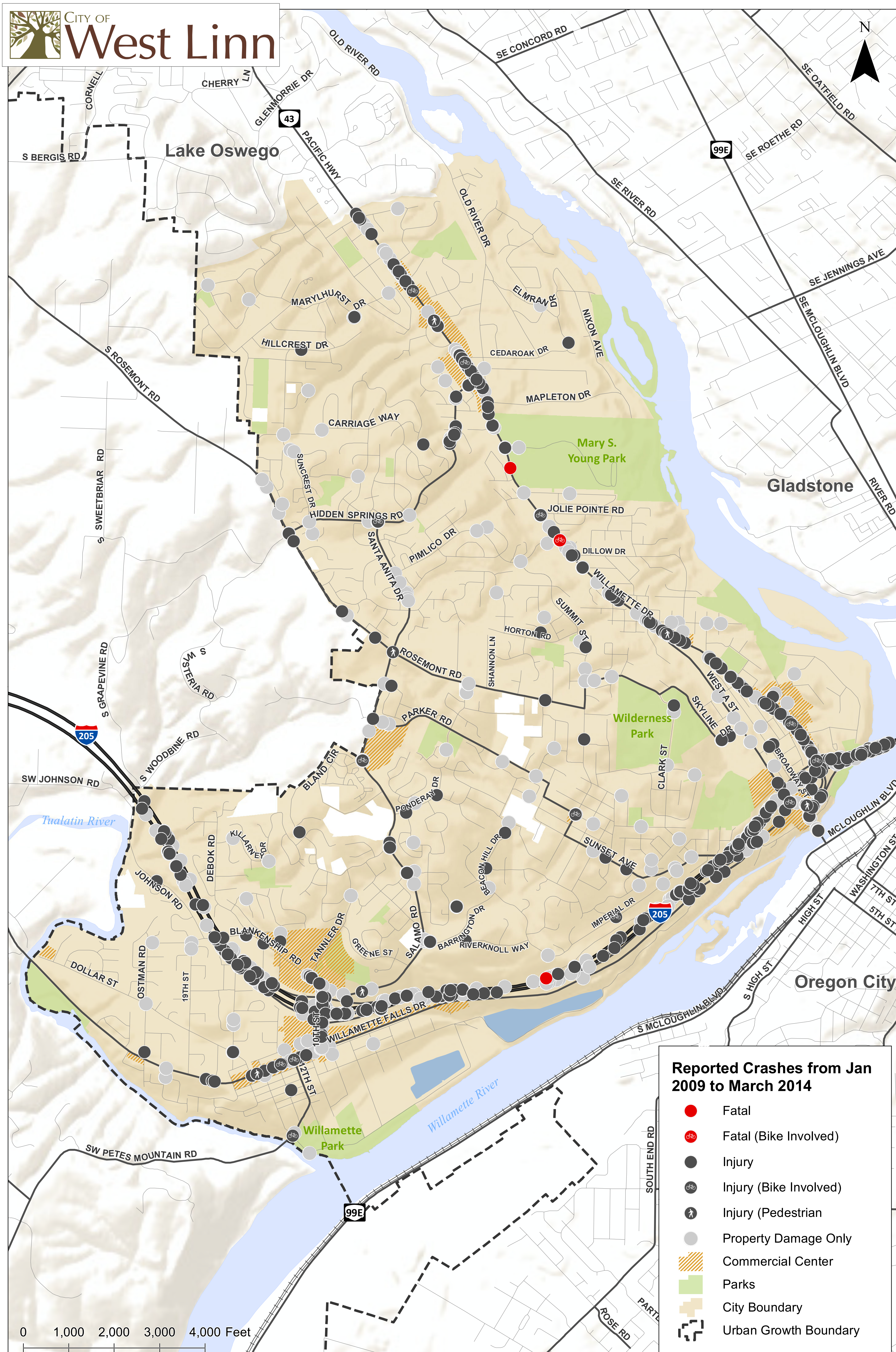
1. As described in the existing conditions memo, traffic volumes within West Linn are generally lower today than they were in 2006 and are projected to be lower in 2040 than they were projected to be 2030. Therefore, use of the existing and projected future traffic volumes from the 2008 TSP to evaluate existing (2015) and future (2040) traffic conditions is a conservative.

Highway 43

As described throughout this memorandum, Highway 43 has a number of transportation-related issues, including a general lack of pedestrian, bicycle, and transit facilities and several intersections and roadway segments that currently operate at or below their respective operating standards. The Highway 43 Conceptual Design Plan, developed by the City of West Linn in coordination with ODOT as part of the 200 TSP update, identifies the needs, deficiencies, and solutions for the portion of Highway 43 between the north City limits and McMillican Street that are assumed for the TSP update, such as pedestrian crossings, street trees, landscaping, transit stops, and lighting to better support the needs of all roadway users as well as adjacent land uses.

Safety

The analysis in the Tech Memo 5: Existing Conditions revealed that there are currently no major safety issues at any of the intersections studied for this TSP. Figure 10 shows the locations of the crashes in West Linn over a five-year period from 2009 to 2013. ODOT uses the safety priority index system (SPIS) to prioritize safety improvements based on crash frequency and severity on state facilities. A potential southbound climbing lane for trucks traveling on I-205 out of West Linn is the only location in West Linn identified in the Top 5% Report. No locations along Willamette Drive were listed.



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Crashes
West Linn, Oregon

Figure
10

There were a total of 19 crashes involving pedestrians and/or bicyclists over the five year period, 5 involved pedestrians and 14 involved bicyclists. One resulted in a fatal crash. The pedestrian and bicycle crash locations are denoted with pedestrian and bicycle symbols in Figure 10.

- Six of the 19 crashes occurred along Willamette Drive
- One of the 19 crashes occurred at a I-205 ramp
- Five of the 19 crashes occurred along Willamette Falls Drive
- Seven of the 19 crashes occurred at various other intersections in the City

There were a total of three fatal crashes that occurred over the five year period. Two occurred along Willamette Drive and one occurred along I-205. The fatal crash locations are denoted in red in Figure 10.

- One occurred at the intersection of Willamette Drive and Pimlico Drive and involved a bicyclist.
- One occurred as a vehicle hit a pole along Willamette Drive just south of the entrance to Mary S. Young Park, and was alcohol-related.
- One occurred as a vehicle hit the median along I-205 while speeding and changing lanes, and was alcohol-related.

While the last two fatal crashes were alcohol-related and more challenging to propose infrastructure safety improvements, the crash that occurred at Pimlico Drive and involved the bicyclist may warrant additional investigation. The vehicle approached the intersection eastbound on Pimlico Drive and it is possible that a combination of vertical and horizontal curves provided insufficient sight distance for the vehicle to slow down enough before seeing the bicyclist along Willamette Drive. There may also be consideration for placing sidewalks at this intersection. There is currently no sidewalk on any leg of the three-legged intersection and with bus stops on both sides of Willamette Drive, this location could benefit from improved pedestrian facilities.

Critical crash rates (CCRs) were calculated for each of the study intersections following the analysis methodology presented in ODOT's *SPR 667 Assessment of Statewide Intersection Safety Performance*. SPR 667 provided average crash rates at a variety of intersection configurations in Oregon based on the number of approaches and traffic control types. The average crash rate represents the approximate number of crashes that are "expected" at a study intersection. Additionally, this average crash rate was used to calculate the critical crash rate for each study intersection, based on the *Highway Safety Manual* methodology. The critical crash rate is calculated for each intersection based on the average crash rate for each facility and serves as a threshold for further analysis.

Table 10 summarizes the critical crash rate for each intersection and compares those values to the observed crash rate. Per ODOT, if the observed crash rate at the study location exceeds the critical rate, it is a possible indication that the location is exceeding average crash rates. The data used by ODOT in establishing the critical crash rates excluded interstate highway on-ramps and off-ramps, as well as local streets, and as such the critical crash rates were not calculated for six of the safety study intersections.

Table 10: Critical Crash Rates

Location	Total Crashes	PM Peak TEV	Critical Crash Rate		Observed Crash Rate	Observed Crash Rate > CCR?
			By Intersection	By Volume		
Willamette Drive/Cedar Oak Drive	4	1,955	0.43	0.44	0.11	No
Willamette DriveHidden Springs Road	9	2,080	0.43	1.06	0.24	No
Willamette DriveI-205 SB Ramps	13	2,120	-	-	0.34	-
Willamette Falls Drive/10th Street	4	1,545	0.26	0.46	0.14	No
10th Street/8th Avenue-Court	12	1,375	-	-	0.48	-
10th Street/Blankenship Road	1	1,715	0.45	0.45	0.03	No
10th Street/I-205 NB Ramps	5	1,700	-	-	0.16	-
10th Street/I-205 SB Ramps	3	1,775	-	-	0.09	-
Blankenship Road/Tannler Drive	5	1,190	-	-	0.23	-
Willamette Drive/I-205 NB Ramps	5	1,795	-	-	0.15	-
Willamette Drive/Willamette Falls Drive	5	1,975	0.24	0.44	0.14	No

As shown in Table 10, none of the observed crash rates exceed the critical crash rate. Based on the analysis presented herein, no safety-related mitigation measures are recommended. There are, however, several strategies for improving safety in the City of West Linn that are consistent with the 2008 TSP. These strategies are aimed at identifying priorities that meet the goals and policies of the city and should be carried forward with this TSP.

- Work with other agencies such as Clackamas County, ODOT, the school district, as well as local businesses and neighborhood groups to help prioritize and fund safety programs in a coordinated approach
- Develop a citywide safety priority system which identifies high accident locations, ranks the locations and identifies safety mitigation measures
- Consider installation of red light photo equipment where appropriate
- Provide safe crossings for pedestrians and bicyclists, particularly near key destinations such as schools and commercial areas. Locations for potential intersection improvements are listed in the Pedestrian Needs and Bicycle Needs sections of this memorandum.
- Address safety issues on an as needed basis

Freight Needs

Freight movement within the City of West Linn consists of 1) the delivery of goods to commercial sites along Willamette Drive, 2) freight movement associated with the West Linn Paper plant, and 3) commercial freight traffic going through West Linn to other destinations on I-205 and Willamette Drive. The considerable truck traffic on I-205 combined with the lack of truck climbing lanes and short merging distances between ramps, often results in conflicts between automobiles and truck traffic, and slows traffic flow near the Willamette Drive/I-205 interchange. The RTP identifies the segment of I-205 that travel through West Linn as a Main Roadway Route, which is intended to connect major activity centers in the region to other areas in Oregon or the United States, Mexico, and Canada. Within Oregon, these routes include I-5, I-84, I-205, US 26, Hwy 217, 99E, and 99W. The RTP identifies five policies to serve as the foundation for the regional freight network, including 1) Use a system approach to plan for and manage the freight network, 2) Reduce delay and increase reliability, 3) Protect industrial lands and freight transportation investments, 4) Look beyond the roadway network to address critical marine and rail needs, and 5) Pursue clean, green and smart technologies and practices.

OTHER TRAVEL MODE NEEDS

There are no other modes of transportation within West Linn, with the exception of the Tualatin and Willamette Rivers, which are primarily used for recreation. All major rail, air, and natural gas pipelines are located north and south of West Linn in neighboring cities.

Rail

There are no railroads located within the City of West Linn. The closest railroads include the Union Pacific Railroad located in Lake Oswego and the Southern Pacific Railroad located in Oregon City. The closest passenger rail service is provided by AMTRAK, with stops in Oregon City (ORC) and downtown Portland at Union Station (PDX). AMRRAK travels between ORC and PDX Monday through Friday at 7:24 a.m., 11:15 a.m., and 5:54 p.m. and between PDX and ORC at 6:00 a.m., 6:05 p.m., and 9:30 p.m. Travel times vary from 21 to 41 minutes depending on time of day and direction.

The Oregon Department of Transportation is currently studying ways to improve intercity passenger rail service between the Eugene-Springfield urban area and the Portland urban area. The study will help decide on a general passenger rail route and evaluate options for train frequency, trip time, and improving on-time performance. The preliminary alternatives include one route that follows the I-205 corridor through West Linn and the other route that follows the 99E corridor through Oregon City.

Travel time to Union Station on existing transit service can be long for the West Linn resident. If/when the new passenger rail service becomes a reality, West Linn residents will need access to the service by all appropriate travel modes.

Air

There are no airports located within the City of West Linn. Domestic and international air passenger service is provided at the Portland International Airport. The General Aviation Airport in Aurora also serves the needs of West Linn residents. Some of the local airports open to the public for private aircraft in the area include Happy Valley, Oregon City, Mulino and Canby. Access to the Portland Airport can be a challenge for West Linn residents due to congestion on I-205, the most direct and commonly used route to the airport. Transit service, which involves transferring in Portland, is a timeconsuming and indirect way to access the Portland Airport. A typical trip from the West Linn park and ride to the Portland International Airport would take 30 minutes by vehicle (depending on traffic) or 90 minutes by public transit with a transfer in downtown Portland to the MAX Red Line.

Water

West Linn lies along the west side of the Willamette River. The Willamette Falls Locks, operated by the U.S. Army Corps of Engineers, were part of the water-borne transportation system through West Linn. The locks are currently closed indefinitely by the U.S. Army Corps of Engineers due to needed gudgeon anchor repairs.

The locks and river do not currently provide transportation alternatives to West Linn residents. However, the potential for river taxis and ferries should be examined in the future.

Pipeline

There are no pipelines transporting commodities in West Linn except those used in the West Linn Paper Company industrial complex, and pipelines from the Smurfit Paper Mill in Oregon City to settling ponds along the Willamette River in West Linn. A sewage force main that is part of the Tri-City Sewerage District facility crosses the Willamette River. Several Northwest Natural Gas mains run through West Linn. Also, the South Fork Water Board has a potable water pipeline across the Willamette River serving West Linn.

There are currently no needs associated with pipelines.

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MEMORANDUM

Date:	February 25, 2015	Project #: 17817.3
To:	Zach Pelz, City of West Linn Gail Curtis, Oregon Department of Transportation	
From:	Susan Wright, P.E. and Matthew Bell, Kittelson & Associates, Inc.	
Project:	West Linn Transportation System Plan (TSP) Update	
Subject:	Draft Technical Memorandum 8: 10^{th} Street Interchange Area Analysis and Recommendations	

This memorandum documents existing and projected future traffic conditions along the segment of 10^{th} Street located between Blankenship-Salamo Road and Willamette Falls Drive in West Linn, Oregon. The information presented in this memorandum is based on a review of previous planning documents, including the City's current Transportation System Plan (2008 TSP - Reference 1), the 10^{th} Street Willamette Falls Drive Intersection Traffic Control Study (10^{th} Street Study - Reference 2); year 2040 traffic volume projections provided by Metro's travel demand model, and; an evaluation of recent traffic counts and field data collected along 10^{th} Street as part of the ongoing West Linn TSP update.

The data shows that traffic volumes along 10^{th} Street are lower today than they were in 2008 and they are projected to be lower in 2040 than previously projected for 2030 based on Metro's most recent travel demand model. As a result, vehicle improvements identified in the 2008 TSP and the 10^{th} Street Study should be modified to meet current 2040 land-use and travel demand projections. This is consistent with findings in the recent Clackamas County TSP Update which also found lower traffic volume forecasts.

As described below, the types of improvements needed to meet current projections include widening along the 10^{th} Street corridor, which could include retaining walls and/or modifications to the I-205 bridge footings, and modifications at each of the study intersections. Full reconstruction of the interchange as a Single Point Urban Interchange (SPUI) or some other alternative interchange form is not projected to be needed based on current 2040 projections. However, given the significant difference in the traffic volume projections used in the 2008 TSP and the 10^{th} Street Study and those used in this analysis, several alternative interchange forms are evaluated in this memorandum at a qualitative level to provide the city and the Oregon Department of Transportation (ODOT) with a variety of potential long-term solutions to accommodate higher traffic volumes.

Additional information about the study methodology, findings, and recommendations is provided below.

STUDY AREA

The study area and intersections included in this analysis were selected based on community needs and direction provided by City and ODOT staff in the scope of work for the West Linn TSP update. Figure 1 illustrates the study area. As shown, the study area consists of the segment of 10th Street from Blankenship-Salamo Road to Willamette Falls Drive with the following study intersections:

- 10th Street/Blankenship-Salamo Road
- 10th Street/I-205 Southbound (SB) Ramps
- 10th Street/I-205 Northbound (NB) Ramps
- 10th Street/8th Avenue-Court
- 10th street/Willamette Falls Drive

ANALYSIS YEARS AND TIME PERIODS

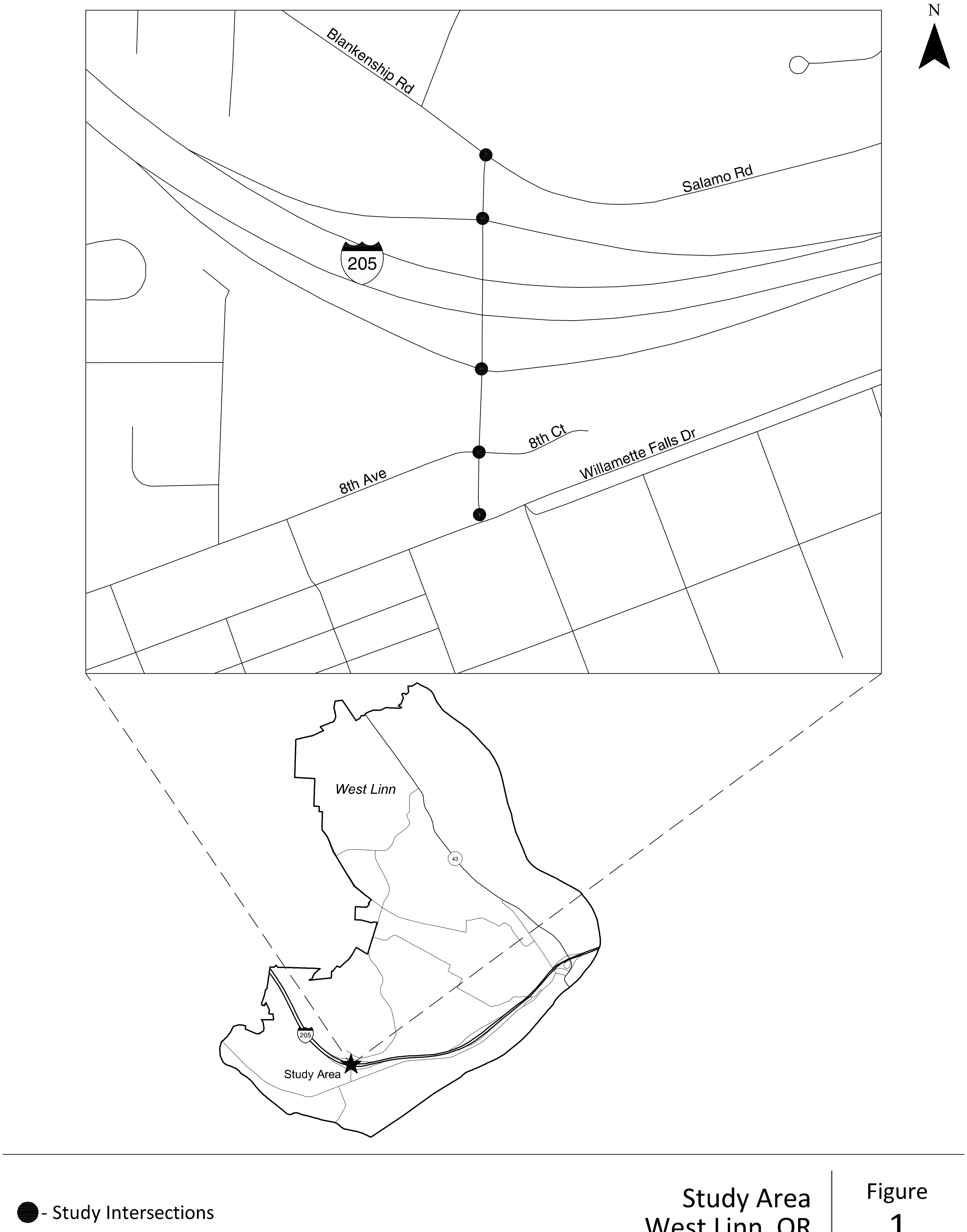
Traffic conditions at the study intersections were analyzed during the weekday p.m. peak hour under year 2014 existing and year 2040 traffic conditions, which is consistent with the base and future traffic volume projections included in Metro's regional travel demand model.

PERFORMANCE MEASURES AND OPERATING STANDARDS

Two performance measures were used to evaluate traffic operations, including level-of-service (LOS) and volume-to-capacity (v/c). A brief description of each performance measure is provided below:

- *Level-of-service* (LOS) ranks intersections from "A" to "F" based on the average control delay experienced by motorists. LOS "A" reflects relatively low vehicle delay times (10 seconds or less) while LOS "F" reflects relatively high vehicle delay times (over 50 seconds at unsignalized intersections), which is considered unacceptable to most motorists.
- *Volume-to-capacity* (v/c) is a ratio that compares the volume of traffic at a particular movement/approach to the theoretical capacity of that movement/approach to accommodate traffic. A v/c ratio of 1.0 indicates a movement/approach that is operating at capacity. A v/c ratio over 1.0 indicates that the capacity of the movement/approach has been (or will be) exceeded.

The 10th Street/Willamette Falls Drive intersection is controlled by the City of West Linn. The City requires all signalized and unsignalized intersections to maintain LOS D or better during peak time periods. The 10th Street/Blankenship-Salamo Road intersection is controlled by ODOT and operated as one signal with the 10th Street/I-205 SB Ramp. The 10th Street/I-205 NB Ramp and the 10th Street/8th Avenue-Court intersections are also controlled by ODOT. Per Policy 1F of the Oregon Highway Plan (OHP – Reference 3), ODOT requires all ramp terminals to maintain a v/c ratio of 0.85 or up to 0.90 in the Metro area if the queuing does not encroach on the deceleration portion of the ramp and all unsignalized intersections to maintain a v/c ration of 0.99 during peak time periods.



Study Area
West Linn, OR

Figure
1

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TRAFFIC ANALYSIS METHODOLOGY

All LOS and v/c analyses described in this report were performed in accordance with the procedures stated in the *2000 Highway Capacity Manual* (HCM – Reference 4). In order to ensure that the analyses were based on a reasonable worst-case scenario, the peak 15-minute flow rates that occur during the weekday p.m. peak hour were used in the evaluation of all intersections. For this reason, the analyses reflect conditions that are only likely to occur for 15 minutes out of each average peak hour. The transportation system will likely operate under conditions better than those described in this report during all other time periods. The analyses were performed using Synchro 8 modeling software, which implements the methods outlined in the 2010 HCM.

BACKGROUND

The 2008 TSP and the 10th Street Study provide recommendations for improvements to the pedestrian, bicycle, transit, and motor vehicle systems within the study area as described below.

West Linn Transportation System Plan

The 2008 TSP provides a general policy framework regarding transportation services, as well as a number of recommendations for improvements to the pedestrian, bicycle, transit and motor vehicle systems. The following provides a summary of the recommended improvements that are expected to improve traffic flow along 10th Street and increase access for all travel modes. None of these recommended improvements have been completed to date.

Pedestrian Recommendations

- Provide sidewalks on the east side of 10th Street from I-205 to 8th Avenue-Court
- Provide sidewalks on the east side of 10th Street from Blankenship Road to I-205
- Provide sidewalks on both sides of Salamo Drive from 10th Street to 330-feet south of Bland Circle
- Provide sidewalks on both sides of Willamette Falls Drive from 6th Street to 10th Street

Bicycle Recommendations

- Provide on-street bike lanes on Salamo Road from 10th Street to Barrington Drive
- Provide on-street bike lanes on 10th Street from Salamo Road to Willamette Falls Drive

Transit Recommendations

While there are no specific transit improvements identified for the 10th Street corridor, many of the planned improvements will impact transit access and circulation, such as:

- Improve service coordination for Route 154

- Provide Transit amenities at major transit stops
- Improve pedestrian connections to transit facilities
- Decrease headways
- Provide more local service

Motor Vehicle Recommendations

- Widen 10th Street from I-205 SB Ramps to 8th Avenue-Court to five-lane section with center turn lane and two travel lanes in each direction
- Add two through lanes on 10th Street from 8th Avenue-Court to Willamette Falls Drive for a total of two lanes in each direction. Prohibit northbound left turn movement and replaces left turn lane with pedestrian island
- Add a second east bound right turn lane at the 10th Street/Blankenship Road intersection and restripe the westbound approach to have exclusive left-turn and shared left-thru lane
- Change/upgrade the traffic control at the 10th Street/Willamette Falls Drive intersection to either signal or roundabout
    - further evaluation of this recommendation was a conducted as part of the 10th Street Study as described below
- Add right-in/right-out access at the 10th Street/8th Avenue-Court intersection at the time of the 8th Court extension
- Add turns lanes at the 10th Street/I-205 NB Ramps, including northbound right turn lane, stripe southbound approach to have dual left turn lanes and one thru lane, add an exclusive NB off-ramp left turn lane, and widen NB on-ramp to have two receiving lanes to support dual SB left turn movement)
- Extend 8th Court to Willamette Falls Drive to provide additional access to 8th Court retail (concurrently restrict access to the 10th Street/8th Avenue-Court intersection to right-in/right-out
- Construct a long-term interchange improvement (SPUI or Split Diamond) at the 1-205/10th Street interchange to accommodate projected future demand.

10th Street at Willamette Falls Drive Intersection Traffic Control Study

The 10th Street Study evaluates three potential alternatives to improve traffic operations at the 10th Street/Willamette Falls Drive intersection. Two of the alternatives include a traffic signal at the intersection and one includes a single-lane roundabout. All three alternatives include near-term and long-term access restrictions at the 10th Street/8th Avenue-Court intersection that are tied to the 8th Court Extension project identified in the 2008 TSP. Given the potential for coordination along the corridor, the traffic signal alternative with dual east-bound left-turn lanes (Alternative 2) was selected as the preferred alternative. The following provides a summary of the recommended improvements that are expected to improve traffic flow along 10th Street. No specific recommendations for improvements to the pedestrian, bicycle, or transit systems were provided in the 10th Street Study.

Motor Vehicle Recommendations

- Install a traffic signal at the 10th Street/Willamette Falls Drive intersection when warranted.
- Install dual eastbound left-turn lanes at the 10th Street/Willamette Falls Drive intersection
  - The additional left-turn lane would require an additional receiving lane on 10th Street and modifications along the south side of Willamette Falls Drive.
- Short-term Access Restriction – install a raised island at the west leg of the 10th Street/8th Avenue-Court intersection that restricts eastbound left, eastbound through, northbound left and westbound through movements.
- Mid-Term Access Restriction (Right-in/Right-out/Left-in) – install channelization at the 10th Street/8th Avenue-Court intersection to restrict eastbound left, eastbound through, westbound left, westbound through, and northbound left movements.
  - As indicated in the 2008 TSP, extension of 8th Court to Willamette Falls Drive is necessary to restrict the westbound left-turn movement.
- Long-Term Access Restriction (Full Median) – install a full median along 10th Street to restrict the eastbound and westbound approaches to the 10th Street/8th Avenue-Court intersection to right-in/right-out.

EXISTING CONDITIONS

The existing pedestrian, bicycle, and transit facilities located along 10th Street were evaluated along with motor vehicle facilities in order to identify potential improvements to these facilities as well as to establish a baseline for future conditions. Kittelson & Associates, Inc. (KAI) staff visited and inventoried the study area in January 2015. At that time, KAI collected information regarding existing traffic operations and transportation facilities.

Pedestrian Facilities

Continuous sidewalks are currently provided along the west side of 10th Street from Blankenship-Salamo Road to Willamette Falls Drive. The sidewalk located between the I-205 SB Ramps and 8th Avenue-Court is adjacent to the curb (i.e. curb tight with no landscape buffer between the road and the sidewalk) while the sidewalk north of the I-205 SB ramp and south of 8th Avenue-Court has landscape buffers. There is no sidewalk on the east side of 10th Street north of 8th Avenue-Court. There is sidewalk on the east side from 8th Avenue-Court to Willamette Falls Drive; however, it is not accessible per the American's with Disability Act (ADA) and there is a shoulder where pedestrians can walk and locations at each corner where they can wait to cross the street.

There are marked pedestrian crossings at each of the major intersections located on 10th Street. The crossings at the Blankenship-Salamo Road, I-205 SB Ramp, and I-205 NB Ramp intersections are signalized with pedestrian actuation. The crossings at the north leg of the I-205 SB Ramp and I-205 NB Ramp intersections are closed. Pedestrian crossing volumes were obtained at the intersections in April 2014 during the weekday evening peak period (4:00 to 6:00 p.m.). The following provides a summary of pedestrian activity at the five intersections during the weekday evening peak hour:

- 10th Street/Blankenship-Salamo Road: No pedestrians were observed at the intersection
- 10th Street/I-205 SB Ramp: No pedestrians were observed at the intersection
- 10th Street/I-205 NB Ramp: Three pedestrians were observed at east/west crossing
- 10th Street/8th Avenue-Court: Eight pedestrians were observed at the north/south crossing and five pedestrians were observed at the east/west crossing
- 10th Street/Willamette Falls Drive: No pedestrians were observed at the intersection

Bicycle Facilities

There are currently no marked bike lanes located along 10th Street from Blankenship-Salamo Road to Willamette Falls Drive. There are shoulders located on both sides of 10th Street from Blankenship-Salamo Road to the I-205 NB Ramps and along the east side of 10th Street from the I-205 NB Ramps to 8th Avenue-Court that could accommodate bicycle travel; however, the southbound right turn at the 10th Street/I-205 SB Ramp intersection and the northbound right turn lane at the 10th street/I-205 NB Ramp intersection conflict with potential bicycle movements.

The northbound approach to the 10th Street/Blankenship-Salamo Road intersection has a marked bike lane at the intersection for bicycles making a northbound left turn. Bicycle crossing volumes were obtained at the intersections in April 2014 during the weekday evening peak period (4:00 to 6:00 p.m.). The following provides a summary of bicycle activity at the five intersections during the evening peak hour:

- 10th Street/Blankenship Road: One bike was observed at the east/west crossing
- 10th Street/I-205 SB Ramp: One bike was observed at the north/south crossing
- 10th Street/I-205 NB Ramp: One bike was observed at the north/south crossing
- 10th Street/8th Avenue: One bike was observed at north/south crossing
- 10th Street/Willamette Falls Drive: One bike was observed at the east/west crossing

Pedestrian and bicycle activity along 10th Street is expected to increase with full build-out of the City's pedestrian and bicycle system plans and the Metro's regional pedestrian and bicycle networks.

Transit Facilities

TriMet operates one fixed-route bus line along the east side of 10th Street. Line 154 (Willamette) travels west along Willamette Falls Drive, north along 10th Street, west along Blankenship Road, south along Ostman Road, and east along Willamette Falls Drive to the Oregon City Transit. Service is provided Monday through Friday from 6:00 a.m. to 7:00 p.m. on 30 to 60 minute headways. Service is not provided on Saturdays and Sundays.

There is one transit stop along 10th Street in the southeast corner of the 10th Street/8th Avenue-Court intersection. Additional stops are located along Blankenship Road across from the main entrance to Albertsons and along Willamette Falls Drive in the southwest corner of the 11th Street/Willamette Falls Drive intersection. Table 1 summarizes the average daily ons and offs at all three transit stop locations.

Table 1: TriMet Route 154 Average Daily Ridership Fall 2014

Stop Location	Stop ID	Ons	Offs	Total
10th Street	9296	4	10	14
Blankenship Road	9297	5	7	12
Willamette Falls Drive	11766	3	0	3

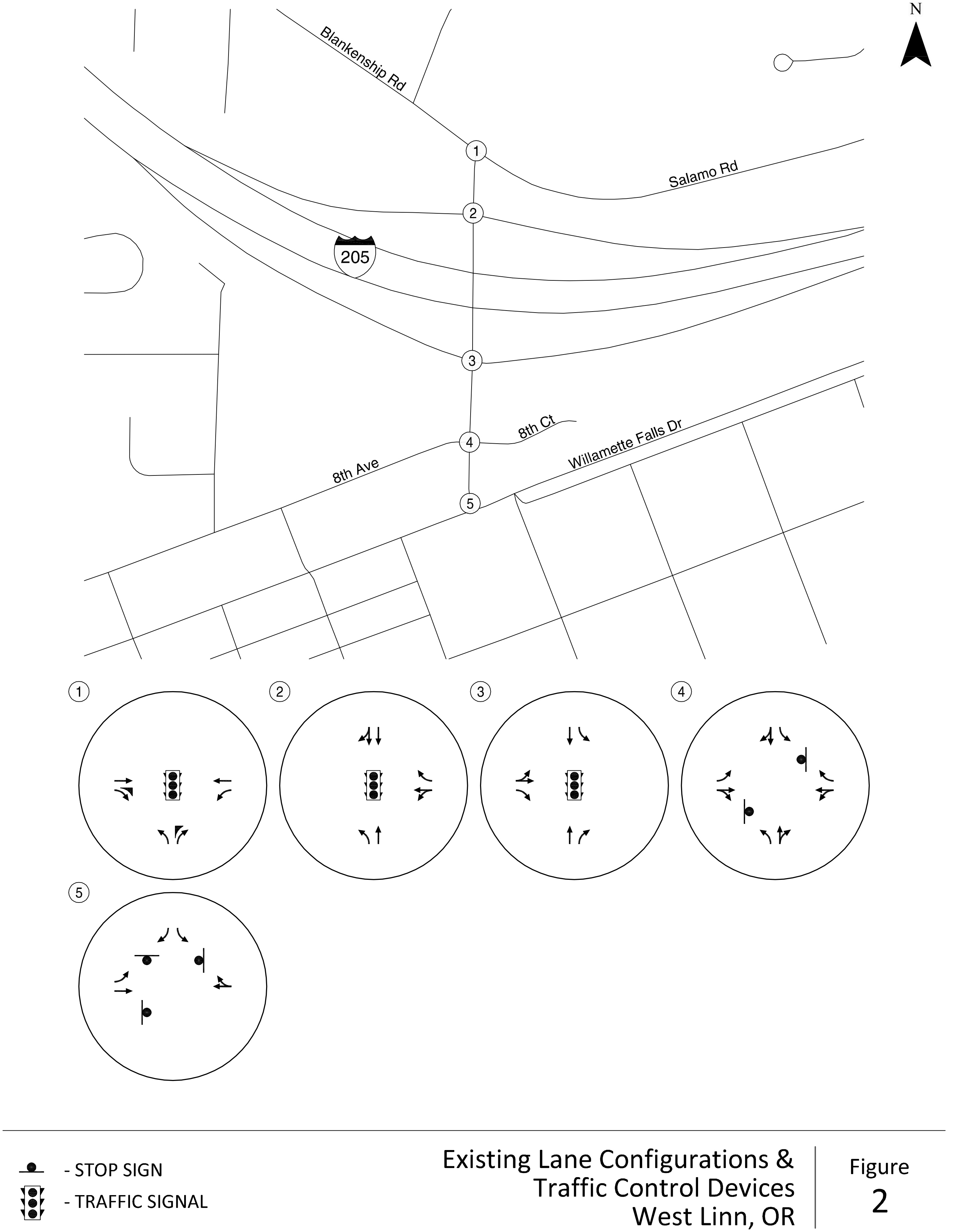
TriMet's plans to reroute Line 154 will not impact the location of transit stops along the 10th Street, Blankenship Road, or Willamette Falls Drive – west of the 10th Street.

Motor Vehicle Facilities

10th Street generally has a three-lane cross section from Blankenship Road to Willamette Falls Drive with separate left-turn lanes at all major intersections and a separate right turn lane at the northbound approach to the I-205 NB Ramps – The northbound left-turn movement at the 10th Street/8th Avenue-Court intersection is restricted during peak time periods. There is a second southbound through lane from Blankenship-Salamo Road to the I-205 SB bridge that tapers to one lane prior to the I-205 NB bridge. The 10th Street/Blankenship-Salamo Road, 10th Street/I-205 SB Ramp, and 10th Street/I-205 NB Ramp intersections are signalized with pedestrian actuation, while the 10th Street/8th Avenue-Court intersection is two-way stop controlled, and the 10th Street/Willamette Falls Drive intersection is all-way stop-controlled. Figure 2 illustrates the existing lane configurations and traffic control devices at the study intersections.

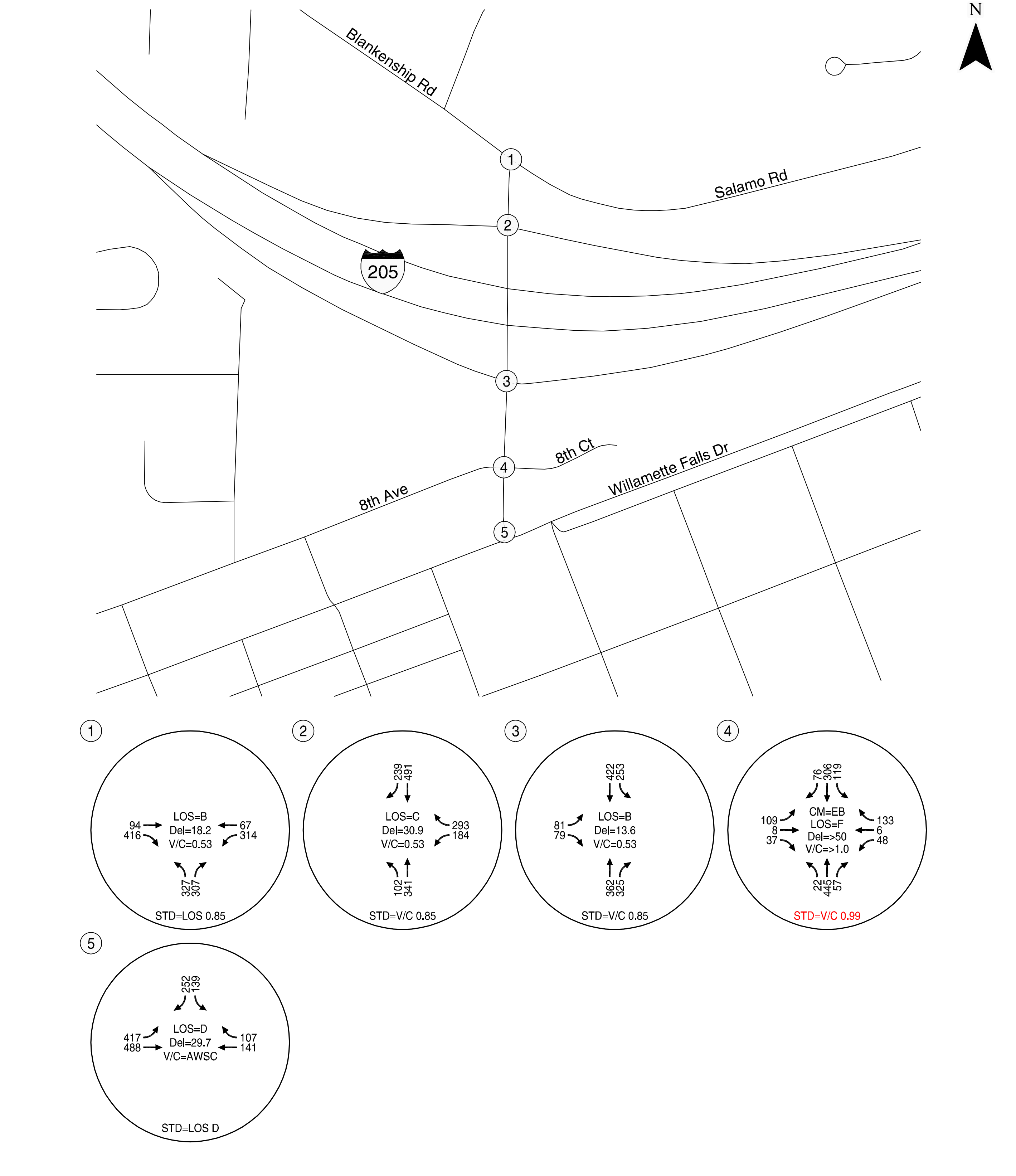
Existing Traffic Volumes

Manual turning-movement counts were conducted at the study intersections in April 2014. All of the counts were conducted on a typical mid-week day during the evening (4:00 to 6:00 p.m.) peak time period. The system-wide peak hour was found to occur from 4:15 to 5:15 p.m. Figure 3 summarizes the year 2014 turning-movement volumes at the study intersections. *Appendix "A" contains the traffic count data used in this study.*



Existing Lane Configurations &
Traffic Control Devices
West Linn, OR

Figure
2



CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = CRITICAL MOVEMENT LEVEL OF SERVICE (SIGNALIZED)/
CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/
CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL CRITICAL VOLUME-TO-CAPACITY RATIO

Existing Traffic Conditions
Weekday PM Peak Hour
West Linn, OR

Figure
3

Intersection Operations

The turning-movement volumes shown in Figure 3 were used to conduct an operational analysis at the study intersections to determine existing traffic conditions along the corridor. As shown, all of the study intersections currently operate acceptably during the weekday p.m. peak hour, with the exception of the 10th Street/8th Avenue-Court intersection. *Appendix "B" contains the year 2014 existing traffic conditions worksheets.*

10th Street/8th Avenue-Court

The eastbound left-turn movements at the 10th Street/8th Avenue-Court intersection currently operates at LOS F and above capacity during the weekday p.m. peak hour. This is primarily due to the relatively high number of eastbound left-turning vehicles conflicting with the relatively high number of north-south through vehicles along 10th Street.

It is important to note that while the other intersections operate acceptably per their respective standards, there are specific movements where the queues are longer than the available storage and impact operations along the corridor. Queuing is discussed further in the following section.

Intersection Queues

Synchro 8 was used to evaluate 95th percentile queues at the signalized study intersections under existing traffic conditions. Table 2 summarizes the 95th percentile queues by movement. The storage lengths shown in Table 2 reflect the striped portion of the turn lanes.

Table 2: Intersection Queues – Existing Traffic Conditions

Intersection	Movement	Queue (feet)	Storage (feet)	Adequate?
10th Street/Blankenship-Salamo Road	EBT	108	Cont.	Yes
	EBR	123	150	Yes
	WBL	272	200	**No**
	WBT	47	Cont.	Yes
	NBL	240	100	**No**
	NBR	18	Cont.	Yes
10th Street/I-205 SB Ramp	WBL	211	200	**No**
	WBR	76	Cont.	Yes
	NBL	103	220	Yes
	NBT	134	Cont.	Yes
	SBT	321	Cont.	Yes
10th Street/I-205 NB Ramp	EBL	78	200	Yes
	EBR	37	Cont.	Yes
	NBT	221	Cont.	Yes
	NBR	109	100	**No**
	SBL	183	130	**No**
	SBT	98	Cont.	Yes

As shown in Table 2, there are several movements where the existing 95th percentile queues currently exceed the available storage, including (most notably) the westbound and northbound left-turn movements at the 10th Street Blankenship-Salamo Road intersection and the southbound left-turn movement at the 10th Street/I-205 NB Ramp intersection. In each case, the movement currently spills into the adjacent lane and prevents other vehicles (through or turning) from continuing through the intersection. The results of the queuing analysis were compared to recent queuing information provided by ODOT and found to be consistent. *Appendix "B" also contains the queuing information provided by ODOT*

Traffic Safety

The crash history of the study intersections was reviewed in an effort to identify any potential safety issues. ODOT provided the five most recent years of crash data available for the study intersections, including January 1, 2008 through December 31, 2012. Table 3 summarizes the crash history of the study intersections over the five-year period.

Table 3: Study Intersection Crash Summary (January 1, 2008 – December 31, 2012)

	Crash Type						Severity		
Location	Angle	Turn	Rear-End	Side Swipe	Fixed Object	Ped/ Bike	PDO*	Injury	Total
10th Street/Blankenship-Salamo Road			1				1		1
10th Street/I-205 SB Ramps		1	2				2	1	3
10th Street/I-205 NB Ramps		1	4				2	3	5
10th Street/8th Avenue-Court	4	8					9	3	12
10th Street/Willamette Falls Drive		2	2				4	0	4

* PDO = Property Damage Only

As shown in Table 3, the highest number of crashes was reported at the 10th Street/8th Avenue-Court intersection. The types of crashes reported at the intersection (Angle and Turn) are typical of two-way stop controlled intersections with side-street movements that are operating above capacity. Also shown in Table 3, two rear-end crashes were reported at the 10th Street/I-205 SB ramps and four rear-end crashes were reported at the 10th Street/I-205 NB ramps. Given ODOT's concern for queues extending into the deceleration lane and/or the I-205 mainline, further review of the crashes was conducted; however, none of the crashes were related to queuing at the intersection. No other trends or patterns were identified in the data that require mitigation associated with the TSP update. *Appendix "C" contains the crash data obtained from ODOT.*

YEAR 2040 (NO-BUILD) TRAFFIC CONDITIONS

Year 2040 Traffic Volumes

Forecast traffic volumes were developed for the study intersections based on the existing traffic counts and information provided in Metro's fiscally constrained travel demand model. The travel demand model provides calibrated base year 2010 and future year 2040 traffic volume projections that reflect anticipated land use changes and planned transportation improvements within the City and the greater region. The year 2040 traffic volumes were developed by applying the post-processing methodology presented in the National Cooperative Highway Research Program (NCHRP) Report 255 *Highway Traffic Data for Urbanized Area Project Planning and Design* (Reference 5), in conjunction with engineering judgment and knowledge of the study area. Figure 4 illustrates the anticipated year 2040 traffic volumes.

Intersection Operations

Figure 4 also summarizes the traffic analysis results for the study intersections under year 2040 (no-build) traffic conditions with no improvements or modifications to the existing roadway or traffic signals. As shown, all of the study intersections are expected to operate acceptably during the weekday p.m. peak hour, with the exception of the 10th Street/8th Avenue-Court and the 10th Street/Willamette Falls Drive intersections. *Appendix "D" includes the year 2040 (no-build) traffic conditions worksheets.*

10th Street/8th Avenue-Court

The eastbound left-turn movement at the 10th Street/8th Avenue-Court intersection is expected to continue to operate at LOS F and above capacity during the weekday p.m. peak hour. This is primarily due to the relatively high number of eastbound left-turning vehicles conflicting with the relatively high number of north-south through vehicles along 10th Street.

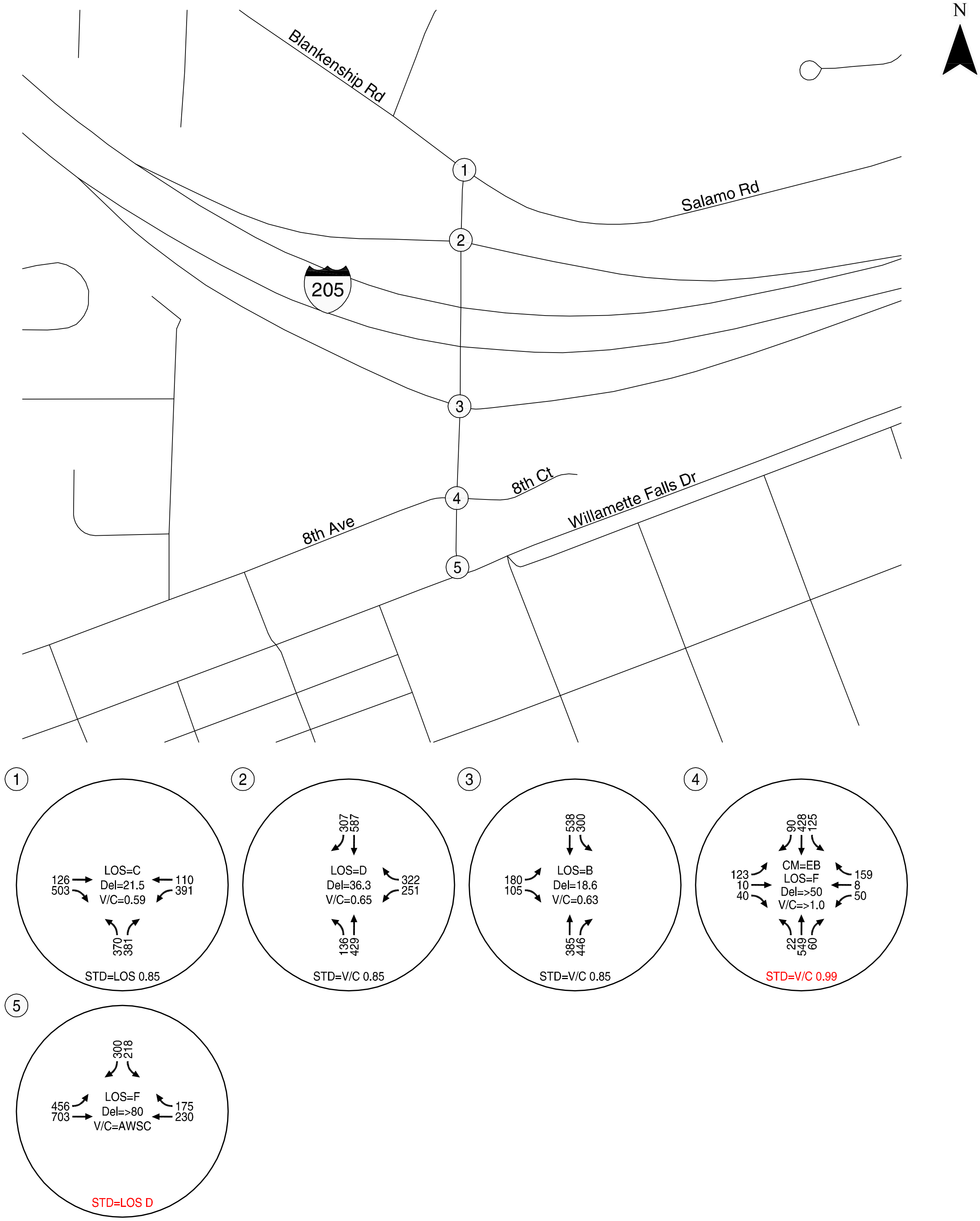
10th Street/Willamette Falls Drive

The eastbound left-turn movement at the 10th Street/Willamette Falls drive intersection is also expected to operate at LOS F and above capacity during the weekday p.m. peak hour. This is primarily due to the relatively high number of eastbound left-turning vehicles conflicting with all other movements at the intersection.

It is important to note that while the other intersections operate acceptably per their respective standards, there are specific movements where the queues are longer than the available storage or where the volumes exceed the capacity of the movement and impact operations along the corridor. Queuing is discussed further in the following section.

Intersection Queues

Synchro 8 was used to evaluate 95th percentile queues at the signalized study intersections under year 2040 (no-build) traffic conditions. Table 4 summarizes the 95th percentile queues by movement. The storage lengths shown in Table 4 reflect the striped portion of the turn lanes.



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CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL CRITICAL VOLUME-TO-CAPACITY RATIO

Year 2040 No-Build Traffic Conditions
Weekday PM Peak Hour
West Linn, OR

Figure
4

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Table 4: Intersection Queues – Year 2040 (No-Build) Traffic Conditions

Intersection	Movement	Queue	Storage	Adequate?
10th Street/Blankenship-Salamo Road	EBT	138	Cont.	Yes
	EBR	214	150	**No**
	WBL	#390	200	**No**
	WBT	70	Cont.	Yes
	NBL	287	100	**No**
	NBR	22	Cont.	Yes
10th Street/I-205 SB Ramp	WBL	287	200	**No**
	WBR	80	Cont.	Yes
	NBL	133	220	Yes
	NBT	177	Cont.	Yes
	SBT	#425	Cont.	Yes
10th Street/I-205 NB Ramp	EBL	159	200	Yes
	EBR	41	Cont.	Yes
	NBT	289	Cont.	Yes
	NBR	142	100	**No**
	SBL	241	130	**No**
	SBT	193	Cont.	Yes

95th percentile volume exceeds capacity, queue may be longer.

As shown in Table 4, there are several additional movements (compared to existing traffic conditions) where the 95th percentile queues are expected to exceed the available storage.

Based on the intersection operations and queuing analyses described above, improvements to the corridor are needed to improve existing and future year 2040 (no-build) traffic conditions.

ALTERNATIVES ANALYSIS

Several alternatives were developed to improve existing and year 2040 traffic conditions along the 10th Street corridor that will meet the needs of the City and ODOT. These alternatives were developed based on the existing and year 2040 analyses described above, the improvements identified in the 2008 TSP and the 10th Street Study, and discussions with City and ODOT staff. Other considerations include limited right-of way along 10th Street, limited transportation funding, topography, and impacts to existing businesses and private residencies.

Corridor Improvements

The corridor improvement alternatives are intended to improve traffic operations along the 10th Street corridor for all travel modes without reconstruction of the interchange. These alternatives include widening along 10th Street and modifications at each of the study intersections, but maintain the existing I-205 ramps and ramp terminals. Two different corridor improvement alternatives were developed as part of the alternatives analysis as described below.

Alternative 1

Alternative 1 includes several of the motor vehicle improvements identified in the 2008 TSP and the 10th Street Study as well as a few new improvements not evaluated in any previous studies conducted by the City or ODOT. The improvements have been separated into near-term and long-term improvements based on an evaluation of existing and year 2040 operations.

Near-Term Improvements

The following near-term improvements are included in Alternative 1 to address issues identified under existing conditions:

- Restripe the westbound approach to the 10th Street/Blankenship-Salamo Road intersection to include an exclusive left-turn lane and shared left-through lane.
- Install a raised median island at the eastbound approach to the 10th Street/8th Avenue-Court intersection to restrict the eastbound left-turn movement.
    - This improvement would result in an increase in the east-bound left-turn volume at the 10th Street/Willamette Falls Drive intersection, where the eastbound left-turn movement would then operate at LOS F (delay = 83.1 seconds) and over capacity (v/c = 1.07); however, the delay would be less than the delay at the 10th Street/8th Avenue-Court intersection and the overall intersection would operate at LOS E.

Long-Term Improvements

The following long-term improvements are included in Alternative 1 to address issues identified under year 2040 conditions:

- Widen the eastbound and westbound Blankenship-Salamo Road approaches approximately 500 feet in each direction to provide dual westbound left-turn lanes, a single westbound through lane, and to accommodate dual northbound left-turn lanes.
- Add a second exclusive right turn lane to the eastbound approach to the 10th Street/Blankenship-Salamo Road intersection.
    - This improvement could increase the crossing distance located at the south leg of the 10th Street Blankenship-Salamo Road intersection.
    - The need for this improvement could be reduced by restricting access to the commercial property located in the southwest corner of the 10th Street Blankenship-Salamo Road intersection.
- Modify and/or widen 10th Street between the I-205 NB Ramps and the I-205 SB Ramps to two lanes in either direction. This allows for one continuous left turn lane and one continuous through-movement lane in either direction between the ramps (the left-turn

lanes between the ramps would be side-by-side instead of back-to-back allowing for twice the amount of queue storage)[1].

- Widen 10th Street between the I-205 NB Ramps and Willamette Falls Drive to provide two lanes in each direction.
- Extend 8th Court to Willamette Falls Drive to provide additional access to 8th Court retail.
- Install a median along 10th Street to restrict the eastbound and westbound approaches to the 10th Street/8th Avenue-Court intersection to right-in/right-out.
- Install a traffic signal and dual eastbound left-turn lanes at the 10th Street/Willamette Falls Drive intersection.

Figure 5 illustrates the assumed lane configuration and traffic control devices with the Alternative 1 improvements. The costs associated with these improvements could range from 4-5 million depending on the need for modifications to the bridge structures and right-of way acquisition.

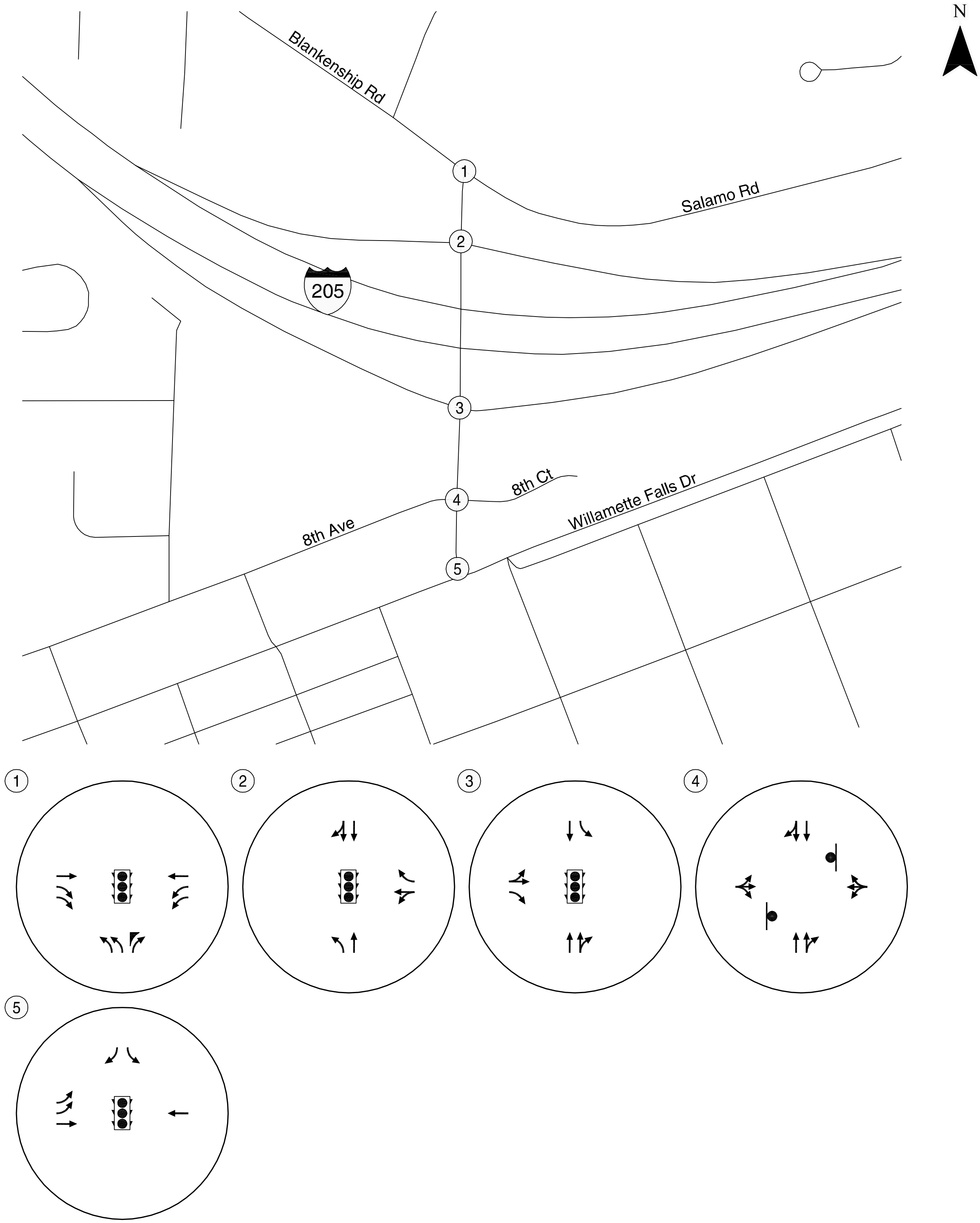
Intersection Operations

Figure 6 summarizes the traffic analysis results for the study intersections under year 2040 traffic conditions assuming all of the near-term and long-term improvements included in Alternative 1. As shown, all of the study intersections are expected to operate acceptably during the weekday p.m. peak hour. *Appendix "E" contains the year 2040 traffic conditions worksheets for Alternative 1.*

Intersection Queuing

Synchro 8 was used to evaluate 95th percentile queues at the signalized study intersections under year 2040 traffic conditions assuming all of the improvements included in Alternative 1. Table 5 summarizes the 95th percentile queues by movement.

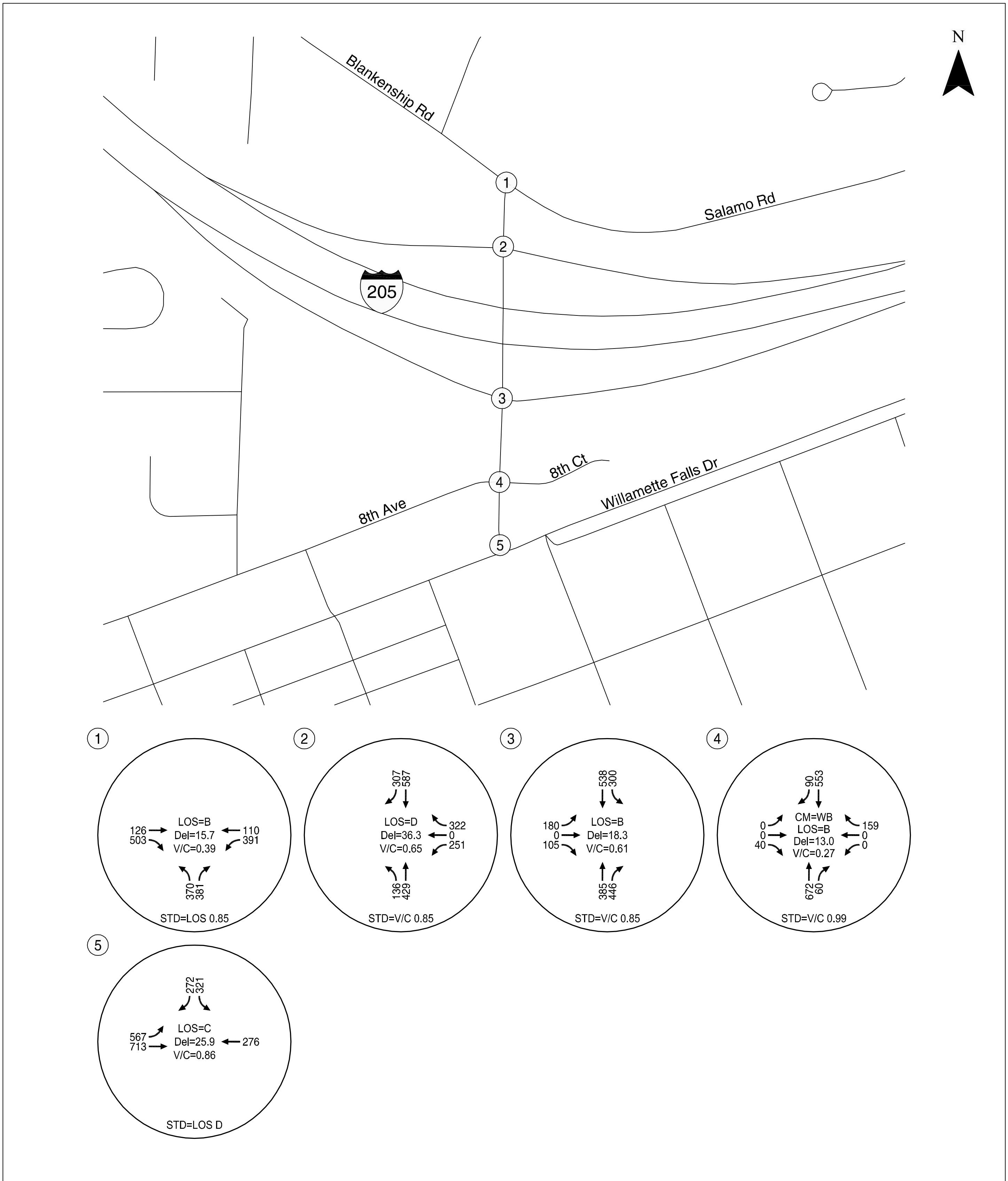
[1] Widening of 10th Street under the I-205 bridges may be possible without complete bridge reconstruction through the use of retaining walls or minor modifications to the bridge structures.



- STOP SIGN
- TRAFFIC SIGNAL

Alternative 1 Lane Configurations & Traffic Control Devices West Linn, OR

Figure 5



CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = CRITICAL MOVEMENT LEVEL OF SERVICE (SIGNALIZED)/
CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/
CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL CRITICAL VOLUME-TO-CAPACITY RATIO

Alternative 1 - Year 2040 Traffic Conditions
Weekday PM Peak Hour
West Linn, OR

Figure 6

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

Table 5: Alternative 1 Intersection Queues – Year 2040 Traffic Conditions

Intersection	Movement	Queue	Storage	Adequate?
10th Street/Blankenship-Salamo Road	EBT	125	Cont.	Yes
	EBR	51	150	Yes
	WBL	155	200	Yes
	WBT	71	Cont.	Yes
	NBL	101	100	**No**
	NBR	22	Cont.	Yes
10th Street/I-205 SB Ramp	WBL	287	200	**No**
	WBR	80	Cont.	Yes
	NBL	133	Cont.	Yes
	NBT	177	Cont.	Yes
	SBT	#425	Cont.	Yes
10th Street/I-205 NB Ramp	EBL	159	200	Yes
	EBR	41	Cont.	Yes
	NBT	193	Cont.	Yes
	SBL	241	Cont.	Yes
	SBT	193	Cont.	Yes
10th Street/Willamette Falls Drive	EBL	#197	220	Yes
	EBT	315	Cont.	Yes
	WBT	#313	Cont.	Yes
	SBL	#220	Cont.	Yes
	SBR	49	Cont.	Yes

95th percentile volume exceeds capacity, queue may be longer.

As shown in Table 5, there continue to be a few movements where the 95th percentile queues are expected to exceed the available storage.

Alternative 2

Alternative 2 also includes several of the motor vehicle improvements identified in the 2008 TSP as well as a few new improvements not evaluated in any previous studies conducted by the City or ODOT. Similar to Alternative 1, the improvements have been separated into near-term and long-term improvements based on an evaluation of existing and year 2040 operations.

Near-Term Improvements

The following improvements are included in Alternative 2 (*Note: the improvements unique to Alternative 2 are identified in **bold** text)*:

- Restripe the westbound approach to the 10th Street/Blankenship-Salamo Road intersection to include an exclusive left-turn lane and shared left-through lane.

Long-Term Improvements

The following long-term improvements are included in Alternative 1 to address issues identified under year 2040 conditions:

- Widen the eastbound and westbound Blankenship-Salamo Road approaches approximately 500 feet in each direction to provide dual westbound left-turn lanes, a single westbound through lane, and to accommodate dual northbound left-turn lanes.
- Add a second exclusive right turn lane to the eastbound approach to the 10th Street/Blankenship-Salamo Road intersection.
    - This improvement could increase the crossing distance located at the south leg of the 10th Street Blankenship-Salamo Road intersection.
    - The need for this improvement could be reduced by restricting access to the commercial property located in the southwest corner of the 10th Street Blankenship-Salamo Road intersection.
- Modify and/or widen 10th Street between the I-205 NB Ramps and the I-205 SB Ramps to two lanes in either direction. This allows for one continuous left turn lane and one continuous through-movement lane in either direction between the ramps (the left-turn lanes between the ramps would be side-by-side instead of back-to-back allowing for twice the amount of queue storage)[2].
- **Install a traffic signal at the 10th Street/8th Avenue-Court intersection[3].**
- Install a traffic signal at the 10th Street/Willamette Falls Drive intersection.
- Coordinate all of the traffic signals along 10th Street to minimize queuing and delay at each approach to the I-205 Ramp terminals.

The installation of a traffic signal at the 10th Street/8th Avenue-Court intersection eliminates the need to widen 10th Street between the I-205 NB Ramps and Willamette Falls Drive. It also eliminates the need for turn movement restrictions at the 10th Street/8th Avenue-Court intersection, which in turn reduces the need for the 8th Court extension to Willamette Falls Drive and dual left-turn lanes at the 10th Street/Willamette Falls. Figure 7 illustrates the assumed lane configuration and traffic control devices with the Alternative 2 improvements. The costs associated with these improvements could range from 1-2 million depending on the need for modifications to the bridge structures and right-of way acquisition.

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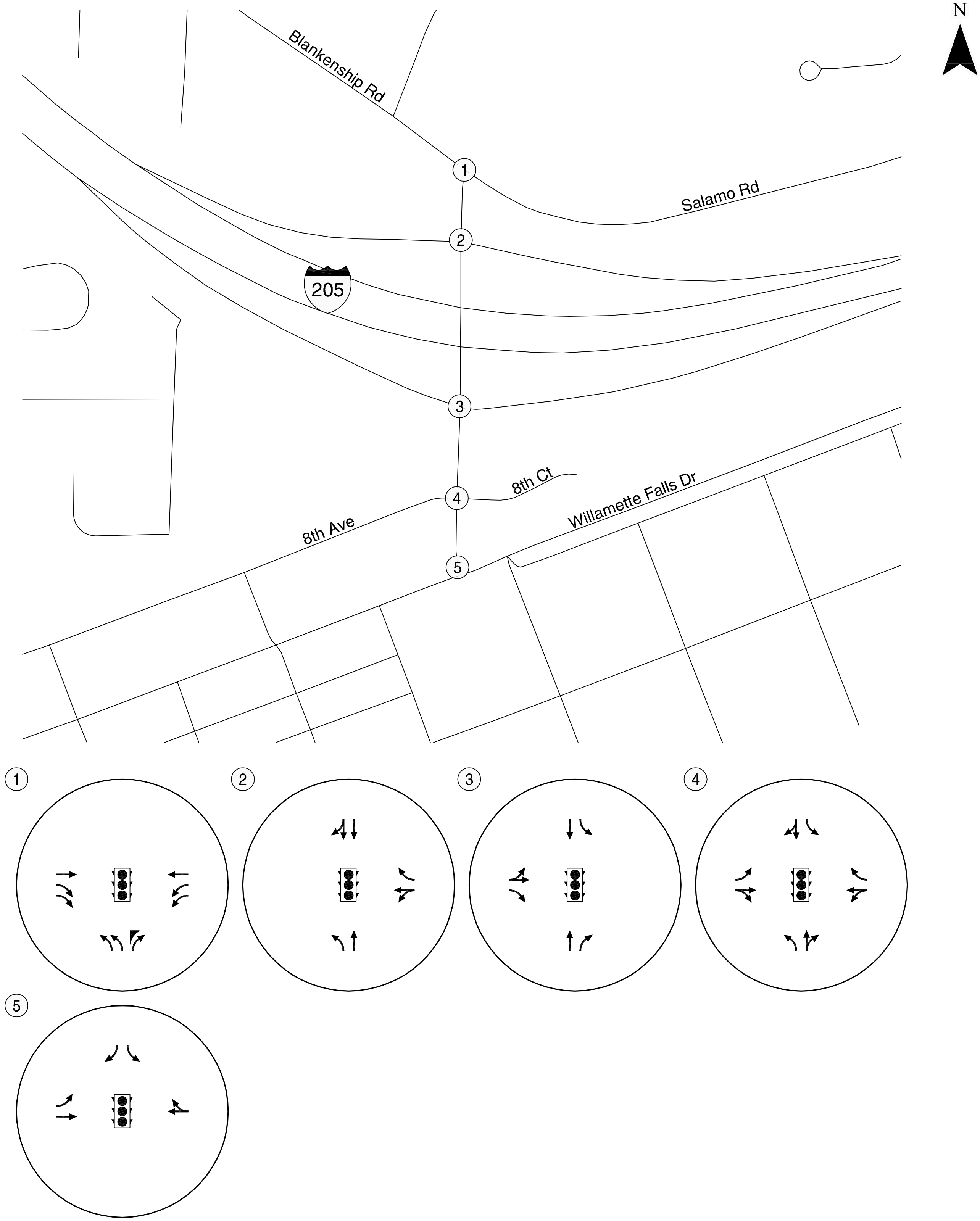
[2] Widening of 10th Street under the I-205 bridges may be possible without complete bridge reconstruction through the use of retaining walls or minor modifications to the bridge structures.

[3] In lieu of access restrictions and the extension of 8th Court.



- STOP SIGN
- TRAFFIC SIGNAL

Alternative 2 Lane Configurations & Traffic Control Devices West Linn, OR

Figure 7

Kittelson & Associates, Inc.
Transportation Engineering/Planning

Intersection Operations

Figure 8 summarizes the traffic analysis results for the study intersections under year 2040 traffic conditions assuming all of the near-term and long-term improvements included in Alternative 2. As shown, all of the study intersections are expected to operate acceptably during the weekday p.m. peak hour. *Appendix "F" contains the year 2040 traffic conditions worksheets for Alternative 2.*

Intersection Queuing

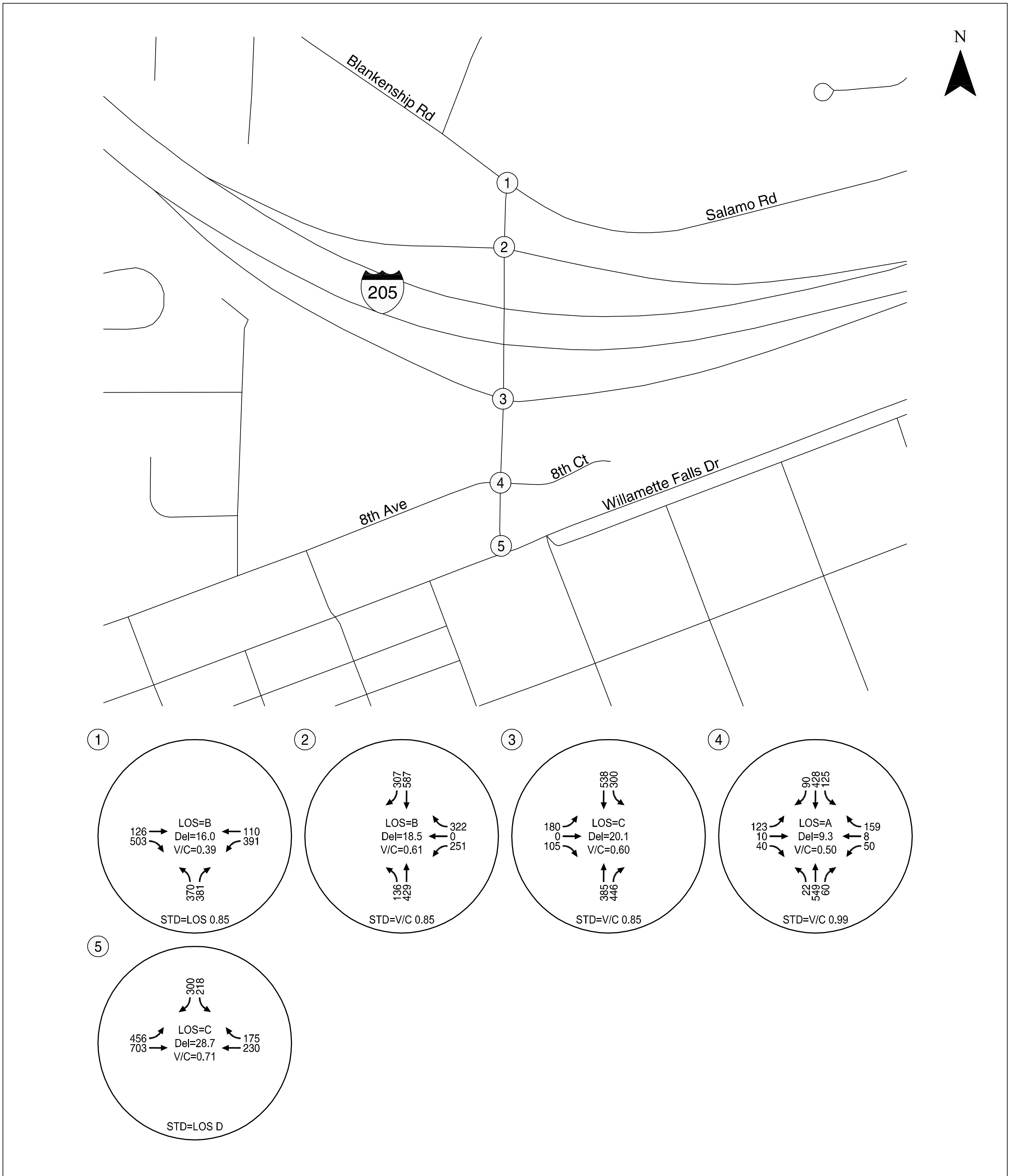
Synchro 8 was used to evaluate 95th percentile queues at the signalized study intersections under year 2040 traffic conditions assuming all of the improvements included in Alternative 2. Table 6 summarizes the 95th percentile queues by movement.

Table 6: Alternative 2 Intersection Queues – Year 2040 Traffic Conditions

Intersection	Movement	Queue	Storage	Adequate?
10th Street/Blankenship-Salamo Road	EBT	122	Cont.	Yes
	EBR	58	150	Yes
	WBL	151	200	**No**
	WBT	69	Cont.	Yes
	NBL	84	100	**No**
	NBR	10	Cont.	Yes
10th Street/I-205 SB Ramp	WBL	213	200	**No**
	WBR	64	Cont.	Yes
	NBL	93	Cont.	Yes
	NBT	8	Cont.	Yes
	SBT	174	Cont.	Yes
10th Street/I-205 NB Ramp	EBL	167	200	Yes
	EBR	43	Cont.	Yes
	NBT	283	Cont.	Yes
	NBR	157	100	**No**
	SBL	181	Cont.	Yes
	SBT	8	Cont.	Yes
10th Street/Willamette Falls Drive	EBL	#352	225	**No**
	EBT	342	Cont.	Yes
	WBT	#323	Cont.	Yes
	SBL	190	125	**No**
	SBR	40	Cont.	Yes
10th Street/Willamette Falls Drive	EBL	#352	220	**No**
	EBT	342	Cont.	Yes
	WBT	#323	Cont.	Yes
	SBL	190	Cont.	Yes
	SBR	40	Cont.	Yes

95th percentile volume exceeds capacity, queue may be longer.

As shown in Table 6, there continue to be a few movements where the 95th percentile queues are expected to exceed the available storage.



CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = CRITICAL MOVEMENT LEVEL OF SERVICE (SIGNALIZED)/
CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/
CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL CRITICAL VOLUME-TO-CAPACITY RATIO

Alternative 2 - Year 2040 Traffic Conditions
Weekday PM Peak Hour
West Linn, OR

Figure
8

Interchange Improvements

Given the significant difference in the traffic volume projections used in the 2008 TSP and the 10th Street study versus those used in this analysis, improvements to the interchange are not anticipated to be necessary to accommodate the 2040 forecast traffic volumes; however, , alternatives that could potentially accommodate greater traffic demand than projected have been evaluated at a qualitative level. These alternatives include a Diverging Diamond Interchange (DDI), a Single Point Urban Interchange (SPUI –recommended in the 2008 TSP), a Raindrop/Dumbbell Interchange, and a Tight Diamond Interchange. The following provides a high level review of each type of interchange, including the advantages and disadvantages of each form, the feasibility for implementation at the 10th Street interchange, and planning level cost estimates. The cost estimates include the interchange ramps and termini only and do not account for the full set of improvements needed along 10th Street from Willamette Falls Drive to Blankenship-Salamo Road.

Diverging Diamond Interchange

The Diverging Diamond Interchange (DDI) is an emerging interchange form that is becoming more utilized as a method to retrofit conventional diamond interchanges with heavy left turns. The DDI works by crossing through-movement traffic over from the right side to the left side of the road on either side of the interchange where the ramp termini of a conventional diamond would normally exist. Figure 9 illustrates a DDI locate in Alcoa, TN.

The main benefit of the DDI over the conventional diamond interchange is the reduced number of required signal phases (two phases compared with three for a conventional diamond). The reduced number of phases results in a lower percentage of lost time at each signalized intersection, as well as reduced delay and queueing at the interchange. Like the conventional diamond, various signal coordination strategies can be used to progress certain turning movements through the interchange. Another major benefit of the DDI when compared with other interchange forms is that it usually can be constructed in place of a conventional diamond while mostly preserving the footprint of the interchange, and usually does not require major bridge reconstruction. While there are currently no comprehensive crash analyses of built DDIs in the United States, they are presumed to be safer than conventional diamond interchanges due to the reduced number of vehicle-to-vehicle conflict points (18 at a DDI compared to 26 at a conventional diamond). DDIs also contain fewer pedestrian-to-vehicle conflict points than conventional diamonds.

The main disadvantage of the DDI is that it is still relatively new as an interchange form, and most design and operations guidance is still emerging. Another disadvantage of the DDI is that it does not tend to work well with closely-spaced adjacent signalized intersections, since movements at those intersections must be coordinated with the movements of the DDI, and most intersections typically have more than two signal phases. Geometrically, it can be difficult to design a DDI crossover that is compact enough to fit between the freeway and a closely-spaced intersection. If traffic volumes (especially left turn volumes) are not high, then the DDI typically does not provide much benefit over the conventional diamond.

Source: Google

Diverging Diamond Interchange (DDI)
Alcoa, TN

Figure
9

At the I-205/10th Street interchange, a DDI would likely result in some operational and safety improvements compared with the existing diamond, especially at the northbound I-205 ramp terminus, but the geometric constraints of the site could make it challenging to fit the DDI within the existing footprint. The short distance (approximately 250 feet) between the southbound I-205 ramp terminus and the Blankenship/Salamo intersection would make it challenging to fit the DDI crossover and coordinate the signal timing between the two intersections. Retrofits of conventional diamond interchanges with a DDI have typically run in the range of $3 million to $8 million, according to the FHWA Diverging Diamond Interchange Informational Guide.

Using a high-level critical movement analysis with the projected 2040 volumes, the traffic operations at the interchange are not expected to improve significantly with the construction of a DDI, so the cost of the DDI will likely outweigh its benefits.

Single Point Urban Interchange

The Single-Point Urban Interchange (SPUI) is an interchange form that is used to retrofit a conventional diamond interchange with heavy traffic where right of way is limited. The SPUI works by bringing all four ramps to a single large intersection with the cross-street either below or above the freeway. This allows opposing left turns to run concurrently. Figure 10 illustrates a SPUI in Salem, OR.

The main benefit of the SPUI over the conventional diamond interchange is the consolidation of all traffic movements into one intersection, which typically allows for more efficient traffic operations. This results in large decreases in delay and travel time compared to a conventional diamond with the same lane configuration. A SPUI can also work well with adjacent signalized intersections or frontage roads, since the one intersection will typically be farther away from adjacent intersections than the two intersections of a conventional diamond.

The main disadvantage of the SPUI is the high cost associated with rebuilding the bridges over 10th Street. If the signal cycle length is low, then some of the operational benefits of the SPUI may also be counteracted with high lost times associated with the large intersection width, which may cause unnecessary delay and queuing during off-peak periods. The SPUI has a similar crash history to the conventional diamond, but pedestrians usually must cross a greater length of crosswalk, since the SPUI usually has a very wide intersection.

Due to the need to rebuild the bridges at the interchange, the SPUI can usually cost upward of $15 million, making it the most expensive of the designs considered. The SPUI would likely result in the greatest operational improvement of any of the designs considered, but it may not be worth the high cost.

N

Source: Google

Single Point Urban Interchange (SPUI)
Salem, OR

Figure
10

Raindrop/Dumbbell Interchange

The raindrop interchange, also known as a dumbbell or diamond with roundabouts, is similar to a conventional diamond but replaces the intersections at the ramp termini with roundabouts. Figure 11 illustrates a raindrop interchange in Gig Harbor, WA.

Many of the advantages of the raindrop interchange correspond with the advantages of roundabouts over signalized or other unsignalized intersections. The main advantage is the reduced queueing and off-peak delay at the ramp termini due to the yield-control at entry. Other benefits include a reduced number of conflict points (eight at each roundabout, compared to 11 at each intersection within a conventional diamond), reduced crash severity associated with low vehicle speeds, reduced maintenance costs, and lower traffic noise and emissions associated with a lower number of stops. Usually, fewer approach lanes are needed to serve the same amount of traffic at a roundabout than at a conventional (signalized or unsignalized) ramp terminus.

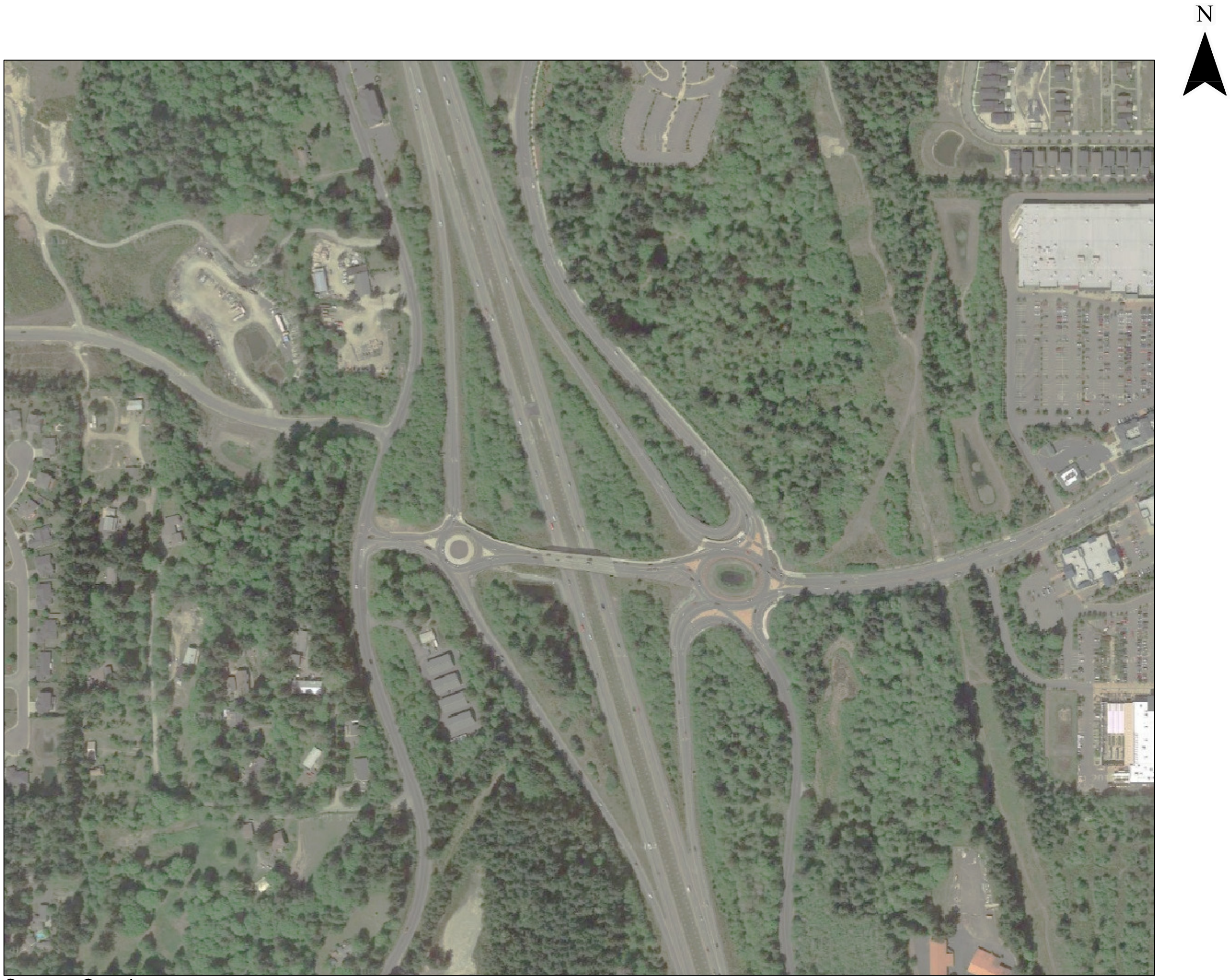
The cost to install a raindrop interchange is typically greater than the cost of constructing two individual roundabouts because of increased complexity of maintaining traffic through the interchange and realigning the ramps. Typically, large arterial roundabouts can cost $200,000 to $400,000 to install, with the total cost of a raindrop interchange in the $3 to 6 million range depending on the extent of modifications to the ramps.

Tight Diamond Interchange

The tight diamond interchange is a form of conventional signalized diamond interchange where the ramps are brought close enough to the over/underpass so that they can function off the same signal controller. Figure 12 illustrates a Tight Diamond Interchange in Hayward, CA.

The main advantage of the tight diamond is the ability to efficiently move traffic through the ramp termini with a single signal controller, resulting in reduced delay and number of stops at the intersections. Another advantage of the tight diamond is that it has a smaller footprint than a conventional diamond. The main disadvantage of a tight diamond is the potential for queue spillback between the ramp termini. Queue spillback can be mitigated through the use of additional storage lanes for turning movements, but this often requires a larger footprint for each ramp terminus, and thus a wider or longer over/underpass.

Using a high-level critical movement analysis with the projected 2040 volumes, the tight diamond would operate below capacity but with slightly worse operations at the northbound I-205 ramp terminus than at the conventional diamond. However, the increased spacing between the southbound I-205 ramp terminus and the Blankenship/Salamo intersection would result in substantially better operations between those two intersections. The cost to construct a tight diamond is highly variable but mainly depends on whether the over/underpass would need to be reconstructed. Given the width of 10th Street underneath I-205 is approximately 46 feet (excluding bicycle lanes), it may be possible to accommodate the necessary four lanes there. Thus, if relocating the ramp termini is the main cost, then the tight diamond would probably cost in the $2 to $4 million range.



Source: Google

Raindrop Interchange
Gig Harbor, WA

Figure
11

N

Source: Google

Tight Diamond Interchange
Hayward, CA

Figure
12

FINDINGS AND RECOMMENDATIONS

The results of this analysis indicate that full reconstruction of the interchange is not required to address existing and forecast year 2040 traffic operational issues along the 10th Street corridor and at the study intersection. Incremental improvements implemented over the next 25 years are sufficient to maintaining safe and acceptable traffic operations. The findings of this analysis and our recommendations are discussed below. The improvements identified under the Corridor Improvements are sufficient to address the issues, and therefore should be carried into the TSP update.

Findings

Existing Traffic Conditions

- All of the study intersections currently meet their respective mobility standards during the weekday p.m. peak hour, with the exception of the 10th Street/8th Avenue-Court intersection.
  - The eastbound left-turn movement at this intersection currently operations at LOS F and above capacity during the weekday p.m. peak hour.
- Several movements at the study intersections currently have 95th percentile queues that are longer than the available storage and impact operations along the corridor.
- A review of historical crash data did not reveal any trends or patterns that require mitigation associated with the TSP update.

Year 2040 (No-Build) Traffic Conditions

- All of the study intersections are expected to meet their respective mobility standards during the weekday p.m. peak hour, with the exception of the 10th Street/8th Avenue-Court and 10th Street/Willamette Falls Drive intersections.
  - The eastbound left-turn movements at both intersections are expected to operate at LOS F and above capacity during the weekday p.m. peak hour.
- Several additional movements at the study intersections (relative to existing conditions) are expected to have 95th percentile queues that are longer than the available storage and impact operations along the corridor.

Alternatives Analysis

Corridor Improvements Alternative 1

- This alternative includes several of the improvement projects identified in the 2008 TSP and the 10th Street Study and includes access restrictions on 10th Street and the extension of 8th Court to Willamette Falls Drive.

    - ODOT is currently evaluating the potential for the 8th Court extension to Willamette Falls Drive as well as the right-of-way acquisition costs associated with many of the other improvements identified in these previous planning documents.
- All of the study intersections are expected to meet their respective mobility standards during the weekday p.m. peak hour with the improvements
- Queuing at many of the study intersections is also expected to be reduced significantly relative to year 2040 (no-build) traffic conditions.
- This alternative would require significant right-of-way acquisition to be completed.

Corridor Improvements Alternative 2

- This alternative includes many of the improvement projects identified in the 2008 TSP for the area located between Blankenship-Salamo Road and the I-205 NB Ramps, but it includes a new traffic signal at the 10th Street/8th Avenue-Court and 10th Street/Willamette Fall Drive intersections that is coordinated with the other signals along the corridor.
    - The final design/timing/phasing of the traffic signals at 8th Avenue-Court and Willamette Falls Drive will need to minimize impacts to the I-205 NB Ramp terminal.
- All of the study intersections are expected to meet their respective mobility standards during the weekday p.m. peak hour with the improvements
- Queuing at many of the study intersections is also expected to be reduced significantly relative to year 2040 (no-build) traffic conditions.
- This alternative would not require significant right-of-way acquisition to be completed as compared to Alternative 1.

Interchange Improvements

- Full reconstruction of the interchange is not needed based on the current 2040 forecast; however, four alternative interchange forms that could potentially accommodate higher forecast volumes were evaluated at a qualitative level including:
    - Diverging Diamond Interchange (DDI),
    - Single Point Urban Interchange (SPUI –recommended in the 2008 TSP),
    - Raindrop/Dumbbell Interchange, and
    - Tight Diamond Interchange.
- Each of these alternative interchange forms could potentially accommodate greater traffic volume than either of the corridor improvement alternatives described above; however, they have significantly higher costs.

Recommendations

All of the pedestrian, bicycle, and transit improvement projects identified in the 2008 TSP should be carried into the TSP update as planning improvements. Similarly, all of the improvement projects identified under Corridor Improvements Alternative 1 and 2 for the segment of 10th Street located between Blankenship-Salamo Road and the I-205 NB Ramps should be carried into the TSP Update, while the remaining improvements at the 8th Avenue/8th Court and Willamette Falls Drive intersections should be evaluated further following ODOT's evaluation of the 8th Court extension feasibility.

REFERENCES

1. City of West Linn. West Linn Transportation System Plan. 2008
2. DKS Associates. 10th Street at Willamette Falls Drive Intersection Traffic Control Study. 2011
3. Oregon Department of Transportation. Oregon Highway Plan. 2012
4. Transportation Research Board. Highway Capacity Manual. 2000.
5. National Cooperative Highway Research Program. Report 255 Highway Traffic Data for Urbanized Area Project Planning and Design. 1982.

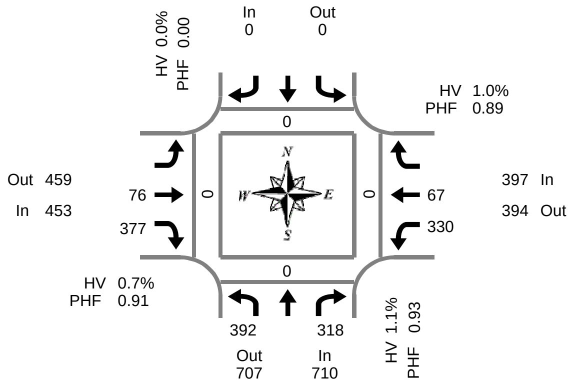
APPENDIX

A. Traffic Counts
B. Existing Traffic Conditions and Queueing Worksheets
C. Crash Data
D. Year 2040 (No-Build) Traffic Conditions and Queuing Worksheets
E. Year 2040 Traffic Conditions and Queuing Worksheets with Corridor Improvements Alternative 1
F. Year 2040 Traffic Conditions and Queuing Worksheets with Corridor Improvements Alternative 2

Appendix A Traffic Counts

Total Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

10th St & Salamo Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound Salamo Rd				Westbound Salamo Rd				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes		T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	98		84	0				0		32	113	0	80	11		0	418	0	0	0	0
4:15 PM	76		70	0				0		24	105	0	93	15		0	383	0	0	0	0
4:30 PM	73		74	0				0		25	100	1	61	19		0	352	0	0	0	0
4:45 PM	83		87	0				0		27	102	0	74	19		0	392	0	0	0	0
5:00 PM	88		70	0				0		18	104	0	83	14		0	377	0	0	0	0
5:15 PM	105		77	0				0		26	87	0	81	21		0	397	0	0	0	0
5:30 PM	90		89	0				0		12	82	0	91	20		0	384	0	0	0	0
5:45 PM	109		82	0				0		20	104	0	75	12		0	402	0	0	0	0
Total Survey	722		633	0				0		184	797	1	638	131		0	3,105	0	0	0	0

Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound 10th St				Southbound 10th St				Eastbound Salamo Rd				Westbound Salamo Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	710	707	1,417	0	0	0	0	0	453	459	912	0	397	394	791	0	1,560	0	0	0	0
%HV	1.1%				0.0%				0.7%				1.0%				1.0%				
PHF	0.93				0.00				0.91				0.89				0.97				

By Movement	Northbound 10th St				Southbound 10th St				Eastbound Salamo Rd				Westbound Salamo Rd				Total
	L		R	Total				Total		T	R	Total	L	T		Total	
Volume	392		318	710				0		76	377	453	330	67		397	1,560
%HV	1.0%	NA	1.3%	1.1%	NA	NA	NA	0.0%	NA	0.0%	0.8%	0.7%	1.2%	0.0%	NA	1.0%	1.0%
PHF	0.90		0.89	0.93				0.00		0.73	0.91	0.91	0.91	0.80		0.89	0.97

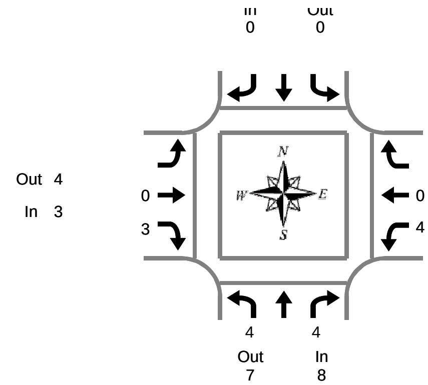
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound Salamo Rd				Westbound Salamo Rd				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes		T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	330		315	0				0		108	420	1	308	64		0	1,545	0	0	0	0
4:15 PM	320		301	0				0		94	411	1	311	67		0	1,504	0	0	0	0
4:30 PM	349		308	0				0		96	393	1	299	73		0	1,518	0	0	0	0
4:45 PM	366		323	0				0		83	375	0	329	74		0	1,550	0	0	0	0
5:00 PM	392		318	0				0		76	377	0	330	67		0	1,560	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

10th St & Salamo Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St L		R	Total	Southbound 10th St			Total	Eastbound Salamo Rd	T	R	Total	Westbound Salamo Rd L	T		Total	Interval Total
4:00 PM	2		1	3				0		0	3	3	2	0		2	8
4:15 PM	1		0	1				0		0	4	4	4	0		4	9
4:30 PM	2		0	2				0		0	0	0	1	0		1	3
4:45 PM	0		2	2				0		0	1	1	0	0		0	3
5:00 PM	1		3	4				0		0	2	2	0	0		0	6
5:15 PM	0		1	1				0		0	0	0	2	0		2	3
5:30 PM	1		0	1				0		0	0	0	1	0		1	2
5:45 PM	2		0	2				0		0	1	1	1	0		1	4
Total Survey	9		7	16				0		0	11	11	11	0		11	38

Heavy Vehicle Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound 10th St In	Out	Total	Southbound 10th St In	Out	Total	Eastbound Salamo Rd In	Out	Total	Westbound Salamo Rd In	Out	Total	Total
Volume	8	7	15	0	0	0	3	4	7	4	4	8	15
PHF	0.25			0.00			0.11			0.14			0.19

By Movement	Northbound 10th St L		R	Total	Southbound 10th St			Total	Eastbound Salamo Rd	T	R	Total	Westbound Salamo Rd L	T		Total	Total
Volume	4		4	8				0		0	3	3	4	0		4	15
PHF	0.20		0.17	0.25				0.00		0.00	0.11	0.11	0.14	0.00		0.14	0.19

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

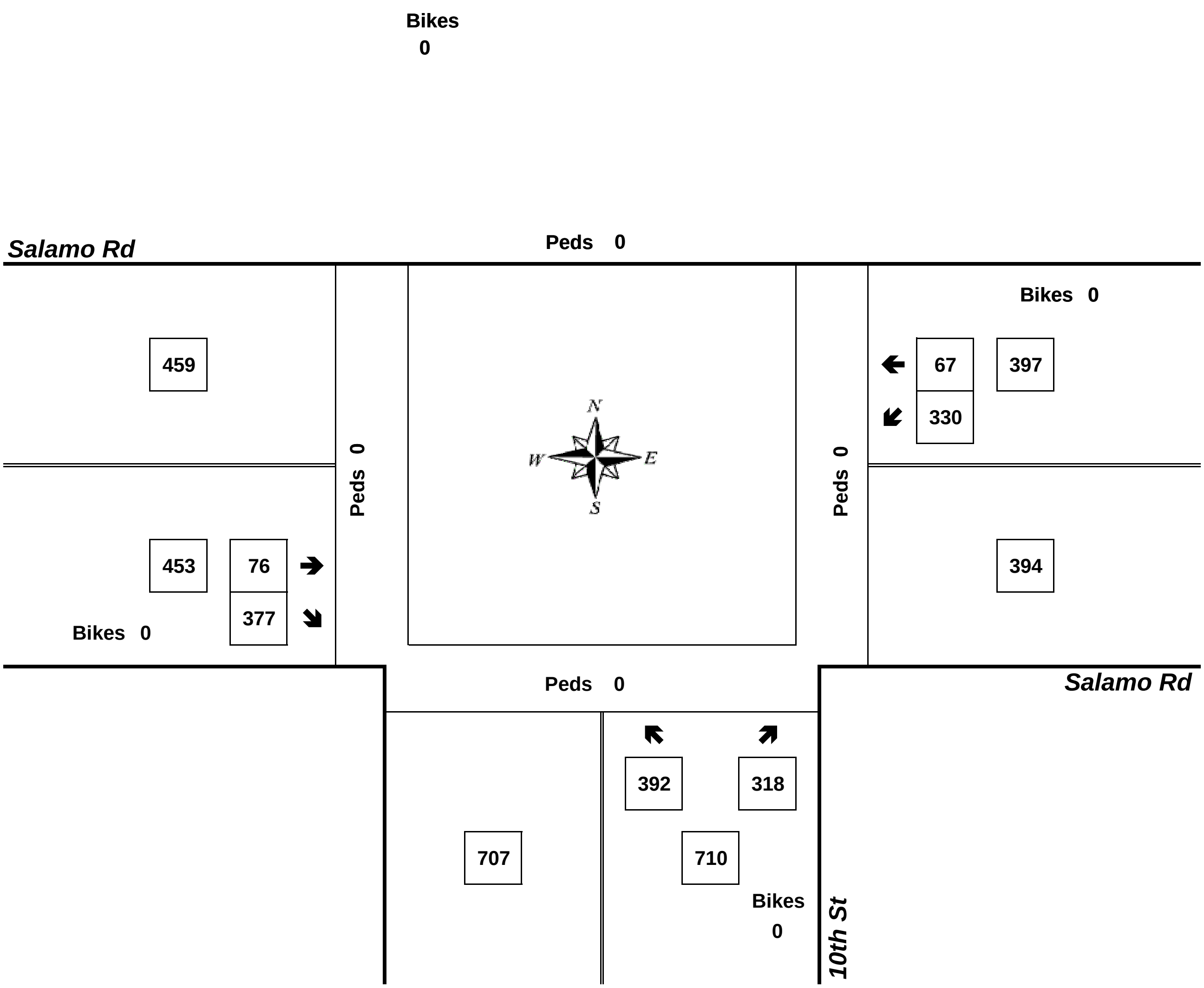
Interval Start Time	Northbound 10th St L		R	Total	Southbound 10th St			Total	Eastbound Salamo Rd	T	R	Total	Westbound Salamo Rd L	T		Total	Interval Total
4:00 PM	5		3	8				0		0	8	8	7	0		7	23
4:15 PM	4		5	9				0		0	7	7	5	0		5	21
4:30 PM	3		6	9				0		0	3	3	3	0		3	15
4:45 PM	2		6	8				0		0	3	3	3	0		3	14
5:00 PM	4		4	8				0		0	3	3	4	0		4	15

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

10th St & Salamo Rd

5:00 PM to 6:00 PM
Wednesday, April 16, 2014



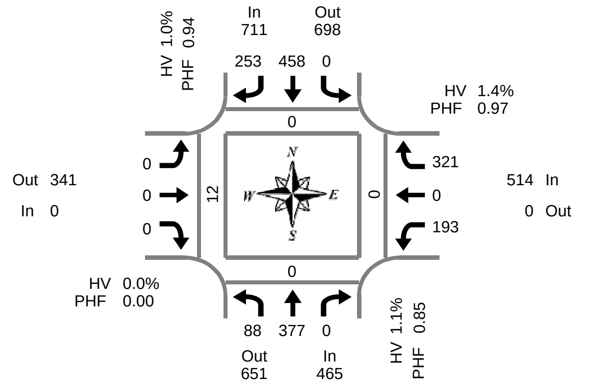
Approach	PHF	HV%	Volume
EB	0.91	0.7%	453
WB	0.89	1.0%	397
NB	0.93	1.1%	710
SB	0.00	0.0%	0
Intersection	0.97	1.0%	1,560

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

10th St & I-205 SB Ramps

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	18	107	0	0	0	136	56	0	0	0	0	0	42	0	71	0	430	0	0	0	0
4:15 PM	31	81	0	0	0	139	61	0	0	0	0	0	41	0	75	0	428	0	0	0	0
4:30 PM	23	80	0	0	0	109	53	1	0	0	0	0	43	0	56	0	364	0	0	0	0
4:45 PM	24	104	0	0	0	120	56	0	0	0	0	0	53	0	80	0	437	0	0	0	0
5:00 PM	23	72	0	0	0	121	69	0	0	0	0	0	46	0	82	0	413	0	0	0	0
5:15 PM	22	96	0	0	0	120	53	0	0	0	0	0	35	0	86	0	412	0	0	0	3
5:30 PM	18	97	0	0	0	101	65	0	0	0	0	0	52	0	80	0	413	0	0	0	5
5:45 PM	25	112	0	0	0	116	66	0	0	0	0	0	60	0	73	0	452	0	0	0	4
Total Survey	184	749	0	0	0	962	479	1	0	0	0	0	372	0	603	0	3,349	0	0	0	12

Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	465	651	1,116	0	711	698	1,409	0	0	341	341	0	514	0	514	0	1,690	0	0	0	12
%HV	1.1%				1.0%				0.0%				1.4%				1.1%				
PHF	0.85				0.94				0.00				0.97				0.93				

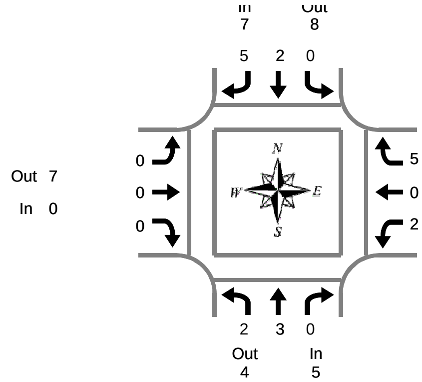
By Movement	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	88	377	0	465	0	458	253	711	0	0	0	0	193	0	321	514	1,690
%HV	2.3%	0.8%	0.0%	1.1%	0.0%	0.4%	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	1.6%	1.4%	1.1%
PHF	0.88	0.84	0.00	0.85	0.00	0.95	0.92	0.94	0.00	0.00	0.00	0.00	0.80	0.00	0.93	0.97	0.93

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	96	372	0	0	0	504	226	1	0	0	0	0	179	0	282	0	1,659	0	0	0	0
4:15 PM	101	337	0	0	0	489	239	1	0	0	0	0	183	0	293	0	1,642	0	0	0	0
4:30 PM	92	352	0	0	0	470	231	1	0	0	0	0	177	0	304	0	1,626	0	0	0	3
4:45 PM	87	369	0	0	0	462	243	0	0	0	0	0	186	0	328	0	1,675	0	0	0	8
5:00 PM	88	377	0	0	0	458	253	0	0	0	0	0	193	0	321	0	1,690	0	0	0	12

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

10th St & I-205 SB Ramps

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	0	2	0	2	0	3	1	4	0	0	0	0	1	0	0	1	7
4:15 PM	2	0	0	2	0	3	5	8	0	0	0	0	0	0	1	1	11
4:30 PM	1	3	0	4	0	1	0	1	0	0	0	0	1	0	0	1	6
4:45 PM	1	1	0	2	0	0	1	1	0	0	0	0	1	0	1	2	5
5:00 PM	0	1	0	1	0	0	2	2	0	0	0	0	0	0	3	3	6
5:15 PM	0	0	0	0	0	0	2	2	0	0	0	0	0	0	1	1	3
5:30 PM	0	1	0	1	0	0	1	1	0	0	0	0	1	0	0	1	3
5:45 PM	2	1	0	3	0	2	0	2	0	0	0	0	1	0	1	2	7
Total Survey	6	9	0	15	0	9	12	21	0	0	0	0	5	0	7	12	48

Heavy Vehicle Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound 10th St			Southbound 10th St			Eastbound I-205 SB Ramps			Westbound I-205 SB Ramps			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	5	4	9	7	8	15	0	7	7	7	0	7	19
PHF	0.16			0.13			0.00			0.29			0.20

By Movement	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	2	3	0	5	0	2	5	7	0	0	0	0	2	0	5	7	19
PHF	0.13	0.15	0.00	0.16	0.00	0.07	0.21	0.13	0.00	0.00	0.00	0.00	0.25	0.00	0.25	0.29	0.20

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

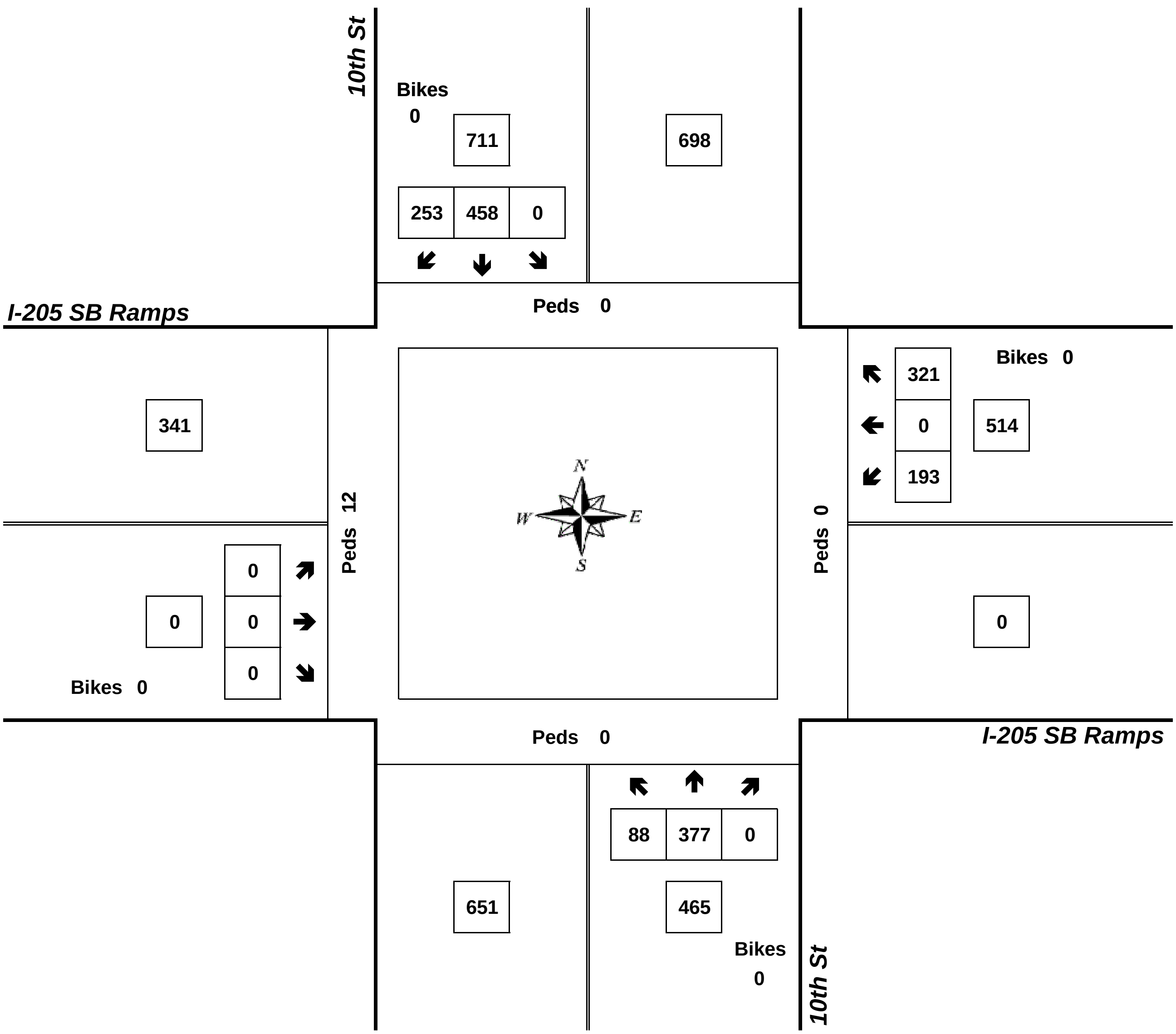
Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 SB Ramps				Westbound I-205 SB Ramps				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	4	6	0	10	0	7	7	14	0	0	0	0	3	0	2	5	29
4:15 PM	4	5	0	9	0	4	8	12	0	0	0	0	2	0	5	7	28
4:30 PM	2	5	0	7	0	1	5	6	0	0	0	0	2	0	5	7	20
4:45 PM	1	3	0	4	0	0	6	6	0	0	0	0	2	0	5	7	17
5:00 PM	2	3	0	5	0	2	5	7	0	0	0	0	2	0	5	7	19

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

10th St & I-205 SB Ramps

5:00 PM to 6:00 PM
Wednesday, April 16, 2014

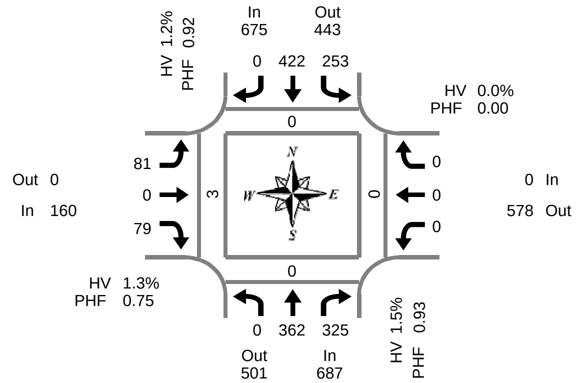


Approach	PHF	HV%	Volume
EB	0.00	0.0%	0
WB	0.97	1.4%	514
NB	0.85	1.1%	465
SB	0.94	1.0%	711
Intersection	0.93	1.1%	1,690

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

10th St & I-205 NB Ramps

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	94	46	0	73	100	0	0	30	0	18	0	0	0	0	0	361	0	0	0	1
4:15 PM	0	87	84	0	69	114	0	0	27	0	16	0	0	0	0	0	397	0	0	0	1
4:30 PM	0	83	77	0	56	99	0	1	23	0	30	0	0	0	0	0	368	0	0	0	1
4:45 PM	0	104	67	0	62	111	0	0	13	0	21	0	0	0	0	0	378	0	0	0	1
5:00 PM	0	88	97	0	66	98	0	0	18	0	12	0	0	0	0	0	379	0	0	0	0
5:15 PM	0	86	65	0	65	91	0	0	30	0	14	0	0	0	0	0	351	0	0	0	3
5:30 PM	0	82	94	0	43	112	0	0	31	0	25	0	0	0	0	0	387	0	0	0	5
5:45 PM	0	95	53	0	44	126	0	0	47	1	35	0	0	0	0	0	401	0	0	0	4
Total Survey	0	719	583	0	478	851	0	1	219	1	171	0	0	0	0	0	3,022	0	0	0	16

Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	687	501	1,188	0	675	443	1,118	1	160	0	160	0	0	578	578	0	1,522	0	0	0	3
%HV	1.5%				1.2%				1.3%				0.0%				1.3%				
PHF	0.93				0.92				0.75				0.00				0.96				

By Movement	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	0	362	325	687	253	422	0	675	81	0	79	160	0	0	0	0	1,522
%HV	0.0%	1.9%	0.9%	1.5%	0.8%	1.4%	0.0%	1.2%	2.5%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	1.3%
PHF	0.00	0.87	0.84	0.93	0.92	0.93	0.00	0.92	0.75	0.00	0.66	0.75	0.00	0.00	0.00	0.00	0.96

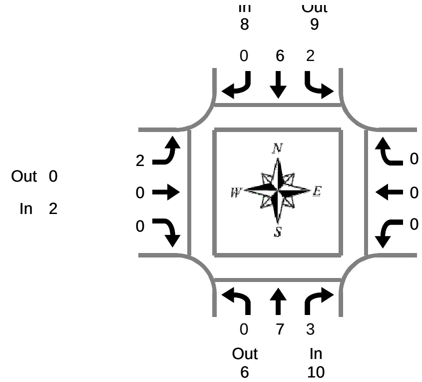
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	368	274	0	260	424	0	1	93	0	85	0	0	0	0	0	1,504	0	0	0	4
4:15 PM	0	362	325	0	253	422	0	1	81	0	79	0	0	0	0	0	1,522	0	0	0	3
4:30 PM	0	361	306	0	249	399	0	1	84	0	77	0	0	0	0	0	1,476	0	0	0	5
4:45 PM	0	360	323	0	236	412	0	0	92	0	72	0	0	0	0	0	1,495	0	0	0	9
5:00 PM	0	351	309	0	218	427	0	0	126	1	86	0	0	0	0	0	1,518	0	0	0	12

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

10th St & I-205 NB Ramps

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	0	3	0	3	1	3	0	4	0	0	0	0	0	0	0	0	7
4:15 PM	0	2	2	4	1	4	0	5	0	0	0	0	0	0	0	0	9
4:30 PM	0	2	1	3	1	1	0	2	1	0	0	1	0	0	0	0	6
4:45 PM	0	3	0	3	0	1	0	1	0	0	0	0	0	0	0	0	4
5:00 PM	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
5:15 PM	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5:30 PM	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	2
5:45 PM	0	2	0	2	0	2	0	2	0	0	2	2	0	0	0	0	6
Total Survey	0	12	4	16	3	12	0	15	3	0	2	5	0	0	0	0	36

Heavy Vehicle Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound 10th St			Southbound 10th St			Eastbound I-205 NB Ramps			Westbound I-205 NB Ramps			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	10	6	16	8	9	17	2	0	2	0	5	5	20
PHF	0.25			0.18			0.17			0.00			0.23

By Movement	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	0	7	3	10	2	6	0	8	2	0	0	2	0	0	0	0	20
PHF	0.00	0.25	0.25	0.25	0.17	0.19	0.00	0.18	0.25	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.23

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound I-205 NB Ramps				Westbound I-205 NB Ramps				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	0	10	3	13	3	9	0	12	1	0	0	1	0	0	0	0	26
4:15 PM	0	7	3	10	2	6	0	8	2	0	0	2	0	0	0	0	20
4:30 PM	0	5	2	7	1	2	0	3	2	0	0	2	0	0	0	0	12
4:45 PM	0	3	1	4	0	2	0	2	2	0	0	2	0	0	0	0	8
5:00 PM	0	2	1	3	0	3	0	3	2	0	2	4	0	0	0	0	10

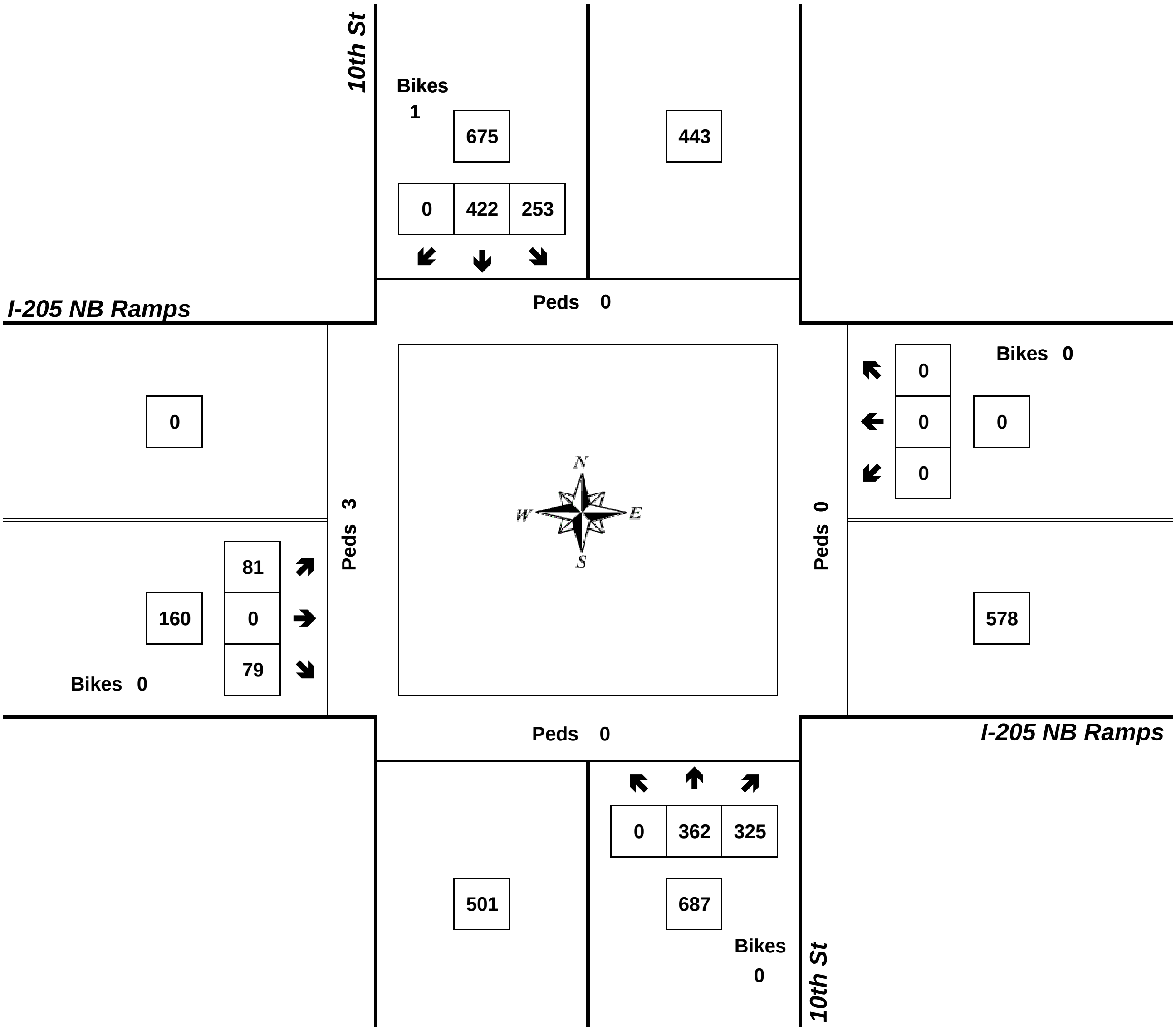
Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

10th St & I-205 NB Ramps

4:15 PM to 5:15 PM

Wednesday, April 16, 2014

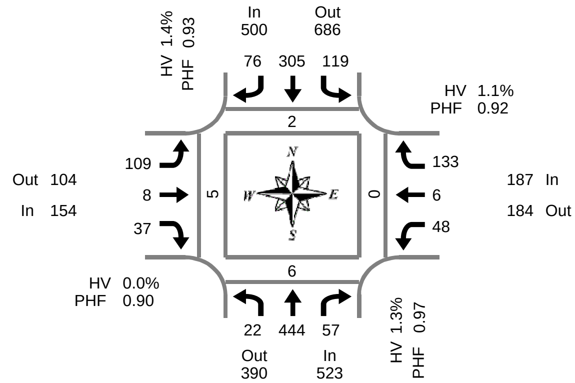


Approach	PHF	HV%	Volume
EB	0.75	1.3%	160
WB	0.00	0.0%	0
NB	0.93	1.5%	687
SB	0.92	1.2%	675
Intersection	0.96	1.3%	1,522

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

10th St & 8th Ave

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	3	76	9	0	32	70	18	0	27	1	5	0	6	1	36	0	284	0	0	0	0
4:15 PM	6	108	12	0	31	75	22	0	29	1	9	0	15	2	33	0	343	2	1	0	1
4:30 PM	4	109	17	0	33	76	14	1	20	3	11	0	10	1	33	0	331	0	1	0	0
4:45 PM	5	115	15	0	30	85	19	0	31	2	10	0	13	2	27	0	354	0	4	0	4
5:00 PM	7	112	13	0	25	69	21	0	29	2	7	0	10	1	40	0	336	0	0	0	0
5:15 PM	6	99	14	0	20	69	11	0	25	1	9	0	5	1	30	0	290	0	2	2	3
5:30 PM	5	122	19	0	29	77	27	0	22	5	3	0	13	1	35	0	358	0	1	0	2
5:45 PM	2	86	13	0	27	116	25	0	17	2	6	0	8	2	44	0	348	0	5	0	3
Total Survey	38	827	112	0	227	637	157	1	200	17	60	0	80	11	278	0	2,644	2	14	2	13

Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	523	390	913	0	500	686	1,186	1	154	104	258	0	187	184	371	0	1,364	2	6	0	5
%HV	1.3%				1.4%				0.0%				1.1%				1.2%				
PHF	0.97				0.93				0.90				0.92				0.96				

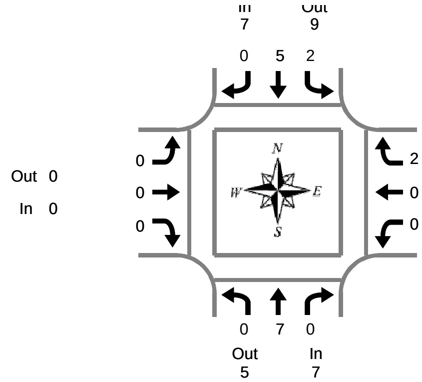
By Movement	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	22	444	57	523	119	305	76	500	109	8	37	154	48	6	133	187	1,364
%HV	0.0%	1.6%	0.0%	1.3%	1.7%	1.6%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	1.1%	1.2%
PHF	0.79	0.97	0.84	0.97	0.90	0.90	0.86	0.93	0.88	0.67	0.84	0.90	0.80	0.75	0.83	0.92	0.96

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	18	408	53	0	126	306	73	1	107	7	35	0	44	6	129	0	1,312	2	6	0	5
4:15 PM	22	444	57	0	119	305	76	1	109	8	37	0	48	6	133	0	1,364	2	6	0	5
4:30 PM	22	435	59	0	108	299	65	1	105	8	37	0	38	5	130	0	1,311	0	7	2	7
4:45 PM	23	448	61	0	104	300	78	0	107	10	29	0	41	5	132	0	1,338	0	7	2	9
5:00 PM	20	419	59	0	101	331	84	0	93	10	25	0	36	5	149	0	1,332	0	8	2	8

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

10th St & 8th Ave

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	0	3	0	3	0	2	1	3	0	0	0	0	0	0	0	0	6
4:15 PM	0	3	0	3	1	4	0	5	0	0	0	0	0	0	0	0	8
4:30 PM	0	3	0	3	1	0	0	1	0	0	0	0	0	0	1	1	5
4:45 PM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	1	3
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5:30 PM	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	2
5:45 PM	0	1	0	1	1	2	0	3	2	0	0	2	0	0	0	0	6
Total Survey	0	11	1	12	3	9	2	14	2	0	0	2	1	0	2	3	31

Heavy Vehicle Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound 10th St			Southbound 10th St			Eastbound 8th Ave			Westbound 8th Ave			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	7	5	12	7	9	16	0	0	0	2	2	4	16
PHF	0.19			0.19			0.00			0.25			0.21

By Movement	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	0	7	0	7	2	5	0	7	0	0	0	0	0	0	2	2	16
PHF	0.00	0.19	0.00	0.19	0.25	0.21	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.21

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound 8th Ave				Westbound 8th Ave				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	0	10	0	10	2	7	1	10	0	0	0	0	0	0	2	2	22
4:15 PM	0	7	0	7	2	5	0	7	0	0	0	0	0	0	2	2	16
4:30 PM	0	4	1	5	1	1	0	2	0	0	0	0	0	0	2	2	9
4:45 PM	0	1	1	2	0	1	1	2	0	0	0	0	1	0	1	2	6
5:00 PM	0	1	1	2	1	2	1	4	2	0	0	2	1	0	0	1	9

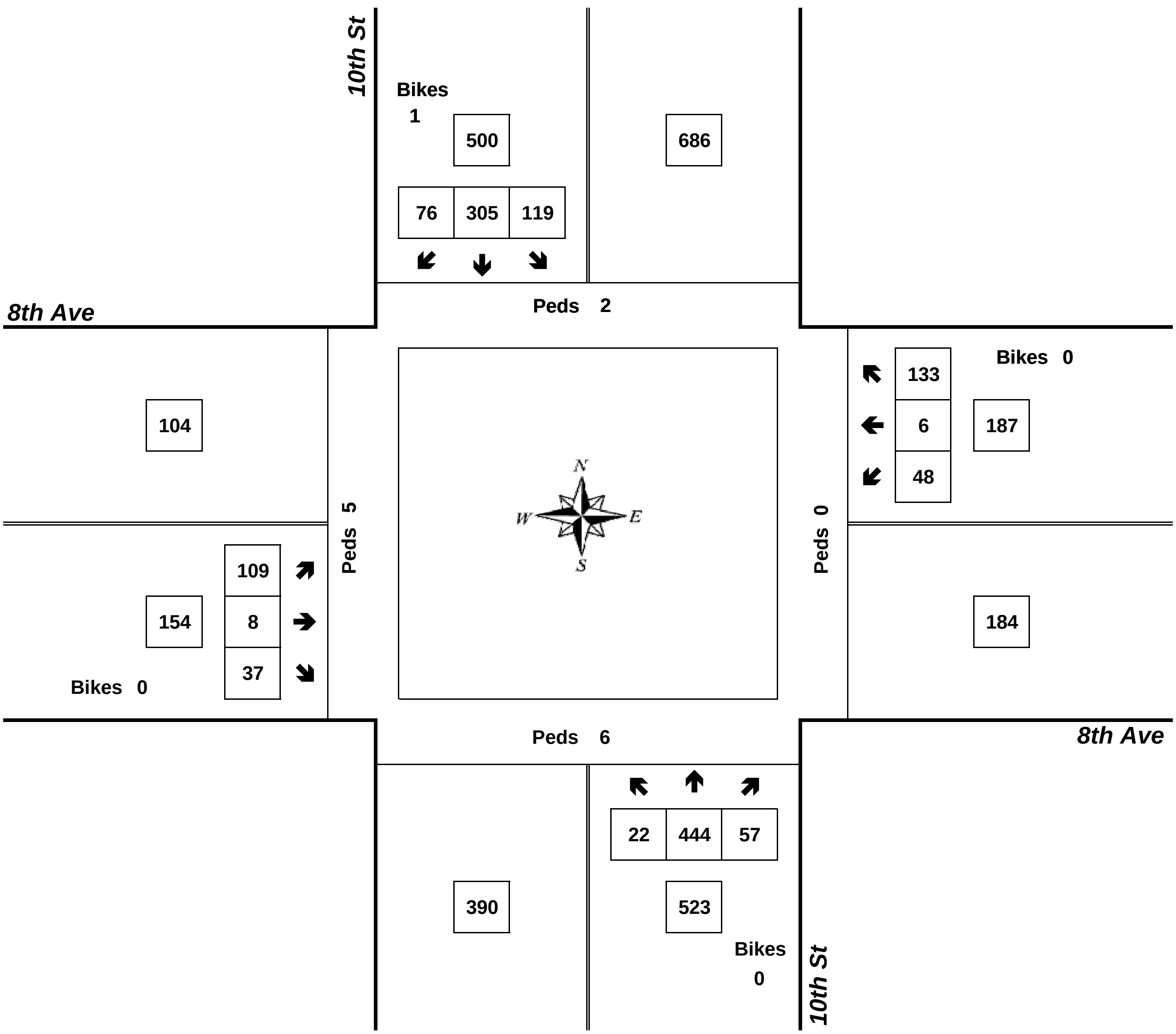
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

10th St & 8th Ave

4:15 PM to 5:15 PM
Wednesday, April 16, 2014

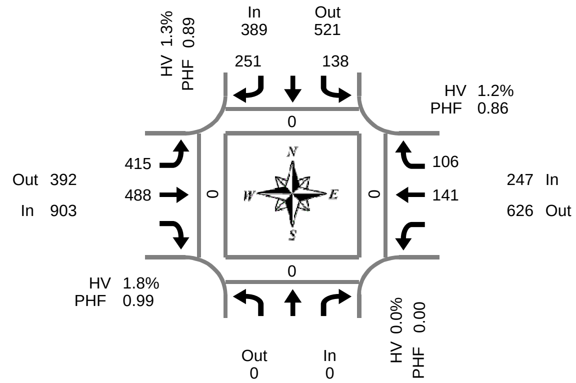


Approach	PHF	HV%	Volume
EB	0.90	0.0%	154
WB	0.92	1.1%	187
NB	0.97	1.3%	523
SB	0.93	1.4%	500
Intersection	0.96	1.2%	1,364

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

Clay Carney
(503) 833-2740



10th St & Willamette Falls Dr

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Peak Hour Summary
4:15 PM to 5:15 PM

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
4:00 PM				0	28		54	0	74	91		0		35	13	0	295	0	0	0	0
4:15 PM				0	37		62	0	101	121		0		33	24	0	378	0	0	0	0
4:30 PM				0	47		50	0	104	123		1		30	26	0	380	0	0	0	0
4:45 PM				0	28		81	0	102	127		0		40	32	0	410	0	0	0	0
5:00 PM				0	26		58	0	108	117		0		38	24	0	371	0	0	0	0
5:15 PM				0	34		50	0	90	108		0		32	30	0	344	2	0	0	0
5:30 PM				0	30		64	0	107	106		0		39	34	0	380	0	0	0	0
5:45 PM				0	46		84	0	81	76		0		23	23	0	333	0	0	0	0
Total Survey				0	276		503	0	767	869		1		270	206	0	2,891	2	0	0	0

Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	0	0	0	389	521	910	0	903	392	1,295	1	247	626	873	0	1,539	0	0	0	0
%HV	0.0%				1.3%				1.8%				1.2%				1.6%				
PHF	0.00				0.89				0.99				0.86				0.94				

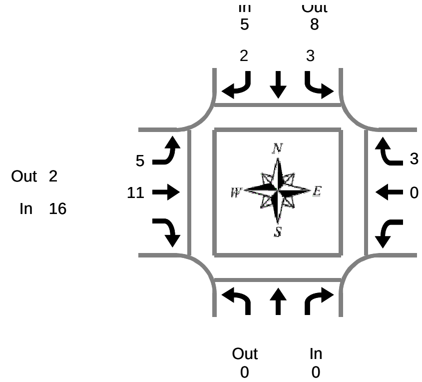
By Movement	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	138		251	389	415	488		903		141	106	247	1,539
%HV	NA	NA	NA	0.0%	2.2%	NA	0.8%	1.3%	1.2%	2.3%	NA	1.8%	NA	0.0%	2.8%	1.2%	1.6%
PHF				0.00	0.73		0.77	0.89	0.96	0.96		0.99		0.88	0.83	0.86	0.94

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
4:00 PM				0	140		247	0	381	462		1		138	95	0	1,463	0	0	0	0
4:15 PM				0	138		251	0	415	488		1		141	106	0	1,539	0	0	0	0
4:30 PM				0	135		239	0	404	475		1		140	112	0	1,505	2	0	0	0
4:45 PM				0	118		253	0	407	458		0		149	120	0	1,505	2	0	0	0
5:00 PM				0	136		256	0	386	407		0		132	111	0	1,428	2	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

10th St & Willamette Falls Dr

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
4:00 PM				0	1		1	2	3	1		4		0	0	0	6
4:15 PM				0	3		1	4	3	3		6		0	1	1	11
4:30 PM				0	0		0	0	2	4		6		0	1	1	7
4:45 PM				0	0		1	1	0	3		3		0	1	1	5
5:00 PM				0	0		0	0	0	1		1		0	0	0	1
5:15 PM				0	0		0	0	1	2		3		0	0	0	3
5:30 PM				0	0		2	2	0	0		0		0	0	0	2
5:45 PM				0	2		0	2	0	1		1		0	1	1	4
Total Survey				0	6		5	11	9	15		24		0	4	4	39

Heavy Vehicle Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound 10th St			Southbound 10th St			Eastbound Willamette Falls Dr			Westbound Willamette Falls Dr			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	0	0	0	5	8	13	16	2	18	3	14	17	24
PHF	0.00			0.21			0.25			0.25			0.25

By Movement	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	3		2	5	5	11		16		0	3	3	24
PHF				0.00	0.19		0.25	0.21	0.16	0.28		0.25		0.00	0.25	0.25	0.25

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound 10th St				Southbound 10th St				Eastbound Willamette Falls Dr				Westbound Willamette Falls Dr				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
4:00 PM				0	4		3	7	8	11		19		0	3	3	29
4:15 PM				0	3		2	5	5	11		16		0	3	3	24
4:30 PM				0	0		1	1	3	10		13		0	2	2	16
4:45 PM				0	0		3	3	1	6		7		0	1	1	11
5:00 PM				0	2		2	4	1	4		5		0	1	1	10

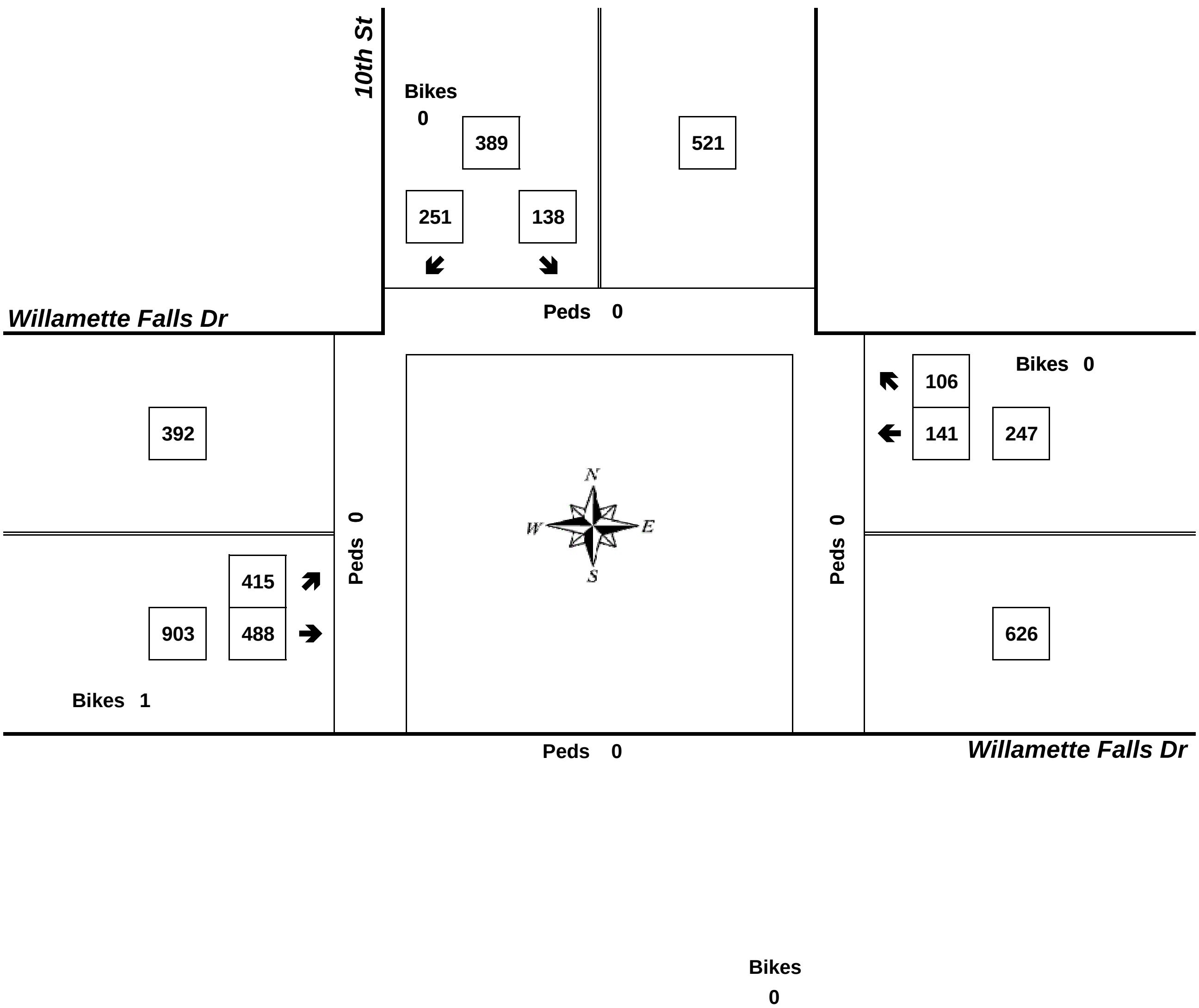
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

10th St & Willamette Falls Dr

4:15 PM to 5:15 PM
Wednesday, April 16, 2014



Approach	PHF	HV%	Volume
EB	0.99	1.8%	903
WB	0.86	1.2%	247
NB	0.00	0.0%	0
SB	0.89	1.3%	389
Intersection	0.94	1.6%	1,539

Count Period: 4:00 PM to 6:00 PM

Appendix B Existing Traffic Operations and Queuing Worksheets

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	98	433	327	70	341	320
v/c Ratio	0.46	0.43	0.77	0.10	0.39	0.24
Control Delay	45.5	5.9	43.9	15.5	18.6	0.8
Queue Delay	0.0	0.0	0.0	0.0	2.6	0.5
Total Delay	45.5	5.9	43.9	15.5	21.2	1.3
Queue Length 50th (ft)	51	45	167	23	117	0
Queue Length 95th (ft)	108	123	272	47	240	18
Internal Link Dist (ft)	590			679	177	
Turn Bay Length (ft)		150	200		100	
Base Capacity (vph)	648	1004	647	1454	870	1428
Starvation Cap Reductn	0	0	0	0	402	712
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.43	0.51	0.05	0.73	0.45

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	94	416	314	67	327	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1900	1580	1770	1900	1787	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1900	1580	1770	1900	1787	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	98	433	327	70	341	320
RTOR Reduction (vph)	0	92	0	0	0	91
Lane Group Flow (vph)	98	341	327	70	341	229
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	0%	2%	2%	0%	1%	2%
Turn Type		pm+ov	Prot			pm+ov
Protected Phases	4	5	3	8	5	3
Permitted Phases		4				5
Actuated Green, G (s)	7.7	48.7	20.1	32.8	41.0	61.1
Effective Green, g (s)	7.7	48.7	20.1	32.8	41.0	61.1
Actuated g/C Ratio	0.09	0.57	0.24	0.38	0.48	0.72
Clearance Time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Vehicle Extension (s)	2.3	5.2	2.3	2.3	5.2	2.3
Lane Grp Cap (vph)	172	1004	417	731	859	1236
v/s Ratio Prot	c0.05	0.16	c0.18	0.04	c0.19	0.04
v/s Ratio Perm		0.05				0.10
v/c Ratio	0.57	0.34	0.78	0.10	0.40	0.19
Uniform Delay, d1	37.2	9.7	30.6	16.8	14.2	4.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.1	8.9	0.0	1.4	0.0
Delay (s)	40.3	9.9	39.4	16.8	15.6	4.0
Level of Service	D	A	D	B	B	A
Approach Delay (s)	15.5			35.4	10.0	
Approach LOS	B			D	A	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.3	Sum of lost time (s)	16.5
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	196	312	109	363	776
v/c Ratio	0.69	0.61	0.16	0.26	0.81
Control Delay	53.4	9.9	23.2	5.7	38.5
Queue Delay	0.0	0.0	0.0	0.0	2.1
Total Delay	53.4	9.9	23.2	5.7	40.6
Queue Length 50th (ft)	119	0	43	65	218
Queue Length 95th (ft)	211	76	103	134	321
Internal Link Dist (ft)	651			256	177
Turn Bay Length (ft)			250		
Base Capacity (vph)	451	633	701	1567	1299
Starvation Cap Reductn	0	0	0	0	361
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.49	0.16	0.23	0.83

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	184	0	293	102	341	0	0	491	239
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.5	5.5	5.5	5.5			5.5	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frpb, ped/bikes					1.00	1.00	1.00	1.00			0.99	
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	
Frt					1.00	0.85	1.00	1.00			0.95	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1787	1583	1736	1881			3353	
Flt Permitted					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (perm)					1787	1583	1736	1881			3353	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	196	0	312	109	363	0	0	522	254
RTOR Reduction (vph)	0	0	0	0	0	262	0	0	0	0	53	0
Lane Group Flow (vph)	0	0	0	0	196	50	109	363	0	0	723	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	4%	1%	0%	0%	1%	3%
Turn Type				Split		Perm	Prot					
Protected Phases				8	8		5	2			6	
Permitted Phases						8						
Actuated Green, G (s)					16.1	16.1	40.6	73.2			27.1	
Effective Green, g (s)					16.1	16.1	40.6	73.2			27.1	
Actuated g/C Ratio					0.16	0.16	0.40	0.73			0.27	
Clearance Time (s)					5.5	5.5	5.5	5.5			5.5	
Vehicle Extension (s)					2.3	2.3	5.2	2.3			2.3	
Lane Grp Cap (vph)					287	254	703	1373			906	
v/s Ratio Prot					c0.11		0.06	c0.19			c0.22	
v/s Ratio Perm						0.03						
v/c Ratio					0.68	0.20	0.16	0.26			0.80	
Uniform Delay, d1					39.7	36.5	19.0	4.5			34.0	
Progression Factor					1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2					5.7	0.2	0.5	0.1			4.7	
Delay (s)					45.4	36.7	19.4	4.6			38.8	
Level of Service					D	D	B	A			D	
Approach Delay (s)		0.0			40.1			8.0			38.8	
Approach LOS		A			D			A			D	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	100.3	Sum of lost time (s)	16.5
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	84	82	377	339	264	440
v/c Ratio	0.33	0.27	0.50	0.42	0.62	0.30
Control Delay	31.4	10.4	18.0	5.8	29.5	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	10.4	18.0	5.8	29.5	4.0
Queue Length 50th (ft)	29	0	103	16	88	48
Queue Length 95th (ft)	78	37	221	78	183	98
Internal Link Dist (ft)	628		216			168
Turn Bay Length (ft)				100	150	
Base Capacity (vph)	663	656	1047	1017	837	1725
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.13	0.36	0.33	0.32	0.26

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	81	0	79	0	0	0	0	362	325	253	422	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1615					1863	1599	1787	1881	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1770	1615					1863	1599	1787	1881	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	84	0	82	0	0	0	0	377	339	264	440	0
RTOR Reduction (vph)	0	0	73	0	0	0	0	0	160	0	0	0
Lane Group Flow (vph)	0	84	9	0	0	0	0	377	179	264	440	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	2%	1%	1%	1%	0%
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		8						6		5	2	
Permitted Phases	8		8						6			
Actuated Green, G (s)		6.3	6.3					24.5	24.5	14.1	43.6	
Effective Green, g (s)		6.3	6.3					24.5	24.5	14.1	43.6	
Actuated g/C Ratio		0.11	0.11					0.41	0.41	0.24	0.73	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		2.3	2.3					6.9	6.9	2.3	6.9	
Lane Grp Cap (vph)		186	170					762	654	421	1369	
v/s Ratio Prot								c0.20		c0.15	0.23	
v/s Ratio Perm		0.05	0.01						0.11			
v/c Ratio		0.45	0.05					0.49	0.27	0.63	0.32	
Uniform Delay, d1		25.2	24.1					13.1	11.8	20.5	2.9	
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.0	0.1					1.8	0.8	2.4	0.5	
Delay (s)		26.2	24.2					14.9	12.6	22.9	3.4	
Level of Service		C	C					B	B	C	A	
Approach Delay (s)		25.2			0.0			13.8			10.7	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	59.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	109	8	37	48	6	133	22	445	57	119	306	76
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	114	8	39	50	6	139	23	464	59	124	319	79
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						4						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											296	
pX, platoon unblocked	0.96	0.96	0.96	0.96	0.96		0.96					
vC, conflicting volume	1188	1175	358	1148	1185	493	398			523		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1176	1162	313	1135	1172	493	354			523		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	95	95	65	96	76	98			88		
cM capacity (veh/h)	108	163	704	142	161	576	1169			1044		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	114	47	195	23	523	124	398
Volume Left	114	0	50	23	0	124	0
Volume Right	0	39	139	0	59	0	79
cSH	108	443	499	1169	1700	1044	1700
Volume to Capacity	1.05	0.11	0.39	0.02	0.31	0.12	0.23
Queue Length 95th (ft)	172	9	46	1	0	10	0
Control Delay (s)	176.3	14.1	22.4	8.1	0.0	8.9	0.0
Lane LOS	F	B	C	A		A	
Approach Delay (s)	128.9		22.4	0.3		2.1	
Approach LOS	F		C				

Intersection Summary			
Average Delay	18.5		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	417	488	141	107	139	252
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	444	519	150	114	148	268

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	444	519	264	148	268
Volume Left (vph)	444	0	0	148	0
Volume Right (vph)	0	0	114	0	268
Hadj (s)	0.52	0.03	-0.24	0.53	-0.68
Departure Headway (s)	6.9	6.4	6.4	7.9	6.7
Degree Utilization, x	0.84	0.92	0.47	0.33	0.50
Capacity (veh/h)	520	552	548	447	528
Control Delay (s)	35.6	44.3	15.0	13.5	14.9
Approach Delay (s)	40.3		15.0	14.4	
Approach LOS	E		C	B	

Intersection Summary			
Delay	29.7		
HCM Level of Service	D		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix C Crash Data

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CRASH SUMMARIES BY YEAR BY COLLISION TYPE

Willamette Falls Drive & 10th Street

January 1, 2009 through December 31, 2013

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2011														
REAR-END	0	0	1	1	0	0	0	1	0	1	0	1	0	0
TURNING MOVEMENTS	0	0	1	1	0	0	0	1	0	1	0	1	0	0
2011 TOTAL	0	0	2	2	0	0	0	2	0	2	0	2	0	0
YEAR: 2010														
REAR-END	0	0	1	1	0	0	0	1	0	1	0	1	0	0
2010 TOTAL	0	0	1	1	0	0	0	1	0	1	0	1	0	0
YEAR: 2009														
TURNING MOVEMENTS	0	0	1	1	0	0	0	1	0	1	0	1	0	0
2009 TOTAL	0	0	1	1	0	0	0	1	0	1	0	1	0	0
FINAL TOTAL	0	0	4	4	0	0	0	4	0	4	0	4	0	0

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

URBAN NON-SYSTEM CRASH LISTING

CITY OF WEST LINN, CLACKAMAS COUNTY

Willamette Falls Drive & 10th Street

January 1, 2009 through December 31, 2013

```
       S    D
       P    R S W                                               INT-TYP                                    SPCL USE
       E A U C O  DATE        CLASS  CITY STREET            RD CHAR   (MEDIAN) INT-REL OFF-RD WTHR  CRASH TYP     TRLR QTY  MOVE                      A  S
SER#   E L G H R  DAY         DIST   FIRST STREET           DIRECT     LEGS    TRAF-   RNDBT  SURF  COLL TYP      OWNER     FROM        PRTC INJ    G  E LICNS  PED
INVEST D C S L K  TIME        FROM   SECOND STREET          LOCTN    (#LANES)  CONTL   DRVWY  LIGHT SVRTY      V# VEH TYPE  TO       P# TYPE SVRTY  E  X RES    LOC ERROR       ACTN EVENT     CAUSE
04581  N N N      11/30/2011  16     WILLAMETTE FALLS DR    INTER      3-LEG   N            N CLR   S-1STOP    01 NONE   0  STRGHT                                                           07
NONE              Wed          0     10TH ST                SW                 STOP SIGN    N DRY   REAR          PRVTE     SW  NE                                           000              00
                  4P                                        06           0                  N DAY   PDO           PSNGR CAR          01 DRVR NONE  00 M UNK        026       000              07
                                                                                                                                                        UNK
                                                                                                               02 NONE   0  STOP
                                                                                                                  PRVTE     SW  NE                                           011              00
                                                                                                                  PSNGR CAR          01 DRVR NONE  46 M OR-Y       000       000              00
                                                                                                                                                        OR<25
02637  N N N      07/23/2011  16     WILLAMETTE FALLS DR    INTER      3-LEG   N            N CLR   ANGL-OTH   01 NONE   0  TURN-R                                                           02
NONE              Sat          0     10TH ST                CN                 STOP SIGN    N DRY   TURN          PRVTE     N   SW                                           015              00
                  7P                                        01           0                  N DAY   PDO           PSNGR CAR          01 DRVR NONE  00 M OR-Y       028       000              02
                                                                                                                                                        OR<25
                                                                                                               02 NONE   0  STRGHT
                                                                                                                  PRVTE     NE  SW                                           000              00
                                                                                                                  PSNGR CAR          01 DRVR NONE  18 F OR-Y       000       000              00
                                                                                                                                                        OR<25
02189  N N N      06/28/2010  16     WILLAMETTE FALLS DR    INTER      3-LEG   N            N CLR   S-1TURN    01 NONE   0  STRGHT                                                 004       07
NONE              Mon          0     10TH ST                CN                 STOP SIGN    N DRY   REAR          PRVTE     NE  SW                                           000              00
                  12P                                       02           0                  N DAY   PDO           PSNGR CAR          01 DRVR NONE  38 F OR-Y       026       000              07
                                                                                                                                                        OR<25
                                                                                                               02 NONE   0  STOP
                                                                                                                  PRVTE     NE  N                                            013 004          00
                                                                                                                  PSNGR CAR          01 DRVR NONE  65 F OR-Y       000       000              00
                                                                                                                                                        OR<25
                                                                                                                                     02 PSNG NO<5  04 M            000       000              00
02098  N N N      06/09/2009  16     WILLAMETTE FALLS DR    INTER      3-LEG   N            N CLR   ANGL-OTH   01 NONE   0  STRGHT                                                           02
NONE              Tue          0     10TH ST                CN                 UNKNOWN      N DRY   TURN          PRVTE     W   E                                            000              00
                  4P                                        03           0                  N DAY   PDO           PSNGR CAR          01 DRVR NONE  21 F OR-Y       028       000              02
                                                                                                                                                        OR<25
                                                                                                               02 NONE   0  TURN-L
                                                                                                                  PRVTE     E   S                                            000              00
                                                                                                                  PSNGR CAR          01 DRVR NONE  43 F OR-Y       000       000              00
                                                                                                                                                        OR<25
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OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
CRASH SUMMARIES BY YEAR BY COLLISION TYPE

10th Street & 8th Avenue/8th Court
January 1, 2009 through December 31, 2013

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2013														
ANGLE	0	0	1	1	0	0	0	1	0	1	0	1	0	0
TURNING MOVEMENTS	0	2	0	2	0	3	0	2	0	1	1	2	0	0
2013 TOTAL	0	2	1	3	0	3	0	3	0	2	1	3	0	0
YEAR: 2012														
ANGLE	0	0	1	1	0	0	0	0	1	0	1	1	0	0
TURNING MOVEMENTS	0	0	2	2	0	0	0	1	1	0	2	2	0	0
2012 TOTAL	0	0	3	3	0	0	0	1	2	0	3	3	0	0
YEAR: 2011														
ANGLE	0	1	0	1	0	1	0	1	0	1	0	1	0	0
2011 TOTAL	0	1	0	1	0	1	0	1	0	1	0	1	0	0
YEAR: 2010														
ANGLE	0	0	1	1	0	0	0	0	1	0	1	1	0	0
TURNING MOVEMENTS	0	0	2	2	0	0	0	1	1	1	1	2	0	0
2010 TOTAL	0	0	3	3	0	0	0	1	2	1	2	3	0	0
YEAR: 2009														
TURNING MOVEMENTS	0	0	2	2	0	0	0	2	0	1	1	2	0	0
2009 TOTAL	0	0	2	2	0	0	0	2	0	1	1	2	0	0
FINAL TOTAL	0	3	9	12	0	4	0	8	4	5	7	12	0	0

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
CONTINUOUS SYSTEM CRASH LISTING

064 EAST PORTLAND FREEWAY

10th Street & 8th Avenue/8th Court
January 1, 2009 through December 31, 2013

```
      S  D
      P   R S W                               RD#  FC                            INT-TYP                                   SPCL USE
      E A U C O  DATE        COUNTY           COMPNT    CONN #          RD CHAR (MEDIAN)  INT-REL OFFRD WTHR  CRASH TYP    TRLR QTY  MOVE                    A  S
SER#  E L G H R  DAY         CITY             MLG TYP   FIRST  STREET   DIRECT    LEGS    TRAF-   RNDBT SURF  COLL TYP     OWNER     FROM       PRTC  INJ    G  E  LICNS PED
INVEST D C S L K TIME        URBAN AREA       MILEPNT   SECOND STREET   LOCTN   (#LANES)  CNTL    DRVWY LIGHT SVRTY     V# VEH TYPE  TO      P# TYPE  SVRTY  E  X  RES   LOC ERROR      ACTN EVENT    CAUSE

00143  N N N     01/12/2012  CLACKAMAS        1  17   2               INTER     CROSS   N           N CLR  ANGL-OTH   01 NONE    0 TURN-L                                                         08
NONE             Thu         WEST LINN         6  0   8TH AVE         N                 STOP SIGN   N DRY  TURN          PRVTE     W  N                                                 015           00
                 7P          PORTLAND UA      6.40    10TH ST         05          0                 N DLIT PDO           PSNGR CAR           01 DRVR NONE  80 M OR-Y        007         000           08
                                                                                                                                                           OR<25

                                                                                                                  02 NONE    0 STRGHT
                                                                                                                     PRVTE     S  N                                                 000           00
                                                                                                                     PSNGR CAR           01 DRVR NONE  20 M OR-Y        000         000           00
                                                                                                                                                           OR<25

00782  N N N     02/28/2009  CLACKAMAS        1  17   2               INTER     CROSS   N           N CLR  ANGL-OTH   01 NONE    0 TURN-L                                                         02
NONE             Sat         WEST LINN         6  0   8TH AVE         CN                STOP SIGN   N DRY  TURN          PRVTE     E  S                                                 015           00
                 11P         PORTLAND UA      6.40    10TH ST         01          0                 N DARK PDO           PSNGR CAR           01 DRVR NONE  17 F OR-Y        028         000           02
                                                                                                                                                           OR<25

                                                                                                                  02 NONE    0 STRGHT
                                                                                                                     PRVTE     N  S                                                 000           00
                                                                                                                     PSNGR CAR           01 DRVR NONE  62 F OR-Y        000         000           00
                                                                                                                                                           OR<25

01005  N N N N N 03/17/2009  CLACKAMAS        1  17   2               INTER     CROSS   N           N CLD  ANGL-OTH   01 NONE    0 TURN-L                                                         02
CITY             Tue         WEST LINN         6  0   8TH CT          CN                STOP SIGN   N DRY  TURN          PRVTE     E  S                                                 000           00
                 3P          PORTLAND UA      6.40    10TH ST         02          0                 N DAY  PDO           PSNGR CAR           01 DRVR NONE  47 M OR-Y        028         000           02
                                                                                                                                                           OR>25

                                                                                                                  02 NONE    0 STRGHT
                                                                                                                     PRVTE     S  N                                                 000           00
                                                                                                                     PSNGR CAR           01 DRVR NONE  34 M OR-Y        000         000           00
                                                                                                                                                           OR<25

02649  N N N     07/29/2010  CLACKAMAS        1  19   2               INTER     CROSS   N           N CLR  ANGL-OTH   01 NONE    0 TURN-L                                                         02
NONE             Thu         WEST LINN         6  0   8TH CT          CN                STOP SIGN   N DRY  TURN          PRVTE     NE SE                                                000           00
                 4P          PORTLAND UA      6.40    10TH ST         03          0                 N DAY  PDO           PSNGR CAR           01 DRVR NONE  00 F UNK         028         000           02
                                                                                                                                                           OR<25

                                                                                                                  02 NONE    0 STRGHT
                                                                                                                     PRVTE     NW SE                                                000           00
                                                                                                                     PSNGR CAR           01 DRVR NONE  38 M OR-Y        000         000           00
                                                                                                                                                           OR<25

03642  N N N     10/09/2010  CLACKAMAS        1  17   2               INTER     CROSS   N           N CLD  ANGL-OTH   01 NONE    0 STRGHT                                                         02
CITY             Sat         WEST LINN         6  0   8TH CT          CN                TRF SIGNAL  N WET  TURN          PRVTE     S  N                                                 000           00
                 9P          PORTLAND UA      6.40    10TH ST         04          0                 N DLIT PDO           PSNGR CAR           01 DRVR NONE  46 M OR-Y        000         000           00
                                                                                                                                                           OR<25

                                                                                                                  02 NONE    0 TURN-L
                                                                                                                     PRVTE     E  S                                                 015           00
                                                                                                                     PSNGR CAR           01 DRVR NONE  20 F OR-Y        028         000           02
                                                                                                                                                           OR>25

04522  N N N N N 11/29/2010  CLACKAMAS        1  17   2               INTER     CROSS   N           N RAIN ANGL-OTH   01 NONE      STRGHT                                                         02
CITY             Mon         WEST LINN         6  0   8TH AVE         CN                STOP SIGN   N WET  ANGL          PRVTE     W  E                                                 015           00
                 5P          PORTLAND UA      6.40    10TH ST         04          0                 N DLIT PDO           PSNGR CAR           01 DRVR NONE  60 F OR-Y        028         000           02
                                                                                                                                                           OR<25
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064 EAST PORTLAND FREEWAY

10th Street & 8th Avenue/8th Court
January 1, 2009 through December 31, 2013

SER# INVEST	S P E E D / A L C / D R U G S / S C H L / W O R K	DATE DAY TIME	COUNTY CITY URBAN AREA	RD# FC COMPNT MLG TYP MILEPNT	CONN # FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS (#LANES)	INT-REL TRAF- CNTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	V#	SPCL USE TRLR QTY OWNER VEH TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
												02	NONE	STRGHT											
													PRVTE	S N									000		00
													PSNGR CAR		01	DRVR	NONE	43	F	OR-Y		000	000		00
																				OR<25					
03280	N N N N N	09/06/2011	CLACKAMAS	1 19	2	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										013	02
CITY		Tue	WEST LINN	6 0	8TH CT	CN		STOP SIGN	N	DRY	ANGL		PRVTE	NW SE									015		00
		3P	PORTLAND UA	6.40	10TH ST	04	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	78	M	OR-Y		028	000		02
																				OR<25					
												02	NONE 0	STRGHT											
													PRVTE	SW NE									000	013	00
													PSNGR CAR		01	DRVR	NONE	19	M	OR-Y		000	000		00
																				OR<25					
												03	NONE 0	STOP											
													PRVTE	SE NW									011	013	00
													PSNGR CAR		01	DRVR	INJC	30	M	OR-Y		000	000		00
																				OR<25					
												04	NONE 0	STOP											
													PRVTE	SE NW									022		00
													PSNGR CAR		01	DRVR	NONE	43	M	OR-Y		000	000		00
																				OR>25					

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

URBAN NON-SYSTEM CRASH LISTING

CITY OF WEST LINN, CLACKAMAS COUNTY

10th Street & 8th Avenue/8th Court

January 1, 2009 through December 31, 2013

SER# INVEST	S P E A U C O / D R S W E L G H R / D C S L K	DATE DAY TIME	CLASS DIST FROM	CITY STREET FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS (#LANES)	INT-REL TRAF-CONTL	OFF-RD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	V#	SPCL USE TRLR QTY OWNER VEH TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
04173	N N N N N	11/06/2012	17	8TH AVE	INTER	CROSS	N	N	CLD	ANGL-OTH	01	NONE 0	STRGHT											02
CITY		Tue	0	10TH ST	CN		STOP SIGN	N	WET	ANGL		PRVTE	W E									015		00
		8A			03	0		N	DAWN	PDO		PSNGR CAR		01	DRVR	NONE	25	M	OR-Y		028	000		02
																			OR<25					
											02	NONE 0	STRGHT											
												PRVTE	N S									015		00
												PSNGR CAR		01	DRVR	NONE	42	F	OR-Y		000	000		00
																			OR<25					
01337	N N N N N	04/19/2013	19	8TH CT	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT											02
CITY		Fri	0	10TH ST	CN		STOP SIGN	N	DRY	ANGL		PRVTE	E W									015		00
		4P			01	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	62	F	OR-Y		028	000		02
																			OR<25					
											02	NONE 0	STRGHT											
												PRVTE	N S									000		00
												PSNGR CAR		01	DRVR	NONE	19	M	OR-Y		000	000		00
																			OR<25					
01621	N N N	05/10/2013	17	8TH CT	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	TURN-L											02
NONE		Fri	0	10TH ST	CN		TRF SIGNAL	N	DRY	TURN		PRVTE	E S									015		00
		11A			01	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	65	M	OR-Y		028	000		02
																			OR<25					
											02	NONE 0	TURN-L											
												PRVTE	N E									000		00
												PSNGR CAR		01	DRVR	NONE	58	M	OR-Y		000	000		00
																			OR<25					
04201	N N N	11/07/2012	17	8TH CT	INTER	CROSS	N	N	UNK	ANGL-OTH	01	NONE 0	TURN-L											02
NONE		Wed	0	10TH ST	CN		STOP SIGN	N	WET	TURN		PRVTE	E S									000		00
		6P			03	0		N	DUSK	PDO		PSNGR CAR		01	DRVR	NONE	16	F	OR-Y		028	000		02
																			OR<25					
											02	NONE 0	STRGHT											
												PRVTE	N S									000		00
												PSNGR CAR		01	DRVR	NONE	00	M	OR-Y		000	000		00
																			OR<25					
04802	N N N N N	12/05/2013	17	8TH CT	INTER	CROSS	N	N	CLR	O-1TURN	01	NONE 0	STRGHT											02,08
CITY		Thu	0	10TH ST	CN		TRF SIGNAL	N	DRY	TURN		PRVTE	S N									000		00
		7P			04	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	INJC	46	M	OR-Y		000	000		00
																			OR<25					
											02	NONE 0	TURN-L											
												PRVTE	N E									000		00
												PSNGR CAR		01	DRVR	INJC	17	M	OR-Y		028,004	000		02,08
																			OR<25					

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
CRASH SUMMARIES BY YEAR BY COLLISION TYPE

10th Street & Blankenship Road/Salamo Road
January 1, 2009 through December 31, 2013

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2013														
REAR-END	0	0	1	1	0	0	0	1	0	0	1	1	0	0
2013 TOTAL	0	0	1	1	0	0	0	1	0	0	1	1	0	0
FINAL TOTAL	0	0	1	1	0	0	0	1	0	0	1	1	0	0

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT
URBAN NON-SYSTEM CRASH LISTING

CITY OF WEST LINN, CLACKAMAS COUNTY

10th Street & Blankenship Road/Salamo Road
January 1, 2009 through December 31, 2013

SER# INVEST	SPEED	ALC	DRUGS	SCHL	WORK	DATE DAY TIME	CLASS DIST FROM	CITY STREET FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS (#LANES)	INT-REL TRAF- CONTL	OFF-RD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	V#	SPCL USE TRLR QTY OWNER VEH TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
05072	N	N	N			12/29/2013	17	BLANKENSHIP RD	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE						Sun	0	10TH ST	SW		TRF SIGNAL	N	DRY	REAR		PRVTE	NW SE									000		00
						5P			09	2		N	DUSK	PDO		PSNGR CAR		01	DRVR	NONE	00	M	UNK		026	000		07
																							OR<25					
															02	NONE 0	STOP											
																PRVTE	NW SE									011		00
																PSNGR CAR		01	DRVR	NONE	28	M	OR-Y		000	000		00
																							OR>25					

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CRASH SUMMARIES BY YEAR BY COLLISION TYPE

10th Street & I-205 (Hwy 064) NB Ramps

January 1, 2009 through December 31, 2013

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2013														
REAR-END	0	1	0	1	0	1	0	1	0	0	1	1	0	0
TURNING MOVEMENTS	0	0	1	1	0	0	0	0	1	0	1	1	0	0
2013 TOTAL	0	1	1	2	0	1	0	1	1	0	2	2	0	0
YEAR: 2010														
REAR-END	0	0	1	1	0	0	0	1	0	0	1	1	0	0
2010 TOTAL	0	0	1	1	0	0	0	1	0	0	1	1	0	0
YEAR: 2009														
REAR-END	0	2	0	2	0	2	0	1	1	1	1	2	0	0
2009 TOTAL	0	2	0	2	0	2	0	1	1	1	1	2	0	0
FINAL TOTAL	0	3	2	5	0	3	0	3	2	1	4	5	0	0

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

064 EAST PORTLAND FREEWAY

10th Street & I-205 (Hwy 064) NB Ramps
January 1, 2009 through December 31, 2013

SER# INVEST	S P E D / E A U C O / E L G H R / D C S L K (S D, R S W)	DATE DAY TIME	COUNTY CITY URBAN AREA	RD# FC COMPNT MLG TYP MILEPNT	CONN # FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS (#LANES)	INT-REL TRAF-CNTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	V#	SPCL USE TRLR QTY OWNER VEH TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
04883	N N N	12/17/2013	CLACKAMAS	1 11	1	INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE		Tue	WEST LINN	6 0	10TH ST	CN		TRF SIGNAL	N	DRY	REAR		PRVTE	W E									000		00
		6P	PORTLAND UA	6.43	EB EXTO 10TH	03	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	46	F	OR-Y		026	000		07
																				OR<25					
												02	NONE 0	STOP											
													PRVTE	W E									013		00
													PSNGR CAR		01	DRVR	INJA	41	F	OR-Y		000	000		00
																				OR<25					
00124	Y N N N N	01/07/2009	CLACKAMAS	1 17	2	INTER	CROSS	N	N	CLD	S-1STOP	01	NONE 0	STRGHT										002	27,01,07
CITY		Wed	WEST LINN	6 0	10TH ST	N		TRF SIGNAL	N	WET	REAR		PRVTE	N S									000		00
		5P	PORTLAND UA	6.46	EB EXTO 10TH	06	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	22	F	OR-Y		016,047,026	038		27,01,07
																				OR<25					
												02	NONE 0	STOP											
													PRVTE	N S									011		00
													PSNGR CAR		01	DRVR	NONE	68	F	OR-Y		000	000		00
																				OR<25					
															02	PSNG	INJC	32	F			000	000		00
02595	N N N N N	07/13/2009	CLACKAMAS	1 17	2	INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										013	07
CITY		Mon	WEST LINN	6 0	10TH ST	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N S									000		00
		12P	PORTLAND UA	6.46	EB EXTO 10TH	06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	20	F	OR-Y		026	000		07
																				OR<25					
												02	NONE 0	STOP											
													PRVTE	N S									011	013	00
													PSNGR CAR		01	DRVR	NONE	25	F	OR-Y		000	000		00
																				OR<25					
												03	NONE 0	STOP											
													PRVTE	N S									022		00
													PSNGR CAR		01	DRVR	NONE	16	F	OR-Y		000	000		00
																				OR<25					
															02	PSNG	INJC	46	F			000	000		00
04320	N N N	11/11/2010	CLACKAMAS	1 19	2	INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											27
NONE		Thu	WEST LINN	6 0	10TH ST	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S N									000		00
		8P	PORTLAND UA	6.46	EB ENFR 10TH	06	0		N	DLIT	PDO		PSNGR CAR		01	DRVR	NONE	46	F	OR-Y		016	000		27
																				OR<25					
												02	NONE 0	STOP											
													PRVTE	S N									011		00
													PSNGR CAR		01	DRVR	NONE	91	M	OR-Y		000	000		00
																				OR<25					
00121	N N N	01/10/2013	CLACKAMAS	1 11	2	INTER	CROSS	N	N	RAIN	O-1TURN	01	NONE 0	STRGHT											04
NONE		Thu	WEST LINN	6 0	10TH ST	CN		TRF SIGNAL	N	WET	TURN		PRVTE	S N									000		00
		8P	PORTLAND UA	6.46	EB ENFR 10TH	03	0		N	DLIT	PDO		PSNGR CAR		01	DRVR	NONE	45	F	OR-Y		000	000		00
																				OR<25					

SER# INVEST	S P E E D	A L C	D R U G S	S C H L	W O R K	DATE DAY TIME	COUNTY CITY URBAN AREA	RD# FC COMPNT MLG TYP MILEPNT	CONN # FIRST STREET SECOND STREET	RD CHAR DIRECT LOCTN	INT-TYP (MEDIAN) LEGS (#LANES)	INT-REL TRAF- CNTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH TYP COLL TYP SVRTY	V#	SPCL USE TRLR QTY OWNER VEH TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
																02	NONE 0	TURN-L											
																	PRVTE	N E									000		00
																	PSNGR CAR		01	DRVR	NONE	00	M	OR-Y		020,004	000		04
																								OR<25					

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CRASH SUMMARIES BY YEAR BY COLLISION TYPE

10th Street & I-205 (Hwy 064) SB Ramps

January 1, 2009 through December 31, 2013

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2012														
REAR-END	0	0	1	1	0	0	0	1	0	1	0	1	0	0
TURNING MOVEMENTS	0	1	0	1	0	1	0	1	0	1	0	1	0	0
2012 TOTAL	0	1	1	2	0	1	0	2	0	2	0	2	0	0
YEAR: 2010														
REAR-END	0	0	1	1	0	0	0	0	0	1	0	1	0	0
2010 TOTAL	0	0	1	1	0	0	0	0	0	1	0	1	0	0
FINAL TOTAL	0	1	2	3	0	1	0	2	0	3	0	3	0	0

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

064 EAST PORTLAND FREEWAY

10th Street & I-205 (Hwy 064) SB Ramps
January 1, 2009 through December 31, 2013

```
      S  D
      P   R S W                                 RD#  FC                                    INT-TYP                                       SPCL USE
      E A U C O  DATE        COUNTY             COMPNT    CONN #              RD CHAR (MEDIAN)   INT-REL  OFFRD WTHR  CRASH TYP    TRLR QTY  MOVE                        A  S
SER#  E L G H R  DAY         CITY               MLG TYP   FIRST  STREET       DIRECT    LEGS     TRAF-    RNDBT SURF  COLL TYP     OWNER     FROM       PRTC INJ       G  E  LICNS PED
INVEST D C S L K TIME        URBAN AREA         MILEPNT   SECOND STREET       LOCTN   (#LANES)  CNTL     DRVWY LIGHT SVRTY     V# VEH TYPE  TO      P# TYPE SVRTY  E  X  RES   LOC ERROR         ACTN EVENT      CAUSE

03096  N N N     08/21/2012  CLACKAMAS            1  17  2                  INTER      CROSS   N            N CLR  S-1STOP    01 NONE   0 STRGHT                                                         013          07
NONE             Tue         WEST LINN            6 0    10TH ST            S                  TRF SIGNAL   N DRY  REAR          PRVTE    S  N                                               000                  00
                 2P          PORTLAND UA          6.57   WB EXTO 10TH       06           0                  N DAY  PDO           PSNGR CAR          01 DRVR NONE  20 M OR-Y         026      000                  07
                                                                                                                                                                     OR<25

                                                                                                                         02 NONE   0 STOP
                                                                                                                            PRVTE    S  N                                               011  013             00
                                                                                                                           PSNGR CAR          01 DRVR NONE  40 F OR-Y         000      000                  00
                                                                                                                                                                     OR<25

                                                                                                                         03 NONE   0 STOP
                                                                                                                            PRVTE    S  N                                               022                  00
                                                                                                                           PSNGR CAR          01 DRVR NONE  67 M OR-Y         000      000                  00
                                                                                                                                                                     OR<25

03497  N N N N N 09/20/2012  CLACKAMAS            1  17  2                  INTER      CROSS   N            N CLR  S-OTHER    01 NONE   0 TURN-R                                                                      27,08
CITY             Thu         WEST LINN            6 0    10TH ST            CN                 TRF SIGNAL   N DRY  TURN          PRVTE    N  W                                               000                  00
                 7P          PORTLAND UA          6.57   WB ENFR 10TH       01           0                  N DAY  INJ           PSNGR CAR          01 DRVR NONE  42 F OTH-Y        016,006  038                  27,08
                                                                                                                                                                     OR<25
                                                                                                                                              02 PSNG INJC  65 F              000      000                  00

                                                                                                                         02 NONE   0 TURN-R
                                                                                                                            PRVTE    N  W                                               000                  00
                                                                                                                           PSNGR CAR          01 DRVR NONE  52 F OR-Y         000      000                  00
                                                                                                                                                                     OR<25

02020  N N N     06/12/2010  CLACKAMAS            1  17  4                  INTER      CROSS   N            N CLR  S-1STOP    01 NONE   0 STRGHT                                                                      07
NONE             Sat         WEST LINN            6 0    10TH ST            SE                 TRF SIGNAL   N UNK  REAR          PRVTE    SE NW                                              000                  00
                 3P          PORTLAND UA          7.01   WB EXTO 10TH       06           0                  N DAY  PDO           PSNGR CAR          01 DRVR NONE  00 M UNK          026      000                  07
                                                                                                                                                                     OR<25

                                                                                                                         02 NONE   0 STOP
                                                                                                                            PRVTE    SE NW                                              011                  00
                                                                                                                           PSNGR CAR          01 DRVR NONE  58 F OR-Y         000      000                  00
                                                                                                                                                                     OR<25
```

ACTION CODE TRANSLATION LIST

ACTION CODE	SHORT DESCRIPTION	LONG DESCRIPTION
000	NONE	NO ACTION OR NON-WARRANTED
001	SKIDDED	SKIDDED
002	ON/OFF V	GETTING ON OR OFF STOPPED OR PARKED VEHICLE
003	LOAD OVR	OVERHANGING LOAD STRUCK ANOTHER VEHICLE, ETC.
006	SLOW DN	SLOWED DOWN
007	AVOIDING	AVOIDING MANEUVER
008	PAR PARK	PARALLEL PARKING
009	ANG PARK	ANGLE PARKING
010	INTERFERE	PASSENGER INTERFERING WITH DRIVER
011	STOPPED	STOPPED IN TRAFFIC NOT WAITING TO MAKE A LEFT TURN
012	STP/L TRN	STOPPED BECAUSE OF LEFT TURN SIGNAL OR WAITING, ETC.
013	STP TURN	STOPPED WHILE EXECUTING A TURN
015	GO A/STOP	PROCEED AFTER STOPPING FOR A STOP SIGN/FLASHING RED.
016	TRN A/RED	TURNED ON RED AFTER STOPPING
017	LOSTCTRL	LOST CONTROL OF VEHICLE
018	EXIT DWY	ENTERING STREET OR HIGHWAY FROM ALLEY OR DRIVEWAY
019	ENTR DWY	ENTERING ALLEY OR DRIVEWAY FROM STREET OR HIGHWAY
020	STR ENTR	BEFORE ENTERING ROADWAY, STRUCK PEDESTRIAN, ETC. ON SIDEWALK OR SHOULDER
021	NO DRVR	CAR RAN AWAY - NO DRIVER
022	PREV COL	STRUCK, OR WAS STRUCK BY, VEHICLE OR PEDESTRIAN IN PRIOR COLLISION BEFORE ACC. STABILIZED
023	STALLED	VEHICLE STALLED
024	DRVR DEAD	DEAD BY UNASSOCIATED CAUSE
025	FATIGUE	FATIGUED, SLEEPY, ASLEEP
026	SUN	DRIVER BLINDED BY SUN
027	HDLGHTS	DRIVER BLINDED BY HEADLIGHTS
028	ILLNESS	PHYSICALLY ILL
029	THRU MED	VEHICLE CROSSED, PLUNGED OVER, OR THROUGH MEDIAN BARRIER
030	PURSUIT	PURSUING OR ATTEMPTING TO STOP A VEHICLE
031	PASSING	PASSING SITUATION
032	PRKOFFRD	VEHICLE PARKED BEYOND CURB OR SHOULDER
033	CROS MED	VEHICLE CROSSED EARTH OR GRASS MEDIAN
034	X N/SGNL	CROSSING AT INTERSECTION - NO TRAFFIC SIGNAL PRESENT
035	X W/ SGNL	CROSSING AT INTERSECTION - TRAFFIC SIGNAL PRESENT
036	DIAGONAL	CROSSING AT INTERSECTION - DIAGONALLY
037	BTWN INT	CROSSING BETWEEN INTERSECTIONS
038	DISTRACT	DRIVER'S ATTENTION DISTRACTED
039	W/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
040	A/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
041	W/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
042	A/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT FACING TRAFFIC
043	PLAYINRD	PLAYING IN STREET OR ROAD
044	PUSH MV	PUSHING OR WORKING ON VEHICLE IN ROAD OR ON SHOULDER
045	WORK ON	WORKING IN ROADWAY OR ALONG SHOULDER
046	W/ TRAFIC	NON-MOTORIST WALKING, RUNNING, RIDING, ETC. WITH TRAFFIC
047	A/ TRAFIC	NON-MOTORIST WALKING, RUNNING, RIDING, ETC. FACING TRAFFIC
050	LAY ON RD	STANDING OR LYING IN ROADWAY
051	ENT OFFRD	ENTERING / STARTING IN TRAFFIC LANE FROM OFF ROAD
052	MERGING	MERGING
055	SPRAY	BLINDED BY WATER SPRAY
088	OTHER	OTHER ACTION

ACTION CODE TRANSLATION LIST

ACTION CODE	SHORT DESCRIPTION	LONG DESCRIPTION
099	UNK	UNKNOWN ACTION

CAUSE CODE TRANSLATION LIST

CAUSE CODE	SHORT DESCRIPTION	LONG DESCRIPTION
00	NO CODE	NO CAUSE ASSOCIATED AT THIS LEVEL
01	TOO-FAST	TOO FAST FOR CONDITIONS (NOT EXCEED POSTED SPEED
02	NO-YIELD	DID NOT YIELD RIGHT-OF-WAY
03	PAS-STOP	PASSED STOP SIGN OR RED FLASHER
04	DIS SIG	DISREGARDED TRAFFIC SIGNAL
05	LEFT-CTR	DROVE LEFT OF CENTER ON TWO-WAY ROAD; STRADDLING
06	IMP-OVER	IMPROPER OVERTAKING
07	TOO-CLOS	FOLLOWED TOO CLOSELY
08	IMP-TURN	MADE IMPROPER TURN
09	DRINKING	ALCOHOL OR DRUG INVOLVED
10	OTHR-IMP	OTHER IMPROPER DRIVING
11	MECH-DEF	MECHANICAL DEFECT
12	OTHER	OTHER (NOT IMPROPER DRIVING)
13	IMP LN C	IMPROPER CHANGE OF TRAFFIC LANES
14	DIS TCD	DISREGARDED OTHER TRAFFIC CONTROL DEVICE
15	WRNG WAY	WRONG WAY ON ONE-WAY ROAD; WRONG SIDE DIVIDED RO.
16	FATIGUE	DRIVER DROWSY/FATIGUED/SLEEPY
17	ILLNESS	PHYSICAL ILLNESS
18	IN RDWY	NON-MOTORIST ILLEGALLY IN ROADWAY
19	NT VISBL	NON-MOTORIST CLOTHING NOT VISIBLE
20	IMP PKNG	VEHICLE IMPROPERLY PARKED
21	DEF STER	DEFECTIVE STEERING MECHANISM
22	DEF BRKE	INADEQUATE OR NO BRAKES
24	LOADSHFT	VEHICLE LOST LOAD OR LOAD SHIFTED
25	TIREFAIL	TIRE FAILURE
26	PHANTOM	PHANTOM / NON-CONTACT VEHICLE
27	INATTENT	INATTENTION
28	NM INATT	NON-MOTORIST INATTENTION
29	F AVOID	FAILED TO AVOID VEHICLE AHEAD
30	SPEED	DRIVING IN EXCESS OF POSTED SPEED
31	RACING	SPEED RACING (PER PAR)
32	CARELESS	CARELESS DRIVING (PER PAR)
33	RECKLESS	RECKLESS DRIVING (PER PAR)
34	AGGRESV	AGGRESSIVE DRIVING (PER PAR)
35	RD RAGE	ROAD RAGE (PER PAR)
40	VIEW OBS	VIEW OBSCURED
50	USED MDN	IMPROPER USE OF MEDIAN OR SHOULDER

COLLISION TYPE CODE TRANSLATION LIST

COLL CODE	SHORT DESCRIPTION	LONG DESCRIPTION
&	OTH	MISCELLANEOUS
-	BACK	BACKING
0	PED	PEDESTRIAN
1	ANGL	ANGLE
2	HEAD	HEAD-ON
3	REAR	REAR-END
4	SS-M	SIDESWIPE - MEETING
5	SS-O	SIDESWIPE - OVERTAKING
6	TURN	TURNING MOVEMENT
7	PARK	PARKING MANEUVER
8	NCOL	NON-COLLISION
9	FIX	FIXED OBJECT OR OTHER OBJECT

CRASH TYPE CODE TRANSLATION LIST

CRASH TYPE	SHORT DESCRIPTION	LONG DESCRIPTION
&	OVERTURN	OVERTURNED
0	NON-COLL	OTHER NON-COLLISION
1	OTH RDWY	MOTOR VEHICLE ON OTHER ROADWAY
2	PRKD MV	PARKED MOTOR VEHICLE
3	PED	PEDESTRIAN
4	TRAIN	RAILWAY TRAIN
6	BIKE	PEDALCYCLIST
7	ANIMAL	ANIMAL
8	FIX OBJ	FIXED OBJECT
9	OTH OBJ	OTHER OBJECT
A	ANGL-STP	ENTERING AT ANGLE - ONE VEHICLE STOPPED
B	ANGL-OTH	ENTERING AT ANGLE - ALL OTHERS
C	S-STRGHT	FROM SAME DIRECTION - BOTH GOING STRAIGHT
D	S-1TURN	FROM SAME DIRECTION - ONE TURN, ONE STRAIGHT
E	S-1STOP	FROM SAME DIRECTION - ONE STOPPED
F	S-OTHER	FROM SAME DIRECTION-ALL OTHERS, INCLUDING PARKING
G	O-STRGHT	FROM OPPOSITE DIRECTION - BOTH GOING STRAIGHT
H	O-1TURN	FROM OPPOSITE DIRECTION - ONE TURN, ONE STRAIGHT
I	O-1STOP	FROM OPPOSITE DIRECTION - ONE STOPPED
J	O-OTHER	FROM OPPOSITE DIRECTION-ALL OTHERS INCL. PARKING

DRIVER LICENSE CODE TRANSLATION LIST

LIC CODE	SHORT DESC	LONG DESCRIPTION
0	NONE	NOT LICENSED (HAD NEVER BEEN LICENSED)
1	OR-Y	VALID OREGON LICENSE
2	OTH-Y	VALID LICENSE, OTHER STATE OR COUNTRY
3	SUSP	SUSPENDED/REVOKED

DRIVER RESIDENCE CODE TRANSLATION LIST

RES CODE	SHORT DESC	LONG DESCRIPTION
1	OR<25	OREGON RESIDENT WITHIN 25 MILE OF HOME
2	OR>25	OREGON RESIDENT 25 OR MORE MILES FROM HOME
3	OR-?	OREGON RESIDENT - UNKNOWN DISTANCE FROM HOME
4	N-RES	NON-RESIDENT
9	UNK	UNKNOWN IF OREGON RESIDENT

ERROR CODE TRANSLATION LIST

ERROR CODE	SHORT DESCRIPTION	FULL DESCRIPTION
000	NONE	NO ERROR
001	WIDE TRN	WIDE TURN
002	CUT CORN	CUT CORNER ON TURN
003	FAIL TRN	FAILED TO OBEY MANDATORY TRAFFIC TURN SIGNAL, SIGN OR LANE MARKINGS
004	L IN TRF	LEFT TURN IN FRONT OF ONCOMING TRAFFIC
005	L PROHIB	LEFT TURN WHERE PROHIBITED
006	FRM WRNG	TURNED FROM WRONG LANE
007	TO WRONG	TURNED INTO WRONG LANE
008	ILLEG U	U-TURNED ILLEGALLY
009	IMP STOP	IMPROPERLY STOPPED IN TRAFFIC LANE
010	IMP SIG	IMPROPER SIGNAL OR FAILURE TO SIGNAL
011	IMP BACK	BACKING IMPROPERLY (NOT PARKING)
012	IMP PARK	IMPROPERLY PARKED
013	UNPARK	IMPROPER START LEAVING PARKED POSITION
014	IMP STRT	IMPROPER START FROM STOPPED POSITION
015	IMP LGHT	IMPROPER OR NO LIGHTS (VEHICLE IN TRAFFIC)
016	INATTENT	INATTENTION (FAILURE TO DIM LIGHTS PRIOR TO 4/1/97)
017	UNSF VEH	DRIVING UNSAFE VEHICLE (NO OTHER ERROR APPARENT)
018	OTH PARK	ENTERING/EXITING PARKED POSITION W/ INSUFFICIENT CLEARANCE; OTHER IMPROPER PARKING MANEUVER
019	DIS DRIV	DISREGARDED OTHER DRIVER'S SIGNAL
020	DIS SGNL	DISREGARDED TRAFFIC SIGNAL
021	RAN STOP	DISREGARDED STOP SIGN OR FLASHING RED
022	DIS SIGN	DISREGARDED WARNING SIGN, FLARES OR FLASHING AMBER
023	DIS OFCR	DISREGARDED POLICE OFFICER OR FLAGMAN
024	DIS EMER	DISREGARDED SIREN OR WARNING OF EMERGENCY VEHICLE
025	DIS RR	DISREGARDED RR SIGNAL, RR SIGN, OR RR FLAGMAN
026	REAR-END	FAILED TO AVOID STOPPED OR PARKED VEHICLE AHEAD OTHER THAN SCHOOL BUS
027	BIKE ROW	DID NOT HAVE RIGHT-OF-WAY OVER PEDALCYCLIST
028	NO ROW	DID NOT HAVE RIGHT-OF-WAY
029	PED ROW	FAILED TO YIELD RIGHT-OF-WAY TO PEDESTRIAN
030	PAS CURV	PASSING ON A CURVE
031	PAS WRNG	PASSING ON THE WRONG SIDE
032	PAS TANG	PASSING ON STRAIGHT ROAD UNDER UNSAFE CONDITIONS
033	PAS X-WK	PASSED VEHICLE STOPPED AT CROSSWALK FOR PEDESTRIAN
034	PAS INTR	PASSING AT INTERSECTION
035	PAS HILL	PASSING ON CREST OF HILL
036	N/PAS ZN	PASSING IN "NO PASSING" ZONE
037	PAS TRAF	PASSING IN FRONT OF ONCOMING TRAFFIC
038	CUT-IN	CUTTING IN (TWO LANES - TWO WAY ONLY)
039	WRNGSIDE	DRIVING ON WRONG SIDE OF THE ROAD (2-WAY UNDIVIDED ROADWAYS)
040	THRU MED	DRIVING THROUGH SAFETY ZONE OR OVER ISLAND
041	F/ST BUS	FAILED TO STOP FOR SCHOOL BUS

ERROR CODE TRANSLATION LIST

ERROR CODE	SHORT DESCRIPTION	FULL DESCRIPTION
042	F/SLO MV	FAILED TO DECREASE SPEED FOR SLOWER MOVING VEHICLE
043	TO CLOSE	FOLLOWING TOO CLOSELY (MUST BE ON OFFICER'S REPORT)
044	STRDL LN	STRADDLING OR DRIVING ON WRONG LANES
045	IMP CHG	IMPROPER CHANGE OF TRAFFIC LANES
046	WRNG WAY	WRONG WAY ON ONE-WAY ROADWAY; WRONG SIDE DIVIDED ROAD
047	BASCRULE	DRIVING TOO FAST FOR CONDITIONS (NOT EXCEEDING POSTED SPEED)
048	OPN DOOR	OPENED DOOR INTO ADJACENT TRAFFIC LANE
049	IMPEDING	IMPEDING TRAFFIC
050	SPEED	DRIVING IN EXCESS OF POSTED SPEED
051	RECKLESS	RECKLESS DRIVING (PER PAR)
052	CARELESS	CARELESS DRIVING (PER PAR)
053	RACING	SPEED RACING (PER PAR)
054	X N/SGNL	CROSSING AT INTERSECTION, NO TRAFFIC SIGNAL PRESENT
055	X W/SGNL	CROSSING AT INTERSECTION, TRAFFIC SIGNAL PRESENT
056	DIAGONAL	CROSSING AT INTERSECTION - DIAGONALLY
057	BTWN INT	CROSSING BETWEEN INTERSECTIONS
059	W/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
060	A/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
061	W/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
062	A/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT FACING TRAFFIC
063	PLAYINRD	PLAYING IN STREET OR ROAD
064	PUSH MV	PUSHING OR WORKING ON VEHICLE IN ROAD OR ON SHOULDER
065	WK IN RD	WORKING IN ROADWAY OR ALONG SHOULDER
070	LAYON RD	STANDING OR LYING IN ROADWAY
071	NM IMP USE	IMPROPER USE OF TRAFFIC LANE BY NON-MOTORIST
073	ELUDING	ELUDING / ATTEMPT TO ELUDE
079	F NEG CURV	FAILED TO NEGOTIATE A CURVE
080	FAIL LN	FAILED TO MAINTAIN LANE
081	OFF RD	RAN OFF ROAD
082	NO CLEAR	DRIVER MISJUDGED CLEARANCE
083	OVRSTEER	OVER-CORRECTING
084	NOT USED	CODE NOT IN USE
085	OVRLOAD	OVERLOADING OR IMPROPER LOADING OF VEHICLE WITH CARGO OR PASSENGERS
097	UNA DIS TC	UNABLE TO DETERMINE WHICH DRIVER DISREGARDED TRAFFIC CONTROL DEVICE

EVENT CODE TRANSLATION LIST

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
001	FEL/JUMP	OCCUPANT FELL, JUMPED OR WAS EJECTED FROM MOVING VEHICLE
002	INTERFER	PASSENGER INTERFERED WITH DRIVER
003	BUG INTF	ANIMAL OR INSECT IN VEHICLE INTERFERED WITH DRIVER
004	INDRCT PED	PEDESTRIAN INDIRECTLY INVOLVED (NOT STRUCK)
005	SUB-PED	"SUB-PED": PEDESTRIAN INJURED SUBSEQUENT TO COLLISION, ETC.
006	INDRCT BIK	PEDALCYCLIST INDIRECTLY INVOLVED (NOT STRUCK)
007	HITCHIKR	HITCHHIKER (SOLICITING A RIDE)
008	PSNGR TOW	PASSENGER OR NON-MOTORIST BEING TOWED OR PUSHED ON CONVEYANCE
009	ON/OFF V	GETTING ON/OFF STOPPED/PARKED VEHICLE (OCCUPANTS ONLY; MUST HAVE PHYSICAL CONTACT W/ VEHI(
010	SUB OTRN	OVERTURNED AFTER FIRST HARMFUL EVENT
011	MV PUSHD	VEHICLE BEING PUSHED
012	MV TOWED	VEHICLE TOWED OR HAD BEEN TOWING ANOTHER VEHICLE
013	FORCED	VEHICLE FORCED BY IMPACT INTO ANOTHER VEHICLE, PEDALCYCLIST OR PEDESTRIAN
014	SET MOTN	VEHICLE SET IN MOTION BY NON-DRIVER (CHILD RELEASED BRAKES, ETC.)
015	RR ROW	AT OR ON RAILROAD RIGHT-OF-WAY (NOT LIGHT RAIL)
016	LT RL ROW	AT OR ON LIGHT-RAIL RIGHT-OF-WAY
017	RR HIT V	TRAIN STRUCK VEHICLE
018	V HIT RR	VEHICLE STRUCK TRAIN
019	HIT RR CAR	VEHICLE STRUCK RAILROAD CAR ON ROADWAY
020	JACKNIFE	JACKKNIFE; TRAILER OR TOWED VEHICLE STRUCK TOWING VEHICLE
021	TRL OTRN	TRAILER OR TOWED VEHICLE OVERTURNED
022	CN BROKE	TRAILER CONNECTION BROKE
023	DETACH TRL	DETACHED TRAILING OBJECT STRUCK OTHER VEHICLE, NON-MOTORIST, OR OBJECT
024	V DOOR OPN	VEHICLE DOOR OPENED INTO ADJACENT TRAFFIC LANE
025	WHEELOFF	WHEEL CAME OFF
026	HOOD UP	HOOD FLEW UP
028	LOAD SHIFT	LOST LOAD, LOAD MOVED OR SHIFTED
029	TIREFAIL	TIRE FAILURE
030	PET	PET: CAT, DOG AND SIMILAR
031	LVSTOCK	STOCK: COW, CALF, BULL, STEER, SHEEP, ETC.
032	HORSE	HORSE, MULE, OR DONKEY
033	HRSE&RID	HORSE AND RIDER
034	GAME	WILD ANIMAL, GAME (INCLUDES BIRDS; NOT DEER OR ELK)
035	DEER ELK	DEER OR ELK, WAPITI
036	ANML VEH	ANIMAL-DRAWN VEHICLE
037	CULVERT	CULVERT, OPEN LOW OR HIGH MANHOLE
038	ATENUATN	IMPACT ATTENUATOR
039	PK METER	PARKING METER
040	CURB	CURB (ALSO NARROW SIDEWALKS ON BRIDGES)
041	JIGGLE	JIGGLE BAR OR TRAFFIC SNAKE FOR CHANNELIZATION
042	GDRL END	LEADING EDGE OF GUARDRAIL
043	GARDRAIL	GUARD RAIL (NOT METAL MEDIAN BARRIER)
044	BARRIER	MEDIAN BARRIER (RAISED OR METAL)
045	WALL	RETAINING WALL OR TUNNEL WALL
046	BR RAIL	BRIDGE RAILING OR PARAPET (ON BRIDGE OR APPROACH)
047	BR ABUTMNT	BRIDGE ABUTMENT (INCLUDED "APPROACH END" THRU 2013)
048	BR COLMN	BRIDGE PILLAR OR COLUMN
049	BR GIRDR	BRIDGE GIRDER (HORIZONTAL BRIDGE STRUCTURE OVERHEAD)
050	ISLAND	TRAFFIC RAISED ISLAND
051	GORE	GORE
052	POLE UNK	POLE - TYPE UNKNOWN
053	POLE UTL	POLE - POWER OR TELEPHONE
054	ST LIGHT	POLE - STREET LIGHT ONLY
055	TRF SGNL	POLE - TRAFFIC SIGNAL AND PED SIGNAL ONLY
056	SGN BRDG	POLE - SIGN BRIDGE
057	STOPSIGN	STOP OR YIELD SIGN
058	OTH SIGN	OTHER SIGN, INCLUDING STREET SIGNS
059	HYDRANT	HYDRANT

EVENT CODE TRANSLATION LIST

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
060	MARKER	DELINEATOR OR MARKER (REFLECTOR POSTS)
061	MAILBOX	MAILBOX
062	TREE	TREE, STUMP OR SHRUBS
063	VEG OHED	TREE BRANCH OR OTHER VEGETATION OVERHEAD, ETC.
064	WIRE/CBL	WIRE OR CABLE ACROSS OR OVER THE ROAD
065	TEMP SGN	TEMPORARY SIGN OR BARRICADE IN ROAD, ETC.
066	PERM SGN	PERMANENT SIGN OR BARRICADE IN/OFF ROAD
067	SLIDE	SLIDES, FALLEN OR FALLING ROCKS
068	FRGN OBJ	FOREIGN OBSTRUCTION/DEBRIS IN ROAD (NOT GRAVEL)
069	EQP WORK	EQUIPMENT WORKING IN/OFF ROAD
070	OTH EQP	OTHER EQUIPMENT IN OR OFF ROAD (INCLUDES PARKED TRAILER, BOAT)
071	MAIN EQP	WRECKER, STREET SWEEPER, SNOW PLOW OR SANDING EQUIPMENT
072	OTHER WALL	ROCK, BRICK OR OTHER SOLID WALL
073	IRRGL PVMT	OTHER BUMP (NOT SPEED BUMP), POTHOLE OR PAVEMENT IRREGULARITY (PER PAR)
074	OVERHD OBJ	OTHER OVERHEAD OBJECT (HIGHWAY SIGN, SIGNAL HEAD, ETC.); NOT BRIDGE
075	CAVE IN	BRIDGE OR ROAD CAVE IN
076	HI WATER	HIGH WATER
077	SNO BANK	SNOW BANK
078	LO-HI EDGE	LOW OR HIGH SHOULDER AT PAVEMENT EDGE
079	DITCH	CUT SLOPE OR DITCH EMBANKMENT
080	OBJ FRM MV	STRUCK BY ROCK OR OTHER OBJECT SET IN MOTION BY OTHER VEHICLE (INCL. LOST LOADS)
081	FLY-OBJ	STRUCK BY ROCK OR OTHER MOVING OR FLYING OBJECT (NOT SET IN MOTION BY VEHICLE)
082	VEH HID	VEHICLE OBSCURED VIEW
083	VEG HID	VEGETATION OBSCURED VIEW
084	BLDG HID	VIEW OBSCURED BY FENCE, SIGN, PHONE BOOTH, ETC.
085	WIND GUST	WIND GUST
086	IMMERSED	VEHICLE IMMERSED IN BODY OF WATER
087	FIRE/EXP	FIRE OR EXPLOSION
088	FENC/BLD	FENCE OR BUILDING, ETC.
089	OTHR CRASH	CRASH RELATED TO ANOTHER SEPARATE CRASH
090	TO 1 SIDE	TWO-WAY TRAFFIC ON DIVIDED ROADWAY ALL ROUTED TO ONE SIDE
091	BUILDING	BUILDING OR OTHER STRUCTURE
092	PHANTOM	OTHER (PHANTOM) NON-CONTACT VEHICLE
093	CELL PHONE	CELL PHONE (ON PAR OR DRIVER IN USE)
094	VIOL GDL	TEENAGE DRIVER IN VIOLATION OF GRADUATED LICENSE PGM
095	GUY WIRE	GUY WIRE
096	BERM	BERM (EARTHEN OR GRAVEL MOUND)
097	GRAVEL	GRAVEL IN ROADWAY
098	ABR EDGE	ABRUPT EDGE
099	CELL WTNSD	CELL PHONE USE WITNESSED BY OTHER PARTICIPANT
100	UNK FIXD	FIXED OBJECT, UNKNOWN TYPE.
101	OTHER OBJ	NON-FIXED OBJECT, OTHER OR UNKNOWN TYPE
102	TEXTING	TEXTING
103	WZ WORKER	WORK ZONE WORKER
104	ON VEHICLE	PASSENGER RIDING ON VEHICLE EXTERIOR
105	PEDAL PSGR	PASSENGER RIDING ON PEDALCYCLE
106	MAN WHLCHR	PEDESTRIAN IN NON-MOTORIZED WHEELCHAIR
107	MTR WHLCHR	PEDESTRIAN IN MOTORIZED WHEELCHAIR
108	OFFICER	LAW ENFORCEMENT / POLICE OFFICER
109	SUB-BIKE	"SUB-BIKE": PEDALCYCLIST INJURED SUBSEQUENT TO COLLISION, ETC.
110	N-MTR	NON-MOTORIST STRUCK VEHICLE
111	S CAR VS V	STREET CAR/TROLLEY (ON RAILS OR OVERHEAD WIRE SYSTEM) STRUCK VEHICLE
112	V VS S CAR	VEHICLE STRUCK STREET CAR/TROLLEY (ON RAILS OR OVERHEAD WIRE SYSTEM)
113	S CAR ROW	AT OR ON STREET CAR OR TROLLEY RIGHT-OF-WAY
114	RR EQUIP	VEHICLE STRUCK RAILROAD EQUIPMENT (NOT TRAIN) ON TRACKS
115	DSTRCT GPS	DISTRACTED BY NAVIGATION SYSTEM OR GPS DEVICE
116	DSTRCT OTH	DISTRACTED BY OTHER ELECTRONIC DEVICE
117	RR GATE	RAIL CROSSING DROP-ARM GATE

EVENT CODE TRANSLATION LIST

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
118	EXPNSN JNT	EXPANSION JOINT
119	JERSEY BAR	JERSEY BARRIER
120	WIRE BAR	WIRE OR CABLE MEDIAN BARRIER
121	FENCE	FENCE
123	OBJ IN VEH	LOOSE OBJECT IN VEHICLE STRUCK OCCUPANT
124	SLIPPERY	SLIDING OR SWERVING DUE TO WET, ICY, SLIPPERY OR LOOSE SURFACE (NOT GRAVEL)
125	SHLDR	SHOULDER GAVE WAY
126	BOULDER	ROCK(S), BOULDER (NOT GRAVEL; NOT ROCK SLIDE)
127	LAND SLIDE	ROCK SLIDE OR LAND SLIDE
128	CURVE INV	CURVE PRESENT AT CRASH LOCATION
129	HILL INV	VERTICAL GRADE / HILL PRESENT AT CRASH LOCATION
130	CURVE HID	VIEW OBSCURED BY CURVE
131	HILL HID	VIEW OBSCURED BY VERTICAL GRADE / HILL
132	WINDOW HID	VIEW OBSCURED BY VEHICLE WINDOW CONDITIONS
133	SPRAY HID	VIEW OBSCURED BY WATER SPRAY

FUNCTIONAL CLASSIFICATION TRANSLATION LIST

FUNC CLASS	DESCRIPTION
01	RURAL PRINCIPAL ARTERIAL - INTERSTATE
02	RURAL PRINCIPAL ARTERIAL - OTHER
06	RURAL MINOR ARTERIAL
07	RURAL MAJOR COLLECTOR
08	RURAL MINOR COLLECTOR
09	RURAL LOCAL
11	URBAN PRINCIPAL ARTERIAL - INTERSTATE
12	URBAN PRINCIPAL ARTERIAL - OTHER FREEWAYS AND EXP
14	URBAN PRINCIPAL ARTERIAL - OTHER
16	URBAN MINOR ARTERIAL
17	URBAN COLLECTOR
19	URBAN LOCAL
78	UNKNOWN RURAL SYSTEM
79	UNKNOWN RURAL NON-SYSTEM
98	UNKNOWN URBAN SYSTEM
99	UNKNOWN URBAN NON-SYSTEM

HIGHWAY COMPONENT TRANSLATION LIST

CODE	DESCRIPTION
0	MAINLINE STATE HIGHWAY
1	COUPLET
3	FRONTAGE ROAD
6	CONNECTION
8	HIGHWAY - OTHER

INJURY SEVERITY CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
1	KILL	FATAL INJURY
2	INJA	INCAPACITATING INJURY - BLEEDING, BROKEN BONES
3	INJB	NON-INCAPACITATING INJURY
4	INJC	POSSIBLE INJURY - COMPLAINT OF PAIN
5	PRI	DIED PRIOR TO CRASH
7	NO<5	NO INJURY - 0 TO 4 YEARS OF AGE

LIGHT CONDITION CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	DAY	DAYLIGHT
2	DLIT	DARKNESS - WITH STREET LIGHTS
3	DARK	DARKNESS - NO STREET LIGHTS
4	DAWN	DAWN (TWILIGHT)
5	DUSK	DUSK (TWILIGHT)

MEDIAN TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	NONE	NO MEDIAN
1	RSDMD	SOLID MEDIAN BARRIER
2	DIVMD	EARTH, GRASS OR PAVED MEDIAN

MILEAGE TYPE CODE TRANSLATION LIST

CODE	LONG DESCRIPTION
0	REGULAR MILEAGE
T	TEMPORARY
Y	SPUR
Z	OVERLAPPING

MOVEMENT TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	STRGHT	STRAIGHT AHEAD
2	TURN-R	TURNING RIGHT
3	TURN-L	TURNING LEFT
4	U-TURN	MAKING A U-TURN
5	BACK	BACKING
6	STOP	STOPPED IN TRAFFIC
7	PRKD-P	PARKED - PROPERLY
8	PRKD-I	PARKED - IMPROPERLY

PEDESTRIAN LOCATION CODE TRANSLATION LIST

CODE	LONG DESCRIPTION
00	AT INTERSECTION - NOT IN ROADWAY
01	AT INTERSECTION - INSIDE CROSSWALK
02	AT INTERSECTION - IN ROADWAY, OUTSIDE CROSSWALK
03	AT INTERSECTION - IN ROADWAY, XWALK AVAIL UNKNWN
04	NOT AT INTERSECTION - IN ROADWAY
05	NOT AT INTERSECTION - ON SHOULDER
06	NOT AT INTERSECTION - ON MEDIAN
07	NOT AT INTERSECTION - WITHIN TRAFFIC RIGHT-OF-WAY
08	NOT AT INTERSECTION - IN BIKE PATH
09	NOT-AT INTERSECTION - ON SIDEWALK
10	OUTSIDE TRAFFICWAY BOUNDARIES
13	AT INTERSECTION - IN BIKE LANE
15	NOT AT INTERSECTION - INSIDE MID-BLOCK CROSSWALK
18	OTHER, NOT IN ROADWAY
99	UNKNOWN LOCATION

ROAD CHARACTER CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	INTER	INTERSECTION
2	ALLEY	DRIVEWAY OR ALLEY
3	STRGHT	STRAIGHT ROADWAY
4	TRANS	TRANSITION
5	CURVE	CURVE (HORIZONTAL CURVE)
6	OPENAC	OPEN ACCESS OR TURNOUT
7	GRADE	GRADE (VERTICAL CURVE)
8	BRIDGE	BRIDGE STRUCTURE
9	TUNNEL	TUNNEL

PARTICIPANT TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	OCC	UNKNOWN OCCUPANT TYPE
1	DRVR	DRIVER
2	PSNG	PASSENGER
3	PED	PEDESTRIAN
4	CONV	PEDESTRIAN USING A PEDESTRIAN CONVEYA
5	PTOW	PEDESTRIAN TOWING OR TRAILERING AN OB
6	BIKE	PEDALCYCLIST
7	BTOW	PEDALCYCLIST TOWING OR TRAILERING AN
8	PRKD	OCCUPANT OF A PARKED MOTOR VEHICLE
9	UNK	UNKNOWN TYPE OF NON-MOTORIST

TRAFFIC CONTROL DEVICE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
000	NONE	NO CONTROL
001	TRF SIGNAL	TRAFFIC SIGNALS
002	FLASHBCN-R	FLASHING BEACON - RED (STOP)
003	FLASHBCN-A	FLASHING BEACON - AMBER (SLOW)
004	STOP SIGN	STOP SIGN
005	SLOW SIGN	SLOW SIGN
006	REG-SIGN	REGULATORY SIGN
007	YIELD	YIELD SIGN
008	WARNING	WARNING SIGN
009	CURVE	CURVE SIGN
010	SCHL X-ING	SCHOOL CROSSING SIGN OR SPECIAL SIGNAL
011	OFCR/FLAG	POLICE OFFICER, FLAGMAN - SCHOOL PATROL
012	BRDG-GATE	BRIDGE GATE - BARRIER
013	TEMP-BARR	TEMPORARY BARRIER
014	NO-PASS-ZN	NO PASSING ZONE
015	ONE-WAY	ONE-WAY STREET
016	CHANNEL	CHANNELIZATION
017	MEDIAN BAR	MEDIAN BARRIER
018	PILOT CAR	PILOT CAR
019	SP PED SIG	SPECIAL PEDESTRIAN SIGNAL
020	X-BUCK	CROSSBUCK
021	THR-GN-SIG	THROUGH GREEN ARROW OR SIGNAL
022	L-GRN-SIG	LEFT TURN GREEN ARROW, LANE MARKINGS, OR SIGNAL
023	R-GRN-SIG	RIGHT TURN GREEN ARROW, LANE MARKINGS, OR SIGNAL
024	WIGWAG	WIGWAG OR FLASHING LIGHTS W/O DROP-ARM GATE
025	X-BUCK WRN	CROSSBUCK AND ADVANCE WARNING
026	WW W/ GATE	FLASHING LIGHTS WITH DROP-ARM GATES
027	OVRHD SGNL	SUPPLEMENTAL OVERHEAD SIGNAL (RR XING ONLY)
028	SP RR STOP	SPECIAL RR STOP SIGN
029	ILUM GRD X	ILLUMINATED GRADE CROSSING
037	RAMP METER	METERED RAMPS
038	RUMBLE STR	RUMBLE STRIP
090	L-TURN REF	LEFT TURN REFUGE (WHEN REFUGE IS INVOLVED)
091	R-TURN ALL	RIGHT TURN AT ALL TIMES SIGN, ETC.
092	EMR SGN/FL	EMERGENCY SIGNS OR FLARES
093	ACCEL LANE	ACCELERATION OR DECELERATION LANES
094	R-TURN PRO	RIGHT TURN PROHIBITED ON RED AFTER STOPPING

095	BUS STPSGN	BUS STOP SIGN AND RED LIGHTS
099	UNKNOWN	UNKNOWN OR NOT DEFINITE

VEHICLE TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
01	PSNGR CAR	PASSENGER CAR, PICKUP, LIGHT DELIVERY, ETC.
02	BOBTAIL	TRUCK TRACTOR WITH NO TRAILERS (BOBTAIL)
03	FARM TRCTR	FARM TRACTOR OR SELF-PROPELLED FARM EQUIPMENT
04	SEMI TOW	TRUCK TRACTOR WITH TRAILER/MOBILE HOME IN TOW
05	TRUCK	TRUCK WITH NON-DETACHABLE BED, PANEL, ETC.
06	MOPED	MOPED, MINIBIKE, SEATED MOTOR SCOOTER, MOTOR BIKE
07	SCHL BUS	SCHOOL BUS (INCLUDES VAN)
08	OTH BUS	OTHER BUS
09	MTRCYCLE	MOTORCYCLE, DIRT BIKE
10	OTHER	OTHER: FORKLIFT, BACKHOE, ETC.
11	MOTRHOME	MOTORHOME
12	TROLLEY	MOTORIZED STREET CAR/TROLLEY (NO RAILS/WIRES)
13	ATV	ATV
14	MTRSCTR	MOTORIZED SCOOTER (STANDING)
15	SNOWMOBILE	SNOWMOBILE
99	UNKNOWN	UNKNOWN VEHICLE TYPE

WEATHER CONDITION CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	CLR	CLEAR
2	CLD	CLOUDY
3	RAIN	RAIN
4	SLT	SLEET
5	FOG	FOG
6	SNOW	SNOW
7	DUST	DUST
8	SMOK	SMOKE
9	ASH	ASH

Appendix D Year 2040 Traffic Operations and Queuing Worksheets

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	131	524	407	115	385	397
v/c Ratio	0.58	0.56	0.83	0.13	0.50	0.30
Control Delay	50.5	11.4	48.2	15.0	24.0	1.0
Queue Delay	0.0	0.0	0.0	0.0	13.5	0.9
Total Delay	50.5	11.4	48.2	15.0	37.5	2.0
Queue Length 50th (ft)	77	124	227	39	171	0
Queue Length 95th (ft)	138	214	#390	70	287	22
Internal Link Dist (ft)	590			679	177	
Turn Bay Length (ft)		150	200		100	
Base Capacity (vph)	570	928	569	1282	765	1356
Starvation Cap Reductn	0	0	0	0	357	677
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.56	0.72	0.09	0.94	0.58

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	126	503	391	110	370	381
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1900	1579	1770	1900	1787	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1900	1579	1770	1900	1787	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	131	524	407	115	385	397
RTOR Reduction (vph)	0	64	0	0	0	117
Lane Group Flow (vph)	131	460	407	115	385	280
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	0%	2%	2%	0%	1%	2%
Turn Type		pm+ov	Prot			pm+ov
Protected Phases	4	5	3	8	5	3
Permitted Phases		4				5
Actuated Green, G (s)	11.3	51.6	25.9	42.2	40.3	66.2
Effective Green, g (s)	11.3	51.6	25.9	42.2	40.3	66.2
Actuated g/C Ratio	0.12	0.55	0.28	0.45	0.43	0.70
Clearance Time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Vehicle Extension (s)	2.3	5.2	2.3	2.3	5.2	2.3
Lane Grp Cap (vph)	228	959	488	853	766	1207
v/s Ratio Prot	0.07	c0.21	c0.23	0.06	0.22	0.06
v/s Ratio Perm		0.09				0.11
v/c Ratio	0.57	0.48	0.83	0.13	0.50	0.23
Uniform Delay, d1	39.1	13.0	32.0	15.2	19.6	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6	0.2	11.4	0.0	2.3	0.1
Delay (s)	41.7	13.2	43.4	15.2	21.9	5.0
Level of Service	D	B	D	B	C	A
Approach Delay (s)	18.9			37.2	13.3	
Approach LOS	B			D	B	

Intersection Summary			
HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	267	343	145	456	951
v/c Ratio	0.81	0.60	0.23	0.34	0.89
Control Delay	63.1	9.0	27.8	7.2	45.7
Queue Delay	0.0	0.0	0.0	0.4	125.1
Total Delay	63.1	9.0	27.8	7.6	170.8
Queue Length 50th (ft)	191	0	77	116	322
Queue Length 95th (ft)	287	80	133	177	#425
Internal Link Dist (ft)	651			256	177
Turn Bay Length (ft)			250		
Base Capacity (vph)	407	625	632	1413	1180
Starvation Cap Reductn	0	0	0	520	434
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.66	0.55	0.23	0.51	1.27

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	251	0	322	136	429	0	0	587	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.5	5.5	5.5	5.5			5.5	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frpb, ped/bikes					1.00	1.00	1.00	1.00			0.99	
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	
Frt					1.00	0.85	1.00	1.00			0.95	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1787	1583	1736	1881			3342	
Flt Permitted					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (perm)					1787	1583	1736	1881			3342	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	267	0	343	145	456	0	0	624	327
RTOR Reduction (vph)	0	0	0	0	0	280	0	0	0	0	58	0
Lane Group Flow (vph)	0	0	0	0	267	63	145	456	0	0	893	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	4%	1%	0%	0%	1%	3%
Turn Type				Split		Perm	Prot					
Protected Phases				8	8		5	2			6	
Permitted Phases						8						
Actuated Green, G (s)					20.4	20.4	40.3	79.2			33.4	
Effective Green, g (s)					20.4	20.4	40.3	79.2			33.4	
Actuated g/C Ratio					0.18	0.18	0.36	0.72			0.30	
Clearance Time (s)					5.5	5.5	5.5	5.5			5.5	
Vehicle Extension (s)					2.3	2.3	5.2	2.3			2.3	
Lane Grp Cap (vph)					330	292	633	1347			1009	
v/s Ratio Prot					c0.15		0.08	c0.24			c0.27	
v/s Ratio Perm						0.04						
v/c Ratio					0.81	0.22	0.23	0.34			0.89	
Uniform Delay, d1					43.2	38.3	24.4	5.9			36.8	
Progression Factor					1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2					13.1	0.2	0.8	0.1			9.3	
Delay (s)					56.3	38.5	25.2	6.0			46.0	
Level of Service					E	D	C	A			D	
Approach Delay (s)		0.0			46.3			10.6			46.0	
Approach LOS		A			D			B			D	

Intersection Summary			
HCM Average Control Delay	36.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	16.5
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	188	109	401	465	312	560
v/c Ratio	0.61	0.29	0.58	0.57	0.74	0.44
Control Delay	38.3	8.7	24.1	8.9	37.8	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	8.7	24.1	8.9	37.8	6.8
Queue Length 50th (ft)	83	0	140	35	136	93
Queue Length 95th (ft)	159	41	289	142	241	193
Internal Link Dist (ft)	628		216			168
Turn Bay Length (ft)				100	150	
Base Capacity (vph)	512	545	808	891	646	1561
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.20	0.50	0.52	0.48	0.36

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	0	105	0	0	0	0	385	446	300	538	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1615					1863	1599	1787	1881	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1770	1615					1863	1599	1787	1881	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	188	0	109	0	0	0	0	401	465	312	560	0
RTOR Reduction (vph)	0	0	90	0	0	0	0	0	217	0	0	0
Lane Group Flow (vph)	0	188	19	0	0	0	0	401	248	312	560	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	2%	1%	1%	1%	0%
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		8						6		5	2	
Permitted Phases	8		8						6			
Actuated Green, G (s)		12.6	12.6					26.9	26.9	17.1	49.0	
Effective Green, g (s)		12.6	12.6					26.9	26.9	17.1	49.0	
Actuated g/C Ratio		0.18	0.18					0.38	0.38	0.24	0.68	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		2.3	2.3					6.9	6.9	2.3	6.9	
Lane Grp Cap (vph)		311	284					700	601	427	1287	
v/s Ratio Prot								c0.22		c0.17	0.30	
v/s Ratio Perm		0.11	0.01						0.15			
v/c Ratio		0.60	0.07					0.57	0.41	0.73	0.44	
Uniform Delay, d1		27.2	24.6					17.8	16.5	25.1	5.1	
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.6	0.1					2.7	1.6	5.8	0.8	
Delay (s)		29.8	24.7					20.4	18.1	30.9	5.9	
Level of Service		C	C					C	B	C	A	
Approach Delay (s)		27.9			0.0			19.2			14.8	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	71.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	123	10	40	50	8	159	22	549	60	125	428	90
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	128	10	42	52	8	166	23	572	62	130	446	94
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						4						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											296	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	1458	1433	493	1402	1449	603	540			634		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1452	1425	361	1389	1442	603	414			634		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	90	93	36	92	67	98			86		
cM capacity (veh/h)	53	102	608	81	100	499	1022			949		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	128	52	226	23	634	130	540
Volume Left	128	0	52	23	0	130	0
Volume Right	0	42	166	0	62	0	94
cSH	53	306	313	1022	1700	949	1700
Volume to Capacity	2.40	0.17	0.72	0.02	0.37	0.14	0.32
Queue Length 95th (ft)	326	15	131	2	0	12	0
Control Delay (s)	802.2	19.2	43.4	8.6	0.0	9.4	0.0
Lane LOS	F	C	E	A		A	
Approach Delay (s)	575.9		43.4	0.3		1.8	
Approach LOS	F		E				

Intersection Summary			
Average Delay	66.4		
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	456	703	230	175	218	300
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	485	748	245	186	232	319

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total (vph)	485	748	431	232	319
Volume Left (vph)	485	0	0	232	0
Volume Right (vph)	0	0	186	0	319
Hadj (s)	0.52	0.03	-0.24	0.53	-0.68
Departure Headway (s)	7.7	7.2	6.7	8.2	7.0
Degree Utilization, x	1.03	1.49	0.81	0.53	0.62
Capacity (veh/h)	466	505	527	425	501
Control Delay (s)	76.5	248.2	32.0	18.8	19.5
Approach Delay (s)	180.6		32.0	19.2	
Approach LOS	F		D	C	

Intersection Summary			
Delay	111.6		
HCM Level of Service	F		
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		

Appendix E Year 2040 Traffic Conditions and Queuing Worksheets with Corridor Improvements Alternative 1

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	131	524	407	115	385	397
v/c Ratio	0.54	0.29	0.66	0.16	0.23	0.31
Control Delay	42.9	3.2	37.2	17.4	13.5	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.6	0.4
Total Delay	42.9	3.2	37.2	17.4	14.0	1.5
Queue Length 50th (ft)	63	23	100	39	54	0
Queue Length 95th (ft)	125	51	155	72	101	22
Internal Link Dist (ft)	590			679	177	
Turn Bay Length (ft)		190	190		100	100
Base Capacity (vph)	654	1811	1265	1471	1704	1506
Starvation Cap Reductn	0	0	0	0	918	613
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.29	0.32	0.08	0.49	0.44

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	126	503	391	110	370	381
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Lane Util. Factor	1.00	0.88	0.97	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1900	2775	3433	1900	3467	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1900	2775	3433	1900	3467	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	131	524	407	115	385	397
RTOR Reduction (vph)	0	94	0	0	0	131
Lane Group Flow (vph)	131	430	407	115	385	266
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	0%	2%	2%	0%	1%	2%
Turn Type		pm+ov	Prot			pm+ov
Protected Phases	4	5	3	8	5	3
Permitted Phases		4				5
Actuated Green, G (s)	10.5	50.7	14.6	30.1	40.2	54.8
Effective Green, g (s)	10.5	50.7	14.6	30.1	40.2	54.8
Actuated g/C Ratio	0.13	0.62	0.18	0.37	0.49	0.67
Clearance Time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Vehicle Extension (s)	2.3	5.2	2.3	2.3	5.2	2.3
Lane Grp Cap (vph)	244	1907	613	699	1704	1167
v/s Ratio Prot	c0.07	0.11	c0.12	0.06	0.11	c0.04
v/s Ratio Perm		0.04				0.13
v/c Ratio	0.54	0.23	0.66	0.16	0.23	0.23
Uniform Delay, d1	33.4	6.9	31.3	17.4	11.9	5.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	0.0	2.3	0.1	0.3	0.1
Delay (s)	34.9	6.9	33.6	17.5	12.2	5.3
Level of Service	C	A	C	B	B	A
Approach Delay (s)	12.5			30.1	8.7	
Approach LOS	B			C	A	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	81.8	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	267	343	145	456	951
v/c Ratio	0.81	0.60	0.23	0.34	0.89
Control Delay	63.1	9.0	27.8	7.2	45.7
Queue Delay	0.0	0.0	0.0	0.4	125.1
Total Delay	63.1	9.0	27.8	7.6	170.8
Queue Length 50th (ft)	191	0	77	116	322
Queue Length 95th (ft)	287	80	133	177	#425
Internal Link Dist (ft)	651			504	177
Turn Bay Length (ft)					
Base Capacity (vph)	407	625	632	1413	1180
Starvation Cap Reductn	0	0	0	520	434
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.66	0.55	0.23	0.51	1.27

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	251	0	322	136	429	0	0	587	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.5	5.5	5.5	5.5			5.5	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frpb, ped/bikes					1.00	1.00	1.00	1.00			0.99	
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	
Frt					1.00	0.85	1.00	1.00			0.95	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1787	1583	1736	1881			3342	
Flt Permitted					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (perm)					1787	1583	1736	1881			3342	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	267	0	343	145	456	0	0	624	327
RTOR Reduction (vph)	0	0	0	0	0	280	0	0	0	0	58	0
Lane Group Flow (vph)	0	0	0	0	267	63	145	456	0	0	893	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	4%	1%	0%	0%	1%	3%
Turn Type				Split		Perm	Prot					
Protected Phases				8	8		5	2			6	
Permitted Phases						8						
Actuated Green, G (s)					20.4	20.4	40.3	79.2			33.4	
Effective Green, g (s)					20.4	20.4	40.3	79.2			33.4	
Actuated g/C Ratio					0.18	0.18	0.36	0.72			0.30	
Clearance Time (s)					5.5	5.5	5.5	5.5			5.5	
Vehicle Extension (s)					2.3	2.3	5.2	2.3			2.3	
Lane Grp Cap (vph)					330	292	633	1347			1009	
v/s Ratio Prot					c0.15		0.08	c0.24			c0.27	
v/s Ratio Perm						0.04						
v/c Ratio					0.81	0.22	0.23	0.34			0.89	
Uniform Delay, d1					43.2	38.3	24.4	5.9			36.8	
Progression Factor					1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2					13.1	0.2	0.8	0.1			9.3	
Delay (s)					56.3	38.5	25.2	6.0			46.0	
Level of Service					E	D	C	A			D	
Approach Delay (s)		0.0			46.3			10.6			46.0	
Approach LOS		A			D			B			D	

Intersection Summary			
HCM Average Control Delay	36.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	16.5
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	SBL	SBT
Lane Group Flow (vph)	188	109	866	312	560
v/c Ratio	0.60	0.29	0.61	0.73	0.44
Control Delay	37.8	8.7	13.6	37.2	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	8.7	13.6	37.2	6.9
Queue Length 50th (ft)	78	0	90	128	92
Queue Length 95th (ft)	159	41	193	241	193
Internal Link Dist (ft)	628		216		504
Turn Bay Length (ft)					
Base Capacity (vph)	516	548	1627	651	1580
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.36	0.20	0.53	0.48	0.35

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	0	105	0	0	0	0	385	446	300	538	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95		1.00	1.00	
Frpb, ped/bikes		1.00	1.00					1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00		1.00	1.00	
Frt		1.00	0.85					0.92		1.00	1.00	
Flt Protected		0.95	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1770	1615					3271		1787	1881	
Flt Permitted		0.95	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1770	1615					3271		1787	1881	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	188	0	109	0	0	0	0	401	465	312	560	0
RTOR Reduction (vph)	0	0	90	0	0	0	0	219	0	0	0	0
Lane Group Flow (vph)	0	188	19	0	0	0	0	647	0	312	560	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	2%	1%	1%	1%	0%
Turn Type	Perm		Perm							Prot		
Protected Phases		8						6		5	2	
Permitted Phases	8		8									
Actuated Green, G (s)		12.5	12.5					26.4		17.0	48.4	
Effective Green, g (s)		12.5	12.5					26.4		17.0	48.4	
Actuated g/C Ratio		0.18	0.18					0.37		0.24	0.68	
Clearance Time (s)		5.0	5.0					5.0		5.0	5.0	
Vehicle Extension (s)		2.3	2.3					6.9		2.3	6.9	
Lane Grp Cap (vph)		312	285					1218		428	1284	
v/s Ratio Prot								c0.20		c0.17	0.30	
v/s Ratio Perm		0.11	0.01									
v/c Ratio		0.60	0.07					0.53		0.73	0.44	
Uniform Delay, d1		26.9	24.3					17.4		24.8	5.1	
Progression Factor		1.00	1.00					1.00		1.00	1.00	
Incremental Delay, d2		2.6	0.1					1.3		5.5	0.8	
Delay (s)		29.5	24.4					18.7		30.4	5.9	
Level of Service		C	C					B		C	A	
Approach Delay (s)		27.6			0.0			18.7			14.7	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	40	0	0	159	0	672	60	0	553	90
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	42	0	0	166	0	700	62	0	576	94
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								275			296	
pX, platoon unblocked												
vC, conflicting volume	1139	1385	335	1061	1401	381	670			762		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1139	1385	335	1061	1401	381	670			762		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	94	100	100	73	100			100		
cM capacity (veh/h)	116	145	667	170	141	617	930			846		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	42	166	467	296	384	286
Volume Left	0	0	0	0	0	0
Volume Right	42	166	0	62	0	94
cSH	667	617	1700	1700	1700	1700
Volume to Capacity	0.06	0.27	0.27	0.17	0.23	0.17
Queue Length 95th (ft)	5	27	0	0	0	0
Control Delay (s)	10.8	13.0	0.0	0.0	0.0	0.0
Lane LOS	B	B				
Approach Delay (s)	10.8	13.0	0.0		0.0	
Approach LOS	B	B				

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	603	759	470	341	289
v/c Ratio	0.88	0.72	0.91	0.78	0.47
Control Delay	40.5	15.0	44.8	34.5	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	40.5	15.0	44.8	34.5	5.6
Queue Length 50th (ft)	110	187	148	111	0
Queue Length 95th (ft)	#197	315	#313	#220	49
Internal Link Dist (ft)		670	736	195	
Turn Bay Length (ft)	220				
Base Capacity (vph)	687	1059	526	488	650
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.88	0.72	0.89	0.70	0.44

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	567	713	276	165	321	272
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5		5.5	5.5
Lane Util. Factor	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.95		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3467	1863	1784		1770	1599
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3467	1863	1784		1770	1599
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	603	759	294	176	341	289
RTOR Reduction (vph)	0	0	36	0	0	217
Lane Group Flow (vph)	603	759	434	0	341	72
Heavy Vehicles (%)	1%	2%	0%	3%	2%	1%
Turn Type	Prot					Perm
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	11.5	32.7	15.7		14.4	14.4
Effective Green, g (s)	11.5	32.7	15.7		14.4	14.4
Actuated g/C Ratio	0.20	0.56	0.27		0.25	0.25
Clearance Time (s)	5.5	5.5	5.5		5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	686	1049	482		439	396
v/s Ratio Prot	0.17	c0.41	c0.24		c0.19	
v/s Ratio Perm						0.04
v/c Ratio	0.88	0.72	0.90		0.78	0.18
Uniform Delay, d1	22.6	9.4	20.4		20.4	17.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	12.3	2.5	19.8		8.4	0.2
Delay (s)	34.9	11.9	40.2		28.8	17.4
Level of Service	C	B	D		C	B
Approach Delay (s)		22.1	40.2		23.6	
Approach LOS		C	D		C	

Intersection Summary			
HCM Average Control Delay	25.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	58.1	Sum of lost time (s)	16.5
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Appendix F Year 2040 Traffic Conditions and Queuing Worksheets with Corridor Improvements Alternative 2

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	131	524	407	115	385	397
v/c Ratio	0.57	0.28	0.69	0.17	0.21	0.31
Control Delay	46.4	3.7	40.8	19.1	11.9	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.4	0.3
Total Delay	46.4	3.7	40.8	19.1	12.3	1.0
Queue Length 50th (ft)	71	28	113	45	50	0
Queue Length 95th (ft)	122	58	151	69	84	10
Internal Link Dist (ft)	590			679	177	
Turn Bay Length (ft)		150	200		100	100
Base Capacity (vph)	623	1859	820	1182	1812	1373
Starvation Cap Reductn	0	0	0	0	900	446
Spillback Cap Reductn	0	22	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.29	0.50	0.10	0.42	0.43

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	126	503	391	110	370	381
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Lane Util. Factor	1.00	0.88	0.97	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1900	2776	3433	1900	3467	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1900	2776	3433	1900	3467	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	131	524	407	115	385	397
RTOR Reduction (vph)	0	72	0	0	0	121
Lane Group Flow (vph)	131	452	407	115	385	276
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	0%	2%	2%	0%	1%	2%
Turn Type		pm+ov	Prot			pm+ov
Protected Phases	4	5	3	8	5	3
Permitted Phases		4				5
Actuated Green, G (s)	10.9	57.9	15.6	31.5	47.0	62.6
Effective Green, g (s)	10.9	57.9	15.6	31.5	47.0	62.6
Actuated g/C Ratio	0.12	0.64	0.17	0.35	0.52	0.70
Clearance Time (s)	5.5	5.5	5.5	6.0	5.5	5.5
Vehicle Extension (s)	2.3	5.2	2.3	2.3	5.2	2.3
Lane Grp Cap (vph)	230	1956	595	665	1811	1198
v/s Ratio Prot	c0.07	0.12	c0.12	0.06	0.11	c0.04
v/s Ratio Perm		0.04				0.13
v/c Ratio	0.57	0.23	0.68	0.17	0.21	0.23
Uniform Delay, d1	37.3	6.7	34.9	20.2	11.6	5.0
Progression Factor	1.00	1.00	1.00	1.00	0.90	0.41
Incremental Delay, d2	2.3	0.0	2.8	0.1	0.2	0.1
Delay (s)	39.7	6.8	37.7	20.3	10.7	2.1
Level of Service	D	A	D	C	B	A
Approach Delay (s)	13.3			33.9	6.3	
Approach LOS	B			C	A	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	267	343	145	456	951
v/c Ratio	0.74	0.58	0.53	0.36	0.60
Control Delay	46.3	7.6	33.9	1.6	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.4
Total Delay	46.3	7.6	33.9	1.6	14.1
Queue Length 50th (ft)	142	0	43	2	110
Queue Length 95th (ft)	213	64	93	8	174
Internal Link Dist (ft)	651			504	177
Turn Bay Length (ft)					
Base Capacity (vph)	459	661	334	1274	1591
Starvation Cap Reductn	0	0	0	0	218
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.58	0.52	0.43	0.36	0.69

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	251	0	322	136	429	0	0	587	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.5	5.5	5.5	5.5			5.5	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frpb, ped/bikes					1.00	1.00	1.00	1.00			0.99	
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	
Frt					1.00	0.85	1.00	1.00			0.95	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1787	1583	1736	1881			3343	
Flt Permitted					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (perm)					1787	1583	1736	1881			3343	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	267	0	343	145	456	0	0	624	327
RTOR Reduction (vph)	0	0	0	0	0	274	0	0	0	0	65	0
Lane Group Flow (vph)	0	0	0	0	267	69	145	456	0	0	886	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	4%	1%	0%	0%	1%	3%
Turn Type				Split		Perm	Prot					
Protected Phases				8	8		5	2			6	
Permitted Phases						8						
Actuated Green, G (s)					18.1	18.1	14.3	60.9			41.1	
Effective Green, g (s)					18.1	18.1	14.3	60.9			41.1	
Actuated g/C Ratio					0.20	0.20	0.16	0.68			0.46	
Clearance Time (s)					5.5	5.5	5.5	5.5			5.5	
Vehicle Extension (s)					2.3	2.3	5.2	2.3			2.3	
Lane Grp Cap (vph)					359	318	276	1273			1527	
v/s Ratio Prot					c0.15		c0.08	0.24			c0.27	
v/s Ratio Perm						0.04						
v/c Ratio					0.74	0.22	0.53	0.36			0.58	
Uniform Delay, d1					33.8	30.0	34.7	6.2			18.1	
Progression Factor					1.00	1.00	0.82	0.13			0.69	
Incremental Delay, d2					7.5	0.2	3.0	0.7			1.5	
Delay (s)					41.2	30.2	31.4	1.5			14.1	
Level of Service					D	C	C	A			B	
Approach Delay (s)		0.0			35.0			8.7			14.1	
Approach LOS		A			D			A			B	

Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	188	109	401	465	312	560
v/c Ratio	0.70	0.32	0.59	0.57	0.55	0.40
Control Delay	50.3	9.4	23.9	8.1	24.0	3.0
Queue Delay	0.0	0.0	4.1	0.9	0.0	0.0
Total Delay	50.3	9.4	28.1	9.0	24.0	3.0
Queue Length 50th (ft)	102	0	177	65	127	104
Queue Length 95th (ft)	167	43	283	157	181	8
Internal Link Dist (ft)	628		216			504
Turn Bay Length (ft)				100		
Base Capacity (vph)	334	393	683	818	564	1388
Starvation Cap Reductn	0	0	202	144	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.28	0.83	0.69	0.55	0.40

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	0	105	0	0	0	0	385	446	300	538	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1615					1863	1599	1787	1881	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1770	1615					1863	1599	1787	1881	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	188	0	109	0	0	0	0	401	465	312	560	0
RTOR Reduction (vph)	0	0	93	0	0	0	0	0	232	0	0	0
Lane Group Flow (vph)	0	188	16	0	0	0	0	401	233	312	560	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	2%	1%	1%	1%	0%
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		8						6		5	2	
Permitted Phases	8		8						6			
Actuated Green, G (s)		13.6	13.6					33.0	33.0	28.4	66.4	
Effective Green, g (s)		13.6	13.6					33.0	33.0	28.4	66.4	
Actuated g/C Ratio		0.15	0.15					0.37	0.37	0.32	0.74	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		2.3	2.3					6.9	6.9	2.3	6.9	
Lane Grp Cap (vph)		267	244					683	586	564	1388	
v/s Ratio Prot								c0.22		c0.17	0.30	
v/s Ratio Perm		0.11	0.01						0.15			
v/c Ratio		0.70	0.07					0.59	0.40	0.55	0.40	
Uniform Delay, d1		36.3	32.8					23.0	21.1	25.5	4.4	
Progression Factor		1.00	1.00					0.87	1.04	0.77	0.45	
Incremental Delay, d2		7.2	0.1					3.4	1.9	3.1	0.7	
Delay (s)		43.5	32.8					23.4	23.8	22.8	2.7	
Level of Service		D	C					C	C	C	A	
Approach Delay (s)		39.6			0.0			23.6			9.9	
Approach LOS		D			A			C			A	

Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	128	52	60	166	23	634	130	540
v/c Ratio	0.62	0.18	0.29	0.43	0.04	0.47	0.26	0.41
Control Delay	47.6	13.9	35.6	8.9	0.2	0.7	2.4	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.3
Total Delay	47.6	13.9	35.6	8.9	0.2	1.6	2.4	2.1
Queue Length 50th (ft)	69	5	31	0	0	1	3	11
Queue Length 95th (ft)	118	34	63	50	m0	m2	14	41
Internal Link Dist (ft)		412	312			195		216
Turn Bay Length (ft)				100	50		125	
Base Capacity (vph)	341	449	341	520	588	1337	504	1322
Starvation Cap Reductn	0	0	0	0	0	395	0	269
Spillback Cap Reductn	0	14	9	12	0	133	0	57
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.12	0.18	0.33	0.04	0.67	0.26	0.51

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	123	10	40	50	8	159	22	549	60	125	428	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.88			1.00	0.85	1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1670			1821	1583	1805	1839		1770	1814	
Flt Permitted	0.72	1.00			0.72	1.00	0.43	1.00		0.37	1.00	
Satd. Flow (perm)	1364	1670			1364	1583	811	1839		694	1814	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	128	10	42	52	8	166	23	572	62	130	446	94
RTOR Reduction (vph)	0	36	0	0	0	141	0	3	0	0	6	0
Lane Group Flow (vph)	128	16	0	0	60	25	23	631	0	130	534	0
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	0%	2%	0%	2%	2%	0%
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	13.7	13.7			13.7	13.7	65.3	65.3		65.3	65.3	
Effective Green, g (s)	13.7	13.7			13.7	13.7	65.3	65.3		65.3	65.3	
Actuated g/C Ratio	0.15	0.15			0.15	0.15	0.73	0.73		0.73	0.73	
Clearance Time (s)	5.5	5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	208	254			208	241	588	1334		504	1316	
v/s Ratio Prot		0.01						c0.34			0.29	
v/s Ratio Perm	c0.09				0.04	0.02	0.03			0.19		
v/c Ratio	0.62	0.06			0.29	0.10	0.04	0.47		0.26	0.41	
Uniform Delay, d1	35.7	32.7			33.8	32.9	3.5	5.2		4.2	4.8	
Progression Factor	1.00	1.00			1.00	1.00	0.03	0.01		0.22	0.18	
Incremental Delay, d2	5.3	0.1			0.8	0.2	0.1	0.7		1.2	0.9	
Delay (s)	41.0	32.8			34.6	33.1	0.2	0.7		2.1	1.7	
Level of Service	D	C			C	C	A	A		A	A	
Approach Delay (s)		38.6			33.5			0.7			1.8	
Approach LOS		D			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	485	748	431	232	319
v/c Ratio	0.88	0.69	0.86	0.44	0.29
Control Delay	39.2	16.3	45.1	32.4	3.6
Queue Delay	0.0	0.0	0.0	1.1	0.4
Total Delay	39.2	16.3	45.1	33.5	4.1
Queue Length 50th (ft)	191	248	206	126	14
Queue Length 95th (ft)	#352	342	#323	190	40
Internal Link Dist (ft)		670	736	195	
Turn Bay Length (ft)	225			125	
Base Capacity (vph)	575	1190	570	523	1124
Starvation Cap Reductn	0	0	0	128	421
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.84	0.63	0.76	0.59	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	456	703	230	175	218	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5		5.5	5.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.94		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	1863	1766		1770	1599
Flt Permitted	0.15	1.00	1.00		0.95	1.00
Satd. Flow (perm)	285	1863	1766		1770	1599
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	485	748	245	186	232	319
RTOR Reduction (vph)	0	0	32	0	0	144
Lane Group Flow (vph)	485	748	399	0	232	175
Heavy Vehicles (%)	1%	2%	0%	3%	2%	1%
Turn Type	pm+pt					pm+ov
Protected Phases	7	4	8		6	7
Permitted Phases	4					6
Actuated Green, G (s)	52.5	52.5	24.0		26.5	49.5
Effective Green, g (s)	52.5	52.5	24.0		26.5	49.5
Actuated g/C Ratio	0.58	0.58	0.27		0.29	0.55
Clearance Time (s)	5.5	5.5	5.5		5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	550	1087	471		521	977
v/s Ratio Prot	c0.23	0.40	0.23		c0.13	0.05
v/s Ratio Perm	c0.29					0.06
v/c Ratio	0.88	0.69	0.85		0.45	0.18
Uniform Delay, d1	22.0	13.1	31.3		25.8	10.1
Progression Factor	1.00	1.00	1.00		1.05	2.59
Incremental Delay, d2	15.3	1.8	13.2		2.6	0.1
Delay (s)	37.3	14.9	44.4		29.7	26.2
Level of Service	D	B	D		C	C
Approach Delay (s)		23.7	44.4		27.7	
Approach LOS		C	D		C	

Intersection Summary			
HCM Average Control Delay	28.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

MEMORANDUM

Daniel Heffernan Company
2525 NE Halsey Street
Portland. OR 97232

DATE: February 25, 2015
TO: Susan Wright, Kittelson Associates
Zach Pelz, City of West Linn, Planning
FROM: DJ Heffernan, DHC
SUBJECT: Draft Technical Memorandum #9 – Regulatory Solutions

Context

As part of the process to update the City of West Linn transportation system plan (TSP), the city is required to review and where necessary update implementation measures, such as its development code and public works design standards. Cities and counties across the state rely on these tools to address specific requirements in the Oregon Transportation Planning Rule (TPR) and the Regional Transportation Functional Plan (RTFP).

The City's implementing measures are used to achieve specific local transportation goals. These include:

1. Safety: Reduce transportation related fatalities and serious injuries across all modes;
2. Mobility, Access and Environment: Improve people's access to jobs, schools, health care and other regular needs in ways that improve health, reduce pollution and retain money in the local economy;
3. Maintenance: Deliver access and safety improvements cost effectively, within available revenues;
4. Equity: Equitably respond to the needs of all users of the transportation system, and in a way that is beneficial to the natural environment.

Performance measures are used over time to monitor the achievement of these goals. Performance measures have been established for safety, vehicles miles traveled per capita, freight reliability, congestion, and walking, bicycling and transit mode shares. Technical Memorandum #3 includes draft "Performance Measures" for West Linn's 2015 TSP update. These measures are used over time to monitor the TSP.[1] and, when performance measures are not being met, they guide the reexamination of city regulations to improve performance.

Purpose

The purpose of this memorandum is to review West Linn's implementation measures for compliance with state and regional requirements. At their core, the state and regional requirements are intended to reduce reliance on single-occupancy vehicles, reduce environmental impacts related to automobile use, and expand mobility choices for transportation system users.

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[1] Section 3.08.230 Performance Targets and Standards, Chapter 3.08, Regional Transportation Function Plan, Exhibit E. to Ordinance No 10-1241B

The implementing measures include local neighborhood plans (NPs), which provide local context and refinement of the West Linn Comprehensive Land Use Plan (Comp Plan), the West Linn Community Development Code (CDC), ancillary transportation plans like the West Linn Master Trails Plan, and West Linn's Public Works Design Standards (PWDS). The analysis also considered the need to improve consistency between the comprehensive plan, the TSP, and the city's implementing measures.

Exhibit A to this memorandum summarizes state and regional compliance requirements and documents where and how the City's implementing measures meet or do not meet these requirements. The review shows that the City complies with most but not all state and regional transportation planning requirements. Where implementing measures are inadequate, the table indicates the reason why.

Compliance Issues Summary

The non-compliance issues identified in the review generally involve state and regional requirements for local transportation regulations, or conflicts within city documents. The following summary highlights the issues and solutions to address them:

1. The West Linn Comprehensive Plan (Comp Plan) includes language that grants neighborhood plans presumptive standing as part of the Comp Plan. The plan needs to clarify that this standing may only apply when a neighborhood plan formally has been adopted as part of the Comp Plan (i.e. by ordinance and in conformance with state post-acknowledgement plan amendment (PAPA) adoption procedures in OAR 660.18.0020). In the absence of such action, the Comp Plan should clarify that land use decision makers may consult neighborhood plans as advisory documents but they may not rely on them in rendering land use decisions.
2. The Comp Plan narrative for Goal 12 – Transportation needs to be updated to reflect the revised improvement program for the I-205/10th Street interchange area.
3. The Functional Street Classifications in the Comp Plan, the TSP, and the West Linn Community Development Code (CDC) are inconsistent. Amendments are needed to bring them into agreement.
4. The Comp Plan and TSP in effect specify that that the city's four mixed-use commercial districts function like "town centers" by supporting transit-oriented development, providing employment opportunities, and enhancing multi-modal accessibility to services for the surrounding neighborhoods. The Comp Plan should include a reference to the term "town center" for these areas to ensure the city is able to access regional, state, and federal resources that specifically pertain to geographic areas that are defined in the Metro 2040 Growth Plan as town centers. CDC regulations should reference the mixed-use districts in a consistent manner. Boundaries should be established for the Mixed Use Commercial Districts, which may be accomplished using an overlay that can be applied to more than one base zone.
5. A number of modifications are recommended to the City's Design Review Approval Criteria:

a. Add requirements for Transportation Demand Management (TDM) measures for all "major" developments, major redevelopments, and conditional use applications;
b. Amend the sidewalk fee-in-lieu program to specify where it may be used and to ensure this revenue is used elsewhere in West Linn for frontage improvements;
c. Allow flexibility to street design standards in locations where terrain or natural features prevent construction of a standard cross-section, but in other areas limit discretionary review of the required transportation improvements;
d. Require land division plats to show connectivity for bike/ped/transit where street connections are not required and the distance between connectivity exceeds recommended RTFP requirements;
e. Reduce discretionary review of land use applications in town centers by offering a clear and objective approval option for all allowed uses and by adopting design standards, for each Town Center area, (e.g. the design standards for the Willamette District).

6. Amend West Linn Public Works Design and Construction Standards to include a cross section standard for a *Neighborhood Route*, a *Green Street*, and streets that share an on-street trail segment.

Specific solutions to these issues are presented in the tables below, which identify specific compliance issues, reviews the city code section or public works standard that needs to be amended, presents a recommendation to address the issue, and references the regulatory requirement that pertains to the issue. Where the proposed solution requires multi-faceted amendments to city documents, a summary of the proposed remedy is presented in the table with a reference to a detailed recommendation in Exhibit B.

Draft Regulatory Solutions for the West Linn Transportation System Plan Update

CITY PLAN AND POLICY SOLUTIONS			
Issue	Summary	Recommendation	Compliance
Neighborhood Plan/ Comp Plan Consistency	✓ West Linn's neighborhood plans (NPs) were not formally adopted as elements of the Comp Plan and have not been review for conformity with statewide land use planning goals. Until they have, NPs do not have standing as part of the Comp Plan and may only be relied on as advisory documents in land use proceedings.	Amend the narrative and policies in the Comp Plan related to Goals 1 and 2 to clarify the role of NPs so that they are treated appropriately in land use proceedings per Statewide Land Use Planning Goal 2. Draft text recommendations are included in Appendix B.	OAR 660.015.0000; OAR 660.018.0020;
Neighborhood Plan Consistency	✓ The Willamette neighborhood plan was prepared in 2003. The Bolton, Marylhurst, and Parker Crest neighborhood plans were adopted in 2006. The Tanner Neighborhood Plan was adopted in 2007. The Robinwood and Sunset neighborhood plans were adopted in 2008. While the policies in these plans generally are compatible and supportive of the Comp Plan and TSP, some are not. All neighborhood plans pre-date the updated TSP.	Amend the Comp Plan to clarify the role of neighborhood plans in land use proceedings; where necessary update neighborhood plans so that they are consistent with the TSP and Comp Plan. Draft text recommendations are included in Appendix B.	OAR 660.015.0000;

CITY PLAN AND POLICY SOLUTIONS			
Issue	Summary	Recommendation	Compliance
Comp Plan, Neighborhood Plan, and TSP Consistency – 10th Street Interchange	✓ There are references to the I-205/10th Street interchange in the Comp Plan, and in the Tanner Basin, Sunset, and Willamette Neighborhood plans. These references may need to be updated to reflect the revised interchange improvement program in the updated TSP.	Update the narrative in the Comp Plan for Goal 12 – Transportation to reflect the program for improving the I-205/10th Avenue interchange area so that the narrative is consistent consistent with the updated TSP. Consider updating NPs, if necessary.	OAR 660-12-0015; ODOT TSP; Metro RTP
Roadway Functional Classifications	✓ West Linn's CDC Chapter 85 lists "Neighborhood Route" as roads whose functional purpose falls between "Collector" and "Local" roadways. The Comp Plan and TSP should define and identify where this classification is applicable. There also is a need for a plan policy that limits the use of alternative street designs to areas where proximity to sensitive resources, steep slopes, narrow rights of way, or other extenuating factors justify alternative design options.	Add "Neighborhood Route" as a functional classification to "Action Measure" #7 under Comp Plan Goal 12 Street policies (page T8). Add descriptions for alternative street designs that place pedestrian and/or bicycle facilities on one side of the roadway and a "Shared Street" classification that permits multi-modal use of the roadway. Add a policy that provides guidance for the use of these alternative designs. Draft text recommendations are included in Appendix B.	

CITY PLAN AND POLICY SOLUTIONS			
Issue	Summary	Recommendation	Compliance
Town Center Designations and Policies	✓ In Comp Plan Goal 2 – Land Use Planning, Section 3, which pertains to West Linn's four Mixed Use Commercial Districts, the narrative should recognized the "Town Center" function that these areas provide West Linn residents. This establishes functional equivalency between the Comp Plan and the Metro 2040 Growth Plan for West Linn's four mixed-use districts that need to meet RTFP requirements for connectivity.	Add policy language to Section 3, Goals 6 and 7 that recognizes the "Town Center" function of West Linn's mixed-use commercial districts. Draft text recommendations are included in Appendix B. The Metro 2040 Growth Plan map in the Comp Plan needs to be updated to the 2014 version.	Metro RTP/2040 Plan; OAR 660.012.0045.3
Town Center Designations and Policies	✓ Policies in Comp Plan Goal 12 – Transportation, especially for bicycles, pedestrians, and transit, should call for multi-modal connectivity between West Linn's mixed-use commercial districts.	Modify city transportation policies that call for strategies to "…connect the four mixed-use commercial centers in Willamette, Bolton, Robinwood, and Tanner Basin" to include bike, ped, transit strategies.	

CITY PLAN AND POLICY SOLUTIONS			
Issue	Summary	Recommendation	Compliance
Town Center and Transit Corridors and TDM Policies	✓ OAR 660.12.0045(5) requires cities in MPO areas to take steps to reduce single-occupancy vehicle (SOV) trips through their land use plans, development regulations and through Transportation Demand Management (TDM) programs. The later is often implemented through a "Transportation Option" program that adds regulations for new development that generates traffic above certain thresholds, or in areas and corridors with significant congestion.	Add the following policy to Goal 12 – Transportation under General Policies and Action Measures: 11. Take action using the following measures to promote the use of Transportation Options: • Support community education to increase efficient use of existing transportation infrastructure and minimize congestion and safety concerns by offering choices of mode, route, and time. • Support and participate in efforts by Metro, the Department of Environmental Quality (DEQ), transit providers, and Transportation Management Associations (TMAs) to develop, monitor and fund local TDM programs. • Provide adequate bicycle and pedestrian facilities connecting mixed-use commercial centers to encourage use of bicycles or walking for the commute to work and to improve access to jobs for workers without cars. • Take steps to reduce drive-alone vehicle trips with the goal to reach 40% non-drive alone trips in mixed-use areas by 2040. • Develop regulations for mixed-use areas that require major new development and redevelopment and conditional use applications to address Transportation Options requirements.	OAR 660.012.0045(4)-(5); RTFP 308.120(C).

CITY PLAN AND POLICY SOLUTIONS			
Issue	Summary	Recommendation	Compliance
Street Design	✓ West Linn's Comp Plan does not include a policy reference to Metro's Street Design Classifications for supporting multi-modal street use and Green Streets.	Add the following policies to the West Linn Comprehensive Land Use Plan (WLCP) under Goal 12 – Transportation: General Policies. *9. Consider the Metro Regional Street Design Classifications for new and redesigned city streets prior to construction or reconstruction.* *10. Minimize impacts of managing storm water by allowing for Metro's alternative street standards, such as "green streets," as design alternatives.*	RTFP reference:

CITY DEVELOPMENT CODE ACTIONS

Issue	Summary	Recommendation	Compliance
CDC Design Review Standards	✓ The purpose statement in CDC Chapter 55.010 states "Multi-family, industrial, commercial, office, and public projects will comply with the Transportation Planning Rule (TPR)". The requirement is aimed at encouraging design features that promote the use of alternative modes and improve connectivity rather than demonstrating project-level compliance with the TPR (OAR 660.12.000). Use alternative wording.	Make the following change to CDC 55.010: Developers of ~~Multi~~multi-family, industrial, commercial, office, and public projects ~~will comply with the Transportation Planning Rule (TPR). The TPR is a State requirement that jurisdictions must~~ are required to take steps to reduce reliance on the automobile by, in part, encouraging other modes of transportation, such as transit, bicycles, and foot traffic, or through building orientation or location.	OAR 660-12-045(3)
CDC Design Review Standards – Transportation Demand Management (TDM)	✓ The TPR mandates that TDM measures be integrated with all "major" new developments, redevelopments, and all conditionally approved development. "Major" is not defined in the rule. We have defined it as any project that requires discretionary (Type 3/Type 4) review.	Amend CDC 55.100.7: *k. Major developments and conditional use applications in designated town center and industrial areas must include a transportation option (TO) elements into the development program. Table A outlines requirements and appropriate TDM measures for various types of development. In general, larger scale developments and development that generates a large amount of auto-trips are required to implement more significant TO measures. (see Exhibit B for the proposed TO requirements).*	RTFP 3.08.120; OAR 660.012.0045(5)

CITY DEVELOPMENT CODE ACTIONS			
Issue	Summary	Recommendation	Compliance
CDC Design Standards for "Town Center" Areas	✓ West Linn's CDC Chapter 55 100 includes design and development standards for multi-family, commercial, public, and employment land uses. Standards do not distinguish between the development requirements in mixed-use areas and other districts in West Linn. Design requirements for multi-family in particular may violate state law that requires all cities to provide a clear and objective path to development approval for needed housing types.	Add language to the CDC that distinguish design standards and public facility requirements for development in mixed-use commercial districts. These are intended to meet RTFP requirements for "Town Center" areas, including parking, bicycle/pedestrian accessibility, transit access, alternative mobility, etc. Adding requirements for enhancing multi-modal access and use within and in proximity to mixed-use districts. Establish a "Type 2" approval process for projects that meet specific design parameters as an alternative to "Type 3" discretionary review. This is especially important for multi-family housing projects that are required by state law to have a clear and objective path to development approval.	OAR 660.012.0045(3); RTFP reference
CDC Design Standards for "Town Center" Areas and Transit Corridors	✓ OAR 660.12.0045(4) and (5) require cities in MPOs to take steps to promote transit where available. The city's approval criteria for building orientation and access is vague for determining when and how an applicant needs to make special accommodations for transit orientation.	Modify the design requirements in CDC55.100.7.g to specify a distance parameter from transit stops that triggers the requirement to orient a main building entrance to transit and establish a pathway to the stop in transit corridors. Add standards and criteria for all development in mixed-use areas to design development for access to transit and to provide information about transit stops/schedules/etc.	RTFP reference

CITY DEVELOPMENT CODE ACTIONS			
Issue	Summary	Recommendation	Compliance
CDC Design Standards for "Town Center" Areas	✓ RTFP 30.8.130 includes an alternate provision for meeting transit accessibility requirements using designating Pedestrian Districts. Town Center areas may be suitable areas for this approach.	Add regulations for property in a designated pedestrian district if applicable.	RTFP 3.08.130.B, OAR 660-12-00045.(3) - (5)
Fee in lieu requirement	✓ CDC 96.010.A.3 allows development in neighborhoods without sidewalks to pay a fee in lieu of building sidewalks in order to match the existing development pattern. These funds, however, go into the City's General Fund where they are not limited in use to sidewalk construction.	West Linn should alter its fee in lieu policy for sidewalk construction. Dedicate fee revenue to a Sidewalk Construction Fund that would be used to build higher priority sidewalks first. The fee in lieu would apply to development applications that are required to construct sidewalks along their site frontage. In certain circumstances, the fee in lieu policy lets them pay a fee equivalent to the cost of constructing the frontage improvement. Prioritize the use of the Sidewalk Construction Fund for sidewalks and multi-modal trails that enhance pedestrian safety on designated safe routes to school and connections to/within mixed-use centers.	RTFP 3.08.130; OAR 660.012.0045.(3); WLCLP Goal 12, General Policy 8, Action #5; Street Policies 9 and 12.

CITY DEVELOPMENT CODE ACTIONS			
Issue	Summary	Recommendation	Compliance
Development Approval Criteria	✓ CDC Chapter 60 - Conditional Uses: The approval criteria in 60.090 - Transportation Facilities (Type II), which are used to review the appropriateness of transportation improvements NOT included in the TSP, does not include a reference to the Metro Regional Transportation Facility Plan (RTFP).	Add to the approval criteria in CDC 60.090. A.1. and include a criterion that requires consistency of the proposed conditional use with the adopted RTP.	OAR 660.012.0015(2)(b).
Increase the availability of Non-discretionary Land Use Approval	✓ Virtually every land use application other than development approval for single-family residential lots is required to go through some form of discretionary review either as a conditional use or through a design review process. This adds cost and opportunities for opponents of development that is consistent with the adopted plan to mobilize at hearings. This tactic has been used to obstruct local connectivity and alternative mode improvements even when these improvements are listed in the TSP and required by plan policies and CDC rule.	Provide a clear path to development approval (Type 1 or 2 review) for developments in mixed-use areas and along transit corridors that meet specific design criteria. Additionally, for Type 3 applications, limit the scope of review for transportation improvements to those that require subjective interpretation of a policy, such as locating a new or improved street near a designated Water Resource Area (WRA), on steep slopes, or in historic districts. Where the WLCP, the TSP, the Trails Plan, and/ or the CDC requirements are definitive, the scope of review by the decision maker/ body may be limited.	

CITY DEVELOPMENT CODE ACTIONS			
Issue	Summary	Recommendation	Compliance
Design requirements and Approval Criteria for Preliminary Plat	✓ CDC Chapter 85 lacks specific guidance for when partition requests need to show tentative street plans for remnant undivided portions of the property. Doing so will serve to protect future street alignments from encroachment by interim development. The regulation also does not require tentative plans to show internal and external connectivity for pedestrians/bicycle/transit access where street connections are not present.	Add the following text to CDC 85.120: Where the tentative subdivision … for the unsubdivided portion. A tentative street plan is required for sites where the un-subdivided portion of the property is greater than 300 percent of the minimum lot size allowed in the underlying zoning district. Add the following text to 85.170.B. Transportation 1. Centerline profiles … of street construction. Where street connections are not proposed within or beyond the limits of the proposed subdivision on blocks exceeding 330 feet, or for cul-de-sacs, the tentative plat or partition shall indicate the location of easements that provide connectivity for bicycle, pedestrian use to accessible public rights of way.	RTFP 3.08.130.B; RTFP 3.08.110.B.6; OAR660.012.0045.(3)
Travel Lane Widths	✓ The travel lane widths in the CDC vary by functional class. Local streets have the widest land widths, presumably because on-street parking and bikeway travel is envisioned to share the standard 24' of pavement. This same approach should be available to Neighborhood Routes where ROW is insufficient to allow for designated bike lanes and sidewalks.	Amend the table in CDC Chapter 85.200 A. Streets, 3. Street Widths to allow travel lane widths on Neighborhood Routes to be 10 - 12 feet. Include a footnote that 12-foot travel lanes may only be used when the ROW is too narrow to accommodate bike lanes and sidewalks.	Policy reference

CITY DEVELOPMENT CODE ACTIONS			
Issue	Summary	Recommendation	Compliance
Flexible Street Design	✓ There are circumstances in West Linn where topography, proximity to sensitive resource sites, or prevailing development conditions make it infeasible or impractical to build a standard street cross section improvement.	Add the following street classification to CDC Chapter 85.200 Approval Criteria, 2. Right of Way: *Neighborhood Route 40-60 feet* Add the following street description to CDC Chapter 85.200 Approval Criteria 3. Streets Widths: *Shared Street – Provides access to residential or commercial uses in areas in which right-of-way is constrained by topography or historically significant structures. The constrained right-of-way prevents typical bicycle and pedestrian facilities such as sidewalks and bicycle lanes. Therefore, pedestrians, bicycles, and motor vehicles may share the entire width of the street. The design of the street should emphasize a slower speed environment and provide clear physical and visual indications that the space is shared across modes.*	Policy reference

CITY PUBLIC WORKS DESIGN STANDARDS			
Issue	Summary	Recommendation	Compliance
On-street Trail	✓ West Linn's Trails Master Plan calls for a number of trail segments on existing streets but the city's design standards do not include guidance for these facilities.	Amend WLPW Design Standards, Division 5.0050 and 5.0060 to provide dimensional standards for on-street trail facilities.	West Linn Trails Plan, TPR ___; RTFP ___.
Shared Street	✓ The updated TSP includes identification of locations where mixed-modal use of the right of way is appropriate because of the existing development pattern or because of natural conditions that preclude building a standard improvement.	Amend WLPW Design Standards, Division 5.0110, to include a cross section and amenities for streets that are designed to integrate autos, bikes, and pedestrian use of the street.	PM #s… TPR, RTFP

CITY PUBLIC WORKS DESIGN STANDARDS			
Issue	Summary	Recommendation	Compliance
Green Street	✓ West Linn's public works design standards do not include guidance for locations where *green streets* may be constructed in place of a more conventional street design.	Amendments are proposed to Public Works Design Standards, Division 5 that will establish clear guidance for the construction of approved green street infrastructure. Details for the proposed standard, which is based on Metro's Green Street Design Manual, are in Exhibit B.	RTFP reference

Exhibit A – Regulatory Review Compliance Matrix

Regional Transportation Functional Plan Requirement	Development Code Compliance
Allow complete street designs consistent with regional street design policies **(Title 1, Street System Design Sec 3.08.110A(1))**	Existing code requirements and the updated TSP meet these RTFP requirements in the following ways.
Allow green street designs consistent with federal regulations for stream protection **(Title 1, Street System Design Sec 3.08.110A(2))**	**Citations needed.**
Allow transit-supportive street designs that facilitate existing and planned transit service pursuant 3.08.120B **(Title 1, Street System Design Sec 3.08.110A(3))**	
Allow implementation of: • narrow streets (<28 ft curb to curb); • wide sidewalks (at least five feet of through zone); • landscaped pedestrian buffer strips or paved furnishing zones of at least five feet, that include street trees; • Traffic calming to discourage traffic infiltration and excessive speeds; • short and direct right-of-way routes and shared-use paths to connect residences with commercial services, parks, schools, hospitals, institutions, transit corridors, regional trails and other neighborhood activity centers; • opportunities to extend streets in an incremental fashion, including posted notification on streets to be extended. **(Title 1, Street System Design Sec 3.08.110B)**	Existing and proposed code amendments (TSP Appendix __), and the updated TSP meet these RTFP requirements as follows: CDC 92.010.B – Extension of streets to subdivisions requires street extensions to intersect with the existing grade of adjacent streets. Street widths may be approved as narrow as 24-feet. Amendments are proposed to CDC … Note that these requirements will serve to implement the TSP's Safe Routes to School plan (TSP Chapter __).
Require new residential or mixed-use development (of five or more acres) that proposes or is required to construct or extend street(s) to provide a site plan (consistent with the conceptual new streets map required by Title 1, Sec 3.08.110D) that: • provides full street connections with spacing of no more than 530 feet between connections except where prevented by barriers • Provides a crossing every 800 to 1,200 feet	Existing code requirements meet these RTFP requirements as follows: Review CDC 85 – General Provisions for land divisions… ,

Regional Transportation Functional Plan Requirement	Development Code Compliance
if streets must cross water features protected pursuant to Title 3 UGMFP (unless habitat quality or the length of the crossing prevents a full street connection) • provides bike and pedestrian accessways in lieu of streets with spacing of no more than 330 feet except where prevented by barriers • limits use of cul-de-sacs and other closed-end street systems to situations where barriers prevent full street connections • includes no closed-end street longer than 220 feet or having no more than 25 dwelling units **(Title 1, Street System Design Sec 3.08.110E)**	
Establish city/county standards for local street connectivity, consistent with Title 1, Sec 3.08.110E, that applies to new residential or mixed-use development (of less than five acres) that proposes or is required to construct or extend street(s). **(Title 1, Street System Design Sec 3.08.110F)**	Existing code requirements meet these RTFP requirements as follows: CDC Chapter 92.010.A – Streets within subdivisions, and C – Local and Minor Collector Streets, requires that streets "shall be graded for the full right-of-way width and improved to the City's permanent improvement standards and specifications". Exceptions to this requirement are allowed with a finding that the full improvement cannot be made to protect a drainage way or wetland, or when there are other reasons demonstrated that the Street ROW is not needed. A change is proposed to CH 92.010..A.2 requiring an alternative trail, bikeway or access way when a street connection is not feasible (Exhibit B)
<u>Applicable to both Development Code and TSP</u> To the extent feasible, restrict driveway and street access in the vicinity of interchange ramp terminals, consistent with Oregon Highway Plan Access Management Standards, and accommodate local circulation on the local system. Public street connections, consistent with regional street design and spacing standards, shall be encouraged and shall supersede this access restriction. Multimodal street design features including pedestrian crossings and on-street parking shall be allowed where appropriate. **(Title 1,Street System Design Sec 3.08.110G)**	Existing code and the updated TSP meet these RTFP requirements as follows: Citation needed.
Include Site design standards for new retail, office, multi-family and institutional buildings located near or at major transit stops shown in Figure 2.15 in the RTP:	West Linn does not have any major transit stops shown on RTP Figure 2.10, which replaced RTP Figure 2.15 in the latest update to the RTP.

Regional Transportation Functional Plan Requirement	Development Code Compliance
• Provide reasonably direct pedestrian connections between transit stops and building entrances and between building entrances and streets adjoining transit stops; • Provide safe, direct and logical pedestrian crossings at all transit stops where practicable. At major transit stops, require the following: • Locate buildings within 20 feet of the transit stop, a transit street or an intersection street, or a pedestrian plaza at the stop or a street intersections; • Transit passenger landing pads accessible to disabled persons to transit agency standards; • An easement or dedication for a passenger shelter and an underground utility connection to a major transit stop if requested by the public transit provider; • Lighting to transit agency standards at the major transit stop; • Intersection and mid-block traffic management improvements as needed and practicable to enable marked crossings at major transit stops. **(Title 1, Transit System Design Sec 3.08.120B(2))**	CDC 55.100 APPROVAL STANDARDS – CLASS II DESIGN REVIEW provides guidance for approval of land use applications that require discretionary design review, which includes most development types except single family uses. The TSP proposes a future work program to improve connectivity within and between Town Center areas, including transit, to establish design standards for development within town centers that promote less single occupancy vehicle use, and to reduce the number of land use actions that required discretionary review. CDC 55.100.B.7 – TPR Compliance generally promote connectivity within and from commercial, multi-family, and office developments to transit stops. In particular, (g) requires a main entrance and a direct pathway to transit stops. CDC 55.100.H – Public Transit requires development that abuts existing or planned transit routes to orient the development to transit facilities, provide transit shelters, bus turnouts, hard surface pathways to stops, and other enhancements that promote safe convenient access to transit service. Inclusion of these approval criteria is recommended in non-discretionary review proceedings for all land uses that abut transit corridors and in town center areas. Development and adoption of these criteria will be made part of a TSP implementation planning process. There are no *"Major Transit Stops"* in West Linn.
(<u>Could be in Comprehensive plan or TSP as well</u>) As an alternative to implementing site design standards at major transit stops (section 3.08.120B(2), a city or county may establish pedestrian districts with the following elements: • A connected street and pedestrian network for the district; • An inventory of existing facilities, gaps and deficiencies in the network of pedestrian routes; • Interconnection of pedestrian, transit and bicycle systems; • Parking management strategies; • Access management strategies; • Sidewalk and accessway location and width; • Landscaped or paved pedestrian buffer strip	There are no designated pedestrian districts in West Linn, although they may be appropriate in some Commercial Town Center Areas. A decision to use this approach may emerge from future planning programs in Town Center Areas and transit corridors.

Regional Transportation Functional Plan Requirement	Development Code Compliance
location and width; • Street tree location and spacing; • Pedestrian street crossing and intersection design; • Street lighting and furniture for pedestrians; • A mix of types and densities of land uses that will support a high level of pedestrian activity. **(Title 1, Pedestrian System Design Sec 3.08.130B)**	
Require new development to provide on-site streets and accessways that offer reasonably direct routes for pedestrian travel. **(Title 1, Pedestrian System Design Sec 3.08.130C)**	Review CDC Chapter 85 and 92.
Establish parking ratios, consistent with the following: • No minimum ratios higher than those shown on Table 3.08-3. • Mo maximum ratios higher than those shown on Table 3.08-3 and illustrated in the Parking Maximum Map. If 20-minute peak hour transit service has become available to an area within a one-quarter mile walking distance from bus transit one-half mile walking distance from a high capacity transit station, that area shall be removed from Zone A. Cities and counties should designate Zone A parking ratios in areas with good pedestrian access to commercial or employment areas (within one-third mile walk) from adjacent residential areas. Establish a process for variances from minimum and maximum parking ratios that include criteria for a variance. Require that free surface parking be consistent with the regional parking maximums for Zones A and B in Table 3.08-3. Following an adopted exemption process and criteria, cities and counties may exempt parking structures; fleet parking; vehicle parking for sale, lease, or rent; employee car pool parking; dedicated valet parking; user-paid parking; market rate parking; and other high-efficiency parking management alternatives from maximum parking standards. Reductions associated with redevelopment may be done in phases. Where	Existing code requirements and the updated TSP meet these RTFP requirements in the following ways. CDC Chapter 46 regulates off street parking. CDC 46.090 A – the minimum parking ratios for residential units mirror those in Metro Table 3.08-3. Parking minimums for non-residential uses are at or below the minimum levels in Metro Table 3.08-3. CDC 46.090.F sets parking maximums for non-residential uses at 10% above the minimum, which conforms to the maximum ratios in in Metro Table 3.08-3. include parking maximums for the following uses: high schools, CDC 46.090.G and CDC 55.100.(H)(5) allow for reductions to parking ratios when developments are in proximity to transit stops. An amendment is proposed to allow reductions in Town Centers and along Transit Corridors. and corridors.

Regional Transportation Functional Plan Requirement	Development Code Compliance
mixed-use development is proposed, cities and counties shall provide for blended parking rates. Cities and counties may count adjacent on-street parking spaces, nearby public parking and shared parking toward required parking minimum standards. Use categories or standards other than those in Table 3.08-3 upon demonstration that the effect will be substantially the same as the application of the ratios in the table. Provide for the designation of residential parking districts in local comprehensive plans or implementing ordinances. Require that parking lots more than three acres in size provide street-like features along major driveways, including curbs, sidewalks and street trees or planting strips. Major driveways in new residential and mixed-use areas shall meet the connectivity standards for full street connections in section 3.08.110, and should line up with surrounding streets except where prevented by topography, rail lines, freeways, pre-existing development or leases, easements or covenants that existed prior to May 1, 1995, or the requirements of Titles 3 and 13 of the UGMFP. Require on-street freight loading and unloading areas at appropriate locations in centers. Establish short-term and long-term bicycle parking minimums for: • New multi-family residential developments of four units or more; • New retail, office and institutional developments; • Transit centers, high capacity transit stations, inter-city bus and rail passenger terminals; and • Bicycle facilities at transit stops and park-and-ride lots. **(Title 4, Parking Management Sec 3.08.410)**	

Regional Transportation Functional Plan Requirement	Public Works Design Standards Compliance
Allow implementation of: • narrow streets (<28 ft curb to curb); • wide sidewalks (at least five feet of through zone); • landscaped pedestrian buffer strips or paved furnishing zones of at least five feet, that include street trees; • Traffic calming to discourage traffic infiltration and excessive speeds; • short and direct right-of-way routes and shared-use paths to connect residences with commercial services, parks, schools, hospitals, institutions, transit corridors, regional trails and other neighborhood activity centers; • opportunities to extend streets in an incremental fashion, including posted notification on streets to be extended. **(Title 1, Street System Design Sec 3.08.110B)**	

Exhibit B – Draft Text for Proposed Comp Plan, TSP, and CDC Amendments

West Linn Comprehensive Land Use Plan

Goal 1 – Citizen Involvement:

Policy 7.

c. Neighborhood plans will be treated as advisory documents in land-use planning proceedings until they are formally adopted as an implementing element of the Comprehensive Plan.

Recommended Action Measures

10. The City Council, together with neighborhood leaders, shall formulate a neighborhood plan adoption process for each neighborhood prior to beginning a neighborhood plan. Neighborhood Plans may be adopted by resolution when intended to be an advisory document, or by ordinance when adopted as part of the Comprehensive Plan. Neighborhood Plans may be periodically amended by the City Council directly or in response to ~~the~~ a request of the neighborhood association, or others~~, in accordance with the plan amendment procedures of the City Of West Linn~~.

Goal 2 - Land Use Planning:

Section 1 – Residential Development

Goal 2. Allow mixed residential and commercial uses in ~~existing~~ in Mixed Use Commercial Districts ~~commercial areas only in conjunction with an adopted neighborhood plan designed~~ to ensure compatibility and maintain the residential character of existing neighborhoods.

Section 3 – Mixed Use /Commercial Development

Background and Findings:

West Linn is unique in that it does not have a major commercial district or downtown… The major districts are Willamette, including the area north of I-205 at the 10th Street interchange, Bolton, the Robinwood area adjacent to Highway 43, and Tanner Basin. These areas function like the “Town Centers” that are shown on the Metro 2040 Growth Concept plan; they have transit service, include a mix of commercial and residential land uses, and provide connections to essential services and employment opportunities for the surrounding neighborhoods.

Goals:

6. Provide for multi-modal connections to and interconnections between mixed use/commercial centers via automobiles, transit, bicycles, and pedestrian ~~pathways~~facilities~~, and other means~~.

7. Require standards for mixed-use commercial districts that promote safe access into and within these areas for walking, biking, and transit use from surrounding neighborhoods ~~areas~~ and that create livable areas ~~that fit in~~ compatible with existing neighborhood character.

Policies:

Amend or redact policies 1 – 3 to remove references to neighborhood plans that have not been adopted as elements of the Comp Plan. Consider replacing these policies with one policy that establishes common land use attributes for these areas.

Section 5 – Intergovernmental Coordination

Policies:

6. Adopt amendments to the West Linn Comprehensive Plan, including ancillary elements that are elements of the Plan such as the Transportation System Plan, Public Facility Plan, and neighborhood plans, as well as implementing ordinances consistent with Statewide Land Use Planning requirements.

Update Figure 2-1 Comprehensive Plan to show boundaries for Mixed Use Commercial Districts;

Update Figure 2-2 Metro 2040 Growth Concept to the current version;

.

West Linn Community Development Code (CDC)

CDC 46.090

G. Parking reductions. CDC 55.100(H)(5) explains reductions of up to 10 percent for development sites ~~next to~~ within ¼ miles of a transit ~~stops~~ corridor or within a town center area, and up to 10 percent for commercial development sites adjacent to ~~large~~ multi-family residential sites with the potential to accommodate more than __ dwelling units.

Street/Bike/Ped Connectivity

CDC 92.010.A – Streets in Subdivisions

2. When the decision-making authority makes these findings, the decision-making authority ~~may~~ shall impose any of the following conditions of approval:

   a. A condition that the applicant initiate vacation proceedings for all or part of the right-of-way.

b. A condition that the applicant build a trail, bicycle path, or other appropriate way.

CDC 92.010

C. Local and minor collector streets within the public rights-of-way abutting a subdivision or within a town center area shall be graded for the full right-of-way width and approved to the City's permanent improvement standards and specifications. The City Engineer shall review the need for street improvements and shall specify whether full street or partial street improvements shall be required. Where a street connection is not feasible and the distance from the nearest street connection exceeds 330', the City Engineer shall require the subdivider to build a trail, bicycle path, or other appropriate way.

Transportation Demand Management:

CDC 55.100.7:
k. Major developments and conditional use applications in designated town center and industrial areas must include a transportation demand management (TDM) elements into the development program. Table A outlines requirements and appropriate TDM measures for various types of development. Larger scale developments that generate more auto-trips are required to implement more significant TDM measures. The measures are organized into three categories based on their level of impact. Development that falls below the threshold for Category 1 are encouraged but not required to address TDM measures..

1. Low– development that is expected to generate from __ to __ new auto trips.
2. Moderate - development that is expected to generate from __ to __ new auto trips.
3. High – development that is expected to generate more than__ new auto trips.

Category 1 developments are required to implement __ strategies from this part of the table. Category 2 developments must choose __ strategies from Category 1 and __ strategies from Category 2. Category 3 developments must meet the requirements for Categories 1 and 2 and also implement __ strategies from Category 3.

Table A: Transportation Demand Management Strategies for Employers[2]

Strategy	Description	Potential Trip Reduction[a]
Category 1 Strategies		
Walking Program	Provide support services for those who walk to work. This could include buying walking shoes or providing lockers and showers.	0-3%
Bicycle Program[b]	Provide support services to those employees that bicycle to work. Examples include: safe/secure bicycle storage, shower facilities, and subsidy of commute bicycle purchase.	0-10% *Percentage of employees living within 6 mi. of work site*

[2] *Guidance for Estimating Trip Reductions from Commute Options*, Oregon Department of Environmental Quality (DEQ), August 1996, and *Employee Commute Options (ECO) Sample Trip Reduction Plan*, Oregon DEQ, October 2006.

Strategy	Description	Potential Trip Reduction[a]
Telecommuting	Allow employees to perform regular work duties at home or at a work center closer to home, rather than commuting from home to work. This can be full time or on selected workdays. This can require computer equipment to be most effective.	82-91% (Full Time) 14-36% (1-2 day/wk) *Per employee participating*
Alternative Mode Subsidy[b]	Provide a monetary bonus to employees that commute to work by modes other than driving alone.	**<u>High Transit Service:</u>** 21-34% (full subsidy) 10-17% (half subsidy) **<u>Medium Transit Service:</u>** 5-7% (full subsidy) 2-4% (half subsidy) **<u>Low Transit Service:</u>** 1-2% (full subsidy) 0.5-1% (half subsidy)21-34%
Category 2 Strategies		
Transit Pass Subsidyb	Pay a portion of the cost of a monthly transit pass for employees that commute to work by bus or other public transportation methods. (The potential trip reduction is lower than the alternative mode subsidy because it does not incentivize bicycle, pedestrian, and vanpool/carpool modes.)	**<u>High Transit Service:</u>** **<u>19-32% (full subsidy)</u>** **<u>10-16% (half subsidy)</u>** **<u>Medium Transit Service:</u>** **<u>4-6% (full subsidy)</u>** **<u>2-3% (half subsidy)</u>** **<u>Low Transit Service:</u>** **<u>0.5-1% (full subsidy)</u>** **<u>0-0.5% (half subsidy)</u>**
Compressed Work Week	Allow employees to work their regularly scheduled number of hours in fewer days per week.	**<u>Most Typical:</u>** **<u>16-18% (4 day/40 hr)</u>** **<u>Other Options:</u>** **<u>7-9% (9 day/80 hr)</u>** **<u>32-36% (3 day/36 hr)</u>** **<u>Per employee participating</u>**

(Continued) Table A: Transportation Demand Management Strategies for Employers

Strategy	Description	Potential Trip Reduction
Category 2 Strategies	(continued)	
Preferential Parking for Carpools	Provide preferred parking stalls to employees using carpools and vanpools.	[c]
Time off with Pay for Alternative Mode Use	Offer employees time off with pay as an incentive to use alternative modes.	1-2%
Gift/Awards for Alternative Mode Use	Offer employees the opportunity to receive a gift or an award for using modes other than driving alone.	0-3%
Category 3 Strategies		
Car-Sharing	Pay for car-sharing memberships (such as Zipcar) for business-related travel during the day	[c] *Dependent upon presence of nearby cars*
On-Site Services	Provide services at the work site that are frequently used by employees (and that employees would typically need to drive to use). Examples include cafes/restaurants, dry cleaners, day care centers, and bank machines.	1-2%
Provide Vanpools[b]	Organize employees that live near each other into a vanpool for their trips to and from work. The employer may subsidize the van's operation and maintenance costs. Existing programs in the area that could be utilized include Valley VanPool (for Salem destinations) and Metro VanPool (for Portland destinations)	30-40% (Fully-subsidize van) 15-25% (Run vanpool but charge fee) *Percentage of employees living more than 20 mi. away from work site*
On-Site Rideshare Matching for HOVs	Match employees who can reasonably carpool or vanpool together based on information that employees provide regarding their work hours, availability of a vehicle, and place of residence.	6-8% (with support strategies) 1-2% (without support strategies)
Company Cars for Business Travel	Provide company cars for business-related travel during the day	0-1%
Guaranteed Ride Home Program	Maintain a company owned or leased vehicle that is available in the case of an emergency for employees that arrived to work using transit or bicycle.	1-3% *When used in combination with other measures*

[a] Reduction applicable to total number of employees, unless otherwise noted.
[b] Tax benefits may be available to employers who provide their employees with certain transportation benefits (see www.irs.gov/pub/irs-pdf/p15b.pdf).
[c] Strategy not identified in Employee Commute Options (ECO) table, so potential trip reduction is unknown.