From: Balm Shells
To: CityRecorder
Subject: West Salem Zoning
Date: Sunday, April 10, 2022 8:00:26 PM

I am writing as a 35 year plus resident of west salem. We do not need another apartment complex, the roads on Wallace are already bottlenecked to the max, and also that farmland is some of the most priceless land for farming given the density of the nutrients, it may be more profitable to keep and maintain it as farmland- even encouraging local stewards- since the nutritional value of the soil is decreasing globally, the northwest holds some of the richest soil in the world. Building an apartment complex on top of that is not healthy for the future of crops, nor the encouragement of further traffic, nor for our local, regional and national level of communities which are already tight with resources and population growth.... I urge you to reconsider and maintain current zoning- especially as several complexes of apartments in west salem are still unfilled, as well as many houses for sale... We have enough space in our community that is going underutilized and further growth is going to damage already the tightness we feel and the underutilized aspects that are present currently....

Thanks for recording this testimony.

From: Jamie Donaldson
To: Amy Johnson
Subject: FW: Council Staff Report - Case No. CPC-ZC21-06 for 2100 Block of Doaks Ferry Rd NW
Date: Monday, April 11, 2022 12:03:48 PM
Attachments: Testimony for Agenda Item No 4.c - 2100 Doaks Ferry Rd NW call up.pdf

Hi Amy,

Testimony submitted for tonight's meeting for the subject case.

Thank you,

Jamie Donaldson
Planner II
City of Salem | Community Development Department
555 Liberty St SE, Suite 305, Salem OR 97301
JDonaldson@cityofsalem.net | 503-540-2328
FaceBook | Twitter | YouTube | CityofSalem.net

From: Christie Dalke <cldalke@gmail.com>
Sent: Monday, April 11, 2022 11:59 AM
To: Shelby Guizar <SGuizar@cityofsalem.net>; Jamie Donaldson <JDonaldson@cityofsalem.net>
Subject: Re: Council Staff Report - Case No. CPC-ZC21-06 for 2100 Block of Doaks Ferry Rd NW

Hello,

I would like to submit the attached written testimony for this evening's city council meeting regarding agenda item number 4.c; 2100 Doaks Ferry NW.

Thank you,

Christie Dalke

On Mon, Apr 4, 2022 at 12:01 PM Shelby Guizar <SGuizar@cityofsalem.net> wrote:

> Hello,
>
> The Council Staff Report for Comprehensive Plan Map Amendment and Zone Change Case No. Case No. CPC-ZC21-06 for 2100 Block of Doaks Ferry Rd NW is attached for your information. This case will be heard digitally before the City Council on Monday, April 11, 2022.
>
> *Application Summary:* City Council Review of the Salem Planning Commission decision to approve the proposal to change the Comprehensive Plan Map Amendment from DR (Developing Residential) to MF (Multiple Family Residential) and a Quasi-Judicial Zone Change from RA (Residential Agriculture) and a portion of NCMU (Neighborhood Center Mixed Use) to RM-II

(Multiple Family Residential).

Please direct questions or comments to the **CASE MANAGER**:

Jamie Donaldson
JDonaldson@cityofsalem.net
503-540-2328

Thank you,

Shelby Guizar
Administrative Analyst
City of Salem | Community Development Department
555 Liberty St SE, Suite 305, Salem, OR 97301
sguizar@cityofsalem.net | 503-540-2315
Facebook | Twitter | LinkedIn | YouTube| CityofSalem.net

From: Robert & Christie Dalke, 2090 Landaggard Drive NW, Salem, OR 97304

To: City Council, City of Salem

RE: Testimony for Agenda item No. 4.c- Minor Comprehensive Plan Change and Zone Change Case No. CPC-ZC21-06 for 2100 Block of Doaks Ferry Rd NW

April 11, 2022

To whom it may concern,

My name is Christie Dalke, my husband, Robert, and I own the property at 2090 Landaggard Drive. I am writing this letter to express our strong opposition to the plans to re-zone land and development in our area. HSF/Bonaventure is looking to have the 23-32 acres on the west side of Doaks Ferry rezoned from Residential to Multi-Use and has tentative plans to build an apartment complex in this area should the rezoning be approved. Our property is in the middle of the re-zone proposal and would become an island within the apartment complex. Aside from our personal concerns that new multistory development will have on our privacy, solar access, and general livability conditions for ourselves and current adjacent neighbors, we feel that maintaining livability in nearby residential areas is critically important and this reclassification should be considered carefully. Most importantly, I find fault with the February 8th CPC-ZC21-06 staff report submitted to members of the Planning Commission.

The report fails to follow the land use process and does not directly address concerns posed by the community Members and ignores zone change legal requirements and affirms inaccurate numerical declarations regarding congestion and impacts on traffic and wetlands in the area. Additionally, the staff report included factually inaccurate statements, and offered past decisions and/or past practices on behalf of an applicant. This suggests that rather than advocating for following the land use process, the staff is advocating for the applicant.

In February 8, 2022, the supplemental staff report there are inaccurate numerical claims, unanswered challenges and it blatantly ignores the legal obligations contained in the Planning Department staff report. One example is the Quasi-judicial Zone Change Criterion SRC 265.005(e)(1)(E):

Staff Response: In 2014, the City conducted the Housing Needs Analysis (HNA) along with the Salem Economic Opportunities Analysis (EOA). The purpose of the HNA was to develop strategies to provide enough land to meet Salem's housing needs through 2035 and to inform policy decisions related to residential land, while the purpose of the EOA was to ensure there is enough land in the Salem area to accommodate expected employment growth. Both the HNA and EOA counted the various land designations in Salem for purposes of the respective studies. For the subject property, these studies counted the NCMU portion for 10 acres out of the 14 total as residential land, as opposed to industrial, commercial, or employment use land. As more than 70 percent of the subject portion of the property was considered residential, this criterion is met." Page 5 Supplemental Staff Report for CPC-ZC21-06

While the described Housing Needs Analysis is accurate, the actual area within the NCMU zone eligible for housing is 9.128 acres and the physical placement of those residential acres is unknown until a formal Neighborhood Center Plan which designates the 5-acre Core-area has been adopted.

The above findings fail to address SRC 532.015. Absent a Neighborhood Center Plan no NCMU zoned land is a designated non-core area. Without the designation of the core 5-acre industrial, commercial or employment use area in the NCMU zone and without a legal mete and bounds designation of the NCMU northern boundary there is no legal basis for declaring specific portions of the Tax Lot 400 as the 9.128-acres eligible for future residential or even potential multi-family zone designation.

Therefore, the staff claim "more than 70 percent of the subject portion of the property was considered residential" is a flawed conclusion because no non-core area has been designated and because 9.128-acres is 65% of 14.128-acres.
Without an adopted Neighborhood Center Plan there are no non-core areas within the NCMU zone. All 15-acres remain potential 5-acre industrial, commercial or employment use areas.

As mentioned, this is one example.We do not feel the findings of the staff report are supported. The conditions do not adequately protect from the unreasonable detriment the density of RM-II zoning would bring to this already congested area and it should be considered carefully.

As indicated by the staff report, the surrounding properties are zoned Residential Agriculture in every direction. Even with conditions, why is RM-II, rather than RM-I being recommended? If keeping the RA status is not being considered, wouldn't RM-I, and the less density it would bring be most appropriate to align to the characteristics of the existing neighborhood? An RM-I classification, with conditions, would be a compromise between the city and the existing neighborhood, limiting the dwellings to 14 per acre, rather than 28 for an RM-II classification.

Even with the proposed condition of limiting development to a maximum of 500 units, it would make a complex of such size one of the largest in Salem. Given that there was a 300-unit apartment complex recently completed, and several areas in West Salem that have been marked for an RM-II classification, less than a mile away, an RM-II classification for this area will only exacerbate an already extremely dense area, causing more congestion by schools and on roadways, forever altering the landscape of West Salem. Another apartment complex is not guaranteed to create more affordability, especially for neighbors that dream of owning their own home.

However, with deliberate and intentional planning on the part of the developer, this area could not only help the city meet the goal for affordable housing but also serve the community by providing a path to homeownership with townhomes, cottage clusters, and expanded housing choices, of which there are few options, rather than apartments, of which West Salem already has many to choose from, providing a project that the community can be proud of in terms of design, function, and fit with the community's character and current infrastructure limitations.

We ask that the city council reject the misinformation offered and deny the proposed zone and comp plan changes in their current form, keeping the feedback of current residents in mind. Please do not allow this area to be re-zoned, forever altering the character of this area and having a negative impact on our community. Rather, partner with the current residents to find a resolution that meets everyone's needs in developing this area.

Thank you for your time, and consideration.

Robert and Christie Dalke

From: Cody Kuenzi
To: CityRecorder
Subject: Case #CPC-ZC21-06
Date: Sunday, April 10, 2022 4:42:02 PM

I am writing in extreme opposition to this proposal. West Salem used to be a good place to live. Now people apologize to me when I tell them I live here!

The Salem City Council has ignored what West Salem citizens have been saying for years now. The traffic is unbearable and they just continue to allow the building of these ridiculous complexes, with no thought whatsoever of the flow of traffic. It’s become unsafe and unbearable. You need to listen to those who live here and stop this craziness.

Sent from my iPhone

From: E Easterly
To: CityRecorder
Subject: Testimony for Agenda Item No 4.c - 2100 Doaks Ferry Rd NW call up
Date: Monday, April 11, 2022 9:35:41 AM
Attachments: 2100 DF staff feb 8 challenge.pdf
April 11 written testimony.pdf
Fwd Salem City Council Appeal Hearing Case No. CPC-ZC21-06.zip

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Please include the four attached PDF documents to the above cited April 11th Hearing Record.

Please acknowledge receipt of this email.

Respectfully,

E.M. Easterly
503-363-6221

To: Salem City Council
From: E.M. Easterly E.M. Easterly

Re: Hearing Agenda # 4.c
Date: April 11, 2022

Below is an email submitted to staff that was not seen by Salem Planning Commission members.

CPC-ZC21-06 February 8 staff report

E Easterly<emeasterly@comcast.net>
2/14/2022 2:57 PM
To JDonaldson@cityofsalem.net

Dear Ms. Donaldson,

I take umbrage with the February 8th CPC-ZC21-06 staff report submitted to members of the Planning Commission.

The report fails to directly answer questions posed by myself and other community members; contains obvious efforts to obfuscate zone change legal requirements and affirms inaccurate numerical declarations.

I am fully aware that you and other Planning Department staff are obliged to facilitate the implementation of land development requests. However, you are also required to affirm that the applicant meets all land use legal requirements. That process requires staff to be more than an advocate for applicants.

Making factually inaccurate statements, offering past decisions and/or past practices on behalf of an applicant are not a staff responsibility. Offering staff opinions before the applicant provides their final rebuttal materials suggests staff believes its opinions will bolster applicant evidence and provide a level of credibility that outweighs other information sources. That Planning Commission members **see** both accurate and unchallenged **false** staff statements before a final decision is adopted is deleterious to the Salem land use approval process.

Since procedures do not permit me to rebut the dubious staff report declarations submitted to the Planning Commission, I am providing a specific example of applicant submitted inaccurate information that staff affirmed in the February 8, 2022 supplemental staff report portions of which are quoted and addressed on the next page.

There are other inaccurate numerical claims, unanswered challenges and obvious efforts to obfuscate the legal obligations contained in the Planning Department staff report dated February 8, 2022. Unfortunately, there is no procedural mechanism that permits me to raise those issues before the Planning Commission.

E.M. Easterly

February 15, 2022 Supplemental Staff Report Discrepancies

> **"4. Site Acreage**
> **Staff Response:** … a survey was conducted for the property which indicates the size of the property to be 36.86 acres. In addition, the survey showed that the adjacent square property to the south along Orchard Heights Rd NW (Tax Lot 900) is actually .987 acres as opposed to the .872 referenced in the Polk County Assessor's Records." Pages 4-5
>
> Supplemental Staff Report for CPC-ZC21-06
> February 15, 2022

The measurements cited above are incorrect. The survey submitted by the applicant does not conform to the legal descriptions of either Tax Lot 400 or Tax Lot 900. In blunt terms, staff has supported the applicant's false survey representation of Polk County Tax Lot 900 in direct contradiction to the applicant submitted Polk County legal description of Tax Lot 900.

> "**5. Quasi-judicial Zone Change Criterion SRC 265.005(e)(1)(E):**
> **Staff Response:** In 2014, the City conducted the Housing Needs Analysis (HNA) along with the Salem Economic Opportunities Analysis (EOA). The purpose of the HNA was to develop strategies to provide enough land to meet Salem's housing needs through 2035 and to inform policy decisions related to residential land, while the purpose of the EOA was to ensure there is enough land in the Salem area to accommodate expected employment growth. Both the HNA and EOA counted the various land designations in Salem for purposes of the respective studies. For the subject property, these studies counted the NCMU portion for 10 acres out of the 14 total as residential land, as opposed to industrial, commercial, or employment use land. As more than 70 percent of the subject portion of the property was considered residential, this criterion is met." Page 5
>
> Supplemental Staff Report for CPC-ZC21-06
> February 15, 2022

The described Housing Needs Analysis is accurate. The actual area within the NCMU zone eligible for housing is 9.128 acres and the physical placement of those residential acres is unknown until a formal *Neighborhood Center Plan* which designates the 5-acre Core-area has been adopted. This challenge was made in my January 26th Topic 2 and 3 written testimonies.

The above findings fail to address SRC 532.015. Absent a *Neighborhood Center Plan* no NCMU zoned land is a designated non-core area. Without the designation of the core 5-acre industrial, commercial or employment use area in the NCMU zone and without a legal mete and bounds designation of the NCMU northern boundary there is no legal basis for declaring specific portions of the Tax Lot 400 as the 9.128-acres eligible for future residential or even potential multi-family zone designation.

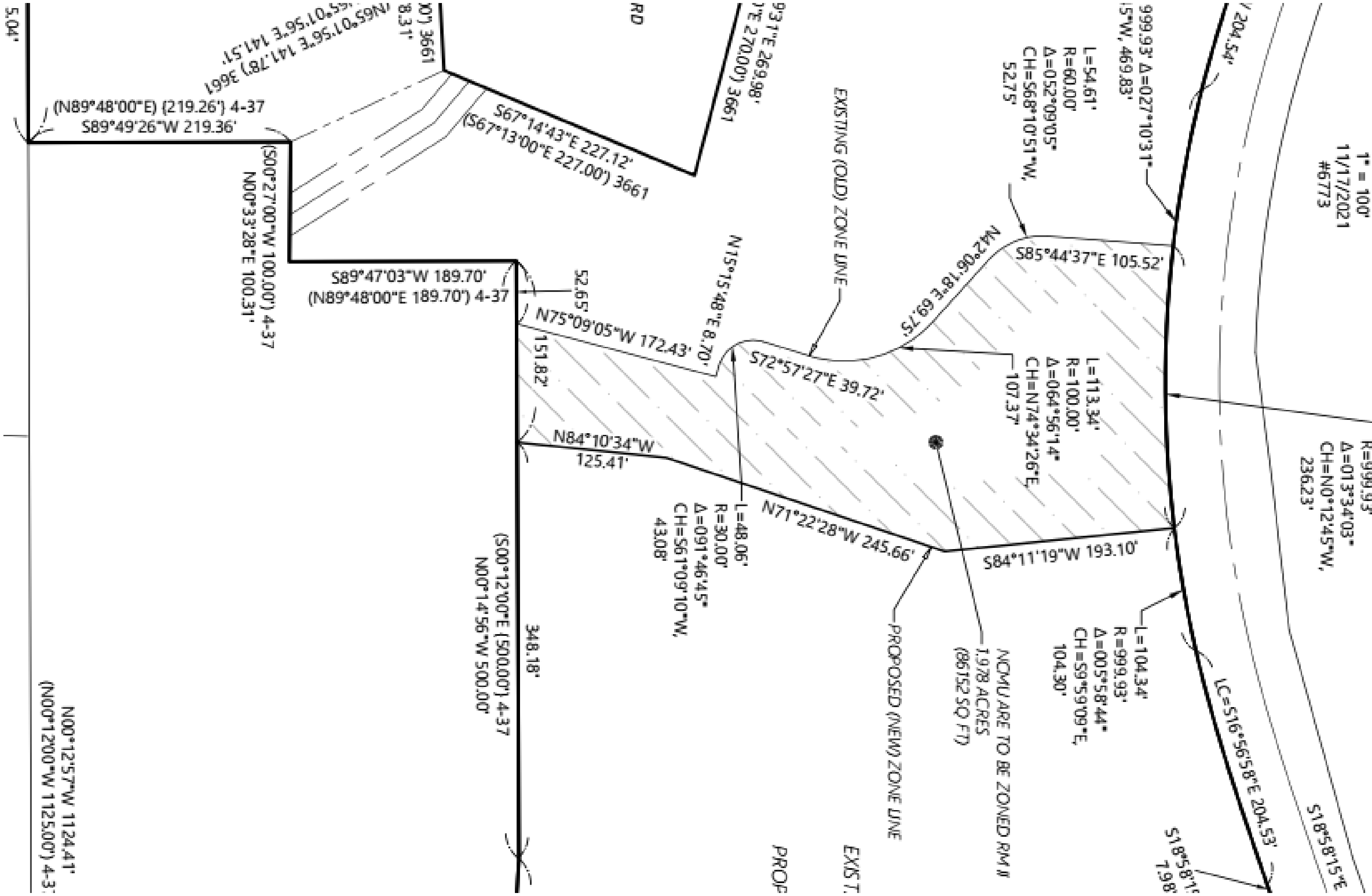
Thus, the staff claim “more than 70 percent of the subject portion of the property was considered residential” is a flawed conclusion because no non-core area has been designated and because 9.128-acres is 65% of 14.128-acres.

Without an adopted Neighborhood Center Plan there are no non-core areas within the NCMU zone. All 15-acres remain potential 5-acre industrial, commercial or employment use areas.

I ask the Council to reject the misinformation offered and deny the proposed zone and comp plan changes in their current form.

To: Salem City Council From: E.M. Easterly Re: Item 4.c 2100 Doaks Ferry Hearing Date: April 11, 2022

Applicant submitted survey segment



The above graphic segment from page 10 of the April 11, 2022 staff report and from page 37 of the January 25, 2022 Planning Commission staff report offers a metes and bounds survey of the designated line between the RA and NCMU zones that is of unclear origin.

When was this survey executed and what is the legal description upon which this survey is based?

I raise these questions because the original Council 2012 adopted creation of the dual zoned Titan Hill property only included a graphic showing a 15-acre area that includes Tax Lot 900 and a portion of Tax Lot 400. That graphic representation found Comments submitted prior to April 11, 2022 page 4 and the 2012 Council approval package at page 12 of the same report does not appear to be accurately reflected in the survey graphic submitted by applicant. Comparison of the two graphics are offered on the next page.

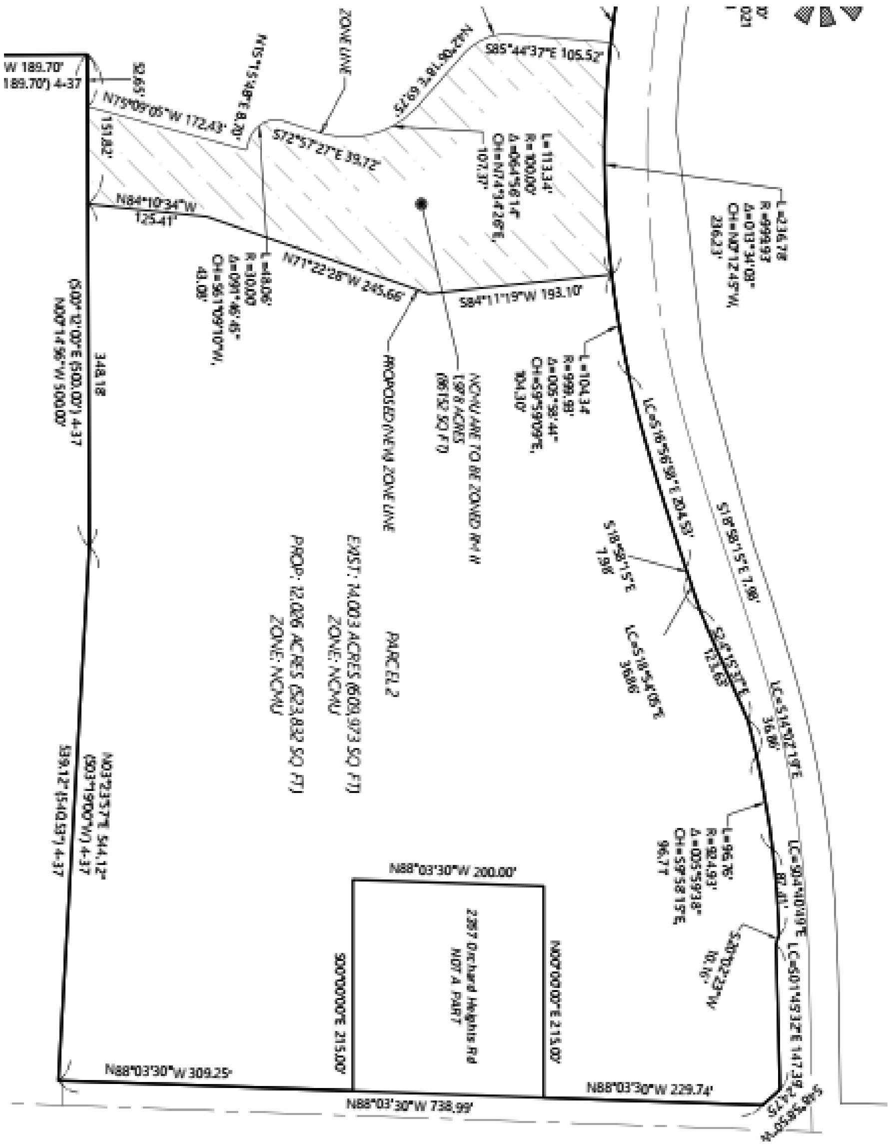
In as much as the submitted survey includes a false rendition of the Tax Lot 400, [See my March 28th testimony at pages 2 and 3 at Comments submitted prior to April 11, 2022] I further challenge the accuracy of the submitted survey and ask that the proposed comp plan and zone changes be denied for failing to provide accurate information in support of the proposed changes.

Respectfully,

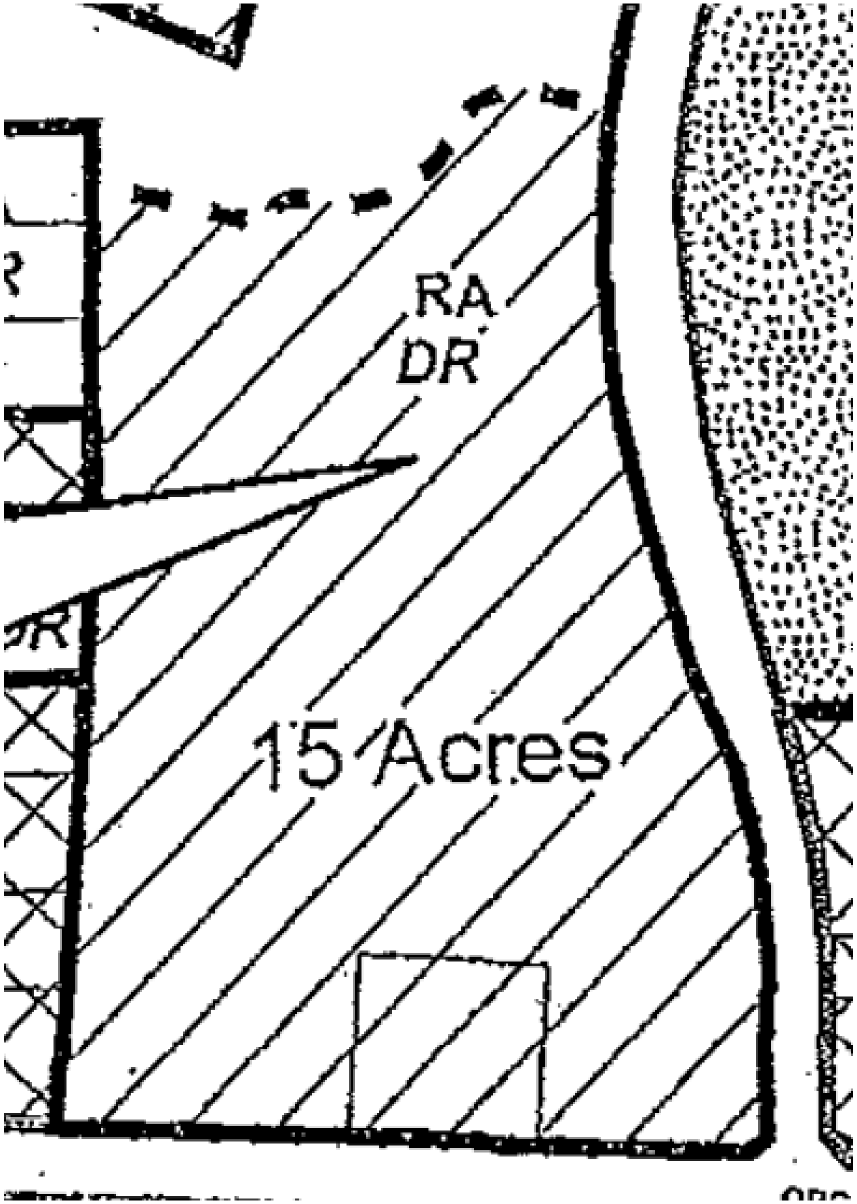
E.M. Easterly

E.M. Easterly

Applicant 2022 graphic

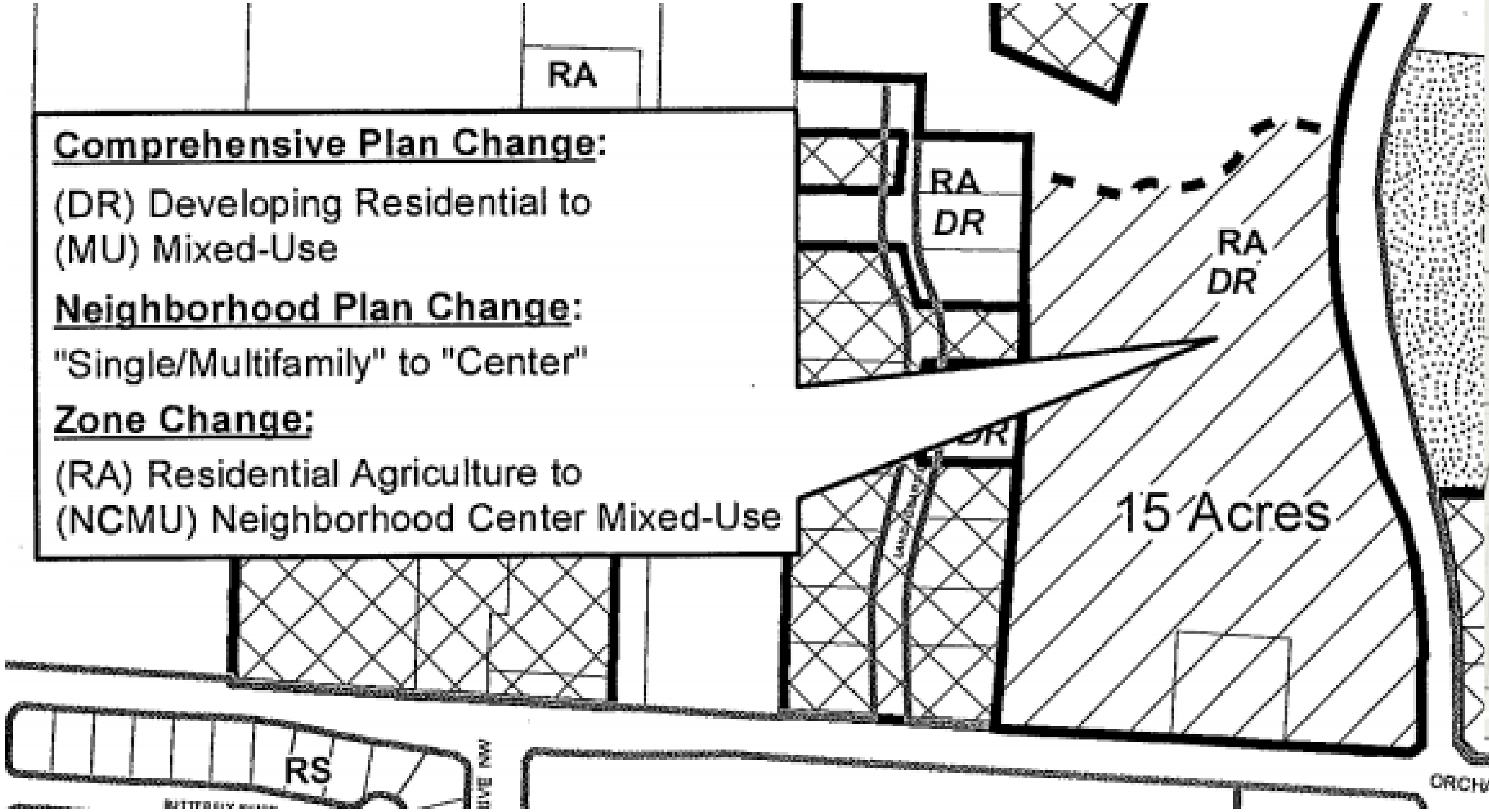


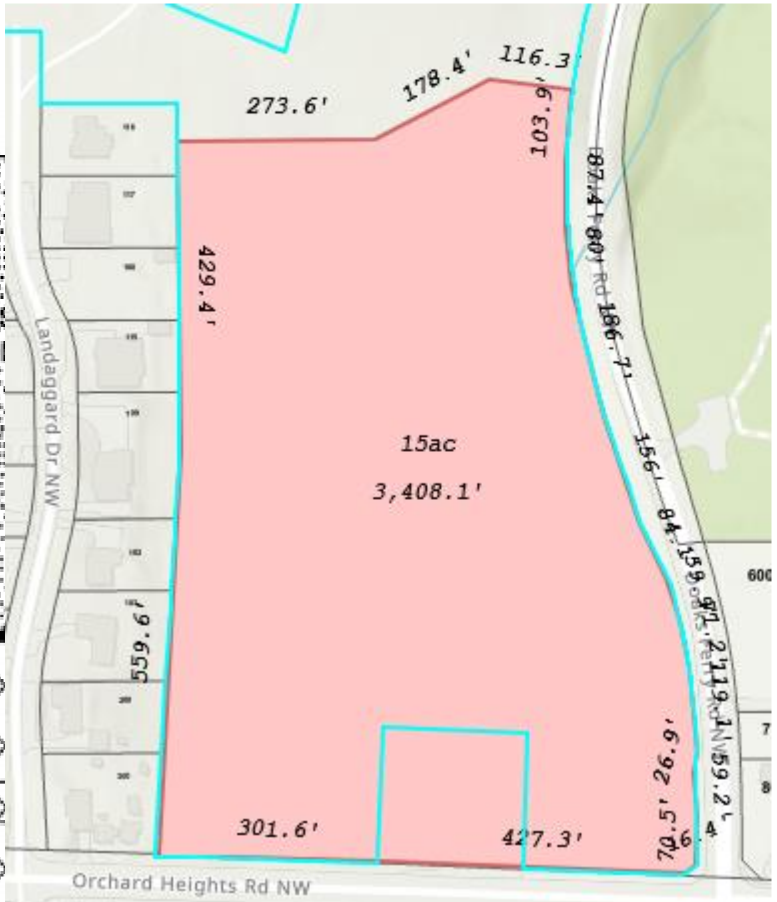
Council Approved 2012 graphic



Testimony challenging the approval of CI-CPC-NPC-ZC11 by E.M. Easterly

The graphic below was extracted from the original 2012 Case No. CI-CPC-NPC-ZC11-12 adopted by the Salem City Council. The adopting document zoned 15-acres extended northward from Orchard Heights Road NW as NCMU. There was or is no legal description defining the boundary between the RA and NCMU zones beyond the 15-acre declaration and the graphic representation below. The 15-acre measurement to the right from the Polk County ESRI site is a reasonable representation of the NCMU area. However, modifications or reduction in the NCMU area only makes sense if and when a Neighborhood Master Plan different from the plan outlined in the adopted findings is proposed and adopted. Without such a plan there is no logical basis to determine the defined core area or even the 50 single-family town houses included in the original proposal. Therefore, no legal basis has been established to extract an area from the NCMU zone and convert it to a multi-family zone.



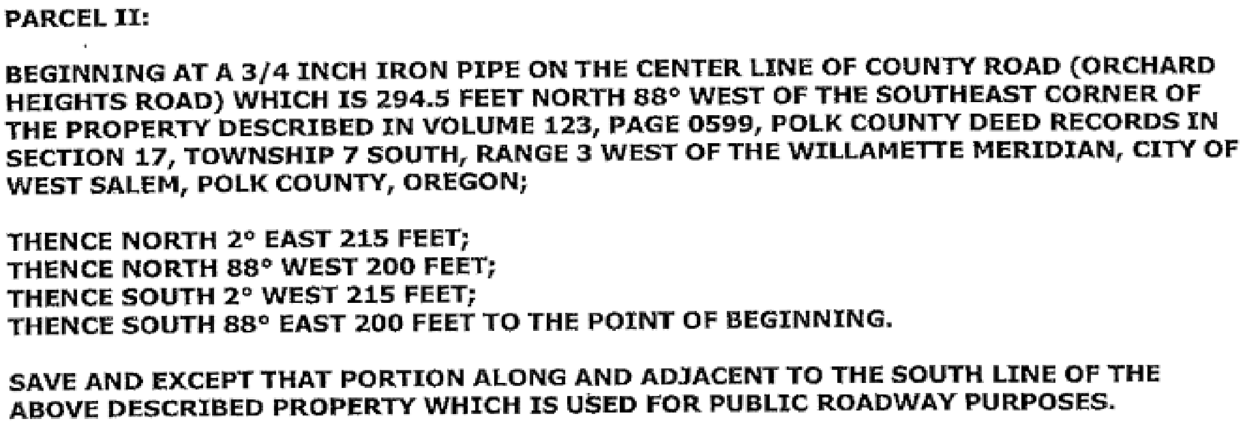


To: Salem City Council
From: E.M. Easterly
Date: March 28, 2021
Re: Appeal of Case No. CPC - ZC21 - 06 Hearing

The legal description offered by the applicant to the right is not equivalent to the survey graphic below it. The required land use burden of proof has not been met by the applicant.

Therefore, I recommend that the proposed rezone request be termination and that the applicant be invited to resubmit a new and more accurate application. eme

Tax Lot 7.3.17.000900

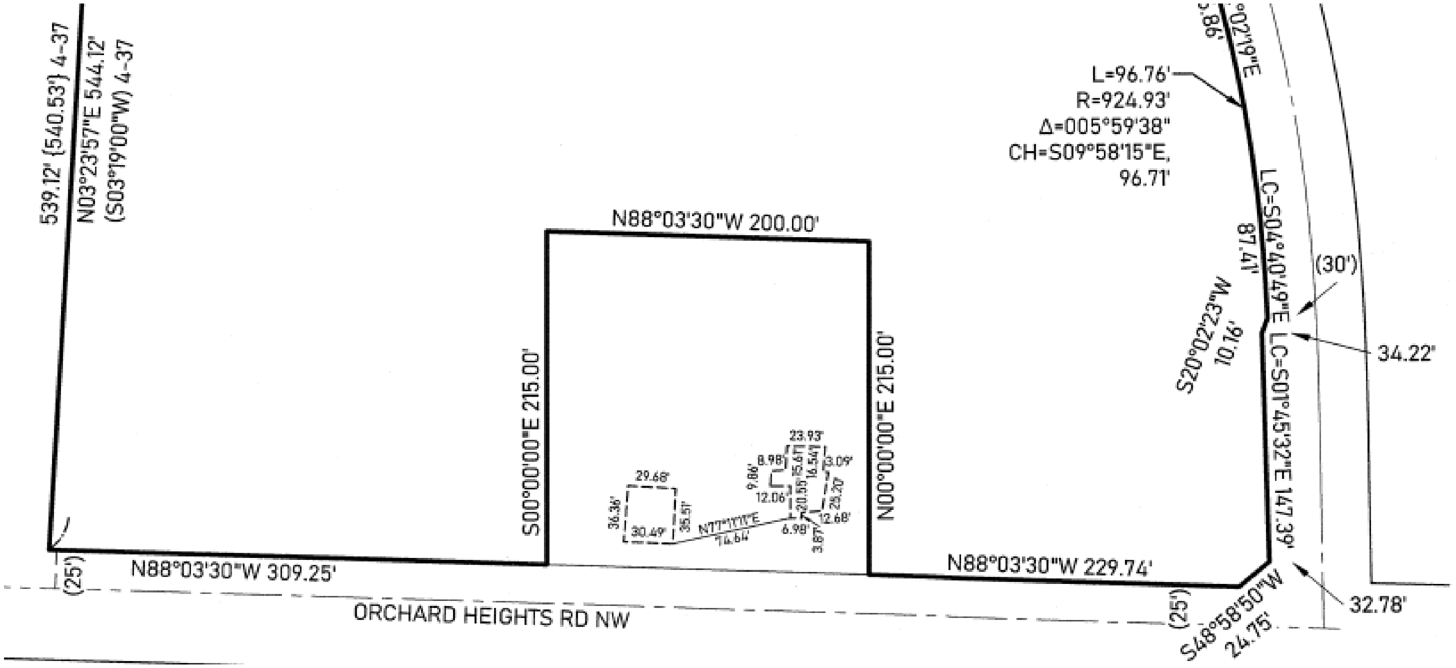


PARCEL II:

BEGINNING AT A 3/4 INCH IRON PIPE ON THE CENTER LINE OF COUNTY ROAD (ORCHARD HEIGHTS ROAD) WHICH IS 294.5 FEET NORTH 88° WEST OF THE SOUTHEAST CORNER OF THE PROPERTY DESCRIBED IN VOLUME 123, PAGE 0599, POLK COUNTY DEED RECORDS IN SECTION 17, TOWNSHIP 7 SOUTH, RANGE 3 WEST OF THE WILLAMETTE MERIDIAN, CITY OF WEST SALEM, POLK COUNTY, OREGON;

THENCE NORTH 2° EAST 215 FEET;
THENCE NORTH 88° WEST 200 FEET;
THENCE SOUTH 2° WEST 215 FEET;
THENCE SOUTH 88° EAST 200 FEET TO THE POINT OF BEGINNING.

SAVE AND EXCEPT THAT PORTION ALONG AND ADJACENT TO THE SOUTH LINE OF THE ABOVE DESCRIBED PROPERTY WHICH IS USED FOR PUBLIC ROADWAY PURPOSES.



The survey segment reproduced on the prior page was submitted in conjunction with CASE NO.: VUL21-04 and by extension to CPC-ZC21-06 does not reflect the legally adopted metes and bounds of either TL 400 or TL 900.

The surveyors did not accurately follow the original Polk County Vol 123 Page 599 deed angles as reduced in 1959 by the public acquisition of a portion of the original approximate one-acre site described in Volume 171 Page 62.

The original Tax Lot 900 approximate acre is a parallelogram with sides of 215 and 200 feet measured from the center line of Orchard Heights Road. The actual area of the current TL 900 is shown below as 0.872 acres.

Thus, all calculations offered by the applicant regarding modification of the NCMU zone are inaccurate and must be resubmitted.

		ft	ft	sq.ft	part of acre	
	Original metes & bounds	200	215	43,000	0.987	
			Acre =	43,560		
	Public R-O-W adjustment	200	190	38,000	0.872	

43,000 square feet.

The pink rectangle overlaying the 2021 Multi-Tec survey and its inaccurate angles reproduced on the prior page reflects the original metes and bounds of TL 900.

As shown in the chart above TL 900 was reduced from 43,000 sq. ft. to 38,000 sq. ft. Therefore, the staff report submitted to the Planning Commission on February 8th is inaccurate as is the graphic submitted to the Salem City Council.


N 01:56:30 E 215 Feet
N 88:3:30 W 200 Feet
S 01:56:30 W 215 Feet
S 88:3:30 E 200 Feet

From: noreply@cityofsalem.net on behalf of Lespaul4me@comcast.net
To: CityRecorder
Subject: City meeting public comment
Date: Sunday, April 10, 2022 9:47:50 PM
Attachments: ATT00001.bin

Your Name	Larry Cornelius
Your Email	Lespaul4me@comcast.net
Your Phone	5419813815
Street	2276 Teakwood Ave NW
City	Salem
State	OR
Zip	97304
Message	I am writing to voice EXTREME OPPOSITION to the proposed Zoning Change for another massive apartment complex to be built in West Salem, in the area across from Straub Nature Park on Doaks Ferry Road, and across Orchard Heights from WSHS. You want to call it "affordable housing" and I call that a LIE. This proposal seems like pure greed for some land developer to make millions, and for the city of Salem to just increase Tax Revenues instead of maintaining QUALITY OF LIFE in West Salem for it's residents and visitors. This specific area is rife with natural habitat and wildlife that are already endangered by the traffic on our busy roads. Students and other residents who like to walk to school or for exercise are ALREADY taking a risk walking up/down DFR where cars and trucks speed CONSTANTLY. There is ZERO enforcement of traffic laws, and seeing a police vehicle even patrolling our streets is rare. Traffic congestion in West Salem is at a terrible level already, and you all know it. There are other words for what results....STRESS, ANGER, ROAD RAGE, DISGUST etc. The Center Street / Marion Street Bridges are ridiculously congested during commute hours. A small accident closes down a lane and traffic backs up for miles. I've gotten stuck on HWY 22 as far away as the turn-off to Independence when accidents have occurred on the bridges. And residents have complained loudly about it yet the CITY COUNCIL continues to push GROWTH and TAX REVENUS. We don't want population expansion and more dense areas of apartment housing that is only going to worsen this problem! West Salem was a highly desirable location to purchase a new home, raise a family etc. but that has changed thanks to the deaf ears of our City Leaders who don't know when enough is enough. START LISTENING, DRIVE ACROSS THE BRIDGES DURING RUSH HOURS, EXPERIENCE THE TRAFFIC JAMS ON WALLACE ROAD DAILY, OBSERVE THE SPEEDING THAT GOES ON EVERYWHERE, AND STOP SHOVING UNWANTED EXPANSION OF POPULATION INTO WEST SALEM! ENOUGH ALREADY!

This email was generated by the dynamic web forms contact us form on 4/10/2022.

From: m.vorderstrasse
To: CityRecorder
Cc: m.vorderstrasse
Subject: The Hearing Notice for Comprehensive Plan Map Amendment and Zone Change Case No. Case No. CPC-ZC21-06 for 2100 Block of Doaks Ferry Rd NW
Date: Sunday, April 10, 2022 8:44:10 PM

I am very disturbed to hear that the 2100 block of Doaks Ferry road is being considered for a zone change to allow multiple housing potentially allowing for 500 unit.
I have lived here for 42 yrs and have watched and made comments about thw City of Salem jamming more.and more density here while not improving the transit corridors over the rivers for at least 20 yrs if not more.
What are the city planners thinking?
A plan to maximize the owners profits and the citys tax base cannot seriously be considered with the traffic system in West Salem being already overloaded more than 50% of the time.
It will bad enough to have the land covered with new s.f. homes on that land.
A better solution for high density housing is build it where there are several avenues for entrance and exit to the citys core, with out that solution there should be no more high density housing built in West Salem.
Sincerely,
Mike Vorderstrasse
long Time West Salem Resident

Sent from my Galaxy

Traffic Impact Analysis

Riverbend Phase 2

Comprehensive Plan Amendment /Zone Change

2499 Wallace Road NW
Salem, Oregon

REGISTERED PROFESSIONAL ENGINEER
61474PE
OREGON
JULY 13, 2004
RICHARD M. NYS
EXPIRATION DATE: DEC. 31 2018

December 23, 2018

GREENLIGHT ENGINEERING
TRAFFIC ENGINEERING/TRANSPORTATION PLANNING

13554 Rogers Road ● Lake Oswego, OR 97035
Phone: 503.317.4559 ● Web: www.greenlightengineering.com

Table of Contents

EXECUTIVE SUMMARY

SM Construction has proposed a comprehensive plan amendment and zone change in support of a project in Salem, Oregon that will consist of a neighborhood shopping center of up to 14,500 square feet and 112 apartment units. This project will hereafter be referred to as "Riverbend Phase 2." Riverbend Phase 2 follows a zone change/comprehensive plan amendment approved for property to the south known as "Riverbend Phase 1" that is currently under construction with a mixed-use development.

This report addresses the Transportation Planning Rule as required in a comprehensive plan amendment and zone change application. A traffic analysis evaluating the City's site plan review requirements is forthcoming. The project is located to the north and west of the intersection of Wallace Road NW (OR 221)/Riverbend Road NW and directly north of Riverbend Phase 1. Riverbend Phases 1 and 2 are being proposed and constructed by the same developer and will share an internal transportation network and access points, affording easy access between the two developments. The following summarizes the key points of this transportation impact analysis (TIA):

- 5.64 of the 7.15 acres site is currently zoned RS (Single Family Residential) and 1.36 acres is zoned RD (Duplex Residential) and will be rezoned to MU-II (Mixed Use). The remaining 0.15 acres of the site is currently zoned RS and will be rezoned to CR (Commercial Retail).
- Analysis periods include 2035 background and total traffic conditions to address the requirements of the Comprehensive Plan Amendment/Zone Change and Oregon's Transportation Planning Rule.
- The proposed development will take access via a new right-in/right-out access to Wallace Road NW (OR 221) approximately 500 feet south of Brush College Road NW and share an existing right-in/right-out access to Wallace Road access with the Riverbend Phase 1 development to the south. Lastly, the development will share an existing full access to Riverbend Road that is being constructed as part of Riverbend Phase 1.

- The following study intersections were coordinated with the City of Salem staff or required by the *City of Salem Public Works Design Standards* and analyzed:
  1) Wallace Road NW (OR 221)/Riverbend Road NW
  2) Riverbend Road NW/Linwood Street NW
  3) Wallace Road NW (OR 221)/Orchard Heights Road NW
  4) Wallace Road NW (OR 221)/Glen Creek Road NW
  5) Wallace Road NW (OR 221)/North Site Access
  6) Riverbend Road NW/Site Access
- With the exception of Wallace Road NW (OR 221)/Orchard Heights Road NW and Wallace Road NW (OR 221)/Glen Creek Road NW, the remaining study intersections will operate in accordance with the Oregon Department of Transportation (ODOT) and City of Salem mobility standards during the 2035 horizon year. However, between the 2035 background and 2035 total traffic conditions, the intersections will experience very minor degradation or no appreciable degradation:
  - Wallace Road NW (OR 221)/Orchard Heights Road NW is expected to operate in the weekday AM peak hour with a v/c ratio of 0.96 in both the 2035 background and total traffic conditions.
  - Wallace Road NW (OR 221)/Glen Creek Road NW is expected to operate in the weekday AM peak hour with a v/c ratio of 1.17 in the 2035 background traffic condition while operating with a v/c ratio of 1.18 in the 2035 total traffic condition
  - Wallace Road NW (OR 221)/Glen Creek Road NW is expected to operate in the weekday PM peak hour with a v/c ratio of 1.11 in the 2035 background traffic condition while operating with a v/c ratio of 1.12 in the 2035 total traffic condition.
- According to the Oregon Highway Plan "In applying OHP mobility targets to analyze mitigation, ODOT recognizes that there are many variables and levels of uncertainty in calculating volume-to-capacity ratios, particularly over a specified planning horizon. After negotiating reasonable levels of mitigation for actions required under OAR 660-012-0060, ODOT considers calculated values for v/c ratios that are within 0.03 of the adopted target in the OHP to be considered in compliance with the target. The adopted mobility target still applies for determining significant affect under OAR 660-012-0060."

INTRODUCTION

This transportation impact analysis (TIA) has been prepared to determine the impacts to the City of Salem and ODOT street systems in the immediate vicinity of a proposed project to the north and west of the intersection of Wallace Road NW (OR 221)/Riverbend Road NW in Salem, Oregon. The proposed project includes a comprehensive plan amendment and zone change in support of a future development that is planned to consist of up to 14,500 square feet of retail space and 112 apartments. In establishing the project scope and performing the analysis, a number of important elements have been identified and considered, including the following items:

- 5.64 of the 7.15 acres site is currently zoned RS (Single Family Residential) and 1.36 acres is zoned RD (Duplex Residential) and will be rezoned to MU-II (Mixed Use). The remaining 0.15 acres of the site is currently zoned RS and will be rezoned to CR (Commercial Retail).
- The projected site generated traffic is based on the addition of a 14,500 square foot neighborhood shopping center that is expected to consist of a number of small shops and 112 apartment units. Trip generation rates are based on the 10th edition of the Institute of Transportation Engineer's *Trip Generation Manual*.
- Typically, the reasonable worst case trip generation of the existing zone is compared to the reasonable worst case trip generation of the proposed as part of a Comprehensive Plan Amendment/Zone Change and Transportation Planning Rule analysis. The difference in trips (if the proposed zoning generates more trips than the existing zone) are then evaluated to assess the impacts of the proposed zone over the existing zone to determine if the project has a "significant effect" per the Transportation Planning Rule. However, in this case, the trip generation of the proposed zone is based upon the development plan described above. The analysis considers the difference in trip generation of the reasonable worst case development in the existing zone versus the trip generation of the proposed development plan rather than a conceptual worst case development. This methodology results in the need to create a "trip cap" on the property to ensure that trip generation of future site plan review application(s) will not exceed that approved as part of the Comprehensive Plan Amendment/Zone Change.
- The project is anticipated to be fully constructed and occupied in 2020.

- In-process trips, or those trips generated by other developments in the project vicinity were generally not included the Comprehensive Plan Amendment/Zone Change analysis as the travel demand model accounts for regional growth in traffic volumes through 2035. However, limited inclusion of Riverbend Phase 1 was considered as the travel demand model did not clearly address those local impacts.
- 2035 traffic volumes were generated utilizing travel demand model outputs provided by the Mid-Willamette Valley Council of Governments (MWVCOG). The outputs were post-processed according to ODOT's *Analysis Procedures Manual* ("*APM*"), which relies upon the methodology of NCHRP Report 765.
- As part of the Comprehensive Plan Amendment/Zone Change evaluation, capacity analysis of critical intersections for both the weekday AM peak hour and weekday PM peak hour under 2035 background and 2035 total traffic conditions were evaluated. Critical intersections were determined based upon communication with City of Salem staff and a review of the *City of Salem Public Works Design Standards* and include the following:
    1) Wallace Road NW (OR 221)/Riverbend Road NW
    2) Riverbend Road NW/Linwood Street NW
    3) Wallace Road NW (OR 221)/Orchard Heights Road NW
    4) Wallace Road NW (OR 221)/Glen Creek Road NW
    5) Wallace Road NW (OR 221)/North Site Access
    6) Riverbend Road NW/Site Access
- Review and identification of the travel lane and traffic control requirements at critical intersections.
- Evaluation of accessibility to nearby transit services.
- Evaluation of planned roadway system as it relates to compliance with the City of Salem Transportation System Plan.
- Evaluation of the project's compliance with Oregon's Transportation Planning Rule.
- Evaluation of the project's compliance with TIA related requirements of the City of Salem and ODOT.
- Queuing analysis for background and total traffic conditions in 2035 based upon the ODOT *APM* procedures.

The Appendices to this report contains technical data including: traffic counts, capacity analysis reports, queuing analysis and crash data.

SITE DESCRIPTION, CRITICAL INTERSECTIONS, AND STREETS

The site is located on north and west of the intersection of Wallace Road NW (OR 221)/Riverbend Road NW. Currently, the site is occupied by three homes, two of which will be demolished. The existing site accesses will be removed. A new access will be proposed to Wallace Road at the north end of the site and will be constructed as a right-in/right-out access only given the presence of the raised concrete median along Wallace Road. Access will also be shared with Riverbend Phase 1 that constructed accesses to both Wallace Road and Riverbend Road. The Wallace Road access is served with right-in/right-out movements only due to the presence of a raised median along Wallace Road. The Riverbend Road access allows for full traffic movements.

A preliminary site plan is provided in Appendix A and a vicinity map is provided below.

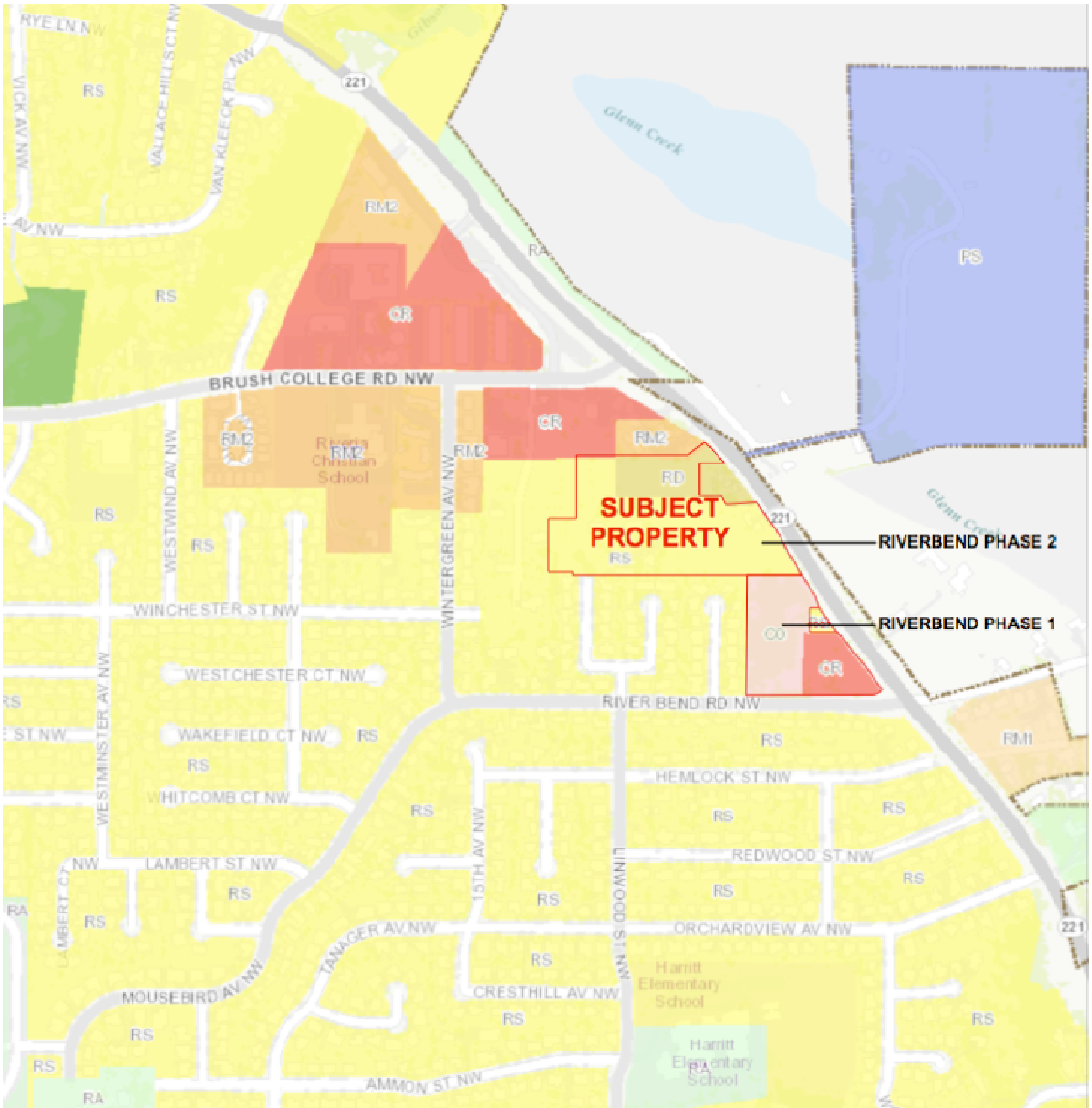


Figure 1: Vicinity Map

Wallace Road NW (OR 221) is under the jurisdiction of ODOT. The road is a five lane facility with two northbound lanes, two southbound lanes and left turn lanes constructed at select intersections. The road has a posted speed of 45 MPH. There are curbs, continuous sidewalks and continuous bicycle lanes on Wallace Road NW. According to the Oregon Highway Plan[1], OR 221 is classified as a Regional Highway by ODOT while the City of Salem's *Transportation System Plan* Map 3-1[2] classifies Wallace Road NW as a major arterial.

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[1] http://www.oregon.gov/ODOT/Planning/Documents/OHP.pdf

[2] http://temp.cityofsalem.net/Departments/PublicWorks/TransportationServices/TransportationPlan/Documents/tsp_street_approved.pdf

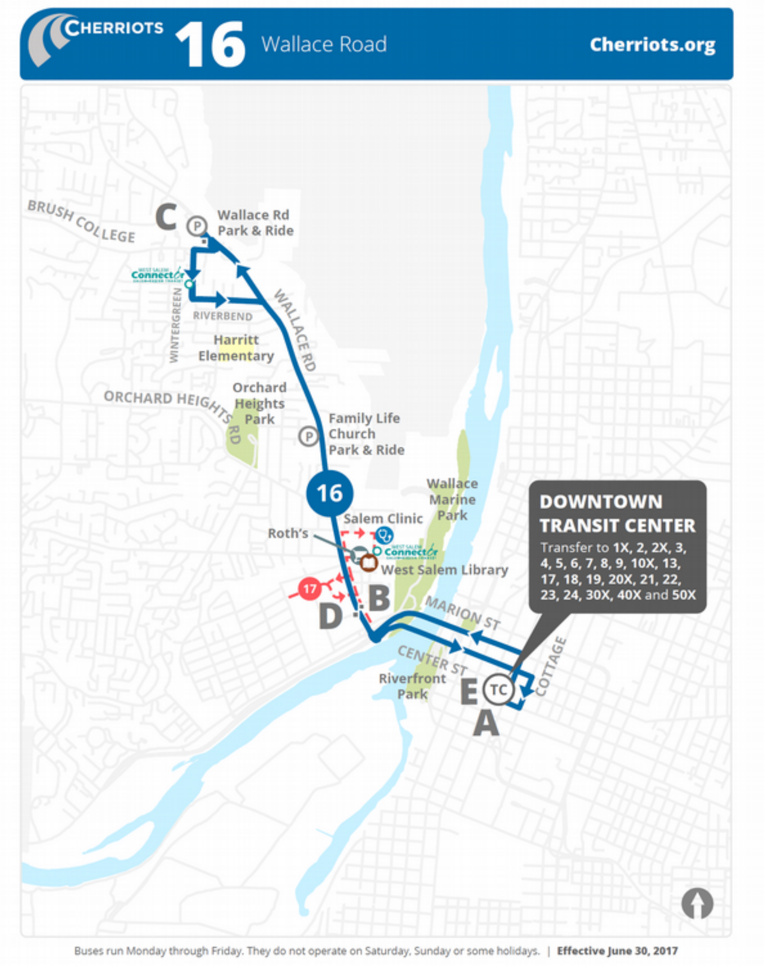
Riverbend Road NW is under the jurisdiction of the City of Salem. The road is a two lane facility with a posted speed of 25 MPH. There are generally curbs and sidewalks on Riverbend Road NW west of the Wallace Road NW (OR 221)/Riverbend Road NW intersection with the exception of the project site. The road is classified as a collector according to the City TSP.

Figure 1 of Appendix F illustrates the existing intersection control and lane configurations.

TRANSIT SERVICE

Salem-Keizer Transit Service “Cherriots” operates line 16 on Wallace Road NW and Riverbend Road NW at one hour headways from approximately 6 AM to 9 PM.

The nearest bus stop is located near Linwood Street NW approximately 500 feet to the west of Riverbend Phase 1. The proposed site plan creates a strong internal pedestrian network between Riverbend Phase 2 and Phase 1 including north/south pedestrian connections via the internal street network as well as La Jolla Drive.



Buses run Monday through Friday. They do not operate on Saturday, Sunday or some holidays. | **Effective June 30, 2017**

Given the relative infrequency of bus service, no specific trip generation reduction is assumed as part of this study. However, it is likely that some users of the proposed development will arrive and depart by transit.

PEDESTRIAN & BICYCLE CIRCULATION

As previously discussed, there are continuous bike lanes and sidewalks on the project's Wallace Road NW frontage. The site also has site frontage along La Jolla Drive. No motor vehicle access is proposed to La Jolla Drive, but a culdesac will be constructed along with a pedestrian and bicycle connection.

The project will construct a network of sidewalks on-site. Multiple sidewalk connections will be constructed to Wallace Road NW as illustrated on the site plan. Bicycles will have easy access between Riverbend Phase 1 and Phase 2.

STUDY INTERSECTIONS

Through coordination with the City of Salem and a review of the *City of Salem Public Works Design Standards*, the following intersections were identified as the necessary study intersections:

1) Wallace Road NW (OR 221)/Riverbend Road NW
2) Riverbend Road NW/Linwood Street NW
3) Wallace Road NW (OR 221)/Orchard Heights Road NW
4) Wallace Road NW (OR 221)/Glen Creek Road NW
5) Wallace Road NW (OR 221)/North Site Access
6) Riverbend Road NW/Site Access

MOBILITY STANDARDS

ODOT has jurisdiction over Wallace Road NW (OR 221). The *Oregon Highway Plan (OHP)* provides that OR 221 is a regional highway along the project frontage. As Salem in within the Mid-Willamette Valley Council of Governments Metropolitan Planning Organization (MPO), the mobility standard for OR 221 is a v/c ratio of 0.95 per Table 6 of the OHP[3].

Riverbend Road NW and Linwood Street NW are both under the jurisdiction of the City of Salem. Table 6-32 of the *City of Salem Public Works Design Standards*[4] requires unsignalized intersections to operate at LOS E or better with total delays less than 50 seconds.

EXISTING TRAFFIC VOLUMES

Manual turning movement counts were collected on September 12, 2017 during the weekday AM and PM peak hours at the study intersections of Wallace Road NW (OR 221)/Riverbend Road NW and Riverbend Road NW/Linwood Street NW and on November 7-8, 2018 at the study intersections of Wallace Road NW (OR 221)/Orchard Heights Road NW and Wallace Road NW (OR 221)/Glen Creek Road NW. As required by ODOT and the City of Salem, traffic counts included three hour auto, bus, truck, bicycles, and pedestrians, with 15-minute breakdowns during the AM (6-9 am) and PM (3-6 pm) peak periods.

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[3] http://www.oregon.gov/ODOT/Planning/Documents/OHP.pdf

[4] http://www.cityofsalem.net/cityDocuments/administrative-rule-109-001_109-007-public-works-design-standards.pdf

To account for growth between 2017 and 2018, the Mid-Willamette Valley Council of Governments travel demand model was referenced (Appendix D). An average growth rate of 2.6% per year was determined and applied to the 2017 traffic counts to adjust to 2018 traffic volumes.

Riverbend Phase 1 is currently under construction and won't be in operation until 2019.

All of the Wallace Road NW intersections raw traffic volumes were seasonally adjusted per ODOT's *APM* to develop 30 highest hour volumes (30 HV). The preferred method for seasonally adjusting raw traffic counts is the "On-Site ATR Method". Near the project site, there is an automatic traffic recorder (ATR) "Brush College (27-001)", which is located approximately 0.09 miles north of Brush College Road NW, or approximately 1/3 of a mile north of the site.

However, according to the Transportation Volume Tables for 2015[5], the 2015 AADT at the ATR was 13,200, while the AADT closer to the project site was 19,500 just 0.02 miles south of Riverbend Road.

According to the *APM*, "[i}t is...important to check that the project area's AADT in the Transportation Volume Table is within +/- 10% of the ATRs AADT." In this case, the AADT of the ATR, although close in proximity to the project site, has an AADT that varies from the AADT near Riverbend Road NW by greater than 10%. Therefore, the On-Site ATR Method should not be utilized in developing the 30 HV.

The ATR Characteristic Table Method of the *APM* was also evaluated as the next best alternative according to the APM. However, there were no ATRs in Oregon that were similar in characteristics to this section of Wallace Road NW (OR 221) and also within 10% of the AADT of the project site.

Finally, the Seasonal Trend Method of the *APM* was evaluated and ultimately used in the seasonal adjustment for this project.

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[5] http://www.oregon.gov/ODOT/Data/Documents/TVT_Complete_2015.pdf

It should be noted that the seasonal trends have changed slightly from the Riverbend Phase 1 TIA and have been updated for the newest factors in this analysis. Appendix B includes the raw traffic counts. Appendix C includes the 30th highest hour volume seasonal adjustment worksheet. Figure 2 of Appendix F illustrates the existing traffic volumes.

2035 BACKGROUND TRAFFIC VOLUMES

Since the application proposes a change in zoning and a comprehensive plan amendment, an estimate of long-term traffic operations is required in order to satisfy the requirements of Oregon's Transportation Planning Rule. As the City of Salem's *Transportation System Plan* is based upon a horizon year of 2035, a planning horizon year of 2035 was used for this analysis. MWVCOG provided 2010 and 2035 travel demand model link volumes. These link volumes have been post-processed in accordance with ODOT's *APM*, which relies heavily upon *NCHRP Report 765, Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

In order to develop traffic volumes at the Wallace Road NW (OR 221)/North Site Access intersection, flows were utilized from the Wallace Road NW (OR 221)/Riverbend Road NW intersection traffic counts.

For the Riverbend Road NW/Site Access intersection, flows were utilized from the Riverbend Phase 1 TIA.

Riverbend Phase 1 is still under construction at the present time, but the development will be operational in 2019. It was determined based on a review of the MWVCOG travel demand forecasting volumes that the model did not fully take into account the impacts of Riverbend 1 although the model has been updated between Riverbend Phase 1 and the most recent 2010 and 2035 travel demand forecasting. The site trip distribution of Riverbend Phase 1 was added to the Wallace Road NW (OR 221)/Riverbend Road NW and Riverbend Road NW/Site Access intersections.

Riverbend Phase 2 is not illustrated to add turning movement trips to the Wallace Road NW (OR 221)/South Site Access. In reality, there will be an impact to the trips at that intersection due to the internal trip capture between Phase 1 and 2. However, both Wallace Road NW site accesses are well under capacity and the internal capture trips of Phase 1 would also utilize the north site access, so no trip redistribution was assumed. It was determined that there would be no appreciable impact to the Wallace Road NW (OR 221)/South Site Access intersection. Therefore, that intersection was not studied within this TIA.

Figure 3 in Appendix F illustrates the 2035 traffic background volumes for both the weekday AM and PM peak hours. Appendix D contains the 2010 and 2035 transportation model data. Appendix E contains the *APM* based post-processing spreadsheet.

TRIP GENERATION

Vehicle trip generation rates from the 10h Edition of the ITE *Trip Generation Manual* were applied in establishing the site's generated trips for the proposed 14,500 foot shopping center and 112 apartment units. Two single-family residential homes will be demolished as part of the site development.

The *Trip Generation Handbook*, 3rd Edition, was referenced in establishing the "pass-by" trips associated with the retail components of the project. Pass-by trips are those driveway trips that are already on the public road network, but enter the site and then when exiting the site, continue on the public road system in their original path.

The methodology of the *Trip Generation Handbook* was used in estimated "internal capture" trips that are associated with mixed-use developments such as this development. Internal capture trips are those that are internal to the site where residential patrons also utilize the commercial portion of the site, office patrons utilize the commercial portion of the site, etc. ITE's internal capture spreadsheet[6] based on *NCHRP Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments* was utilized in this analysis.

It should be noted that due to the site layout of Riverbend Phase 1 and Riverbend Phase 2, internal capture trips were considered between the two developments. When Riverbend Phase 1 was developed, only the internal capture trips between the uses of Riverbend Phase 1 were

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[6] http://www.ite.org/tripgeneration/NCHRP%20Report%20684%20estimator%20update%20073113.xlsx

considered. With Riverbend Phase 2, there is more opportunity for internal capture trips as there are more retail and residential units. Therefore, Table 1 below presents a internal trip capture for the interaction between Riverbend Phase 1 and Riverbend Phase 2. It should be noted that although internal trip capture methodology calculated a higher level of internal trip capture, trip capture rates are limited to 15% in order to remain conservative. The internal capture calculations associated with this project are included in Appendix G.

The trip generation of the proposed development is presented in Table 1.

Table 1. Projected trip generation – proposed zoning/full project

ITE Land Use	Units (DU)	Weekday						
		ADT	AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Mult-Family Housing Mid Rise (ITE #221)	112							
Directional Distribution				26%	74%		61%	39%
Total Trips		**609**	**38**	10	28	**49**	30	19
Internal Trip Rate				7%	11%		15%	15%
Internal Trips			4	1	3	7	5	3
External Trips			**34**	**9**	**25**	**42**	**26**	**16**
Pass-By Rate			0%			0%		
Pass-By Trips			0	0	0	0	0	0
Non-Pass-By Trips			**34**	**9**	**25**	**42**	**26**	**16**
ITE Land Use	Units (ksf)	Weekday						
		ADT	AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Shopping Center (#826)	14.5							
Directional Distribution				62%	38%		48%	52%
Total Trips		**1617**	**159**	99	60	**130**	62	68
Internal Trip Rate				2%	14%		15%	15%
Internal Trips			10	2	8	20	9	10
External Trips			**149**	**97**	**52**	**111**	**53**	**58**
Pass-By Rate [1]			20%			34%		
Pass-By Trips			30	19	10	38	18	20
Non-Pass-By Trips			**119**	**78**	**42**	**73**	**35**	**38**
Total Trips (full project)		**2226**	**197**	**109**	**88**	**179**	**92**	**87**
Internal Trips			14	3	11	27	14	13
Pass-By Trips			30	19	10	38	18	20
Non-Pass-By Trips			153	87	67	115	61	54

Internal trip rates consider the multi-use development benefits of Riverbend 1 to the south. See interna
trip capture spreadsheet in Appendix G for more details.

In order to establish compliance with the City's zone change and comprehensive plan amendment requirements as well as Oregon's Transportation Planning Rule, the difference in trip generation of the proposed zone versus the existing zone must be evaluated. Based on a review of City code, it was determined that the worse case development in the existing zoning would be 57 single-family residential homes. The trip generation of 57 single-family homes is included in Table 2 below.

Table 2. Projected trip generation – existing zoning

ITE Land Use	Units (DU)	ADT	Weekday					
			AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Single-Family Detached Housing (ITE #210)	57							
Directional Distribution				25%	75%		63%	37%
Total Trips		**620**	**45**	11	34	**59**	37	22
Internal Trip Rate				0%	0%		0%	0%
Internal Trips				0	0		0	0
External Trips			**45**	11	34	**59**	37	22
Pass-By Rate			0%			0%		
Pass-By Trips			0	0	0	0	0	0
Non-Pass-By Trips			**45**	11	34	**59**	37	22

Typically, the reasonable worst case trip generation of the existing zone is compared to the reasonable worst case trip generation of the proposed as part of a Comprehensive Plan Amendment/Zone Change and Transportation Planning Rule analysis. The difference in trips (if the proposed zoning generates more trips than the existing zone) are then evaluated to assess the impacts of the proposed zone over the existing zone to determine if the project has a "significant effect" per the Transportation Planning Rule. However, in this case, the trip generation of the proposed zone is based upon the development plan described herein. The analysis considers the difference in trip generation of the reasonable worst case development in the existing zone versus the trip generation of the proposed development plan rather than a conceptual worst case development. This methodology results in the need to create a "trip cap" on the property to ensure that trip generation of future site plan review application(s) will not exceed that approved as part of the Comprehensive Plan Amendment/Zone Change.

Table 3 establishes the difference in trip generation between the existing zoning and the proposed zoning and illustrates the new trips generated as part of the zone change/comprehensive plan amendment that are used to establish compliance with the Transportation Planning Rule.

Table 3. Net Trip Generation Summary (Proposed zoning minus existing zoning)

Proposed Zoning	Weekday						
	ADT	AM Peak Hour			PM Peak Hour		
		Total	Enter	Exit	Total	Enter	Exit
Total	**2226**	**197**	**109**	**88**	**179**	**92**	**87**
Internal Trips		14	3	11	27	14	13
Pass-By Trips		30	19	10	38	18	20
Non-Pass-By Trips		153	87	67	115	61	54
Existing Zoning	Weekday						
	ADT	AM Peak Hour			PM Peak Hour		
		Total	Enter	Exit	Total	Enter	Exit
Total	**620**	**45**	**11**	**34**	**59**	**37**	**22**
Internal Trips		0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0
Non-Pass-By Trips		45	11	34	59	37	22
Net Trips (New Trips as a result of zone change)	Weekday						
	ADT	AM Peak Hour			PM Peak Hour		
		Total	Enter	Exit	Total	Enter	Exit
Total	**1606**	**152**	**98**	**54**	**120**	**55**	**65**
Internal Trips		14	3	11	27	14	13
Pass-By Trips		30	19	10	38	18	20
Non-Pass-By Trips		108	76	33	56	24	32

TRIP DISTRIBUTION

The trips estimated in Table 3 were distributed on the transportation network based upon a review of MWVCOG link volumes, existing traffic volumes and patterns, a review of the existing street network, and the evaluation of driveway use. This trip generation and distribution were performed to establish the 2035 total traffic volumes to be compared with the impact of the zone change and with the 2035 background traffic condition.

Except at the driveway locations, the intersections do not reflect the full impact of the development in year 2035 as MWVCOG's travel demand model already assumes some growth associated with the existing zoning of the site. Additionally, the TPR requires analysis of only the difference in trips between the proposed zone and the existing zone.

Figure 4 in Appendix F illustrates the assumed trip distribution pattern and the assignment of site generated trips to the study intersections during both the weekday AM and PM peak hours in 2035.

2035 TOTAL TRAFFIC VOLUMES

In order to determine the impacts of the proposed zone change and comprehensive plan amendment on the street system as required by city code and Oregon's Transportation Planning Rule, a comparative analysis of trips generated by the existing zoning compared to the proposed zoning was provided in Table 3. The increase in trips from the existing zoning to the proposed zoning was then added to the 2035 background traffic condition to determine the zone change/comprehensive plan amendment's impact on the transportation network. This summation represents the 2035 total traffic condition.

Figure 5 in Appendix F illustrates the 2035 total traffic volumes.

TRAFFIC OPERATIONS ANALYSIS

Capacity analysis for 2035 background and 2035 total traffic conditions has been performed at each of the relevant study intersections.

Existing traffic signal timing has been utilized, yet optimized as allowed per ODOT standards.

A saturation flow rate of 1800 passenger cars per hour of green per lane (pcphgl) was assumed as required by City of Salem standards.

Synchro 10 and SimTraffic 10 software was utilized in our analysis.

Traffic flow figures show the traffic data and turn movements for the weekday AM and PM peak hour conditions that were used in the traffic operation analysis.

Generally, level of service (LOS) ‘A’, ‘B’, ‘C’, and ‘D’ are desirable service levels ranging from no vehicle delays to average or longer than average delays in the peak hours. LOS 'E' and 'F' indicate the possible need for mitigation with users experiencing higher delays.

Tables 5 to 8 provide a summary of the intersection capacity results. The Synchro software capacity summary reports are included in Appendix H.

Table 5. Wallace Road NW (OR 221)/Riverbend Road NW

Traffic Scenario	2000 HCM Methodology			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Intersection LOS/Delay	Intersection V/C	Intersection LOS/Delay	Intersection V/C
2035 Background Traffic	B/13.6	0.76	B/13.6	0.77
2035 Total Traffic	B/15.2	0.79	B/13.8	0.76

Note: *2000 Highway Capacity Manual* methodology used in analysis.

Table 6. Riverbend Rd NW/Linwood St NW

Traffic Scenario	HCM 6th Edition Methodology			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Critical Movement	Critical LOS/Delay	Critical Movement	Critical LOS/Delay
2035 Background Traffic	SB	B/11.4	NB	B/13.1
2035 Total Traffic	SB	B/11.4	NB	B/13.1

Note: 6th Edition *Highway Capacity Manual* methodology used in analysis.

Table 7. Wallace Road NW (OR 221)/Orchard Heights Rd NW

Traffic Scenario	2000 HCM Methodology			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Intersection LOS/Delay	Intersection V/C	Intersection LOS/Delay	Intersection V/C
2035 Background Traffic	C/34.1	0.96	C/25.3	0.94
2035 Total Traffic	D/34.9	0.96	C/26.1	0.95

Note: *2000 Highway Capacity Manual* methodology used in analysis.

Table 8. Wallace Road NW (OR 221)/Glen Creek Rd NW

Traffic Scenario	2000 HCM Methodology			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Intersection LOS/Delay	Intersection V/C	Intersection LOS/Delay	Intersection V/C
2035 Background Traffic	F/91.5	1.17	F/103.2	1.11
2035 Total Traffic	F/91.3	1.18	F/104.7	1.12

Note: *2000 Highway Capacity Manual* methodology used in analysis.

Table 9. Wallace Road NW/North Site Access

Traffic Scenario	HCM 6th Edition Methodology			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Critical Approach	Critical V/C	Critical Approach	Critical V/C
2035 Total Traffic	EB	0.09	EB	0.09

Note: Highway Capacity Manual 6th Edition methodology used in analysis.

Table 10. Riverbend Road NW/Site Access

Traffic Scenario	HCM 6th Edition Methodology			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Critical Approach	Critical LOS/Delay	Critical Approach	Critical LOS/Delay
2035 Total Traffic	SB	B/11.0	SB	B/12.4

Note: Highway Capacity Manual 6th Edition methodology used in analysis.

As described previously, ODOT's mobility standard requires the Wallace Road intersections to operate with a v/c ratio of 0.95 or less. The City of Salem's mobility standard requires City unsignalized intersections to operate at LOS E or better with total delays less than 50 seconds. Based on the results provided above, both the Wallace Road NW (OR 221)/Orchard Heights Road NW and Wallace Road NW (OR 221)/Glen Creek Road NW intersections are anticipated to not meet the ODOT mobility standard.

With the exception of Wallace Road NW (OR 221)/Orchard Heights Road NW and Wallace Road NW (OR 221)/Glen Creek Road NW, the remaining study intersections will operate in accordance with the Oregon Department of Transportation (ODOT) and City of Salem mobility standards during the 2035 horizon year. However, between the 2035 background and 2035 total traffic conditions, the intersections will experience very minor degradation or no appreciable degradation:

- Wallace Road NW (OR 221)/Orchard Heights Road NW is expected to operate in the weekday AM peak hour with a v/c ratio of 0.96 in both the 2035 background and total traffic conditions.
- Wallace Road NW (OR 221)/Glen Creek Road NW is expected to operate in the weekday AM peak hour with a v/c ratio of 1.17 in the 2035 background traffic condition while operating with a v/c ratio of 1.18 in the 2035 total traffic condition
- Wallace Road NW (OR 221)/Glen Creek Road NW is expected to operate in the weekday PM peak hour with a v/c ratio of 1.11 in the 2035 background traffic condition while operating with a v/c ratio of 1.12 in the 2035 total traffic condition.

According to the Oregon Highway Plan "In applying OHP mobility targets to analyze mitigation, ODOT recognizes that there are many variables and levels of uncertainty in calculating volume-to-capacity ratios, particularly over a specified planning horizon. After negotiating reasonable levels of mitigation for actions required under OAR 660-012-0060, ODOT considers calculated values for v/c ratios that are within 0.03 of the adopted target in the OHP to be considered in compliance with the target. The adopted mobility target still applies for determining significant affect under OAR 660-012-0060."

TRANSPORTATION PLANNING RULE ANALYSIS

The Transportation Planning Rule (TPR) is a statewide regulation that ensures that the transportation system is adequate planned and requires the evaluation of traffic impacts that could result from changes to adopted zoning and comprehensive plans. The Transportation Planning Rule reads as follows:

660-012-0060
Plan and Land Use Regulation Amendments

> (1) *If an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation (including a zoning map) would significantly affect an existing or planned transportation facility, then the local government must put in place measures as provided in section (2) of this rule, unless the amendment is allowed under section (3), (9) or (10) of this rule. A plan or land use regulation amendment significantly affects a transportation facility if it would:*
>
> a) *Change the functional classification of an existing or planned transportation facility (exclusive of correction of map errors in an adopted plan);*
> b) *Change standards implementing a functional classification system; or*
> c) *Result in any of the effects listed in paragraphs (A) through (C) of this subsection based on projected conditions measured at the end of the planning period identified in the adopted TSP. As part of evaluating projected conditions, the amount of traffic projected to be generated within the area of the amendment may be reduced if the amendment includes an enforceable, ongoing requirement that would demonstrably limit traffic generation, including, but not limited to, transportation demand management. This reduction may diminish or completely eliminate the significant effect of the amendment.*
>
> A) *Types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;*
>
> B) *Degrade the performance of an existing or planned transportation facility such that it would not meet the performance standards identified in the TSP or comprehensive plan; or*
>
> C) *Degrade the performance of an existing or planned transportation facility that is otherwise projected to not meet the performance standards identified in the TSP or comprehensive plan.*

In this case, subsection (A) is not applicable since the proposed zone change and subsequent development is not expected to impact nor alter the functional classification of any existing or planned facility. The proposal does not include a change to any functional classification standards. (A) is not triggered as the types of travel or access would not be inconsistent with the functional classification of any of the transportation facilities in the vicinity of the site.

Our analysis illustrates that Subsection (B) is also not applicable. All intersections that operate inadequately in the 2035 background traffic condition continue to operate inadequately in the

2035 total traffic condition. The proposed zone change/comprehensive plan amendment does not push any intersections into failure, therefore (B) is not applicable.

Our analysis illustrates that Subsection (C) is applicable and requires further review. The analysis indicates that any changes in the v/c ratio are so minor that they will be imperceptible and represent a de minimus impact on the transportation system. ODOT standards indicate that v/c ratios within 0.03 of the mobility target do not require mitigation.

The requirements of the Transportation Planning Rule can be determined to be met.

QUEUING ANALYSIS

Queuing is a critical issue in the review of the operations and safety of intersections and access points. Left turn queue spill back not only impacts the capacity of an intersection, but can also result in safety issues.

The impact of the project on queuing is reported for 2035 background and 2035 total traffic conditions.

The simulation analysis was performed using SimTraffic 10 and is based upon the procedures and calibration per ODOT's *APM*[7]. Full intersection queuing results are provided in Appendix I.

SUMMARY AND RECOMMENDATIONS

The proposed zone change/comprehensive plan amendment can be approved with no mitigation. The Transportation Planning Rule requirements can be determined to be met due to the de minimus impact of the zone change/comprehensive plan amendment. Two of the study intersections fail to operate adequately in the City of Salem's TSP horizon year of 2035. With the exception of Wallace Road NW (OR 221)/Orchard Heights Road NW and Wallace Road NW (OR 221)/Glen Creek Road NW, the remaining study intersections will operate in accordance with the Oregon Department of Transportation (ODOT) and City of Salem mobility standards

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[7] Accessed at http://www.oregon.gov/odot/td/tp/pages/apm.aspx

during the 2035 horizon year. With the proposed change in zoning, the two intersections will experience very minor degradation or no appreciable degradation:

- Wallace Road NW (OR 221)/Orchard Heights Road NW is expected to operate in the weekday AM peak hour with a v/c ratio of 0.96 in both the 2035 background and total traffic conditions.
- Wallace Road NW (OR 221)/Glen Creek Road NW is expected to operate in the weekday AM peak hour with a v/c ratio of 1.17 in the 2035 background traffic condition while operating with a v/c ratio of 1.18 in the 2035 total traffic condition
- Wallace Road NW (OR 221)/Glen Creek Road NW is expected to operate in the weekday PM peak hour with a v/c ratio of 1.11 in the 2035 background traffic condition while operating with a v/c ratio of 1.12 in the 2035 total traffic condition.

According to the Oregon Highway Plan "In applying OHP mobility targets to analyze mitigation, ODOT recognizes that there are many variables and levels of uncertainty in calculating volume-to-capacity ratios, particularly over a specified planning horizon. After negotiating reasonable levels of mitigation for actions required under OAR 660-012-0060, ODOT considers calculated values for v/c ratios that are within 0.03 of the adopted target in the OHP to be considered in compliance with the target. The adopted mobility target still applies for determining significant affect under OAR 660-012-0060."

A trip cap shall be implemented based upon Table 3 of this report to ensure that future development does not exceed the trips estimated in this report.

APPENDICES

A) Preliminary Site Plan

B) Traffic Counts

C) 30th Highest Hour Volumes (30 HV)/Seasonal Adjustment Worksheet/Traffic Volumes

D) Mid-Willamette Valley Council of Governments Travel Demand Model Output Sheets

E) 2035 Volumes Post Processing Worksheet

F) Traffic Flow Figures

- Figure 1, Intersection Control & Lane Channelization
- Figure 2, 2018 Existing Traffic Weekday AM & PM Traffic Volumes
- Figure 3, 2035 Background Traffic Weekday AM & PM Traffic Volumes
- Figure 4, Net New Site Trip Distribution Weekday AM & PM Peak Hour
- Figure 5, 2035 Total Traffic Weekday AM & PM Traffic Volumes

G) Trip Generation Internal Capture Worksheet

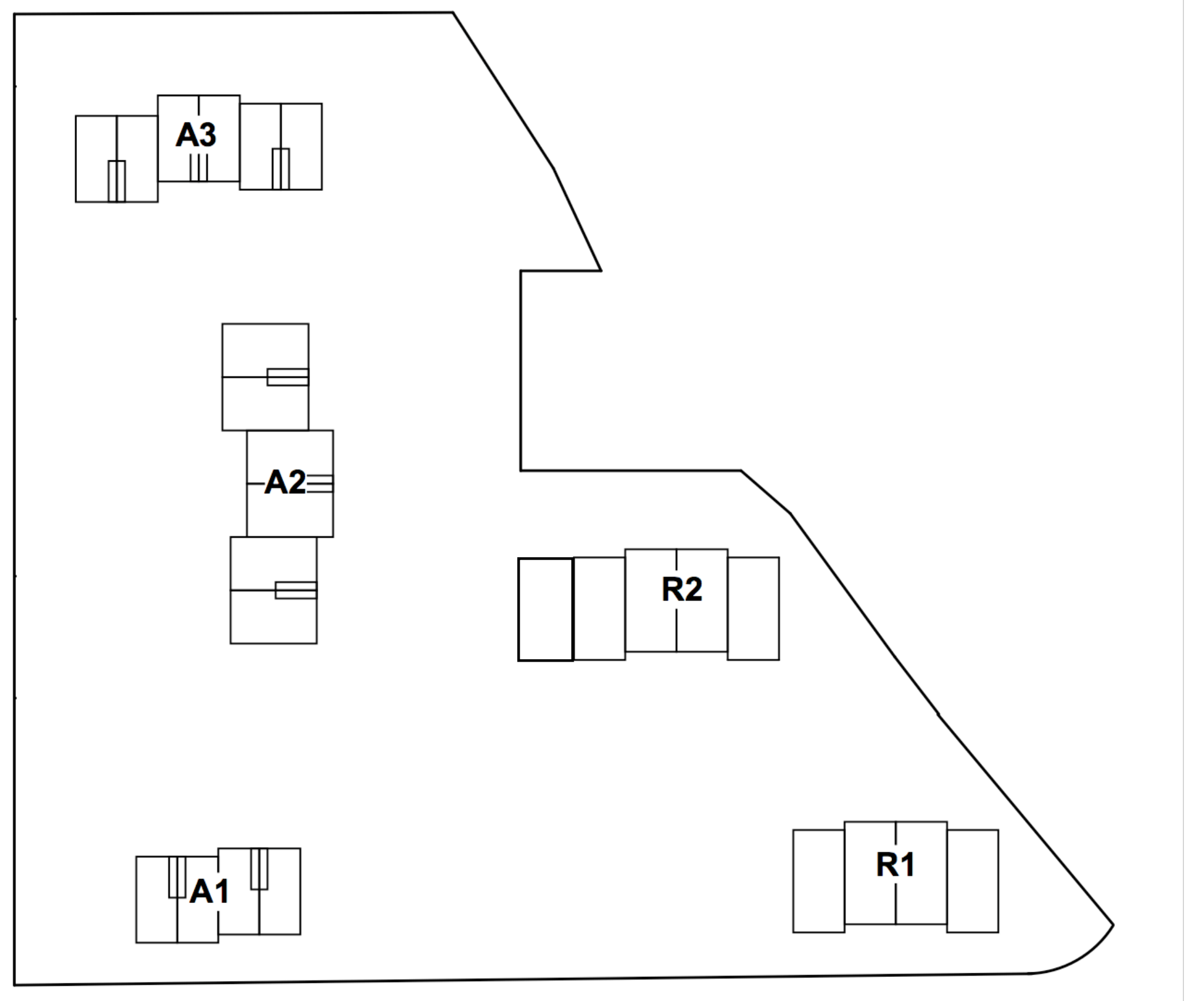
H) Synchro Intersection Capacity Analysis Report Outputs

I) SimTraffic Queuing Results

Appendix A

Preliminary Site Plan

RETAIL BUILDING R-3
10,000 SQ.FT. LOT
ZONE CHANGE RS TO CR



KEY MAP
BUILDING NUMBERS

Geoffrey James A.I.A.
MEMBER OF THE AMERICAN INSTITUTE OF ARCHITECTS

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REGISTERED ARCHITECT
GEOFFREY JAMES
SALEM, OREGON
STATE OF OREGON

RIVERBEND CENTER PHASE 1

1200 BLOCK
RIVERBEND RD
SALEM, OREGON

PROJECT NUMBER
GJAIA-2018-10

DRAWN BY: GCJ

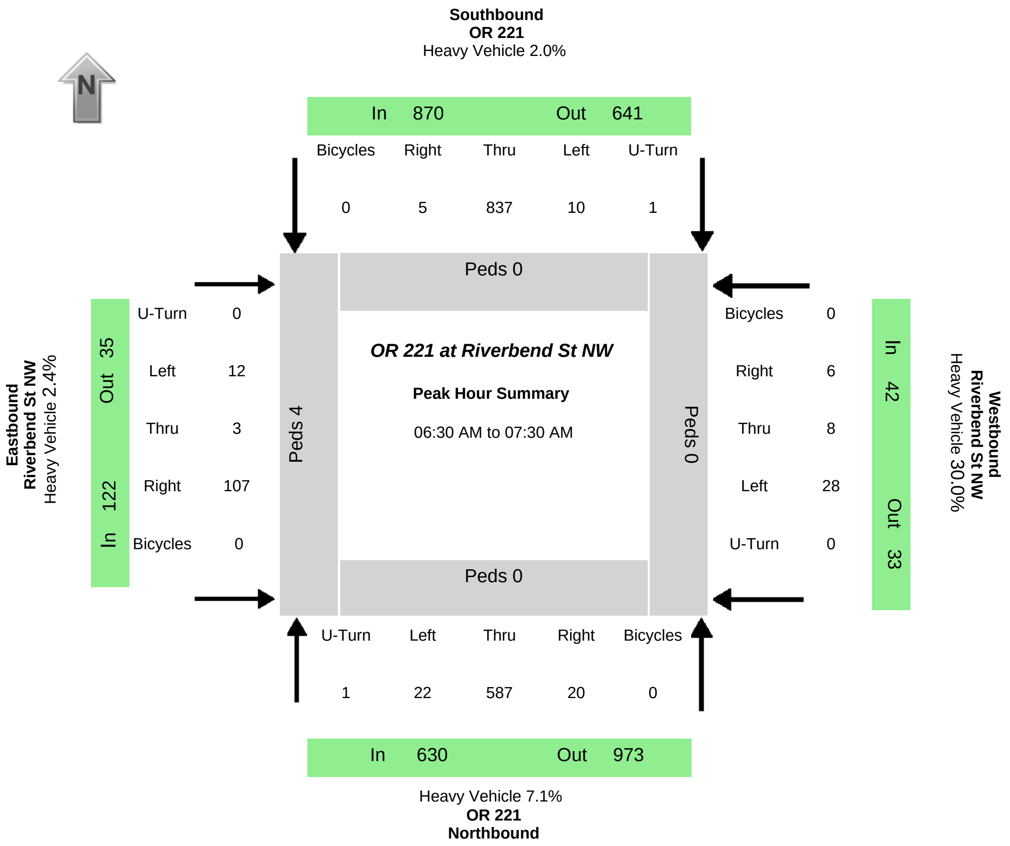
DATE: 11-21-2018

<u>Appendix B</u>

Traffic Counts

K-D-N
KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	***OR 221***
E/W street	***Riverbend St NW***
City, State	Salem OR
Site Notes	
Location	44.968083 - -123.060219
Start Date	Tuesday, September 12, 2017
Start Time	06:00:00 AM
Weather	
Study ID #	
Peak Hour Start	06:30:00 AM
Peak 15 Min Start	07:00:00 AM
PHF (15-Min Int)	0.89



Peak-Hour Volumes (PHV)

Northbound				Southbound				Eastbound				Westbound				Entering				Leaving			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
22	587	20	1	10	837	5	1	12	3	107	0	28	8	6	0	630	853	122	42	973	606	35	33

Percent Heavy Vehicles

0.0%	5.6%	75.0%	0.0%	40.0%	1.6%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	57.1%	0.0%	33.3%	0.0%	7.6%	2.0%	2.5%	42.9%	3.3%	5.8%	0.0%	57.6%

PHV- Bicycles																	PHV - Pedestrians				
Northbound				Southbound				Eastbound				Westbound					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4

All Vehicle Volumes

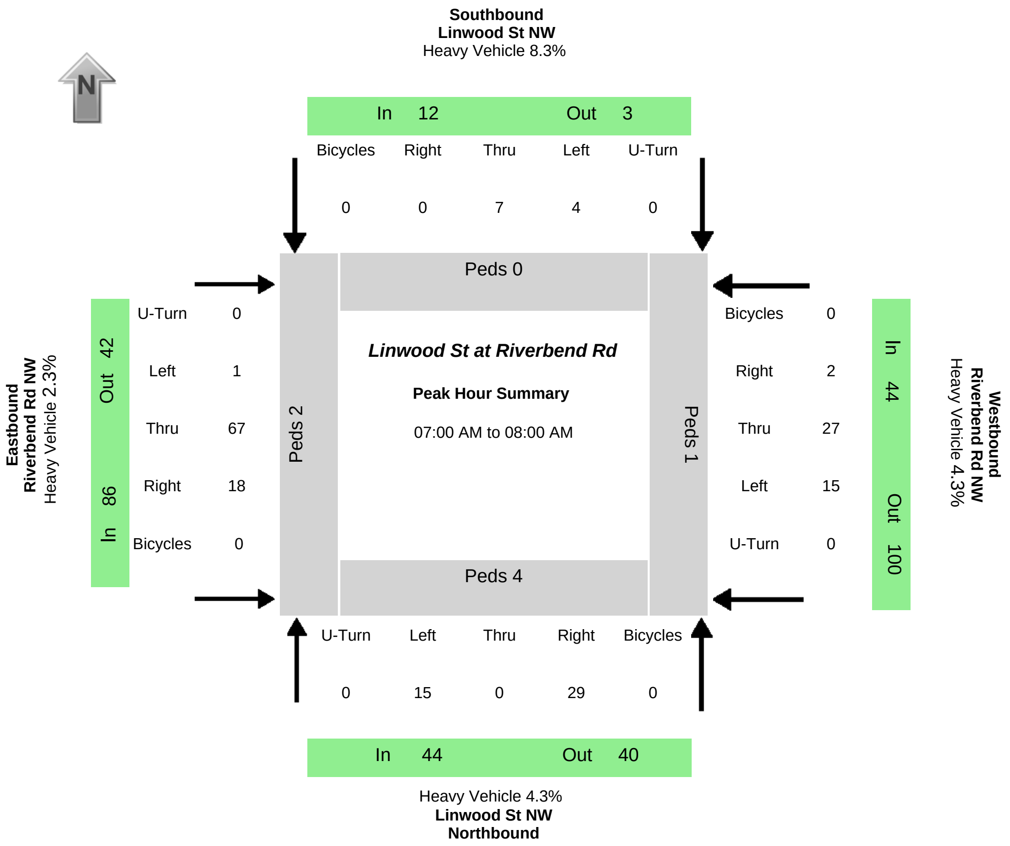
	Northbound				Southbound				Eastbound				Westbound					
	OR 221				OR 221				Riverbend St NW				Riverbend St NW				15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
06:00:00 AM	0	34	0	0	0	26	0	0	0	0	2	0	0	0	0	0		
06:05:00 AM	0	32	1	1	1	30	0	0	1	0	3	0	0	0	0	0		
06:10:00 AM	0	34	2	0	1	30	0	0	1	0	5	0	0	0	0	0	204	
06:15:00 AM	1	46	1	0	0	32	1	0	0	0	5	0	2	0	0	0	230	
06:20:00 AM	2	43	2	0	0	41	1	0	0	0	3	0	0	0	0	0	253	
06:25:00 AM	2	45	1	0	0	33	0	0	0	1	4	0	1	0	0	0	267	
06:30:00 AM	1	55	2	0	1	45	0	1	0	0	5	0	0	0	0	0	289	
06:35:00 AM	0	59	1	0	0	56	0	0	1	0	12	0	3	0	0	0	329	
06:40:00 AM	1	55	0	0	2	69	0	0	1	0	9	0	2	0	0	0	381	
06:45:00 AM	1	69	5	0	0	65	1	0	0	1	12	0	0	0	0	0	425	
06:50:00 AM	1	41	1	0	1	72	1	0	1	1	7	0	2	2	0	0	423	
06:55:00 AM	5	61	2	1	0	67	1	0	0	0	8	0	3	0	1	0	433	1285
07:00:00 AM	2	50	2	0	0	79	2	0	0	0	10	0	3	0	0	0	427	1371
07:05:00 AM	4	49	3	0	0	84	0	0	0	1	13	0	3	2	0	0	456	1461
07:10:00 AM	3	43	1	0	1	97	0	0	1	0	5	0	5	1	0	0	464	1545
07:15:00 AM	1	32	0	0	1	57	0	0	4	0	11	0	2	1	4	0	429	1570
07:20:00 AM	1	33	1	0	1	79	0	0	0	0	6	0	3	0	0	0	394	1602
07:25:00 AM	2	40	2	0	3	67	0	0	4	0	9	0	2	2	1	0	369	1647
07:30:00 AM	1	45	0	0	1	47	0	0	1	0	6	0	3	0	0	0	360	1641
07:35:00 AM	3	43	1	0	0	53	2	0	2	0	10	0	1	0	3	0	354	1627
07:40:00 AM	1	48	0	0	0	54	1	0	1	0	2	0	2	0	1	0	332	1598
07:45:00 AM	3	30	0	0	1	49	0	0	1	0	3	0	1	0	1	0	317	1533
07:50:00 AM	2	27	2	0	0	36	0	0	1	0	5	0	2	0	0	0	274	1478
07:55:00 AM	6	37	0	0	4	43	0	0	1	0	2	0	2	0	0	0	259	1424

08:00:00 AM	2	24	3	0	2	44	0	0	2	1	5	0	0	0	1	0	254	1360
08:05:00 AM	2	31	7	0	0	35	0	0	1	0	4	0	2	0	0	0	261	1283
08:10:00 AM	2	47	1	0	2	55	0	0	0	0	8	0	1	0	0	0	282	1242
08:15:00 AM	3	32	3	0	0	43	0	0	0	0	3	0	2	0	4	0	288	1219
08:20:00 AM	3	31	3	0	1	52	0	0	1	0	6	0	2	0	2	0	307	1196
08:25:00 AM	1	32	2	0	1	45	0	0	0	0	4	0	1	0	0	0	277	1150
08:30:00 AM	4	37	3	0	2	41	0	0	0	0	6	0	4	0	0	0	284	1143
08:35:00 AM	1	42	3	0	0	57	1	0	1	0	4	0	1	0	3	0	296	1138
08:40:00 AM	1	30	0	0	2	56	2	0	0	0	6	0	6	0	1	0	314	1132
08:45:00 AM	5	31	2	0	2	56	0	0	0	0	5	0	2	0	0	0	320	1146
08:50:00 AM	2	49	2	0	0	56	0	0	0	2	9	0	1	0	0	0	328	1192
08:55:00 AM	4	43	2	0	0	75	4	0	2	0	3	0	1	0	3	0	361	1234

K-D-N
KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224

N/S street	***Linwood St NW***
E/W street	***Riverbend Rd NW***
City, State	Salem OR
Site Notes	
Location	44.968042 - -123.064594
Start Date	Tuesday, September 12, 2017
Start Time	06:00:00 AM
Weather	
Study ID #	
Peak Hour Start	07:00:00 AM
Peak 15 Min Start	07:05:00 AM
PHF (15-Min Int)	0.73



Peak-Hour Volumes (PHV)

Northbound				**Southbound**				**Eastbound**				**Westbound**				**Entering**				**Leaving**			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
15	0	29	0	4	7	0	0	1	67	18	0	15	27	2	0	44	11	86	44	40	3	42	100

Percent Heavy Vehicles

0.0%	0.0%	6.9%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	13.3%	0.0%	0.0%	0.0%	4.5%	9.1%	2.3%	4.5%	7.5%	0.0%	0.0%	4.0%

PHV- Bicycles																	PHV - Pedestrians				
Northbound				**Southbound**				**Eastbound**				**Westbound**					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	1	7

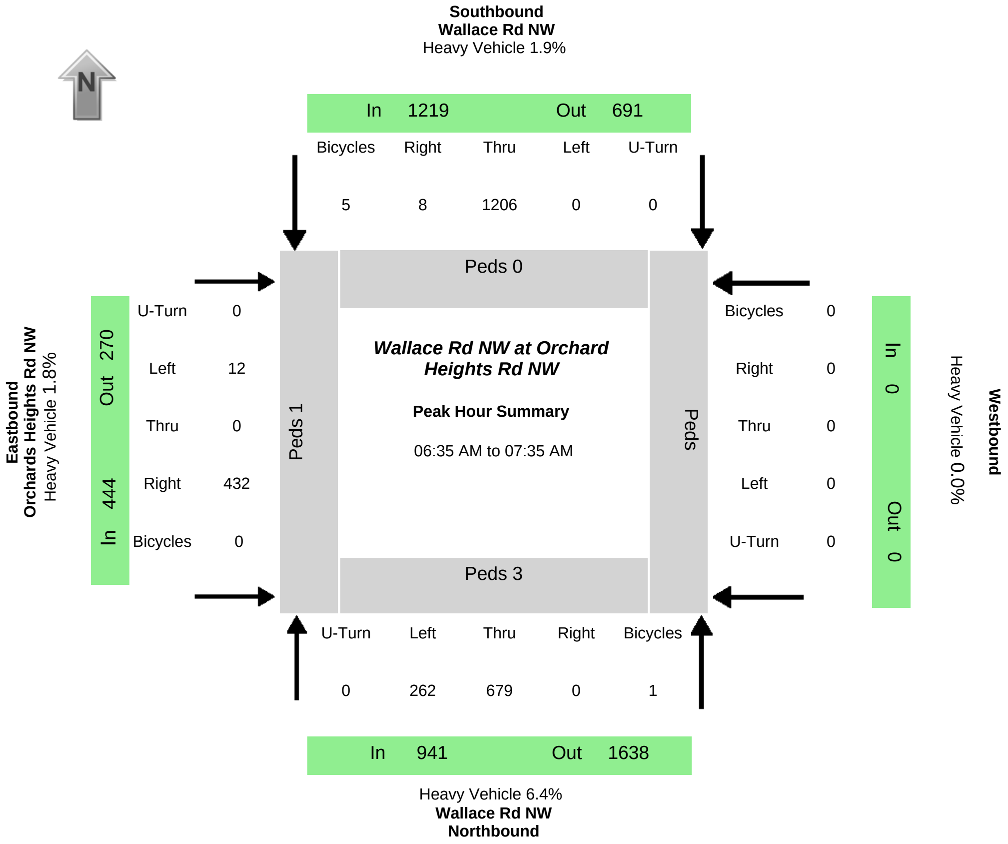
All Vehicle Volumes

	Northbound				**Southbound**				**Eastbound**				**Westbound**					
	Linwood St NW				Linwood St NW				Riverbend Rd NW				Riverbend Rd NW				15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
06:00:00 AM	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0	0		
06:05:00 AM	0	0	1	0	0	0	0	0	0	2	1	0	0	0	0	0		
06:10:00 AM	1	0	1	0	1	0	0	0	0	4	0	0	0	0	1	0	16	
06:15:00 AM	0	0	1	0	0	0	0	0	0	4	0	0	1	2	0	0	20	
06:20:00 AM	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	20	
06:25:00 AM	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0	0	18	
06:30:00 AM	2	0	0	0	0	0	0	0	0	9	0	0	0	1	0	0	22	
06:35:00 AM	1	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	30	
06:40:00 AM	0	0	3	0	0	0	0	0	0	6	1	0	2	1	0	0	37	
06:45:00 AM	1	0	2	0	1	0	0	0	0	8	0	0	1	0	0	0	38	
06:50:00 AM	3	0	1	0	0	0	0	0	0	3	0	0	1	1	0	0	35	
06:55:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	93
07:00:00 AM	1	0	0	0	2	1	0	0	0	9	0	0	0	3	1	0	26	106
07:05:00 AM	0	0	3	0	0	0	0	0	0	11	1	0	1	5	0	0	38	123
07:10:00 AM	4	0	0	0	1	1	0	0	0	4	2	0	1	2	0	0	53	130
07:15:00 AM	3	0	5	0	0	1	0	0	0	13	1	0	2	2	0	0	63	149
07:20:00 AM	0	0	4	0	0	1	0	0	1	5	2	0	3	1	0	0	59	162
07:25:00 AM	2	0	2	0	0	0	0	0	0	3	1	0	1	2	0	0	55	167
07:30:00 AM	2	0	4	0	1	1	0	0	0	6	6	0	3	0	0	0	51	178
07:35:00 AM	1	0	3	0	0	0	0	0	0	4	1	0	2	1	1	0	47	179
07:40:00 AM	1	0	1	0	0	0	0	0	0	2	0	0	0	2	0	0	42	172
07:45:00 AM	0	0	0	0	0	1	0	0	0	5	1	0	1	3	0	0	30	170
07:50:00 AM	0	0	1	0	0	0	0	0	0	3	2	0	0	2	0	0	25	169
07:55:00 AM	1	0	6	0	0	1	0	0	0	2	1	0	1	4	0	0	35	185

08:00:00 AM	0	0	2	0	0	1	0	0	0	4	1	0	1	2	0	0	35	179
08:05:00 AM	0	0	0	0	0	0	0	0	0	7	3	0	1	2	1	0	41	172
08:10:00 AM	1	0	1	0	1	1	0	0	0	2	4	0	0	1	0	0	36	168
08:15:00 AM	0	0	1	0	0	0	0	0	0	3	0	0	1	2	1	0	33	149
08:20:00 AM	2	1	1	0	0	0	0	0	0	5	0	0	0	2	0	0	30	143
08:25:00 AM	0	0	0	0	0	0	0	0	0	3	2	0	0	1	0	0	25	138
08:30:00 AM	2	0	1	0	0	0	0	0	0	9	3	0	1	2	0	0	35	133
08:35:00 AM	1	0	0	0	0	0	0	0	0	2	3	0	0	1	0	0	31	127
08:40:00 AM	3	0	0	0	1	0	0	0	0	6	0	0	2	3	0	0	40	136
08:45:00 AM	2	0	1	0	0	0	1	0	0	5	0	0	2	3	0	0	36	139
08:50:00 AM	4	0	0	0	0	0	0	0	0	7	9	0	0	2	0	0	51	153
08:55:00 AM	7	0	2	0	0	0	0	0	0	5	4	0	4	6	0	0	64	165

K-D-N
KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	***Wallace Rd NW***
E/W street	***Orchards Heights Rd NW***
City, State	Salem OR
Site Notes	
Location	44.953357 - -123.052622
Start Date	Thursday, November 08, 2018
Start Time	06:00:00 AM
Weather	
Study ID #	
Peak Hour Start	06:35:00 AM
Peak 15 Min Start	07:10:00 AM
PHF (15-Min Int)	0.95



Peak-Hour Volumes (PHV)

Northbound				Southbound				Eastbound				Westbound				Entering				Leaving			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
262	679	0	0	0	1206	8	0	12	0	432	0	0	0	0	0	941	1214	444	0	1638	691	270	0
Percent Heavy Vehicles																							
5.0%	6.9%	0.0%	0.0%	0.0%	1.8%	12.5%	0.0%	8.3%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	6.4%	1.9%	1.8%	0.0%	1.8%	6.9%	5.2%	0.0%

PHV- Bicycles																	PHV - Pedestrians				
Northbound				Southbound				Eastbound				Westbound					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
1	0		0		5	0	0	0		0	0					6	3	0	1		4

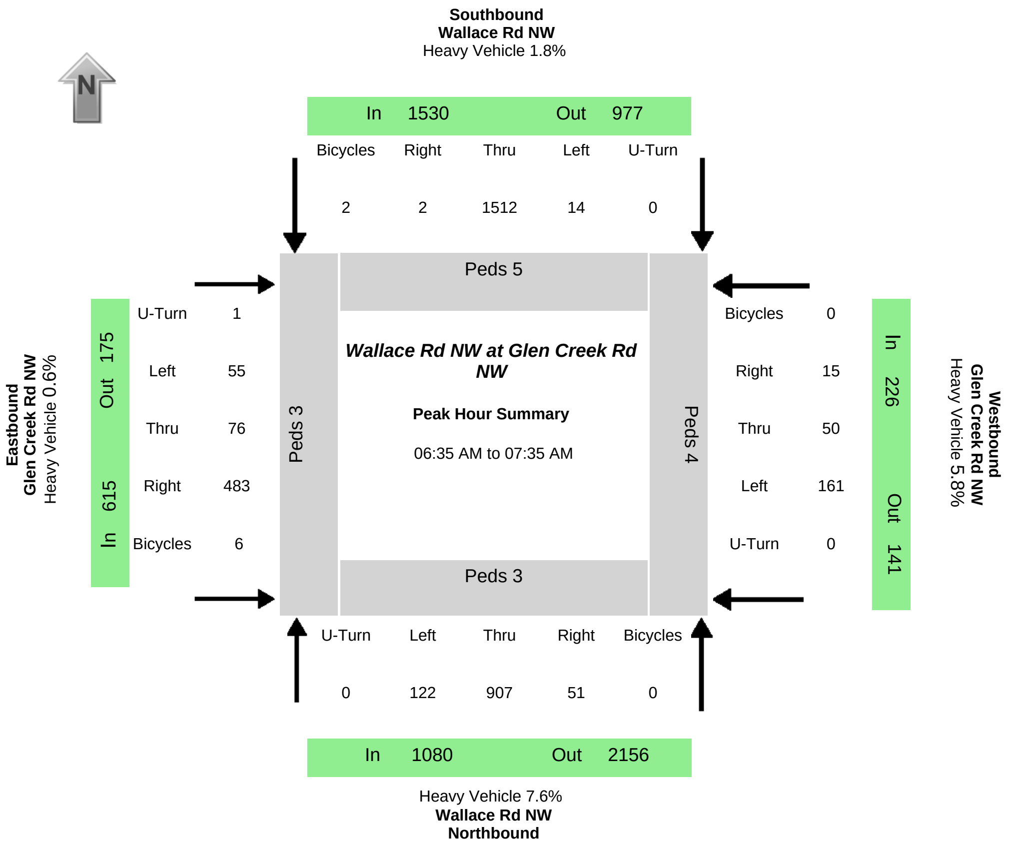
All Vehicle Volumes

	Northbound				Southbound				Eastbound				Westbound					
	Wallace Rd NW				Wallace Rd NW				Orchards Heights Rd NW								15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
06:00:00 AM	3	21		0		45	0	0	0		17	0						
06:05:00 AM	8	36		0		49	0	0	0		15	0						
06:10:00 AM	3	34		0		59	0	0	1		16	0					307	
06:15:00 AM	3	49		0		59	0	0	1		21	0					354	
06:20:00 AM	9	39		0		66	0	0	0		13	0					373	
06:25:00 AM	6	48		0		50	0	0	1		12	0					377	
06:30:00 AM	3	53		0		86	0	0	0		23	0					409	
06:35:00 AM	8	69		0		111	0	0	1		29	0					500	
06:40:00 AM	14	71		0		95	0	0	0		37	0					600	
06:45:00 AM	13	65		0		92	1	0	2		32	0					640	
06:50:00 AM	19	47		0		115	0	0	0		26	0					629	
06:55:00 AM	29	72		0		84	0	0	1		37	0					635	1919
07:00:00 AM	19	55		0		96	0	0	1		39	0					640	2043
07:05:00 AM	26	54		0		114	2	0	0		32	0					661	2163
07:10:00 AM	28	59		0		101	2	0	2		41	0					671	2283
07:15:00 AM	39	45		0		102	1	0	0		33	0					681	2370
07:20:00 AM	28	47		0		109	1	0	3		45	0					686	2476
07:25:00 AM	18	49		0		92	1	0	1		38	0					652	2558
07:30:00 AM	21	46		0		95	0	0	1		43	0					638	2599
07:35:00 AM	17	36		0		61	2	0	3		52	0					576	2552
07:40:00 AM	17	53		0		52	1	0	1		36	0					537	2495
07:45:00 AM	16	50		0		56	0	0	1		30	0					484	2443
07:50:00 AM	15	41		0		72	1	0	0		32	0					474	2397
07:55:00 AM	10	38		0		63	1	0	1		26	0					453	2313

08:00:00 AM	12	35		0		43	1	0	1		14	0		406	2209
08:05:00 AM	20	60		0		59	1	0	0		28	0		413	2149
08:10:00 AM	7	34		0		67	0	0	1		24	0		407	2049
08:15:00 AM	21	46		0		77	0	0	0		31	0		476	2004
08:20:00 AM	17	50		0		64	0	0	0		29	0		468	1931
08:25:00 AM	20	38		0		73	0	0	0		26	0		492	1889
08:30:00 AM	19	54		0		80	2	0	3		26	0		501	1867
08:35:00 AM	23	48		0		77	0	0	1		23	0		513	1868
08:40:00 AM	21	38		0		89	1	0	1		37	0		543	1895
08:45:00 AM	11	46		0		74	3	0	1		42	0		536	1919
08:50:00 AM	23	38		0		72	0	0	0		46	0		543	1937
08:55:00 AM	21	57		0		83	0	1	0		32	0		550	1992

KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	***Wallace Rd NW***
E/W street	***Glen Creek Rd NW***
City, State	Salem OR
Site Notes	
Location	44.95015 - -123.051639
Start Date	Thursday, November 08, 2018
Start Time	06:00:00 AM
Weather	
Study ID #	
Peak Hour Start	06:35:00 AM
Peak 15 Min Start	07:05:00 AM
PHF (15-Min Int)	0.96



Peak-Hour Volumes (PHV)

Northbound				**Southbound**				**Eastbound**				**Westbound**				**Entering**				**Leaving**			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
122	907	51	0	14	1512	2	0	55	76	483	1	161	50	15	0	1080	1528	615	226	2156	977	175	141

Percent Heavy Vehicles

6.6%	7.6%	9.8%	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	5.6%	2.0%	20.0%	0.0%	7.6%	1.8%	0.7%	5.8%	1.9%	7.4%	5.1%	3.5%

PHV- Bicycles

Northbound				**Southbound**				**Eastbound**				**Westbound**				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**
0	0	0	0	0	2	0	0	0	4	2	0	0	0	0	0	8

PHV - Pedestrians

in Crosswalk				
NB	SB	EB	WB	**Sum**
3	5	3	4	15

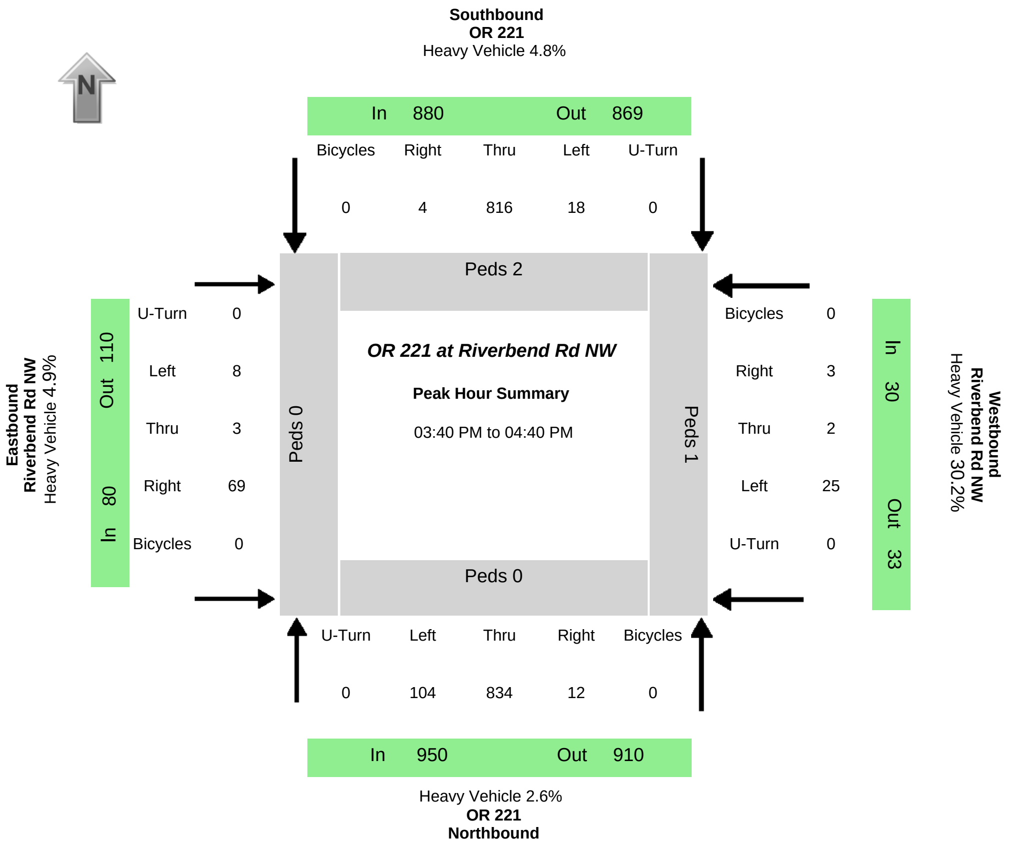
All Vehicle Volumes

	Northbound				**Southbound**				**Eastbound**				**Westbound**					
	Wallace Rd NW				Wallace Rd NW				Glen Creek Rd NW				Glen Creek Rd NW				15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
06:00:00 AM	4	20	5	0	2	52	1	0	3	0	16	0	10	3	3	0		
06:05:00 AM	2	39	1	0	0	64	0	0	3	0	15	0	7	5	3	0		
06:10:00 AM	3	40	2	0	0	60	2	0	5	2	18	0	4	4	2	0	400	
06:15:00 AM	5	50	4	0	0	69	1	0	1	4	25	0	18	4	3	0	465	
06:20:00 AM	4	47	2	0	0	66	2	0	5	8	20	0	9	3	1	0	493	
06:25:00 AM	4	56	2	0	1	74	0	0	1	1	18	0	9	1	3	0	521	
06:30:00 AM	1	63	3	0	2	97	0	0	4	3	31	0	10	5	0	0	556	
06:35:00 AM	5	63	5	0	1	136	1	0	4	3	30	0	8	4	1	0	650	
06:40:00 AM	11	84	2	0	1	124	0	0	4	5	47	0	9	4	2	0	773	
06:45:00 AM	6	71	1	0	1	97	1	0	5	13	44	0	13	5	1	0	812	
06:50:00 AM	10	78	4	0	3	154	0	0	2	4	37	0	19	4	1	0	867	
06:55:00 AM	11	88	6	0	1	115	0	0	3	1	31	0	7	6	1	0	844	2538
07:00:00 AM	16	67	3	0	0	102	0	0	6	2	42	0	21	4	1	0	850	2683
07:05:00 AM	10	93	3	0	0	133	0	0	3	6	39	0	13	2	3	0	839	2849
07:10:00 AM	10	80	7	0	1	156	0	0	2	2	37	0	8	4	1	0	877	3015
07:15:00 AM	8	72	5	0	1	100	0	0	7	9	59	1	15	3	2	0	895	3113
07:20:00 AM	10	69	4	0	4	131	0	0	5	10	41	0	14	5	2	0	885	3241
07:25:00 AM	13	85	6	0	1	142	0	0	7	9	26	0	18	3	0	0	887	3381
07:30:00 AM	12	57	5	0	0	122	0	0	7	12	50	0	16	6	0	0	892	3449
07:35:00 AM	7	52	15	0	1	95	1	0	6	10	39	0	15	9	0	0	847	3438
07:40:00 AM	8	88	10	0	2	113	0	0	2	6	34	1	24	3	1	0	829	3437
07:45:00 AM	7	54	14	0	0	89	0	0	6	9	42	0	16	3	1	0	783	3420
07:50:00 AM	16	56	9	0	0	87	2	0	6	17	43	1	11	8	0	0	789	3360
07:55:00 AM	14	57	15	0	0	127	1	0	5	9	33	0	9	4	0	0	771	3364

08:00:00 AM	9	62	8	0	0	62	1	0	1	5	32	0	11	1	1	0	723	3293
08:05:00 AM	18	60	14	0	0	69	1	0	6	9	27	0	18	3	2	0	694	3215
08:10:00 AM	8	50	16	0	4	86	0	0	2	3	25	0	17	3	3	0	637	3124
08:15:00 AM	12	59	19	0	0	105	0	0	8	10	27	0	16	2	3	0	705	3103
08:20:00 AM	15	56	10	0	2	76	0	0	6	12	33	0	14	5	4	0	711	3041
08:25:00 AM	11	53	9	0	1	91	3	0	2	7	22	0	22	5	3	0	723	2960
08:30:00 AM	10	65	7	0	1	82	0	0	6	13	38	0	13	8	2	0	707	2918
08:35:00 AM	9	67	6	0	4	96	1	0	4	5	29	0	6	4	3	0	708	2902
08:40:00 AM	9	63	10	0	3	120	3	0	3	9	30	0	15	3	5	0	752	2883
08:45:00 AM	13	54	15	0	3	97	0	0	2	11	46	0	14	5	6	0	773	2908
08:50:00 AM	20	60	19	0	1	98	0	0	5	13	30	1	9	7	3	0	805	2918
08:55:00 AM	9	73	19	0	4	108	2	0	4	2	30	0	12	9	5	0	809	2921

K-D-N
KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	***OR 221***
E/W street	***Riverbend Rd NW***
City, State	Salem OR
Site Notes	
Location	44.968083 - -123.060219
Start Date	Tuesday, September 12, 2017
Start Time	03:00:00 PM
Weather	
Study ID #	
Peak Hour Start	03:40:00 PM
Peak 15 Min Start	04:20:00 PM
PHF (15-Min Int)	0.86



Peak-Hour Volumes (PHV)

Northbound				**Southbound**				**Eastbound**				**Westbound**				**Entering**				**Leaving**			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
104	834	12	0	18	816	4	0	8	3	69	0	25	2	3	0	950	838	80	30	910	845	110	33

Percent Heavy Vehicles

1.9%	2.5%	16.7%	0.0%	44.4%	4.2%	0.0%	0.0%	12.5%	0.0%	4.3%	0.0%	40.0%	0.0%	100.0%	0.0%	2.6%	5.0%	5.0%	43.3%	5.2%	3.0%	1.8%	30.3%

PHV- Bicycles																	PHV - Pedestrians				
Northbound				**Southbound**				**Eastbound**				**Westbound**					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	3

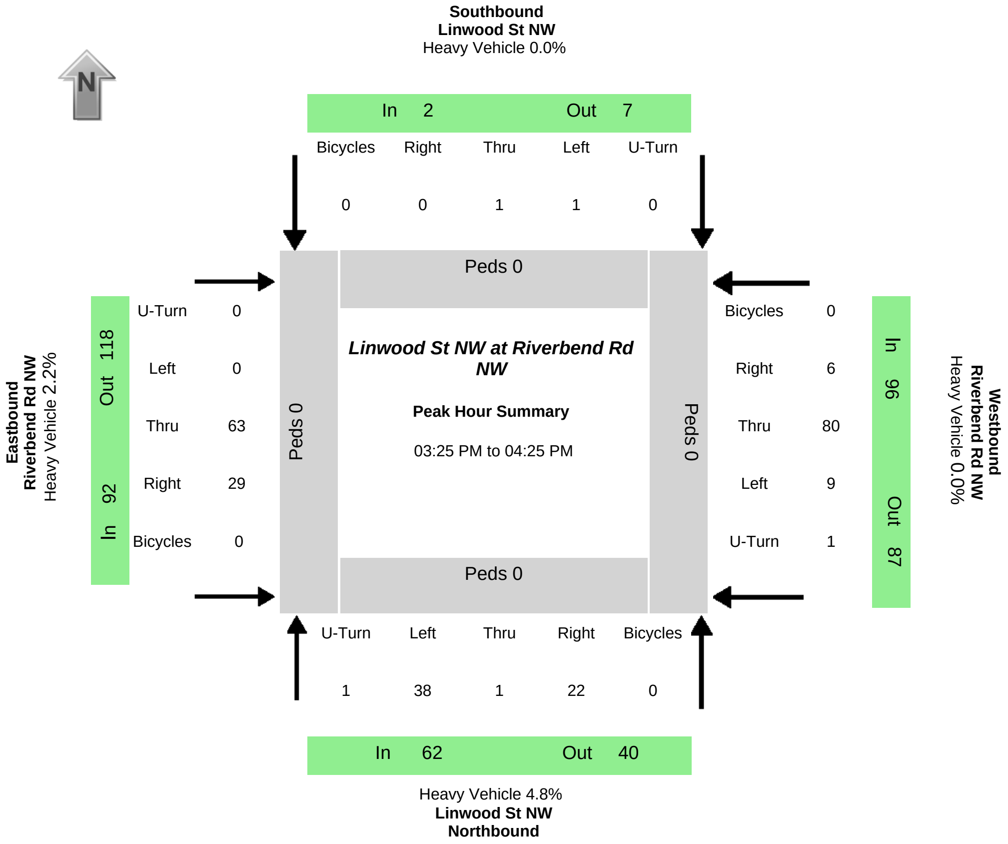
All Vehicle Volumes

	Northbound				**Southbound**				**Eastbound**				**Westbound**					
	OR 221				OR 221				Riverbend Rd NW				Riverbend Rd NW				15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
03:00:00 PM	3	53	5	0	0	60	0	0	1	0	7	0	0	0	0	0		
03:05:00 PM	8	59	2	0	0	61	1	0	0	1	5	0	4	0	1	0		
03:10:00 PM	7	72	3	0	0	44	0	0	0	0	3	0	6	0	0	0	406	
03:15:00 PM	10	54	1	0	0	57	0	0	0	1	5	0	4	1	0	0	410	
03:20:00 PM	3	57	2	0	1	50	1	0	0	0	2	0	5	1	0	0	390	
03:25:00 PM	4	60	4	0	0	57	0	0	4	0	7	0	0	0	1	0	392	
03:30:00 PM	10	58	2	0	0	54	2	0	0	0	5	0	0	1	2	0	393	
03:35:00 PM	7	41	0	0	0	54	0	0	4	0	12	0	5	0	1	0	395	
03:40:00 PM	9	87	0	0	4	55	0	0	0	1	9	0	2	0	0	0	425	
03:45:00 PM	4	61	0	0	0	52	0	0	0	0	7	0	5	0	0	0	420	
03:50:00 PM	8	65	0	0	1	65	0	0	1	0	8	0	1	0	0	0	445	
03:55:00 PM	11	68	1	0	2	46	1	0	1	0	7	0	2	1	2	0	420	1643
04:00:00 PM	7	62	2	0	3	50	0	0	0	1	7	0	2	0	0	0	425	1648
04:05:00 PM	5	70	3	0	2	53	1	0	2	0	1	0	4	0	0	0	417	1647
04:10:00 PM	10	74	2	0	1	70	1	0	0	0	6	0	1	0	0	0	440	1677
04:15:00 PM	8	69	0	0	2	66	0	0	2	0	6	0	3	0	0	0	462	1700
04:20:00 PM	13	81	0	0	1	86	0	0	0	0	6	0	2	0	0	0	510	1767
04:25:00 PM	7	60	1	0	2	109	0	0	1	1	4	0	1	0	0	0	531	1816
04:30:00 PM	12	69	2	0	0	84	1	0	1	0	6	0	2	0	0	0	552	1859
04:35:00 PM	10	68	1	0	0	80	0	0	0	0	2	0	0	1	1	0	526	1898
04:40:00 PM	6	70	3	0	0	56	0	0	2	0	6	0	1	0	1	0	485	1876
04:45:00 PM	11	64	0	0	1	46	0	0	2	0	5	0	1	1	0	0	439	1878
04:50:00 PM	6	64	1	0	0	52	0	0	0	0	5	0	0	0	0	0	404	1857
04:55:00 PM	8	67	2	0	1	67	0	0	1	1	4	0	1	1	0	0	412	1868

05:00:00 PM	8	77	0	0	0	53	1	0	2	1	5	0	1	0	1	0	430	1883
05:05:00 PM	8	72	1	0	0	65	1	0	0	0	7	0	1	0	0	0	457	1897
05:10:00 PM	6	64	0	0	1	63	0	0	0	0	6	0	2	0	0	0	446	1874
05:15:00 PM	8	71	0	0	0	54	0	0	0	0	2	0	2	0	0	0	434	1855
05:20:00 PM	7	71	0	0	0	57	0	0	0	0	6	0	0	0	0	0	420	1807
05:25:00 PM	13	68	1	0	0	47	0	0	0	0	4	0	0	0	2	0	413	1756
05:30:00 PM	9	94	2	0	0	42	0	0	1	0	3	0	2	0	0	0	429	1732
05:35:00 PM	9	73	4	0	0	66	0	0	0	0	4	0	1	0	0	0	445	1726
05:40:00 PM	8	71	0	0	1	53	0	0	1	0	10	0	1	0	0	0	455	1726
05:45:00 PM	8	64	2	0	1	63	0	0	0	0	4	0	1	0	1	0	446	1739
05:50:00 PM	8	78	1	0	0	65	1	0	1	0	5	0	2	0	0	0	450	1772
05:55:00 PM	12	68	3	0	0	44	0	0	0	0	4	0	0	0	0	0	436	1750

K-D-N
KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	*Linwood St NW*
E/W street	*Riverbend Rd NW*
City, State	Salem OR
Site Notes	
Location	44.968042 - -123.064594
Start Date	Tuesday, September 12, 2017
Start Time	03:00:00 PM
Weather	
Study ID #	
Peak Hour Start	03:25:00 PM
Peak 15 Min Start	03:25:00 PM
PHF (15-Min Int)	0.73



Peak-Hour Volumes (PHV)																							
Northbound				**Southbound**				**Eastbound**				**Westbound**				**Entering**				**Leaving**			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
38	1	22	1	1	1	0	0	0	63	29	0	9	80	6	1	62	2	92	96	40	7	118	87
Percent Heavy Vehicles																							
5.3%	0.0%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	0.0%	2.2%	0.0%	0.0%	0.0%	1.7%	3.4%

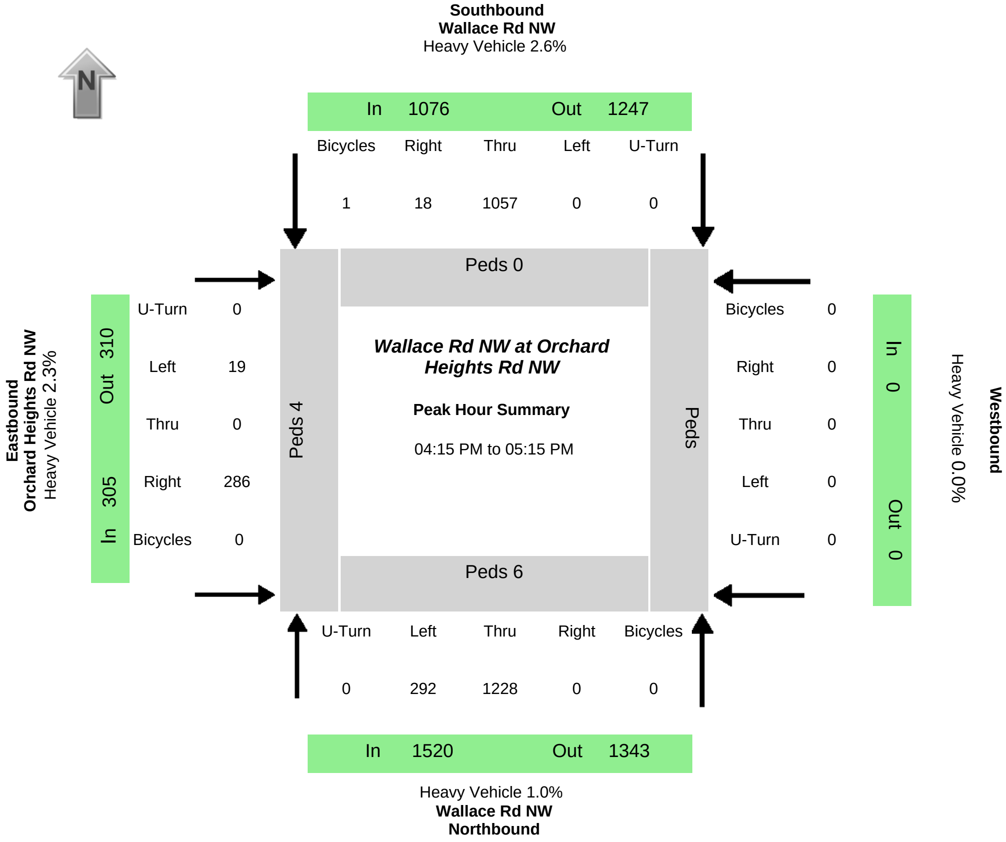
PHV- Bicycles																	PHV - Pedestrians				
Northbound				**Southbound**				**Eastbound**				**Westbound**					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

All Vehicle Volumes																		
	Northbound				**Southbound**				**Eastbound**				**Westbound**					
	Linwood St NW				Linwood St NW				Riverbend Rd NW				Riverbend Rd NW				15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
03:00:00 PM	0	0	0	0	0	0	0	0	0	5	2	0	0	2	0	0		
03:05:00 PM	3	0	0	0	0	0	0	0	0	3	4	0	1	10	0	0		
03:10:00 PM	0	1	0	0	0	0	0	0	1	5	2	0	1	4	0	0	44	
03:15:00 PM	1	0	2	0	0	0	0	0	0	5	1	0	3	7	0	0	54	
03:20:00 PM	0	0	0	0	1	0	0	0	0	3	3	0	2	3	0	0	45	
03:25:00 PM	3	0	2	0	0	0	0	0	0	6	7	0	0	3	1	0	53	
03:30:00 PM	6	0	5	0	0	0	0	0	0	6	2	0	1	12	1	0	67	
03:35:00 PM	9	0	4	0	0	0	0	0	0	7	5	0	0	5	1	0	86	
03:40:00 PM	4	0	0	1	0	0	0	0	0	5	1	0	0	8	0	1	84	
03:45:00 PM	2	0	1	0	0	0	0	0	0	4	3	0	1	3	0	0	65	
03:50:00 PM	6	0	1	0	0	0	0	0	0	8	1	0	1	5	1	0	57	
03:55:00 PM	0	0	0	0	1	0	0	0	0	9	1	0	0	8	1	0	57	238
04:00:00 PM	0	0	2	0	0	0	0	0	0	6	2	0	0	5	0	0	58	244
04:05:00 PM	0	0	0	0	0	0	0	0	0	2	1	0	1	6	0	0	45	233
04:10:00 PM	4	0	3	0	0	0	0	0	0	4	0	0	2	6	0	0	44	238
04:15:00 PM	1	0	3	0	0	1	0	0	0	4	4	0	2	7	1	0	52	242
04:20:00 PM	3	1	1	0	0	0	0	0	0	2	2	0	1	12	0	0	64	252
04:25:00 PM	2	0	1	0	1	0	0	0	1	5	2	0	2	3	1	0	63	248
04:30:00 PM	3	0	0	0	0	0	0	0	0	4	3	0	1	9	0	0	60	235
04:35:00 PM	2	0	1	0	0	0	0	0	0	0	1	0	2	6	1	0	51	217
04:40:00 PM	0	2	2	0	0	0	0	0	0	6	0	0	1	7	0	0	51	215
04:45:00 PM	2	0	2	0	0	1	0	0	0	2	1	0	0	8	0	0	47	217
04:50:00 PM	1	0	2	0	1	0	1	0	0	3	2	0	0	6	0	0	50	210
04:55:00 PM	4	0	2	0	0	0	0	0	0	4	0	0	1	6	1	0	50	208

05:00:00 PM	1	0	1	0	0	0	0	0	0	6	1	0	0	7	0	0	50	209
05:05:00 PM	1	0	1	0	0	0	0	0	0	8	0	0	1	6	0	0	51	216
05:10:00 PM	1	0	0	0	0	0	0	0	0	1	1	0	1	8	0	0	45	209
05:15:00 PM	0	1	1	0	0	0	0	0	0	5	0	0	1	6	0	0	43	200
05:20:00 PM	3	1	0	0	0	0	0	0	0	3	2	0	0	6	1	0	42	194
05:25:00 PM	0	0	1	0	0	0	0	0	0	3	1	0	2	12	0	0	49	195
05:30:00 PM	2	0	2	0	0	0	0	0	0	3	2	0	0	5	1	0	50	190
05:35:00 PM	1	0	2	0	0	0	0	0	0	4	0	0	0	8	1	0	50	193
05:40:00 PM	2	0	0	0	0	0	0	0	0	6	0	0	1	7	1	0	48	192
05:45:00 PM	2	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	41	184
05:50:00 PM	1	0	0	0	0	0	0	0	0	5	0	0	1	7	1	0	40	183
05:55:00 PM	4	1	1	0	1	1	0	0	0	3	3	0	2	10	0	0	49	191

K-D-N
KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	***Wallace Rd NW***
E/W street	***Orchard Heights Rd NW***
City, State	Salem OR
Site Notes	
Location	44.953357 - -123.052622
Start Date	Wednesday, November 07, 2018
Start Time	03:00:00 PM
Weather	
Study ID #	
Peak Hour Start	04:15:00 PM
Peak 15 Min Start	04:40:00 PM
PHF (15-Min Int)	0.95



Peak-Hour Volumes (PHV)

Northbound				**Southbound**				**Eastbound**				**Westbound**				**Entering**				**Leaving**			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
292	1228	0	0	0	1057	18	0	19	0	286	0	0	0	0	0	1520	1075	305	0	1343	1247	310	0
Percent Heavy Vehicles																							
0.7%	1.1%	0.0%	0.0%	0.0%	2.6%	5.6%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	2.6%	2.3%	0.0%	2.5%	1.0%	1.0%	0.0%

PHV- Bicycles																	PHV - Pedestrians				
Northbound				**Southbound**				**Eastbound**				**Westbound**					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
0	0		0		1	0	0	0		0	0					1	6	0	4		10

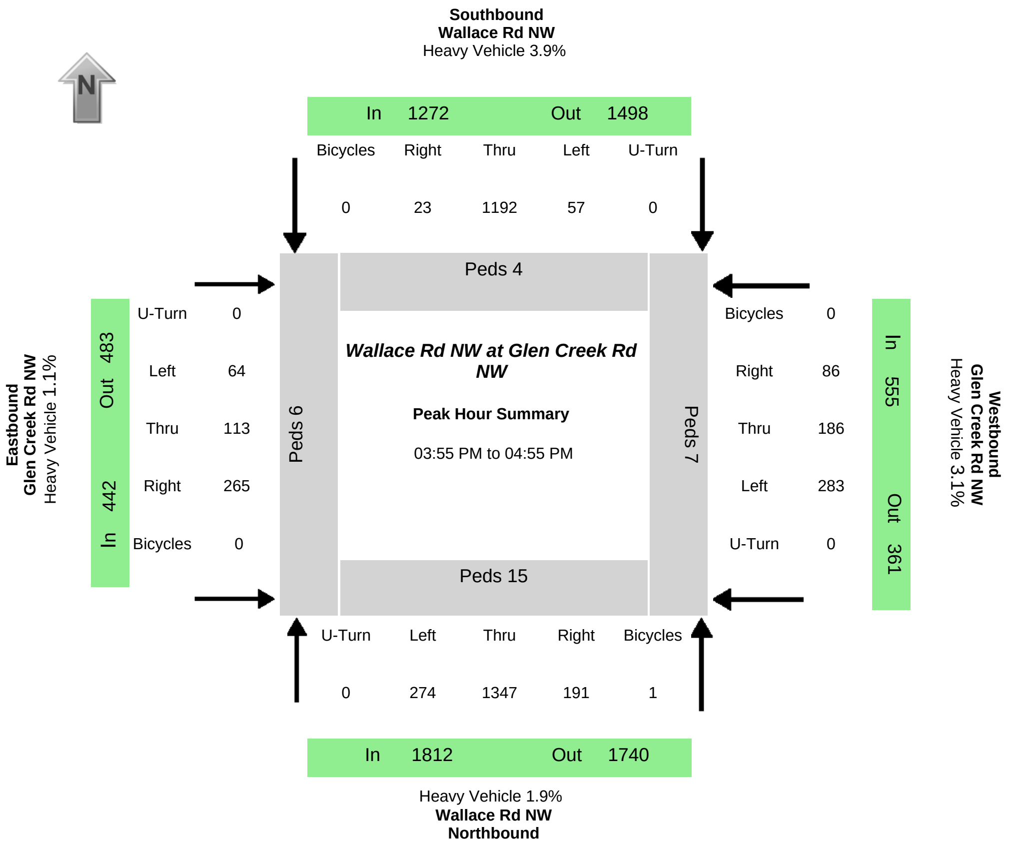
All Vehicle Volumes

	Northbound				**Southbound**				**Eastbound**				**Westbound**					
	Wallace Rd NW				Wallace Rd NW				Orchard Heights Rd NW								15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
03:00:00 PM	27	85		0		55	1	0	1		25	0						
03:05:00 PM	31	79		0		56	3	0	2		30	0						
03:10:00 PM	26	80		0		65	1	0	1		13	0					581	
03:15:00 PM	35	96		0		70	3	0	1		30	0					622	
03:20:00 PM	36	79		0		45	0	0	0		29	0					610	
03:25:00 PM	23	94		0		61	2	0	2		12	0					618	
03:30:00 PM	34	93		0		82	1	0	3		28	0					624	
03:35:00 PM	30	115		0		77	1	0	2		55	0					715	
03:40:00 PM	21	88		0		84	1	0	4		43	0					762	
03:45:00 PM	19	73		0		60	2	0	2		42	0					719	
03:50:00 PM	27	98		0		92	4	0	3		32	0					695	
03:55:00 PM	31	86		0		64	1	0	1		29	0					666	2627
04:00:00 PM	21	95		0		104	1	0	2		23	0					714	2679
04:05:00 PM	26	96		0		74	1	0	3		32	0					690	2710
04:10:00 PM	36	75		0		70	0	0	0		29	0					688	2734
04:15:00 PM	29	96		0		88	1	0	1		17	0					674	2731
04:20:00 PM	23	106		0		97	0	0	2		25	0					695	2795
04:25:00 PM	28	114		0		84	2	0	3		25	0					741	2857
04:30:00 PM	14	89		0		97	2	0	0		23	0					734	2841
04:35:00 PM	17	99		0		92	1	0	1		18	0					709	2789
04:40:00 PM	39	97		0		86	2	0	3		28	0					708	2803
04:45:00 PM	25	106		0		97	1	0	0		26	0					738	2860
04:50:00 PM	18	107		0		97	3	0	1		25	0					761	2855
04:55:00 PM	29	104		0		79	2	0	0		32	0					752	2889

05:00:00 PM	23	110		0		75	0	0	2		18	0					725	2871
05:05:00 PM	18	104		0		84	2	0	4		27	0					713	2878
05:10:00 PM	29	96		0		81	2	0	2		22	0					699	2900
05:15:00 PM	31	90		0		76	1	0	0		24	0					693	2890
05:20:00 PM	26	94		0		96	0	0	1		24	0					695	2878
05:25:00 PM	25	96		0		63	2	0	0		18	0					667	2826
05:30:00 PM	27	83		0		71	0	0	1		24	0					651	2807
05:35:00 PM	28	101		0		84	1	0	1		22	0					647	2816
05:40:00 PM	18	110		0		80	0	0	4		22	0					677	2795
05:45:00 PM	35	96		0		70	0	0	1		25	0					698	2767
05:50:00 PM	24	88		0		75	2	0	2		20	0					672	2727
05:55:00 PM	31	89		0		58	2	0	1		18	0					637	2680

KEY DATA NETWORK

Data Provided by K-D-N.com 503-594-4224	
N/S street	***Wallace Rd NW***
E/W street	***Glen Creek Rd NW***
City, State	Salem OR
Site Notes	
Location	44.95015 - -123.051639
Start Date	Wednesday, November 07, 2018
Start Time	03:00:00 PM
Weather	
Study ID #	
Peak Hour Start	03:55:00 PM
Peak 15 Min Start	04:40:00 PM
PHF (15-Min Int)	0.97



Peak-Hour Volumes (PHV)

Northbound				**Southbound**				**Eastbound**				**Westbound**				**Entering**				**Leaving**			
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	NB	SB	EB	WB	NB	SB	EB	WB
274	1347	191	0	57	1192	23	0	64	113	265	0	283	186	86	0	1812	1272	442	555	1740	1497	483	361

Percent Heavy Vehicles

1.5%	2.2%	1.0%	0.0%	1.8%	4.0%	0.0%	0.0%	1.6%	0.9%	1.1%	0.0%	4.2%	1.6%	2.3%	0.0%	1.9%	3.9%	1.1%	3.1%	3.6%	2.1%	1.4%	1.1%

PHV- Bicycles																	PHV - Pedestrians				
Northbound				**Southbound**				**Eastbound**				**Westbound**					in Crosswalk				
Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	**Sum**	NB	SB	EB	WB	**Sum**
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15	4	6	7	32

All Vehicle Volumes

	Northbound				**Southbound**				**Eastbound**				**Westbound**					
	Wallace Rd NW				Wallace Rd NW				Glen Creek Rd NW				Glen Creek Rd NW				15 Min	1 HR
Time	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Left	Thru	Right	Uturn	Sum	Sum
03:00:00 PM	23	110	15	0	3	70	1	0	2	13	26	0	21	17	5	0		
03:05:00 PM	22	81	19	0	1	65	0	0	7	12	30	0	22	13	6	0		
03:10:00 PM	23	108	19	0	10	72	2	0	1	4	14	0	22	12	4	0	875	
03:15:00 PM	31	110	19	0	4	87	1	0	4	9	23	0	15	10	5	0	887	
03:20:00 PM	25	121	16	0	4	62	0	0	2	11	30	0	22	16	7	0	925	
03:25:00 PM	31	91	15	0	5	64	8	0	2	6	24	0	20	16	8	0	924	
03:30:00 PM	21	133	11	0	5	84	5	0	2	9	17	0	22	15	5	0	935	
03:35:00 PM	37	113	17	0	3	94	5	0	6	10	36	0	17	11	6	0	974	
03:40:00 PM	14	95	13	0	5	92	1	0	4	10	30	0	27	24	3	0	1002	
03:45:00 PM	24	113	12	0	6	105	2	0	4	7	24	0	15	13	3	0	1001	
03:50:00 PM	22	118	21	0	3	93	0	0	2	13	28	0	13	17	6	0	982	
03:55:00 PM	24	98	12	0	5	90	2	0	9	13	24	0	33	16	9	0	999	3800
04:00:00 PM	25	109	15	0	7	104	4	0	2	10	19	0	18	17	7	0	1008	3831
04:05:00 PM	30	119	20	0	7	88	4	0	6	8	21	0	26	11	7	0	1019	3900
04:10:00 PM	20	91	20	0	3	87	2	0	5	18	37	0	14	20	10	0	1011	3936
04:15:00 PM	25	128	12	0	7	102	1	0	8	6	19	0	35	12	6	0	1035	3979
04:20:00 PM	20	117	15	0	4	102	3	0	4	6	23	0	32	13	5	0	1032	4007
04:25:00 PM	19	99	16	0	3	82	1	0	5	6	20	0	29	19	13	0	1017	4029
04:30:00 PM	20	96	17	0	4	107	2	0	0	5	8	0	22	21	8	0	966	4010
04:35:00 PM	22	126	15	0	7	109	1	0	6	12	26	0	18	11	4	0	979	4012
04:40:00 PM	24	108	16	0	1	92	1	0	8	12	24	0	17	14	8	0	992	4019
04:45:00 PM	19	122	17	0	6	98	1	0	3	10	25	0	24	21	7	0	1035	4044
04:50:00 PM	26	134	16	0	3	131	1	0	8	7	19	0	15	11	2	0	1051	4081
04:55:00 PM	27	113	11	0	5	93	2	0	3	9	24	0	17	10	3	0	1043	4063

05:00:00 PM	30	114	9	0	1	79	0	0	4	6	15	0	22	17	12	0	999	4035
05:05:00 PM	21	111	12	0	5	106	2	0	3	10	13	0	20	10	3	0	942	4004
05:10:00 PM	30	124	18	0	7	87	5	0	0	2	38	0	14	12	3	0	965	4017
05:15:00 PM	20	93	14	0	7	80	4	0	1	12	16	0	22	21	7	0	953	3953
05:20:00 PM	21	123	15	0	3	103	2	0	4	10	19	0	19	12	1	0	969	3941
05:25:00 PM	22	109	13	0	5	101	2	0	2	15	23	0	17	16	7	0	961	3961
05:30:00 PM	17	88	4	0	2	86	1	0	7	8	21	0	17	17	4	0	936	3923
05:35:00 PM	14	96	14	0	4	75	1	0	3	9	22	0	32	15	6	0	895	3857
05:40:00 PM	16	146	12	0	7	113	5	0	2	5	28	0	7	10	7	0	921	3890
05:45:00 PM	37	111	14	0	2	81	3	0	3	7	43	0	11	14	6	0	981	3869
05:50:00 PM	21	93	9	0	6	72	1	0	2	5	27	0	13	8	5	0	952	3758
05:55:00 PM	24	117	13	0	12	85	3	0	3	6	16	0	8	11	6	0	898	3745

Appendix C

30th Highest Hour Volumes (30 HV)
Seasonal Adjustment Worksheet
Traffic Volumes

Traffic volumes

Weekday AM Peak Hour

Wallace Rd NW (OR 221) & Riverbend Rd NW

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2017 Existing Volumes (9/12/17)	**5**	**837**	**5**	**6**	**8**	**28**	**20**	**587**	**22**	**107**	**3**	**12**
Growth (2.6%/Yr for 1 Yr)	0	22	0	0	0	1	1	15	1	3	0	0
Count Date Seasonal Factor	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289
Peak Period Seasonal Factor	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168
Count Date Seasonal Factor / Peak Period Seasonal Factor	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132
2018 30th Highest Hour Volume	**5**	**870**	**5**	**6**	**8**	**29**	**21**	**610**	**23**	**111**	**3**	**12**
MWVCOG Estimate	**10**	**1405**	**10**	**15**	**20**	**75**	**25**	**720**	**30**	**115**	**5**	**15**
Riverbend 1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**23**	**9**	**0**	**7**
2035 Background Traffic	**10**	**1405**	**10**	**15**	**20**	**75**	**25**	**720**	**53**	**124**	**5**	**22**
2035 Site Generated Traffic	**0**	**20**	**2**	**0**	**4**	**0**	**0**	**-11**	**57**	**0**	**0**	**16**
2035 Total Traffic	**10**	**1425**	**12**	**15**	**24**	**75**	**25**	**709**	**110**	**124**	**5**	**38**

Riverbend Rd NW & Linwood St NW

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2017 Existing Volumes (9/12/17)	**0**	**7**	**4**	**2**	**27**	**15**	**29**	**0**	**15**	**18**	**67**	**1**
Growth (2.6%/Yr for 1 Yrs)	0	0	0	0	1	0	1	0	0	0	2	0
2018 Traffic Volumes	**0**	**7**	**4**	**2**	**28**	**15**	**30**	**0**	**15**	**18**	**69**	**1**
2035 Background Traffic	**0**	**15**	**10**	**5**	**30**	**15**	**45**	**5**	**25**	**25**	**100**	**5**
2035 Site Generated Traffic	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**0**	**0**	**0**	**0**	**0**
2035 Total Traffic	**0**	**15**	**10**	**5**	**30**	**17**	**49**	**5**	**25**	**25**	**100**	**5**

Wallace Rd NW (OR 221) & Orchard Heights

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2018 Existing Volumes (11/8/18)	**8**	**1206**	**0**	**0**	**0**	**0**	**0**	**679**	**262**	**432**	**0**	**12**
Count Date Seasonal Factor	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479
Peak Period Seasonal Factor	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891
Count Date Seasonal Factor / Peak Period Seasonal Factor	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639
2018 30th Highest Hour Volume	**9**	**1283**	**0**	**0**	**0**	**0**	**0**	**722**	**279**	**460**	**0**	**13**
2035 Background Traffic	**10**	**1385**	**0**	**0**	**0**	**0**	**0**	**815**	**315**	**585**	**0**	**15**
2035 Site Generated Traffic	**0**	**19**	**0**	**0**	**0**	**0**	**0**	**42**	**0**	**0**	**0**	**0**
2035 Total Traffic	**10**	**1404**	**0**	**0**	**0**	**0**	**0**	**857**	**315**	**585**	**0**	**15**

Wallace Rd NW (OR 221) & Glen Creek

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2018 Existing Volumes (11/8/18)	**2**	**1512**	**14**	**15**	**53**	**161**	**51**	**907**	**102**	**483**	**76**	**55**
Count Date Seasonal Factor	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479
Peak Period Seasonal Factor	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891
Count Date Seasonal Factor / Peak Period Seasonal Factor	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639
2018 30th Highest Hour Volume	**2**	**1609**	**15**	**16**	**56**	**171**	**54**	**965**	**109**	**514**	**81**	**59**
2020 Background Traffic	**2**	**1694**	**16**	**17**	**59**	**180**	**57**	**1016**	**115**	**541**	**85**	**62**
2020 Site Generated Traffic												
2020 Total Traffic	**2**	**1694**	**16**	**17**	**59**	**180**	**57**	**1016**	**115**	**541**	**85**	**62**
2035 Background Traffic	**5**	**1710**	**15**	**25**	**75**	**235**	**65**	**1140**	**130**	**1000**	**160**	**115**
2035 Site Generated Traffic	**1**	**16**	**1**	**2**	**0**	**0**	**0**	**38**	**0**	**0**	**0**	**2**
2035 Total Traffic	**6**	**1726**	**16**	**27**	**75**	**235**	**65**	**1178**	**130**	**1000**	**160**	**117**

Wallace Rd NW (OR 221) & North Site Access

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2035 Background Traffic	**0**	**1428**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2035 Site Generated Traffic	**29**	**-6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**25**	**0**	**0**
2035 Total Traffic	**29**	**1422**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**25**	**0**	**0**

Riverbend Rd NW & Site Access

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2035 Background Traffic	**2**	**0**	**32**	**28**	**120**	**0**	**0**	**0**	**0**	**0**	**119**	**2**
2035 Site Generated Traffic			**7**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
2035 Total Traffic	**2**	**0**	**39**	**40**	**120**	**0**	**0**	**0**	**0**	**0**	**119**	**3**

Weekday PM Peak Hour

Wallace Rd NW (OR 221) & Riverbend Rd NW

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2017 Existing Volumes (9/12/17)	**4**	**816**	**18**	**3**	**2**	**25**	**12**	**834**	**104**	**69**	**3**	**8**
Growth (2.6%/Yr for 1 Yr)	0	21	0	0	0	1	0	22	3	2	0	0
Count Date Seasonal Factor	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289	0.9289
Peak Period Seasonal Factor	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168	0.9168
Count Date Seasonal Factor / Peak Period Seasonal Factor	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132
2018 30th Highest Hour Volume	**4**	**848**	**18**	**3**	**2**	**26**	**12**	**867**	**108**	**72**	**3**	**8**
MWVCOG Estimate	**5**	**1270**	**30**	**10**	**5**	**75**	**20**	**1450**	**180**	**50**	**5**	**5**
Riverbend 1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**19**	**35**	**0**	**29**
2035 Background Traffic	**5**	**1270**	**30**	**10**	**5**	**75**	**20**	**1450**	**199**	**85**	**5**	**34**
2035 Site Generated Traffic	**0**	**19**	**2**	**0**	**1**	**0**	**0**	**-11**	**26**	**0**	**0**	**10**
2035 Total Traffic	**5**	**1289**	**32**	**10**	**6**	**75**	**20**	**1439**	**225**	**85**	**5**	**44**

Riverbend Rd NW & Linwood St NW

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2017 Existing Volumes (9/12/17)	**0**	**1**	**1**	**6**	**80**	**9**	**22**	**1**	**38**	**29**	**63**	**0**
Growth (2.6%/Yr for 1 Yrs)	0	0	0	0	2	0	1	0	1	1	2	0
2018 Traffic Volumes	**0**	**1**	**1**	**6**	**82**	**9**	**23**	**1**	**39**	**30**	**65**	**0**
2035 Background Traffic	**5**	**10**	**10**	**10**	**125**	**15**	**35**	**5**	**65**	**50**	**105**	**5**
2035 Site Generated Traffic	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**
2035 Total Traffic	**5**	**10**	**10**	**10**	**125**	**17**	**36**	**5**	**65**	**50**	**105**	**5**

Wallace Rd NW (OR 221) & Orchard Heights

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2018 Existing Volumes (11/7/18)	**18**	**1057**	**0**	**0**	**0**	**0**	**0**	**1228**	**292**	**286**	**0**	**19**
Count Date Seasonal Factor	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479
Peak Period Seasonal Factor	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891
Count Date Seasonal Factor / Peak Period Seasonal Factor	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639
2018 30th Highest Hour Volume	**19**	**1125**	**0**	**0**	**0**	**0**	**0**	**1306**	**311**	**304**	**0**	**20**
2035 Background Traffic	**25**	**1375**	**0**	**0**	**0**	**0**	**0**	**1610**	**385**	**560**	**0**	**40**
2035 Site Generated Traffic	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**0**	**0**
2035 Total Traffic	**25**	**1393**	**0**	**0**	**0**	**0**	**0**	**1624**	**385**	**560**	**0**	**40**

Wallace Rd NW (OR 221) & Glen Creek

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2018 Existing Volumes (11/7/18)	**23**	**1192**	**57**	**86**	**186**	**283**	**191**	**1347**	**274**	**265**	**113**	**64**
Count Date Seasonal Factor	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479	0.9479
Peak Period Seasonal Factor	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891
Count Date Seasonal Factor / Peak Period Seasonal Factor	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639	1.0639
2018 30th Highest Hour Volume	**24**	**1268**	**61**	**91**	**198**	**301**	**203**	**1433**	**291**	**282**	**120**	**68**
2035 Background Traffic	**30**	**1520**	**75**	**80**	**175**	**265**	**295**	**2070**	**420**	**465**	**200**	**115**
2035 Site Generated Traffic	**1**	**16**	**1**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**1**
2035 Total Traffic	**31**	**1536**	**76**	**80**	**175**	**265**	**295**	**2082**	**420**	**465**	**200**	**116**

Wallace Rd NW (OR 221) & North Site Access

Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2035 Background Traffic	**0**	**1306**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2035 Site Generated Traffic	**29**	**-6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**27**	**0**	**0**
2035 Total Traffic	**29**	**1300**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**27**	**0**	**0**

Riverbend Rd NW & Site Access

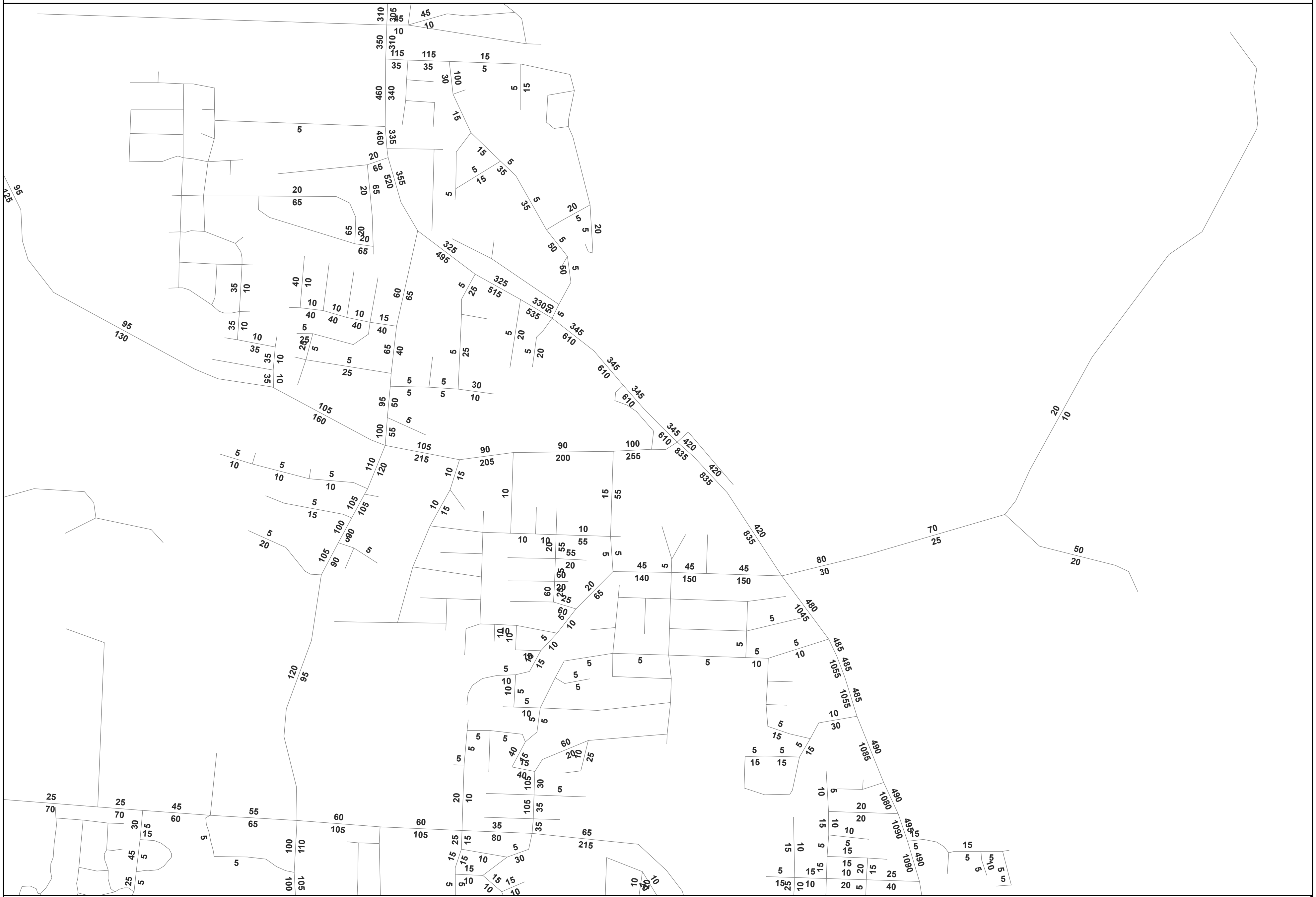
Movement	SB RT	SB TH	SB LT	WB RT	WB TH	WB LT	NB RT	NB TH	NB LT	EB RT	EB TH	EB LT
2035 Background Traffic	**2**	**0**	**81**	**36**	**120**	**0**	**0**	**0**	**0**	**0**	**119**	**2**
2035 Site Generated Traffic	**3**	**0**	**23**	**28**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
2035 Total Traffic	**5**	**0**	**104**	**64**	**120**	**0**	**0**	**0**	**0**	**0**	**119**	**4**

Appendix D

Mid-Willamette Valley Council of Governments Travel Demand Model Output Sheets

2010 AM Peak Volume Demand

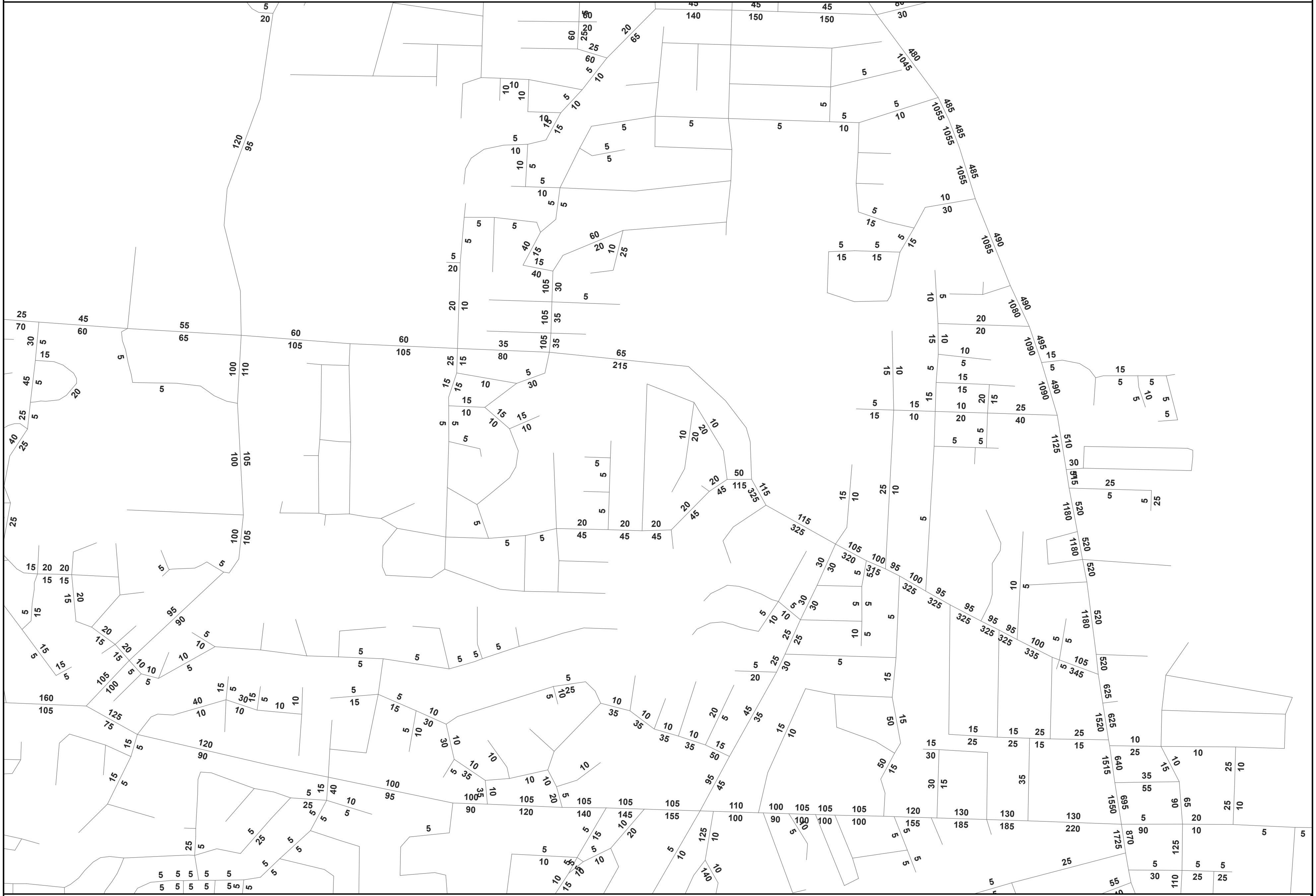
Riverbend/Doaks Ferry/Wallace



2018 Mid-Willamette Valley Council of Governments

2010 AM Peak Volume Demand

Doaks Ferry/Glen Creek/Wallace



2018 Mid-Willamette Valley Council of Governments

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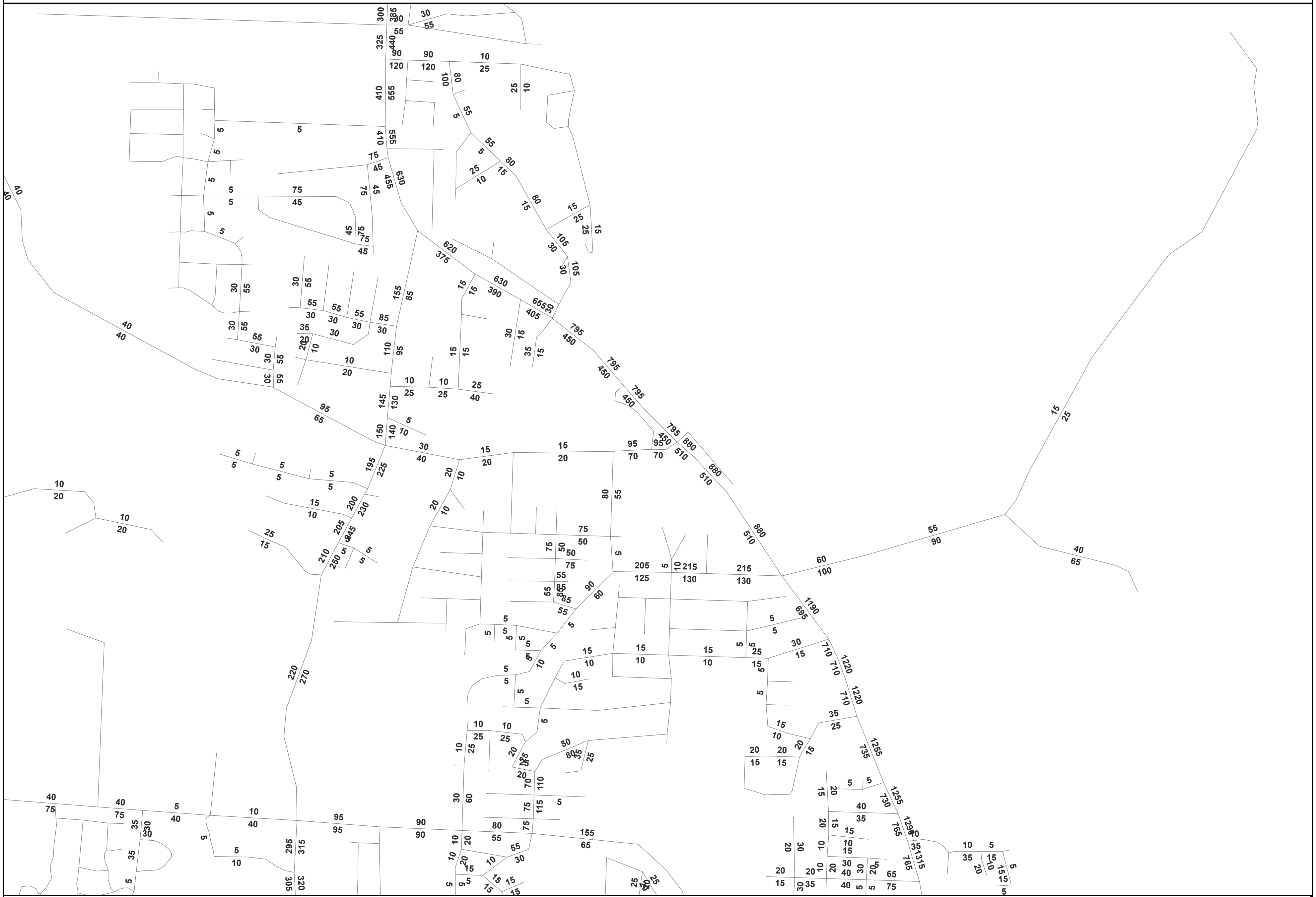
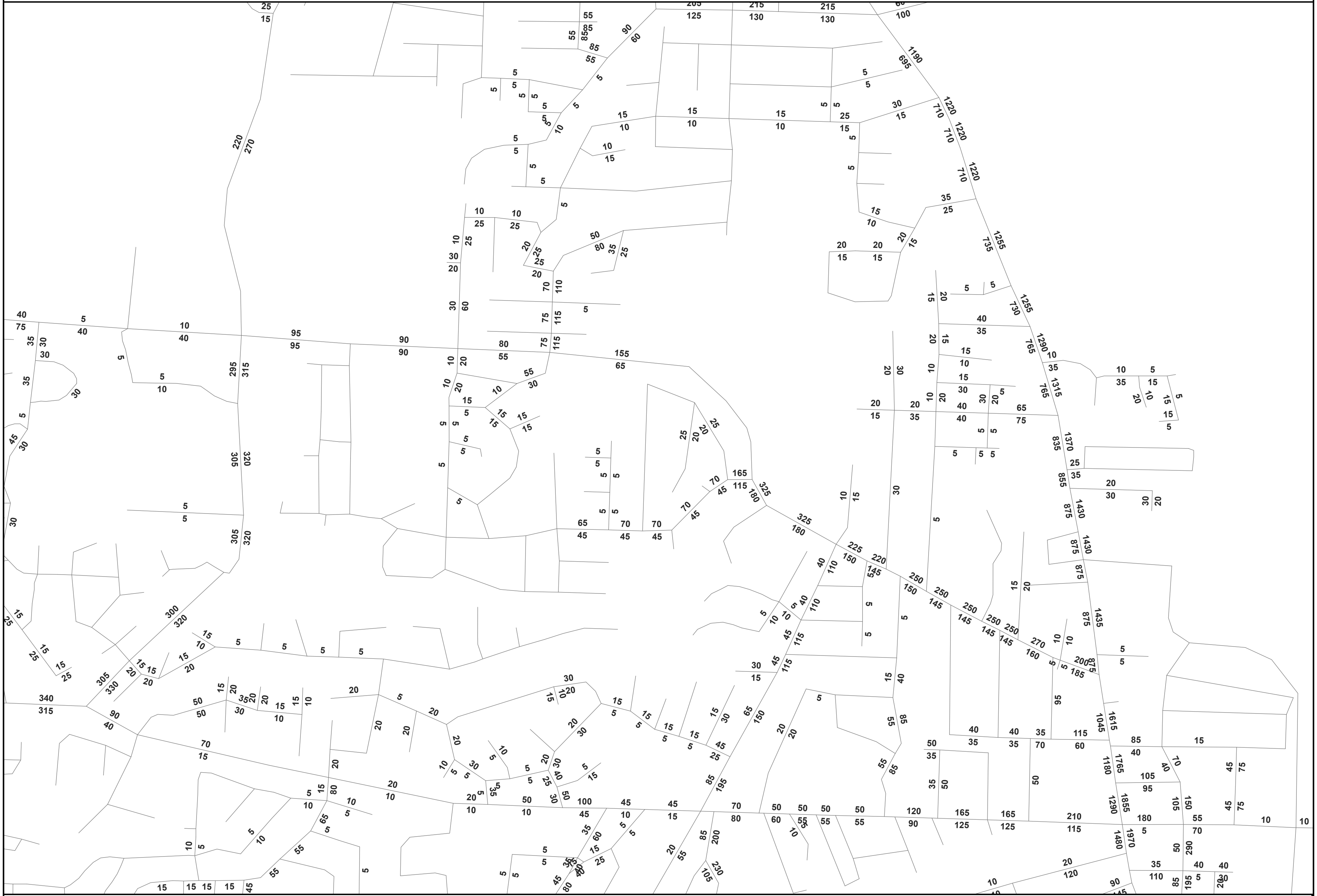
2010 PM Peak Volume Demand
Riverbend/Doaks Ferry/Wallace



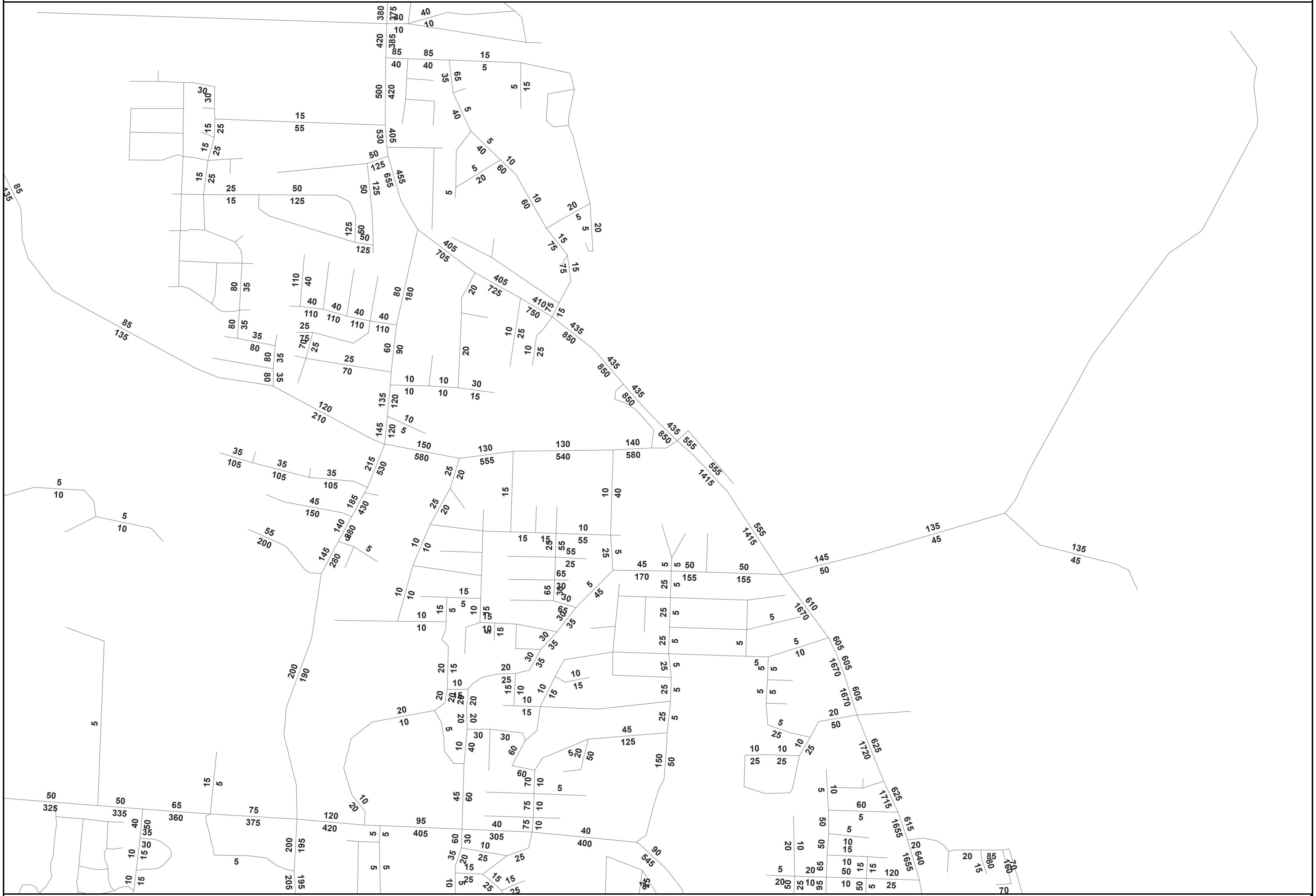
2010 PM Peak Volume Demand

Doaks Ferry/Glen Creek/Wallace



2035 AM Peak Volume Demand

Riverbend/Doaks Ferry/Wallace



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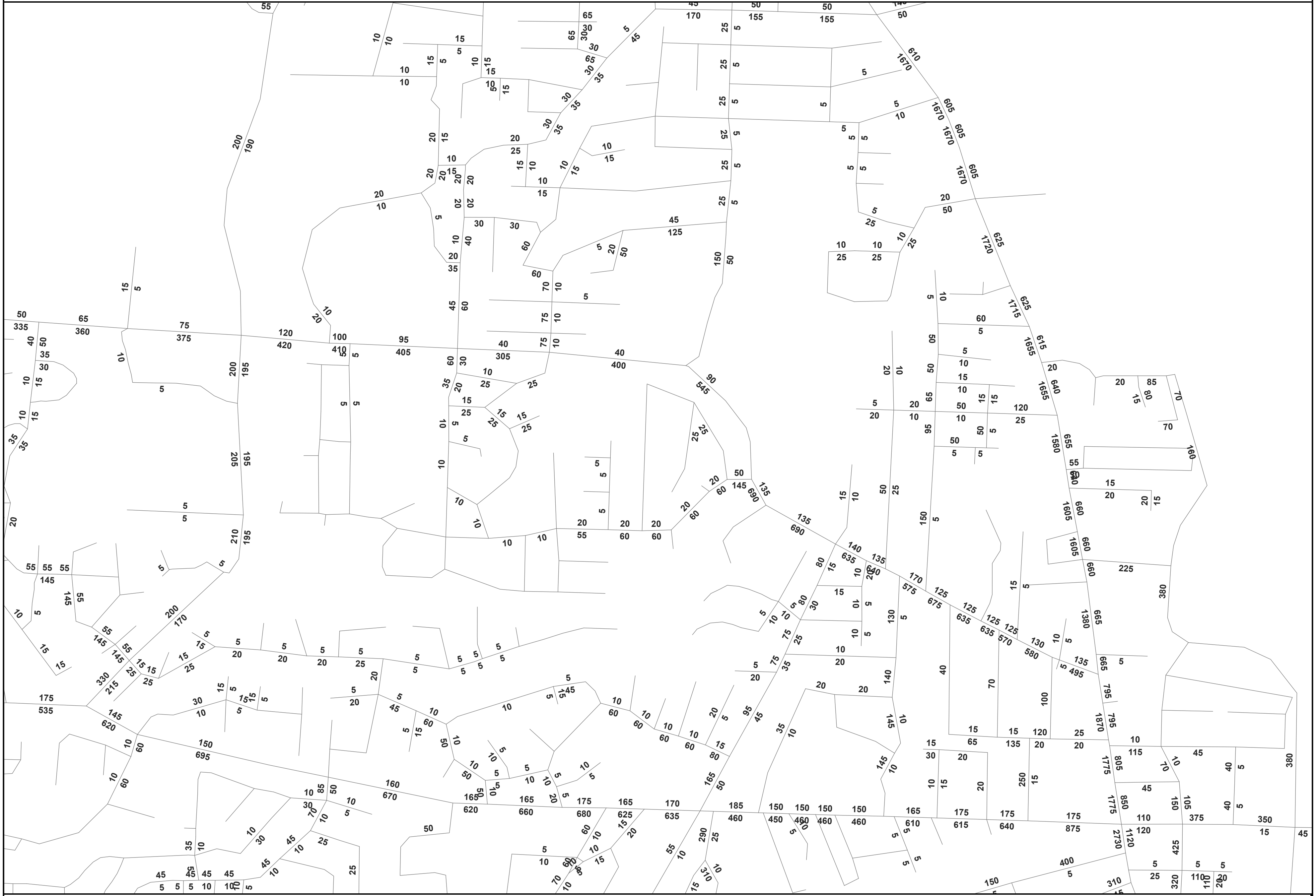
2035 AM Peak Volume Demand

Doaks Ferry/Glen Creek/Wallace



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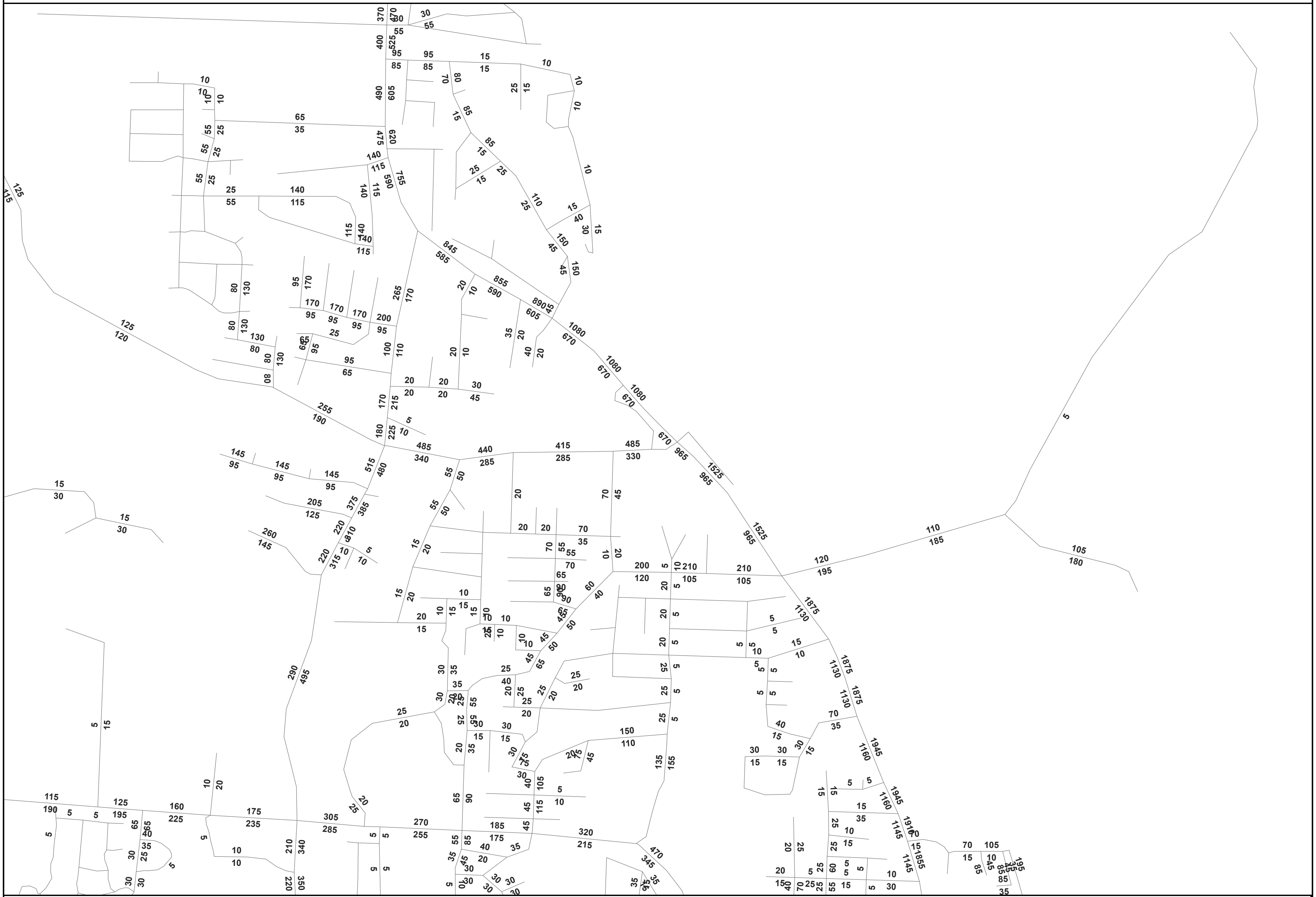
2035 PM Peak Volume Demand

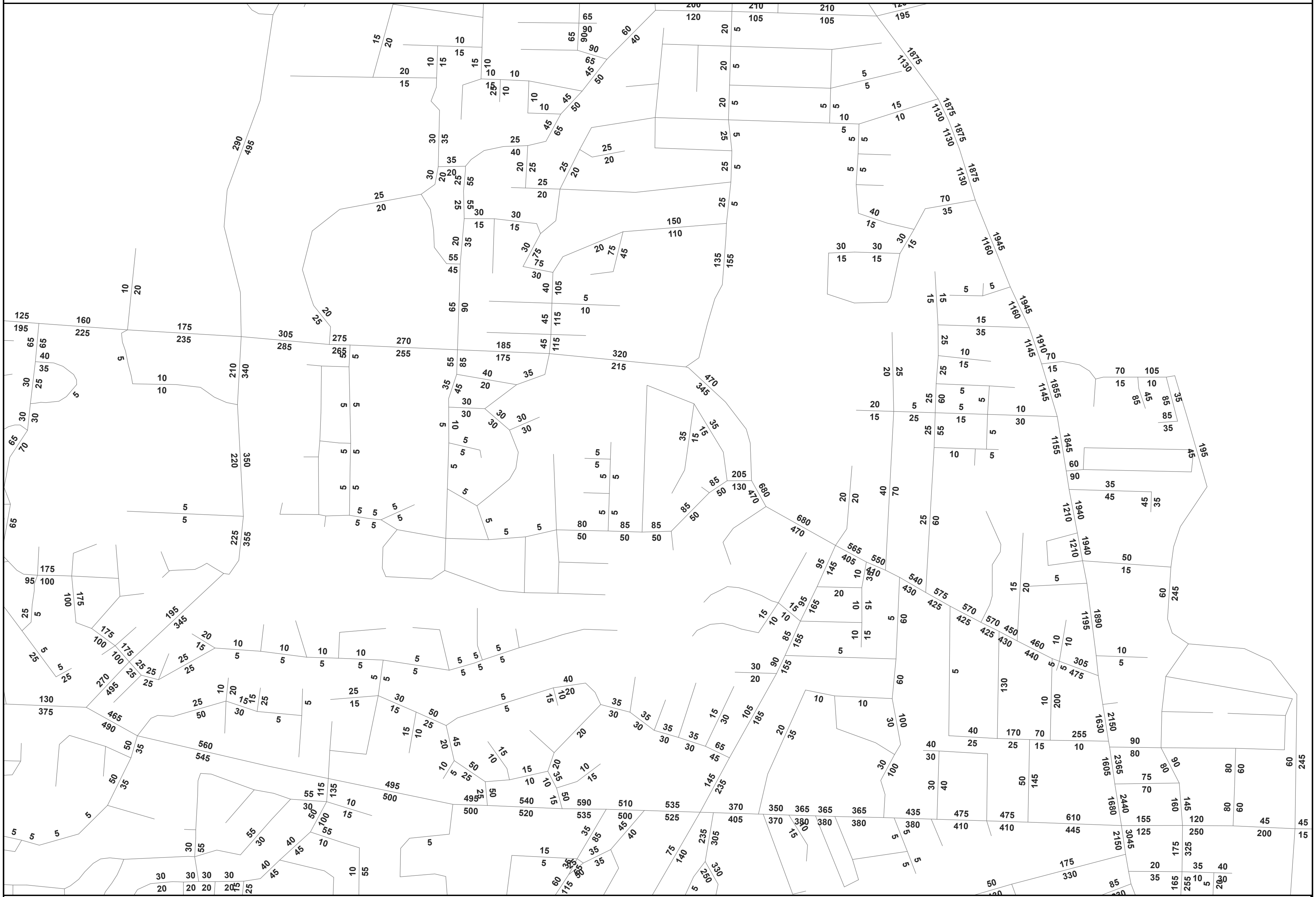
Riverbend/Doaks Ferry/Wallace



2018 Mid-Willamette Valley Council of Governments

2035 PM Peak Volume Demand

Doaks Ferry/Glen Creek/Wallace



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Appendix E

2035 Volumes Post Processing Worksheet

Estimated 2035 Background Traffic Volumes

Weekday AM Peak Hour

Wallace/Riverbend

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	Rounded	
WB	42	80	145	1.033	103	145	107	75		-42.667	**107**	**110**	Difference
SB	858	835	1415	1.028	1040	1415	1438	1405		-2.349	**1421.5**	**1420**	Average
EB	123	150	155	1.001	152	155	128	126		-1.587	**127**	**130**	Average
NB	637	480	610	1.011	523	610	767	773		0.776	**770**	**770**	Average
Sum	1660	1545									**2425.5**	**2430**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	12	3	108	28	8	6	22	595		20	5	848	5
Approach Vol			123			42				637			858
% of movement	0.098	0.024	0.878	0.667	0.190	0.143	0.035	0.934		0.031	0.006	0.988	0.006
PP Link Vol			130			110				770			1420
Final	**13**	**3**	**114**	**73**	**21**	**16**	**27**	**719**		**24**	**8**	**1403**	**8**
Rounded	**15**	**5**	**115**	**75**	**20**	**15**	**30**	**720**		**25**	**10**	**1405**	**10**

Riverbend/Linwood

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	
WB	44	45	50	1.004	47	50	49	48		-2.083	**50**	Difference
SB	11	5	5	1.000	5	5	11	11		0.000	**25**	Estimated Minimum
EB	86	140	170	1.009	150	170	116	100		-16.000	**125**	Estimated Minimum
NB	44	0	5	#DIV/0!	#DIV/0!	5	49	#DIV/0!		#DIV/0!	**65**	Estimated Minimum
Sum	185	190									**265**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	1	66	18	14	27	2	15	0		27	4	7	0
Approach Vol			85			43				42			11
% of movement	0.012	0.776	0.212	0.326	0.628	0.047	0.357	0.000		0.643	0.364	0.636	0.000
PP Link Vol			125			50				65			25
Final	**1**	**97**	**26**	**16**	**31**	**2**	**23**	**0**		**42**	**9**	**16**	**0**
Rounded	**5**	**100**	**25**	**15**	**30**	**5**	**25**	**5**		**45**	**10**	**15**	**5**

Wallace/Orchard Heights

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	Rounded	
WB	0	0	0	#DIV/0!	#DIV/0!	0	0	#DIV/0!		#DIV/0!	**5**	**5**	
SB	1214	1180	1380	1.007	1246	1380	1414	1371		-3.136	**1392.5**	**1395**	Average
EB	444	345	495	1.017	396	495	594	606		1.980	**600**	**600**	Average
NB	941	625	795	1.011	682	795	1111	1143		2.800	**1127**	**1130**	Average
Sum	2599	2150									**3124.5**	**3130**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	12	0	432	0	0	0	262	679		0	0	1206	8
Approach Vol			444			0				941			1214
% of movement	0.027	0.000	0.973	#DIV/0!	#DIV/0!	#DIV/0!	0.278	0.722		0.000	0.000	0.993	0.007
PP Link Vol			600							1130			1395
Final	**16**	**0**	**584**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**315**	**815**		**0**	**0**	**1386**	**9**
Rounded	**15**	**0**	**585**	**0**	**0**	**0**	**315**	**815**		**0**	**0**	**1385**	**10**

Wallace/Glen Creek

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	Rounded	
WB	226	5	110	1.840	657	110	331	1E+007		99.997	**331**	**330**	Difference
SB	1528	1550	1775	1.006	1623	1775	1753	1696		-3.361	**1724.5**	**1725**	Average
EB	615	220	875	1.119	541	875	1270	4661		72.753	**1270**	**1270**	Difference
NB	1080	870	1120	1.011	953	1120	1330	1327		-0.226	**1328.5**	**1330**	Average
Sum	3449	2645									**4654**	**4655**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	55	76	483	161	53	15	102	907		51	14	1512	2
Approach Vol			614			229				1060			1528
% of movement	0.090	0.124	0.787	0.703	0.231	0.066	0.096	0.856		0.048	0.009	0.990	0.001
PP Link Vol			1270			330				1330			1725
Final	**114**	**157**	**999**	**232**	**76**	**22**	**128**	**1138**		**64**	**16**	**1707**	**2**
Rounded	**115**	**160**	**1000**	**235**	**75**	**25**	**130**	**1140**		**65**	**15**	**1710**	**5**

Weekday PM Peak Hour

Wallace/Riverbend

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	Rounded	
WB	30	60	120	1.040	82	120	90	61		-47.541	**90**	**90**	Difference
SB	849	510	965	1.036	675	965	1304	1596		18.296	**1304**	**1305**	Difference
EB	81	130	105	0.992	122	105	56	70		20.000	**56**	**55**	Difference
NB	962	1190	1875	1.023	1428	1875	1647	1449		-13.665	**1647**	**1650**	Difference
Sum	1922	1890									**3097**	**3100**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	8	3	70	25	2	3	105	845		12	18	827	4
Approach Vol			81			30				962			849
% of movement	0.099	0.037	0.864	0.833	0.067	0.100	0.109	0.878		0.012	0.021	0.974	0.005
PP Link Vol			55			90				1650			1305
Final	**5**	**2**	**48**	**75**	**6**	**9**	**180**	**1449**		**21**	**28**	**1271**	**6**
Rounded	**5**	**5**	**50**	**75**	**5**	**10**	**180**	**1450**		**20**	**30**	**1270**	**5**

Riverbend/Linwood

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	
WB	95	215	205	0.998	212	205	85	92		7.609	**150**	Estimated Minimum
SB	2	5	5	1.000	5	5	2	2		0.000	**15**	Estimated Minimum
EB	92	0	120	#DIV/0!	#DIV/0!	120	212	#DIV/0!		#DIV/0!	**150**	Estimated Minimum
NB	61	0	10	#DIV/0!	#DIV/0!	10	71	#DIV/0!		#DIV/0!	**100**	Estimated Minimum
Sum	250	220									**415**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	0	63	29	9	80	6	38	1		22	1	1	0
Approach Vol			92			95				61			2
% of movement	0.000	0.685	0.315	0.095	0.842	0.063	0.623	0.016		0.361	0.500	0.500	0.000
PP Link Vol			150			150				100			15
Final	**0**	**103**	**47**	**14**	**126**	**9**	**62**	**2**		**36**	**8**	**8**	**0**
Rounded	**5**	**105**	**50**	**15**	**125**	**10**	**65**	**5**		**35**	**10**	**10**	**5**

Wallace/Orchard Heights

Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	Rounded	
WB	0	0	0	#DIV/0!	#DIV/0!	0	0	#DIV/0!		#DIV/0!	**5**	**5**	
SB	1075	875	1195	1.015	983	1195	1395	1396		0.072	**1395.5**	**1395**	Average
EB	305	185	475	1.063	301	475	595	911		34.687	**595**	**595**	Difference
NB	1520	1615	2150	1.013	1794	2150	2055	1926		-6.698	**1990.5**	**1990**	Average
Sum	2900	2675									**3986**	**3985**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	19	0	286	0	0	0	292	1228		0	0	1057	18
Approach Vol			305			0				1520			1075
% of movement	0.062	0.000	0.938	#DIV/0!	#DIV/0!	#DIV/0!	0.192	0.808		0.000	0.000	0.983	0.017
PP Link Vol			595							1990			1395
Final	**37**	**0**	**558**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**382**	**1608**		**0**	**0**	**1372**	**23**
Rounded	**40**	**0**	**560**	**0**	**0**	**0**	**385**	**1610**		**0**	**0**	**1375**	**25**

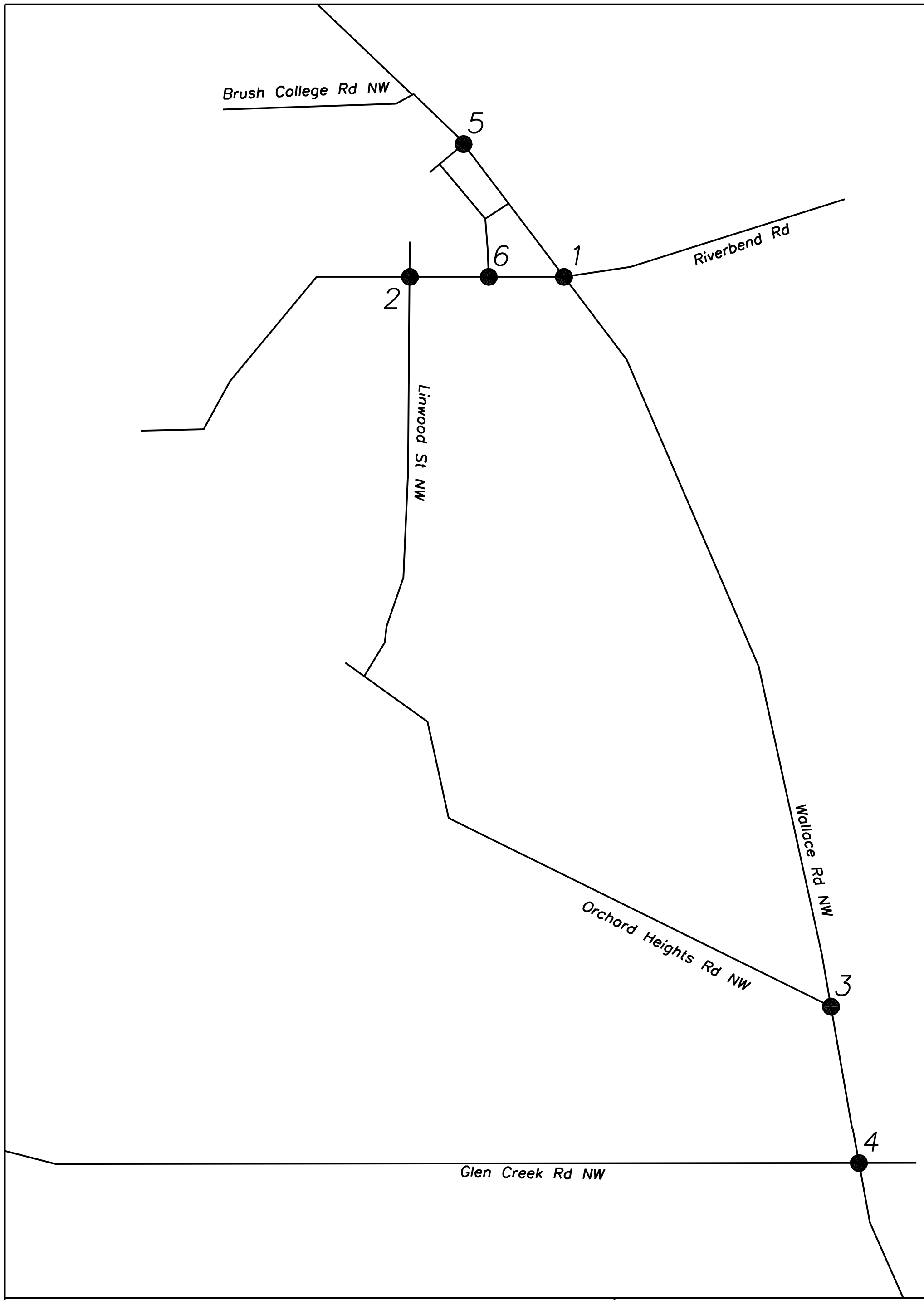
Wallace/Glen Creek

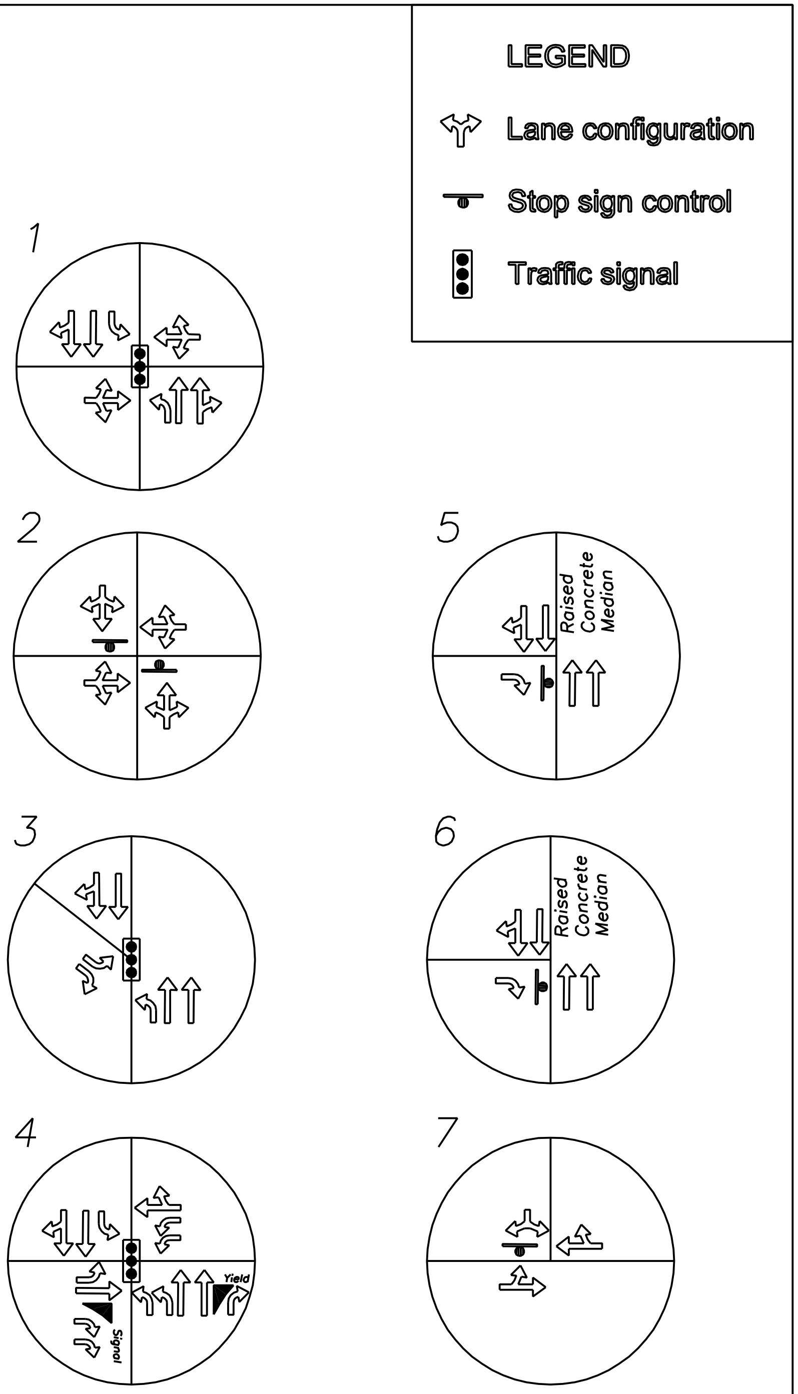
Link	Existing	2010 Model	2035 Model	Annual Growth Rate	Base Adjust to Existing Year	Future Adjust to Project Year	Difference Method	Growth Method		% Difference	Selected Method	Rounded	
WB	555	180	155	0.994	172	155	530	502		-5.578	**516**	**515**	Average
SB	1272	1290	1680	1.012	1420	1680	1662	1579		-5.256	**1620.5**	**1620**	Average
EB	442	115	445	1.115	274	445	772	3125		75.296	**772**	**775**	Difference
NB	1812	1970	3045	1.022	2341	3045	2887	2673		-8.006	**2780**	**2780**	Average
Sum	4081	3555									**5688.5**	**5690**	

Turning Volumes	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH		NBRT	SBLT	SBTH	SBRT
Existing	64	113	265	283	186	86	274	1347		191	57	1192	23
Approach Vol			442			555				1812			1272
% of movement	0.145	0.256	0.600	0.510	0.335	0.155	0.151	0.743		0.105	0.045	0.937	0.018
PP Link Vol			775			515				2780			1620
Final	**112**	**198**	**465**	**263**	**173**	**80**	**420**	**2067**		**293**	**73**	**1518**	**29**
Rounded	**115**	**200**	**465**	**265**	**175**	**80**	**420**	**2070**		**295**	**75**	**1520**	**30**

Appendix F

Traffic Flow Figures



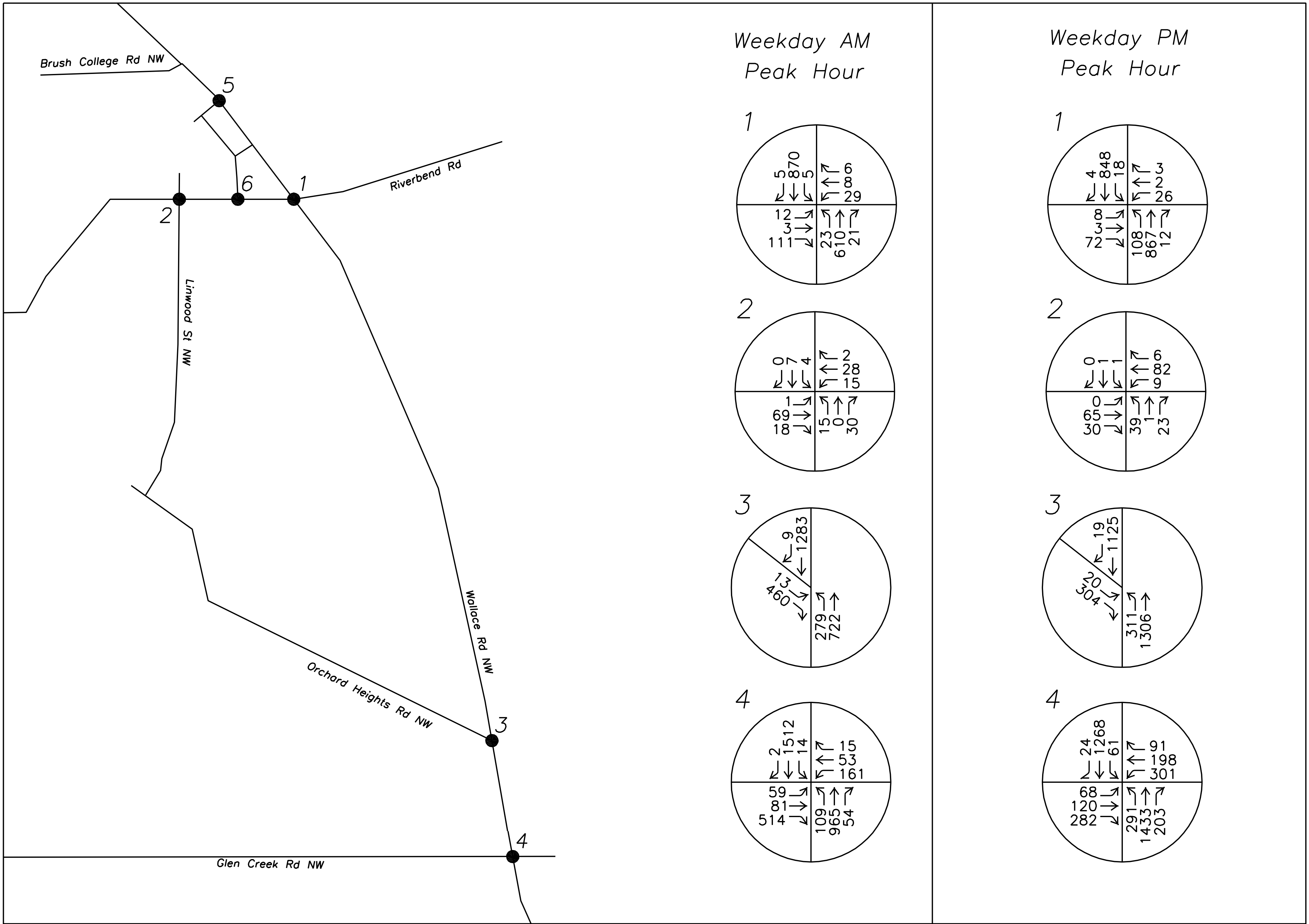


GREENLIGHT ENGINEERING
TRAFFIC ENGINEERING/TRANSPORTATION PLANNING

NOTES:

Intersection Control
& Lane Channelization

FIGURE
1

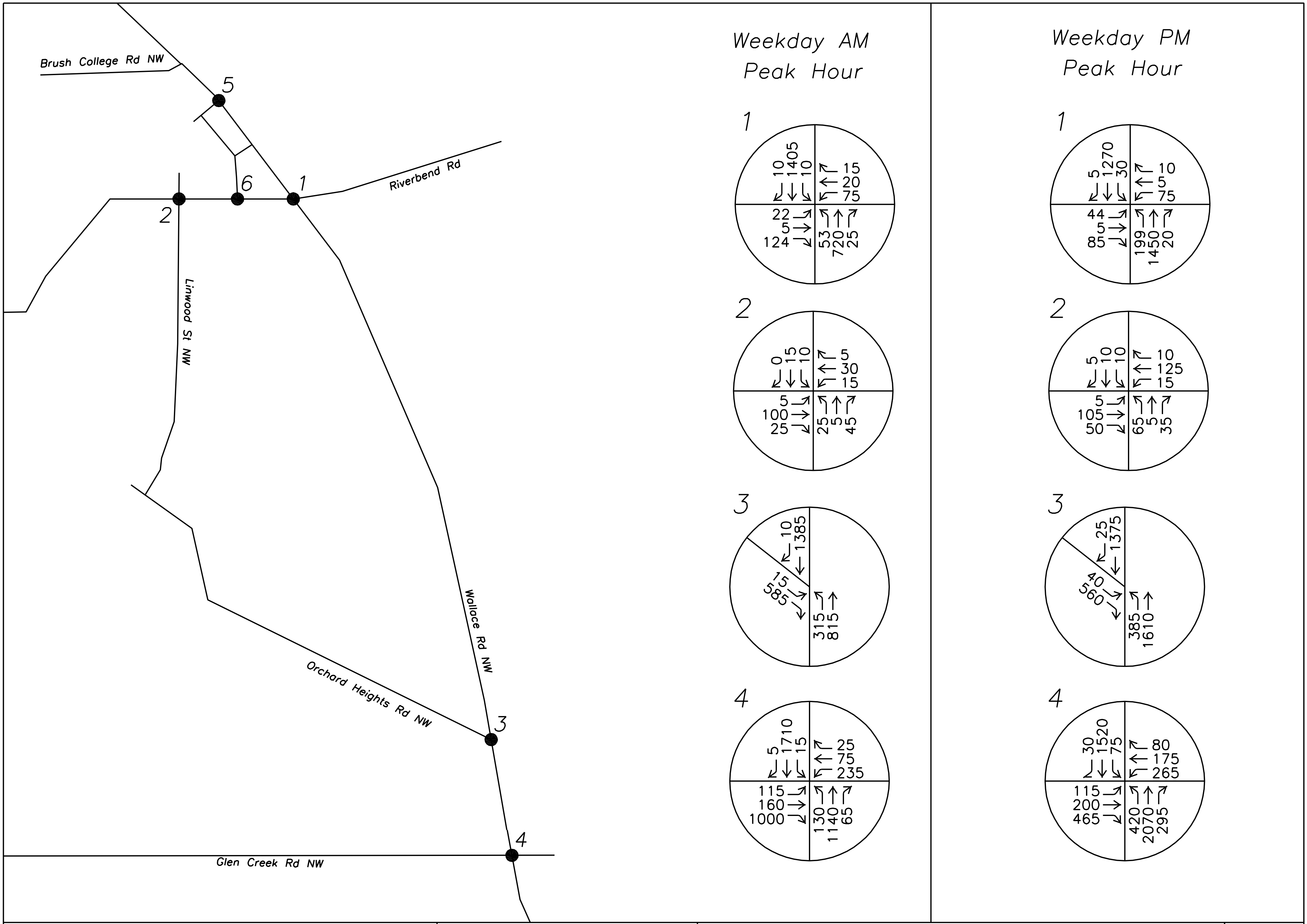


GREENLIGHT ENGINEERING
TRAFFIC ENGINEERING/TRANSPORTATION PLANNING

NOTES:
ODOT Intersections
Seasonally Adjusted (30 HV)

2018 Existing Traffic
Weekday AM & PM Peak Hours

FIGURE
2



GREENLIGHT ENGINEERING

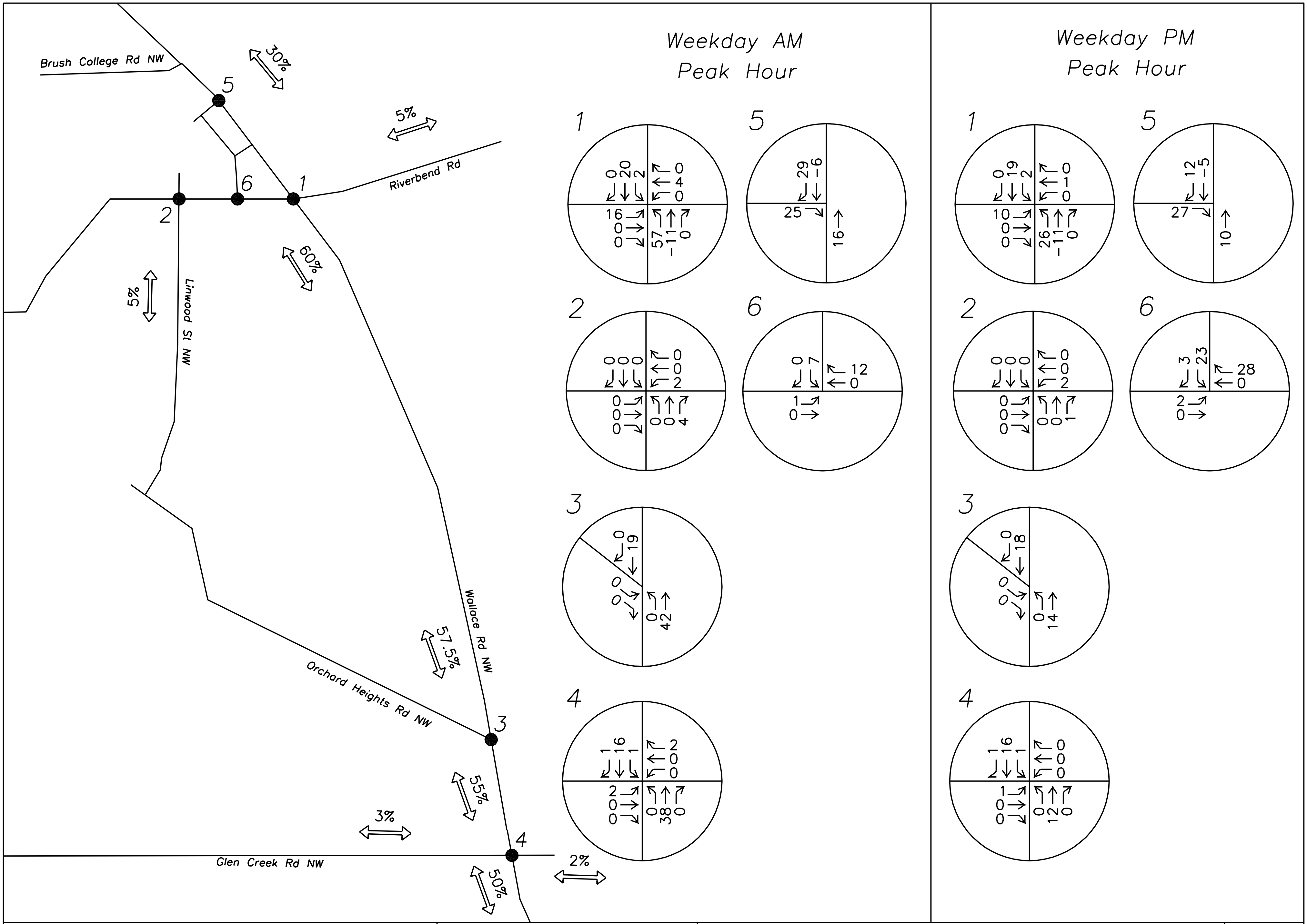
TRAFFIC ENGINEERING/TRANSPORTATION PLANNING

NOTES:
Post Processed 2010/2035
MWVCOG Link Volumes

2035 Background Traffic
Weekday AM & PM Peak Hours

FIGURE

3

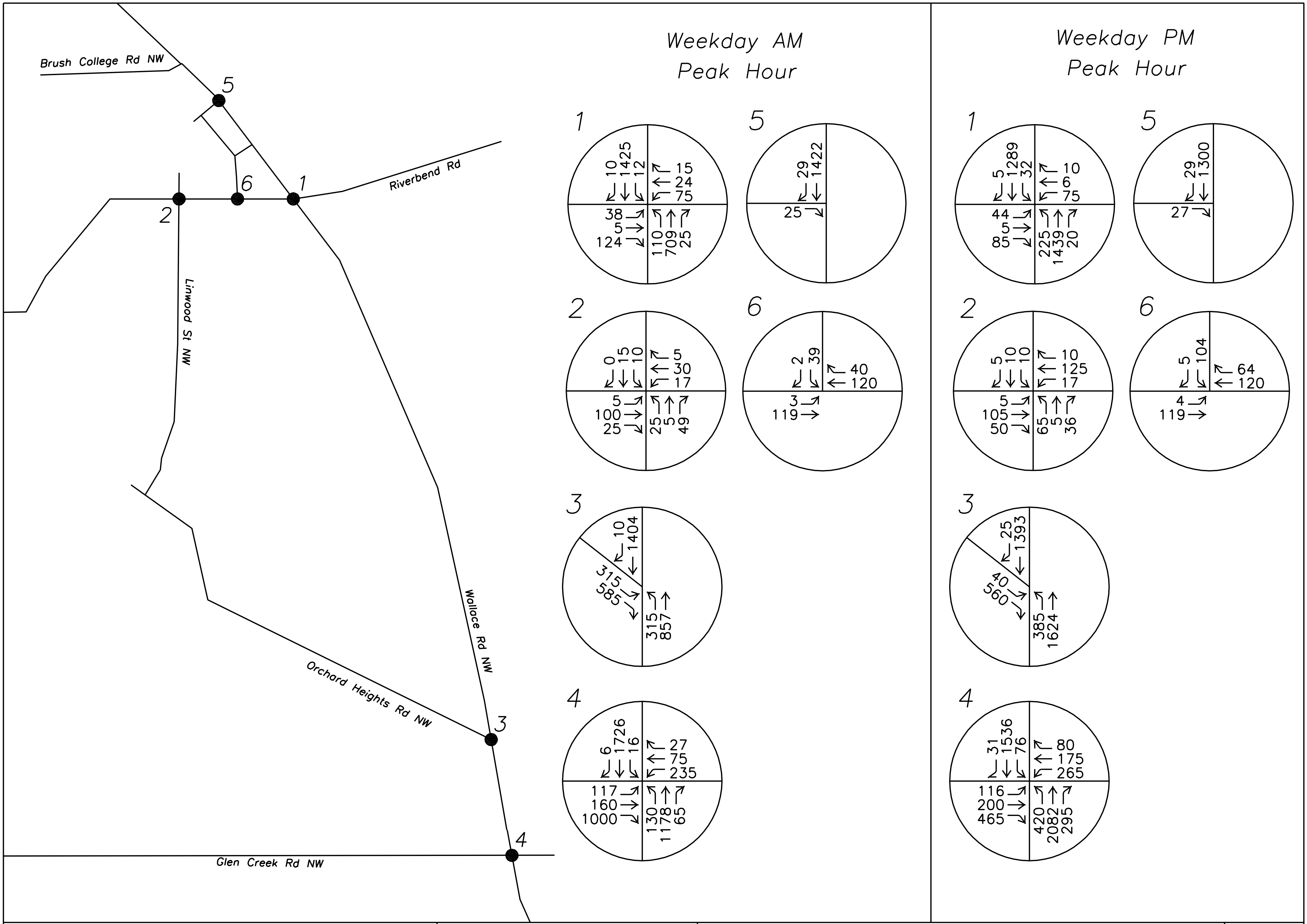


GREENLIGHT ENGINEERING
TRAFFIC ENGINEERING/TRANSPORTATION PLANNING

NOTES:
Primary and Pass-By Trips

2035 Net New Trip Distribution
Weekday AM & PM Peak Hours

FIGURE
4



GREENLIGHT ENGINEERING
TRAFFIC ENGINEERING/TRANSPORTATION PLANNING

NOTES:
2035 Background Traffic +
Net New Trip Distribution

2035 Total Traffic
Weekday AM & PM Peak Hours

FIGURE
5

Appendix G

Trip Generation
Internal Capture Worksheet

NCHRP 684 Internal Trip Capture Estimation Tool

Project Name:	Riverbend Phase 2	**Organization:**	Greenlight Engineering
Project Location:		**Performed By:**	Rick Nys
Scenario Description:	Weekday AM Peak Hour	**Date:**	11/28/18
Analysis Year:	2035	**Checked By:**	
Analysis Period:	**AM Street Peak Hour**	**Date:**	

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				20	18	2
Retail				187	113	74
Restaurant				32	18	14
Cinema/Entertainment				0		
Residential				65	17	48
Hotel				0		
All Other Land Uses[2]				0		
				304	166	138

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	1	0	0	0
Retail	1		9	0	0	0
Restaurant	3	2		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	0	4	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	304	166	138
Internal Capture Percentage	14%	13%	16%
External Vehicle-Trips[5]	260	144	116
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	28%	50%
Retail	2%	14%
Restaurant	78%	43%
Cinema/Entertainment	N/A	N/A
Residential	6%	10%
Hotel	N/A	N/A

[1] Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3] Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4] Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

[6] Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Riverbend Phase 2
Analysis Period:	**AM Street Peak Hour**

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-A (D): Entering Trips			Table 7-A (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	18	18	1.00	2	2
Retail	1.00	113	113	1.00	74	74
Restaurant	1.00	18	18	1.00	14	14
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	17	17	1.00	48	48
Hotel	1.00	0	0	1.00	0	0

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1	1	0	0	0
Retail	21		10	0	10	0
Restaurant	4	2		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	0	10	0		0
Hotel	0	0	0	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		36	4	0	0	0
Retail	1		9	0	0	0
Restaurant	3	9		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	19	4	0		0
Hotel	1	5	1	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	5	13	18	13	0	0
Retail	2	111	113	111	0	0
Restaurant	14	4	18	4	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	1	16	17	16	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	1	1	2	1	0	0
Retail	10	64	74	64	0	0
Restaurant	6	8	14	8	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	5	43	48	43	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A

[2] Person-Trips

[3] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 684 Internal Trip Capture Estimation Tool

Project Name:		**Organization:**	
Project Location:		**Performed By:**	
Scenario Description:		**Date:**	
Analysis Year:		**Checked By:**	
Analysis Period:	**PM Street Peak Hour**	**Date:**	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				85	14	71
Retail				217	104	113
Restaurant				30	18	12
Cinema/Entertainment				0		
Residential				106	67	39
Hotel				0		
All Other Land Uses[2]				0		
				438	203	235

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		8	0	0	1	0
Retail	2		5	0	29	0
Restaurant	0	5		0	2	0
Cinema/Entertainment	0	0	0		0	0
Residential	2	10	3	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	438	203	235
Internal Capture Percentage	31%	33%	29%
External Vehicle-Trips[5]	304	136	168
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	29%	13%
Retail	22%	32%
Restaurant	44%	58%
Cinema/Entertainment	N/A	N/A
Residential	48%	38%
Hotel	N/A	N/A

[1] Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3] Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4] Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-P, 9-P (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6] Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	0
Analysis Period:	**PM Street Peak Hour**

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-P (D): Entering Trips				Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*		Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	14	14		1.00	71	71
Retail	1.00	104	104		1.00	113	113
Restaurant	1.00	18	18		1.00	12	12
Cinema/Entertainment	1.00	0	0		1.00	0	0
Residential	1.00	67	67		1.00	39	39
Hotel	1.00	0	0		1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		14	3	0	1	0
Retail	2		33	5	29	6
Restaurant	0	5		1	2	1
Cinema/Entertainment	0	0	0		0	0
Residential	2	16	8	0		1
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		8	0	0	3	0
Retail	4		5	0	31	0
Restaurant	4	52		0	11	0
Cinema/Entertainment	1	4	1		3	0
Residential	8	10	3	0		0
Hotel	0	2	1	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates				External Trips by Mode*		
	Internal	External	Total		Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	4	10	14		10	0	0
Retail	23	81	104		81	0	0
Restaurant	8	10	18		10	0	0
Cinema/Entertainment	0	0	0		0	0	0
Residential	32	35	67		35	0	0
Hotel	0	0	0		0	0	0
All Other Land Uses[3]	0	0	0		0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates				External Trips by Mode*		
	Internal	External	Total		Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	9	62	71		62	0	0
Retail	36	77	113		77	0	0
Restaurant	7	5	12		5	0	0
Cinema/Entertainment	0	0	0		0	0	0
Residential	15	24	39		24	0	0
Hotel	0	0	0		0	0	0
All Other Land Uses[3]	0	0	0		0	0	0

[1] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

[2] Person-Trips

[3] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

Table 7.1a Adjusted Internal Trip Capture Rates for Trip Origins within a Multi-Use Development

Land Use Pairs		Weekday	
		AM Peak Hour	PM Peak Hour
From OFFICE	To Office	0.0%	0.0%
	To Retail	28.0%	20.0%
	To Restaurant	63.0%	4.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	1.0%	2.0%
	To Hotel	0.0%	0.0%
From RETAIL	To Office	29.0%	2.0%
	To Retail	0.0%	0.0%
	To Restaurant	13.0%	29.0%
	To Cinema/Entertainment	0.0%	4.0%
	To Residential	14.0%	26.0%
	To Hotel	0.0%	5.0%
From RESTAURANT	To Office	31.0%	3.0%
	To Retail	14.0%	41.0%
	To Restaurant	0.0%	0.0%
	To Cinema/Entertainment	0.0%	8.0%
	To Residential	4.0%	18.0%
	To Hotel	3.0%	7.0%
From CINEMA/ENTERTAINMENT	To Office	0.0%	2.0%
	To Retail	0.0%	21.0%
	To Restaurant	0.0%	31.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	0.0%	8.0%
	To Hotel	0.0%	2.0%
From RESIDENTIAL	To Office	2.0%	4.0%
	To Retail	1.0%	42.0%
	To Restaurant	20.0%	21.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	0.0%	0.0%
	To Hotel	0.0%	3.0%
From HOTEL	To Office	75.0%	0.0%
	To Retail	14.0%	16.0%
	To Restaurant	9.0%	68.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	0.0%	2.0%
	To Hotel	0.0%	0.0%

Table 7.2a Adjusted Internal Trip Capture Rates for Trip Destinations within a Multi-Use Development

Land Use Pairs		Weekday	
		AM Peak Hour	PM Peak Hour
To OFFICE	From Office	0.0%	0.0%
	From Retail	4.0%	31.0%
	From Restaurant	14.0%	30.0%
	From Cinema/Entertainment	0.0%	6.0%
	From Residential	3.0%	57.0%
	From Hotel	3.0%	0.0%
To RETAIL	From Office	32.0%	8.0%
	From Retail	0.0%	0.0%
	From Restaurant	8.0%	50.0%
	From Cinema/Entertainment	0.0%	4.0%
	From Residential	17.0%	10.0%
	From Hotel	4.0%	2.0%
To RESTAURANT	From Office	23.0%	2.0%
	From Retail	50.0%	29.0%
	From Restaurant	0.0%	0.0%
	From Cinema/Entertainment	0.0%	3.0%
	From Residential	20.0%	14.0%
	From Hotel	6.0%	5.0%
To CINEMA/ENTERTAINMENT	From Office	0.0%	1.0%
	From Retail	0.0%	26.0%
	From Restaurant	0.0%	32.0%
	From Cinema/Entertainment	0.0%	0.0%
	From Residential	0.0%	0.0%
	From Hotel	0.0%	0.0%
To RESIDENTIAL	From Office	0.0%	4.0%
	From Retail	2.0%	46.0%
	From Restaurant	5.0%	16.0%
	From Cinema/Entertainment	0.0%	4.0%
	From Residential	0.0%	0.0%
	From Hotel	0.0%	0.0%
To HOTEL	From Office	0.0%	0.0%
	From Retail	0.0%	17.0%
	From Restaurant	4.0%	71.0%
	From Cinema/Entertainment	0.0%	1.0%
	From Residential	0.0%	12.0%
	From Hotel	0.0%	0.0%

NCHRP 684 Internal Trip Capture Estimation Tool

Project Name:	Riverbend Phase 2	**Organization:**	Greenlight Engineering
Project Location:		**Performed By:**	Rick Nys
Scenario Description:	Weekday AM Peak Hour	**Date:**	11/28/18
Analysis Year:	2035	**Checked By:**	
Analysis Period:	**AM Street Peak Hour**	**Date:**	

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				20	18	2
Retail				187	113	74
Restaurant				32	18	14
Cinema/Entertainment				0		
Residential				65	17	48
Hotel				0		
All Other Land Uses[2]				0		
				304	166	138

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	1	0	0	0
Retail	1		9	0	0	0
Restaurant	3	2		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	0	4	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	304	166	138
Internal Capture Percentage	14%	13%	16%
External Vehicle-Trips[5]	260	144	116
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	28%	50%
Retail	2%	14%
Restaurant	78%	43%
Cinema/Entertainment	N/A	N/A
Residential	6%	10%
Hotel	N/A	N/A

[1] Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3] Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4] Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

[6] Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Riverbend Phase 2
Analysis Period:	**AM Street Peak Hour**

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-A (D): Entering Trips			Table 7-A (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	18	18	1.00	2	2
Retail	1.00	113	113	1.00	74	74
Restaurant	1.00	18	18	1.00	14	14
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	17	17	1.00	48	48
Hotel	1.00	0	0	1.00	0	0

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1	1	0	0	0
Retail	21		10	0	10	0
Restaurant	4	2		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	0	10	0		0
Hotel	0	0	0	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		36	4	0	0	0
Retail	1		9	0	0	0
Restaurant	3	9		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	19	4	0		0
Hotel	1	5	1	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	5	13	18	13	0	0
Retail	2	111	113	111	0	0
Restaurant	14	4	18	4	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	1	16	17	16	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	1	1	2	1	0	0
Retail	10	64	74	64	0	0
Restaurant	6	8	14	8	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	5	43	48	43	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A

[2] Person-Trips

[3] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 684 Internal Trip Capture Estimation Tool

Project Name:	Riverbend Phase 2	**Organization:**	Greenlight Engineering
Project Location:		**Performed By:**	Rick Nys
Scenario Description:	Weekday PM Peak Hour	**Date:**	11/29/18
Analysis Year:	2035	**Checked By:**	
Analysis Period:	**PM Street Peak Hour**	**Date:**	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				85	14	71
Retail				217	104	113
Restaurant				30	18	12
Cinema/Entertainment				0		
Residential				106	67	39
Hotel				0		
All Other Land Uses[2]				0		
				438	203	235

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		8	0	0	1	0
Retail	2		5	0	29	0
Restaurant	0	5		0	2	0
Cinema/Entertainment	0	0	0		0	0
Residential	2	10	3	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	438	203	235
Internal Capture Percentage	31%	33%	29%
External Vehicle-Trips[5]	304	136	168
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	29%	13%
Retail	22%	32%
Restaurant	44%	58%
Cinema/Entertainment	N/A	N/A
Residential	48%	38%
Hotel	N/A	N/A

[1] Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3] Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4] Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-P, 9-P (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6] Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Riverbend Phase 2
Analysis Period:	**PM Street Peak Hour**

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	14	14	1.00	71	71
Retail	1.00	104	104	1.00	113	113
Restaurant	1.00	18	18	1.00	12	12
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	67	67	1.00	39	39
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		14	3	0	1	0
Retail	2		33	5	29	6
Restaurant	0	5		1	2	1
Cinema/Entertainment	0	0	0		0	0
Residential	2	16	8	0		1
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		8	0	0	3	0
Retail	4		5	0	31	0
Restaurant	4	52		0	11	0
Cinema/Entertainment	1	4	1		3	0
Residential	8	10	3	0		0
Hotel	0	2	1	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	4	10	14	10	0	0
Retail	23	81	104	81	0	0
Restaurant	8	10	18	10	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	32	35	67	35	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	9	62	71	62	0	0
Retail	36	77	113	77	0	0
Restaurant	7	5	12	5	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	15	24	39	24	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1] Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

[2] Person-Trips

[3] Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

Table 7.1a Adjusted Internal Trip Capture Rates for Trip Origins within a Multi-Use Development

Land Use Pairs		Weekday	
		AM Peak Hour	PM Peak Hour
From OFFICE	To Office	0.0%	0.0%
	To Retail	28.0%	20.0%
	To Restaurant	63.0%	4.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	1.0%	2.0%
	To Hotel	0.0%	0.0%
From RETAIL	To Office	29.0%	2.0%
	To Retail	0.0%	0.0%
	To Restaurant	13.0%	29.0%
	To Cinema/Entertainment	0.0%	4.0%
	To Residential	14.0%	26.0%
	To Hotel	0.0%	5.0%
From RESTAURANT	To Office	31.0%	3.0%
	To Retail	14.0%	41.0%
	To Restaurant	0.0%	0.0%
	To Cinema/Entertainment	0.0%	8.0%
	To Residential	4.0%	18.0%
	To Hotel	3.0%	7.0%
From CINEMA/ENTERTAINMENT	To Office	0.0%	2.0%
	To Retail	0.0%	21.0%
	To Restaurant	0.0%	31.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	0.0%	8.0%
	To Hotel	0.0%	2.0%
From RESIDENTIAL	To Office	2.0%	4.0%
	To Retail	1.0%	42.0%
	To Restaurant	20.0%	21.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	0.0%	0.0%
	To Hotel	0.0%	3.0%
From HOTEL	To Office	75.0%	0.0%
	To Retail	14.0%	16.0%
	To Restaurant	9.0%	68.0%
	To Cinema/Entertainment	0.0%	0.0%
	To Residential	0.0%	2.0%
	To Hotel	0.0%	0.0%

Table 7.2a Adjusted Internal Trip Capture Rates for Trip Destinations within a Multi-Use Development

Land Use Pairs		Weekday	
		AM Peak Hour	PM Peak Hour
To OFFICE	From Office	0.0%	0.0%
	From Retail	4.0%	31.0%
	From Restaurant	14.0%	30.0%
	From Cinema/Entertainment	0.0%	6.0%
	From Residential	3.0%	57.0%
	From Hotel	3.0%	0.0%
To RETAIL	From Office	32.0%	8.0%
	From Retail	0.0%	0.0%
	From Restaurant	8.0%	50.0%
	From Cinema/Entertainment	0.0%	4.0%
	From Residential	17.0%	10.0%
	From Hotel	4.0%	2.0%
To RESTAURANT	From Office	23.0%	2.0%
	From Retail	50.0%	29.0%
	From Restaurant	0.0%	0.0%
	From Cinema/Entertainment	0.0%	3.0%
	From Residential	20.0%	14.0%
	From Hotel	6.0%	5.0%
To CINEMA/ENTERTAINMENT	From Office	0.0%	1.0%
	From Retail	0.0%	26.0%
	From Restaurant	0.0%	32.0%
	From Cinema/Entertainment	0.0%	0.0%
	From Residential	0.0%	0.0%
	From Hotel	0.0%	0.0%
To RESIDENTIAL	From Office	0.0%	4.0%
	From Retail	2.0%	46.0%
	From Restaurant	5.0%	16.0%
	From Cinema/Entertainment	0.0%	4.0%
	From Residential	0.0%	0.0%
	From Hotel	0.0%	0.0%
To HOTEL	From Office	0.0%	0.0%
	From Retail	0.0%	17.0%
	From Restaurant	4.0%	71.0%
	From Cinema/Entertainment	0.0%	1.0%
	From Residential	0.0%	12.0%
	From Hotel	0.0%	0.0%

Appendix H

Synchro Intersection Capacity Analysis Report Outputs

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Riverbend Rd NW

12/23/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	22	5	124	75	20	15	53	720	25	10	1405	10
Future Volume (vph)	22	5	124	75	20	15	53	720	25	10	1405	10
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	16	16	16	13	13	13	12	11	11	12	11	11
Grade (%)		-5%			0%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
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		0.89			0.98		1.00	1.00		1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1802			1230		1710	3038		1221	3237	
Flt Permitted		0.95			0.60		0.10	1.00		0.34	1.00	
Satd. Flow (perm)		1721			766		184	3038		443	3237	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	6	139	84	22	17	56	758	26	11	1479	11
RTOR Reduction (vph)	0	80	0	0	8	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	90	0	0	115	0	56	782	0	11	1490	0
Confl. Peds. (#/hr)							4					4
Heavy Vehicles (%)	0%	0%	3%	57%	0%	33%	0%	6%	75%	40%	2%	0%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		13.5			13.5		47.4	45.4		44.6	44.0	
Effective Green, g (s)		13.5			13.5		47.4	45.4		44.6	44.0	
Actuated g/C Ratio		0.18			0.18		0.64	0.61		0.60	0.59	
Clearance Time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Vehicle Extension (s)		1.0			1.0		1.0	0.5		1.0	0.5	
Lane Grp Cap (vph)		311			138		158	1851		271	1911	
v/s Ratio Prot							c0.01	0.26		0.00	c0.46	
v/s Ratio Perm		0.05			c0.15		0.22			0.02		
v/c Ratio		0.29			0.83		0.35	0.42		0.04	0.78	
Uniform Delay, d1		26.4			29.4		8.0	7.7		6.1	11.6	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			31.6		0.5	0.1		0.0	1.9	
Delay (s)		26.5			61.0		8.5	7.7		6.1	13.5	
Level of Service		C			E		A	A		A	B	
Approach Delay (s)		26.5			61.0			7.8			13.4	
Approach LOS		C			E			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	74.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	5	100	25	15	30	5	25	5	45	10	15	0
Future Vol, veh/h	5	100	25	15	30	5	25	5	45	10	15	0
Conflicting Peds, #/hr	0	0	4	4	0	0	2	0	1	1	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	73	73	73	73	73	73	73	73	73
Heavy Vehicles, %	0	2	0	7	0	0	0	0	0	0	14	0
Mvmt Flow	7	137	34	21	41	7	34	7	62	14	21	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	48	0	0	175	0	0	271	262	159	291	276	47
Stage 1	-	-	-	-	-	-	172	172	-	87	87	-
Stage 2	-	-	-	-	-	-	99	90	-	204	189	-
Critical Hdwy	4.1	-	-	4.17	-	-	7.1	6.5	6.2	7.1	6.64	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.64	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.64	-
Follow-up Hdwy	2.2	-	-	2.263	-	-	3.5	4	3.3	3.5	4.126	3.3
Pot Cap-1 Maneuver	1572	-	-	1372	-	-	686	646	892	665	612	1028
Stage 1	-	-	-	-	-	-	835	760	-	926	800	-
Stage 2	-	-	-	-	-	-	912	824	-	803	722	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1572	-	-	1367	-	-	654	630	888	603	597	1026
Mov Cap-2 Maneuver	-	-	-	-	-	-	654	630	-	603	597	-
Stage 1	-	-	-	-	-	-	827	753	-	921	787	-
Stage 2	-	-	-	-	-	-	872	811	-	736	716	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	2.3	10.4	11.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	774	1572	-	-	1367	-	-	599
HCM Lane V/C Ratio	0.133	0.004	-	-	0.015	-	-	0.057
HCM Control Delay (s)	10.4	7.3	0	-	7.7	0	-	11.4
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.5	0	-	-	0	-	-	0.2

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Orchard Heights Rd NW

12/16/2018

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↱	
Traffic Volume (vph)	15	585	315	815	1385	10
Future Volume (vph)	15	585	315	815	1385	10
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width	12	12	15	12	12	12
Total Lost time (s)	4.5	4.5	4.5	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
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	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1583	1497	1791	3196	3346	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	1583	1497	151	3196	3346	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	616	332	858	1458	11
RTOR Reduction (vph)	0	8	0	0	0	0
Lane Group Flow (vph)	16	608	332	858	1469	0
Confl. Peds. (#/hr)		1				
Confl. Bikes (#/hr)						5
Heavy Vehicles (%)	8%	2%	5%	7%	2%	13%
Turn Type	Perm	pm+ov	pm+pt	NA	NA	
Protected Phases		1	1	6	2	
Permitted Phases	8	8	6			
Actuated Green, G (s)	7.9	47.1	113.1	111.6	67.9	
Effective Green, g (s)	7.9	47.1	113.1	111.6	67.9	
Actuated g/C Ratio	0.06	0.36	0.87	0.86	0.52	
Clearance Time (s)	4.5	4.5	4.5	6.0	6.0	
Vehicle Extension (s)	1.5	1.0	1.0	0.5	0.5	
Lane Grp Cap (vph)	96	594	625	2743	1747	
v/s Ratio Prot		c0.31	0.16	0.27	c0.44	
v/s Ratio Perm	0.01	0.10	0.30			
v/c Ratio	0.17	1.02	0.53	0.31	0.84	
Uniform Delay, d1	57.9	41.4	23.1	1.8	26.4	
Progression Factor	1.00	1.00	1.46	0.89	1.00	
Incremental Delay, d2	0.3	43.2	0.4	0.3	5.1	
Delay (s)	58.2	84.6	34.0	1.8	31.5	
Level of Service	E	F	C	A	C	
Approach Delay (s)	84.0			10.8	31.5	
Approach LOS	F			B	C	

Intersection Summary			
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Glen Creek Rd NW

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱↱	↰↰	↱		↰↰	↑↑	↱	↰	↑↱	
Traffic Volume (vph)	115	160	1000	235	75	25	130	1140	65	15	1710	5
Future Volume (vph)	115	160	1000	235	75	25	130	1140	65	15	1710	5
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00		0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1710	1800	2639	3159	1619		3252	3353	1456	1710	3352	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1710	1800	2639	3159	1619		3252	3353	1456	1710	3352	
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)	120	167	1042	245	78	26	135	1188	68	16	1781	5
RTOR Reduction (vph)	0	0	42	0	10	0	0	0	26	0	0	0
Lane Group Flow (vph)	120	167	1000	245	94	0	135	1188	42	16	1786	0
Confl. Peds. (#/hr)			3			4			3			5
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	1%	5%	2%	20%	2%	2%	2%	0%	2%	0%
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	3	8	1	7	4		1	6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)	11.7	16.0	42.6	12.9	17.7		26.6	79.5	79.5	2.1	54.5	
Effective Green, g (s)	11.7	16.0	42.6	12.9	17.7		26.6	79.5	79.5	2.1	54.5	
Actuated g/C Ratio	0.09	0.12	0.33	0.10	0.14		0.20	0.61	0.61	0.02	0.42	
Clearance Time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lane Grp Cap (vph)	153	221	956	313	220		665	2050	890	27	1405	
v/s Ratio Prot	0.07	0.09	c0.21	c0.08	0.06		0.04	0.35		0.01	c0.53	
v/s Ratio Perm			0.16						0.03			
v/c Ratio	0.78	0.76	1.05	0.78	0.43		0.20	0.58	0.05	0.59	1.27	
Uniform Delay, d1	57.9	55.1	43.7	57.2	51.5		42.9	15.2	10.1	63.5	37.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	0.90	0.96	
Incremental Delay, d2	21.1	12.2	41.8	11.2	0.5		0.1	1.2	0.1	8.9	124.4	
Delay (s)	79.0	67.3	85.5	68.3	52.0		43.0	16.4	10.2	66.2	160.7	
Level of Service	E	E	F	E	D		D	B	B	E	F	
Approach Delay (s)		82.6			63.5			18.7			159.8	
Approach LOS		F			E			B			F	

Intersection Summary			
HCM 2000 Control Delay	91.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Riverbend Rd NW

12/23/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	34	5	85	75	5	10	199	1450	20	30	1270	5
Future Volume (vph)	34	5	85	75	5	10	199	1450	20	30	1270	5
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	16	16	16	13	13	13	12	11	11	12	11	11
Grade (%)		-5%			0%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
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		0.91			0.98		1.00	1.00		1.00	1.00	
Flt Protected		0.99			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1783			1351		1660	3202		1629	3147	
Flt Permitted		0.90			0.63		0.11	1.00		0.11	1.00	
Satd. Flow (perm)		1634			881		199	3202		191	3147	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	40	6	99	87	6	12	209	1526	21	32	1337	5
RTOR Reduction (vph)	0	82	0	0	7	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	63	0	0	98	0	209	1546	0	32	1342	0
Confl. Peds. (#/hr)	2					2			1	1		
Heavy Vehicles (%)	5%	5%	5%	30%	30%	30%	3%	3%	3%	5%	5%	5%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		12.3			12.3		50.1	44.5		41.3	40.1	
Effective Green, g (s)		12.3			12.3		50.1	44.5		41.3	40.1	
Actuated g/C Ratio		0.17			0.17		0.69	0.61		0.57	0.55	
Clearance Time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Vehicle Extension (s)		1.0			1.0		1.0	0.5		1.0	0.5	
Lane Grp Cap (vph)		275			148		248	1951		131	1728	
v/s Ratio Prot							c0.06	0.48		0.00	0.43	
v/s Ratio Perm		0.04			c0.11		c0.51			0.13		
v/c Ratio		0.23			0.66		0.84	0.79		0.24	0.78	
Uniform Delay, d1		26.2			28.4		11.3	10.8		8.4	12.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			8.4		21.3	2.1		0.4	2.1	
Delay (s)		26.4			36.8		32.6	12.9		8.7	15.0	
Level of Service		C			D		C	B		A	B	
Approach Delay (s)		26.4			36.8			15.2			14.8	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	5	105	50	15	125	10	65	5	35	10	10	5
Future Vol, veh/h	5	105	50	15	125	10	65	5	35	10	10	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	73	73	73	73	73	73	73	73	73
Heavy Vehicles, %	2	2	2	0	0	0	5	5	5	0	0	0
Mvmt Flow	7	144	68	21	171	14	89	7	48	14	14	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	185	0	0	212	0	0	423	419	178	440	446	178
Stage 1	-	-	-	-	-	-	192	192	-	220	220	-
Stage 2	-	-	-	-	-	-	231	227	-	220	226	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.15	6.55	6.25	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.55	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.55	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.545	4.045	3.345	3.5	4	3.3
Pot Cap-1 Maneuver	1390	-	-	1370	-	-	536	521	857	531	510	870
Stage 1	-	-	-	-	-	-	803	736	-	787	725	-
Stage 2	-	-	-	-	-	-	765	711	-	787	721	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1390	-	-	1370	-	-	511	509	857	487	498	870
Mov Cap-2 Maneuver	-	-	-	-	-	-	511	509	-	487	498	-
Stage 1	-	-	-	-	-	-	798	732	-	782	713	-
Stage 2	-	-	-	-	-	-	732	699	-	732	717	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.8	13.1	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	590	1390	-	-	1370	-	-	539
HCM Lane V/C Ratio	0.244	0.005	-	-	0.015	-	-	0.064
HCM Control Delay (s)	13.1	7.6	0	-	7.7	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.2

HCM Signalized Intersection Capacity Analysis
Wallace Road NW (OR 221)/Orchard Heights Rd NW

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↱	
Traffic Volume (vph)	40	560	385	1610	1375	25
Future Volume (vph)	40	560	385	1610	1375	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width	12	12	15	12	12	12
Total Lost time (s)	4.5	4.5	4.5	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
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	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1710	1494	1862	3386	3308	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	1710	1494	162	3386	3308	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	589	405	1695	1447	26
RTOR Reduction (vph)	0	9	0	0	1	0
Lane Group Flow (vph)	42	580	405	1695	1472	0
Confl. Peds. (#/hr)		6	4			4
Confl. Bikes (#/hr)						1
Heavy Vehicles (%)	0%	2%	1%	1%	3%	6%
Turn Type	Perm	pm+ov	pm+pt	NA	NA	
Protected Phases		1	1	6	2	
Permitted Phases	8	8	6			
Actuated Green, G (s)	9.8	46.1	111.2	109.7	68.9	
Effective Green, g (s)	9.8	46.1	111.2	109.7	68.9	
Actuated g/C Ratio	0.08	0.35	0.86	0.84	0.53	
Clearance Time (s)	4.5	4.5	4.5	6.0	6.0	
Vehicle Extension (s)	1.5	1.0	1.0	0.5	0.5	
Lane Grp Cap (vph)	128	581	613	2857	1753	
v/s Ratio Prot		c0.28	0.18	0.50	c0.44	
v/s Ratio Perm	0.02	0.11	0.38			
v/c Ratio	0.33	1.00	0.66	0.59	0.84	
Uniform Delay, d1	57.0	41.9	25.8	3.2	25.9	
Progression Factor	1.00	1.00	0.96	0.37	1.00	
Incremental Delay, d2	0.5	36.6	0.2	0.1	5.0	
Delay (s)	57.5	78.5	25.0	1.3	30.9	
Level of Service	E	E	C	A	C	
Approach Delay (s)	77.1			5.8	30.9	
Approach LOS	E			A	C	

Intersection Summary			
HCM 2000 Control Delay	25.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
Wallace Road NW (OR 221)/Glen Creek Rd NW

12/16/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱↱	↰↰	↱		↰↰	↑↑	↱	↰	↑↱	
Traffic Volume (vph)	115	200	465	265	175	80	420	2070	295	75	1520	30
Future Volume (vph)	115	200	465	265	175	80	420	2070	295	75	1520	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00		0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	1.00	0.95	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1676	1782	2666	3190	1672		3252	3353	1435	1676	3280	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1676	1782	2666	3190	1672		3252	3353	1435	1676	3280	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	119	206	479	273	180	82	433	2134	304	77	1567	31
RTOR Reduction (vph)	0	0	198	0	14	0	0	0	69	0	1	0
Lane Group Flow (vph)	119	206	281	273	248	0	433	2134	235	77	1597	0
Confl. Peds. (#/hr)						4			10			6
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	2%	1%	1%	4%	2%	2%	2%	2%	1%	2%	4%	0%
Turn Type	Prot	NA	Prot	Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	3	8	8	7	4		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	11.0	19.2	19.2	13.7	22.4		22.7	67.0	67.0	10.6	54.4	
Effective Green, g (s)	11.0	19.2	19.2	13.7	22.4		22.7	67.0	67.0	10.6	54.4	
Actuated g/C Ratio	0.08	0.15	0.15	0.11	0.17		0.17	0.52	0.52	0.08	0.42	
Clearance Time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lane Grp Cap (vph)	141	263	393	336	288		567	1728	739	136	1372	
v/s Ratio Prot	0.07	0.12	0.11	c0.09	c0.15		c0.13	c0.64		0.05	0.49	
v/s Ratio Perm									0.16			
v/c Ratio	0.84	0.78	0.72	0.81	0.86		0.76	1.23	0.32	0.57	1.16	
Uniform Delay, d1	58.7	53.4	52.8	56.9	52.3		51.1	31.5	18.3	57.5	37.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.02	0.89	
Incremental Delay, d2	33.3	13.1	5.1	13.2	21.5		5.5	110.9	1.1	1.3	77.3	
Delay (s)	92.0	66.5	57.9	70.1	73.8		56.6	142.4	19.4	59.8	110.9	
Level of Service	F	E	E	E	E		E	F	B	E	F	
Approach Delay (s)		65.1			71.9			116.5			108.6	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	103.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Riverbend Rd NW

12/23/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	38	5	124	75	24	15	110	709	25	12	1425	10
Future Volume (vph)	38	5	124	75	24	15	110	709	25	12	1425	10
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	16	16	16	13	13	13	12	11	11	12	11	11
Grade (%)		-5%			0%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
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		0.90			0.98		1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1821			1247		1710	3037		1221	3237	
Flt Permitted		0.91			0.59		0.09	1.00		0.36	1.00	
Satd. Flow (perm)		1682			758		160	3037		462	3237	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	43	6	139	84	27	17	116	746	26	13	1500	11
RTOR Reduction (vph)	0	80	0	0	8	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	108	0	0	120	0	116	770	0	13	1511	0
Confl. Peds. (#/hr)							4					4
Heavy Vehicles (%)	0%	0%	3%	57%	0%	33%	0%	6%	75%	40%	2%	0%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		13.7			13.7		50.4	46.8		44.4	43.8	
Effective Green, g (s)		13.7			13.7		50.4	46.8		44.4	43.8	
Actuated g/C Ratio		0.18			0.18		0.66	0.61		0.58	0.58	
Clearance Time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Vehicle Extension (s)		1.0			1.0		1.0	0.5		1.0	0.5	
Lane Grp Cap (vph)		302			136		179	1867		275	1863	
v/s Ratio Prot							c0.03	0.25		0.00	c0.47	
v/s Ratio Perm		0.06			c0.16		0.40			0.03		
v/c Ratio		0.36			0.88		0.65	0.41		0.05	0.81	
Uniform Delay, d1		27.3			30.4		10.0	7.6		6.7	12.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			42.7		5.9	0.1		0.0	2.6	
Delay (s)		27.6			73.1		15.9	7.6		6.7	15.5	
Level of Service		C			E		B	A		A	B	
Approach Delay (s)		27.6			73.1			8.7			15.4	
Approach LOS		C			E			A			B	

Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	76.1	Sum of lost time (s)	15.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	5	100	25	17	30	5	25	5	49	10	15	0
Future Vol, veh/h	5	100	25	17	30	5	25	5	49	10	15	0
Conflicting Peds, #/hr	0	0	4	4	0	0	2	0	1	1	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	73	73	73	73	73	73	73	73	73
Heavy Vehicles, %	0	2	0	7	0	0	0	0	0	0	14	0
Mvmt Flow	7	137	34	23	41	7	34	7	67	14	21	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	48	0	0	175	0	0	275	266	159	297	280	47
Stage 1	-	-	-	-	-	-	172	172	-	91	91	-
Stage 2	-	-	-	-	-	-	103	94	-	206	189	-
Critical Hdwy	4.1	-	-	4.17	-	-	7.1	6.5	6.2	7.1	6.64	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.64	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.64	-
Follow-up Hdwy	2.2	-	-	2.263	-	-	3.5	4	3.3	3.5	4.126	3.3
Pot Cap-1 Maneuver	1572	-	-	1372	-	-	681	643	892	659	609	1028
Stage 1	-	-	-	-	-	-	835	760	-	921	797	-
Stage 2	-	-	-	-	-	-	908	821	-	801	722	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1572	-	-	1367	-	-	648	626	888	594	593	1026
Mov Cap-2 Maneuver	-	-	-	-	-	-	648	626	-	594	593	-
Stage 1	-	-	-	-	-	-	827	753	-	916	783	-
Stage 2	-	-	-	-	-	-	867	807	-	729	716	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	2.5	10.4	11.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	776	1572	-	-	1367	-	-	593
HCM Lane V/C Ratio	0.139	0.004	-	-	0.017	-	-	0.058
HCM Control Delay (s)	10.4	7.3	0	-	7.7	0	-	11.4
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.5	0	-	-	0.1	-	-	0.2

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Orchard Heights NW

12/16/2018

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↱	
Traffic Volume (vph)	15	585	315	857	1404	10
Future Volume (vph)	15	585	315	857	1404	10
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width	12	12	15	12	12	12
Total Lost time (s)	4.5	4.5	4.5	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
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	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1583	1496	1791	3196	3346	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	1583	1496	157	3196	3346	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	616	332	902	1478	11
RTOR Reduction (vph)	0	7	0	0	0	0
Lane Group Flow (vph)	16	609	332	902	1489	0
Confl. Peds. (#/hr)		1				
Confl. Bikes (#/hr)						5
Heavy Vehicles (%)	8%	2%	5%	7%	2%	13%
Turn Type	Perm	pm+ov	pm+pt	NA	NA	
Protected Phases		1	1	6	2	
Permitted Phases	8	8	6			
Actuated Green, G (s)	7.9	44.7	113.1	111.6	70.3	
Effective Green, g (s)	7.9	44.7	113.1	111.6	70.3	
Actuated g/C Ratio	0.06	0.34	0.87	0.86	0.54	
Clearance Time (s)	4.5	4.5	4.5	6.0	6.0	
Vehicle Extension (s)	1.5	1.0	1.0	0.5	0.5	
Lane Grp Cap (vph)	96	566	599	2743	1809	
v/s Ratio Prot		c0.30	0.16	0.28	c0.44	
v/s Ratio Perm	0.01	0.10	0.32			
v/c Ratio	0.17	1.08	0.55	0.33	0.82	
Uniform Delay, d1	57.9	42.6	23.4	1.8	24.7	
Progression Factor	1.00	1.00	1.47	0.87	1.00	
Incremental Delay, d2	0.3	59.8	0.5	0.3	4.4	
Delay (s)	58.2	102.4	34.9	1.8	29.1	
Level of Service	E	F	C	A	C	
Approach Delay (s)	101.3			10.7	29.1	
Approach LOS	F			B	C	

Intersection Summary			
HCM 2000 Control Delay	35.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Glen Creek Rd NW

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱↱	↰↰	↱		↰↰	↑↑	↱	↰	↑↱	
Traffic Volume (vph)	117	160	1000	235	75	27	130	1178	65	16	1726	6
Future Volume (vph)	117	160	1000	235	75	27	130	1178	65	16	1726	6
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00		0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1710	1800	2636	3159	1612		3207	3299	1397	1710	3351	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1710	1800	2636	3159	1612		3207	3299	1397	1710	3351	
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)	122	167	1042	245	78	28	135	1227	68	17	1798	6
RTOR Reduction (vph)	0	0	43	0	11	0	0	0	26	0	0	0
Lane Group Flow (vph)	122	167	999	245	95	0	135	1227	42	17	1804	0
Confl. Peds. (#/hr)			3			4			3			5
Confl. Bikes (#/hr)			2									2
Heavy Vehicles (%)	0%	0%	1%	5%	2%	20%	2%	2%	2%	0%	2%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	7	8	10	0	0	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	3	8	1	7	4		1	6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)	11.9	16.0	41.6	12.9	17.5		25.6	79.9	79.9	1.7	55.5	
Effective Green, g (s)	11.9	16.0	41.6	12.9	17.5		25.6	79.9	79.9	1.7	55.5	
Actuated g/C Ratio	0.09	0.12	0.32	0.10	0.13		0.20	0.61	0.61	0.01	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lane Grp Cap (vph)	156	221	934	313	217		631	2027	858	22	1430	
v/s Ratio Prot	0.07	0.09	c0.21	c0.08	0.06		0.04	0.37		0.01	c0.54	
v/s Ratio Perm			0.17						0.03			
v/c Ratio	0.78	0.76	1.07	0.78	0.44		0.21	0.61	0.05	0.77	1.26	
Uniform Delay, d1	57.8	55.1	44.2	57.2	51.7		43.8	15.4	10.0	64.0	37.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	0.92	0.95	
Incremental Delay, d2	20.5	12.2	50.0	11.2	0.5		0.1	1.4	0.1	44.1	120.0	
Delay (s)	78.3	67.3	94.2	68.3	52.2		43.8	16.7	10.1	102.7	155.4	
Level of Service	E	E	F	E	D		D	B	B	F	F	
Approach Delay (s)		89.3			63.5			19.0			155.0	
Approach LOS		F			E			B			F	

Intersection Summary			
HCM 2000 Control Delay	91.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	107.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↱	
Traffic Vol, veh/h	0	25	0	0	1422	29
Future Vol, veh/h	0	25	0	0	1422	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	85	75	75	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	29	0	0	1497	31

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	764	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	346	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	346	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	346	-	-
HCM Lane V/C Ratio	-	0.085	-	-
HCM Control Delay (s)	-	16.4	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	0.3	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		⋎	
Traffic Vol, veh/h	3	119	120	40	39	2
Future Vol, veh/h	3	119	120	40	39	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	75	75	75	75	75	75
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	159	160	53	52	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	213	0	-	0	354	187
Stage 1	-	-	-	-	187	-
Stage 2	-	-	-	-	167	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1357	-	-	-	644	855
Stage 1	-	-	-	-	845	-
Stage 2	-	-	-	-	863	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1357	-	-	-	642	855
Mov Cap-2 Maneuver	-	-	-	-	642	-
Stage 1	-	-	-	-	842	-
Stage 2	-	-	-	-	863	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	11
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1357	-	-	-	650
HCM Lane V/C Ratio	0.003	-	-	-	0.084
HCM Control Delay (s)	7.7	0	-	-	11
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Riverbend Rd NW

12/23/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	44	5	85	75	6	10	225	1439	20	32	1290	5
Future Volume (vph)	44	5	85	75	6	10	225	1439	20	32	1290	5
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	16	16	16	13	13	13	12	11	11	12	11	11
Grade (%)		-5%			0%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
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		0.91			0.98		1.00	1.00		1.00	1.00	
Flt Protected		0.98			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1790			1351		1660	3202		1629	3147	
Flt Permitted		0.89			0.64		0.11	1.00		0.12	1.00	
Satd. Flow (perm)		1612			902		186	3202		202	3147	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	5	89	79	6	11	237	1515	21	34	1358	5
RTOR Reduction (vph)	0	75	0	0	7	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	65	0	0	89	0	237	1535	0	34	1363	0
Confl. Peds. (#/hr)	2					2			1	1		
Heavy Vehicles (%)	5%	5%	5%	30%	30%	30%	3%	3%	3%	5%	5%	5%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		12.0			12.0		51.2	45.4		41.4	40.1	
Effective Green, g (s)		12.0			12.0		51.2	45.4		41.4	40.1	
Actuated g/C Ratio		0.16			0.16		0.69	0.62		0.56	0.54	
Clearance Time (s)		4.5			4.5		4.5	6.0		4.5	6.0	
Vehicle Extension (s)		1.0			1.0		1.0	0.5		1.0	0.5	
Lane Grp Cap (vph)		262			146		261	1972		138	1712	
v/s Ratio Prot							c0.08	0.48		0.00	0.43	
v/s Ratio Perm		0.04			c0.10		c0.55			0.13		
v/c Ratio		0.25			0.61		0.91	0.78		0.25	0.80	
Uniform Delay, d1		26.9			28.7		15.4	10.4		8.3	13.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			5.2		31.6	1.8		0.3	2.5	
Delay (s)		27.1			33.9		47.0	12.3		8.6	16.0	
Level of Service		C			C		D	B		A	B	
Approach Delay (s)		27.1			33.9			16.9			15.8	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	17.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	5	105	50	15	125	10	65	5	35	10	10	5
Future Vol, veh/h	5	105	50	15	125	10	65	5	35	10	10	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	73	73	73	73	73	73	73	73	73	73	73
Heavy Vehicles, %	2	2	2	0	0	0	5	5	5	0	0	0
Mvmt Flow	7	144	68	21	171	14	89	7	48	14	14	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	185	0	0	212	0	0	423	419	178	440	446	178
Stage 1	-	-	-	-	-	-	192	192	-	220	220	-
Stage 2	-	-	-	-	-	-	231	227	-	220	226	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.15	6.55	6.25	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.55	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.55	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.545	4.045	3.345	3.5	4	3.3
Pot Cap-1 Maneuver	1390	-	-	1370	-	-	536	521	857	531	510	870
Stage 1	-	-	-	-	-	-	803	736	-	787	725	-
Stage 2	-	-	-	-	-	-	765	711	-	787	721	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1390	-	-	1370	-	-	511	509	857	487	498	870
Mov Cap-2 Maneuver	-	-	-	-	-	-	511	509	-	487	498	-
Stage 1	-	-	-	-	-	-	798	732	-	782	713	-
Stage 2	-	-	-	-	-	-	732	699	-	732	717	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.8	13.1	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	590	1390	-	-	1370	-	-	539
HCM Lane V/C Ratio	0.244	0.005	-	-	0.015	-	-	0.064
HCM Control Delay (s)	13.1	7.6	0	-	7.7	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.2

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Orchard Heights Rd NW

12/16/2018

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↱	
Traffic Volume (vph)	40	560	385	1624	1393	25
Future Volume (vph)	40	560	385	1624	1393	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width	12	12	15	12	12	12
Total Lost time (s)	4.5	4.5	4.5	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
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	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1710	1493	1862	3386	3308	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	1710	1493	160	3386	3308	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	589	405	1709	1466	26
RTOR Reduction (vph)	0	9	0	0	1	0
Lane Group Flow (vph)	42	581	405	1709	1491	0
Confl. Peds. (#/hr)		6	4			4
Heavy Vehicles (%)	0%	2%	1%	1%	3%	6%
Turn Type	Perm	pm+ov	pm+pt	NA	NA	
Protected Phases		1	1	6	2	
Permitted Phases	8	8	6			
Actuated Green, G (s)	9.8	45.0	111.2	109.7	70.0	
Effective Green, g (s)	9.8	45.0	111.2	109.7	70.0	
Actuated g/C Ratio	0.08	0.35	0.86	0.84	0.54	
Clearance Time (s)	4.5	4.5	4.5	6.0	6.0	
Vehicle Extension (s)	1.5	1.0	1.0	0.5	0.5	
Lane Grp Cap (vph)	128	568	597	2857	1781	
v/s Ratio Prot		c0.28	0.18	0.50	c0.45	
v/s Ratio Perm	0.02	0.11	0.40			
v/c Ratio	0.33	1.02	0.68	0.60	0.84	
Uniform Delay, d1	57.0	42.5	26.2	3.2	25.2	
Progression Factor	1.00	1.00	0.97	0.39	1.00	
Incremental Delay, d2	0.5	43.4	0.2	0.1	4.9	
Delay (s)	57.5	85.9	25.7	1.3	30.1	
Level of Service	E	F	C	A	C	
Approach Delay (s)	84.1			6.0	30.1	
Approach LOS	F			A	C	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
Wallace Rd NW (OR 221)/Glen Creek Rd NW

12/16/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱↱	↰↰	↱		↰↰	↑↑	↱	↰	↑↱	
Traffic Volume (vph)	117	200	465	265	175	82	420	2080	295	77	1534	32
Future Volume (vph)	117	200	465	265	175	82	420	2080	295	77	1534	32
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00		0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1676	1782	2666	3190	1680		3252	3353	1483	1676	3281	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1676	1782	2666	3190	1680		3252	3353	1483	1676	3281	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	121	206	479	273	180	85	433	2144	304	79	1581	33
RTOR Reduction (vph)	0	0	43	0	14	0	0	0	69	0	1	0
Lane Group Flow (vph)	121	206	436	273	251	0	433	2144	235	79	1613	0
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	2%	1%	1%	4%	2%	2%	2%	2%	1%	2%	4%	0%
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	3	8	1	7	4		1	6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)	11.0	19.3	41.8	13.7	22.5		22.5	66.6	66.6	10.9	54.5	
Effective Green, g (s)	11.0	19.3	41.8	13.7	22.5		22.5	66.6	66.6	10.9	54.5	
Actuated g/C Ratio	0.08	0.15	0.32	0.11	0.17		0.17	0.51	0.51	0.08	0.42	
Clearance Time (s)	4.5	4.5	4.5	5.0	4.5		4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lane Grp Cap (vph)	141	264	949	336	290		562	1717	759	140	1375	
v/s Ratio Prot	0.07	0.12	0.08	c0.09	c0.15		c0.13	c0.64		0.05	0.49	
v/s Ratio Perm			0.08						0.16			
v/c Ratio	0.86	0.78	0.46	0.81	0.87		0.77	1.25	0.31	0.56	1.17	
Uniform Delay, d1	58.7	53.3	35.1	56.9	52.3		51.3	31.7	18.4	57.3	37.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.02	0.88	
Incremental Delay, d2	36.0	12.9	0.1	13.2	21.9		5.9	116.9	1.1	1.2	81.2	
Delay (s)	94.8	66.2	35.2	70.1	74.2		57.2	148.6	19.4	59.6	114.4	
Level of Service	F	E	D	E	E		E	F	B	E	F	
Approach Delay (s)		52.1			72.1			121.3			111.8	
Approach LOS		D			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	104.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Wallace Rd NW (OR 221)/North Site Access

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↱	
Traffic Vol, veh/h	0	27	0	0	1300	29
Future Vol, veh/h	0	27	0	0	1300	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	92	92	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	36	0	0	1368	31

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	700	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	382	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	382	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	382	-	-
HCM Lane V/C Ratio	-	0.094	-	-
HCM Control Delay (s)	-	15.4	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	0.3	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Vol, veh/h	4	119	120	64	104	5
Future Vol, veh/h	4	119	120	64	104	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	75	75	75	75	75	75
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	159	160	85	139	7

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	245	0	-	0	372	203
Stage 1	-	-	-	-	203	-
Stage 2	-	-	-	-	169	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1321	-	-	-	629	838
Stage 1	-	-	-	-	831	-
Stage 2	-	-	-	-	861	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1321	-	-	-	626	838
Mov Cap-2 Maneuver	-	-	-	-	626	-
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	861	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1321	-	-	-	633
HCM Lane V/C Ratio	0.004	-	-	-	0.23
HCM Control Delay (s)	7.7	0	-	-	12.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.9

Appendix I

SimTraffic Queuing Results

Intersection: 2: Wallace Rd NW (OR 221) & Riverbend Rd NW

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	140	171	58	182	178	239	277	253
Average Queue (ft)	56	69	20	76	93	22	237	185
95th Queue (ft)	108	131	50	143	159	121	290	292
Link Distance (ft)		583		5683	5683			
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			255			215		
Storage Blk Time (%)						0	21	
Queuing Penalty (veh)						0	2	

Intersection: 3: Linwood St NW & Riverbend Rd NW

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	14	34	66	73
Average Queue (ft)	0	2	35	20
95th Queue (ft)	7	17	56	54
Link Distance (ft)	212		238	100
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Wallace Rd NW (OR 221)/Wallace Road NW (OR 221)

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9: Wallace Road NW (OR 221)/Walllace Rd NW (OR 221) & Brush College Rd NW/Private D

Movement	EB	EB	NB	SB	SB
Directions Served	L	TR	UL	T	TR
Maximum Queue (ft)	216	294	138	10	32
Average Queue (ft)	61	144	59	1	2
95th Queue (ft)	138	250	109	7	13
Link Distance (ft)		529		742	742
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150		465		
Storage Blk Time (%)	2	12			
Queuing Penalty (veh)	12	6			

Intersection: 15: Riverbend Rd NW

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 17: Wallace Rd NW (OR 221) & Orchard Heights Rd NW

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	T	TR
Maximum Queue (ft)	220	888	264	428	377	1775	1803
Average Queue (ft)	30	448	171	77	47	856	872
95th Queue (ft)	134	775	279	289	205	2205	2232
Link Distance (ft)		1200		1165	1165	5683	5683
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	120		165				
Storage Blk Time (%)	0	51	15	0			
Queuing Penalty (veh)	1	8	59	1			

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	R	R	L	L	TR	L	L	T	T	L
Maximum Queue (ft)	255	341	350	347	243	296	330	173	322	500	449	196
Average Queue (ft)	78	330	138	117	100	167	202	43	114	177	116	26
95th Queue (ft)	250	345	407	373	252	327	473	140	221	370	288	116
Link Distance (ft)		322					402			671	671	
Upstream Blk Time (%)		86	18	10			30					
Queuing Penalty (veh)		0	0	0			0					
Storage Bay Dist (ft)	155		350	350	200	200		315	315			175
Storage Blk Time (%)	4	87	18	10	1	9	30			1	1	
Queuing Penalty (veh)	46	969	49	27	1	9	70			2	1	

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	SB	SB
Directions Served	T	TR
Maximum Queue (ft)	1160	1176
Average Queue (ft)	668	690
95th Queue (ft)	1185	1212
Link Distance (ft)	1165	1165
Upstream Blk Time (%)	1	3
Queuing Penalty (veh)	11	26
Storage Bay Dist (ft)		
Storage Blk Time (%)	37	
Queuing Penalty (veh)	6	

Network Summary

Network wide Queuing Penalty: 1306

Intersection: 2: Wallace Rd NW (OR 221) & Riverbend Rd NW

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	82	132	204	423	435	239	297	287
Average Queue (ft)	30	63	74	133	153	45	235	190
95th Queue (ft)	65	120	147	288	311	164	305	303
Link Distance (ft)		583		5683	5683			
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			255			215		
Storage Blk Time (%)			0	1		0	20	
Queuing Penalty (veh)			0	2		0	6	

Intersection: 3: Linwood St NW & Riverbend Rd NW

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	34	49	99	50
Average Queue (ft)	1	3	44	21
95th Queue (ft)	13	22	73	50
Link Distance (ft)	212		238	100
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Wallace Rd NW (OR 221)/Wallace Road NW (OR 221)

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9: Wallace Road NW (OR 221)/Walllace Rd NW (OR 221) & Brush College Rd NW/Private D

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	UL	T	TR	L	T	TR
Maximum Queue (ft)	250	548	445	390	318	28	5	26
Average Queue (ft)	242	513	169	24	16	4	0	2
95th Queue (ft)	258	648	342	204	144	22	4	14
Link Distance (ft)		529					742	742
Upstream Blk Time (%)		90						
Queuing Penalty (veh)		0						
Storage Bay Dist (ft)	150		465			100		
Storage Blk Time (%)	100	6	1	0				
Queuing Penalty (veh)	355	3	7	1				

Intersection: 15: Riverbend Rd NW

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 17: Wallace Rd NW (OR 221) & Orchard Heights Rd NW

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	T	TR
Maximum Queue (ft)	220	769	264	486	488	1162	1162
Average Queue (ft)	58	376	201	161	113	621	640
95th Queue (ft)	179	669	305	434	354	1271	1287
Link Distance (ft)		1200		1165	1165	5683	5683
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	120		165				
Storage Blk Time (%)	0	45	17	1			
Queuing Penalty (veh)	0	18	135	4			

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	R	R	L	L	TR	L	L	T	T	R
Maximum Queue (ft)	255	341	341	324	246	300	434	339	415	716	711	320
Average Queue (ft)	122	232	225	99	60	115	410	192	329	576	536	132
95th Queue (ft)	259	384	387	305	208	345	430	308	493	872	861	389
Link Distance (ft)		322					402			671	671	
Upstream Blk Time (%)		23	6	1			90			18	10	
Queuing Penalty (veh)		0	0	0			0			0	0	
Storage Bay Dist (ft)	155		350	350	200	200		315	315			220
Storage Blk Time (%)	6	38	6	1	1	7	92	0	3	23	24	
Queuing Penalty (veh)	42	218	20	2	2	17	243	2	34	95	70	

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	SB	SB	SB
Directions Served	L	T	TR
Maximum Queue (ft)	275	1118	1122
Average Queue (ft)	117	639	664
95th Queue (ft)	265	1100	1142
Link Distance (ft)		1165	1165
Upstream Blk Time (%)		0	1
Queuing Penalty (veh)		3	5
Storage Bay Dist (ft)	175		
Storage Blk Time (%)	1	37	
Queuing Penalty (veh)	4	27	

Network Summary

Network wide Queuing Penalty: 1316

Intersection: 2: Wallace Rd NW (OR 221) & Riverbend Rd NW

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	143	172	112	217	235	239	268	268
Average Queue (ft)	59	77	45	80	100	30	246	223
95th Queue (ft)	109	144	90	167	183	145	274	301
Link Distance (ft)		583		5683	5683			
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			255			215		
Storage Blk Time (%)				0		0	30	
Queuing Penalty (veh)				0		0	4	

Intersection: 3: Linwood St NW & Riverbend Rd NW

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	12	38	66	58
Average Queue (ft)	1	2	35	20
95th Queue (ft)	8	18	56	53
Link Distance (ft)	212		238	100
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Wallace Rd NW (OR 221)/Wallace Road NW (OR 221)

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9: Wallace Road NW (OR 221)/Walllace Rd NW (OR 221) & Brush College Rd NW/Private

Movement	EB	EB	NB	SB	SB
Directions Served	L	TR	UL	T	TR
Maximum Queue (ft)	242	504	146	15	10
Average Queue (ft)	86	197	54	1	0
95th Queue (ft)	205	388	107	8	5
Link Distance (ft)		529		742	742
Upstream Blk Time (%)		1			
Queuing Penalty (veh)		0			
Storage Bay Dist (ft)	150		465		
Storage Blk Time (%)	1	25			
Queuing Penalty (veh)	4	13			

Intersection: 15: Riverbend Rd NW

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 17: Wallace Rd NW (OR 221) & Orchard Heights Rd NW

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	T	TR
Maximum Queue (ft)	220	962	264	408	291	2649	2679
Average Queue (ft)	33	473	188	111	61	1105	1133
95th Queue (ft)	138	788	294	349	234	2302	2329
Link Distance (ft)		1200		1165	1165	5683	5683
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	120		165				
Storage Blk Time (%)		51	17	0			
Queuing Penalty (veh)		8	74	1			

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	R	R	L	L	TR	L	L	T	T	R
Maximum Queue (ft)	255	341	345	356	246	296	356	160	348	516	474	192
Average Queue (ft)	80	330	143	107	129	190	135	35	107	222	163	7
95th Queue (ft)	255	345	413	355	245	288	309	119	212	427	362	82
Link Distance (ft)		322					402			671	671	
Upstream Blk Time (%)		88	16	6			2			0	0	
Queuing Penalty (veh)		0	0	0			0			0	0	
Storage Bay Dist (ft)	155		350	350	200	200		315	315			220
Storage Blk Time (%)	5	89	16	6	0	8	8			3	2	
Queuing Penalty (veh)	62	991	45	18	1	8	19			4	1	

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	SB	SB	SB
Directions Served	L	T	TR
Maximum Queue (ft)	187	1179	1181
Average Queue (ft)	28	807	833
95th Queue (ft)	111	1328	1342
Link Distance (ft)		1165	1165
Upstream Blk Time (%)		1	4
Queuing Penalty (veh)		14	42
Storage Bay Dist (ft)	175		
Storage Blk Time (%)		41	
Queuing Penalty (veh)		7	

Network Summary

Network wide Queuing Penalty: 1315

Intersection: 2: Wallace Rd NW (OR 221) & Riverbend Rd NW

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	96	158	279	456	480	239	289	268
Average Queue (ft)	40	64	86	170	189	50	240	200
95th Queue (ft)	76	124	192	352	373	181	300	298
Link Distance (ft)		583		5683	5683			
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			255			215		
Storage Blk Time (%)			0	3		0	24	
Queuing Penalty (veh)			0	6		0	8	

Intersection: 3: Linwood St NW & Riverbend Rd NW

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	24	33	101	47
Average Queue (ft)	1	2	44	19
95th Queue (ft)	10	17	81	49
Link Distance (ft)	212		238	100
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Wallace Rd NW (OR 221)/Wallace Road NW (OR 221)

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9: Wallace Road NW (OR 221)/Walllace Rd NW (OR 221) & Brush College Rd NW/Private

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	UL	T	TR	L	T	TR
Maximum Queue (ft)	250	548	404	174	61	38	5	15
Average Queue (ft)	240	513	156	11	2	5	0	2
95th Queue (ft)	264	655	310	117	44	25	4	13
Link Distance (ft)		529					742	742
Upstream Blk Time (%)		87						
Queuing Penalty (veh)		0						
Storage Bay Dist (ft)	150		465			100		
Storage Blk Time (%)	100	17	0					
Queuing Penalty (veh)	353	8	2					

Intersection: 15: Riverbend Rd NW

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 17: Wallace Rd NW (OR 221) & Orchard Heights Rd NW

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	T	TR
Maximum Queue (ft)	219	717	265	530	490	1119	1125
Average Queue (ft)	58	402	219	217	155	640	666
95th Queue (ft)	176	675	309	491	421	1149	1169
Link Distance (ft)		1200		1165	1165	5683	5683
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	120		165				
Storage Blk Time (%)	0	45	22	3			
Queuing Penalty (veh)	0	18	176	10			

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	R	R	L	L	TR	L	L	T	T	R
Maximum Queue (ft)	255	345	340	309	249	300	440	328	415	708	702	320
Average Queue (ft)	90	326	101	53	76	139	411	194	295	433	396	134
95th Queue (ft)	271	372	322	217	238	372	444	305	455	831	794	389
Link Distance (ft)		322					402			671	671	
Upstream Blk Time (%)		87	2	1			87			10	5	
Queuing Penalty (veh)		0	0	0			0			0	0	
Storage Bay Dist (ft)	155		350	350	200	200		315	315			220
Storage Blk Time (%)	8	90	2	1	0	9	90	0	2	14	15	
Queuing Penalty (veh)	54	524	6	2	1	23	237	2	25	59	44	

Intersection: 18: Wallace Rd NW (OR 221) & Glen Creek Road NW

Movement	SB	SB	SB
Directions Served	L	T	TR
Maximum Queue (ft)	274	955	986
Average Queue (ft)	113	477	499
95th Queue (ft)	257	804	836
Link Distance (ft)		1165	1165
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	175		
Storage Blk Time (%)	1	29	
Queuing Penalty (veh)	5	22	

Network Summary

Network wide Queuing Penalty: 1588

From:	STEVEN ANDERSON
To:	CityRecorder
Subject:	Documents to Add to Record and Council Packets April 11th Meeting
Date:	Monday, April 11, 2022 9:43:27 AM
Attachments:	Riverbend_Phase_2_Traffic Impact Analysis.pdf SRC_TrafficTrans_FinalTechRpt_Addendum.pdf

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Please add the attached two documents for inclusion in Council packets and into the record for the public hearing tonight in support of the West Salem Neighborhood Association testimony,

Agenda 4.c. 22-102
Comprehensive Plan Map Amendment and Zone Change
2100 Doaks Ferry Rd NW

Please confirm receipt and inclusion for tonight's public hearing. Any questions, please let me know. Thank you.

Steve Anderson, West Salem Neighborhood Association Land Use Chair
503-602-1623
andersonriskanalysis@comcast.net

Final Technical Report Addendum

Salem River Crossing Project
Traffic and Transportation
Technical Report Addendum

Prepared for

Oregon Department of Transportation

October 2016

Prepared by

ch2m

Contents

SECTION PAGE

Acronyms and Abbreviations

AADT	annual average daily traffic
ADT	average daily traffic
AM Peak	AM peak hour
API	area of potential impact
APWA	American Public Works Association
BMP	best management practice
CBD	central business district
Commercial/Liberty couplet	Commercial Street/Liberty Street couplet (that is, paired one-way streets)
DEIS	Draft Environmental Impact Statement (FHWA, ODOT, and City of Salem, 2012)
EIS	environmental impact statement
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FR	Federal Register
I-5	Interstate 5
LOS	level of service
MPO	metropolitan planning organization
MVM	million vehicle miles
MWVCOG	Mid-Willamette Valley Council of Governments
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
OAR	Oregon Administrative Rules
ODOT	Oregon Department of Transportation
OR 22	Oregon State Route 22
OR 22 Connector	a viaduct running north-south to connect to OR 22
OR 221	Oregon State Route 221

OR 51	Oregon State Route 51
OR 99E-B	Oregon State Route 99E–Business Route
OR 99W	Oregon State Route 99W
PHF	peak-hour factor
Pine/Hickory couplet	Pine Street/Hickory Street couplet (that is, paired one-way streets)
PM Peak	PM peak hour
RTSP	Regional Transportation Systems Plan
SAAQS	state ambient air quality standard(s)
SKATS	Salem-Keizer Area Transportation Study
SKATS MPO	Salem-Keizer Area Transportation Study Metropolitan Planning Organization
SOV	single-occupant vehicle
TDM	Transportation Demand Management
TIP	Transportation Improvement Program
Trade/Ferry couplet	Trade Street/Ferry Street couplet (that is, paired one-way streets)
TSM	Transportation System Management
TSP	Transportation System Plan
TWSC	two-way stop control
UGB	Urban Growth Boundary
Union Street Pedestrian Bridge	Union Street railroad bicycle/pedestrian bridge
U.S.C.	United States Code
v/c	volume to capacity
VHD	vehicle hours of delay
VHT	vehicle hours traveled
VMT	vehicle miles traveled

CHAPTER 1

Introduction

This addendum to the Draft Traffic and Transportation Technical Report, which was submitted as an appendix of the Draft Environmental Impact Statement that was published in April 2012 (Federal Highway Administration [FHWA], Oregon Department of Transportation [ODOT], and City of Salem, 2012; DEIS), that was published in April 2012, describes the Salem River Crossing Project Final Environmental Impact Statement (FEIS) preferred alternative, assesses traffic and transportation impacts, and describes associated mitigation actions. Greater detail on the preferred alternative, including how it was selected, is provided in Chapter 2 of the FEIS.

1.1 Summary of Project Purpose and Need

The purpose of the Salem River Crossing Project (project) is to improve mobility and safety for people and freight for local, regional, and through travel across the Willamette River in the Salem-Keizer metropolitan area while alleviating congestion on the Center Street and Marion Street Bridges and on the connecting highway and arterial street systems.

Primary measures to satisfy the purpose statement include the following:

- Reducing congestion levels at the existing bridgeheads
- Remediating safety and operational deficiencies on the existing bridges and in the study area in locations where crash rates are higher than average

The following statements identify the need for the project:

- Need Statement #1. Based on available data, the existing river crossing facilities and local bridge system in Salem are inadequate for current and future traffic demand, resulting in a need to improve traffic operations in the study area over the No Build Alternative conditions.
- Need Statement #2. Based on available data, the existing river crossing facilities and local bridge connections in Salem are inadequate for current and future users (vehicles, freight, bicycles, and pedestrians) with regard to safety conditions, resulting in a need to improve traffic safety for all these users.
- Need Statement #3. Based on available data, the existing river crossing facilities and local bridge system in Salem are inadequate for current and future freight-vehicle capacity, resulting in a need to improve freight mobility in the area of the Center Street and Marion Street Bridges.
- Need Statement #4. Congestion levels on the existing river crossing facilities result in unreliable public transportation service, thereby necessitating an improvement in transit travel time and reliability from/to West Salem.

- Need Statement #5. The existing river crossing options in Salem are inadequate to accommodate emergency response vehicles in the event of restricted access to and/or closure of the existing bridges because of an emergency or other incident, resulting in the need to provide improved crossings or an additional crossing in case the Center Street and Marion Street Bridges are closed or limited because of an incident.

1.2 Description of the Preferred Alternative

This section describes the project preferred alternative evaluated in the FEIS. An overview of the preferred alternative is shown on Figure 1.2-1.

1.2.1 National Environmental Policy Act (NEPA)

Compliance with the National Environmental Policy Act (NEPA) is required because the proposed action intends to satisfy a transportation need and is funded or partially funded with FHWA funds. NEPA provides the overall regulatory setting for this section. With regard to traffic forecasts, in general, the design traffic year should be set so as to accommodate a 20-year period from the expected date of completion of the facility (Title 23, *United States Code*, [U.S.C.], Highways Section 109 Standards).

1.2.2 Crossing Location and Bridge Description

Under the preferred alternative, a new bridge would be constructed. The bridge would connect to Hope Avenue at Wallace Road on the west, cross Wallace Marine Park at its northern tip, cross the Willamette River and McLane Island, and cross over a realigned Front Street (see Figure 1.2-2). The bridge would connect to Pine and Hickory Streets at Commercial Street on the east. The bridge could be constructed as a single structure or two side-by-side structures.

In order to ensure adequate right-of-way to accommodate all modes, the new bridge would include, in each direction of travel:

- Two 12-foot-wide travel lanes
- 8-foot-wide left-hand shoulders
- 10-foot-wide right-hand shoulders
- 10-foot-wide multi-use paths on outermost part of both sides of the bridge that would be separated from the paved roadway raised by a barrier

The new bridge span would also have a 16-foot-wide center median. The cross-section of the proposed new bridge main span is shown on Figure 1.2-3. The existing Center Street and Marion Street Bridges would remain in service, without modification.

1.2.3 Eastside Bridgehead and Distribution Network

This subsection describes the preferred alternative on the east side of the new bridgehead and on the road network east of the Willamette River (see Figure 1.2-4).

Figure 1.2-1: Overview of Preferred Alternative

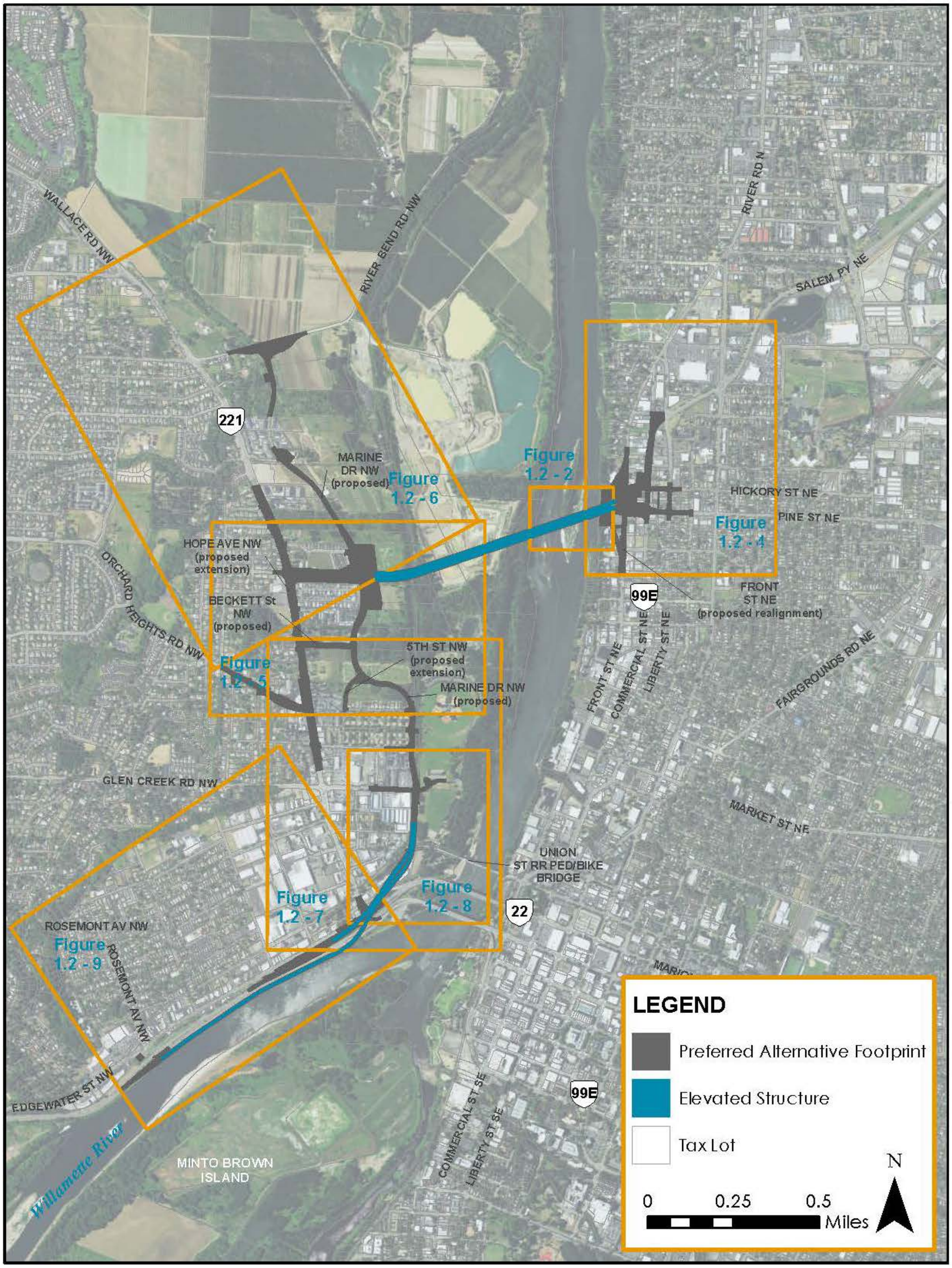


Figure 1.2-2: Preferred Alternative Crossing Location

Figure 1.2-3: Cross-Section of Preferred Alternative New Bridge (Main Span)

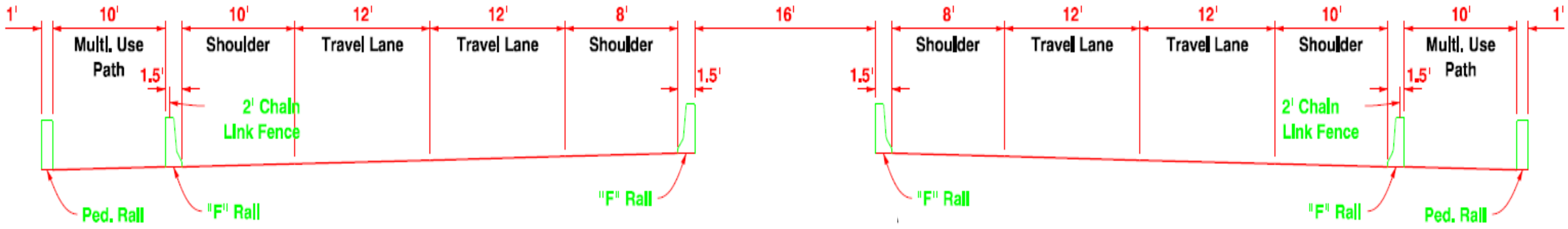
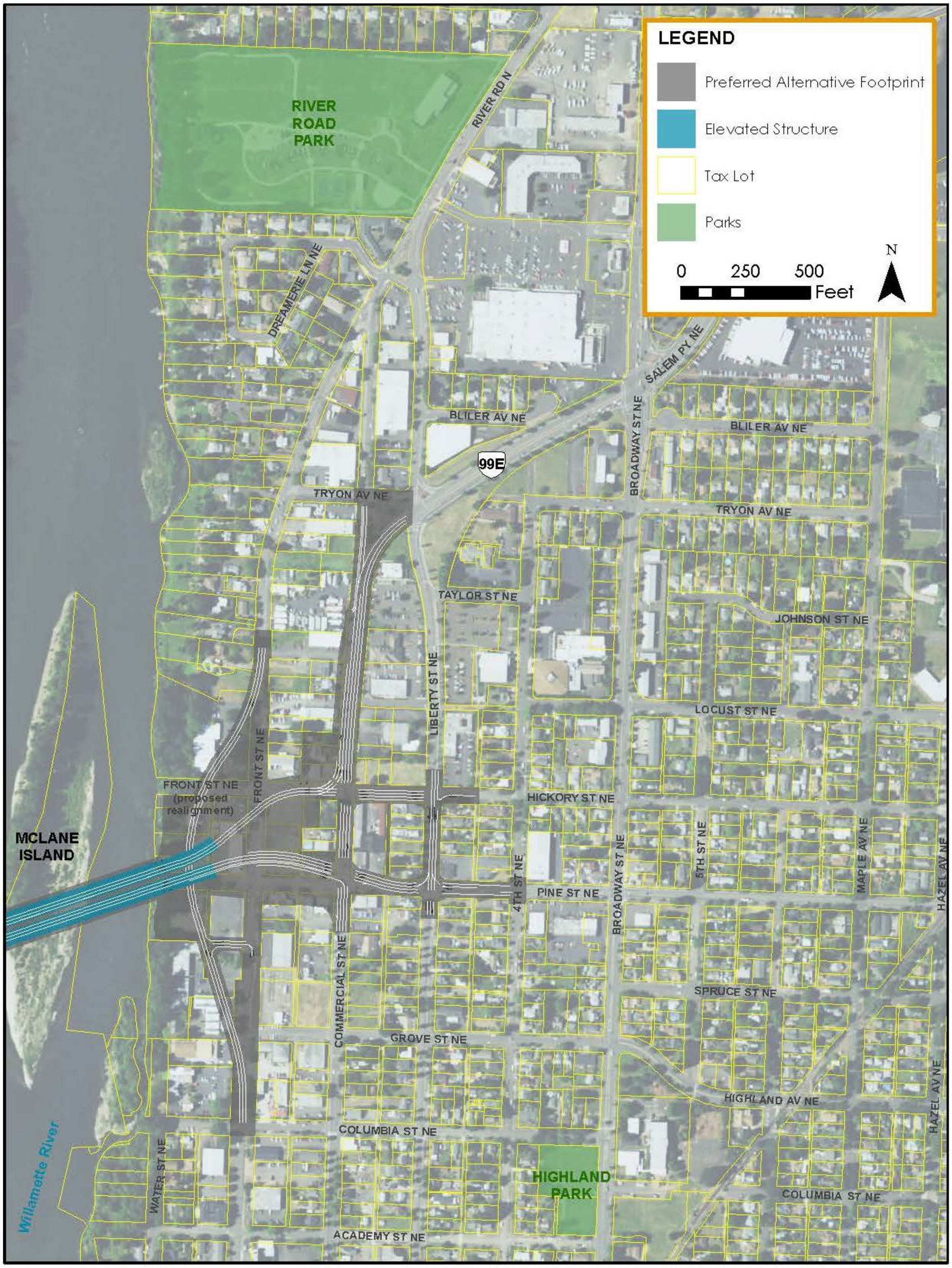


Figure 1.2-4: Preferred Alternative – Eastside Bridgehead and Distribution Network



The preferred alternative new bridge would have an eastbound connection at Commercial Street (via an exit ramp aligned with Pine Street) and a westbound connection (via an entrance ramp aligned with Hickory Street). Entrance and exit ramps would connect at-grade to a proposed short Pine Street/Hickory Street couplet (that is, paired one-way streets) just east of Front Street. This couplet would be only two blocks in length, extending from the bridge ramps to Liberty Street, including the respective Pine and Hickory Street intersections with Commercial Street. Bridge access to and from Salem Parkway would be via the existing north-south Commercial/Liberty couplet. The new bridge would also be accessible from the north from River Road (via Commercial Street).

A portion of Front Street would be reconstructed closer to the river below the bridge ramps in the segment between Columbia Street and a point approximately 540 feet south of Tryon Street to maintain Front Street's north-south connectivity. The remnant segments of Front Street in this area would allow access to existing businesses (on both sides of the bridge approaches). The former segment of Front Street below the bridge approaches would be closed to vehicles.

Commercial Street would be widened in its segment between Tryon Avenue and Hickory Street to provide enough space for the installation of two right turn-only lanes from southbound Commercial Street to the westbound bridge approach on Hickory Street. The segment of Pine Street between Liberty Street and 4th Street would be widened slightly to accommodate the proposed double-right turn lane from westbound Pine Street to northbound Liberty Street.

1.2.4 Westside Bridgehead and Distribution Network

This subsection describes the preferred alternative on the west side of the new bridgehead and on the road network west of the Willamette River (see Figures 1.2-5 through 1.2-9).

The westside bridgehead approaches would combine into a single roadway at the intersection with Marine Drive (which would be constructed as part of the preferred alternative). This roadway ("Hope Avenue Extension") would then continue to the Wallace Road intersection at Hope Avenue. There would be no driveway access to the Hope Avenue Extension roadway (either westbound or eastbound) from Wallace Road eastward; all existing driveway access to Wallace Road and Hope Avenue (west of Wallace Road) would be maintained.

The Wallace Road/Hope Avenue intersection would be widened to accommodate the additional traffic traveling to and from the new bridge. There would also be a widening of the Wallace Road/Orchard Heights Road intersection to accommodate increased traffic volumes, including widening along Wallace Road between Taybin Road and Narcissus Court to accommodate the additional turn lanes; Orchard Heights Road would remain in its current alignment. See Figures 1.2-5 and 1.2-7.

Figure 1.2-5: Preferred Alternative – Westside Bridgehead and Distribution Network

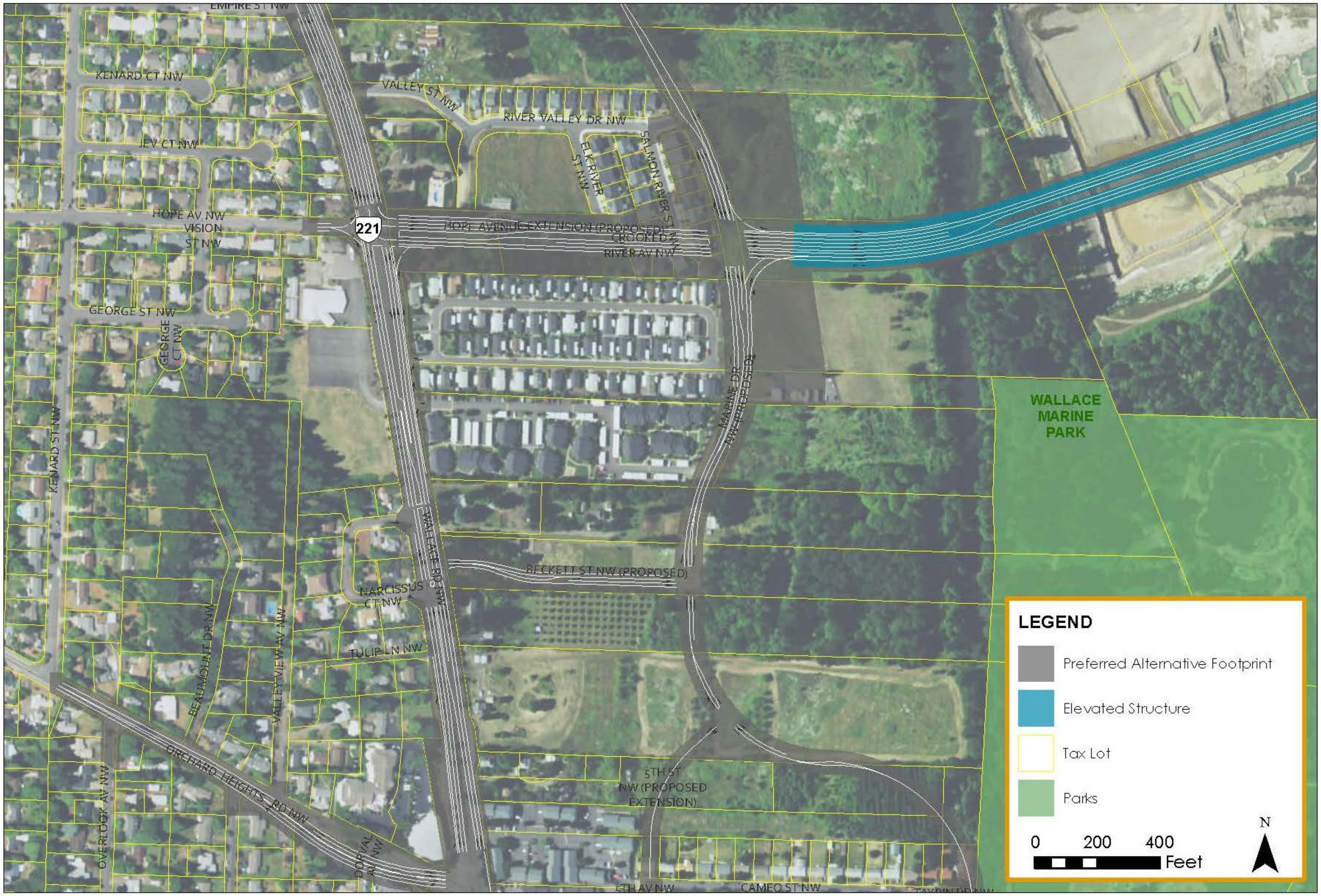
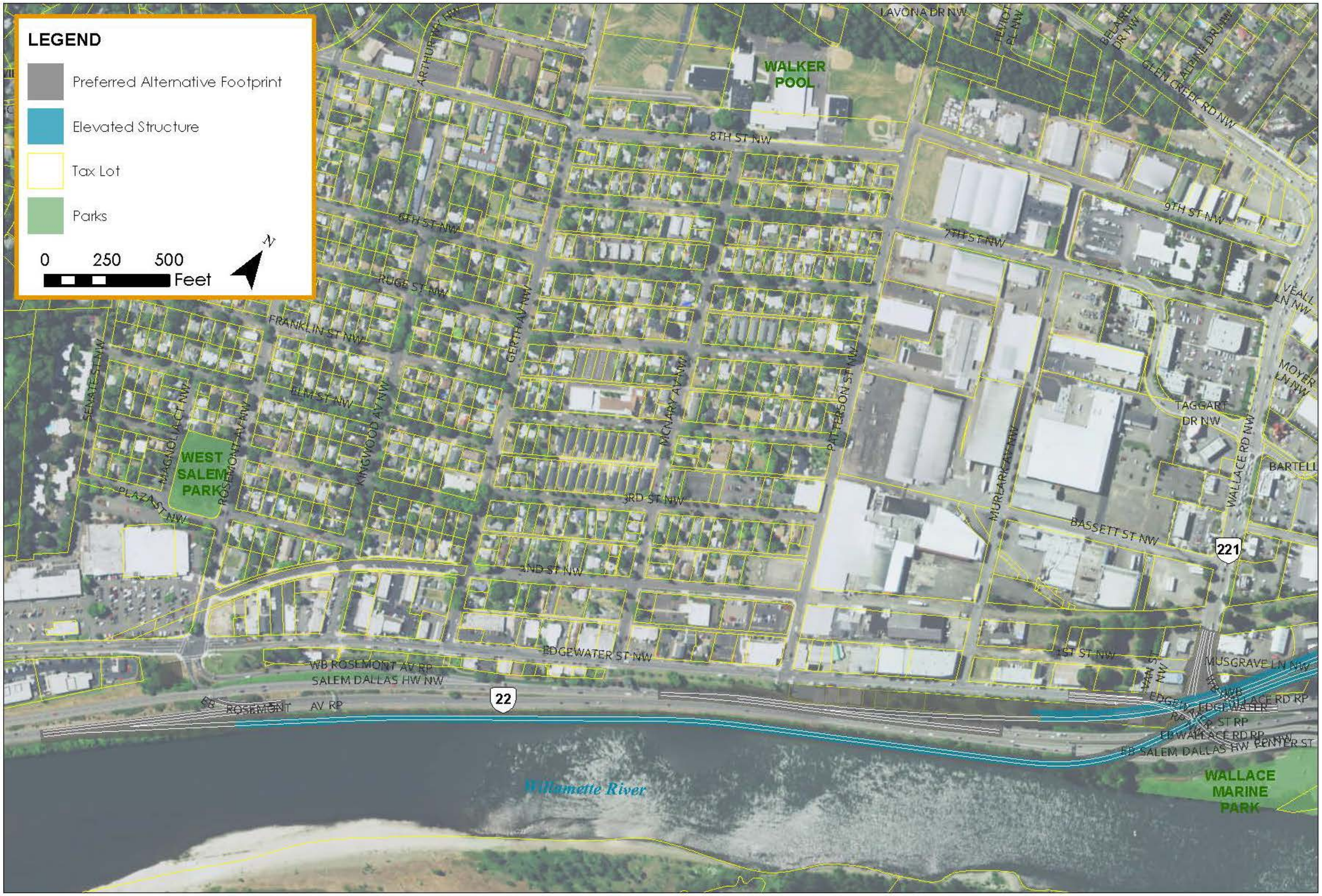


Figure 1.2-6: Preferred Alternative – Westside Distribution Network 1 of 4

Figure 1.2-7: Preferred Alternative – Westside Distribution Network 2 of 4

Figure 1.2-8: Preferred Alternative – Westside Distribution Network 3 of 4

Figure 1.2-9: Preferred Alternative – Westside Distribution Network 4 of 4



Marine Drive would be constructed at-grade from River Bend Road in the north to Glen Creek Road in the south. South of Glen Creek Road, Marine Drive would ramp up to an elevated structure that would cross over the existing pedestrian/bicycle multi-use trail as well as the existing Marion Street Bridge exit ramp, before descending back to grade near its connection with Oregon State Route 22 (OR 22). Marine Drive would contain one through-lane in each direction of travel with turn lanes at intersections.[1]. A 12-foot-wide paved multi-use path would be constructed adjacent to the east side of Marine Drive from River Bend Road to Glen Creek Road (a 5-foot buffer strip would separate the multi-use path from the northbound Marine Drive travel lane). The proposed alignment of Marine Drive, as well as all new proposed roadway connections from Marine Drive to Wallace Road, is consistent with the Salem Transportation System Plan (TSP).

At its northern terminus, Marine Drive would intersect with River Bend Road via a three-legged roundabout (see Figure 1.2-6). The segment of Marine Drive between River Bend Road and the Hope Avenue Extension would include a connection to existing Harritt Drive. South of the Hope Avenue Extension, a new roadway would be built between Marine Drive and Wallace Road ("Beckett Street") as well as between Marine Drive and the Cameo Street/5th Avenue intersection ("5th Avenue"). There would be a new full intersection at Marine Drive and Glen Creek Road (at the entrance to Wallace Marine Park).

Eastbound OR 22 would need to be widened out onto the riverbank (not into the river itself) to allow for the installation of the flyover ramp from OR 22 to Marine Drive. When the Marine Drive-OR 22 connection ramps are installed, the existing Rosemont Avenue westbound exit-ramp would be closed. (see Figure 1.2-9). This closure would be done for safety reasons – the existence of both a Marine Drive-to-OR 22 ramp and a westbound Rosemont exit-ramp at its current location would result in undesirable weaving conditions; the potential for conflict would occur during all periods of the day, but would likely be more severe during the off-peak periods when speeds are higher. With the closure of the Rosemont Avenue exit-ramp, it is forecasted that former Rosemont Avenue-bound traffic wishing to access West Salem neighborhoods would shift to the Wallace Road exit (either to access Edgewater Street or to continue north on Wallace Road) or would continue west on OR 22 to Rosewood Drive, College Drive, or Doaks Ferry Road. The eastbound on-ramp from Rosemont Avenue to OR 22 would continue to function as it does today, but would not have access to the eastbound ramps exiting to northbound Marine Drive.

1.2.5 Bridge Type

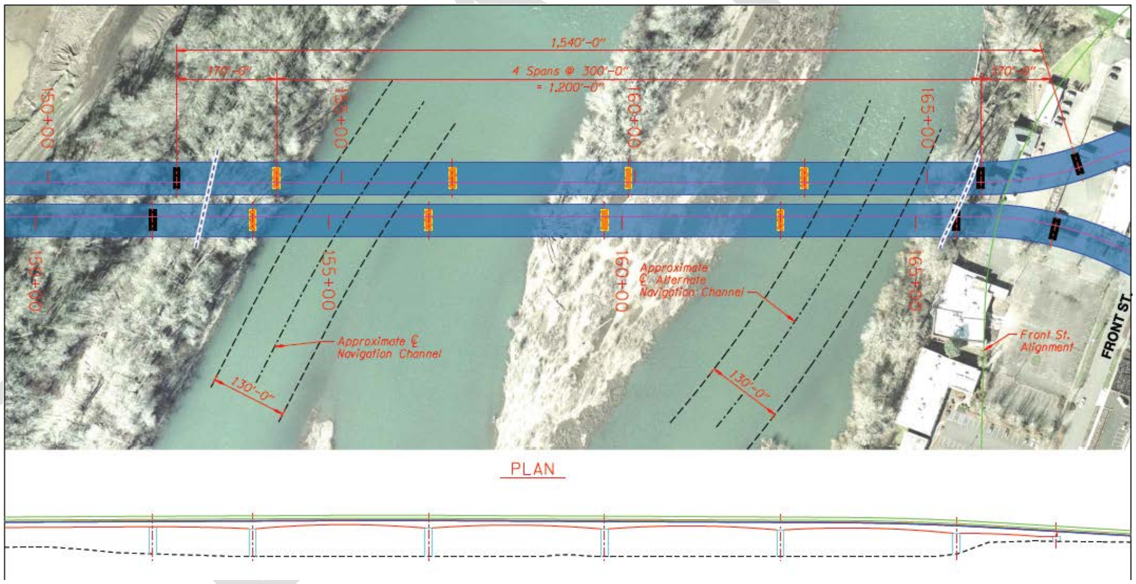
In September 2014, the project Oversight Team identified a segmental precast concrete box as the recommended bridge type for the preferred alternative new bridge over the Willamette River. A visual simulation and engineering plan/profile drawing of this bridge type are provided on Figures 1.2-10 and 1.2-11.

---

[1] Between Hope Avenue and the new Beckett Street, Marine Drive would have two southbound lanes to receive traffic going from the bridge south onto Marine Drive. This additional lane would drop as a right-turn lane at Beckett Street.

Figure 1.2-10: Visual Simulation of Segmental Precast Concrete Box Bridge Type

Figure 1.2-11: Plan/Profile of Segmental Precast Concrete Box Bridge Type



This bridge type would have 300-foot spans between piers across the river, thereby allowing for full navigational clearance in both channels of the river astride McLane Island (see the orange pier symbols on Figure 1.2-11). This bridge type would have a vertical clearance of 45 feet over mean high water and 53 feet over mean low water.

On the east side of the river at Commercial Street, the new bridge would connect to a realigned Pine Street with a three-lane exit ramp for eastbound traffic, and to Hickory Street with a two-lane entrance ramp for westbound traffic. Construction of these two bridge ramps would require the realignment of Front Street closer to the riverfront. The east leg of the Hickory Street/Liberty Street intersection would be converted to a right-in only configuration. Pine Street between Commercial and Liberty streets would be realigned to connect to the new bridge exit ramp. Bicycles on Commercial Street would be directed to a separated multi-use path from Taylor Street to south of Pine Street.

1.2.6 Construction Activities

The estimated total project cost of the preferred alternative is $424.6 million (in 2020 dollars); this includes the cost associated with purchasing right-of-way. If built as a single project, the preferred alternative would take approximately 4 years to construct.

1.2.6.1 Construction Impacts on East Side of Willamette River

Construction staging on the east side of the river would be relatively minor due to the localized nature of the work. Modifications of the Commercial Street/Liberty Street and Pine Street/Liberty Street intersections would interrupt traffic for one construction season and would include lane closures. Front Street would be out of service for at least two construction seasons due to overhead bridge construction and realignment of the street. Other construction activities on the east side of the river would primarily be offline of the existing transportation system. Temporary construction impacts to properties in the immediate four-block area such as noise, dust, and traffic delays could be high for at least one construction season. Alternate routes for impacted traffic include Broadway Street and Cherry Avenue.

1.2.6.2 Construction Impacts on West Side of Willamette River

Construction staging of the preferred alternative on the west side of the river would consists of work both online and offline of the existing transportation system. Offline work would include the construction of Marine Drive from Glen Creek Road to River Bend Road, the new river crossing and its connection to Marine Drive, the extension of 5th Avenue to Marine Drive, and Beckett Street between Wallace Road and Marine Drive.

Online work would include the intersection construction work on Wallace Road, Orchard Heights Road, Glen Creek Road, and River Bend Road. Construction activities on Wallace Road would entail widening for additional turn lanes at Hope Avenue and Orchard Heights Road. On River Bend Road, activities would entail the construction of a roundabout at the new intersection with the proposed Marine Drive. On Glen Creek Road, activities would entail a new intersection with proposed Marine Drive.

A major component of the preferred alternative is the construction of a new elevated flyover roadway connection from proposed Marine Drive to OR 22 in the Edgewater Street area. This work would cause disruptions to OR 22 and Edgewater Street for at least two to three construction seasons.

If built as a single project, the duration of construction activities on the west side of the river would be completed in two to three construction seasons.

1.2.6.3 Construction Mitigation Measures

The preferred alternative creates opportunities to implement best practices for construction staging. Many measures can be implemented to mitigate temporary impacts caused by construction, including the following:

- Minimize construction duration using alternative delivery methods that place a high emphasis on an accelerated construction schedule.
- Implement a highly effective public involvement/public relations plan to educate travelers about the project and keep them regularly informed of construction activities.
- Place a high priority on maintaining regional mobility during construction; the existing Marion/Center Street Bridge river crossing is pivotal and must continue to operate during construction.
- Develop high-quality construction staging and traffic control plans that balance the needs of the construction contractor with the ongoing needs of the traveling public and local landowners.
- Demonstrate strong community leadership in the planning, design, and construction of the project.

1.2.7 River Traffic

No impacts to river traffic (e.g., recreational boating, Willamette River Queen tours) in the Willamette River are anticipated as a result of the preferred alternative. The preferred alternative new bridge would have full navigational clearance in both channels of the river around McLane Island and it is located far north of the boat ramp.

CHAPTER 2

Affected Environment

2.1 Regulations and Standards

2.1.1 Federal Highway Administration (FHWA) Regulations

FHWA regulations provide policies and procedures relating to the provision of pedestrian and bicycle accommodations, and to federal participation in the cost of these accommodations. FHWA directs that full consideration should be given to the safe accommodation of pedestrians and bicyclists. FHWA further directs that the special needs of the elderly and the disabled must be considered in all federal-aid projects that include pedestrian facilities. When current or anticipated pedestrian and/or bicycle traffic presents a potential conflict with motor-vehicle traffic, every effort must be made to avoid, minimize, and mitigate the detrimental effects on all highway users who share the facility (23 Code of Federal Regulations [CFR] 652).

2.1.2 Oregon "Bike Bill"

The Oregon Legislature passed Oregon Revised Statute (ORS) 366.514, also known as the "Bike Bill," in 1971. Footpaths and bicycle trails, including curb cuts or ramps as part of the project, shall be provided wherever a highway, road, or street is being constructed, reconstructed, or relocated. This bill applies to projects being proposed by ODOT as well as by all cities and counties in Oregon. It also allows ODOT, cities, and counties to spend reasonable amounts of their share of the state highway fund on facilities for pedestrians and bicyclists.

2.1.3 Americans with Disabilities Act (ADA)

The 1990 Americans with Disabilities Act (ADA) extends civil rights protection to individuals with disabilities similar to that provided to persons on the basis of race, sex, national origin, and religion under the Civil Rights Act of 1964. Federal-aid highway projects must comply with the ADA by building transportation facilities that provide equal access for all persons. All projects shall comply with the most current ADA guidelines. The same degree of convenience, accessibility, and safety available to the general public will be provided to persons with disabilities. Design, signing, and marking of pedestrian and bicycle facilities shall be in conformance with the Oregon Bicycle and Pedestrian Plan (ODOT, 1995).

2.1.4 Oregon Highway Plan

The Oregon Highway Plan (OHP) is a statewide plan that directs how ODOT plans, manages, and funds state highway facilities. The OHP addresses management strategies to increase safety, preserve the system, and extend its capacity. Several OHP policies establish general mobility objectives and approaches for maintaining mobility on the state highway system. One of these policies, Highway Mobility Targets, identifies state highway mobility performance expectations for ODOT projects. These mobility targets were developed as a method to gauge reasonable and consistent standards for traffic flow along state highways (ODOT, 2006). The term “mobility targets” replaces the term “mobility standards,” which were previously used in the OHP.

ODOT measures vehicular highway mobility performance through volume to capacity (v/c) ratios. However, when making initial determinations of facility needs necessary to maintain acceptable and reliable levels of mobility on the state highway system, achieving v/c targets is not necessarily the determinant of a transportation solution(s). Through Policy 1F of the OHP, the State acknowledges that achieving important community goals may impact mobility performance and that higher levels of congestion may result in certain areas. For intersections with two intersecting highways, such as the Wallace Road (Oregon State Route 221 [OR 221]) and the Marion Street Bridge (OR 22) intersection, the highway with the lowest v/c target determines the applicable mobility target.

2.1.5 City of Salem Transportation System Plan

The Salem Transportation System Plan (TSP) is the City's master plan to guide its actions and transportation system investments for the next 25 years. The TSP is a comprehensive document containing goals, objectives, policies, projects, and programs needed to provide mobility options for all modes of travel: automobile, transit, bicycle, pedestrian, and freight.

Salem TSP Policy 2.5 dictates that traffic analysis being performed for non-state facilities use City of Salem mobility standards (City of Salem, 2007a): a v/c standard of 1.0 for all streets (applying to existing conditions and the future No Build Alternative) and streets are to be designed to function at a v/c standard of 0.90 (applying to the preferred alternative). Use of a v/c standard has been adapted from the City standard, which uses intersection level of service (LOS), for consistency’s sake with this analysis. The v/c ratios are more representative of overall performance than LOS because LOS ratings are assessed based on the worst performing intersection approach.

State mobility targets were applied to the four state highways in the project area, and City of Salem mobility standards were applied to local roadways (Table 2.1-1).

TABLE 2.1-1

Mobility Targets and Standards Applicable to Operational Analysis of Existing Conditions

Highway Category	Land Use	Applicable v/c Ratio
Inside Urban Growth Boundary		
Statewide (NHS/non-NHS) Expressways	MPO	0.85
Regional Highway	MPO	0.95
Local Transportation System Plan (TSP)		
Regional highway facilities, not operated by ODOT	City of Salem	0.90

NHS = National Highway System Sources: OHP Policy 1F Revisions (ODOT, 2011)

Salem TSP (City of Salem, 2007)

2.2 Study Area

The study area for traffic and transportation analysis is shown on Figure 2.2-1. The study area accounts for the geographic area that could be affected by project actions either directly or indirectly.

The following highways in the study area are classified as National Highway System (NHS) Statewide Expressways:

- Willamina–Salem Highway (OR 22), from Rosemont Avenue to the intersection with Commercial Street
- Salem Highway/Mission Street (OR 22/Oregon State Route 99E–Business Route [OR 99E-B]), from milepost 5.01 to milepost 8.48 (that is, from Center Street to Interstate 5 [I-5])

The 34 study area intersections assessed in this report are listed in Table 2.2-1 and shown on Figure 2.2-1. Table 2.2-1 contains both existing intersections and intersections that would be created as a result of project actions.

2.3 Roadway System Operations

This section describes existing roadway system operational conditions. This report utilizes two categories of analysis to assess roadway system operations in the API: regional measures analysis and intersection-level analysis.

It is important to note that, although this final tech report appropriately focuses on analyzing the preferred alternative, FHWA directed the project team to process the previously dismissed DEIS alternatives using the 2040 model that has been used for assessing the preferred alternative. As can be seen in the v/c results provided in Appendix A, there was no measurable change in the comparative differences between DEIS alternatives under the 2040 model versus the 2031 model that was used for analysis in the DEIS.

2.3.1 Regional Measures Analysis

To assess regional transportation performance, the project utilized vehicle miles traveled (VMT), vehicle hours of delay (VHD), and vehicle hours traveled (VHT). Of the three regional measures, VHD is the most relevant because it is a measure of congestion. These measures are provided for the one-hour, peak hour.

Vehicle Miles of Travel
VMT measures the miles traveled by vehicles within the SKATS study area for the AM and PM peak time period.

The study area for assessing regional traffic performance is the Salem-Keizer Area Transportation Study Metropolitan Planning Organization (SKATS MPO) travel demand forecast model area, which includes both the Salem and Keizer Urban Growth Boundaries (UGB). The area for these measures is broad, and well beyond the direct influence area for the existing bridge and preferred alternative. It is important to keep in mind that the measures reflect regional trips, most of which do not use the bridge, for example, travel along I-5, South Commercial Street, and River Road North are all included in the calculations of VMT, VHD, and VHT. For this reason, these measures provide a very general comparison of a broad area. Regional measures for the No Build Alternative and the preferred alternative are reported in Section 4.4, Indirect Impacts.

Figure 2.2-1: Study Area Intersections

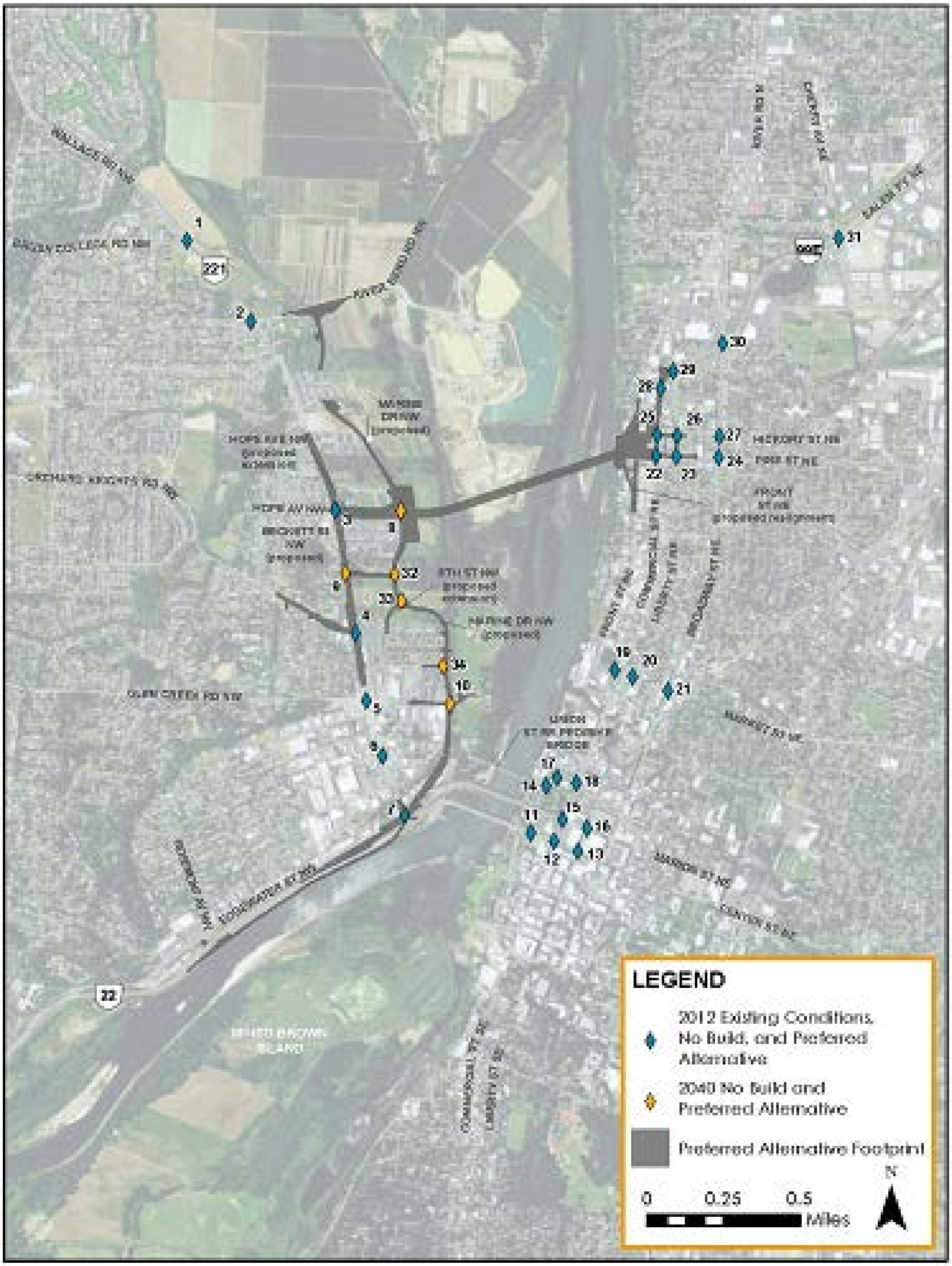


TABLE 2.2-1
Study Area Intersections

		2012 Existing Conditions		2040 No Build Alternative		2040 Preferred Alternative	
ID #	Intersection	Control Type	Analyzed	Control Type	Analyzed	Control Type	Analyzed
1	Wallace Rd./ Brush College Rd.	TWSC	X	TWSC	X	TWSC	X
2	Wallace Rd./ River Bend Rd.	Signal	X	Signal	X	Signal	X
3	Wallace Rd./ Hope Ave.	TWSC	X	TWSC	X	Signal	X
4	Wallace Rd./ Orchard Heights	Signal	X	Signal	X	Signal	X
5	Wallace Rd./ Glen Creek Rd.	Signal	X	Signal	X	Signal	X
6	Wallace Rd./ Taggart Rd.	Signal	X	Signal	X	Signal	X
7	Wallace Rd./ OR 22/Edgewater	Signal	X	Signal	X	Signal	X
8	Hope Ave./ Marine Drive	Does Not Exist		TWSC	X	Signal	X
9	Wallace Road/ Becket Street	Does Not Exist		TWSC	X	TWSC	X
10	Marine Drive/ Glen Creek Rd.	Does Not Exist		TWSC	X	Signal	X
11	Center St. Off/ NB Front Street	Signal	X	Signal	X	Signal	X
12	Center St./ Commercial St.	Signal	X	Signal	X	Signal	X
13	Center St./ Liberty St.	Signal	X	Signal	X	Signal	X
14	Front St./ Union St.	Signal	X	Signal	X	Signal	X
15	Marion St. / Commercial St.	Signal	X	Signal	X	Signal	X
16	Marion St./ Liberty St.	Signal	X	Signal	X	Signal	X
17	Front St./ Front St. (OR 99E)	TWSC	X	TWSC	X	TWSC	X
18	Division St./ Commercial St.	Signal	X	Signal	X	Signal	X
19	Market St./ Commercial St.	Signal	X	Signal	X	Signal	X

TABLE 2.2-1
Study Area Intersections

ID #	Intersection	2012 Existing Conditions		2040 No Build Alternative		2040 Preferred Alternative	
		Control Type	Analyzed	Control Type	Analyzed	Control Type	Analyzed
20	Market St./ Liberty St.	Signal	X	Signal	X	Signal	X
21	Market St./ Broadway	Signal	X	Signal	X	Signal	X
22	Commercial St./ Pine St.	Signal	X	Signal	X	Signal	X
23	Liberty St./ Pine St.	Signal	X	Signal	X	Signal	X
24	Broadway St./ Pine St.	Signal	X	Signal	X	Signal	X
25	Commercial St./ Hickory St.	TWSC	X	TWSC	X	Signal	X
26	Liberty St./ Hickory St.	TWSC	X	TWSC	X	Signal	X
27	Broadway St./ Hickory St.	TWSC	X	TWSC	X	TWSC	X
28	Salem Pkwy./ Commercial St.	Merge	X	Merge	X	Merge	X
29	Salem Pkwy./ Liberty St.	Signal	X	Signal	X	Signal	X
30	Salem Pkwy./ Broadway St.	Signal	X	Signal	X	Signal	X
31	Salem Pkwy./ Cherry St.	Signal	X	Signal	X	Signal	X
32	Marine Dr./ Beckett St.	Does Not Exist		TWSC	X	TWSC	X
33	Marine Dr./ 5th Ave. NW	Does Not Exist		TWSC	X	Signal	X
34	Marine Dr./ Taybin Rd.	Does Not Exist		TWSC	X	TWSC	X

TWSC – two-way stop control

VMT, VHD, and VHT existing condition (2014) measures provide a general understanding of how well the existing regional transportation system is performing from a traffic operations standpoint. The results of these existing condition regional measures are then compared against the regional measure results of the 2040 No Build Alternative and the 2040 preferred alternative.

Overall VHD for the study area is 1,342 hours in the AM peak hour (AM Peak) and 3,256 hours in the PM peak hour (PM Peak), with PM Peak delay being substantially more than during the AM Peak. VMT and VHT are also both greater during the PM Peak (Table 2.3-1).

TABLE 2.3-1
Regional Measures: Existing Conditions 2014

	Existing Conditions (2014)	
Metric	**AM**	**PM**
VMT	321,630	412,961
VHT	8,711	13,233
VHD	1,342	3,256

2.3.2 Peak Hour Spreading

Road and intersections have a given amount of capacity based on the number of lanes, the timing of the signal phases, nearby land uses, and other factors. When traffic volumes approach or exceed that capacity, congestion occurs. The greater the volume is over capacity, the greater the congestion, with longer queues of vehicles and greater delay. This is evident on many facilities in the study area in the base year (2012) traffic analysis, where traffic demand on Wallace Road, Marion Street, and other streets in the study area result in congestion and significant delay in the peak hours. Traffic analysis of the base year and future year show many intersections where the v/c ratio that is greater than 1.0 for the peak hour. In these instances, the peak hour can “spread” beyond 1 hour. This occurs not only because of the capacity limitations, but also when some drivers (who are aware of recurring delays in the peak hour) shift their driving to times before or after the peak.

Peak hour spreading occurs when vehicle demands exceed capacity and when the demands are distributed outside of the analyzed traffic peak hour. While this peak spreading is not quantified in this document, it would occur due to most intersections with volume to capacity ratios greater than 1.0.

2.3.3 Intersection-Level Analysis

The existing conditions operational analysis (2012 analysis year) shows that 7 out of 28 intersections failed to meet mobility targets or standards during the AM Peak only, PM Peak only, or both the AM and PM peak hours. These seven intersections (shown on Figures 2.3-1 and 2.3-2 and listed in Table 2.3-2) are:

Figure 2.3-1: AM Intersection Mobility – Existing Conditions

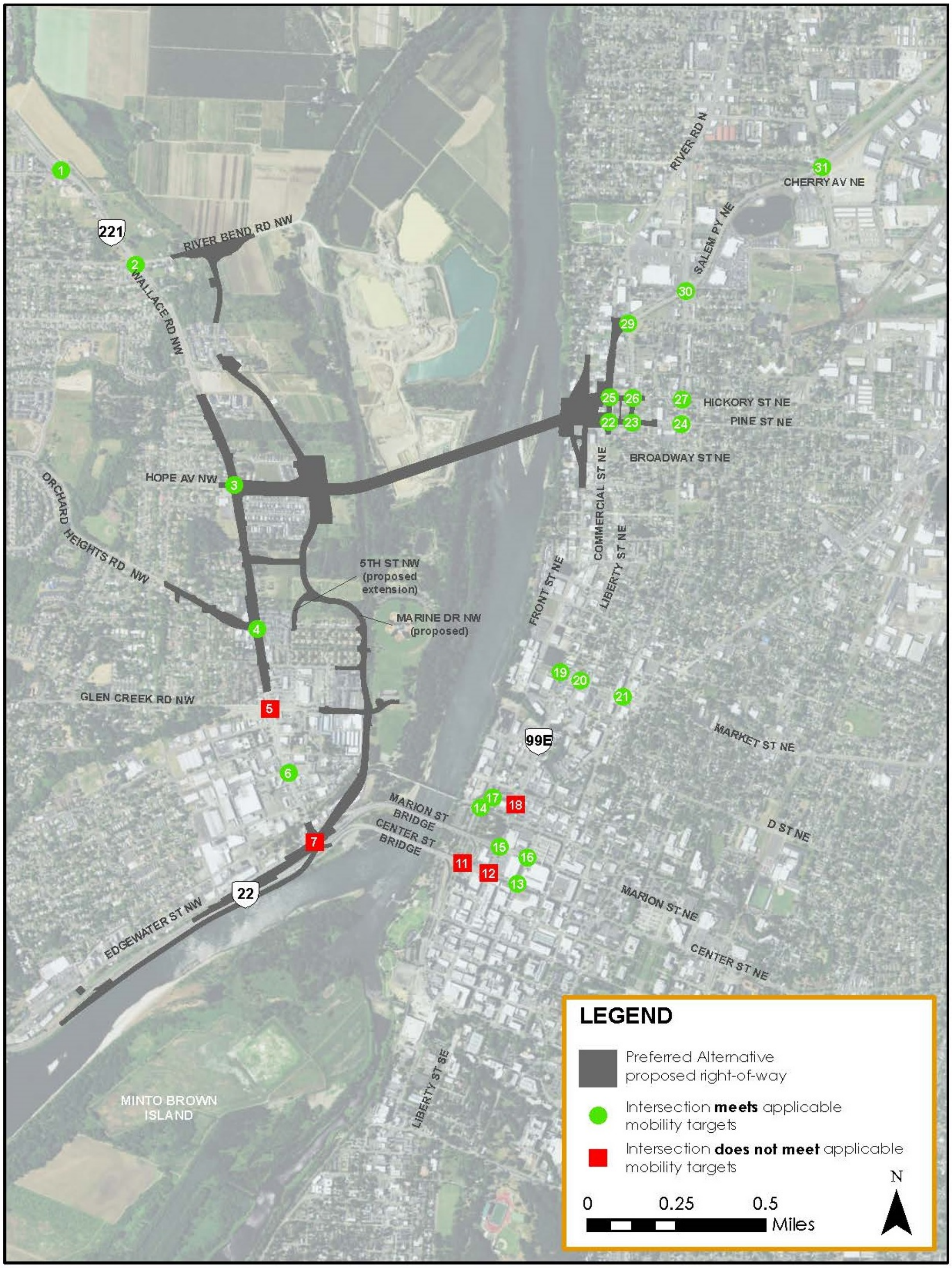


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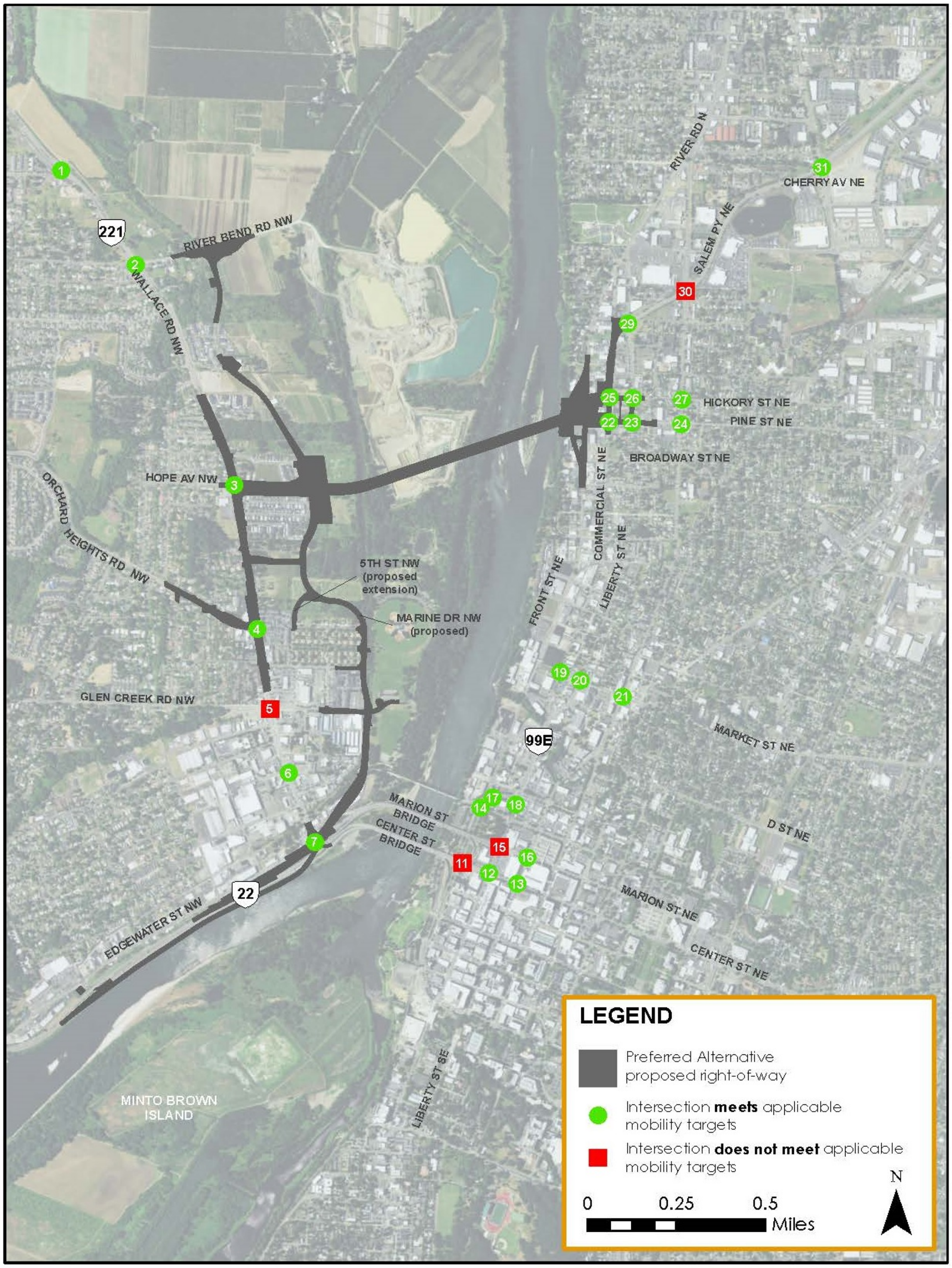
Figure 2.3-2: PM Intersection Mobility – Existing Conditions



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- ID 5: Wallace Road/Glen Creek Road (1.07 AM)
- ID 7: Wallace Road/OR 22/Edgewater (1.01 AM)
- ID 11: Center Street Off/Northbound Front Street (0.88 AM, 0.90 PM)
- ID 12: Center Street/Commercial Street (0.88 AM)
- ID 15: Marion Street/Commercial Street (1.16 PM)
- ID 18: Division Street/Commercial Street (0.90 AM)
- ID 30: Salem Parkway/Broadway Street (1.01 PM)

TABLE 2.3-2
2012 Existing Conditions Intersection Analysis for AM and PM Peak and Control Type

ID #	Intersection	2012 Existing Conditions			
		Control Type	**Mobility Target/Standard (v/c ratio)**	**AM Peak**	**PM Peak**
1	Wallace Rd./Brush College Rd.	TWSC	0.95	0.27	0.72
2	Wallace Rd./River Bend Rd.	Signal	0.95	0.54	0.51
3	Wallace Rd./Hope Ave.	TWSC	0.95	0.42	0.43
4	Wallace Rd./Orchard Heights	Signal	0.95	0.72	0.76
5	Wallace Rd./Glen Creek Rd.*	Signal	0.95	**1.07**	**0.97**
6	Wallace Rd./Taggart Rd.	Signal	0.95	0.92	0.94
7	Wallace Rd./OR 22/Edgewater	Signal	0.95	**1.01**	0.76
8	Hope Ave./Marine Drive	Does Not Exist			
9	Wallace Road/Becket Street	Does Not Exist			
10	Marine Drive/Glen Creek Rd.	Does Not Exist			
11	Center St. Off/NB Front Street	Signal	0.85	**0.88**	**0.90**
12	Center St./Commercial St.	Signal	0.85	0.88	0.51
13	Center St./Liberty St.	Signal	1.00	0.78	0.63
14	Front St./Union St.	Signal	0.90	0.57	0.61
15	Marion St. /Commercial St.	Signal	0.85	0.55	1.16
16	Marion St./Liberty St.	Signal	1.00	0.53	0.80
17	Front St./Front St. (OR 99E)	TWSC	0.90	0.62	0.70
18	Division St./Commercial St.	Signal	0.85	0.90	0.81
19	Market St./Commercial St.	Signal	0.90	0.87	0.82
20	Market St./Liberty St.	Signal	0.90	0.68	0.83
21	Market St./Broadway	Signal	1.00	0.75	0.81

TABLE 2.3-2
2012 Existing Conditions Intersection Analysis for AM and PM Peak and Control Type

ID #	Intersection	2012 Existing Conditions			
		Control Type	**Mobility Target/Standard (v/c ratio)**	**AM Peak**	**PM Peak**
22	Commercial St./Pine St.	Signal	0.90	0.58	0.52
23	Liberty St./Pine St.	Signal	0.90	0.38	0.56
24	Broadway St./Pine St.	Signal	0.90	0.40	0.59
25	Commercial St./Hickory St.	TWSC	0.90	0.59	0.46
26	Liberty St./Hickory St.	TWSC	0.90	0.32	0.50
27	Broadway St./Hickory St.	TWSC	0.90	0.15	0.34
28	Salem Pkwy./Commercial St.	Merge	N/A	N/A	N/A
29	Salem Pkwy./Liberty St.	Signal	0.90	0.59	0.85
30	Salem Pkwy./Broadway St.	Signal	0.90	0.83	**1.01**
31	Salem Pkwy./Cherry St.	Signal	0.90	0.77	0.79
32	Marine Dr./Beckett St.	Does Not Exist			
33	Marine Dr./5th Ave. NW	Does Not Exist			
34	Marine Dr./Taybin Rd.	Does Not Exist			

TWSC – two-way stop control
Analysis used *Highway Capacity Manual 2000* (TRB, 2000) methods.
Black and bolded cells indicate locations where mobility standards would not be met.
For non-signal intersections, the roadway with the greatest (worst) v/c ratio was reported.

NOTE: Existing conditions analysis does not assume recent intersection improvements at Wallace Road and Glen Creek Road because traffic counts were taken prior to improvements.

Wallace Road carries the greatest volume of trips in the West Salem area. This facility receives heavy directional traffic during the AM and PM peak hours. In the mornings, the majority of trips travel southbound towards OR 22 and the Center Street Bridge. In the evenings, this movement reverses, and the majority of trips travel northbound on Wallace Road.

Roadways surrounding the Center Street Bridge experience congestion during the AM and PM peak hours. This congestion is associated with people getting on and off the bridges. The Center Street Bridge carries traffic eastbound across the Willamette River. This bridge has a four-lane cross-section with two lanes originating from OR 22, and two lanes from the Wallace Road and Edgewater Street intersection. Four lanes arrive at the Center Street and Commercial Street intersection on the eastside of the river, with ramps to southbound Front Street and northbound Front Street.

The intersections at the existing Center Street Bridge experience demand that either approaches or exceeds capacity. The intersections of Center Street (bridge off-ramp) and northbound Front Street (AM and PM), the intersection of Center Street and Commercial Street, at the bridgehead, operate poorly in the AM.

To address congestion in this area, recently, projects have widened the Center Street ramp to southbound Front Street Bypass and a signal has been added to the end of the northbound Front Street Bypass to meter entering traffic. While these projects reduce congestion and delay, congestion can still occur.

The Marion Street Bridge carries westbound traffic across the Willamette River. It has a four-lane cross-section with three lanes originating at the Commercial Street and Marion Street intersection and one lane from northbound Front Street. The bridge arrives on the west side of the Willamette River with two lanes to OR 22 and two lanes to the Wallace Road and Edgewater Street intersection. Intersections at the Marion Street Bridgeheads met mobility targets for the AM Peak only.

Salem Parkway, in North Salem, dictates operations along OR 99E-B (which is Salem Parkway and the Commercial Street/Liberty Street couplet). Salem Parkway and Broadway Street fail to meet mobility targets during the PM Peak.

2.3.4 Bridge and Roadway Volumes

Volumes reported are calculated using the 2009 base year travel volume, and are not counts. The volumes represent the year 2012. The analysis reflects conditions from 2009 when overall volumes on the bridge (ADT = 85,929) were lower than the pre-recession peak of 2006 (ADT = 88,088) and the return of higher volumes in 2015 (ADT = 91,213).

Roadways surrounding the Center Street and Marion Street Bridges experience congestion during the AM and PM peak hours. This congestion is associated with people getting on and off the bridges. Stop-and-go conditions on the Marion Street Bridge cause Marion Street to back up several blocks into the downtown grid and vehicle queues can frequently extend back to the Capitol Mall area (Cottage Street, Winter Street, or Summer Street).

Figures 2.3-3 and 2.3-4 provide a segment-by-segment depiction of AM and PM peak hour volumes for existing conditions (2012). Traffic volumes for road segments depicted on figures in this section are derived from traffic-model roadway segments that best represent conditions on that particular segment.

2.3.4.1 Center Street Bridge

The Center Street Bridge carries traffic eastbound across the Willamette River. This bridge has a four-lane cross-section with two lanes originating from OR 22, and two lanes from the Wallace Road & Edgewater Street intersection. Four lanes arrive at the Center Street & Commercial Street intersection on the east side of the river, with ramps to southbound Front Street and northbound Front Street.

Volumes during the AM Peak on the Center Street Bridge are 4,090 vehicles per hour. During the PM Peak, Volumes are 3,950 vehicles per hour. This pattern reflects the commuting pattern of eastbound travel from West Salem being heavier in the mornings than in the evenings.

Figure 2.3-3: AM Peak Hour Volumes – Existing Conditions

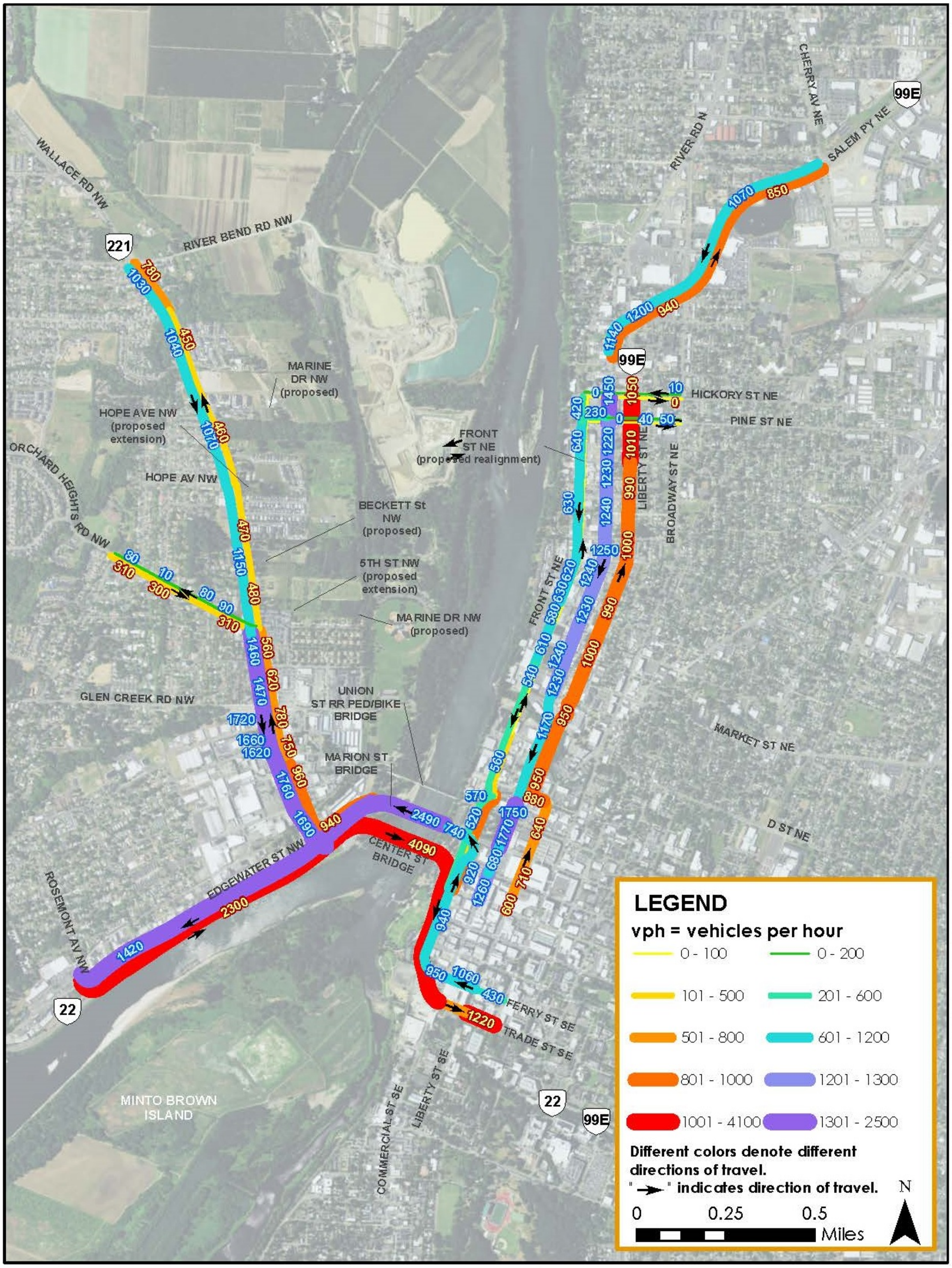

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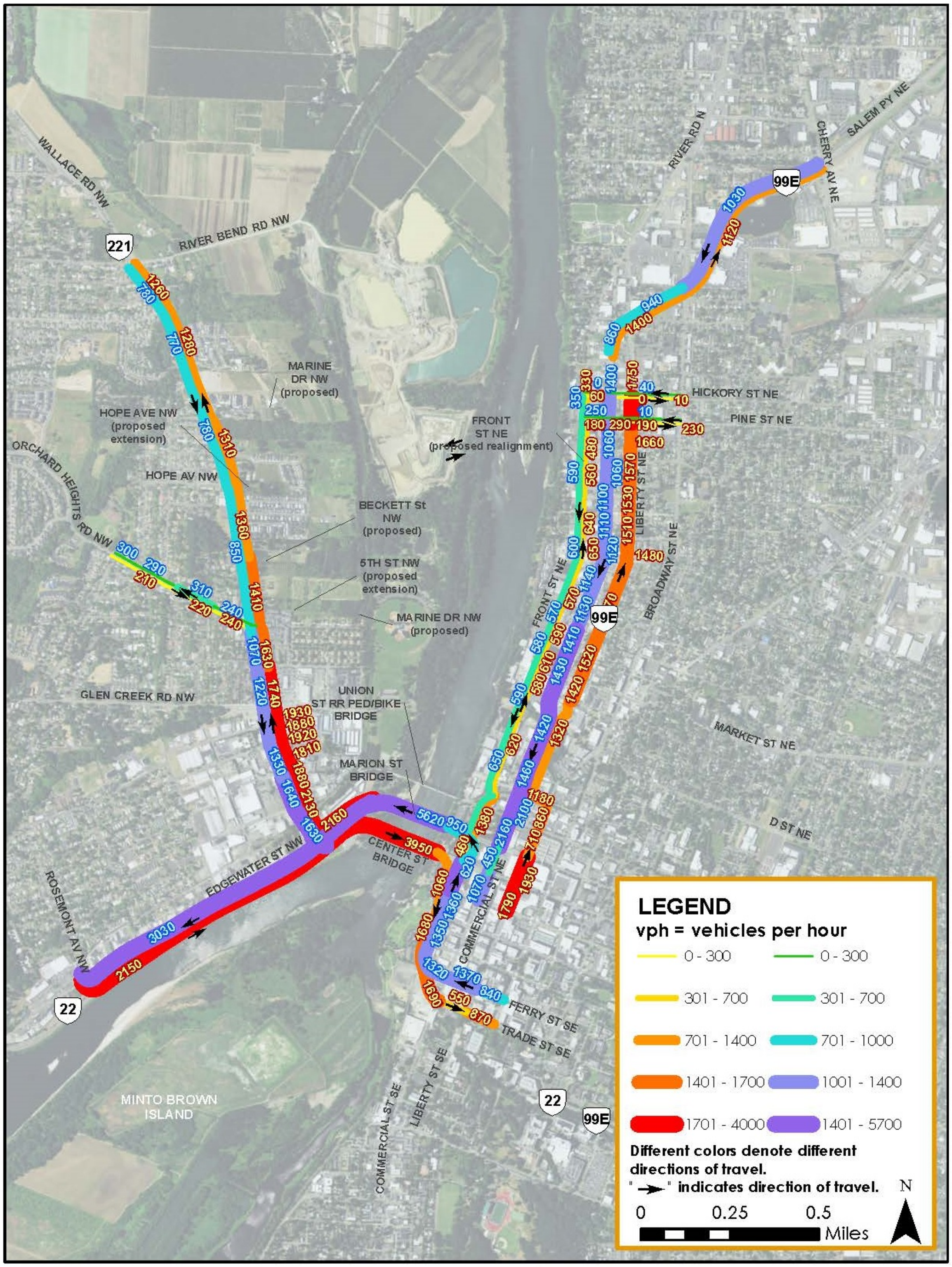
Figure 2.3-4: PM Peak Hour Volumes – Existing Conditions



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2.3.4.2 Marion Street Bridge

The Marion Street Bridge carries westbound traffic across the Willamette River. It has a four-lane cross-section with three lanes originating at the Commercial Street & Marion Street intersection and one lane from northbound Front Street. The bridge arrives on the west side of the Willamette River with two lanes to OR 22 and two lanes to the Wallace Road & Edgewater Street intersection. Under existing conditions, traffic on the Marion Street Bridge experiences a large amount of weaving from vehicles traveling from Commercial Street to OR 22 (crossing two lanes). Additional weaving occurs because of vehicles traveling from northbound Front Street to Wallace Road (crossing two lanes as well).

Volumes during the AM Peak on the Marion Street Bridge are 2,490 vehicles per hour. During the PM Peak, volumes increase to 5,620 vehicles per hour. This pattern reflects the commuting pattern of westbound travel from the central business district (CBD), North Salem (and travel originating from other places east of the bridges) being heavier in the evenings than in the mornings.

To augment volume analysis and demonstrate the level of congestion that occurs within the CBD due to congestion, traffic queues were modeled for westbound travel on Marion Street (across the Marion Street Bridge) (Table 2.3-3).

TABLE 2.3-3
Westbound Marion Street Queues at High Street

	Existing Conditions	
	AM	**PM**
Avg. Queue (feet)	70	135
95th % Queue (feet)	90	170[a]

Notes:

[a] 95th percentile volume exceeds capacity, queue may be longer

Queue shown is maximum after two traffic signal cycles

These queue lengths provide a basis for comparison for the No Build Alternative. The 95th percentile queue length represents a queue that has a 5-percent probability of being exceeded during the peak-hour.

During the PM Peak, queue lengths approaching the Marion Street bridge can extend into past Market and Norway Street, into the downtown, experiencing heavy congestion and delay.

2.3.4.3 North Salem Area

OR 99E-B (which is Salem Parkway and the Commercial/Liberty Street couplet) experiences higher volumes southbound towards the bridges during the AM Peak compared to northbound. During the PM Peak, this pattern reverses, with more volume traveling northbound; however, the difference in direction is not as great as during the AM Peak.

Because of significant volumes and congestion on the approaches to the Marion Street Bridge from Front Street, Marion Street, and Commercial Street in the PM Peak, southbound traffic on Commercial Street is very congested, with queues that increase “upstream” during the peak on Commercial Street and frequently extend past Market Street, Norway Street, or even further.

2.3.4.4 West Salem Area

OR 221 (which is Wallace Road), during the AM Peak, experiences higher volumes in the southbound direction than in the northbound direction. During the PM Peak, this pattern reverses, and northbound volumes are higher than southbound.

OR 22 volumes are greater eastbound during the AM Peak compared to westbound. Again, this pattern reverses during the PM Peak, when westbound volumes are higher than eastbound volumes.

2.4 Safety Conditions Analysis

This section analyzes vehicle crash data for study area intersections and major corridors for the years beginning January 1, 2010, through December 31, 2014. The crash data were analyzed to identify crash patterns that might describe safety deficiencies within the study area.

2.4.1 Corridor Crash Rates

Crash rates, expressed in “crashes per million vehicle-miles (MVM) traveled,” were used to compare the crash experience of one roadway segment to another. This rate expresses how many crashes might be expected for vehicles traveling through a particular section of roadway for a cumulative total of one million miles. For example, a crash rate of 1.0 would mean that, for every million-vehicle miles for the segment, there is an average of one vehicle crash.

The four segments listed in Table 2.4-1 were analyzed as part of the Salem River Crossing Project. These corridors were selected based on the study area boundaries and the footprint of the preferred alternative. Crash rates for two of these segments (OR 22 and OR99E-B [Commercial/Liberty Couplet]) exceed their corresponding average state rates.

Two segments experience crash rates that are greater than the statewide average. The segment of OR 22 includes the existing bridges and has higher-than-average congestion compared to other comparable statewide facilities. On the westside of the existing bridges, drivers weave to/from OR 22 or Wallace Road. The combination of congestion and weaving contributes to a higher-than-statewide-average crash rate, as evidenced by the high percentage of rear-end crashes.

The segment of OR 99E-B that experiences a higher-than-statewide-average crash rate is a couplet with many intersections and driveways. The high number of driveways contributes to a higher crash rate. Couplets experience a higher number of turning movements at intersections because people are trying to go in the opposite direction and cross lanes to make these turns. The combination of higher speeds, volumes, weaving, and turning movements all contribute to a higher-than-statewide-average crash rate. This is supported by the high percentage of rear-end and angle/turning crashes that occurred.

TABLE 2.4-1
Historical Segment Crash Data Summary in the Study Area (2010-2014)

State Highway	From	To	Length (miles)	Avg. AADT[a]	Number of Crashes[b]	Crash Rate[c]	
						State Average[d]	5-year Segment Average
OR 22	High Street	Rosemont Ramps	1.69	30,120	323	2.82[e]	3.48
OR 221 (Wallace Road)	OR 22 Ramps	Brush College Road	2.01	37,760	262	2.82[e]	1.89
OR 99E-B (Salem Parkway)	Commercial/ Liberty Couplet	Cherry Avenue	0.74	23,420	84	2.82[e]	2.66
OR 99E-B (Commercial/Liberty Couplet)	Chemeketa	Pine	1.60	29,270	372	2.82[e]	4.35

[a] AADT = average annual daily traffic

[b] Total number of crashes over 5-year period (2010-2014)

[c] Crashes per million vehicle miles

[d] Source: ODOT 2013 Crash Rate Table II (ODOT, 2013)

[e] Statewide average crash rate for other principal arterials in urban cities on the urban highway system (2013)

Cells shaded in gray indicate segments that exceeded their corresponding average state rate.

2.4.2 Safety Priority Index System

In addition to crash rates, ODOT also assesses roadway safety using the Safety Priority Index System (SPIS). The SPIS takes into account crash frequency, crash rate, and crash severity. SPIS scores are computed for sections that are one-tenth of a mile. The scores for different roadway segments can be compared to determine the best places to spend safety improvement funds. Typically, ODOT prioritizes improvements at locations where SPIS scores fall within the top 10 percent in the entire state or region. The 2014 top 10 percent SPIS data (ODOT, 2014) were analyzed for this report. These intersections in the top 10 percent are considered to have high intersection crash rates. Six locations within the crash-analysis study area appear in the top 10 percent of 2014 SPIS scoring. The 2014 SPIS data, which are the most recent data available, include crash information from January 1, 2011, through December 31, 2013. Table 2.4-2 lists the locations of the top 10 percent Region 2 SPIS sites in the study area.

TABLE 2.4-2
Locations of the Top 10 Percent Region 2 Safety Priority Index System (SPIS) Sites in Study Area

Location	Milepost (Location)	
	Start	**End**
OR 22 (Marion Street; Willamina- Salem Highway)	26.09 Front Street NE	26.18 Marion Street Bridge west end
OR 22 (Commercial Street/Front Street/Ferry Street; Salem Highway)	5.35 Center Street	5.53 Commercial Street SE
OR 22 (Liberty Street; Salem Highway)	5.38 Center Street	5.48 Liberty Street SE
OR 99E-B (Salem Parkway)	3.07 Northeast of Broadway Street NE	3.25 Northeast of Liberty Street NE
OR 221 (Wallace Road)	20.23 Taybin Road	20.43 9th Street NW
OR 221 (Wallace Road)	20.48 7th Street NW	20.70 North of Bassett Street NW

2.5 Transit Service

Salem-Keizer Transit, branded as Cherriots, provides public transportation services in the Salem and Keizer metropolitan area. There are currently three modes of transportation offered, which include fixed route bus service, demand-responsive service in West Salem Hills, the Connector, and a paratransit service known as CherryLift. Cherriots' bus operations include 25 routes with a mix of local and express services. There are two routes (the 5/5A and 6) that connect West Salem across the Willamette River via the Marion Street and Center Street Bridges. The 5/5A operates between West Salem and Lancaster/Walker. The 6 operates from the Wallace Park & Ride in West Salem to South Commercial Street. Both routes run Monday through Friday, from approximately 5:30 AM to 9:30 PM. However, neither route operates Saturday, Sunday, or some holidays. The adult full fare costs $1.60 for a one-way trip, or $3.25 for a day pass. In 2009, Salem-Keizer Transit District routes underwent major changes because of funding limitations. Service hours were reduced and Saturday service was eliminated. In September 2015, the system was redesigned, and routes and frequencies were changed. The Connector service in West Salem was introduced after a pilot period.

2.6 Pedestrian and Bicycle System

Existing pedestrian and bicycle facilities on the Center Street and Marion Street Bridges are minimally adequate and, in some cases, do not meet Oregon Highway Design Manual (ODOT, 2003) bridge cross-section standards for bicycle/pedestrian facilities. Improvements to these facilities would make walking and bicycling more feasible travel options in Salem. The existing pedestrian and bicycle facility across the river is on the north side of the Center Street Bridge, which is a two-way, 10-foot-wide, barrier-separated concrete path. In addition, sight distance and illumination are limited along the segment of the existing bike path located between Wallace Road and the Marion Street Bridge.

The Marion Street Bridge has no on-street bicycle facilities. It does have a 5-foot-wide sidewalk on the north side of the bridge that is separated from traffic lanes by a barrier and railing. This width is significantly below ODOT standards. Consequently, the sidewalk presents safety hazards to users, such as from two-way traffic or mixed pedestrian-bicycle traffic. Pedestrian and bicyclist connections to and from the bridges are indirect. On the east, one path connects to Water Street within Riverfront Park and the other path goes along the exit ramp to northbound Front Street; therefore, neither ramp provides connection to the downtown Salem street system. The westside connection at the Wallace Road intersection is indirect and awkward, in particular for users traveling to and from the west side of Wallace Road.

The recent conversion, in 2009, of the Union Street Railroad Bridge to a pedestrian/bicycle facility only partially addresses the pedestrian/bicycle needs noted previously. This bridge and associated pathways currently stop at Wallace Road (at the west end) and Union Street (at the east end). In 2014, a path connecting the west end of the bridge to Glen Creek Road was constructed. No clear and/or convenient connections exist to the Edgewater Street corridor in West Salem or to downtown Salem.

The Union Street Railroad Bridge Pedestrian and Bicycle Trail is a recreational facility that was renovated in 2009. The City of Salem owns the trail, which includes the bridge and a segment of trail extending from the west side of the bridge to Wallace Road SW.

The Edgewater Bicycle/Pedestrian Trail is a 6-foot-wide, paved, off-street bicycle and pedestrian facility in West Salem that is approximately 0.75 mile in length. The trail extends in a primarily east-west manner in the OR 22 corridor on State of Oregon and City of Salem highway right-of way located directly adjacent to OR 22. The trail provides a bicycle commuter connection from southern West Salem to downtown Salem.

CHAPTER 3

Data Sources and Data Collection Methods

3.1 Data Collection and Analysis Methods

The existing year analysis was conducted using the most recent traffic counts (ranging from 2008–2011) that were available for each study area intersection. The team balanced and added traffic growth to all intersections to represent 2012 traffic volumes, which corresponds to the base year (also known as "existing conditions") for the FEIS.

The team collected intersection traffic counts from a variety of sources. A combination of counts collected between the years 2008 and 2011 from three different traffic studies (2008 Salem River Crossing DEIS, 2011 Central Salem Mobility Study, and 2010 Wallace Road/Glen Creek Road intersection analysis) and counts taken in 2012 for AM and PM peak hours were used as the basis for the existing conditions analysis.

Peak Hour
Traffic analysis was conducted for peak traffic hours, which occur in the morning and evening. The system AM and PM peak hours were based on traffic data collected for study intersections.

- AM peak hour is 7:15 AM to 8:15 AM (AM Peak)
- PM peak hour is 4:30 PM to 5:30 PM (PM Peak)

The traffic analysis used these system-wide peak hours.

Traffic analysis results are provided for existing conditions (2012), the 2040 No Build Alternative, and the 2040 preferred alternative. The team used the Synchro software package to analyze traffic conditions and optimize signal controllers for each future scenario. Analysis was conducted for both the AM and the PM peak hours.

For each study intersection, the team calculated Volume-to-capacity (v/c) ratios and compared to ODOT and City of Salem updated mobility guidelines. The team performed Synchro traffic analysis in accordance with the *Highway Capacity Manual 2000* (TRB, 2000) methodology.

SKATS, the regional MPO, created the travel demand forecasting models for the existing year (calibrated for 2009) and the future year (2040) using VISUM software.

For both the future No Build Alternative and the preferred alternative, post-processed intersection turning movements were developed using National Cooperative Highway Research Program 255 techniques. For the preferred alternative, additional adjustments to the new north bridge were based on the 2040 SKATS VISUM travel

Formula for Travel Demand Forecasting

- No Build Alternative volumes = Existing traffic counts + (No Build Alternative forecast model – Existing forecast model)

- Preferred alternative volumes = No Build volumes + (Preferred Alternative forecast model – No Build Alternative forecast model) demand model. Truck percentages were based on existing data, and the peak hour factor used for the future analysis was as follows:

- If > 0.95, same as existing conditions
- If <= 0.95, use 0.95

Traffic capacity analysis uses the peak 15-minute rate of flow. When reported, flow rates are typically expressed in vehicles per hour. Therefore, the peak-hour factor (PHF) is the relationship between the 15-minute flow rate and the hourly volume. It is defined as:

> PHF = Hourly Volume/(Peak 15-minute interval of volume multiplied by 4 periods in an hour)

The PHF represents how peak hour traffic volume is spread out over the course of the peak hour. The PHF can range between 0.25 and 1.00. The lower the number, the more compressed peak hour traffic is into the highest 15-minute interval. Typically, urban areas have higher values of PHF (greater than 0.90), indicating the peak hour traffic volume is close to evenly distributed across the peak hour.

Intersection operational analysis was modeled using Synchro software. Post-processed traffic volumes were entered in the traffic operations model for 2040 No Build Alternative AM and PM peak hours and 2040 preferred alternative AM and PM peak hours. For operational analysis, signalized intersection timings were optimized based on future traffic volumes. Growth rates and mode splits were taken from the SKATS regional travel demand model.

Appendix A provides a comparison of DEIS alternatives for the model years 2031 and 2040. FHWA requested a comparison of the DEIS alternatives for the two model years because of the substantial time difference. The relative differences in performance among alternatives for each model year are similar. Overall, failing intersections were the same during the two model years and, in some cases, the year 2040 has worse performance because of greater levels of traffic.

CHAPTER 4

Impacts Analysis

4.1 Overview of Impact Analysis

This chapter contains an analysis of the direct, indirect, cumulative, and temporary impacts related to the Salem Crossing Project preferred alternative. This chapter also discusses measures to mitigate anticipated negative impacts from preferred alternative actions.

- **Direct impacts** are defined as those permanent impacts that are caused by proposed alternative actions and occur at the same time and place as those actions. For the purpose of the traffic and transportation report, direct impacts are considered to be those related to traffic, bicycle, pedestrian, and transit performance during project operation.
- **Indirect impacts** are defined as those permanent impacts that are caused by proposed alternative actions and are later in time or farther removed in distance but are still reasonably foreseeable.
- **Cumulative impacts** are defined as impacts on the environment resulting from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. A number of actions have been (or are likely to be) undertaken that, when combined with any of the alternatives, would have cumulative impacts on the social and natural environment in the study area. To evaluate cumulative impacts, the project team established a time frame of reference for evaluating how past actions have shaped the social and natural environment of the study area, and how future actions might further change the conditions resulting from these past actions. The "past" runs from the 1840s (settlement of the Salem area) to the present. Past, present, and reasonably foreseeable future actions related to traffic and transportation are addressed in Sections 5.1.1 and 5.1.2.
- **Temporary construction impacts** are defined as those short-term impacts that are caused by constructing the proposed alternative action.

4.1.1 Past and Present Actions

The following summary list of key historic events provides a basis for analyzing past and present actions that have helped shape current traffic and transportation conditions.

- Salem approved City charter (1857)
- Voters reaffirmed Salem as the Oregon state capital (1864)
- A wooden truss bridge was built over the Willamette River (1886); it was washed out and replaced with a steel bridge (1891)
- First streets were improved in downtown Salem; City installed water and sewer systems (1870s–90s)
- Streetcar service began in Salem (1889)

- A flood destroyed most of West Salem's buildings (1890)
- Major annexation was made to the City of Salem (1903)
- West Salem approved its city charter (1913)
- A railroad bridge was built across the Willamette River (1913)
- The third Center Street Bridge was constructed (1917–18)
- The streetcar stopped operation; bus service was initiated (1927)
- Major institutions and facilities were constructed (library, schools, hospital, state buildings, and so forth) and the City of Salem developed a municipal water system (1930–35)
- Fire destroyed the State Capitol (1935)
- City of Salem adopted a Planning and Zoning Code (1945)
- West Salem voted to become part of the City of Salem (1949)
- Dams constructed along the Willamette River reduced flooding and allowed development in low-lying areas, such as Keizer (1950s)
- Marion Street Bridge was constructed; Center Street Bridge was modified (1952)
- ODOT completed a 308-mile section of the I-5 section through Oregon (1966)
- Interstate 305 (I-305) was proposed to connect I-5 to the Salem CBD and continue over the Willamette River (1963); opposition to I-305 led the City of Salem and Marion County to opt for a trade-in of $65 million in funds for several transportation improvements such as Salem Parkway, North River Road, parts of Front Street Bypass, and so forth (1976)
- Salem Area Mass Transit District was created; prior to this time, this function was part of the City of Salem (1979)
- District bus service began (1981)
- Marion Street Bridge was widened to four lanes (1981–82)
- Center Street Bridge was reconstructed to include four lanes (1982–83)
- Salem Parkway, which connected I-5 at Keizer to downtown Salem, was completed (1986)
- SKATS MPO plan includes two additional river crossings—Chemawa/Lockhave/Olsen corridor and south Salem location between Homestead Road and Mission Street (1988)
- Major national retailers opened stores in suburban Salem and in Keizer (1980s–90s)
- Park and open space areas were acquired and developed, including Minto-Brown Island Park (early 1970s), Salem Riverfront Park (late 1990s), and Wallace Marine Park (1950s–70s)

- Numerous detailed plans were adopted for Salem Urban Area Public Facilities (1992), Willamette River Greenway (1979), Water (1994), Wastewater (1996), Transportation (1998), Parks (1999), and Stormwater (2000)
- *Willamette River Bridgehead Engineering Study* (SKATS MPO, 1998) was completed with recommendations for increasing capacity in the short term (1998)
- Salem Downtown Historic District was listed in the National Register of Historic Places (2001)
- *Willamette River Crossing Capacity Study* (SKATS MPO, 2002) identifies Pine/Tryon Street as the preferred corridor, with the Kuebler Boulevard corridor retained for further study (2002)
- West Salem Neighborhood Plan was adopted (2004)
- The *West Salem Gateway Area Refinement Plan* (Satre Associates, 2005), was presented to City Council (2005).
- Changes were made to street and ramp approaches and exits from bridges (2000–09) including the following:
  - Wallace Road was widened between Orchard Heights Road and Salem city limits
  - The signal on Wallace Road was moved from 7th Street to Taggart Drive
  - The Edgewater Street left turn to northbound Wallace Road was closed
  - A median and phased pedestrian crossing were constructed on Front Street at Court Street and on Front Street at State Street
  - The Center Street Bridge off-ramp to southbound Front Street was widened
  - A red-light camera was installed at Marion Street and Commercial Street
  - The Front Street & Commercial Street & Division Street intersection was modified to allow a third southbound through lane on Commercial Street
  - Taggart Drive and Bartell Drive in West Salem were constructed to improve local circulation and reduce traffic on Wallace Road
  - The stop sign at the end of the ramp from Center Street Bridge to northbound Front Street was replaced by a traffic signal
- Urban renewal plans were adopted with identified projects and improvements for several Urban Renewal Areas, including Riverfront-Downtown (1975), North Gateway (1990), West Salem (2001), and South Waterfront (2007)
- Collaborative city center planning and actions for Salem Vision 2020 were conducted (2008)
- New River Road wastewater treatment facility was constructed (2008–09)
- Salem Hospital was expanded (to include a new patient tower and laboratory) (2008–09)
- Union Street railroad bridge was converted to a bicycle/pedestrian facility (2009)

- Salem-Keizer Transit (Cherriots) restructured its transit service because of reduced property-tax revenues; Saturday service was eliminated and transit routes in West Salem were reduced from five to two lines (2009)
- A new signal at the end of the Center Street exit ramp at northbound Front Street was constructed (2009)
- Chemeketa Community College was expanded (to include a new four-story Business and Industry Center building located at the intersection of Union & High Streets) (2009)
- Water Place, in the CBD on Liberty Street across from City Hall, was expanded to include a Class A office and restaurant (2010)
- A new multi-story condominium tower (The Rivers Condominium Building) was constructed at 156 Front Street (between Court and State streets, across from Salem Riverfront Park) (2010)
- New middle and elementary schools in West Salem opened in the fall of 2011. Walker Middle School affects traffic patterns in the AM Peak; shifting traffic to the new middle school will reduce traffic on Wallace Road in the near term.

4.1.2 Reasonably Foreseeable Future Actions

- Willamette University will be expanded toward the CBD (to include a new performing arts center).
- State of Oregon will expand office space in the Capitol Mall.
- Existing Wells Fargo Building in the CBD will be torn down and replaced with a three- to four-story office/retail building (to include a grocery store, a floor of parking, residential units on the top floor, and a pedestrian connection on the second level to an adjacent building that would have an additional floor of underground parking).
- Undeveloped 27.4-acre parcel on Brush College Road, approximately 1.2 miles west of Wallace Road, will be subdivided into approximately 166 lots; these lots would be located on land zoned Residential Agriculture (RA).
- SKATS MPO Population Forecasts for the Salem-Keizer UGB are:
  - 2020: 258,314 residents
  - 2030: 282,755 residents
  - 2035: 333,696 residents

4.2 Direct Impacts

4.2.1 No Build Alternative

The No Build Alternative is based on the 2040 base network. It assumes that the transportation network would be the same as under existing conditions plus any planned modifications to the facilities. The No Build Alternative includes programmed roadway projects from the City of Salem TSP, detailed in Table 4.2-1.

TABLE 4.2-1
2040 No Build Alternative Future Projects Included

Programmed Project Improvements Assumed within Future No Build Alternative

Intersection Improvements at Wallace Road/Glen Creek Road

Commercial Street /Marion Street restriping: restripe SB through/right to right only and remove WB dual left turn pockets[a]

Edgewater Street/Wallace Road: increase radius of WB ramp to NB Wallace Road in order to add an additional through lane on the westbound approach to Edgewater[a]

Edgewater Street/Wallace Road: Additional bridge entrance lane on EB Edgewater to Center Street Bridge[a]

Center Street/Liberty Street: Restripe EB Center Street to have 3 through lanes with one exclusive left-turn lane. Restripe Liberty NB to have 2 through lanes with one exclusive right-turn lane.

Add Marine Drive extension from Glen Creek Road to River Bend Road with the following project elements:

- Create two-way stop control intersection at Glen Creek Road/Marine Drive
- Create new two-way stop control intersection at Wallace Road/Beckett Street with Wallace Road having the right-of-way
- Extend Hope Road from Wallace Road to new Marine Drive extension
- Create two-way stop control intersection at Marine Drive/Hope Avenue with Marine Drive having the right-of-way
- Create two-way stop control intersection at Marine Drive/5th Street with Marine Drive having the right-of-way
- Create two-way stop control intersection at Marine Drive/Beckett Street with Marine Drive having the right-of-way
- Create right in, right out intersection along Marine at Taybin Road, Calico Street, and Cameo Street

[a] Project sources from the *Willamette River Bridgehead Engineering Study* (SKATs, 1998).

Source: City of Salem TSP

As was the case for the DEIS, the No Build Alternative and the preferred alternative were designed assuming that the future (year 2040) peak-hour traffic volumes across the river would be 8 percent less than those forecasted with the SKATS MPO 2040 traffic model. By using this approach, the analysis ensures that the future need for highway capacity is not overstated.

The 8-percent reduction assumes that, in 2040: (1) transit service across the river will expand, (2) the use of non-SOV (single-occupant vehicle) modes (such as carpooling and bicycling) will increase, and (3) some departure times will shift (for example, because of alternative work hours/peak spreading). Federal Highway Administration directed use of an 8-percent reduction to help ensure capacity is not overbuilt.

4.2.1.1 Roadway System Operations: Intersection-Level Analysis

Discussion of the intersection analysis is divided into three sub-geographies − CBD, West Salem, and North Salem (on the eastside). The No Build Alternative operational analysis (2040 analysis year) shows that 16 out of 33 intersections failed to meet mobility targets or standards during the AM Peak only, PM Peak only, or both AM and PM peak hours (Table 4.2-2 and Figures 4.2-1 and 4.2-2).

TABLE 4.2-2
2040 No Build Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

ID #	Intersection	2040 No Build Alternative			
		Control Type	**Mobility Target/Standard (v/c ratio)**	**AM Peak**	**PM Peak**
1	Wallace Rd./Brush College Rd.	TWSC	0.95	**0.99**	**>1.50**
2	Wallace Rd./River Bend Rd.	Signal	0.95	0.73	0.64
3	Wallace Rd./Hope Ave.	TWSC	0.95	0.85	**>1.50**
4	Wallace Rd./Orchard Heights	Signal	0.95	0.85	0.87
5	Wallace Rd./Glen Creek Rd.	Signal	0.95	**1.18**	**1.00**
6	Wallace Rd./Taggart Rd.	Signal	0.95	**1.46**	**1.46**
7	Wallace Rd./OR 22/Edgewater	Signal	0.95	**1.50**	**1.07**
8	Hope Ave./Marine Drive	Does Not Exist for this Alternative			
9	Wallace Road/Becket Street	TWSC	0.95	0.52	**>1.50**
10	Marine Drive/Glen Creek Rd.	TWSC	0.90	0.30	0.17
11	Center St. Off/NB Front Street	Signal	0.85	**1.24**	**1.02**
12	Center St./Commercial St.	Signal	0.85	**1.08**	0.74
13	Center St./Liberty St.	Signal	1.00	0.85	0.76
14	Front St./Union St.	Signal	0.90	0.89	0.89
15	Marion St. /Commercial St.	Signal	0.85	0.64	**1.53**
16	Marion St./Liberty St.	Signal	1.00	0.65	**1.07**
17	Front St./Front St. (OR 99E)	TWSC	0.90	0.59	**0.99**
18	Division St./Commercial St.	Signal	0.85	**0.90**	**1.02**
19	Market St./Commercial St.	Signal	0.90	0.79	**1.05**
20	Market St./Liberty St.	Signal	0.90	0.81	0.88
21	Market St./Broadway	Signal	1.00	0.78	0.94
22	Commercial St./Pine St.	Signal	0.90	0.54	0.65
23	Liberty St./Pine St.	Signal	0.90	0.47	0.67
24	Broadway St./Pine St.	Signal	0.90	0.53	**0.96**
25	Commercial St./Hickory St.	TWSC	0.90	0.48	0.54
26	Liberty St./Hickory St.	TWSC	0.90	0.40	0.52
27	Broadway St./Hickory St.	TWSC	0.90	0.24	0.32
28	Salem Pkwy./Commercial St.[a]	Merge	N/A	–	–
29	Salem Pkwy./Liberty St.	Signal	0.90	0.62	**0.93**

TABLE 4.2-2
2040 No Build Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

ID #	Intersection	2040 No Build Alternative			
		Control Type	**Mobility Target/Standard (v/c ratio)**	**AM Peak**	**PM Peak**
30	Salem Pkwy./Broadway St.	Signal	0.90	0.80	**1.21**
31	Salem Pkwy./Cherry St.	Signal	0.90	0.85	**0.94**
32	Marine Dr./Beckett St.	TWSC	0.90	0.26	0.09
33	Marine Dr./5th Ave. NW	TWSC	0.90	0.26	0.03
34	Marine Dr./Taybin Rd.	TWSC	0.90	0.18	0.20

[a] Location does not have a value because it is a merge and has no intersection control.

TWSC – two-way stop control
Analysis used *Highway Capacity Manual 2000* (TRB, 2000) methods.
Black and bolded cells indicate locations where mobility standards would not be met.
For non-signal intersections, the roadway with the greatest (worst) v/c ratio was reported.

Central Business District

In the downtown area, with the No Build Alternative, six study intersections would fail to meet mobility targets or standards during the AM Peak, PM Peak, or both. Of these intersections, Center Street Off (Bridge off-ramp) to Front Street (northbound), and Marion Street & Commercial Street have the worst operations. These intersections are the entry/exit locations for the existing bridges, which experience severe congestion under the No Build Alternative, with significant delays and traffic queues. Those intersections that failed to meet standards during the AM Peak only, PM Peak only, or both AM and PM peak hours are:

- ID 11: Center Street Off/Northbound Front Street (1.24 AM, 1.02 PM)
- ID 12: Center Street/Commercial Street (1.08 AM)
- ID 15: Marion Street/Commercial Street (1.53 PM)
- ID 16: Marion Street/Liberty Street (1.07 PM)
- ID 17: Front Street/Front Street (OR 99E) (0.99 PM)
- ID 18: Division Street/Commercial Street (0.90 AM, 1.02 PM)

Figure 4.2-1: AM Intersection Mobility – No Build Alternative (2040)

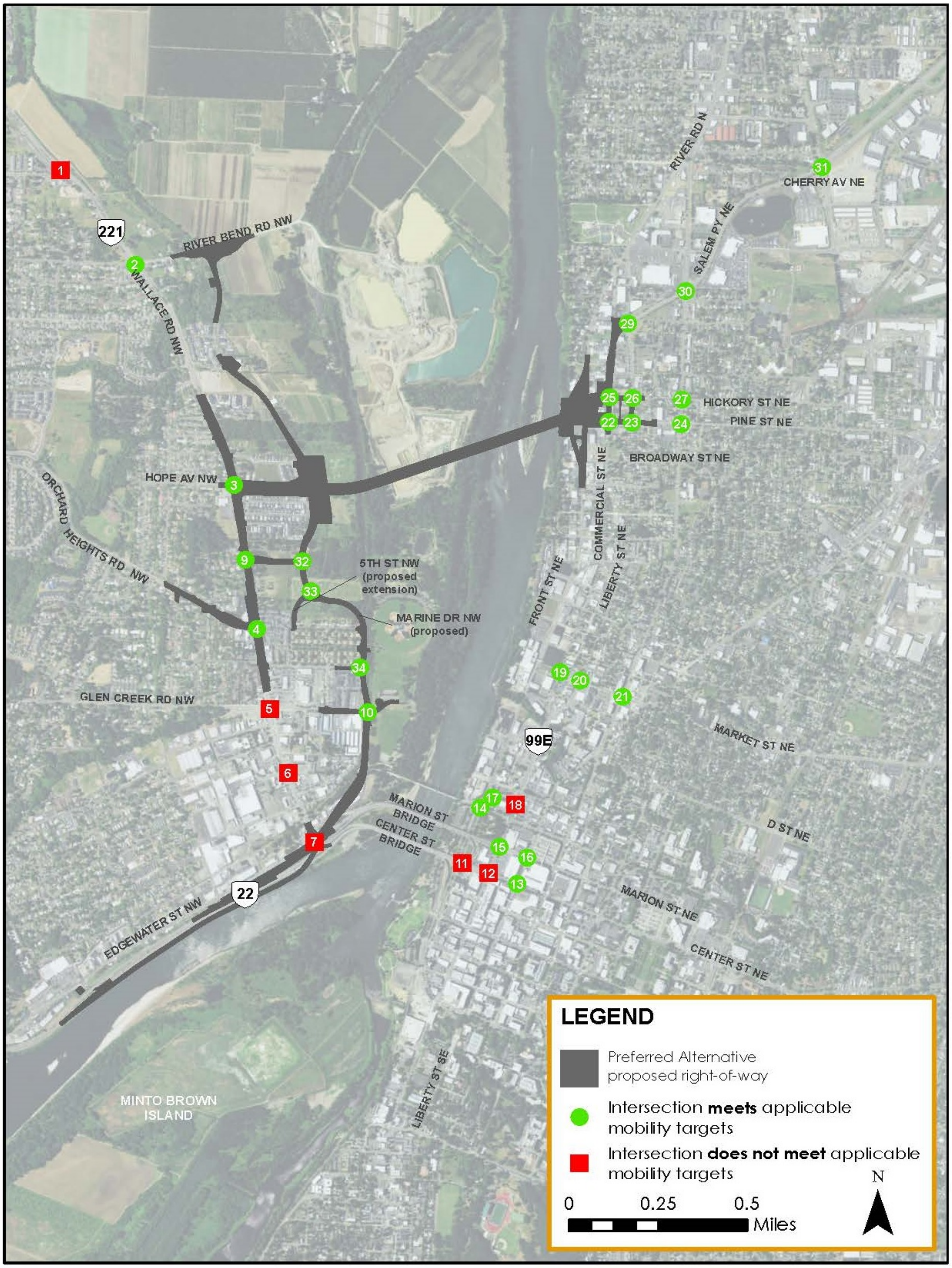

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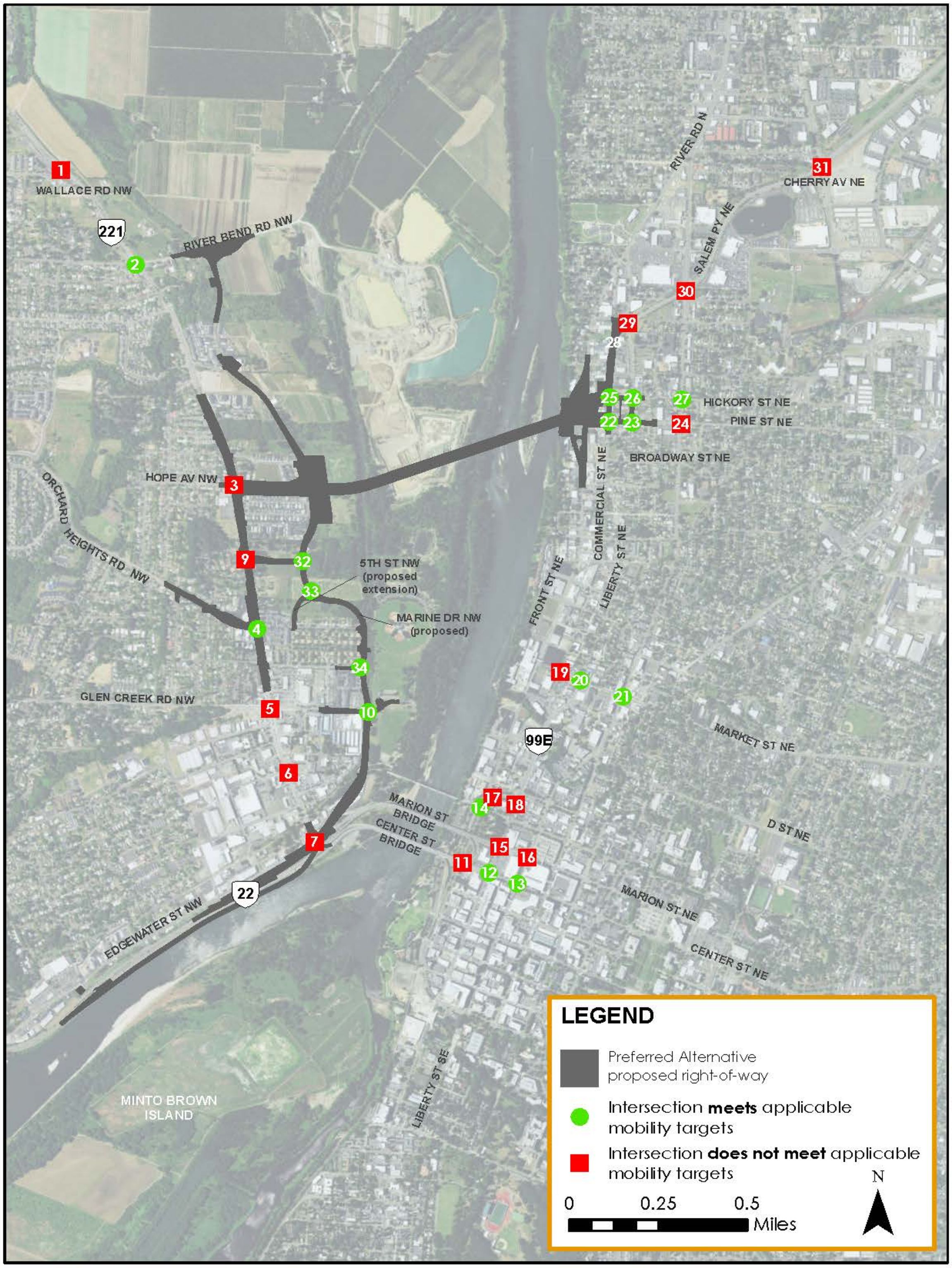
Figure 4.2-2: PM Intersection Mobility – No Build Alternative (2040)



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West Salem

Wallace Road carries the greatest volume of trips in West Salem area. Six intersections on Wallace Road would fail during the AM Peak, PM Peak, or both peaks due to increased travel demand and lack of capacity. Marine Drive would provide some relief to Wallace Road to meet applicable mobility targets. Marine Drive has limited ability to act as a parallel route to Wallace Road because it will terminate at Glen Creek Road. To access the Center Street and Marion Street Bridges from Marine Drive, drivers would be required to drive back to Wallace Road via Glen Creek Road, which is why that intersection fails to meet mobility targets during the AM and PM peak hours. Those intersections that failed to meet standards during the AM Peak only, PM Peak only, or both AM and PM peak hours are:

- ID 1: Wallace Road/Brush College Road (0.99 AM, >1.50 PM)
- ID 3: Wallace Road/Hope Avenue (>1.50 PM)
- ID 5: Wallace Road/Glen Creek Road (1.18 AM, 1.00 PM)
- ID 6: Wallace Road/Taggart Road (1.46 AM, 1.46 PM)
- ID 7: Wallace Road/OR 22/Edgewater (1.50 AM, 1.07 PM)
- ID 9: Wallace Road/Beckett Street (>1.50 PM)

North Salem

In North Salem, with the No Build Alternative, three study intersections would fail to meet mobility standards during the PM Peak. These three intersections are located at the northern most part of the project study area on Salem Parkway, with the worst operating intersection located at the intersection of Salem Parkway & Broadway Street. Those intersections that failed to meet standards during the AM Peak only, PM Peak only, or both AM and PM peak hours are:

- ID 24: Broadway Street/Pine Street (0.96PM)
- ID 29: Salem Parkway/Liberty Street (0.93 PM)
- ID 30 Salem Parkway/Broadway Street (1.21 PM)
- ID 31: Salem Parkway/Cherry Street (0.94 PM)

4.2.1.2 Bridge and Roadway Volumes

Similar to existing conditions, with the No Build Alternative, roadways surrounding the Center Street and Marion Street Bridges experience congestion during the AM and PM peak hours. This congestion is associated with people getting on and off the bridges.

Figures 4.2-3 and 4.2-4 provide a segment-by-segment analysis for the AM and PM peak hour volumes for the No Build Alternative (2040). Traffic volumes for road segments depicted on figures in this section are derived from traffic-model roadway segments that best represent conditions on that particular segment.

Figure 4.2-3: AM Peak Hour Volumes – No Build Alternative (2040)

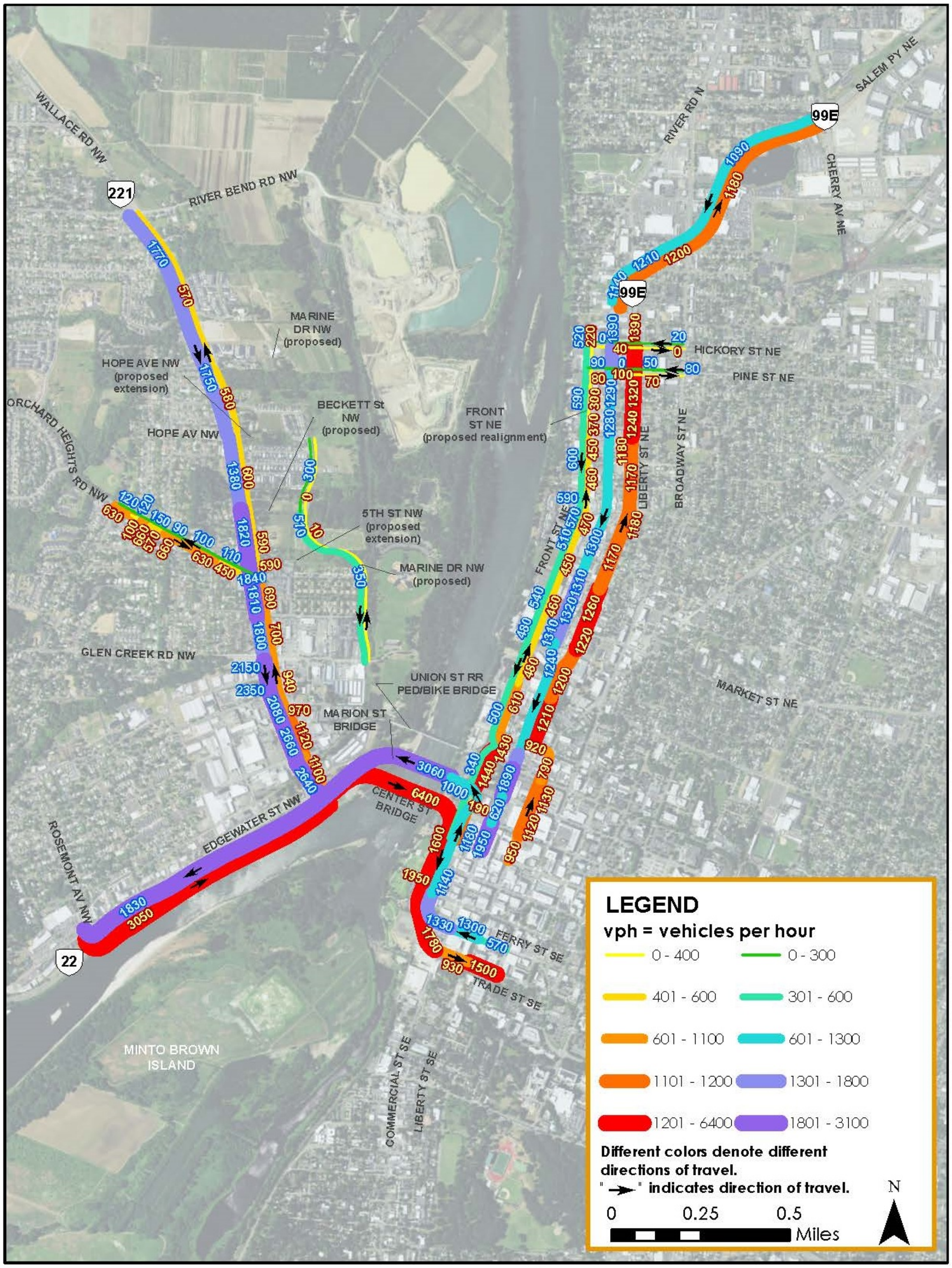

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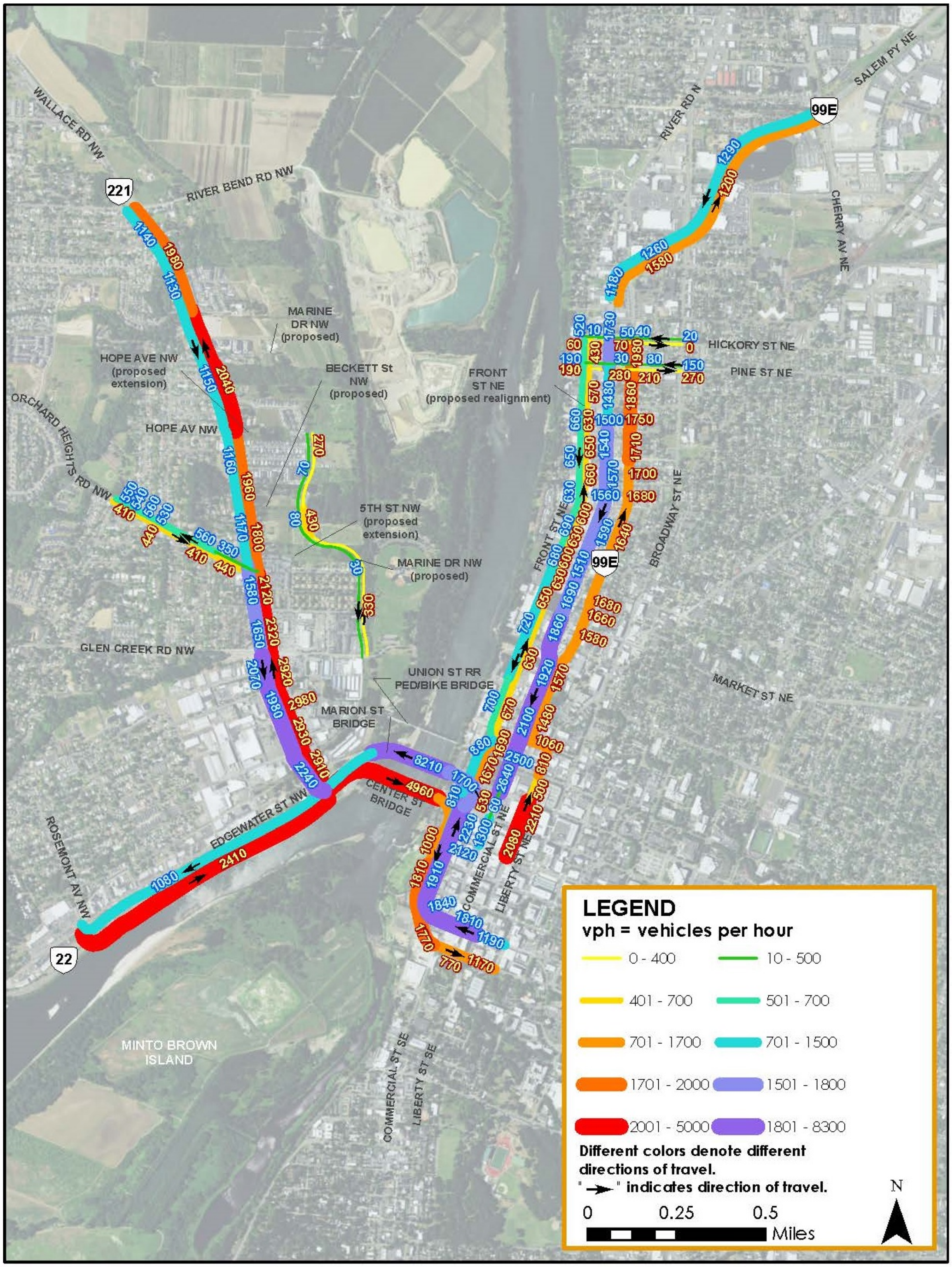
Figure 4.2-4: PM Peak Hour Volumes – No Build Alternative (2040)



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Center Street Bridge

The Center Street Bridge carries eastbound traffic across the Willamette River.

With the No Build Alternative, forecasted future volumes from the model are calculated to be 6400 vehicles per hour during the AM Peak on the Center Street Bridge, well above the Existing Conditions volume of 4090 vehicles per hour. During the PM Peak, volumes are calculated to be 4,960 vehicles per hour, also above the Existing Conditions volume calculations of 3,950 vehicles per hour. This pattern reflects the commuting pattern of eastbound travel from West Salem being heavier in the mornings than in the evenings.

Marion Street Bridge

The Marion Street Bridge carries westbound traffic across the Willamette River.

With the No Build Alternative, volumes during the AM Peak on the Marion Street Bridge are 3,060 vehicles per hour, above the Existing Conditions volume of 2,490 vehicles per hour. During the PM Peak, volumes increase to 8,210 vehicles per hour, well above the 5620 vehicles per hour during Existing Conditions. This pattern reflects the commuting pattern of westbound travel from the CBD, North Salem (and travel originating from other places east of the bridges) being heavier in the evenings than in the mornings.

To augment volume analysis and demonstrate the level of congestion that occurs within the CBD because of congestion, traffic queues were modeled for westbound travel on Marion Street (across the Marion Street Bridge) (Table 4.2-3).

TABLE 4.2-3
Westbound Marion Street Queues at High Street

	No Build Alternative	
	AM	**PM**
Avg. Queue (feet)	70	245
95th % Queue (feet)	90	350[a]

Notes:

[a] 95th percentile volume exceeds capacity, queue may be longer

Queue shown is maximum after two traffic signal cycles

These queue lengths provide a basis for comparison for the preferred alternative. The 95th percentile queue length represents a queue that has a 5-percent probability of being exceeded during the peak-hour.

These queue lengths far surpass the queue lengths estimated for existing conditions analysis, especially during the PM Peak. Queue lengths would be expected to extend farther east, beyond the existing, observed queue lengths approaching the Marion Street Bridge past Market and Norway Street.

North Salem Area

OR 99E-B (which is Salem Parkway and the Commercial/Liberty Street couplet) experiences higher volumes southbound towards the bridges during the AM Peak compared to northbound. Compared to Existing Conditions, volumes in both directions are greater during the AM Peak. During the PM Peak, this pattern reverses, with more volume traveling northbound. Compared to Existing Conditions, during the PM Peak, No Build Alternative volumes heading south/westbound from OR-99-E and north/westbound from Ferry Street, are substantially greater.

West Salem Area

Similar to existing conditions, OR 221 (Wallace Road), during the AM Peak, experiences higher volumes in the southbound direction than the northbound direction. Volumes with the No Build Alternative are substantially greater than with existing conditions. During the PM Peak, this pattern reverses, and northbound volumes are higher than southbound. Similarly, volumes are substantially greater than existing conditions.

OR 22 volumes are greater eastbound during the AM Peak compared to westbound. With the No Build Alternative, eastbound volumes are substantially greater compared to existing conditions.

During the PM Peak, westbound No Build Alternative volumes on OR 22 would actually be substantially greater compared to existing conditions. Compared to existing conditions, eastbound volumes are significantly greater under the No Build Alternative.

4.2.1.3 Transit Service

The No Build Alternative provides a baseline against which to measure and compare the effects of the preferred alternative for transit. With the No Build Alternative, Wallace Road would become increasingly congested and a majority of its intersections would fail to meet applicable mobility targets, particularly during the PM Peak. Transit travel times would increase and reliability would likely decrease. The primary routes affected would be routes traveling to the west side (5/5A and 6), which connect West Salem across the Willamette River via the Marion Street and Center Street Bridges. The 5/5A operates between West Salem and Lancaster Drive. The 6 operates from the Wallace Park & Ride in West Salem to South Commercial Street.

4.2.1.4 Pedestrian and Bicycle System

With the No Build Alternative, the existing infrastructure would remain the same and the Center Street and Marion Street bridges configuration would continue to operate as it does today. The existing local arterial and highway connections on both sides of the Willamette River would not change. The existing cross-sections of the two bridges would remain as they are today. The Union Street Railroad Bridge Pedestrian and Bicycle Trail gives bicycles and pedestrians access across the river. However, access to the off-street path located south of Edgewater Street (and the bike lane on Edgewater Street itself) and to the west side of Wallace Road (south of Glen Creek Road) are indirect. Inadequate and substandard bicycle and pedestrian facilities to, and across, the bridge crossings (concerns that were identified in the Purpose and Need statement) would persist. However, projects elsewhere within the study area will make walking and bicycling more accessible. A signal at Commercial Street and Union Street (funded) and the Union Street Family Friendly Bike project (partially funded and planned for construction in 2020) will enhance pedestrian and bicycle crossings.

4.2.2 Preferred Alternative

Section 1.2 provides a general description of the preferred alternative. The preferred alternative would add capacity to the network with an additional crossing over the Willamette River.

The preferred alternative would connect to Hope Avenue at Wallace Road on the west, cross Wallace Marine Park at its northern tip, cross the Willamette River and McLane Island, cross over a realigned Front Street, and connect to Pine and Hickory streets at Commercial Street on the east. The bridge could be a single structure or two side-by-side structures. The new bridge would have two lanes traveling east and two lanes traveling west.

Bridge Crossing Volumes

Overall, the preferred alternative would be able to accommodate a higher number of overall bridge crossings compared to the No Build Alternative—10,420 vehicles during the AM Peak and 15,600 during the PM Peak.

4.2.2.1 Roadway System Operations: Intersection-Level Analysis

Discussion of the intersection-level analysis is divided into three sub-geographies − CBD, West Salem, and North Salem (on the eastside).

The preferred alternative operational analysis (2040 analysis year) shows that 20 out of 33 intersections failed to meet mobility targets or standards during the AM Peak only, PM Peak only, or both AM and PM peak hours.

Important Note: In some cases, a different mobility standard or target applies to the preferred alternative compared to the No Build Alternative, because the intersection would have improvements that trigger a higher standard/target. In other cases, the intersection control type is changed and, therefore, a different type of standard/target applies (Table 4.2-4 and Figures 4.2-5 and 4.2-6).

Central Business District

In the downtown area, most intersections improve over No Build Alternative 2040 conditions. Three intersections continue to fail mobility standard; however, the v/c ratio is lower than under No Build Alternative conditions, indicating less congestion. They are Center Street/Commercial Street, Marion Street/Commercial Street, and Marion Street/Liberty Street. This result indicates a more distributed pattern of traffic with the preferred alternative, with volumes shifting to the new bridge.

Conversely, two intersections that fail to meet mobility targets with the No Build Alternative meet targets with the preferred alternative. They are Division Street/Commercial Street and Market Street/Commercial Street.

These intersections are entry and exit points in downtown Salem for the existing bridges, and indicated improved conditions with less congestion in the CBD with the preferred alternative, compared to the No Build Alternative. The preferred alternative would have the effect of redistributing traffic north to the new bridge.

TABLE 4.2-4
2040 Preferred Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

ID #	Intersection			2040 No Build Alternative		2040 Preferred Alternative		
		Control Type	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**
1	Wallace Rd./ Brush College Rd.	TWSC	0.95	**0.99**	**>1.50**	0.95	**>1.50**	**>1.50**
2	Wallace Rd./ River Bend Rd.	Signal	0.95	0.73	0.64	0.95	0.91	**0.97**
3	Wallace Rd./ Hope Ave.	TWSC	0.95	0.85	**>1.50**	0.95	**0.97**	0.93
4	Wallace Rd./ Orchard Heights	Signal	0.95	0.85	0.87	0.95	0.83	0.90
5	Wallace Rd./ Glen Creek Rd.	Signal	0.95	**1.18**	**1.00**	0.95	**1.26**	**1.00**
6	Wallace Rd./ Taggart Rd.	Signal	0.95	**1.46**	**1.46**	0.95	*1.40*	*1.33*
7	Wallace Rd./ OR 22/Edgewater	Signal	0.95	**1.50**	**1.07**	0.95	*1.08*	*0.97*
8	Hope Ave./ Marine Drive	Signal	0.95	Does Not Exist for this Alternative		0.90	**1.20**	**0.96**
9	Wallace Road/ Becket Street	0.95	TWSC	0.52	**>1.50**	0.95	0.51	0.58
10	Marine Drive[d]/ Glen Creek Rd.	TWSC	1.00	0.30	0.17	0.95[a]	0.59	0.54
11	Center St. Off/ NB Front Street	Signal	0.85	**1.24**	**1.02**	0.85	0.49	0.63
12	Center St./ Commercial St.	Signal	0.85	**1.08**	0.74	0.85	*0.96*	0.64
13	Center St./ Liberty St.	Signal	1.00	0.85	0.76	0.90	0.83	0.72
14	Front St./ Union St.	Signal	0.90	0.89	0.89	0.90	0.48	0.72
15	Marion St.[d]/ Commercial St.	Signal	0.85	0.64	**1.53**	0.85	0.66	*1.33*
16	Marion St.[d]/ Liberty St.	Signal	1.00	0.65	**1.07**	0.85	0.61	*1.01*
17	Front St./ Front St. (OR 99E)	TWSC	0.90	0.59	**0.99**	0.90	0.37	0.81

TABLE 4.2-4
2040 Preferred Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

				2040 No Build Alternative		2040 Preferred Alternative		
ID #	**Intersection**	**Control Type**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**
18	Division St./ Commercial St.	Signal	0.85	**0.90**	**1.02**	0.90	0.55	0.80
19	Market St./ Commercial St.	Signal	0.90	0.79	**1.05**	0.85	0.76	0.81
20	Market St./ Liberty St.	Signal	0.90	0.81	0.88	0.90	0.72	0.74
21	Market St./ Broadway	Signal	1.00	0.78	0.94	0.90	**0.93**	**0.96**
22	Commercial St./ Pine St.	Signal	0.90	0.54	0.65	0.90	**1.12**	0.59
23	Liberty St./ Pine St.	Signal	0.90	0.47	0.67	0.90	0.83	**1.20**
24	Broadway St./ Pine St.	Signal	1.00	0.53	0.96	0.90	**0.97**	**1.10**
25	Commercial St./ Hickory St.	TWSC	0.90	0.48	0.54	0.90[b]	0.52	**1.06**
26	Liberty St./ Hickory St.	TWSC	0.90	0.40	0.52	0.90[c]	0.57	**1.01**
27	Broadway St./ Hickory St.	TWSC	1.00	0.24	0.32	0.90	0.42	**1.25**
28	Salem Pkwy./ Commercial St.[e]	Merge/ Free flowing	N/A	–	–	N/A	–	–
29	Salem Pkwy./ Liberty St.	Signal	0.90	0.62	**0.93**	0.90	**0.94**	**1.18**
30	Salem Pkwy./ Broadway St.	Signal	0.90	0.80	**1.21**	0.90	**0.91**	**1.42**
31	Salem Pkwy./ Cherry St.	Signal	0.90	0.85	**0.94**	0.90	**1.01**	**1.05**
32	Marine Dr.[d]/ Beckett St.	TWSC	0.95	0.26	0.09	0.95	0.76	0.73
33	Marine Dr.[d]/ 5th Ave. NW	Signal	0.95	0.26	0.03	0.95	0.69	0.78
34	Marine Dr.[d]/ Taybin Rd.	TWSC	0.95	0.18	0.20	0.95	0.48	0.44

TABLE 4.2-4
2040 Preferred Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

				2040 No Build Alternative		2040 Preferred Alternative		
ID #	Intersection	Control Type	Mobility Standard (v/c ratio)	AM Peak	PM Peak	Mobility Standard (v/c ratio)	AM Peak	PM Peak

[a] Control type is signal.
[b] Control type is signal.
[c] Control type is no control.
[d] Highway standards are assumed for Marine Drive for the purposes of comparison. Final determination of jurisdiction and ownership of Marine Drive under the preferred alternative has not yet been determined.
[e] Intersection #28 is free-flowing with no intersection control; therefore, no intersection analysis was conducted.

TWSC – two-way stop control
Analysis used *Highway Capacity Manual 2000* (TRB, 2000) methods.
Note: In some cases, the mobility standard is different for the preferred alternative compared to the No Build Alternative. This is because intersection improvements assumed trigger a higher standard.
For non-signal intersections, the roadway with the greatest (worst) v/c ratio was reported

Black and bolded cells indicate locations where mobility standards would not be met.
Grey and italicized cells indicate locations where mobility standards would not be met, but mobility would be improved over the No Build Alternative.

Those intersections that failed to meet standards during the AM Peak only, PM Peak only, or both AM and PM peak hours are:

- ID 12: Center Street/Commercial Street (0.96 AM)
- ID 15: Marion Street/Commercial Street (1.33 PM)
- ID 16: Marion Street/Liberty Street (1.01 PM)
- ID 21: Market Street/Broadway Street (0.93 AM, 0.96 PM)

West Salem

With the preferred alternative, Wallace Road/Hope Avenue would be widened to accommodate additional traffic traveling to and from the bridge. Wallace Road/Orchard Heights Road intersection would be widened to accommodate increased traffic volumes, including widening along Wallace Road between Taybin Road and Narcissus Court to accommodate the additional turn lanes.

Some roadway access would also change. With the preferred alternative, access from Rosemont to eastbound OR 22 would remain. Exiting from Rosemont westbound on OR 22 would be closed because of the violation of interchange spacing standards with the on-ramp from Marine Drive. The westbound ramp from Marine Drive and the westbound off-ramp from Rosemont would be so close together with high volume and high-speeds, they would cause safety conflicts. Marine Drive connections would include an eastbound off-ramp from OR 22 to Marine Drive just west of the on-ramp from Rosemont. In the westbound direction, an on-ramp to OR 22 from Marine Drive would be just east of the Rosemont off-ramp that would be closed.

Figure 4.2-5: AM Intersection Mobility – Preferred Alternative (2040)

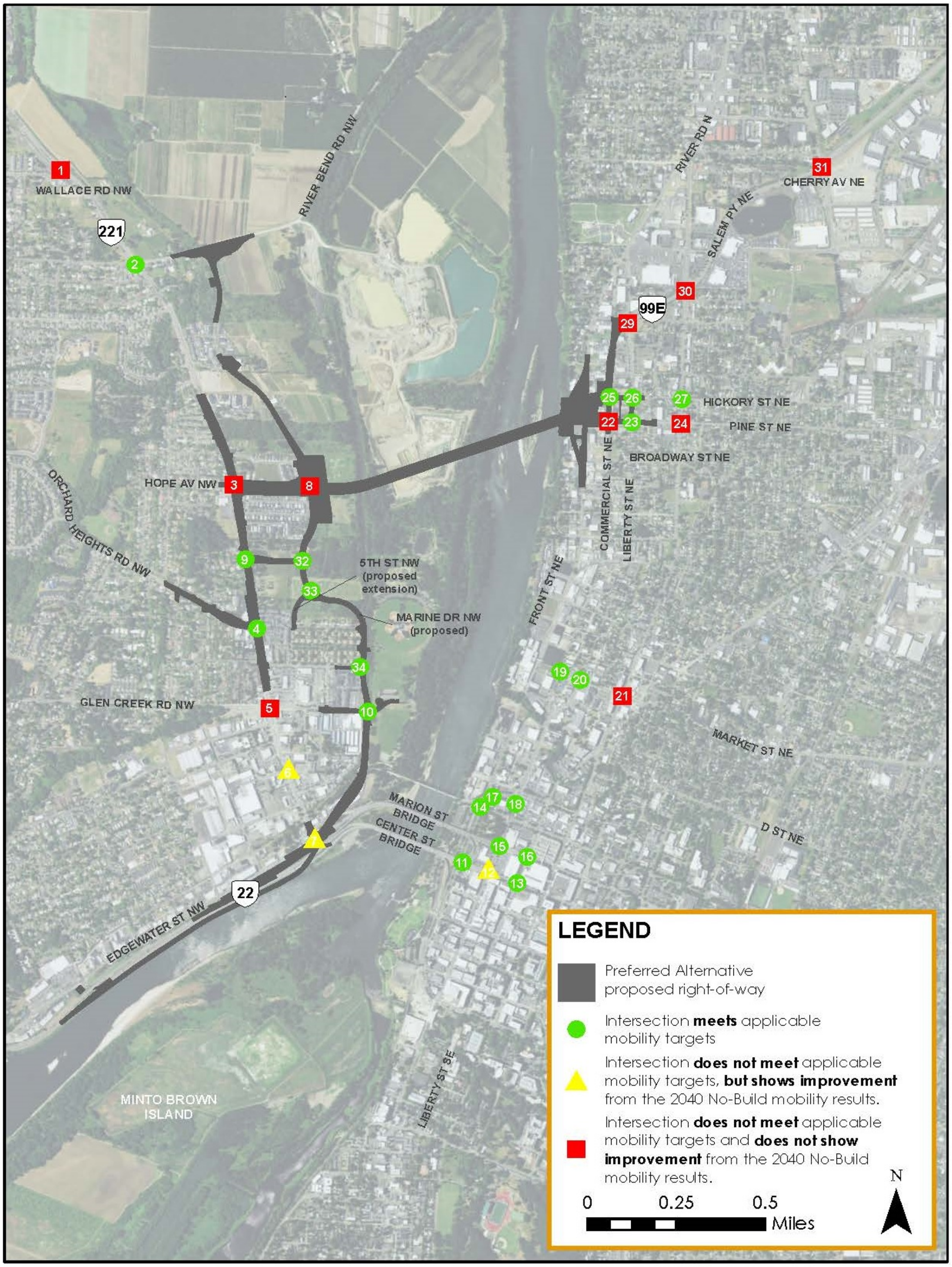

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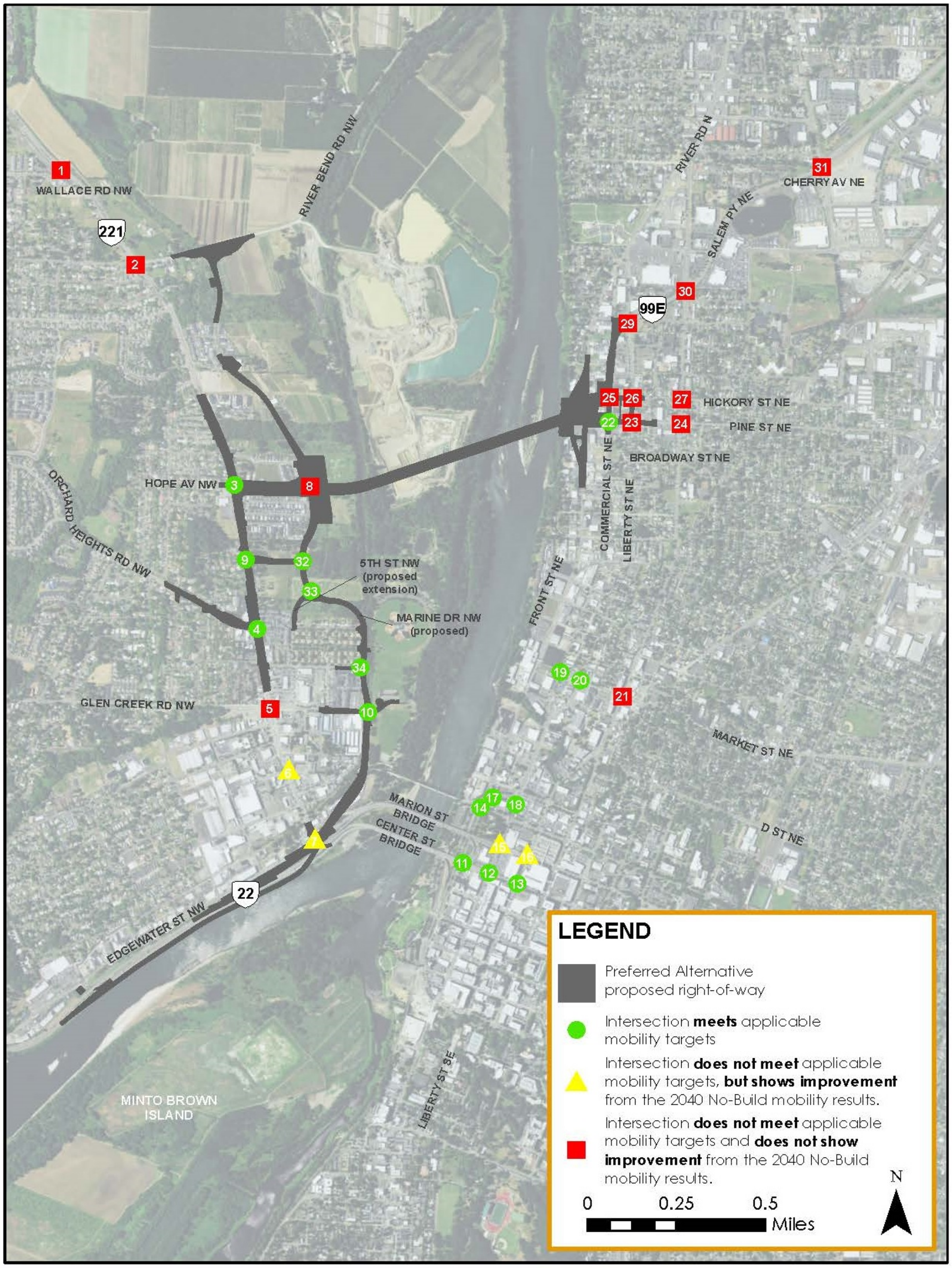
Figure 4.2-6: PM Intersection Mobility – Preferred Alternative (2040)



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Marine Drive will serve as a parallel route to Wallace Road, providing access to the new bridge from Hope Street to Pine Street. With the preferred alternative, the City would seek to upgrade the classification of Marine Drive from a neighborhood collector to an arterial to reflect the change in function and volumes it would serve.

On the west side of Salem, Wallace Road intersections would experience seven intersections that fail to meet standards or targets. Wallace Road/Brush College Road would have the highest v/c ratios during the AM and PM peak hours. Wallace Road/Glen Creek Road and Wallace Road/Taggart Road would also have high v/c ratios that exceed the mobility target. This result demonstrates the redistribution of traffic volumes from the existing bridges with the No Build Alternative to the new bridge with the preferred alternative.

Compared to the No Build Alternative, intersection analysis for the preferred alternative shows that Wallace Road and Brush College Road would continue to fail during the AM and PM Peaks. Wallace Road and River Bend Road would actually fail during the PM Peak with the preferred alternative, but not under the No Build Alternative. Wallace Road and Hope Avenue and Wallace Road and Glen Creek Road would both fail under both alternatives, and Wallace Road and Taggart Road, Wallace Road and OR 22/Edgewater, and Wallace Road and Becket Street would improve under the preferred alternative.

Those intersections that failed to meet standards during the AM Peak only, PM Peak only, or both AM and PM peak hours are:

- ID 1: Wallace Road/Brush College Road (>1.50 AM, >1.50 PM)
- ID 2: Wallace Road/River Bend Road (0.97 PM)
- ID 3: Wallace Road/Hope Ave. (0.97 AM)
- ID 5: Wallace Road/Glen Creek Road (1.26 AM, 1.00 PM)
- ID 6: Wallace Road/Taggart Road (1.40 AM, 1.33 PM)
- ID 7: Wallace Road & OR 22/Edgewater (1.08 AM, 0.97 PM)
- ID 8: Hope Ave./Marine Drive (1.20AM, 0.96 PM)

Hope Avenue and Marine Drive would be a new intersection that would fail to meet mobility targets. This reflects the redistribution of traffic and the fact that even upstream and downstream improvements of the bridge crossings do not accommodate all traffic demand.

North Salem

In North Salem, with the preferred alternative, four study intersections would fail to meet mobility standards during the AM and PM peak hours. These three intersections are located at the northern most part of the project study area on Salem Parkway, with the worst operating intersection located at the intersection of Salem Parkway/Broadway Street. With the No Build Alternative, these intersections fail to meet mobility targets during the PM Peak only. Overall, v/c ratios increase for these intersections with the preferred alternative compared to the No Build Alternative.

Those intersections that failed to meet standards during the AM Peak only, PM Peak only, or both AM and PM peak hours are:

- ID 22: Commercial Street/Pine Street (1.12 AM)
- ID 23: Liberty Street/Pine Street (1.20 PM)
- ID 24: Broadway Street/Pine Street (0.97 AM, 1.10 PM)
- ID 25: Commercial Street/Hickory Street (1.06 PM)
- ID 26: Liberty Street/Hickory Street (1.01 PM)
- ID 27: Broadway Street/Hickory Street (1.25 PM)
- ID 29: Salem Parkway/Liberty Street (0.94 AM, 1.18 PM)
- ID 30 Salem Parkway/Broadway Street (0.91 AM, 1.42 PM)
- ID 31: Salem Parkway/Cherry Street (1.01 AM, 1.05 PM)

4.2.2.2 Bridge and Roadway Volumes

The effect of the preferred alternative (2040) is to distribute traffic over a broader network, in some cases decreasing volumes levels and in some cases increasing volumes compared to the No Build Alternative (2040). Overall, the existing bridges and the new bridge with the preferred alternative will accommodate a higher volume of traffic. During the AM Peak, the preferred alternative would carry 10,420 vehicles over the existing and new bridge, compared to 9,460 vehicles with the No Build Alternative, a 960 volume increase with the preferred alternative. During the PM Peak, when volumes are overall greater, the preferred alternative would carry 15,600 vehicles over the existing and new bridge, compared to 13,170 vehicles with the No Build Alternative, a 2,430 volume increase with the preferred alternative.

The reason that the preferred alternative shows an increase in total trips over the Willamette River (compared to the No Build Alternative) is an outcome of the different transportation system represented in the travel model by the addition of the new bridge and other network changes in the preferred alternative. As an input, the travel model used for both the 2040 No Build Alternative and 2040 preferred alternative forecasts uses the same total trips in the Salem-Keizer area, as well as the same total trips coming/going from outside the area. What occurs with the preferred alternative is that the travel model redistributes the destinations of some trips because of the availability (shorter travel distances and lower travel times) for trips that use the new bridge. As some trips are diverted to the new bridge, this lowers the travel time on the existing bridges (as congestion decreases), which attracts more trips using the existing bridge. The result of both bridges providing the combination of shorter travel distances and lower travel time to destinations is a 930 volume difference in the AM Peak and 2,430 volume difference in the PM Peak between the two alternatives.

Figures 4.2-7 and 4.2-8 provide a segment-by-segment analysis for the AM and PM peak hour volumes for the preferred alternative (2040). Traffic volumes for road segments depicted on figures in this section are derived from traffic-model roadway segments that best represent conditions on that particular segment.

Eastbound Bridge Crossing

For eastbound crossing, the Center Street Bridge and the preferred alternative carry eastbound traffic across the Willamette River.

Eastbound travel is dominant during the AM Peak, and AM volumes are greater than PM volumes. During the AM Peak, the preferred alternative and Center Street Bridge would carry 6,880 vehicles, compared to the No Build Alternative, which would carry 6,400 – 480 fewer vehicles.

Eastbound travel is minor during the PM Peak. During the PM Peak, the preferred alternative and Center Street Bridge would carry 6,130 vehicles, compared to the No Build Alternative, which would carry 4,960, a difference of 1,170 fewer vehicles.

Westbound Bridge Crossing

The Marion Street Bridge carries westbound traffic, and the preferred alternative carries both east and westbound traffic across the Willamette River.

Across the bridges, westbound travel is the minor direction during the AM Peak. For both the No Build Alternative and the preferred alternative, AM Peak volumes are less than PM Peak volumes. During the AM Peak, the preferred alternative and Marion Street Bridge would carry 4,950 vehicles, compared to the No Build Alternative, which would carry 3,060, a difference of 1,890 fewer vehicles.

The PM Peak overall has more bridge crossing volumes, and more in the westbound direction. During the PM Peak, the preferred alternative and Marion Street Bridge would carry 9,470 vehicles westbound, compared to the No Build Alternative, which would carry 8,210 vehicles westbound, 1,260 fewer vehicles.

To augment volume analysis and demonstrate the level of congestion that occurs within the CBD because of congestion, traffic queues were modeled for westbound travel on Marion Street (across the Marion Street Bridge) (Table 4.2-5).

TABLE 4.2-5
Westbound Marion Street Queues at High Street

	No Build Alternative		**Preferred Alternative**	
	AM	**PM**	**AM**	**PM**
Avg. Queue (feet)	70	245	65	215
95th % Queue (feet)	90	350[a]	90	270

Notes:

[a] 95th percentile volume exceeds capacity, queue may be longer
Queue shown is maximum after two traffic signal cycles

The 95th percentile queue length represents a queue that has a 5-percent probability of being exceeded during the peak-hour.

These queue lengths within the CBD at High Street for the preferred alternative are shorter in length compared to the No Build Alternative. During the PM Peak, the 95th percentile queue is significantly less, demonstrating a benefit of congestion relief with the preferred alternative.

Figure 4.2-7: AM Peak Hour Volumes – Preferred Alternative (2040)

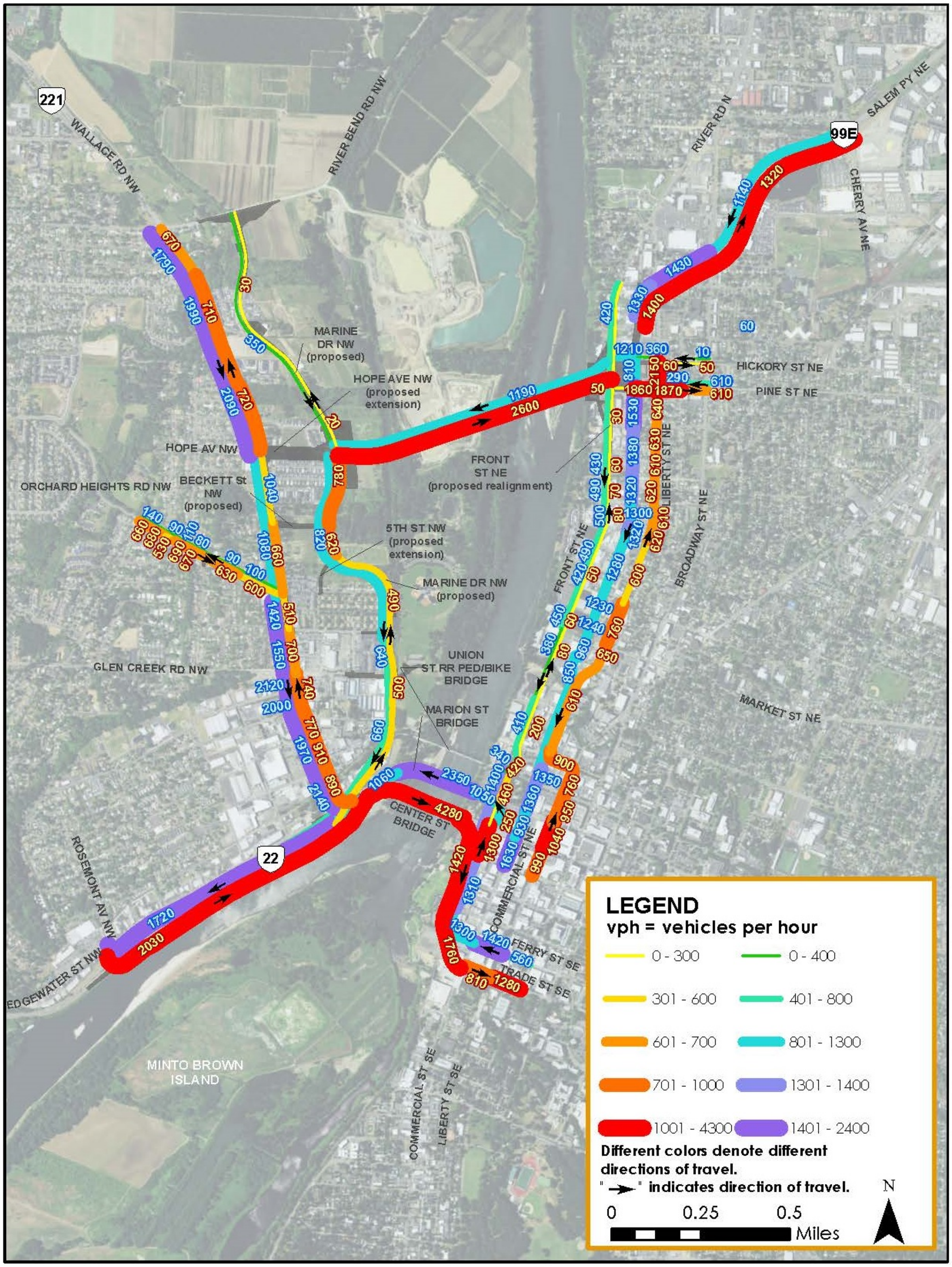

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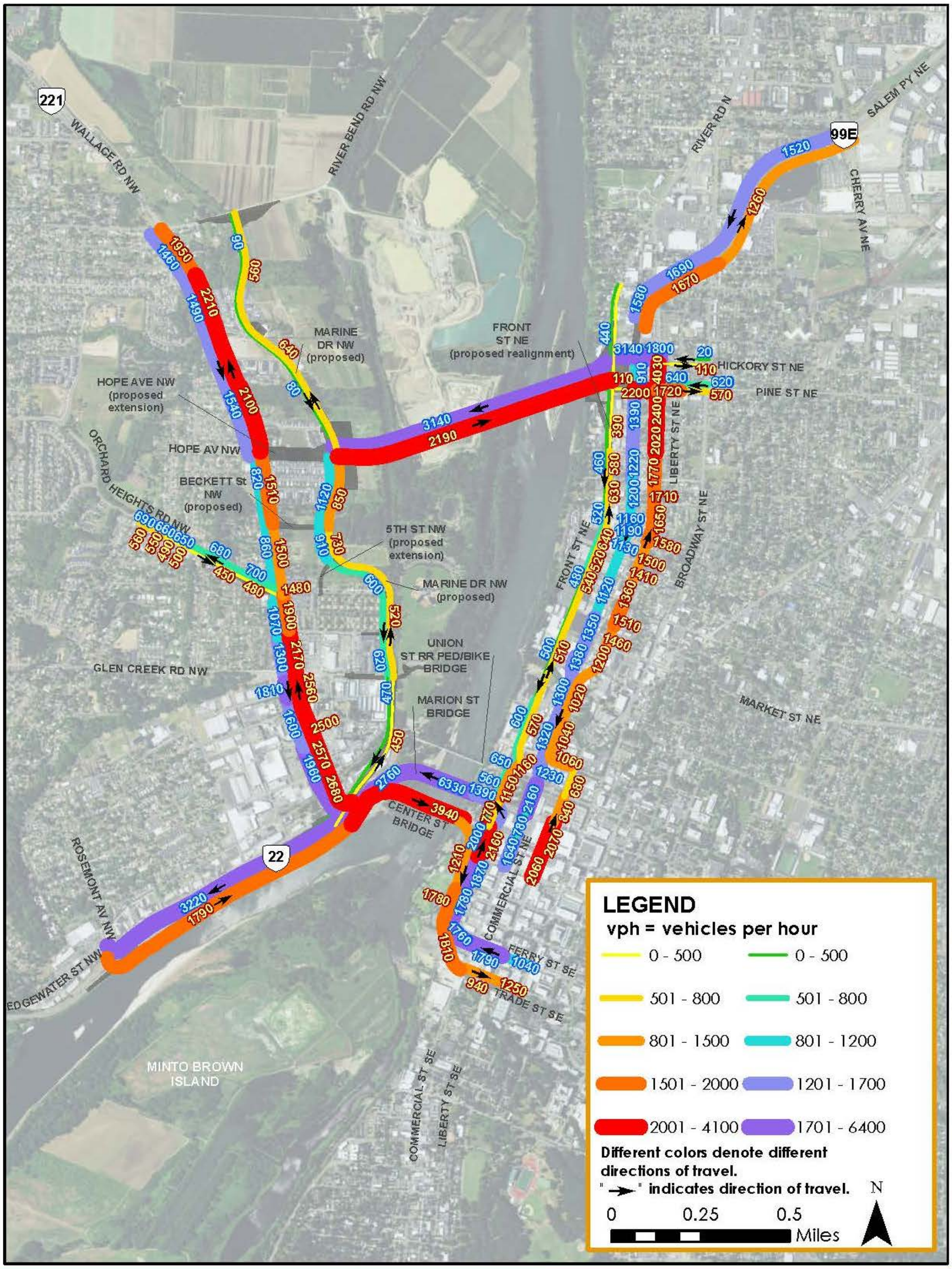
Figure 4.2-8: PM Peak Hour Volumes – Preferred Alternative (2040)



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North Salem Area

With the preferred alternative, OR 99E-B (which is Salem Parkway and the Commercial/Liberty Street couplet) carries higher overall volumes during both the AM and PM Peak in both directions compared to the No Build Alternative. This reflects additional traffic demand accommodated by the preferred alternative.

During the both the AM and PM peak hours, Pine Street would experience substantially greater volumes compared to the No Build Alternative. Volumes on Hickory Street would increase modestly. During the AM Peak, Pine Street would have 610 vehicles in each direction; whereas with the No Build Alternative, Pine Street would have 80 westbound and 70 eastbound, a 530-540 vehicle increase in each direction. During the PM Peak, Pine Street would have 620 vehicles westbound and 570 vehicles eastbound, compared to the No Build Alternative, which would have 150 vehicles westbound and 270 vehicles eastbound, a difference of 300-470 greater vehicles with the preferred alternative.

Pine Street and Hickory Street would both be upgraded to a major arterial between Front and Liberty Street to reflect their function and use with the preferred alternative. The design team included treatments that would discourage traffic on Hickory Street because it is a local neighborhood street now. The design focuses east-west traffic on Pine Street.

Compared to the No Build Alternative, both Commercial Street and Liberty Street would experience lower volumes during both the AM and PM peak hours with the preferred alternative, reflecting the effect of a greater distribution of traffic volumes over a broader network.

West Salem Area

With the preferred alternative, Marine Drive provides volume relief to Wallace Road that is greater compared to the No Build Alternative because it spans between River Bend Road and Glen Creek Road. This permits trips between areas of West Salem without requiring use of Wallace Road (that is, from the homes and apartments east of Wallace Road to the shopping and service areas near Glen Creek Road.) Wallace Road still experiences congestion with the preferred alternative, because it provides access to many West Salem area destinations.

Compared to the No Build Alternative, with the preferred alternative, Marine Drive carries substantially more traffic to the new bridge crossing. This greater level of traffic would include trucks, which could bypass the narrow street grid of downtown Salem (using the existing bridges). With the No Build Alternative, Marine Drive would be a neighborhood collector. With the preferred alternative, the City of Salem would establish Marine Drive as a higher order street, possibly an arterial, reflecting the different function Marine Drive would serve with the preferred alternative.

4.2.2.3 Transit Service

The preferred alternative has the effect of redistributing traffic, providing congestion relief to intersections surrounding the Marion and Center Street Bridges. Some intersections on Wallace Road continue to be congested. The effect to transit is that routes 5/5A and 6, which cross the river using the Marion and Center Street Bridges, would face less congestion compared to the No Build Alternative, which would improve travel times and reliability.

The preferred alternative also provides a new crossing north of the existing bridges, providing access on the west side to Wallace Road and a to-be-constructed Marine Drive. The new crossing would expand potential route options in West Salem, and increase connectivity and transit access. More places, north of the existing crossing, would be accessible on the Westside by transit with the preferred alternative compared to the No Build Alternative.

4.2.2.4 Pedestrian and Bicycle System

With the preferred alternative, bicycle and pedestrian access via the Union Street Bridge, and substandard access via Marion and Center Street bridges would remain. In addition, the new crossing would have a 10-foot wide multi-use path that would be separated from the paved roadway by a raised barrier in each direction. The multi-use path would provide both pedestrian and bicycle rider access. In addition, the west side network would include construction of a 12-foot wide paved multi-use path from River Bend Road to Glen Creek Road (with a 5-foot buffer strip separating the multi-use path from the northbound marine Drive travel lane.) These additional facilities expand pedestrian and bicycle rider access across the river into west Salem and along the to-be-constructed Marine Drive.

On the eastside, pedestrians and bicycle riders would be able to access the multi-use path on both sides of Commercial Street using sidewalk ramps that lead to the bridge. Front Street also provides sidewalk access to both sides of the bridge. The preferred alternative would increase east-west pedestrian and bicycle rider access across the river.

4.3 Construction Impacts

4.3.1 Impacts on East Side of Willamette River

Construction staging on the east side of the river would be relatively minor due to the localized nature of the work. Modifications of the Commercial Street/Liberty Street and Pine Street/Liberty Street intersections would interrupt traffic for one construction season and would include lane closures. Front Street would be out of service for at least two construction seasons due to overhead bridge construction and realignment of the street. Other construction activities on the east side of the river would primarily occur offline of the existing transportation system. Temporary construction impacts to properties in the immediate four-block area such as noise, dust, and traffic delays could be high for at least one construction season. Alternate routes for impacted traffic include Broadway Street and Cherry Avenue.

4.3.2 Impacts on West Side of Willamette River

Online work would include the intersection construction work on Wallace Road, Orchard Heights Road, Glen Creek Road, and River Bend Road. Construction activities on Wallace Road would entail widening for additional turn lanes at Hope Avenue and Orchard Heights Road. On River Bend Road, activities would entail the construction of a roundabout at the new intersection with the proposed Marine Drive. On Glen Creek Road, activities would entail a new intersection with proposed Marine Drive. On Orchard Heights Road, activities would entail widening for additional turn lanes and the realignment of Orchard Heights Road.

If built as a single project, the duration of construction activities on the west side of the river would be completed in two to three construction seasons.

4.4 Indirect Impacts

4.4.1 No Build Alternative

Due to congestion on Wallace Road, it is expected that traffic would divert to Eola Drive, Doaks Ferry Road, and Rosemont Avenue to access OR 22 and the existing bridges.

4.4.1.1 No Build Alternative Roadway System Operations: Regional Measures Analysis

No Build Alternative VMT, VHD, and VHT measures provide an understanding of overall travel distances and times during the year 2040, and compared to the year 2012 (existing conditions) (Table 4.4-1). It is important to note, these are regional measures that are derived for the entire Salem-Keizer region, and trips, particularly those within east Salem, may not be influenced by the bridge. These measures, which offer a general comparison of regional travel between existing conditions (2012) and the No Build Alternative (2040), provide a proxy for indirect effects.

TABLE 4.4-1
VMT, VHT, and VHD for No Build Alternative Compared to Existing Conditions

	Existing Conditions (2012)		**No Build Alternative (2040)**		**Percent Change**	
Metric	**AM**	**PM**	**AM**	**PM**	**AM % Change**	**PM % Change**
VMT	321,630	412,961	451,921	588,544	+41	+43
VHT	8,711	13,233	14,549	27,102	+67	+105
VHD	1,342	3,256	4,100	12,584	+ 206	+286

Overall, the No Build Alternative AM Peak VHD would experience a 206-percent increase and the PM Peak a 286-percent increase compared to existing conditions. Of the three measures, VHD provides an indication of the level of congestion system-wide. These results show that the No Build Alternative would experience significantly increased congestion. VHT for the No Build Alternative AM Peak would experience a 67-percent increase and the PM Peak would experience a 105-percent increase compared to existing conditions, which is closely tied to traffic volumes on the system. VMT for the No Build Alternative AM Peak would experience a 41-percent increase and the PM Peak would experience a 43-percent increase compared to existing conditions, meaning that drivers would be driving more miles during the same period.

Overall, regional traffic (trips originating and/or ending outside of Salem) between I-5 (north of Salem/Keizer) and OR 22 (west of West Salem) would continue to use Salem Parkway, OR 99E-B (the Commercial and Liberty N couplet), and the existing bridges between these two locations. Wallace Road is expected to become very congested, causing some traffic to divert to Eola Drive, Riggs Avenue, and Rosemont Avenue to access OR 22 and the existing bridges.

4.4.2 Preferred Alternative

In the North Salem area, Hickory Street and Pine Street would be converted from two two-way streets to a one-way couplet between Commercial Street and Liberty Street. This would change driveway accesses from full-service driveways to either right-in/right-out or left-in/left-out, and drivers would need to drive around the block to access driveways. Hickory Street east of Liberty Street to 4th Street would be converted to one-way eastbound. Hickory Street would continue to be a two-way street between 4th Street and Broadway. Front Street would be realigned to provide room for the proposed bridge structure from north of Hickory Street down to Columbia Street. The existing Front Street alignment would be capped between Hickory Street and Pine Street, which would require drivers to drive out of direction for a minor amount to access properties at the capped Front Street. Compared to the No Build Alternative, through traffic (which would be accommodated on the newly aligned Front Street) would not require out-of-direction travel.

With the preferred alternative, due to access control changes, out-of-direction travel is anticipated in the West Salem and North Salem areas.

In the West Salem area, median control would be added to Wallace Road from slightly north of Lynda Lane to Taggart Drive. This median would change all non-signalized access points to right-in/right-out with the following exception:

- Full movements would still be allowed at Wallace Road & Lynda Lane
- Northbound left turns would be allowed at Wallace Road onto one of the Narcissus Loops

Because full access would be maintained at Lynda Lane and Taggart Drive, any out-of-direction travel would be minor. The west leg of Hope Avenue at Wallace Road would be restricted to right-in/right-out. Northbound drivers wishing to reach Hope Avenue west of Wallace Road would need to make a U-turn at Lynda Lane or use Orchard Heights Road.

With the preferred alternative, east–west connectivity across Wallace Road would be affected. Hope Avenue currently provides eastbound access to Wallace Road, but does not cross west of Wallace Road. The new bridge would provide new east–west connectivity. However, the west leg of Hope Avenue would be right-in/right-out. Taybin Road would become right-in/right-out only on both sides of Wallace Road. No longer would drivers be able to cross Wallace Road on Taybin Road, which is a skewed intersection, increasing potential for safety conflicts. Instead, drivers who wanted to cross Wallace Road and continue eastbound on Taybin Road would be required to turn right onto Wallace Road and turn left at Glen Creek Road. Similarly, drivers on Taybin Road who wanted to travel westbound across Wallace Road would be required to turn right onto Wallace Road, and then turn left turn, or make a U-turn, at Orchard Heights Road.

On Wallace Road, south of Taggart Drive, no additional median control is proposed. Streets between the signalized intersections of Glen Creek Road and Taggart Drive would become right-in/right-out only. Streets between these intersections currently do not provide east–west connectivity; therefore, east–west connectivity would not be impacted.

In the North Salem area, Hickory Street and Pine Street would be converted from two two-way streets to a one-way couplet between Front Street and Liberty Street. This would change driveway accesses from full-service driveways to either right-in/right-out or left-in/left-out, requiring some drivers to circle the block to access driveways. Front Street would be realigned to provide room for the proposed bridge structure from a point north of Hickory Street down to Columbia Street. The existing Front Street alignment would be capped between Hickory Street and Pine Street. This would change the way drivers would access points along the existing Front Street in this area, causing out-of-direction travel. Through travelers, however, would be unaffected.

4.4.2.1 Roadway System Operations: Regional Measures Analysis

The preferred alternative VMT, VHD, and VHT measures provide an understanding of overall travel distances and times during the year 2040 and compared to the No Build Alternative (2040) (Table 4.4-2). It is important to note, these are regional measures that are derived for the entire region, and trips, particularly those within east Salem, may not be influenced by the bridge. These measures, which offer a general comparison of regional travel between the No Build Alternative (2040) and the preferred alternative (2040), provide a proxy for indirect effects.

TABLE 4.4-2
VMT, VHT, and VHD for Preferred Alternative Compared to No Build Alternative

	No Build Alternative (2040)		**Preferred Alternative (2040)**		**Percent Change**	
Metric	**AM**	**PM**	**AM**	**PM**	**AM % Change**	**PM % Change**
VMT	451,921	588,544	455,626	597,236	+1%	+1%
VHT	14,549	27,102	14,093	26,875	-3%	-1%
VHD	4,100	12,584	3,588	12,153	-12%	-3%

Of the three measures, VHD provides an indication of level of congestion system wide. Overall, the preferred alternative AM Peak VHD would experience a 12-percent reduction and a PM Peak 3-percent reduction compared to the No Build Alternative. VHT for the preferred alternative AM Peak would experience a 3-percent decrease and PM Peak would experience a 1-percent decrease compared to the No Build Alternative. VMT for the preferred alternative AM Peak and PM Peak would experience an increase of 1 percent.

VMT increases with the preferred alternative because the preferred alternative introduces more overall capacity, which accommodates more travel demand, resulting in more miles traveled. Specifically, VMT increases with the preferred alternative because the new bridge (and other infrastructure that is part of the preferred alternative) provides new routes. Some individual trips may be shorter (for example, a trip from Wallace at Hope to Keizer will be shorter using the new bridge as opposed to the existing bridge). Other individual trips will be longer, as the increased capacity of a new bridge may have a shorter travel time between locations but a longer travel distance. Both changes will occur, with the model forecasting an increase in VMT.

The greatest benefit of the preferred alternative crossing (in measures of VHD and VHT) is during the AM Peak. During the PM Peak, greater volumes cross the existing and preferred alternative crossing. The result is a smaller improvement over the No Build Alternative compared to the AM Peak. It is important to note that these are regional measures that reflect traffic operations over the entire Salem metropolitan area and the bridge influence is relatively limited.

4.5 Cumulative Impacts

4.5.1 No Build Alternative

Transportation has had a strong role in shaping the land use patterns of the Salem area. Downtown Salem is located where it is because the Willamette River served as the first conveyer of cargo, although the area was also served by wagon, horseback, and foot traffic. The first bridge (constructed in 1886) was located at a narrow crossing of the Willamette River. Boats and ferries of both the Salem and West Salem (Eola) areas also docked near this location. The first Center Street Bridge provided a necessary tie between Salem and West Salem. Though the first bridge was washed out in a flood, it was quickly replaced. Since then, there has been a bridge, or bridges, at this location continuously.

A railroad bridge crossed the Willamette River in 1912, which underlined the economic importance of this east–west corridor. The earliest products in this corridor were logs and lumber.

In the downtown area of Salem, and to the east, public transit was established early—first with streetcars (1889) and then with buses (1946). Buses are now the only form of public transit within the city.

As freight traffic moved to trucks, the rail line crossing the Willamette River was abandoned. The structure was renovated for bicycle and pedestrian traffic as the Union Street Railroad Bridge Pedestrian and Bicycle Trail.

Salem has an airport, but regional airlines have had difficulties trying to sustain service because Portland International Airport is close. Rail traffic for both passengers and freight remains robust in the north–south corridor that I-5 also serves.

The cumulative effects of changes over time in the Salem transportation network have resulted in a system that relies heavily on highways, automobiles, bicycling, walking, buses, and trucks to move people and goods. These modes are used almost exclusively in the east–west corridor and predominantly in the north–south corridor.

Land-use requirements have also influenced the area’s transportation network. Statewide land use planning was initiated to preserve agricultural land from residential sprawl. Since its advent, residential development in the agriculturally significant Willamette Valley has been directed toward the more hilly areas of south Salem and West Salem, and away from the prime farmlands east and north of Salem. The damming of several tributaries to the Willamette River, which has lessened the frequency of floods, has opened the Keizer area (directly north of Salem) to residential development.

The primary arterials serving development both north and south of the downtown area are Liberty and Commercial Streets, which become North River Road in the Keizer area. The Center Street and Marion Street bridges provide access from the west. Center Street is a major arterial running east–west throughout the east side of Salem. All these arterials are in the project area. In West Salem, Wallace Road has been a farm-to-market road since the late 1800s and early 1900s.

The existing system of bridges and arterials continues to encourage economic and community growth. Today, the automobiles and trucks on this highway and street system, constitutes almost exclusively the transportation system of Salem for these areas. Less than 2 percent of trips taken use alternate transportation modes such as bicycles, pedestrian travel, or public transit.

The capacity of the existing system is showing signs of strain. If not expanded or modified, the transportation system will begin to substantially impact choices of residential location, shopping behavior, and the efficiency of commercial travel for both freight movement and service delivery.

This report assumes that efforts to increase transit, ridesharing, other demand management techniques, and bicycle and pedestrian use for trips across the bridge will reduce peak-hour vehicle volumes by 8 percent compared to volumes if these efforts were not implemented. Because no alternatives for freight traffic (such as rail) are available in the east–west corridor, this forecasted change relies completely on travelers moving away from automobile use and towards public transit, ridesharing, bicycles, and pedestrian travel. More attractive bicycle and pedestrian facilities, which are included in the long-range plans of the Salem TSP and SKATS RTSP, would be required to effect this change because travel mode is voluntary on the part of the trip taker. Travelers usually use transit in areas with higher density housing where stations and stops are comfortable and within a quarter-mile radius of the user. Current densities in West Salem, and the hilly topography, will make it challenging to meet the 8 percent decrease in peak-hour vehicle volumes. On the other hand, expected increases in fuel costs will create an incentive.

The No Build Alternative would add to the expected cumulative impact because congestion would continue to increase at the east and west bridgeheads, as well as at the connecting arterials in West Salem and downtown Salem. The peak congestion period is spreading into the hours before and after the current peak hour. Frustration related to the traffic situation would eventually impact people’s decisions relating to where to live, where and how often to shop, and where to locate businesses and industrial facilities.

4.5.2 Preferred Alternative

The cumulative impact of the preferred alternative would be greater distribution of traffic over a broader network through Salem’s core.

The preferred alternative assumes the same cumulative transportation and traffic impacts as those of the No Build Alternative for the past and present. In the future, although the preferred alternative would have slightly less congestion in the CBD area than the No Build Alternative, it would still lead to some concentrated traffic at the existing bridgeheads on either side of the river.

On the west side, the preferred alternative would introduce more capacity and redistribute traffic to reduce congestion on Wallace Road. While limiting access to right-in/right-out along Wallace Road would enable traffic to move more efficiently, it would also increase out-of-direction travel. High levels of traffic, as experienced with the No Build Alternative, can create a de facto access limitation. Therefore, in practice, out-of-direction travel may already occur with No Build Alternative conditions, especially during peak-hour traffic. With the preferred alternative, however, the access control would be permanent, and during all hours.

Overall, traffic conditions with the preferred alternative would be better than with the No Build Alternative. The increased traffic flow and mobility achieved through access management with the preferred alternative would overcompensate for the out-of-direction travel that might result.

4.6 Mitigation Measures

Additional mitigation measures beyond those elements included as part of the design of the preferred alternative could be integrated into the design of the project at an advanced level of engineering. Possible mitigation measures for consideration include the following:

- **Alternate mobility standards.** Modification of the mobility standards in some way that would allow greater levels of congestion. Alternate mobility standards are meant to be part of a potential desired planning solution when there are constraints or objectives that make meeting current OHP mobility standards infeasible. In this way, transportation system modifications could be constructed to meet the new alternate mobility standards, whereas these same improvements would not have been permitted to be built using the current OHP standards.
- **Change in functional classification.** In some cases, roadway segments would experience a substantial increase in traffic volumes, changing the role and function of that street. In these cases, the City of Salem may seek a higher functional classification recognizing the change in street function, which opens the street segment up to different standards, potential improvements, and priority in maintenance.
- **Additional auxiliary lanes at intersections** (additional left- or right-turn-only lanes). The benefits of adding additional left-turn lanes include removing stopped or slow-moving left-turning motor vehicles from the stream of through traffic, eliminating the primary cause of rear-end crashes at intersections. Left-turn lanes also improve capacity by freeing the travel lanes for through traffic only.

  Right-turn lanes are used to remove decelerating right-turning motor vehicles from the flow of traffic. They also provide an additional lane for the storage of right-turning motor vehicles. Where the right-turn volume is heavy, the removal of the turning motor vehicle from the traffic stream can also remove a primary cause of rear-end crashes at intersections.
- **Signal optimization** (that is, modification of signal timing to better accommodate demand). Traffic signal retiming is a cost effective way to improve traffic flow along a corridor and can greatly reduce delays and stops experienced by motorists. This can, in turn, improve safety for all road users, enhance the schedule reliability of transit buses, and reduce fuel consumption and emissions.
- **Intelligent transportation applications.** For example, conveyance of real-time traffic information that would allow drivers to adjust their routes depending on driving conditions.

- **Access management.** Closure of driveways or the addition of medians to increase traffic flow. Access management is designed to do the following:
  - Limit the number of conflict points at driveway locations
  - Separate conflict areas
  - Reduce the interference of turning traffic with through traffic
  - Provide sufficient spacing between at-grade signalized intersections
  - Provide adequate storage and circulation for traffic on abutting properties
  - Limit direct access on higher speed roads

  Implementation of access management can accomplish the following:
  - Reduce crashes and crash potential
  - Preserve roadway capacity and the useful life of roads
  - Decrease travel time and congestion
  - Improve orderly and safe access to properties
  - Maintain travel efficiency and related economic benefit
- Implement recommendations of the Alternative Mode Study (CH2M HILL, 2010).

Mitigation measure considered, but not recommended:

- **Land use changes.** Changes to land uses have limited ability to relieve demand for bridge crossings. Land use changes were considered in the development of the *Salem Willamette River Crossing Alternate Modes Study* (CH2M, 2010), which evaluated the potential impact to trip generation that land use changes would cause. The *Alternate Modes Study* showed land use factors have little impact for the West Salem area. Adding 500 jobs would have no substantial effect on traffic congestion in the West Salem area because 95+ percent of the jobs would be located east of the mitigation measures would require additional traffic analysis and simulation, as well as consideration of river.

CHAPTER 5

Conclusions

5.1 Summary of Impacts

A summary comparison of anticipated impacts for the No Build Alternative and preferred alternative are provided in Table 5.1-1.

5.1.1 Direct Impacts

This section provides the following overall comparison of direct impacts among the No Build Alternative and the preferred alternative.

- River crossing volumes
- Intersection operational results for the 2040 analysis year
- Advantages and disadvantages associated with the No Build Alternative and the preferred alternative.

5.1.1.1 River Crossing Volumes

Overall, the preferred alternative would be able to accommodate a higher number of bridge crossings compared to the No Build Alternative—10,420 vehicles during the AM Peak and 15,600 during the PM Peak. The No Build Alternative would carry 7,150 vehicles during the AM Peak and 13,170 vehicles during the PM Peak. Accommodating more trips during people's preferred travel time, the AM and PM Peak, is a benefit to those traveling locally and regionally.

5.1.1.2 Intersection Operation Analysis

- Overall, the preferred alternative has the effect of distributing travel demand during the AM and PM Peaks over a broader network, including the new bridge, accommodating more travel demand during the peak hours, and lessoning congestion in some areas (Table 5.1-1).
- Division Street/Commercial Street, and Market Street/Commercial Street would fail to meet mobility standards with the No Build Alternative, but meet standards with the preferred alternative. These intersections are entry and exit points in downtown Salem for the existing bridges, and indicated improved conditions with less congestion in the CBD with the preferred alternative, compared to the No Build Alternative. The preferred alternative would have the effect of redistributing traffic north to the new bridge.
- Compared to the No Build Alternative, both Commercial Street and Liberty Street would experience lower volumes during both the AM and PM peak hours with the preferred alternative, reflecting the effect of a greater distribution of traffic volumes over a broader network.

TABLE 5.1-1
2040 Preferred Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

ID #	Intersection			2040 No Build Alternative		2040 Preferred Alternative		
		Control Type	Mobility Standard (v/c ratio)	AM Peak	PM Peak	Mobility Standard (v/c ratio)	AM Peak	PM Peak
1	Wallace Rd./ Brush College Rd.	TWSC	0.95	**0.99**	**>1.50**	0.95	**>1.50**	**>1.50**
2	Wallace Rd./ River Bend Rd.	Signal	0.95	0.73	0.64	0.95	0.91	**0.97**
3	Wallace Rd./ Hope Ave.	TWSC	0.95	0.85	**>1.50**	0.95	**0.97**	0.93
4	Wallace Rd./ Orchard Heights	Signal	0.95	0.85	0.87	0.95	0.83	0.90
5	Wallace Rd./ Glen Creek Rd.	Signal	0.95	**1.18**	**1.00**	0.95	**1.26**	**1.00**
6	Wallace Rd./ Taggart Rd.	Signal	0.95	**1.46**	**1.46**	0.95	*1.40*	*1.33*
7	Wallace Rd./ OR 22/Edgewater	Signal	0.95	**1.50**	**1.07**	0.95	*1.08*	*0.97*
8	Hope Ave./ Marine Drive	Signal	0.95	Does Not Exist for this Alternative		0.95	**1.20**	**0.96**
9	Wallace Road/ Becket Street	0.95	TWSC	0.52	**>1.50**	0.95	0.51	0.58
10	Marine Drive/ Glen Creek Rd.	TWSC	1.00	0.30	0.17	0.95[a]	0.59	0.54
11	Center St. Off/ NB Front Street	Signal	0.85	**1.24**	**1.02**	0.85	0.49	0.63
12	Center St./ Commercial St.	Signal	0.85	**1.08**	0.74	0.85	*0.96*	0.64
13	Center St./ Liberty St.	Signal	1.00	0.85	0.76	0.90	0.83	0.72
14	Front St./ Union St.	Signal	0.90	0.89	0.89	0.90	0.48	0.72
15	Marion St. / Commercial St.	Signal	0.85	0.64	**1.53**	0.85	0.66	*1.33*
16	Marion St./ Liberty St.	Signal	1.00	0.65	**1.07**	0.85	0.61	*1.01*
17	Front St./ Front St. (OR 99E)	TWSC	0.90	0.59	**0.99**	0.90	0.37	0.81

TABLE 5.1-1
2040 Preferred Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

				2040 No Build Alternative		2040 Preferred Alternative		
ID #	**Intersection**	**Control Type**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**
18	Division St./ Commercial St.	Signal	0.85	**0.90**	**1.02**	0.90	0.55	0.80
19	Market St./ Commercial St.	Signal	0.90	0.79	**1.05**	0.85	0.76	0.81
20	Market St./ Liberty St.	Signal	0.90	0.81	0.88	0.90	0.72	0.74
21	Market St./ Broadway	Signal	1.00	0.78	0.94	0.90	**0.93**	**0.96**
22	Commercial St./ Pine St.	Signal	0.90	0.54	0.65	0.90	**1.12**	0.59
23	Liberty St./ Pine St.	Signal	0.90	0.47	0.67	0.90	0.83	**1.20**
24	Broadway St./ Pine St.	Signal	1.00	0.53	0.96	0.90	**0.97**	**1.10**
25	Commercial St./ Hickory St.	TWSC	0.90	0.48	0.54	0.90[b]	0.52	**1.06**
26	Liberty St./ Hickory St.	TWSC	0.90	0.40	0.52	0.90[c]	0.57	**1.01**
27	Broadway St./ Hickory St.	TWSC	1.00	0.24	0.32	0.90	0.42	**1.25**
28	Salem Pkwy./ Commercial St.	Merge	N/A	–	–	N/A	–	–
29	Salem Pkwy./ Liberty St.	Signal	0.90	0.62	**0.93**	0.90	**0.94**	**1.18**
30	Salem Pkwy./ Broadway St.	Signal	0.90	0.80	**1.21**	0.90	**0.91**	**1.42**
31	Salem Pkwy./ Cherry St.	Signal	0.90	0.85	**0.94**	0.90	**1.01**	**1.05**
32	Marine Dr./ Beckett St.	TWSC	0.95	0.26	0.09	0.95	0.76	0.73
33	Marine Dr./ 5th Ave. NW	Signal	0.95	0.26	0.03	0.95	0.69	0.78
34	Marine Dr./ Taybin Rd.	TWSC	0.95	0.18	0.20	0.95	0.48	0.44

TABLE 5.1-1
2040 Preferred Alternative Intersection Analysis for AM and PM Peak Hours and Control Types

				2040 No Build Alternative		**2040 Preferred Alternative**		
ID #	**Intersection**	**Control Type**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**	**Mobility Standard (v/c ratio)**	**AM Peak**	**PM Peak**

[a] Control type is signal
[b] Control type is signal
[c] Control type is no control

TWSC – two-way stop control
Analysis used *Highway Capacity Manual 2000* (TRB, 2000) methods.
Note: In some cases, the mobility standard is different for the preferred alternative compared to the No Build Alternative. This is because intersection improvements assumed trigger a higher standard.
For non-signal intersections, the roadway with the greatest (worst) v/c ratio was reported

Black and bolded cells indicate locations where mobility standards would not be met.
Grey and italicized cells indicate locations where mobility standards would not be met, but mobility would be improved over the No Build Alternative.

- With the preferred alternative, Wallace Road/Hope Avenue would be widened to accommodate additional traffic traveling to and from the bridge. Wallace Road/Orchard Heights Road intersection would be widened to accommodate increased traffic volumes, including widening along Wallace Road between Taybin Road and Narcissus Court to accommodate the additional turn lanes.
- With the preferred alternative, access from Rosemont to eastbound OR 22 would remain. Access from Rosemont westbound on OR 22 would be closed because of the violation of interchange spacing standards with the on-ramp from Marine Drive. Two westbound entrances so close together with high volume and high-speed traffic would create safety concerns. Marine Drive connections would include an eastbound off-ramp from OR 22 to Marine Drive just west of the on-ramp from Rosemont. In the westbound direction, an on-ramp to OR 22 from Marine Drive would be just east of the Rosemont off-ramp that would be closed.
- Marine Drive will serve as a parallel route to Wallace Road, providing access to the new bridge. With the preferred alternative, the City would seek to upgrade the classification of Marine Drive from a neighborhood collector to an arterial to reflect the change in function and volumes it would serve.
- On the West side of Salem, Wallace Road intersections would experience seven intersections that fail to meet standards or targets. Wallace Road/Brush College Road would have the highest v/c ratios during the AM and PM peak hours, >1.50. Wallace Road/Glen Creek Road (1.26 AM, 1.00 PM) and Wallace Road/Taggart Road (1.40 AM, 1.33 PM) would also have high v/c ratios that exceed the mobility standard/target. This result demonstrates the redistribution of traffic volumes from the existing bridges with the No Build Alternative to the new bridge with the preferred alternative.

5.1.2 Indirect Impacts

The preferred alternative VMT, VHD, and VHT measures provide an understanding of overall travel distances and times during the year 2040 and compared to the No Build Alternative (2040) (Table 5.1-2). It is important to note, these are regional measures that are derived for the entire region, and trips, particularly those within east Salem, may not be influenced by the bridge. These measures, which offer a general comparison of regional travel between the No Build Alternative (2040) and the preferred alternative (2040), provide a proxy for indirect effects.

TABLE 5.1-2
VMT, VHT, and VHD for Preferred Alternative Compared to No Build Alternative

	No Build Alternative (2040)		Preferred Alternative (2040)		Percent Change	
Metric	**AM**	**PM**	**AM**	**PM**	**AM % Change**	**PM % Change**
VMT	451,921	588,544	455,626	597,236	+1%	+1%
VHT	14,549	27,102	14,093	26,875	-3%	-1%
VHD	4,100	12,584	3,588	12,153	-12%	-3%

Of the three measures, VHD provides an indication of level of congestion system wide. Overall, the preferred alternative AM Peak VHD would experience a 12-percent reduction and a PM Peak 3-percent reduction compared to the No Build Alternative. VHT for the preferred alternative AM Peak would experience a 3-percent decrease and PM Peak would experience a 1-percent decrease compared to the No Build Alternative. VMT for the preferred alternative AM Peak and PM Peak would experience an increase of 1 percent.

VMT increases with the preferred alternative because the preferred alternative introduces more overall capacity, which accommodates more travel demand, resulting in more miles traveled. Specifically, VMT increases with the preferred alternative because the new bridge (and other infrastructure that is part of the preferred alternative) provides new routes. Some individual trips may be shorter (for example, a trip from Wallace at Hope to Keizer will be shorter using the new bridge as opposed to the existing bridge). Other individual trips will be longer, as the increased capacity of a new bridge may have a shorter travel time between locations but a longer travel distance. Both changes will occur, with the model forecasting an increase in VMT.

The greatest benefit of the preferred alternative crossing is during the AM Peak. During the PM Peak, greater volumes cross the existing and preferred alternative crossing. The result is a smaller improvement over the No Build Alternative compared to the AM Peak. It is important to note, these are regional measures that reflect traffic operations over the entire Salem metropolitan area and the bridge influence is relatively limited.

5.1.3 Construction Impacts

Construction staging on the east side of the river would be relatively minor due to the localized nature of the work. Modifications of the Commercial Street/Liberty Street and Pine Street/Liberty Street intersections would interrupt traffic for one construction season and would include lane closures. Front Street would be out of service for at least two construction seasons due to overhead bridge construction and realignment of the street. Other construction activities on the east side of the river would primarily occur offline of the existing transportation system. Temporary construction impacts to properties in the immediate four-block area such as noise, dust, and traffic delays could be high for at least one construction season. Alternate routes for impacted traffic include Broadway Street and Cherry Avenue.

Online work would include the intersection construction work on Wallace Road, Orchard Heights Road, Glen Creek Road, and River Bend Road. Construction activities on Wallace Road would entail widening for additional turn lanes at Hope Avenue and Orchard Heights Road. On River Bend Road, activities would entail the construction of a roundabout at the new intersection with the proposed Marine Drive. On Glen Creek Road, activities would entail a new intersection with proposed Marine Drive. On Orchard Heights Road, activities would entail widening for additional turn lanes and the realignment of Orchard Heights Road.

If built as a single project, the duration of construction activities on the west side of the river would be completed in two to three construction seasons.

5.2 Permits Likely Needed

No transportation-related permits are likely to be needed.

CHAPTER 6

Contacts and Coordination

The analysis team coordinated primarily with SKATS, the regional MPO, who created the travel demand forecasting models for the existing year (calibrated for 2009) and the future year (2040) using VISUM software. The analysis team consulted with SKATS, ODOT, and the City of Salem regarding the methodology for assessing impacts in this report.

The analysis team post-processed intersection turning movements for both the future No Build Alternative and the preferred alternative using National Cooperative Highway Research Program 255 techniques. For the preferred alternative, additional adjustments to the new north bridge were based on the 2040 SKATS VISUM travel demand model.

CHAPTER 7

References

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Appendix A
Final Environmental Impact Statement (FEIS) Traffic Analysis Results

Appendix A: Salem River Crossing: Final Environmental Impact Statement (FEIS) Traffic Analysis Results

ID #	Intersection	Mobility Standard	2031 No Build Alternative		2040 No Build Alternative		Mobility Standard	2031 Alternative 2A		2040 Alternative 2A		Mobility Standard	2031 Alternative 2B		2040 Alternative 2B		Mobility Standard	2031 Alternative 3		2040 Alternative 3	
			AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak
1	Wallace Rd./ Brush College Rd.	0.95	0.56	0.64	0.99	> 1.50	0.95	0.84	0.73	1.47	> 1.50	0.95	0.72	0.6	> 1.50	> 1.50	0.95	0.84	0.72	> 1.50	> 1.50
2	Wallace Rd./ River Bend Rd.	0.95	0.44	0.46	0.73	0.64	0.95	0.80	0.61	0.73	0.85	0.95	0.56	0.54	0.70	0.87	0.95	0.69	0.64	0.99	1.04
3	Wallace Rd./Hope Ave.	0.95	0.27	0.09	0.85	> 1.50	0.95	1.03	0.84	0.70	0.93	0.95	0.75	0.6	0.59	0.78	0.95	0.94	0.98	0.98	0.89
4	Wallace Rd./ Orchard Heights Rd.	0.95	0.79	1.08	0.85	0.87	0.95	1.08	0.66	0.68	0.81	0.95	0.93	0.89	0.89	0.91	0.95	1.19	1.20	1.03	1.40
5	Wallace Rd./ Glen Creek Rd.	0.95	1.12	1.18	1.18	1.00	0.95	1.27	1.02	1.26	1.22	0.95	1.14	1.21	1.05	1.12	0.95	1.35	1.24	1.27	1.14
6	Wallace Rd./ Taggart Rd.	0.95	1.34	1.26	1.46	1.46	0.95	1.44	1.07	1.45	1.33	0.95	1.2	1.18	1.24	1.44	0.95	1.17	1.2	1.22	1.45
7	Wallace Rd./Hwy 22- Edgewater St.	0.95	1.39	1.05	1.50	1.07	0.95	1.18	0.8	1.49	1.01	0.95	0.93	0.57	1.15	0.88	0.95	0.85	0.55	1.11	0.86
8	Hope Ave./Marine Dr.	0.90	N/A	N/A	Does not exist for this alternative		0.90	N/A	N/A	Does not exist for this alternative		Does not exist for this alternative					0.90	0.81	0.59	0.96	0.89
9	Orchard Heights/ Marine Dr.	0.90	N/A	N/A	Does not exist for this alternative		0.90	N/A	N/A	Does not exist for this alternative		0.90	0.51	0.39	0.41	0.23	Does not exist for this alternative				
10	Marine Dr./ Glen Creek Rd.	0.9 or 1.0[a]	0[b]	0.2	0.30	0.17	0.90	0.26	0.54	0.23	0.27	0.90	0.89	0.72	0.57	0.48	Does not exist for this alternative				
11	Center St. off-ramp/ NB Front Street	0.85	1.44	1.12	1.24	1.02	0.85	1.80	1.5	1.48	1.13	0.85	0.85	0.68	0.82	0.82	0.85	1.05	0.77	0.88	0.60
12	Center St./ Commercial St.	0.85	1.69	0.82	1.08	0.74	0.85	1.25	0.8	1.06	0.83	0.85	0.95	0.75	0.75	0.44	0.85	1.03	0.69	0.94	0.66
13	Center St./Liberty St.	0.90 or 1.0[a]	0.73	0.9	0.85	0.76	0.90	0.97	0.89	0.95	0.83	0.90	0.88	0.8	0.81	0.76	0.90	0.87	0.82	0.88	0.78
14	Front St./Union St.	0.90	0.91	0.73	0.89	0.89	0.90	1.13	1.01	1.06	1.01	0.90	0.50	0.58	0.57	0.60	0.90	0.57	0.53	0.69	0.69
15	Marion St. / Commercial St.	0.85	0.81	2.01	0.64	1.53	0.85	0.54	1.29	0.47	1.14	0.85	0.12	0.18	0.24	0.72	0.85	0.59	0.83	0.57	1.06
16	Marion St./Liberty St.	0.90 or 1.0[a]	0.69	1.17	0.65	1.07	0.90	0.67	0.87	0.66	1.03	0.90	0.51	0.88	0.65	1.02	0.90	0.54	0.77	0.62	0.86
17	Front St./Front St. (OR 99E)	0.90	0.46	0.85	0.59	0.99	0.90	0.41	0.84	0.70	0.99	0.90	0.75	0.55	0.77	0.84	0.90	0.42	0.64	0.54	0.87
18	Division St./ Commercial St.	0.85	0.61	0.81	0.90	1.02	0.85	1.01	0.98	0.99	1.16	Does not exist for this alternative					0.85	0.62	0.88	0.76	0.74
19	Market St./ Commercial St.	0.90	0.66	0.89	0.79	1.05	0.90	0.79	1.39	0.87	1.32	0.90	0.94	1.12	0.94	1.24	0.90	0.72	0.84	0.80	0.94
20	Market St./Liberty St.	0.90	0.66	0.78	0.81	0.88	0.90	0.84	0.98	0.84	1.02	0.90	1.19	1.30	0.99	1.05	0.90	0.67	0.88	0.75	0.83
21	Market St./Broadway St.	0.90 or 1.0[a]	0.33	0.79	0.78	0.94	0.90	1.11	0.82	0.84	1.04	0.90	0.85	1.04	0.81	1.12	0.90	0.97	0.83	0.88	1.03
22	Commercial St./Pine St.	0.90	0.51	0.63	0.54	0.65	0.90	0.66	0.76	0.58	0.67	0.90	0.72	0.68	0.54	0.63	0.90	0.76	0.64	0.67	0.61
23	Liberty St./Pine St.	0.90	0.63	0.81	0.47	0.67	0.90	0.65	0.91	0.48	0.68	0.90	0.70	0.79	0.45	0.64	0.90	0.61	0.75	0.42	0.69
24	Broadway St./Pine St.	0.90 or 1.0[a]	0.56	0.7	0.53	0.96	0.90	0.39	0.69	0.58	0.99	0.90	0.51	0.67	0.52	0.93	0.90	0.70	0.8	0.61	1.07
25	Commercial St./ Hickory St.	0.90	0.18	0.82	0.48	0.54	0.90	0.69	3.09	0.52	0.56	0.90	0.37	1.98	0.48	0.74	0.90	1.95	0.73	0.66	0.47
26	Liberty St./Hickory St.	0.90	0.04	0.17	0.40	0.52	0.90	0.06	0.72	0.42	0.52	0.90	0.05	0.48	0.39	0.49	0.90	0.32	0.26	0.32	0.50
27	Broadway St./ Hickory St.	0.90 or 1.0[a]	0.26	0.07	0.24	0.32	0.90	0.09	0.08	0.25	0.46	0.90	0.11	0.07	0.23	0.38	0.90	0.43	0.45	0.23	0.52
28	Salem Pkwy./ Commercial St.	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-
29	Salem Pkwy./Liberty St.	0.90	0.33	0.93	0.62	0.93	0.90	0.73	0.74	0.70	0.95	0.90	0.63	0.7	0.64	0.89	0.90	0.73	0.73	0.55	0.67
30	Salem Pkwy./ Broadway St.	0.90	0.75	0.98	0.80	1.21	0.90	1.07	1.19	0.89	1.23	0.90	0.97	1.13	0.83	1.16	0.90	0.61	0.95	0.75	1.02
31	Salem Pkwy./Cherry St.	0.90	0.74	0.89	0.85	0.94	0.90	0.98	1.05	0.93	0.95	0.90	0.93	1.07	0.86	0.91	0.90	0.85	0.96	0.83	0.89
32	Marine Dr./Beckett St.	0.95	N/A	N/A	0.26	0.09	0.95	N/A	N/A	0.23	0.07	Does not exist for this alternative					0.95	N/A	N/A	0.62	0.64
33	Marine Dr./5th Ave. NW	0.95	N/A	N/A	0.26	0.03	0.95	N/A	N/A	0.18	0.14	Does not exist for this alternative					0.95	N/A	N/A	0.29	0.93
34	Marine Dr./Taybin Rd.	0.95	N/A	N/A	0.18	0.20	0.95	N/A	N/A	0.20	0.16	Does not exist for this alternative					0.95	N/A	N/A	0.14	0.37
35	Wallace Rd./Beckett St.	0.95	N/A	N/A	0.52	> 1.50	0.95	N/A	N/A	1.47	> 1.50	Does not exist for this alternative					0.95	N/A	N/A	0.45	0.62

ID #	Intersection	Mobility Standard	2031 Alternative 4A		2040 Alternative 4A		Mobility Standard	2031 Alternative 4B		2040 Alternative 4B		Mobility Standard	2031 Alternative 4C		2040 Alternative 4C		Mobility Standard	2031 Alternative 4D		2040 Alternative 4D	
			AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak
1	Wallace Rd./ Brush College Rd.	0.95	0.80	0.67	> 1.50	> 1.50	0.95	0.85	0.78	1.31	> 1.50	0.95	0.78	0.63	1.03	0.98	0.95	0.78	0.63	1.03	0.98
2	Wallace Rd./ River Bend Rd.	0.95	0.69	0.59	0.93	0.92	0.95	0.7	0.59	0.93	0.92	0.95	0.52	0.5	0.75	0.73	0.95	0.52	0.5	0.75	0.73
3	Wallace Rd./Hope Ave.	0.95	1.03	1.12	0.85	0.93	0.95	0.9	1	0.78	0.75	0.95	0.69	0.85	0.73	0.87	0.95	0.74	0.79	0.73	0.87
4	Wallace Rd./ Orchard Heights Rd.	0.95	1.06	1.14	0.89	1.26	0.95	0.75	0.71	0.60	0.85	0.95	0.90	0.90	0.75	1.05	0.95	0.83	0.85	0.75	1.05
5	Wallace Rd./ Glen Creek Rd.	0.95	1.26	1.02	1.21	0.93	0.95	1.01	1.04	1.09	0.93	0.95	1.00	0.89	1.07	0.88	0.95	0.96	0.87	1.07	0.88
6	Wallace Rd./ Taggart Rd.	0.95	0.96	0.92	1.19	1.20	0.95	0.99	0.83	1.19	1.04	0.95	1.10	1.10	1.25	1.22	0.95	1.09	1.14	1.25	1.22
7	Wallace Rd./Hwy 22- Edgewater St.	0.95	0.78	0.59	1.05	0.84	0.95	0.73	0.44	0.98	0.78	0.95	0.79	0.5	1.05	0.88	0.95	0.78	0.51	1.05	0.88
8	Hope Ave./Marine Dr.	0.90	0.90	0.58	0.98	0.90	0.95	0.68	0.65	0.75	0.78	0.95	0.88	0.43	0.92	0.74	0.95	0.86	0.44	0.92	0.74
9	Orchard Heights/ Marine Dr.	Does not exist for this alternative					Does not exist for this alternative					0.90	0.12	0.60	0.76	> 1.50	0.90	0.15	0.44	0.76	> 1.50
10	Marine Dr./ Glen Creek Rd.	0.90	0 b	0.05	0.16	0.40	0.90	0.14	0.33	0.09	0.22	0.90	0 b	0.04	0.15	0.19	0.90	0 b	0.04	0.15	0.19
11	Center St. off-ramp/ NB Front Street	0.85	0.89	0.77	0.73	0.62	0.85	1.23	1.06	0.86	0.79	0.85	0.62	0.48	0.44	0.49	0.85	0.61	0.51	0.44	0.49
12	Center St./ Commercial St.	0.85	0.94	0.79	0.91	0.70	0.85	0.91	0.7	0.90	0.59	0.85	0.97	0.79	0.92	0.68	0.85	0.96	0.78	0.92	0.68
13	Center St./Liberty St.	0.90	0.83	0.98	0.74	0.76	0.90	0.93	0.78	0.80	0.73	0.90	0.90	0.8	0.78	0.73	0.90	0.90	0.79	0.78	0.73
14	Front St./Union St.	0.90	0.61	0.54	0.63	0.61	0.90	0.78	0.71	0.68	0.66	0.90	0.42	0.43	0.42	0.54	0.90	0.41	0.47	0.42	0.54
15	Marion St. / Commercial St.	0.85	0.72	1.17	0.61	1.35	0.85	0.57	0.88	0.41	1.08	0.85	0.66	1.03	0.51	1.13	0.85	0.64	1.06	0.51	1.13
16	Marion St./Liberty St.	0.90	0.51	0.84	0.59	1.00	0.90	0.48	0.81	0.58	0.95	0.90	0.46	0.79	0.57	0.88	0.90	0.45	0.87	0.57	0.88
17	Front St./Front St. (OR 99E)	0.90	0.33	0.53	0.53	0.69	0.90	0.21	0.53	0.34	0.80	0.90	0.23	0.38	0.36	0.65	0.90	0.23	0.37	0.36	0.65
18	Division St./ Commercial St.	0.85	0.62	0.88	0.61	0.74	0.85	0.70	0.87	0.76	0.73	0.85	0.42	0.76	0.52	0.67	0.85	0.4	0.73	0.52	0.67
19	Market St./ Commercial St.	0.90	0.78	0.85	0.84	0.98	0.90	0.73	0.78	0.77	0.85	0.90	0.69	0.73	0.75	0.79	0.90	0.68	0.72	0.75	0.79
20	Market St./Liberty St.	0.90	0.77	0.84	0.80	0.73	0.90	0.76	0.91	0.76	0.85	0.90	0.51	0.83	0.66	0.74	0.90	0.51	0.82	0.66	0.74
21	Market St./Broadway St.	0.90	0.90	0.88	0.80	1.07	0.90	0.92	0.84	0.92	0.94	0.90	0.80	1	0.84	0.82	0.90	0.83	0.98	0.84	0.82
22	Commercial St./Pine St.	0.90	1.05	0.76	0.92	0.64	0.90	1.06	0.79	0.92	0.66	0.90	0.86	0.55	0.75	0.48	0.90	0.87	0.53	0.75	0.48
23	Liberty St./Pine St.	0.90	1.30	1.69	0.77	0.96	0.90	1.27	1.63	0.78	0.97	0.90	0.64	0.74	0.67	0.83	0.90	1.58	1.88	0.90	1.02
24	Broadway St./Pine St.	0.90	1.04	1.14	1.04	0.76	0.90	1.03	1.04	1.04	0.76	0.90	0.75	0.74	0.69	0.63	0.90	1.25	1.04	1.13	0.82
25	Commercial St./ Hickory St.	0.90	0.61	0.88	0.39	0.62	0.90	0.64	0.81	0.44	0.62	0.90	0.60	0.82	0.49	0.71	0.90	0.59	0.83	0.49	0.71
26	Liberty St./Hickory St.	0.90	0.72	0.82	0.64	0.78	0.90	0.71	0.77	0.45	0.58	0.90	0.39	0.83	0.42	0.71	0.90	0.26	0.59	0.42	0.74
27	Broadway St./ Hickory St.	0.90	0.43	1.04	0.35	1.20	0.90	0.33	0.78	0.39	0.74	0.90	0.47	0.64	0.42	0.59	0.90	0.20	0.47	0.69	> 1.50
28	Salem Pkwy./ Commercial St.	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-
29	Salem Pkwy./Liberty St.	0.90	0.74	0.78	0.78	0.89	0.90	0.73	0.76	0.75	0.90	0.90	0.37	0.39	0.46	0.56	0.90	0.35	0.39	0.46	0.56
30	Salem Pkwy./ Broadway St.	0.90	1.07	1.14	0.88	1.11	0.90	0.99	1.17	0.79	1.12	0.90	0.76	1.04	0.77	1.00	0.90	N/A	N/A	0.78	1.01
31	Salem Pkwy./Cherry St.	0.90	1.04	1.07	0.94	0.95	0.90	1.01	1.06	0.89	0.97	0.90	0.98	1.06	0.85	1.00	0.90	1.04	1.08	0.85	1.00
32	Marine Dr./Beckett St.	0.95	N/A	N/A	0.42	0.74	0.95	N/A	N/A	0.25	0.50	Does not exist for this alternative					Does not exist for this alternative				
33	Marine Dr./5th Ave. NW	0.95	N/A	N/A	0.48	0.53	0.95	N/A	N/A	0.22	0.59	0.90	N/A	N/A	0.11	0.17	0.95	N/A	N/A	0.11	0.17
34	Marine Dr./Taybin Rd.	0.95	N/A	N/A	0.12	0.42	0.95	N/A	N/A	0.08	0.21	Does not exist for this alternative					Does not exist for this alternative				
35	Wallace Rd./Beckett St.	0.95	N/A	N/A	0.54	0.58	0.95	N/A	N/A	0.31	0.49	Does not exist for this alternative					Does not exist for this alternative				

[a] Traffic analysis for non-state facilities performed for this FEIS used City of Salem mobility standards (a volume-to-capacity [v/c] standard of 1.0 for the existing and future No Build Alternative, and a v/c standard of 0.90 for all Build alternatives) based on Salem Transportation System Plan Policy 2.5 (City of Salem, 2007).

[b] A v/c ratio of 0.0 is reported because the v/c ratio is calculated based on the controlled approach. Volumes on the controlled movement are near zero, which is why the v/c ratio is reported as 0.0

Notes:

Analysis based on *Highway Capacity Manual 2000* (TRB, 2000) methods.

Black shading represents intersection not meeting mobility standards.

Grey shading represents a location that would not meet mobility standards, but would improve mobility compared to the No Build Alternative's intersection not meeting mobility standards.

For non-signals, worst v/c by movement was reported.

Marine Drive/Taybin Rd. and Wallace Rd./ Beckett St. were not modeled for year 2031.

From: STEVEN ANDERSON
To: CityRecorder
Subject: Document for inclusion Council packet & record Agenda Items 4.c.
Date: Monday, April 11, 2022 9:45:58 AM
Attachments: traffic-congestion-task-force-recommendations-final-report.pdf

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Please add the attached document for inclusion in Council packets and into the record for the public hearing tonight in support of the West Salem Neighborhood Association testimony,

Agenda 4.c. 22-102
Comprehensive Plan Map Amendment and Zone Change
2100 Doaks Ferry Rd NW

Please confirm receipt and inclusion for tonight's public hearing. With the previous email there should be three documents needing inclusion. Any questions, please let me know. Thank you.

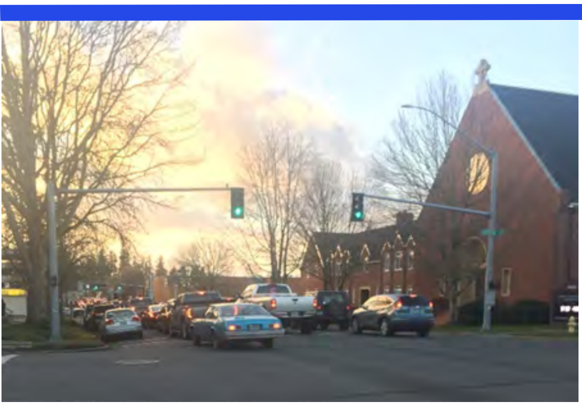
Steve Anderson, West Salem Neighborhood Association Land Use Chair
503-602-1623
andersonriskanalysis@comcast.net

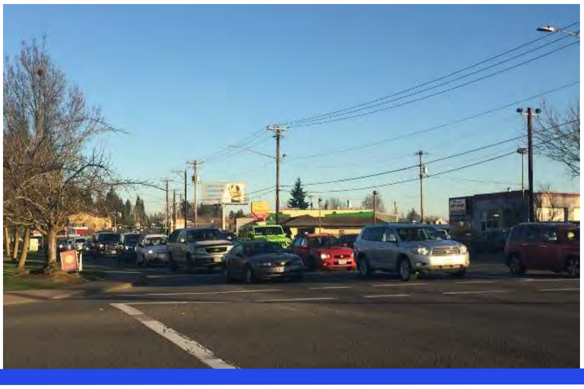
DKS

CITY OF Salem
AT YOUR SERVICE

SALEM CONGESTION RELIEF TASK FORCE

FINAL REPORT





SALEM CONGESTION RELIEF TASK FORCE

FINAL REPORT

Prepared for:

City of Salem
Public Works Department

Prepared by:

DKS Associates
Scott Mansur, P.E., PTOE
Jenna Hills, EIT

Cogito Partners
Julie Fischer, Principal

Angelo Planning Group
Matt Hastie, AICP

Table of Contents

1. PROJECT BACKGROUND AND GOAL

Over the past decade, regional transportation experts, City staff, and the community have been considering transportation options to relieve congestion in downtown and west Salem that have included a new Willamette River crossing and other capacity improvements. While these discussions have been ongoing, no specific transportation improvement projects have been approved by the City or ODOT.

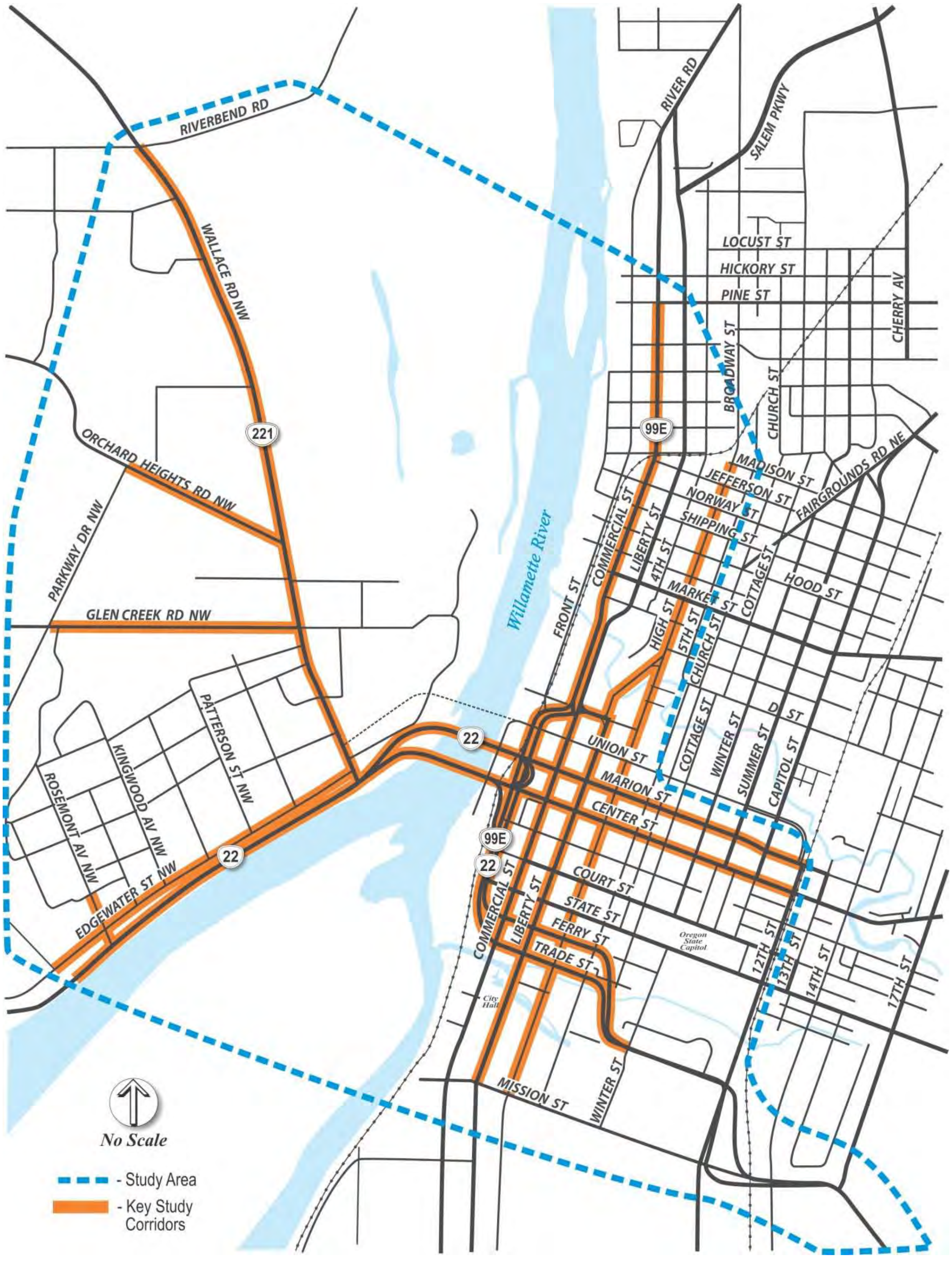
In the meantime, congestion and vehicular mobility continue to plague the downtown and west Salem areas near the existing bridges. There is a need to address vehicular mobility and traffic congestion immediately and independent of decisions related to the proposed Willamette River crossing.

On November 13, 2017, the Salem City Council directed staff to hire a consultant team to facilitate a four-member Task Force to develop a list of short-, medium-, and long-term projects and a funding strategy that, when implemented, would reduce traffic congestion and improve vehicular mobility. (See Appendix A.) The consultant prepared for and facilitated six Task Force meetings. The four members of the Task Force consisted of Mayor Chuck Bennett and three mayor-appointed councilors: Councilor Cara Kaser, Councilor Chris Hoy, and Councilor Jim Lewis.

Task Force Goal

Investigate potential ways for the City to relieve congestion in the project area and advise the City on policies and actions to improve traffic flow.

While improving non-vehicular modes of transportation (including pedestrian, bicycle, and public transit) and considering the possibility of other travel demand management measures were discussed among the Task Force members, the work of this Task Force was focused on identifying transportation infrastructure projects and policies to improve vehicular mobility and ways to reduce vehicular congestion within the study area. The study area and key corridors are pictured on the following page.



Project Study Area

2. TASK FORCE MEETINGS

A key goal of the project was to provide a focused and neutral environment to fully investigate and evaluate the transportation challenges in the project area. In order to ensure a balanced and objective process, the consultant team gathered information, analyzed issues, and provided options for the Task Force to consider.

The Task Force actively engaged in reviewing both the technical analysis and public comments throughout the course of the project. The two-hour Task Force meetings began with a presentation by the lead transportation engineer, followed by informal questions and discussion by Task Force members. A facilitator provided general structure, including a brief recap of the previous meeting content and summary of key decisions or conclusions at the end of each meeting. City staff were available for questions and to clarify issues as they arose.

Task Force members provided feedback through discussion with each other and the consultant team. The audio from the meetings was recorded and posted on the City website along with a meeting agenda and summary. At the fifth meeting, the consultant presented a list of possible improvements and Task Force members were asked to take a week to provide input on the improvements. The input was reviewed by the Task Force members at the final meeting and the resulting decisions provided the basis for this final report and recommendations.

Appendix B provides an overview of existing and projected future traffic conditions in the Study Area. Appendix C contains information regarding how potential projects were developed. Appendix D summarizes public survey comments. Appendices E through J contain the agendas and handout materials from each of the six Task Force meetings.

3. TASK FORCE CONCLUSIONS

Based on the materials presented and discussions at the meetings, the Task Force made the following conclusions:

TRAFFIC CONDITIONS

Existing traffic congestion is directly related to vehicle flows to, from, and across the Center Street and Marion Street bridges. During morning and evening commutes, traffic on the bridges nears or exceeds capacity in many areas. This produces long vehicle queues on Wallace Road, Highway 22, and Glen Creek Road leading to the Center Street Bridge in the peak morning traffic commuting hours. In the evening peak traffic commuting hours, Commercial Street, Marion Street, and Front Street leading to the Marion Street Bridge are also congested with long vehicle queues. An additional challenge to address congestion on and near the Salem bridges is that there are no nearby alternative routes to cross the Willamette River. The nearest alternative Willamette River crossings are located in Newberg (located 26 miles to the north) and in Independence (located 12 miles to the south).

The population of Salem and the region is projected to grow more than 20 percent over the next 20 years. With the increase in population, vehicle congestion in the study area is also projected to increase. This will result in longer travel times, longer vehicle queues, and an increase in the duration of the morning and evening peak commutes over the two bridges.

With heavy congestion already present in the study area, a lack of alternate river crossing routes in Salem, and an increase in projected traffic in the next 20 years, vehicle delays and travel times will continue to degrade if nothing is done to relieve the congestion.

PROJECT IDEAS

To relieve vehicle congestion in the study area, the Task Force considered potential capital improvements that would increase vehicular traffic flows across the Marion and Center Street bridges, including improvements to roads leading to and from the bridges. After evaluating many project ideas to relieve congestion in this area, it was concluded that there is no single project at a specific location that would significantly reduce congestion across the Marion Street and Center Street bridges. To significantly reduce congestion, a set of capital projects must be packaged together. These "packages" of project ideas were called Solution Packages, each of which constituted potential major, long-term capital projects. In total, seven Solution

Packages were evaluated, four Solution Packages to help relieve congestion on the Marion Street Bridge and three Solution Packages for Center Street Bridge.

After performing queuing analysis, intersection analysis, and an evaluation of project feasibility and impacts, three of the seven Solution Packages were recommended for elimination by the consultant, which was supported by the Task Force. Further detailed analysis and cost estimates were prepared for the four remaining Solution Packages. The Task Force then narrowed down the four Solution Packages to two, one for the Center Street Bridge (referred to as Center Street Bridge Solution Package #1 in meeting documents) and one for the Marion Street Bridge (referred to as Marion Street Bridge Solution Package #4 in meeting documents).

The Center Street Bridge Solution Package involves widening Wallace Road NW to three lanes southbound; widening the eastbound bridge approach structure; adding a fifth lane on the bridge; making modifications to the north and southbound off-ramps to Front Street NE and addressing downstream bottlenecks at intersections of Front/Commercial/Division streets and Front/Commercial/Trade streets. If constructed, this option is estimated to cost between $100 and $115 million if conducted in conjunction with projects to address westbound traffic (Marion Street Bridge). If not conducted in conjunction with Marion Street Bridge projects, the cost increases by approximately $19 to $22 million. Initially the Center Street package would reduce peak travel times up to 50 percent. Travel times would return to pre-construction levels approximately ten years following project completion.

The Marion Street Bridge Solution Package involves adding a third right turn lane on Commercial Street; adding an additional westbound lane on Marion Street NE by removing parking; widening the bridge approaches; adding a fifth lane on the bridge; removing the pedestrian sidewalk on the bridge; and widening Wallace Road NW to three northbound lanes. If enacted, this option is estimated to cost between $55M and $65 million. Initially the Marion Street package would reduce peak travel times 30 and 50 percent for vehicular traffic originating from north and east of the Marion Street Bridge, respectively. Travel times for traffic originating from south of the bridge would remain unchanged. All travel times would return to pre-construction levels less than ten years following project completion.

Currently, Salem does not have adopted standards for travel times between points and has not established a threshold above which a travel time is considered unacceptable. Salem does have adopted standards for roadways and intersections related to volumes and capacities. Either of the preferred Solution Packages would result in improvements to these standards, but traffic growth over time would erode these gains.

In addition to the capital costs of each of the project packages, there are also social, environmental, and economic costs. This would include, for example, property acquisition and condemnation; business and travel disruption; impacts to public parks and recreation; and construction involving the regulated floodplain, over-water work, and the Willamette Greenway. Quantifying these costs was outside of the scope of the Task Force.

Policy ideas beyond infrastructure improvements were also considered, such as growth management plans and travel demand management (TDM) policies. For example, a congestion pricing (tolling) program could be effective in reducing vehicle congestion at peak hours in the study area. New TDM policies such as commute trip reduction programs could also create additional capacity. Programs could include voluntary change in employment start and end times, incentives to use available ridesharing programs, and increased transit frequency during peak hours.

4. TASK FORCE RECOMMENDATIONS

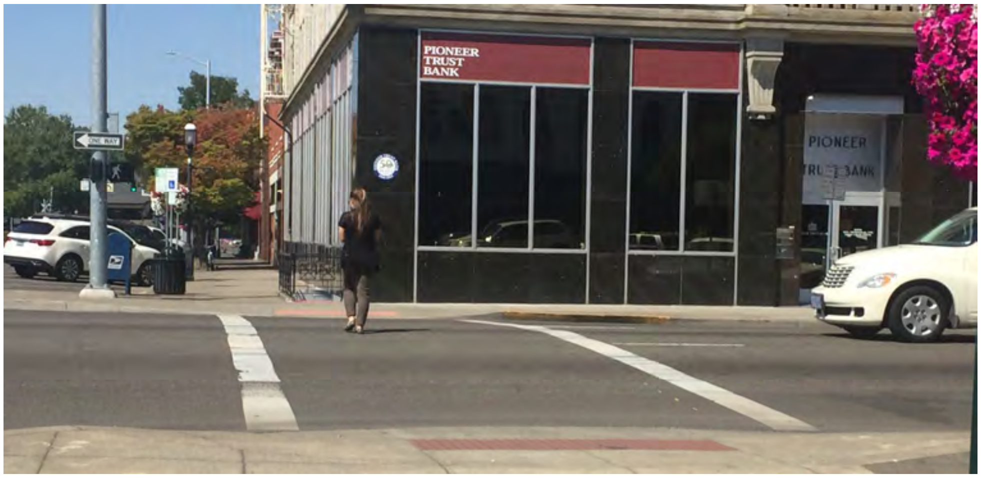
In the end, the Task Force did not reach consensus on recommending any long-term major capital improvements. They did, however, agree to recommend a list of short-term and medium-term projects, policies, and programs that may provide benefits at specific locations or to a limited number of users. These short-term and medium-term recommendations include: intersection modifications; additional guide signage; enacting turn restrictions at certain times of day; providing a park and ride/walk/shuttle facility at Wallace-Marine Park; creating a circulator/trolley program; and implementing Intelligent Traffic System technologies. Examples of the short- and medium-term recommendations are illustrated below. Other recommended projects, policies, and programs are included in the table following.

Install travel time signage in the study area.

Install variable speed limit signs on Highway 22.

Improve guide signs leading up to and on the bridges

Remove the barrier on Musgrave Avenue east of Wallace Road to allow traffic to access Wallace Marine Park.



Optimize signal timing and investigate Adaptive Signal Timing; this could include increasing pedestrian delays at signalized intersections during peak periods

Other Recommended Project Ideas
Operations
Improve response to emergencies on the bridges
Infrastructure
Construct Marine Drive
Add additional through and/or right turn lanes on the east and westbound Taggart Dr approaches at Wallace Road
Close the north crosswalk at Front St/Court St
Limit left turns to/from Wallace Road either by installing a median barrier or by instituting peak-hour turn restrictions; also consider prohibiting left turns at Wallace Rd/Taggard Rd intersection during peak congestion periods.
Travel Demand Management (TDM)
Encourage employers to implement flexible work hours
Work with employers to develop and implement incentives for employees to bike, walk, transit, and carpool
Provide downtown circulator bus or trolley
Provide park and walk/bike/shuttle services at Wallace Marine Park
Develop and implement parking management strategies
Policies/Plans
Develop a Comprehensive Growth Management Plan

APPENDICES

A. COUNCIL MOTION TO FORM TASK FORCE

COUNCIL STAFF REPORT FOR NOVEMBER 13, 2017

555 Liberty St SE
Salem, OR 97301

CITY OF SALEM

Staff Report

File #: 17-545
Version: 1
Date: 11/13/2017
Item #: 5. c.

TO: Mayor and City Council

THROUGH: Steve Powers, City Manager

FROM: Chuck Bennett, Mayor

SUBJECT:
Creation of a Council Task Force to evaluate options for reducing traffic congestion and improving vehicular mobility around the Marion and Center Street bridges.

Ward(s): Ward 1, 2
Councilor(s): Kaser, Andersen
Neighborhood(s): CANDO, SCAN, West Salem

ISSUE:

I move that the City Council create a four-member Council Task Force to evaluate options for reducing traffic congestion and improving vehicular mobility around the Marion and Center Street bridges. I further move that City Council direct the City Manager to fund the Task Force's activities, and designate Public Works Department staff to support the Task Force with data collection and analysis, and contract consultant assistance.

SUMMARY AND BACKGROUND:

Over the past decade, regional transportation experts, City staff, and the community have been considering options and alternatives related to a new Willamette River crossing. The process has been lengthy and controversial. When completed, the process will yield a Final Environmental Impact Statement for a new facility, *not* the facility itself. We understand that even with a Final EIS in place, it may take another decade or more to fund, design, and begin construction of a new bridge.

In the meantime, congestion and vehicular mobility continue to plague the downtown and inner west Salem areas around the existing bridges. There is a need to address vehicular mobility and traffic congestion immediately and independent of decisions related to the Willamette River crossing. If approved by Council, the charge of the Task Force will be to study the issues and develop a list of short-, medium-, and long-term projects and a funding strategy that-when implemented-will reduce traffic congestion and improve vehicular mobility.

While acknowledging the importance of improving non-vehicular modes of transportation-including pedestrian, bicycle, and public transit-and the possibility that other travel demand management measures-such as changed work hours-the work of this Task Force is to be directed primarily at identifying opportunities for improving vehicular mobility and ways to reduce vehicular congestion within the study area.

The Task Force, if authorized, will be a City Council committee. Member shall be appointed by the Mayor, pursuant to Section 22 of the Charter.

The idea was discussed with staff prior to developing the motion. Based on these discussions, the following work scope outline was developed. The work scope will be further refined when the Task Force gets underway.

1. Schedule, Study Boundaries, and Public Involvement
    a. Project Schedule
        i. Begin: December 2017
        ii. End: June 2018
    b. Study Boundaries
        i. North: Union Street NE/Orchard Heights Road NW
        ii. South: Mission Street SE/Edgewater Street NW
        iii. East: 12th Street SE/NE
        iv. West: Wallace Road NW
    c. Public Involvement
        i. Public involvement in this effort will be limited to attendance at the Task Force meetings. Robust public review and comment on recommended projects and funding will be expected when the recommendations are proposed for inclusion in infrastructure plans and the *Capital Improvement Program*.
2. Work Scope
    a. Existing Conditions (Within the study area boundaries)
        i. Compile studies and projects completed within the last 20 years.
        ii. Compile active studies and projects with estimated completion dates.
        iii. Compile active studies, projects, and proposals from private groups such as Main Street.
        iv. Map all current traffic volume, speed, and queueing data.
    b. Future Conditions (Using results from existing travel demand models and limited to the study area boundaries)
        i. Map future traffic volume, speed, and queueing data.
    c. Policy Analysis (Within the study area boundaries)
        i. Review adopted policies in the *Salem Transportation System Plan* related to mobility, congestion management, and parking.
        ii. Review adopted policies in the *Salem Comprehensive Parks Master Plan* related to parks and their uses.
        iii. Review adopted policies, programs, and planned projects in the Riverfront/Downtown and West Salem Urban Renewal Area Plans.
        iv. Review existing practices and policies related to providing on-street parking and alternate modes of transportation.
        v. Recommend changes to adopted policies, practices, and projects that

may facilitate improved traffic congestion and vehicular mobility.

- d. Idea Development (Based on the information developed above)
    - i. Develop ideas to reduce traffic congestion and vehicular mobility in the short- (within 5 years), medium- (within 10 years), and long-term (longer than 10 years).
    - ii. Select the most promising ideas for detailed traffic engineering analysis
    - iii. Conduct traffic engineering analysis on the selected ideas that include the following.
        1. Estimated immediate improvement in traffic flow, delay, and queueing.
        2. Estimated future improvement in traffic flow, delay, and queueing.
    - iv. Develop planning-level cost estimates for the selected ideas.
- e. Financial Plan
    - i. Develop a funding strategy to implement the selected ideas.
- f. Recommendations and Reporting
    - i. Develop a list of recommendations that includes the following:
        1. Changes to adopted policies, practices, and projects that facilitate improved traffic congestion and vehicular mobility.
        2. Projects that facilitate improved traffic congestion and vehicular mobility in the short-, medium-, and long-term.
        3. A funding strategy to implement the selected ideas.
        4. A prioritized listing of areas recommended for further research, presented in the form of questions to be answered.
    - ii. Draft a report to the City Council documenting the recommendations.

Attachment: None

B. OVERVIEW: TRAFFIC CONDITIONS

Today, residents and commuters in West Salem deal with significant congestion on Wallace Road, Glen Creek Road, and Edgewater Street during the morning commute period. Queued vehicles on Wallace Road routinely back up past the Orchard Heights Road intersection. During the evening commute period, congestion, queuing and long travel times exist on Commercial Street NE, Marion Street NE, Front Street, and Ferry Street SE. Traffic can be observed backing up on many of the downtown surface streets, impacting downtown businesses. The following sections describe the existing morning and evening commute hours.

MORNING COMMUTE CONDITIONS

During the morning commute period, traffic on Wallace Road, Orchard Heights Road, Glen Creek Road, and Highway 22 is often highly congested. Below is a table showing the average travel time on these roadways during the morning peak traffic hours.

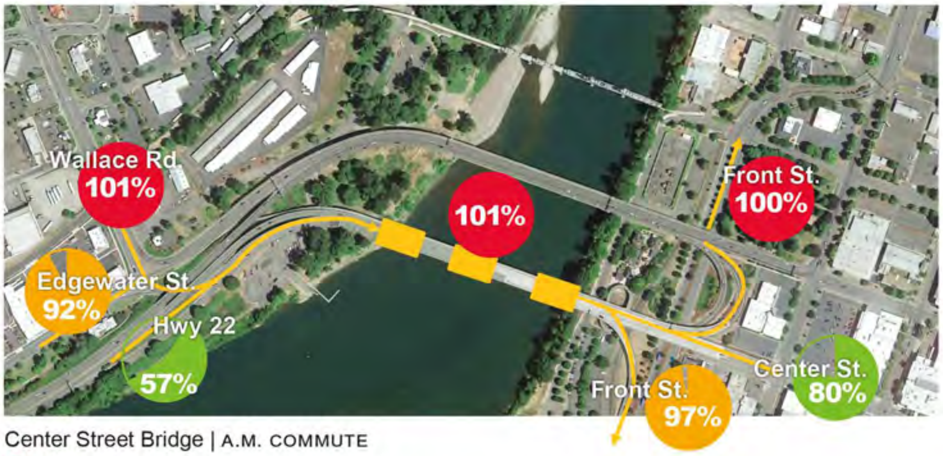
Average AM Peak Travel Metrics

Map	Road	Travel Time	Travel Speed
A to E	Wallace Road	11 mins	10 mph
B to E	Orchard Heights Road	10 mins	10 mph
C to E	Glen Creek Road	7 mins	9 mph
D to E	Highway 22	5 mins	15 mph

Congestion on Wallace Road southbound during the AM peak period

The following two figures show the estimated vehicle queues, intersection performance compared to standards, and the percent of capacity on the Center Street Bridge during the AM peak period. As shown, the intersections on Wallace Road leading to the Center Street Bridge fail to meet standards and the Wallace Road and Edgewater Street approaches onto the Center Street Bridge are near or over capacity.

Measures Of Road Capacity Used During Weekday Morning Peak Traffic Hours



Center Street Bridge | A.M. COMMUTE

● At or over capacity

● Near capacity

● Below capacity

Capacity is the maximum number of vehicles that a street can accommodate based on street design characteristics like number and width of lanes, driveway locations, traffic control (signals, stop signs, etc.), intersection spacing, etc. Generally, when the number of vehicles reaches 85% to 95%, delays and queuing become significant and performance is reduced.

Morning Intersection Operations

● Fails to meet standards

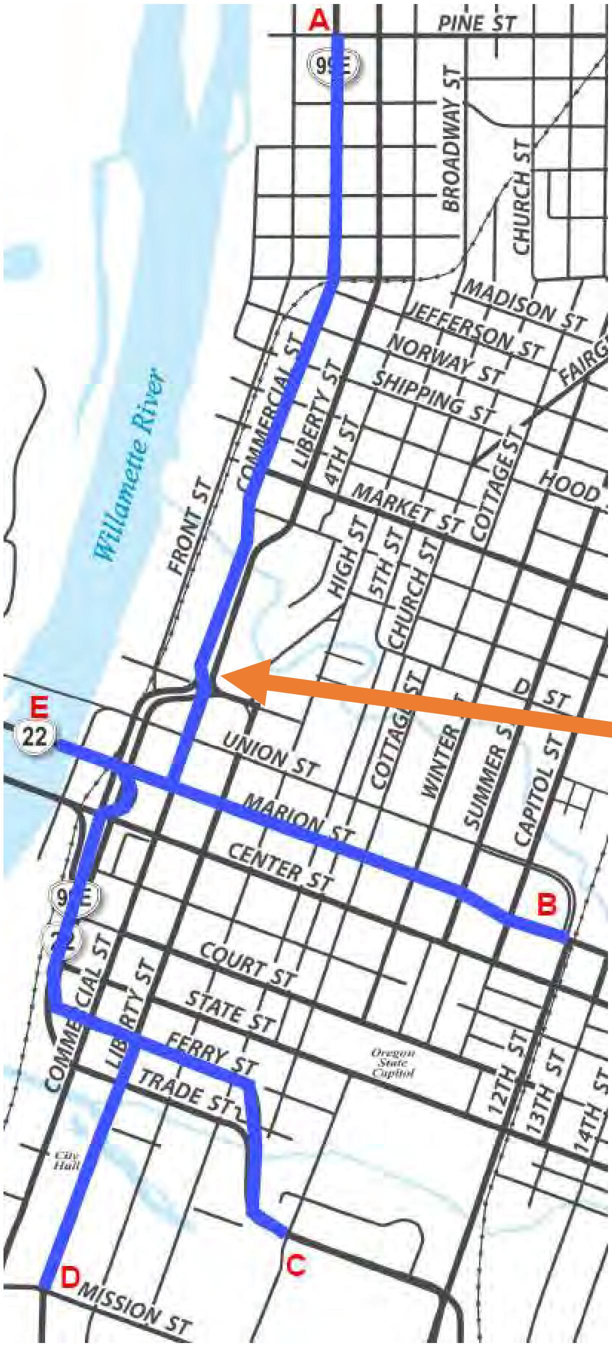
○ At or near standards

▬ Vehicle queuing (back-ups) during peak traffic hours

Standards for the streets and intersections in the study area are set by ODOT and the City of Salem. The standards set by ODOT and the City range from 85% to 95% of available capacity and an average intersection delay of up to 80 seconds

EVENING COMMUTE CONDITIONS

During the evening commute period, traffic on Commercial Street, Marion Street, and Front Street is often highly congested as vehicles wish to travel to west Salem using the Marion Street Bridge. Below is a table showing the average travel time on these roadways during the evening peak traffic hours.

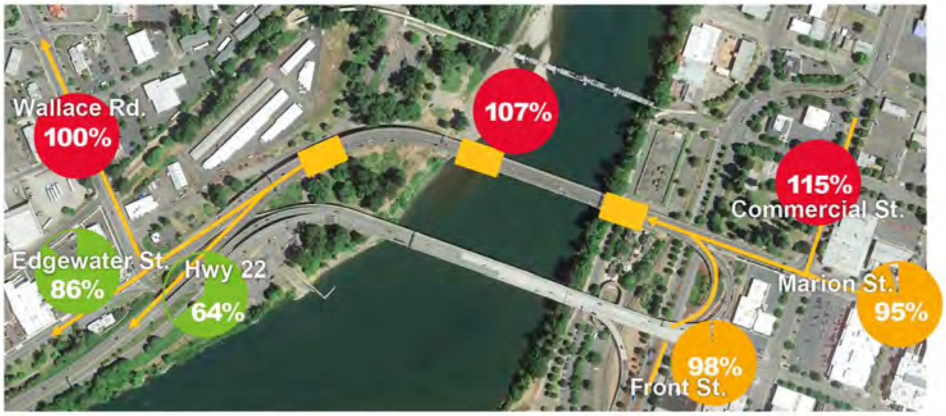


Average PM Peak Travel Metrics			
Map	**Road**	**Travel Time**	**Travel Speed**
A to E	Commercial Street	10 mins	9 mph
B to E	Marion Street	11 mins	4 mph
C to E	Ferry Street to Front Street	9 mins	7 mph
D to E	Liberty Street to Front Street	8 mins	7 mph

Congestion on Commercial Street southbound during the PM peak period

The following two figures show the estimated vehicle queues, intersection performance compared to standards, and the percent of capacity on the Marion Street Bridge during the PM peak period. As shown, the intersections on Marion Street leading to the Marion Street Bridge fails to meet standards and all the three approaches onto the Marion Street Bridge are near or over capacity.

Measures Of Road Capacity Used During Weekday Evening Peak Traffic Hours



Marion Street Bridge | P.M. COMMUTE

- 🔴 At or over capacity
- 🟠 Near capacity
- 🟢 Below capacity

Evening Intersection Operations

- ● Fails to meet standards
- ○ At or near standards
- ▬ Vehicle queuing (back-ups) during peak traffic hours

EXISTING TRAFFIC CONDITIONS SUMMARY

The congestion discussed above is directly related to vehicle flows to, from, and across the Marion Street and Center Street bridges. During morning and evening commutes, traffic on the bridges nears or exceeds capacity in many areas as shown in the previous figures. To reduce or relieve congestion in the study area, capacity must be increased in multiple key areas and/or traffic volume must be decreased.

An additional challenge to address congestion on and near the Salem bridges is that there are no nearby alternative routes to cross the Willamette River. The nearest alternative Willamette River crossings are located in Newberg (located 26 miles to the north) and in Independence (located 12 miles to the south).

FUTURE TRAFFIC CONDITIONS

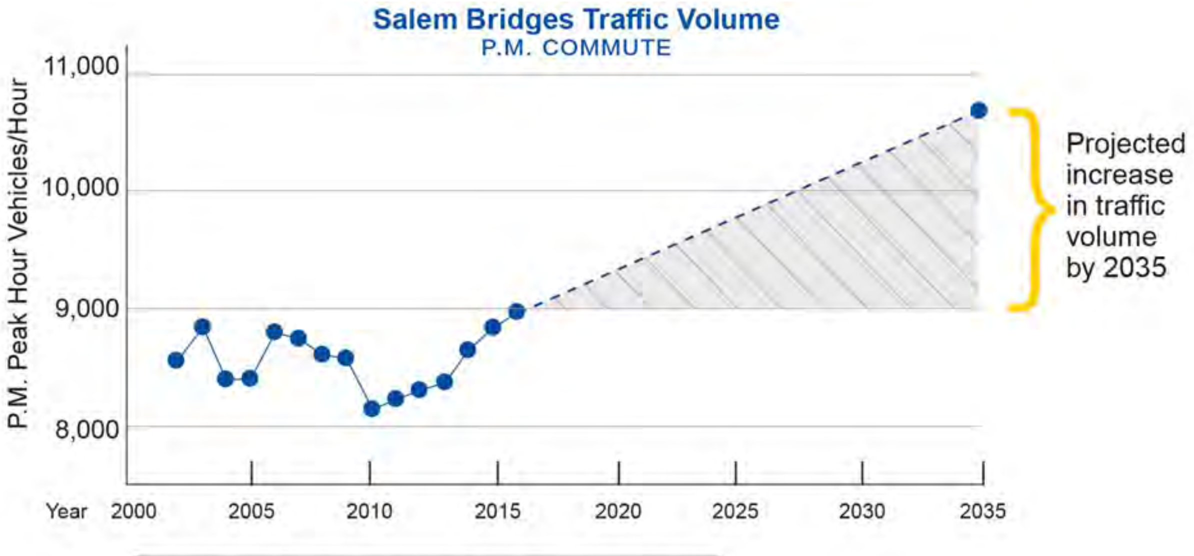
According to data from the Portland State University Population Research Center (PRC), the population of Salem and the region is projected to grow more than 20% over the next 20 years. Most of residential growth is expected to occur west and south of downtown. With the increase in population, vehicle congestion in the study area is also projected to increase (see graph below). The projected traffic increase was estimated using the Salem-Keizer regional travel demand forecasting model which is maintained by the Salem-Keizer Area Transportation Study (SKATS). This model estimates future traffic based on the population estimates from the PRC. If no efforts are made to reduce congestion, this will result in longer commutes during the morning and evening peak periods than what exists today.

As the population of Salem increases, traffic and congestion will increase.

+20% → **+1% per year**

GROWTH IN SALEM'S POPULATION predicted, 2018 to 2038

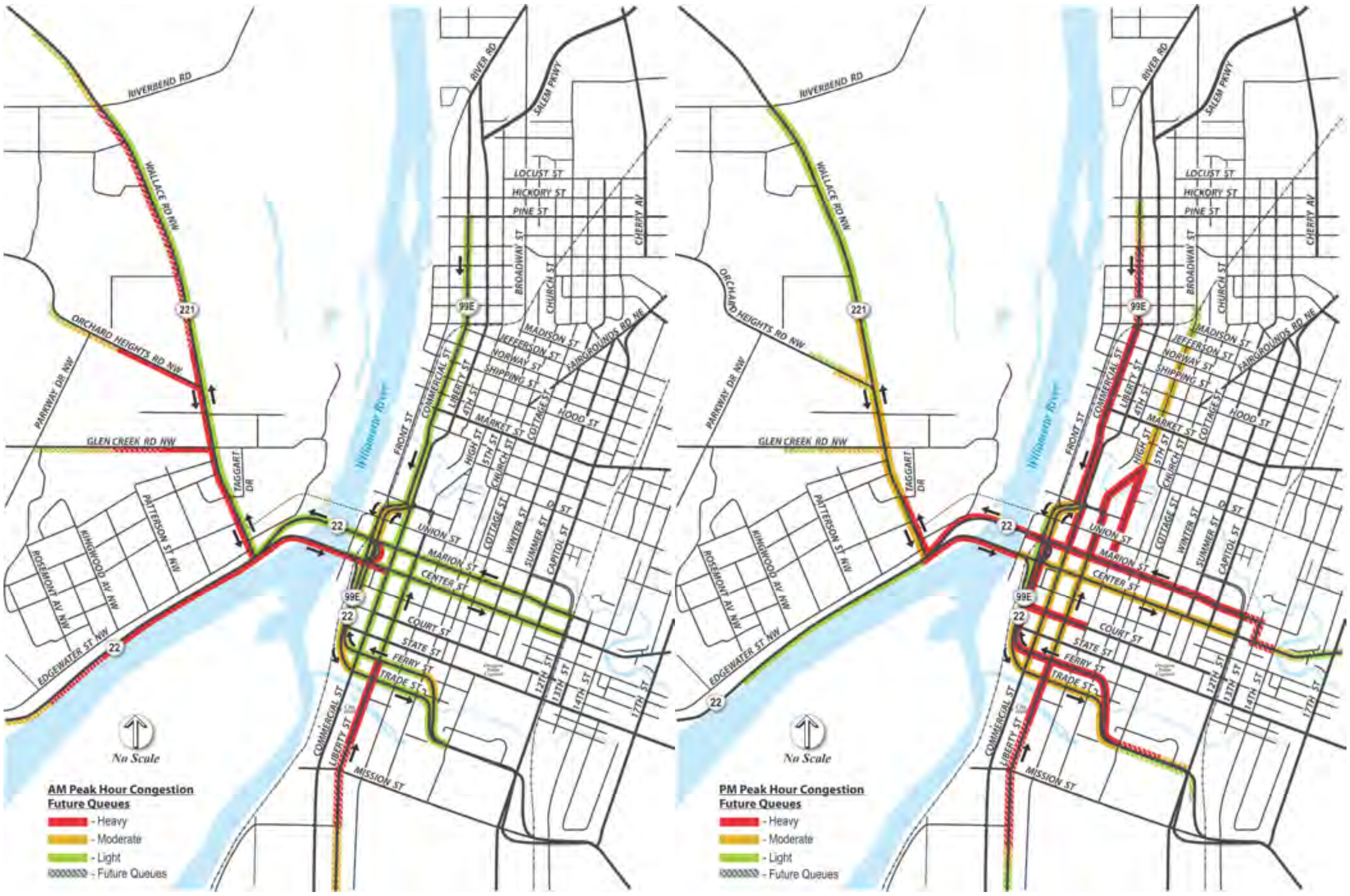
AVERAGE GROWTH IN TRAFFIC VOLUME predicted, 2016 to 2035**



*2002-2016 data based on ODOT Traffic Recorders Data

**2035 PM peak hour volume based on data from the PSU Population Research Center forecasts

The two figures below show the estimated increased congestion in future year, 2035. The hatched segments show where traffic is expected to increase from current conditions.



Future AM and PM Queues

With heavy congestion already present in the study area, a lack of alternate river crossing routes in Salem, and an increase in projected traffic in the next 20 years, vehicle delays and travel times will only continue to degrade if nothing is done to relieve the congestion.

C. DEVELOPING SOLUTION PACKAGES

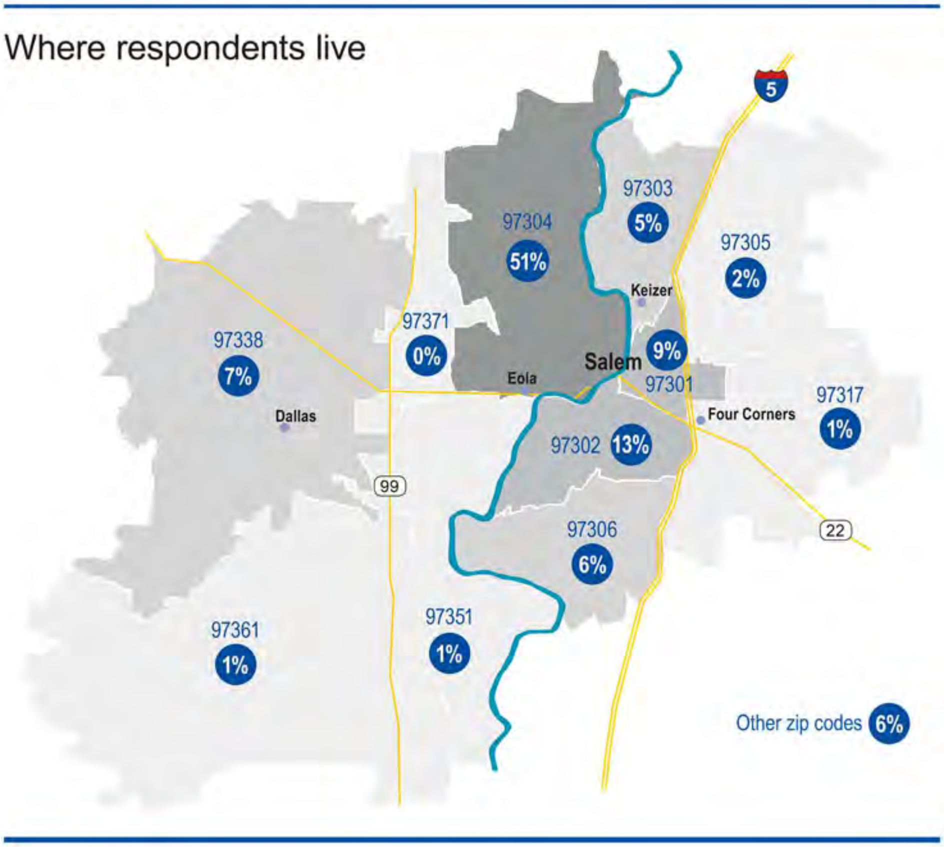
To begin developing a list of projects that would reduce traffic congestion and improve vehicular mobility, many sources were referenced. After project ideas were identified, many were evaluated and analyzed. Project ideas were categorized by short-term, medium-term, and long-term ideas. During the analysis, it was concluded that there was no single project at a specific location that significantly reduced congestion across the Marion Street and Center Street bridges. In order to significantly reduce congestion, a set of single projects must be packaged together. These "packages" of project ideas were called Solution Packages. In total, seven Solution Packages were created, four Solution Packages to help relieve congestion on the Marion Street Bridge and three Solution Packages for Center Street Bridge.

PROJECT SOURCES

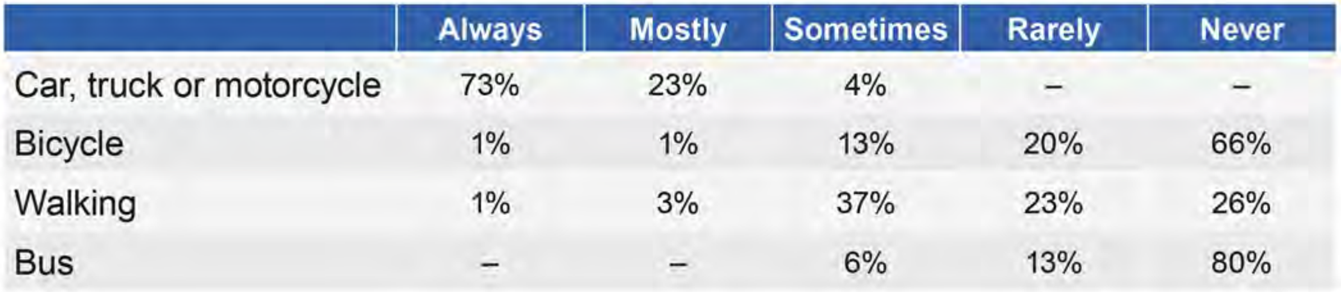
The sources for project ideas included:

- public survey
- previous studies
- consultants and City staff input
- Task Force members' input

The public survey was available to from February 24 to March 10, 2018. During this time the City of Salem provided online and hard copy surveys to residents asking for ideas to relieve traffic congestion in the project area. Approximately 1,300 people responded to the survey, with over half of them living in west Salem as shown in the figure on the following page. A summary of respondents' comments of this survey can be found in Appendix D.



According to the survey, 72% of respondents own property in Salem and 77% work in Salem. The table below shows how respondents get around Salem and how often they use that mode of transportation.



	Always	Mostly	Sometimes	Rarely	Never
Car, truck or motorcycle	73%	23%	4%	–	–
Bicycle	1%	1%	13%	20%	66%
Walking	1%	3%	37%	23%	26%
Bus	–	–	6%	13%	80%

Previous studies completed for the City of Salem were also consulted for possible project ideas. These studies provided past recommended projects in the study area that have not yet been built. Some of the studies also provided traffic data and transportation operational and forecasting tools that aided in the evaluation of project ideas. The previous studies are listed below.

- Wallace Road Local Access & Circulation Study - 1997
- Bridge Head Engineering Study (BHES) – 1998

- West Salem Gateway Area Refinement Plan - 2005
- Salem Willamette River Crossing Alternate Modes Study – 2010
- Salem River Crossing Draft EIS Alternative 2A (EIS) - 2012
- Central Salem Mobility Study – 2013
- West Salem Business District Action Plan - 2015
- City of Salem Transportation System Plan (TSP) – Updated 2016
- MWVCOG Regional Transportation System Plan (RTSP) – Updated 2016

PROJECT ANALYSIS

Project ideas that were considered included infrastructure projects such as building intersection improvements at major intersections in the study area, adding additional lanes on existing roadways in the study area, enacting turn restrictions at certain times of day, adding lanes on the Marion Street and Center Street bridges, and building new bridge exit and entrance ramps and connections.

Project ideas also included multimodal programs such as providing a park and ride/walk/shuttle facility at Wallace-Marine Park, creating a downtown circulator/trolley program, and implementing downtown parking management strategies.

Many of the infrastructure project ideas were analyzed to see whether they could increase capacity. The Salem-Keizer regional travel demand forecasting model is maintained by the Salem-Keizer Area Transportation Study (SKATS) and was used to analyze the impact that a project could have on the study area.

The analysis showed that each project only improved traffic operations in the immediate vicinity, and that there was no single project at a specific location that significantly reduced congestion across the Marion Street and Center Street bridges.

To significantly reduce congestion, a set of capital projects must be packaged together. These “packages” of project ideas were called Solution Packages, each of which constituted potential major, long-term capital projects. In total, seven Solution Packages were created, four Solution Packages to help relieve congestion on the Marion Street Bridge and three Solution Packages for Center Street Bridge. Refer to Appendix G for descriptions of each Solution Package.

After performing queuing analysis, intersection analysis, and an evaluation of project feasibility and impacts, three of the seven Solution Packages were recommended for elimination by the consultant, which was supported by the Task Force. Further detailed analysis and cost estimates were prepared for the four remaining Solution Packages. The Task Force then narrowed down the four Solution Packages to two, one for the Center Street Bridge (referred to as Center Street Bridge Solution Package #1 in meeting documents) and one for the Marion Street Bridge (referred to as Marion Street Bridge Solution Package #4 in meeting documents).

The Center Street Bridge Solution Package involves widening Wallace Road NW to three lanes southbound; widening the eastbound bridge approach structure; adding a fifth lane on the bridge; making modifications to the north and southbound off-ramps to Front Street NE and addressing downstream bottlenecks at intersections of Front/Commercial/Division streets and Front/Commercial/Trade streets. The Center Street Bridge Solution Package #1 is shown below. In the figure, vph refers to vehicles per hour and indicates the capacity that the given improvement adds or subtracts to the existing capacity. This Solution Package was estimated to cost $100 - $137 million.

Solution Package - Center Steet Bridge #1

The Marion Street Bridge Solution Package involves adding a third right turn lane on Commercial Street; adding an additional westbound lane on Marion Street NE by removing parking; widening the bridge approaches; adding a fifth lane on the bridge; removing the pedestrian sidewalk on the bridge and widening Wallace Road NW to three northbound lanes. The Marion Street Bridge Solution Package #4 is shown below. In the figure, vph refers to vehicles per hour and indicates the capacity that the given improvement adds or subtracts to the existing capacity. This soltuion package was esimated to cost $55-$65 million.

Solution Package - Marion Steet Bridge #4

SOLUTION PACKAGES SUMMARY

The two Solution Packages discussed above were analyzed and found to initially reduce peak travel times by approximately 30 - 50 percent for some of the study area streets. However, travel times would return to pre-construction levels approximately ten years following project completion. Currently, Salem does not have adopted standards for travel times between points and has not established a threshold above which a travel time is considered unacceptable. Salem does have adopted standards for roadways and intersections related to volumes and capacities. Either of the preferred Solution Packages would result in improvements to these standards, but traffic growth over time would erode these gains.

In addition to the capital costs of each of the project packages, there are also social, environmental, and economic costs. This would include, for example, property acquisition and condemnation; business and travel disruption; impacts to public parks and recreation; and construction involving the regulated floodplain, over-water work, and the Willamette Greenway. Quantifying these costs was outside of the scope of the Task Force.

Seismic retrofits are likely for the Center Street Bridge but unlikely for the Marion Street Bridge. The Oregon Department of Transportation (ODOT) will be conducting a study to determine whether the Center Street Bridge needs to be seismically retrofitted and, if so, the cost for retrofitting. Depending on the results of the study, ODOT may retrofit the bridge; $60 million was identified in legislation towards this work. ODOT has determined it will not retrofit the Marion Street Bridge because doing so is not cost-effective.

D. SUMMARY OF PUBLIC SURVEY COMMENTS

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Compiled Comments to the ***Share Your Ideas*** Questionnaire

From February 24 to March 10, 2018, the City of Salem distributed an online and hard copy questionnaire to residents asking for their ideas to relieve traffic congestion in the project area. The following compilation of comments, edited for clarity, provides detailed information about the suggested ideas. For a full list of the verbatim comments, contact Judy Postier at jpostier@cityofsalem.net. This document is a compilation of public comments and reflects the tone and style of the participants. Variations in street names and directional descriptions are common and do not reflect the City of Salem style standards.

TRAFFIC LANES

General Comments

1. Build more left-turn lanes and right-turn lanes.
2. Discourage left turns except at traffic lights.
3. Change more one-way streets to two-way streets downtown.
4. Make turn outs for bus stops so that traffic is not impeded.
5. Make left turns during peak hours illegal and make the lights blink.
6. Eliminate merge lanes.
7. Narrow traffic lanes to slow traffic.
8. Increase the number of lanes going north to south and east to west through Salem.

Bridge Lanes

1. Increase capacity of the bridges by widening bridges or adding a second tier to bridges.
2. Convert bike lanes to travel lanes on bridges.
3. Add more lanes to move traffic off the bridges.
4. Implement reversible travel lanes.
5. Make both bridges dual direction. Change the number of lanes to accommodate peak hours.
6. Create fly-overs that funnel traffic into the proper bridge exit lanes.
7. Do not allow any lane changes on the bridges. Have designated lanes for specific destinations that must be chosen before a vehicle enters the bridge.
8. Add back the lanes to Front St. heading south.
9. Develop an updated incident response plan to clear crashes and accidents quickly.

Center Street Bridge

1. Allow a free right turn from Center to Front.
2. Expand exit to Front Street to two lanes; do the same on southbound side to Commercial Street.
3. Narrow northbound Front Street to one lane before the bridge.
4. Make the off-ramp to Front Street a merge lane, rather than a traffic signal.
5. Extend the Jersey barrier for the far left lane, completely isolating that lane, and make it an exit-only option to Front Street. (Drivers from Wallace that want to go to north will have to use Liberty and Division to connect to Commercial Street northbound).
6. Add a couple of westbound lanes for express access to Edgewater.

7. Extend low barriers on the bridge between the lanes coming from Wallace and the lanes coming from the highway so cars from Wallace can see the traffic before they start changing lanes.
8. Allow traffic to turn right from Edgewater onto the bridge on the red light at anytime except 6 a.m. to 9 a.m. Monday – Friday.

Marion Street Bridge

1. Block all lane changes until after Wallace Road, requiring drivers to select the proper lane before entering the bridge.
2. Designate the left two lanes for feeding onto Highway 22, and right two lanes for west Salem.
3. Do not allow traffic from Front Street south to cross three lanes of traffic onto exit for Wallace Rd.

Streets

1. Parking Downtown
    a. Build more parking downtown so traffic doesn't back up from people looking for a place to park.
    b. Eliminate double parking downtown by vehicles off-loading goods which blocks traffic lanes at peak times. Have them use the alleys behind the businesses.

2. Commercial Street
    a. Provide a free right-turn lane to enter the Marion Street bridge.
    b. After a certain point, make it illegal to switch from left lane to right lane (to turn to get onto bridge).
    c. Have three southbound lanes turn right on to Marion Street Bridge.
    d. South Commercial/Liberty is vastly under capacity. Look at adding a third lane in each direction between City Hall and Madrona.
    e. Change markings for southbound right turns on Commercial at base of Marion Street bridge. Right-most lane should only turn into first lane on bridge, allow combined southbound through/right lane to turn into next two lanes on bridge.

3. Center Street: Allow two left-turn lanes at Center St/Liberty St. and connect back to Commercial at Division where the new Salem Police Department will be built.

4. Union Street: Allow cars heading east on Union to cross Commercial (change current bike lane to bike/car share lane).

5. Marion Street
    a. At High and Marion, create a dedicated right from southbound to westbound; allow free flow during peak hours.
    b. Make the far right lane of Marion Street a right turn only at each downtown intersection. Eliminate problem of people using the far right lane to bypass traffic in the through lanes.
    c. The new turn lane from High St. onto Marion St. needs to have the two lanes farther north on High St. to split the traffic before the intersection with Union Street.
    d. Reduce the number of left-turn lanes from Church St. to Marion St. to only one so traffic flows better on Marion Street.
    e. Eliminate the bike lane on High Street and have both southbound lanes allow turns. Cars driving south at Marion Street get so backed up at rush hour because everyone needs to turn from the right lane.
    f. Build more sky bridge connections crossing over Marion Street, so that cars are not hampered by people using the crosswalks and stalling traffic turning left off of Marion.

6. Highway 22/Wallace/Edgewater
    a. Create an active transportation management corridor along Highway 22 with variable speed limits to manage speeds during congestion and during crashes and prevent secondary crashes.
    b. Highway 22 traffic not getting off at Rosemont and heading toward Dallas should route to Chemeketa onto Front to enter the Marion St. Bridge from the south-most lane.
    c. Wallace:
        i. Add right-turn lanes at intersections.
        ii. Install median barrier in the center of Wallace Rd from Hope Ave to Edgewater St. and allow turns only at lights.
        iii. Make six lanes wide from Harritt Dr. to Edgewater.
        iv. Widen Wallace Rd and extend widened area north of Brush College Rd.

    d. Revamp interchanges off Highway 22 at Rosemont, Wallace Road or even a new one at Eola.
    e. Widen the westbound Rosemount exit on Highway 22.

7. Other Streets
    a. Close the lane next to Salem First Baptist on Marion Street.
    b. Fix the dangerous crossing from Glen Creek to Parkway to Cascade.
    c. Do not allow turning off and on Mission Street during high traffic time.
    d. Make State Street one-way going east.
    e. Mission Street cannot handle the amount of traffic that is being pushed on to it.

TRAFFIC SIGNALS AND INTERSECTIONS

General

1. Improve timing and use road sensors.
2. Time crosswalks independent of traffic signals.
3. Pedestrian crossing:
    a. Make two light cycles without allowing for pedestrian crossing.
    b. Time lights for walkers and cyclists instead of drivers.
    c. Remove pedestrian crossings that impede traffic.
4. Create roundabouts

Traveler information (signage)

1. Install traffic advisory signs on I-5 and Highway 22 to warn people of traffic congestion.
2. Improve signage and lane markings on the bridges to/from west Salem, to get drivers to slow down and be aware of what is ahead.
3. Improve signage to let people know of alternate routes through town.
4. Install traffic information signs at entrance of bridges to inform drivers of issues and time of anticipated delay.

East Salem

1. Commercial Street:
    a. Reduce the number of lights.
    b. Make longer green lights during peak hours.

    c. Install an advance-timed near-side traffic signal for southbound Commercial St. at Division.
2. Improve east-west light timing between Capitol and High.
3. Front Street:
    a. Install a grade-separated pedestrian crossing.
    b. Front at Court: Close the north pedestrian crossing.
    c. Reconsider an underpass pedestrian crossing to Riverfront park to allow continuous southbound flow on Front Street.
    d. Reduce the number of traffic lights.
    e. Remove the traffic light from the ramp off the Center Bridge to Front Street NE.
4. Union Street: Remove most recently added light.
5. Intersection of Center and Liberty: To improve bridge flow, remove pedestrian crosswalk on north leg, or eliminate dual left-turn option from the second lane, or institute part-time turn restrictions for the second lane during peak times.
6. Intersection of Liberty and Trade: Remove pedestrian crosswalk on the west leg where dual left-turn lanes are.
7. Intersection of Liberty and Division: Separate northbound traffic, let straight northbound traffic flow as is, but stop the northbound left-turn traffic.
8. High Street: Install a longer right-turn lane on southbound High Street where Fairgrounds Rd peels off to Division at Boon's Treasury. (sic)

West Salem

1. Wallace Street NW
    a. Create a 2nd Street crossing at Wallace.
    b. Create a pedestrian crossing of Wallace Road from 2nd Street to the Union Street Bridge rail path.
    c. Eliminate crosswalks on Wallace Road at the intersection of Edgewater Street and construct a low-cost bicycle/pedestrian bridge over Wallace Road, adjacent to existing OR 22 westbound bridge.
    d. Improve light timing to move traffic.
    e. Close the entrance to Dutch Bros on Wallace Road.
    f. Convert Wallace and Glen Creek intersection into a roundabout.
    g. Remove the traffic lights at Edgewater St. NW and Wallace Rd. and close the lane that connects Marion St. Bridge to Edgewater St. NW.
    h. Westbound movements out of Roth's onto Wallace Road (between Burger King and US Bank) must be restricted to right-turns only.
    i. Westbound movements from Taybin Road onto Wallace Road must be restricted to right-turns only.
    j. Add right-turn lanes at intersections.
2. Orchard Heights and Wallace intersection: Improve and fix timing of lights.
3. Orchard Heights and Glen Creek intersection: Make "no turn on a red light."

BYPASS/ALTERNATE ROUTES/ON-OFF RAMPS

General

1. Improve signage.
2. Reconfigure bridge access.
3. Build the Salem Beltline.
4. Union Street Bridge: Upgrade for vehicles. Use all the time, or some of the time for cars, or use for trolley service (see Transportation Demand Management below)

5. Create alternate routes for through traffic. For example, route traffic from coast or 99 to south Commercial, north Parkway, or ultimately, I-5.
6. Add “back-of-queue detectors” for ramps off bridge to both Front Street ramps, allowing bridge through-traffic to downtown to better use all lanes on bridge.
7. Conduct seismic upgrades to bridges.

West Salem

1. Open Musgrave to vehicles; allow vehicles to go through the park.
2. Build Marine Drive (from 5th Avenue to Harritt Drive).
3. Connect all streets west of Wallace Road.
4. Extend Murlark Avenue and/or Patterson Street to the north and connect to Glen Creek Road.
5. Create bypass from Edgewater in south to north of Riverbend Rd.
6. Close Edgewater at Wallace. Edgewater St. should only be accessible via the Rosemont Highway 22 exit. The light at Wallace and Edgewater stops the flow of traffic going east over the bridge and in turn, backs up Wallace.
1. Revise “back of queue detector” for Rosemont ramp to ensure no queues on Highway 22 westbound.

East Salem

1. Turn Front Street north of the bridges into a bypass road that routes traffic under the bridges.

Center Street Bridge

1. Build a free-flow ramp from the Center Street Bridge to northbound Front Street.
2. Reconfigure the off-ramp from Center St. bridge to eliminate the traffic light at Front St.
3. Add a second lane to the bridge ramp at Front Street.
4. Construct a ramp all the way to Liberty.

Marion Street Bridge

1. Create an off-ramp that exits left and loops under the Marion Street bridge to the Wallace Road underpass street (1st or 2nd street). This would remove the need for a traffic light at Edgewater and Wallace.
2. Put an off-ramp from the Marion Street Bridge to Musgrave Ave then extend Musgrave until it intersects with Wallace Rd in the area of Brush College Road.
3. Add an on-ramp to Marion Street Bridge coming from north Commercial onto Front St. and possibly build a bypass lane that takes cars above Wallace Road bypassing past Glen Creek Road.
4. Close the High St. exit of the Parkade (make it enter-only) at Marion and High St, but keep the right turn-only lane.
5. Ramp one lane Marion St. over Liberty and Commercial for each half of bridge with median barrier starting at top of ramp with two lanes through and two to Wallace Rd. (sic)
6. Provide an off-ramp from the Marion Street Bridge to a new road along the river and tie it in at River Bend.
7. Use the SE corner of the Marion Square Park to put a west Salem only on-ramp with single dedicated lane into west Salem.
8. Divert people going to Wallace Road from Front Street around Marion Square Park. Then they won't tie up the bridge when they cross over it.
9. If you are going to west Salem, enter the bridge from Marion Street. If you are traveling down Highway 22, enter the bridge from Front Street.

10. Split Salem Parkway so half can go on 99E and then half can go across the river and merge onto Wallace Rd NW.

TRANSPORTATION DEMAND MANAGEMENT

These ideas are geared toward reducing the number of vehicles traveling on congested roads.

Transit Service

1. Streamline transit services (back and forth to pick and drop off areas, and park and rides).
2. Provide a shuttle from the Park and Ride at Brush College.
3. Create a downtown circulator.
4. Provide a free shuttle across the bridges from parking areas.
5. Designate dedicated lanes for public transit on the bridges.
6. Schedule express buses every 30 minutes from Roth's or Safeway in west Salem to/from the downtown bus station.
7. Improve schedules:
    a. Add weekend service.
    b. Increase access in west Salem; provide services to the Capitol Mall by 7:30 am.
    c. Provide more frequent service during peak hours.
    d. Implement a fifteen-minute rotation (especially on the "key study corridors"), have more direct transit routes, and clean up the downtown transit center.
    e. Provide services seven days a week, every 15-30 minutes, 6 a.m. – 10 p.m.
8. Use smaller buses that can make more trips to west Salem and throughout the city. Allow companies to advertise on the sides of these buses to help defray costs. Provide transit employees an incentive/commission to find advertisers.
9. Add more benches to bus stops to make waiting for the bus a better experience.
10. Provide a transit parking area in west Salem and have bus service to large employers approximately every 15 minutes. Make the rides free or have some incentive to use it.
11. Improve efficiency of Cherriots.
12. Other public transportation suggestions:
    a. Augment public transit service by adding Uber and Lyft.
    b. Reroute the trains.
    c. Add a trolley to the Union Street Bridge to ferry foot traffic across the bridge.
    d. Create a free streetcar district downtown with a large parking structure outside of downtown.
    e. Install a ferry for autos and/or shuttles for state and hospital employees.
    f. Build a pontoon bridge.
    g. Prepare mass transit to adapt and leverage self-driving vehicles, allowing for community-owned and operated self-driving mass transit options that provide door-to-door service for subscribers.
    h. Negotiate with the school district for more school buses to reduce parent traffic to and from schools.
    i. Provide better Amtrak service options to/from Portland.

Employer-Based Strategies

1. Encourage employers to allow employees to work from home.
2. Implement staggered work hours to reduce peak hours of traffic, especially for State employees.
3. Expand flexible work hours.
4. Have businesses stagger business days.
5. Reinstitute a strong Commute Trip Reduction program for all state agencies and large

employers in Salem; this should include state funding for bus passes and incentives not to drive

6. Provide paid van shuttles for state workers.
7. **7.** Require state and city governments to supply free bus rides from west Salem to government offices.
8. **8.** Put some state offices in west Salem so everyone isn't trying to get to the same spot in downtown Salem at the same time of day.

Incentives to Change Travel Behavior

1. Incentivize park-and-walk option via Wallace Marine Park.
2. Implement carpool lanes.
3. Charge tolls on the bridges. Investigate congestion pricing; what would be the impact of a $1 toll placed on eastbound traffic during the morning rush hour? What about a $2 toll?
4. Increase the gas tax.
5. Create and air public service announcements that encourage (and provide some sort of bonus or incentive) for one-vehicle households, with two vehicles as a maximum.
6. Implement incentives for people to bike, ride-share, or take the bus.
7. Offer incentives to employers to stagger employee shifts to avoid peak travel times.
8. Provide a tax credit to businesses that allow their employees to work from home and/or work a shift other than at peak hours.
9. Develop a rewards program app for those using public transportation into and out of the downtown core. Build up points per ride and turn in for discounts/free items at participating local restaurants or businesses.
10. Manage demand for drive-alone trips.
11. Use Trip Choice to match riders and drivers to reduce the number of cars coming into downtown.

Future Development

1. Stop building apartments in west Salem.
2. Do not grant any additional building permits in west Salem and the surrounding area.
3. Put a stop to all building of multi-family housing along the north east side of Wallace Rd.
4. Raise permit fees on all new residential buildings in west Salem by $20K to discourage building and raise funds for transportation improvements.
5. Increase Systems Development Charges for housing in west Salem to levels that discourage new construction.
6. Re-zone, create tax incentives, etc., to encourage more business in west Salem to prevent the need to drive across the bridge for services; such as improve west Salem library, open fire and police substation, zone for increased retail (Bimart, Fred Meyer). Also, avoid concentrating large multi-family developments on Wallace Rd. NW.
7. Don't allow a Costco on Commercial, the traffic back up will be awful. Don't allow a casino in town, traffic on Portland Rd can't take it.
8. Require that when a downtown building is demolished and built back up, that at least one level of under ground parking is established like at the Grand Hotel.
9. Build more affordable housing downtown so people could walk or take the bus to work.
10. Require extensive parking review, management, and solution before moving forward with new residential and commercial building and development.
11. Stop urban sprawl and embrace true mixed land-use development.
12. Use empty lots and city-owned properties along bus stops for affordable housing developments. Working class people are traveling long distances to jobs because of lack of housing within the city. Transit-oriented development and affordable housing need more emphasis.
13. Work with the transit district when reviewing new development to make it convenient to take the bus from home to work.

Pedestrians/Bicyclists

1. Continue to improve amenities, safe routes and infrastructure for bicycle travel downtown and elsewhere in Salem.
2. Construct a low-cost bicycle/pedestrian bridge over Wallace Road, adjacent to existing OR 22 westbound bridge.
3. Add lighting to the Wallace Marine parking lot near the bridge so that people will use the parking lot and walk to work over the Union Street Bridge.
4. Have a bike commuter parking lot in Wallace Park and implement bike rental stations like in Portland.
5. Build pedestrian over/under crossings for critical intersections:
    a. Create a crossing of Wallace Road from 2nd Street to the Union Street Bridge rail path for people who want to walk and bike.
    b. Create an overpass for pedestrians crossing Front St.
6. Have free or low-cost bicycle hubs, similar to BikeTown.
7. Create a biking incentive program.
8. Implement a fully protected bicycle infrastructure program and a bicycle/pedestrian encouragement program. Provide bicycle safety classes for adults and incorporate bicycle and pedestrian safety into driver's education classes.
9. Close some downtown streets to vehicles and make them pedestrian-only.
10. Make Court Street a pedestrian mall.
11. Study the option of a pedestrian and bicycle esplanade along the Willamette River to create an attractive option for cycling and walking to downtown.
12. Revise bicycle-crossing markings at Edgewater intersections with Highway 22 on-ramp and with Wallace Road to better mark bicycle path (green stripe).
13. Increase the number of lockable bike boxes within the downtown commuter area.

Parking

1. Implement part-time parking restrictions.
2. Ban parking downtown for system workers.
3. Add park and ride lots, such as on N. Wallace Rd. and Highway 22.
4. Create a park and ride option with a secure location to leave bicycles overnight.
5. Charge for parking downtown.
6. Tax parking lots at employers.
7. Increase cost of parking at state offices.
8. Implement metered parking downtown.

Other

1. Increase traffic enforcement downtown to make the area more bike and pedestrian friendly.
2. Improve radio coverage of what the problem is and how/when it is better (Wallace Road).
3. Boost the vehicle registration fee.
4. Change the speed limit in Salem to 30 or 35 miles per hour.
5. Get the homeless camps out of down town and off the bridge ramps.
6. Give the money to the poorest of areas, not to the rich in west Salem. Already, they have some of the best schools and the best roads in the city. It is a social injustice for you to give any more to them, while ignoring the areas of the county and city that are in poverty.
7. Increase quality of all east Salem schools above that of west Salem schools to encourage families not to live in west Salem.

8. Encourage people to buy homes on the side of the river where their job is located.
9. Encourage informal ride share. For instance, provide a covered shelter behind Roth's where people can "thumb a ride" across the bridge. I can drive by and offer a ride. I hear outcries. Liability. Stranger danger. But this works in New York City and San Francisco.
10. Limit the number of cars allowed into an area at a time; institute fees for overuse of an area.

E. TASK FORCE MEETING #1

AGENDA FOR FEBRUARY 23, 2018

MATERIAL FOR FEBRUARY 23, 2018

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

MEETING GOALS

1. Welcome and Introductions ▶ 7:00

2. Meeting Goals and Agenda Review ▶ 7:05

3. Task Force Process ▶ 7:10

Agreement on:

- Task Force Goals — Public project description
- Public Survey — Content, timeframe

Weigh-in on:

- Task Force Operating Agreements — Roles and communications

4. Key Transportation Issues ▶ 7:30

Agreement on:

- Key Problem Areas

5. Current Policies and Existing Constraints ▶ 8:00

Weigh-in on:

- Which policies are flexible and which are not? To what degree?

6. Wrap up and Next Steps ▶ 8:20

DATE	MEETING TOPIC
Feb. 23	**1. Project Introduction** a. Task Force goals and process b. Key transportation issues c. Current policies and constraints
March 23	**2. Future Conditions, Transportation Ideas, Evaluation Criteria**
April 20	**3. Transportation Idea Results:** Tier 1 Screening (choose 3)
May 4	**Optional meeting**
May 18	**4. Transportation Idea Results:** Tier 2 Screening
June 29	**6. Recommendations**
July	**7. Additional meeting if needed**

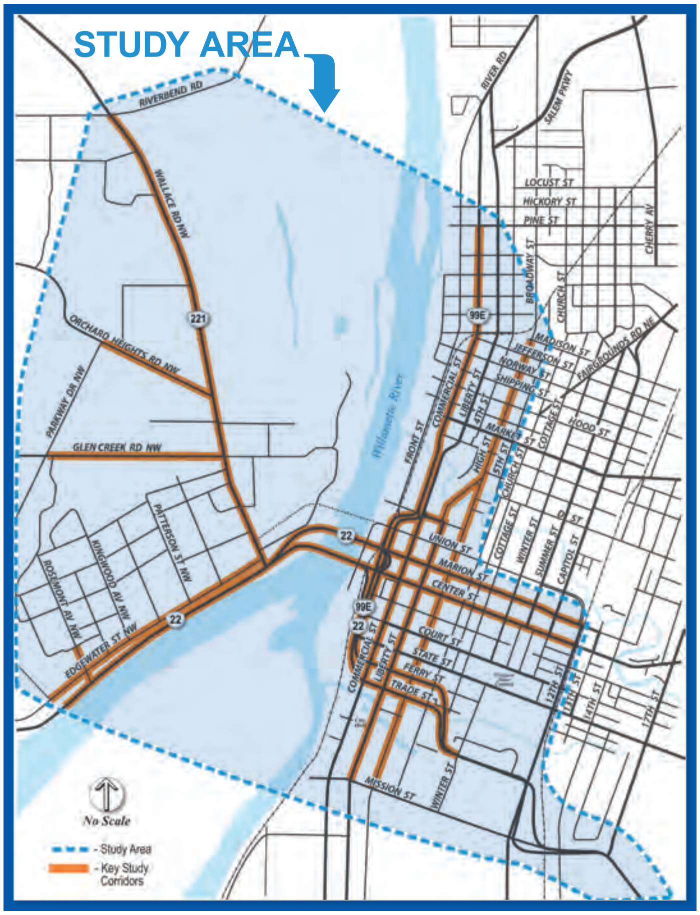
CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

CITY OF Salem
AT YOUR SERVICE

With traffic levels hampering downtown circulation, and long delays in west Salem, residents are asking for transportation infrastructure improvements.

Composed of the Mayor and three City Councilors, the Task Force will investigate potential ways for the City to relieve congestion in the project area and advise the City on policies and actions to improve traffic flow.



The Task Force will:

1. Collect ideas from the public on how to reduce congestion.
2. Evaluate past transportation studies to build off prior solutions.
3. Conduct a technical analysis to evaluate traffic options for the near-term.
4. Share the results of the technical analysis and a list of recommendations for public comment later this year.

CITY OF SALEM PUBLIC WORKS DEPARTMENT

555 Liberty St. SE · Suite 325 · Salem, OR 97301-3513 · Email: *publicworks@cityofsalem.net* · Tel: 503-588-6211 · cityofsalem.net

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

CITY OF Salem
AT YOUR SERVICE

TASK FORCE GOAL

The Congestion Relief Task Force is investigating potential ways for the City to relieve congestion in the project area and advise the City on policies and actions to improve traffic flow.

MEETING GUIDELINES

1. **Honor the agenda.**
2. **Listen carefully to speakers.**
3. **Focus on issues, not people.**
4. **Be recognized before speaking and don't interrupt.**
5. **Monitor speaking time to give others a chance to speak.**
6. **Avoid side conversations.**

- The public is welcome to observe meetings and provide written input — comment cards are provided.
- All individuals are expected to observe respectful behavior during Task Force meetings.
- Please turn all cell phones to silent and refrain from talking.
- Anyone acting in a disruptive, disorderly or threatening manner will be asked to leave, and may be precluded from participating in future meetings.
- Recordings of Task Force meetings will be posted online one week after each meeting.
- Public input will be received in writing at anytime during the course of the Task Force process. Send all comments to *publicworks@cityofsalem.net.*

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Task Force Meeting #1, February 23, 2018

DKS

Prepared by DKS Associates

CITY OF Salem AT YOUR SERVICE

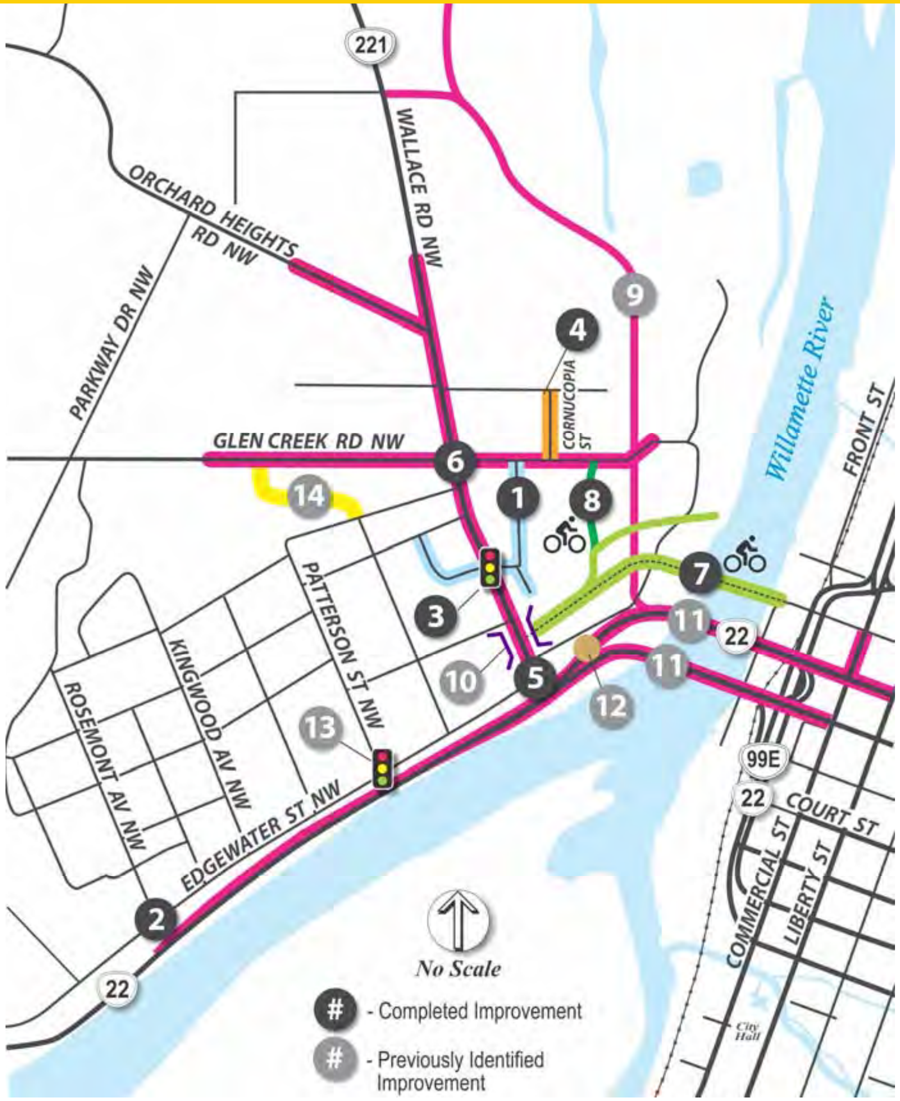
Past Accomplishments

Previous Transportation Studies Completed

- Wallace Road Local Access & Circulation Study - 1997
- Bridge Head Engineering Study (BHES) – 1998
- West Salem Gateway Area Refinement Plan - 2005
- Salem Willamette River Crossing Alternate Modes Study – 2010
- Salem River Crossing Draft EIS Alternative 2A (EIS) - 2012
- *Central Salem* Mobility Study – 2013
- *West Salem* Business District Action Plan - 2015
- City of Salem Transportation System Plan (TSP) – Updated 2016
- MWVCOG Regional Transportation System Plan (RTSP) – Updated 2016

West Salem

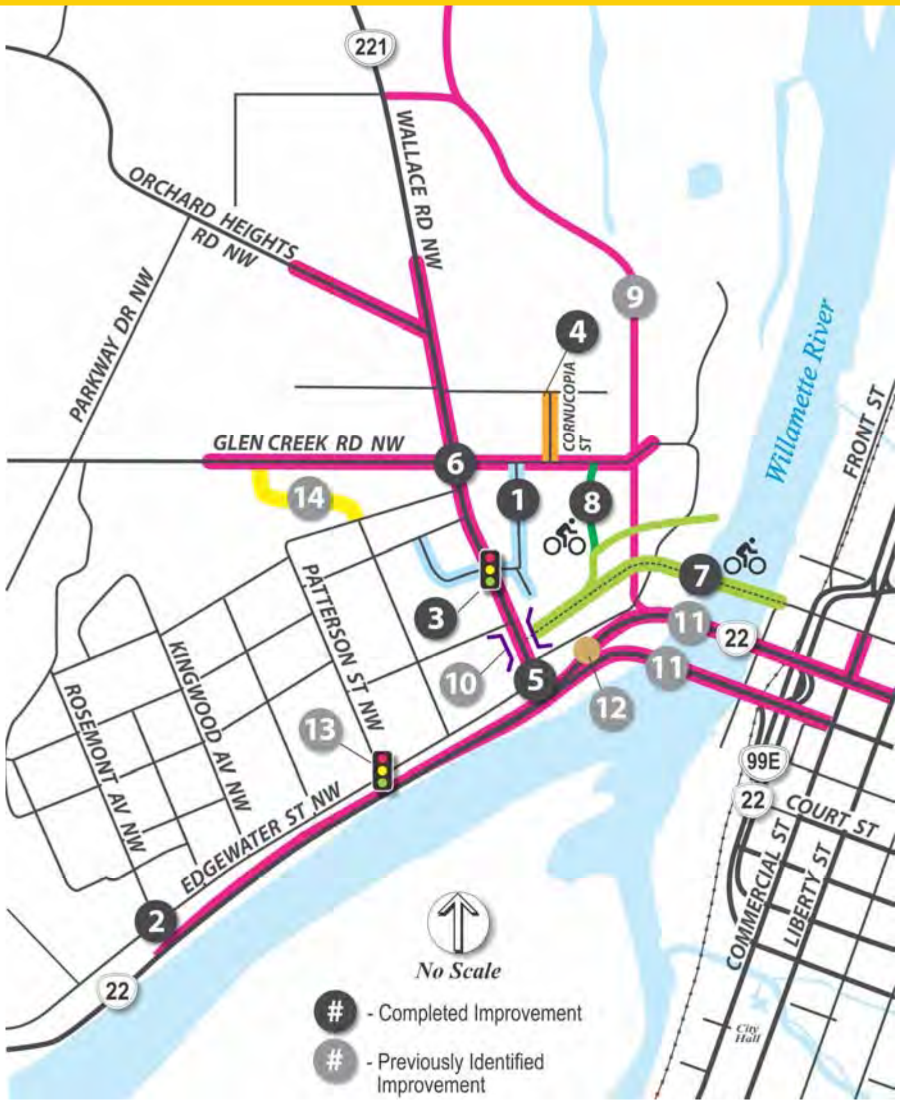
Completed Improvements



	Improvement
1	Taggart connector roads
2	Edgewater Street NW/Rosemont Ave intersection capacity improvements
3	Relocated traffic signal from 7th St to Taggart Dr
4	Cornucopia St connector road with transit facilities
5	Wallace Rd/Edgewater St traffic signal capacity improvements (Left turn prohibition)
6	Wallace Road/Glen Creek Road capacity improvements
7	Union Street Railroad Bridge converted to ped-bike bridge with trail connections constructed
8	Multi-use trail connection from Union St. Bridge trail to Glen Creek Road

West Salem

Previously Identified Transportation Improvements



	Improvement
5	Wallace Rd/Edgewater St: • Add eastbound and westbound lanes on Wallace Rd. • Improve geometry, and • Close Musgrave Ln.
9	Marine Dr. connector roadway
10	Multimodal grade-separated crossing at 2nd St/Wallace Rd
11	Marion Street Bridge increase to six westbound lanes and provide Marine Dr off-ramp
	Center St Bridge widen to five eastbound lanes
12	Wallace Rd improvements: Three ramp lanes and six-lane cross section
13	Signal at Edgewater/Patterson St
14	Murlark Ave. connector roadway to Glen Creek Rd

East Salem

Completed Improvements

	Improvement
1	Commercial/Division improvements
2	Ramp from Center St bridge to southbound Front St. widened to two lanes
3	Front St pedestrian median improvements
4	Traffic signal at Center St/Front St ramp (ITS detection for congestion management)
5	Traffic signal at Commercial/Union for east-west bicycle/pedestrian movements

East Salem

Previously Identified Transportation Improvements

	Improvement
6	Construct Union St bikeway
7	Widen ramp to two lanes or provide uncontrolled right turn
8	Commercial/Marion St Bridge capacity improvements: Exclusive double right turn lanes Alternatively Uncontrolled right turn ramp onto Marion St Bridge over park, no pedestrian crossing
9	Widen Front Street to a Minor Arterial standard.

AM Peak Hour Congestion

Wallace Rd (southbound)

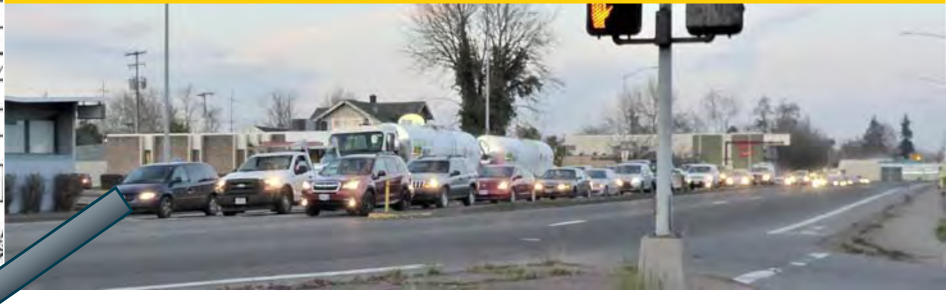
PM Peak Hour Congestion

Marion Street at Cottage St (westbound)

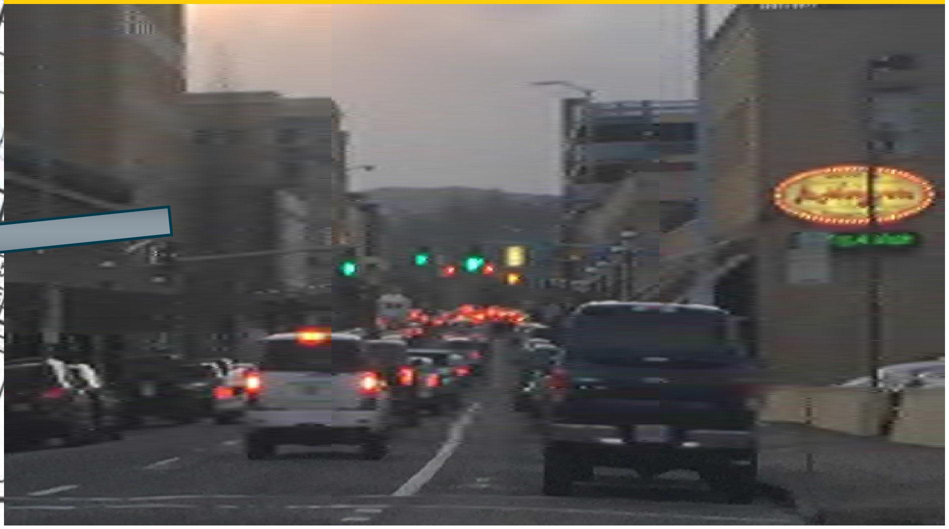
Marion Street at Capitol St (westbound)

PM Peak Hour Congestion

Commercial St at Division St/Front St (southbound)



Ferry Street at Church St (westbound)



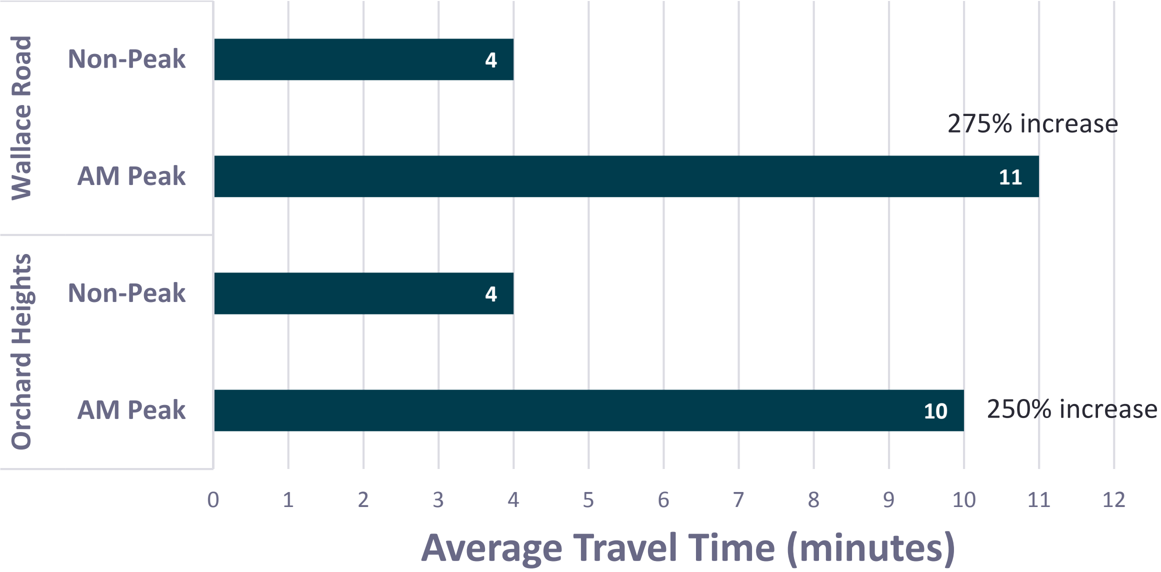
Typical Travel Times (AM Peak Hour)

Wallace Road

Start	End	Condition	Speed	Average Travel Time	Delay
A	E	Non-Peak	32 mph	4 mins	-
A	E	AM Peak	10 mph	11 mins	**7 mins**

Orchard Heights Road

Start	End	Condition	Speed	Average Travel Time	Delay
B	E	Non-Peak	23 mph	4 mins	-
B	E	AM Peak	10 mph	10 mins	**6 mins**



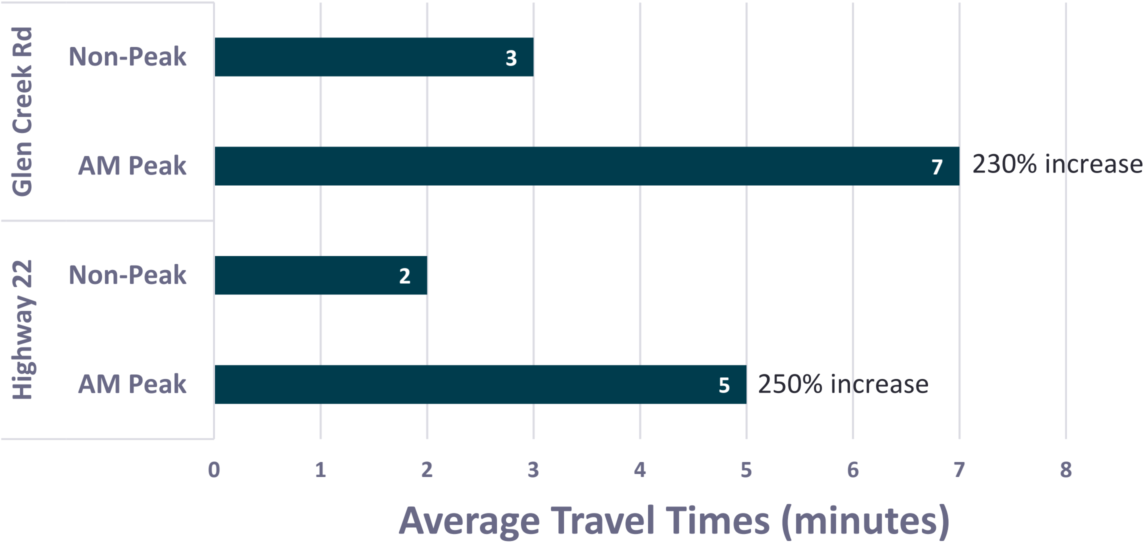
Typical Travel Times (AM Peak Hour)

Glen Creek Road

Start	End	Condition	Speed	Average Travel Time	Delay
C	E	Non-Peak	22 mph	3 mins	-
C	E	AM Peak	9 mph	7 mins	**4 mins**

Highway 22

Start	End	Condition	Speed	Average Travel Time	Delay
D	E	Non-Peak	33 mph	2 mins	-
D	E	AM Peak	15 mph	5 mins	**3 mins**



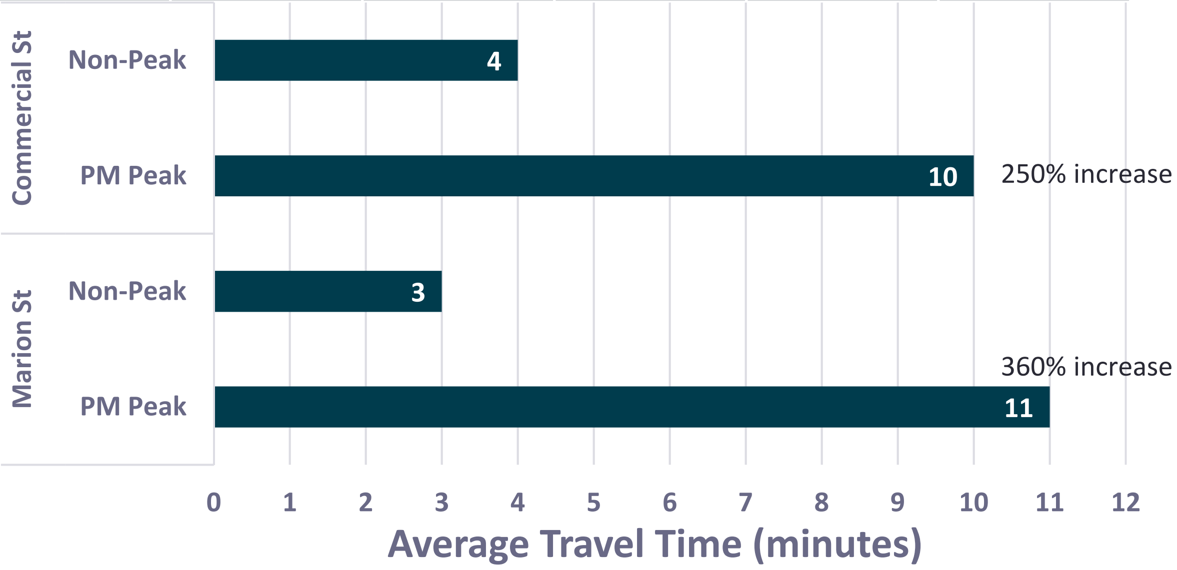
Typical Travel Times (PM Peak Hour)

Commercial Street

Start	End	Condition	Speed	Average Travel Time	Delay
A	E	Non-Peak	23 mph	4 mins	-
A	E	PM Peak	9 mph	10 mins	**6 mins**

Marion Street

Start	End	Condition	Speed	Average Travel Time	Delay
B	E	Non-Peak	16 mph	3 mins	-
B	E	PM Peak	4 mph	11 mins	**8 mins**



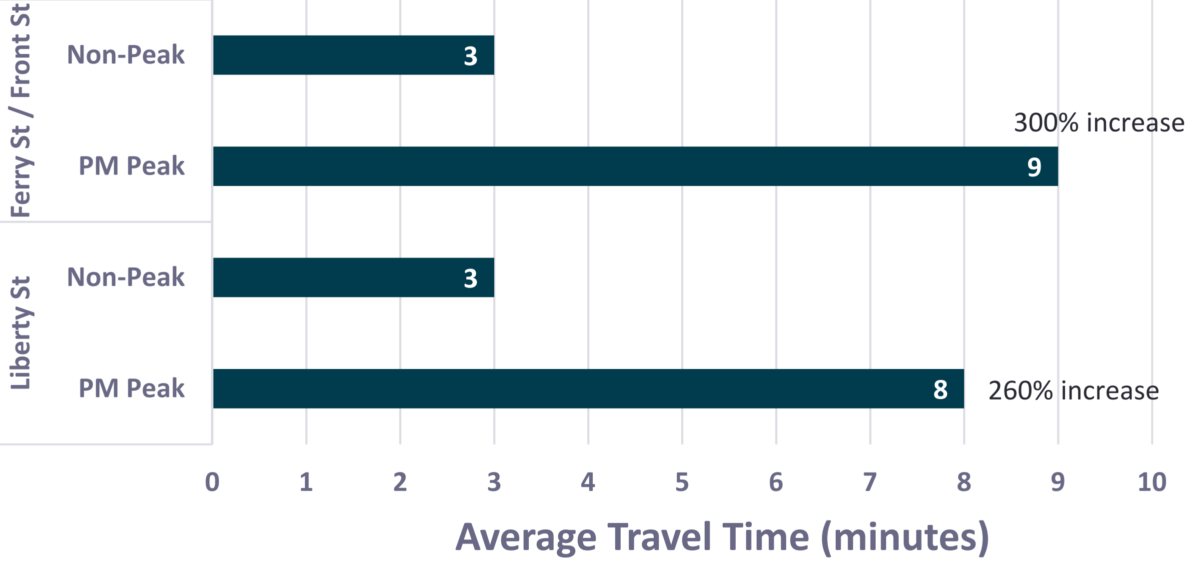
Typical Travel Times (PM Peak Hour)

Ferry Street / Front Street

Start	End	Condition	Speed	Average Travel Time	Delay
C	E	Non-Peak	22 mph	3 mins	-
C	E	PM Peak	7 mph	9 mins	**6 mins**

Liberty Street

Start	End	Condition	Speed	Average Travel Time	Delay
D	E	Non-Peak	17 mph	3 mins	-
D	E	PM Peak	7 mph	8 mins	**5 mins**



F. TASK FORCE MEETING #2

AGENDA FOR APRIL 20, 2018

MATERIAL FOR APRIL 20, 2018

CITY OF Salem AT YOUR SERVICE

April 20, 2018

MEETING GOALS

1. Agenda Review and Meeting #1 Recap ▶ **7:00**

2. Future Transportation Conditions ▶ **7:10**

3. Transportation Solution Ideas ▶ **7:20**

Weigh-in on: Summary List of Ideas

4. Evaluation Criteria ▶ **8:10**

Agreement on: Evaluation Criteria

5. Wrap-up and Next Steps ▶ **8:25**

DATE	MEETING TOPIC
Feb. 23	**1. Project Introduction** a. Task Force goals and process b. Key transportation issues c. Current policies and constraints
April 20	**2. Future Conditions, Transportation Ideas, Evaluation Criteria**
May 4	**3. Optional meeting**
May 18	**4. Transportation Idea Results:** Tier 1 Screening (choose 3)
June 29	**5. Transportation Idea Results:** Tier 2 Screening
July	**6. Recommendations**

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

CITY OF Salem AT YOUR SERVICE

Share Your Ideas!

With traffic levels hampering downtown circulation and long delays in west Salem, residents are asking for transportation infrastructure improvements. The Task Force will investigate potential ways for the City to relieve congestion in the project area and advise the City Council on policies and actions to improve traffic flow (see back page for map). **From February 24 to March 10, the City of Salem welcomes your ideas on possible solutions.** The City will then conduct a technical analysis to evaluate traffic options that can happen in the near-term. The City will share the results of the technical analysis and a list of recommendations for public comment later this year.

1. My ideas for transportation congestion relief in the project area (use back of page if needed, see map other side):

2. My address zip code is: ________________
3. I work in Salem: ☐ yes ☐ no
4. I own property in Salem: ☐ yes ☐ no
5. The street intersection closest to where I live is: ____________________
6. Please check the appropriate boxes:

In Salem, I get from one place to another by:	**All the time**	**Most of the time**	**Sometimes**	**Rarely**	**Never**
A. Driving or riding in a car, truck, or motorcycle	☐	☐	☐	☐	☐
B. Riding a bicycle	☐	☐	☐	☐	☐
C. Walking	☐	☐	☐	☐	☐
D. Taking the bus	☐	☐	☐	☐	☐
E. Other:	☐	☐	☐	☐	☐

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Task Force Meeting #2, April 20, 2018

DKS

Prepared by DKS Associates

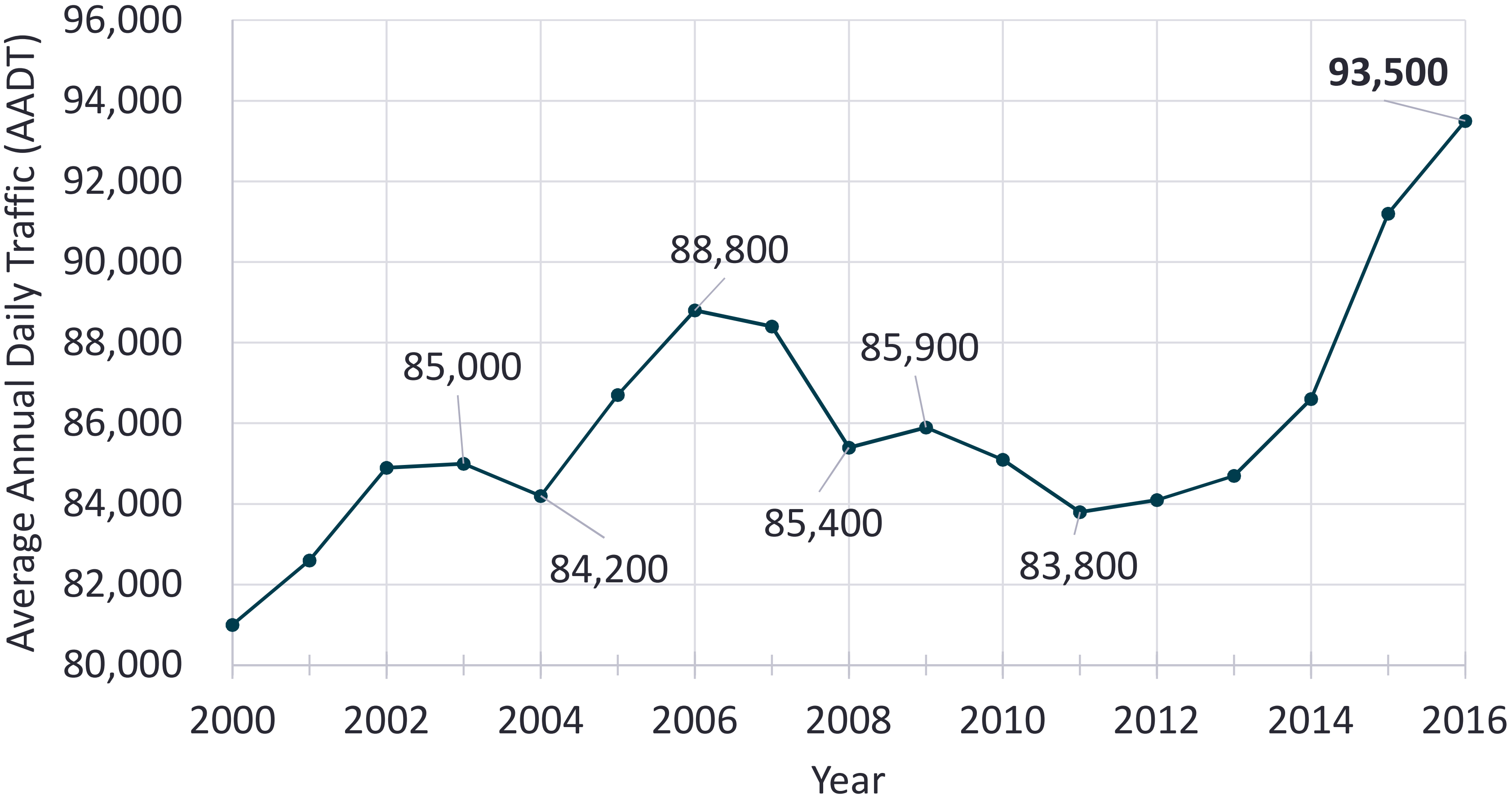
CITY OF Salem AT YOUR SERVICE

Agenda

- Agenda Review and Meeting #1 Recap
- Future Transportation Conditions
- Transportation Solution Ideas
- Evaluation Criteria (handout)
- Wrap up and Next Steps

Traffic Growth Over the Years

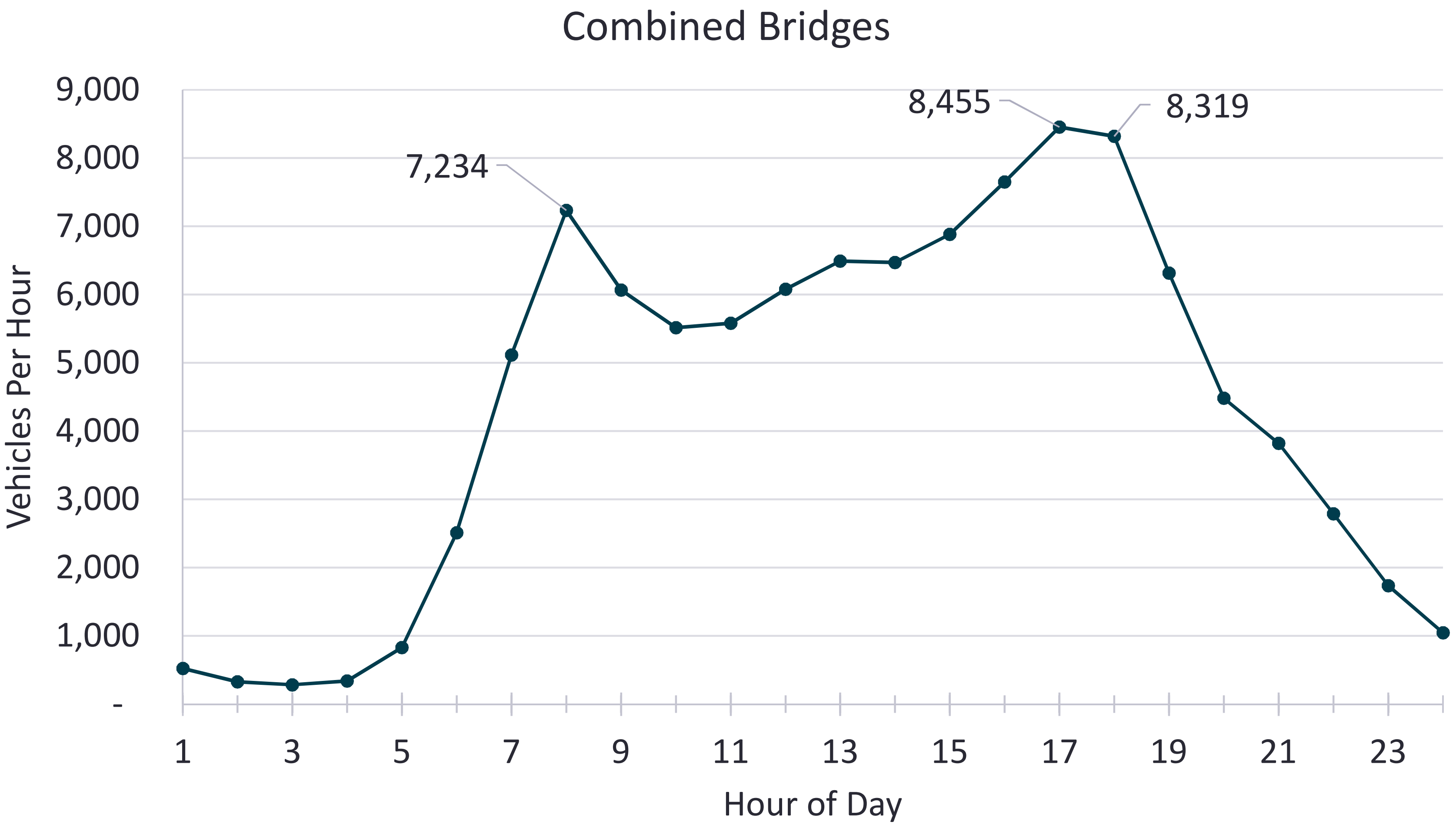
Using data from ODOT Traffic Recorders, traffic across the Salem Bridges has increased by 12% from 2011 to 2016 or an average of 2.3% per year



CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Average Hourly Weekday Volumes

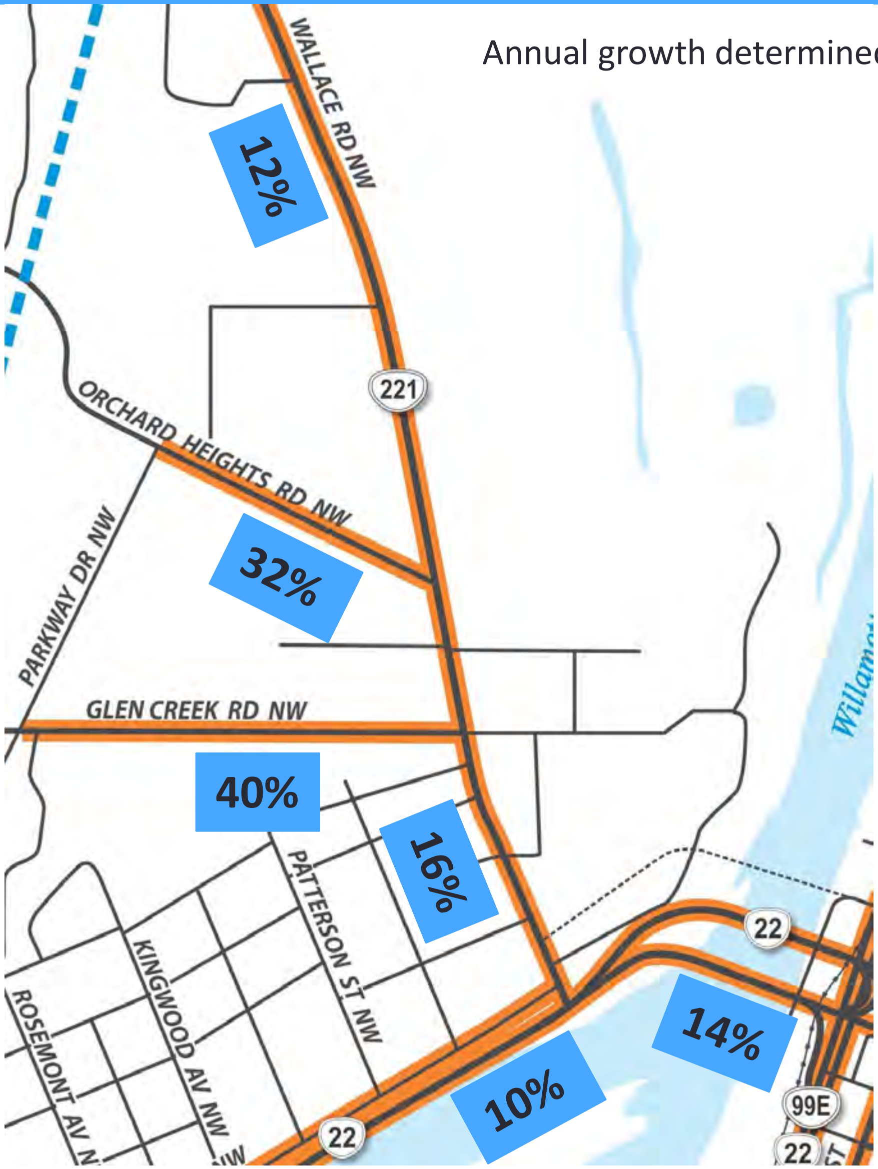


Bi-directional volume data from ODOT ATR #24-014, typical weekday April to June of 2017

CONGESTION RELIEF TASK FORCE
A Technical Review of Transportation Infrastructure Options

AM Estimated 10-year Trip Growth

Annual growth determined using MWVCOG model



CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

PM Estimated 10-year Trip Growth

Annual growth determined using MWVCOG models

2035 Estimated AM Queuing

See Handout

Southbound Wallace Road

Eastbound Orchard Heights Road

Eastbound Glen Creek Road

Eastbound HWY 22

Northbound Liberty Street

CONGESTION RELIEF TASK FORCE
A Technical Review of Transportation Infrastructure Options

2035 Estimated PM Queuing

See Handout

Orchard Heights Road

Eastbound Glen Creek Road

Northbound Liberty Street

Southbound Commercial Street

Westbound Marion Street

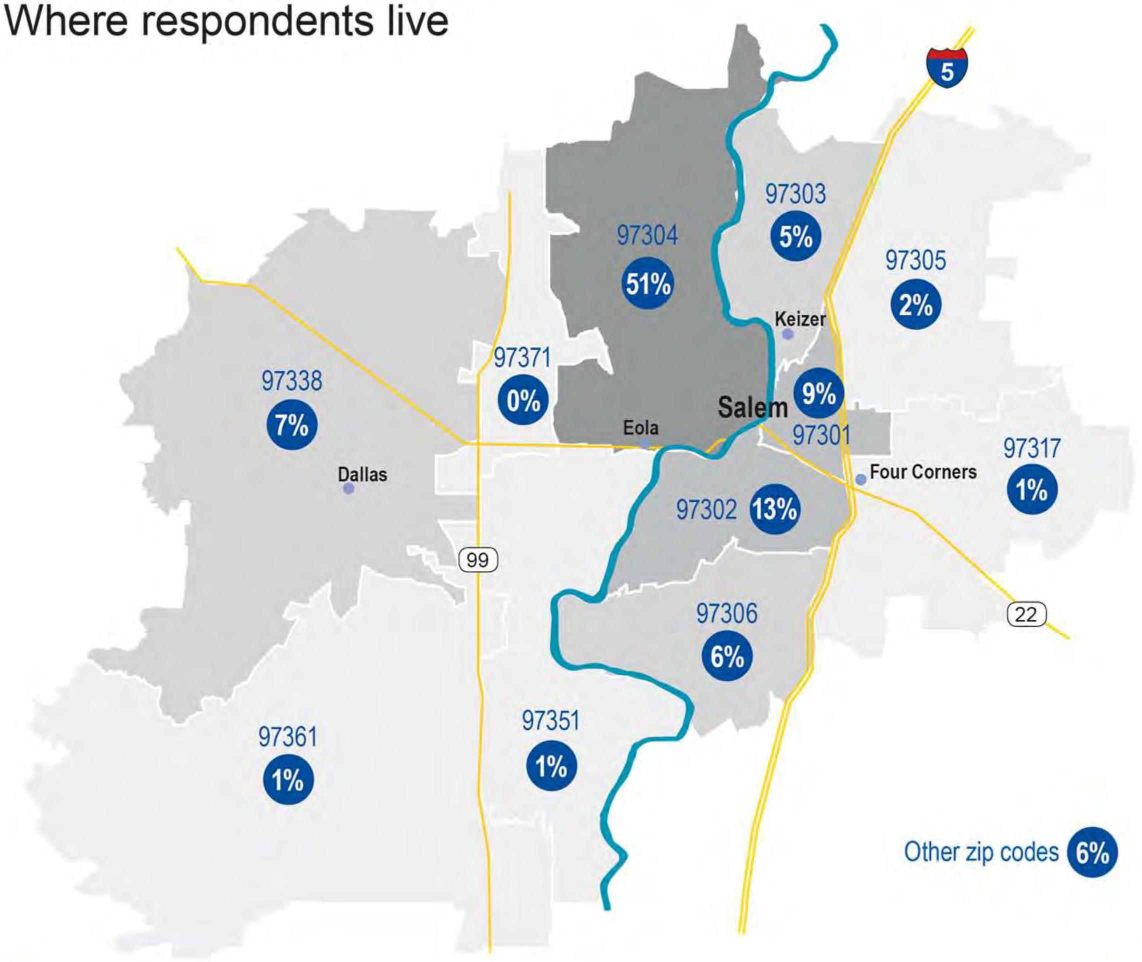
Westbound Ferry Street

CONGESTION RELIEF TASK FORCE
A Technical Review of Transportation Infrastructure Options

My Ideas Questionnaire

Public Responses

Where respondents live



Online and hard copy questionnaire, non-scientific, distributed via City website and social media from 2/24/18 to 3/10/18, asking for ideas to relieve traffic congestion in the project area.

1,300 RESPONSES
99 PAGES OF COMMENTS
CODED TO REVEAL THEMES

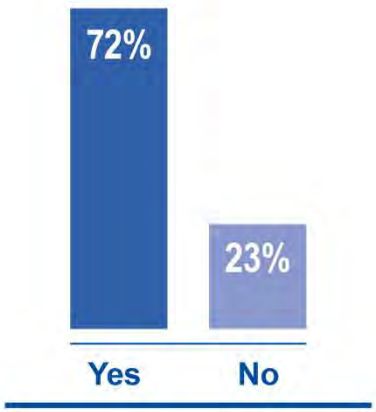
My Ideas Questionnaire

Public Responses

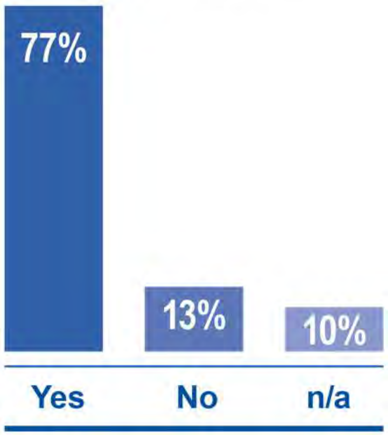
How respondents get around:

	Always	Mostly	Sometimes	Rarely	Never
Car, truck or motorcycle	73%	23%	4%	–	–
Bicycle	1%	1%	13%	20%	66%
Walking	1%	3%	37%	23%	26%
Bus	–	–	6%	13%	80%

Respondents who own property in Salem



Respondents who work in Salem



Idea Goal

GOAL: Improving vehicular mobility and identifying ways to reduce vehicular congestion within the study area.

- Develop ideas to reduce traffic congestion and vehicular mobility in the:
    - Short term (within 5 years)
    - Medium term (within 10 years)
    - Long term (longer than 10 years)
- Select the most promising ideas for high-level traffic engineering analysis
- Conduct traffic engineering analysis on three selected ideas that include the following:
    - Estimated immediate improvement in traffic flow, delay, and queuing.
    - Estimated future improvement in traffic flow, delay, and queuing.

Solution Ideas

Previously Identified Transportation Ideas

	Ideas
5	Wallace Rd/Edgewater St: • Add eastbound and westbound lanes on Wallace Rd. • Improve geometry, and • Close Musgrave Ln.
9	Marine Dr. connector roadway
10	Multimodal grade-separated crossing at 2nd St/Wallace Rd
11	Marion Street Bridge increase to six westbound lanes and provide Marine Dr off-ramp
	Center St Bridge widen to five eastbound lanes
12	Wallace Rd improvements: Three ramp lanes and six-lane cross section
13	Signal at Edgewater/Patterson St
14	Murlark Ave. connector roadway to Glen Creek Rd

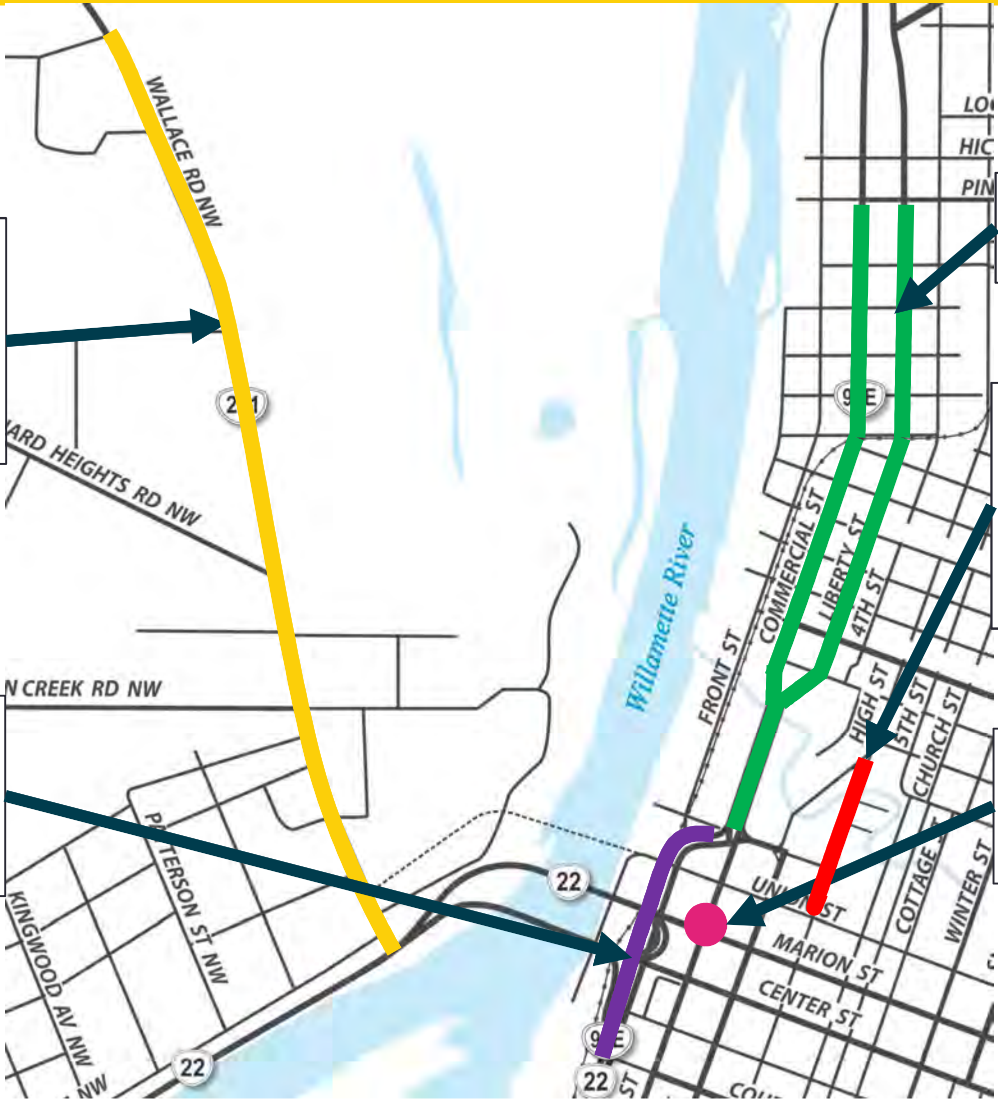
Solution Ideas

Previously Identified Transportation Ideas

	Ideas
6	Construct Union St bikeway
7	Widen ramp to two lanes or provide uncontrolled right turn
8	Commercial/Marion St Bridge capacity improvements: - Exclusive double right turn lanes *Alternatively* - Uncontrolled right turn ramp onto Marion St Bridge over park, no pedestrian crossing
9	Widen Front Street to a Minor Arterial standard.

Solution Ideas

Added Lanes



Add through and right turn lanes to Wallace Road from Hwy 22 to Brush College Rd

Add two SB lanes to Front Street (from Commercial St to Court St)

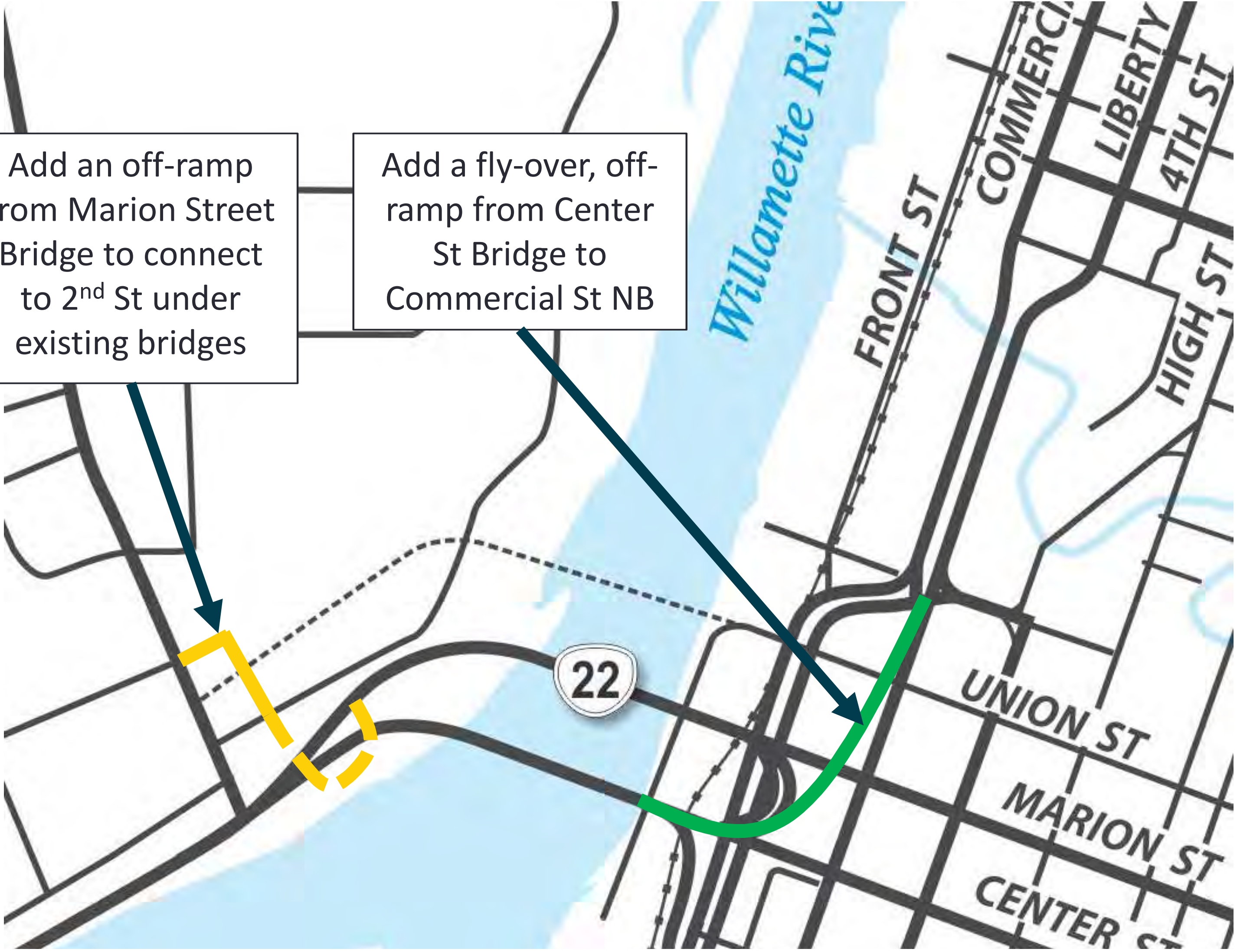
Add lanes to Commercial Street/Liberty Street

Extend two SB lanes on High St past Union Street (remove parking) & make SBRT free flow at Marion Street

Triple Right Turn Lanes at Commercial St/Marion St onto Marion St Bridge

Solution Ideas

Ramps



Add an off-ramp from Marion Street Bridge to connect to 2nd St under existing bridges

Add a fly-over, off-ramp from Center St Bridge to Commercial St NB

Solution Ideas

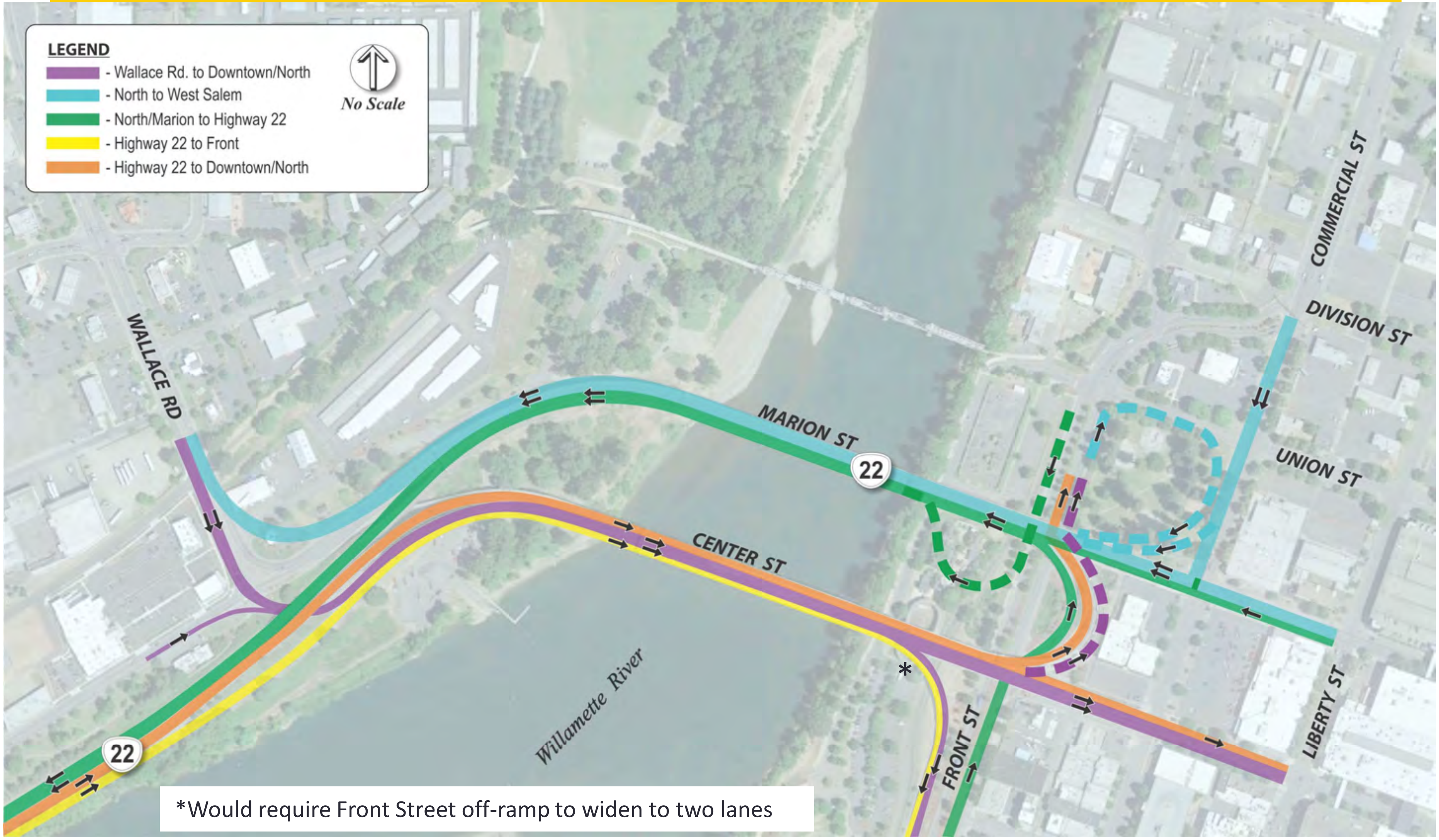
Ramps

Add an on-ramp to Marion Street Bridge from Front St SB

Add an on-ramp to Marion Street Bridge from Front St NB through the park

Solution Ideas

Remove Weaving and Lane Changes on Bridges



*Would require Front Street off-ramp to widen to two lanes

Solution Ideas

Improved Operations

- Improved Signal Timing and Synchronization
  - Marion Street and Center Street
  - Wallace Road
  - Commercial Street
- Pedestrian Crossing Modifications
  - Increase Pedestrian Delays during peak periods (longer cycle lengths)
  - Add grade-separated crossing of Front Street between downtown and Riverfront Park
- Remove Traffic Signals
  - Commercial Street/Union Street
  - Edgewater Road/Wallace Road

Solution Ideas

Others

- Improve Signage
- Allow motor vehicle traffic on Union Street Bridge during peak congestion
- Add Bus Pull-out Lanes
- Reversible travel lanes
- Open Musgrave Avenue through Wallace Marine Park to Glen Creek Road

Solution Ideas

Travel Demand Management (TDM)

Transit

- Increase bus frequency to west Salem
- Downtown circulator
- Expanded Park and Ride services
- Dedicated transit/carpool lanes

Other

- Improve facilities for bicycles and pedestrians
- Discourage future development in west Salem
- Encourage high-density land use in downtown
- Incentives to change travel behavior: telecommuting, staggered work hours
- Implement tolls and increase gas tax and parking costs in downtown

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Evaluation Criteria

See Handout

EVALUATION CRITERIA

Primary: Relieve congestion in the project area and advise the City on policies and actions to improve traffic flow.

Secondary:

Transportation

- Safety
- On-street parking
- Pedestrian facilities
- Bicycle facilities
- Transit facilities
- Property impacts/acquisition
- Emergency vehicle access and response time
- Grade-separated facilities
- Medians/turning/driveway limitations

Other

- Parks
- Landscaping/visual impacts
- Community livability
- Area economic vitality
- Historical resources
- Cultural resources
- Consistency with city/state design standards
- Consistency with city/state adopted plans
- Project costs

G. TASK FORCE MEETING #3

AGENDA FOR MAY 18, 2018

MATERIAL FOR MAY 18, 2018

CITY OF Salem
AT YOUR SERVICE
Public Works Department

Congestion Relief Task Force

Si necesita ayuda para comprender esta información, por favor llame 503-588-6211.
Disability-related modification or accommodation, including auxiliary aids or services, in order to participate in this meeting or event, are available upon request. Sign language and interpreters for languages other than English are also available on request. To request such an accommodation or interpretation, contact Judy Postier at 503-588-6008 or jpostier@cityofsalem.net at least two business days before meeting; or TTD/TTY telephone 503-588-6439, is also available 24/7.

MEMBERS

Mayor Bennett
Councilor Chris Hoy
Councilor Cara Kaser
Councilor Jim Lewis

CITY STAFF

Julie Warncke
Peter Fernandez
Kevin Hottmann
Robert Chandler

OTHER

Scott Mansur, DKS
Julie Fischer, Cogito
Terry Cole, ODOT
Mike Jaffe, MWVCOG

NEXT MEETING

Friday, June 29, 2018
7:00-8:30 a.m.

MEETING AGENDA

Friday, May 18, 2018
7:00-9:00 a.m.
Public Works Department
555 Liberty Street SE, Room 325

1.	**Agenda Review and Meeting #2 Recap**	**7:00**
2.	**Capacity Relationship Concepts**	**7:10**
3.	**Transportation Solutions**	**7:30**
4.	**Evaluation of Solution Packages**	**8:00**
5.	**Wrap up and Next Steps**	**8:50**

It is the City of Salem's policy to assure that no person shall be discriminated against on the grounds of race, religion, color, sex, marital status, familial status, national origin, age, mental or physical disability, sexual orientation, gender identity, and source of income, as provided by Salem Revised Code Chapter 97. The City also fully complies with Title VI of the Civil Rights Act of 1964, and related statutes and regulations, in all programs and activities.

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Task Force Meeting #3, May 18, 2018

DKS

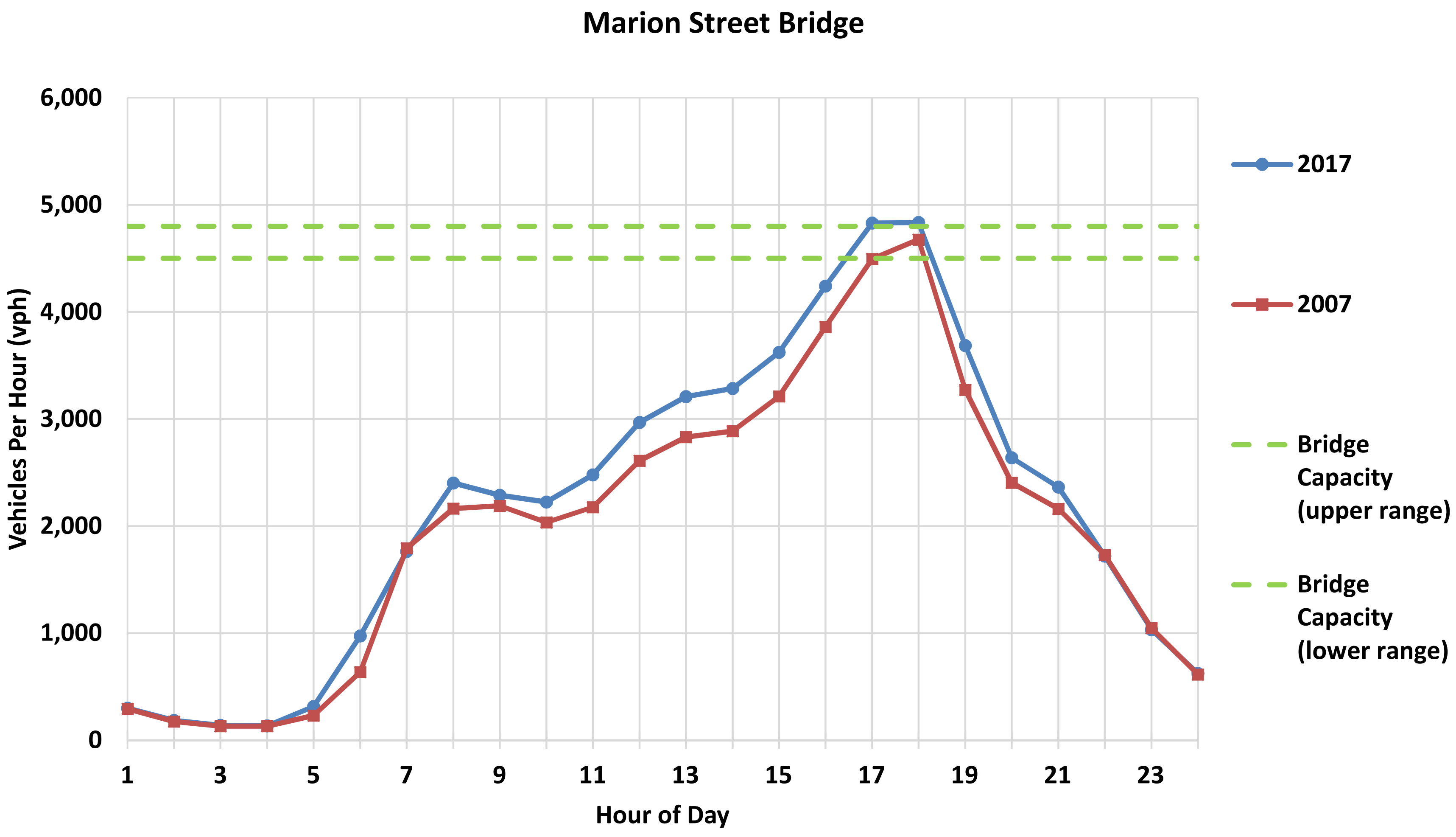
Prepared by DKS Associates

CITY OF Salem AT YOUR SERVICE

Agenda

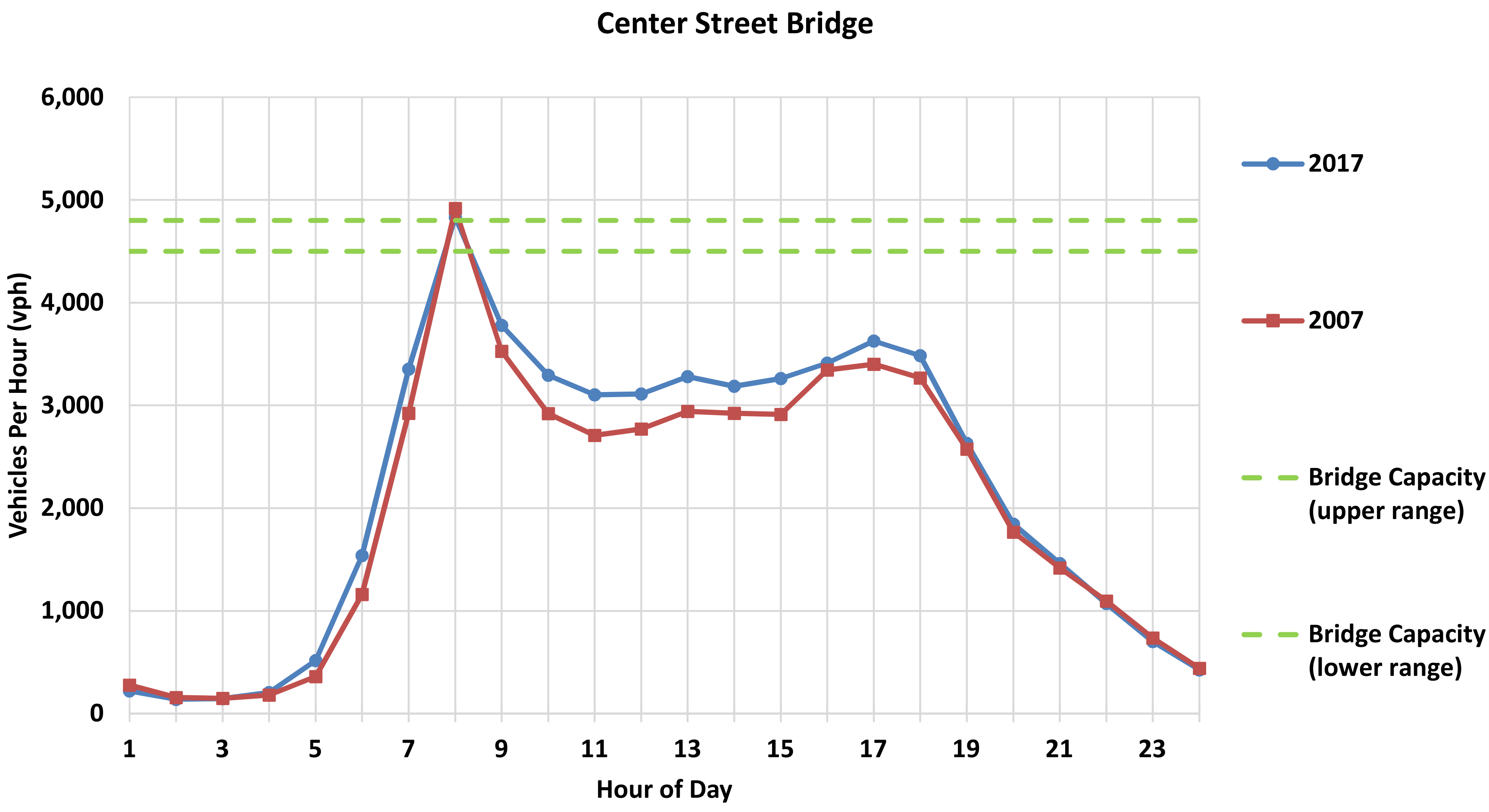
- Agenda Review and Meeting #2 Recap
- Capacity Relationship Concept
- Transportation Solutions
- Evaluation of Solution Packages
- Wrap-up and Next Steps

Average Hourly Weekday Volumes



Average typical weekday data from April to June of 2007 and 2017

Average Hourly Weekday Volumes



Average typical weekday data from April to June of 2007 and 2017

Capacity Relationship Concept

Marion St Bridge

Commercial Ingress

Marion Ingress

Front Ingress

Wallace/Edgewater Egress

Hwy 22 Egress

Capacity Relationship Concept

Wallace/Edgewater Ingress

Hwy 22 Ingress

Center St Bridge

Front (NB) Egress

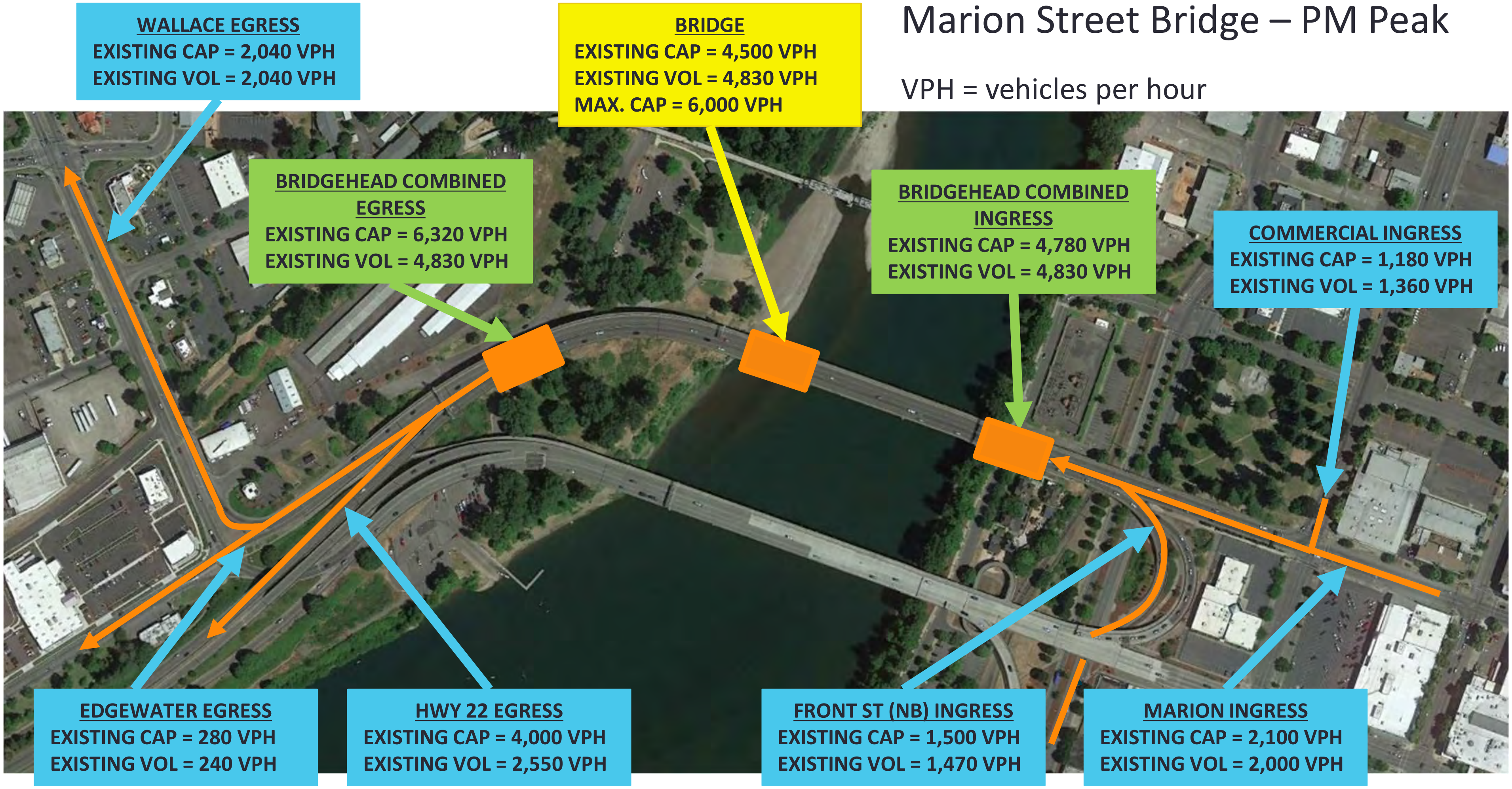
Front (SB) Egress

Center Egress

Bridge and Bridgehead Capacity Summary

Marion Street Bridge – PM Peak

VPH = vehicles per hour



WALLACE EGRESS
EXISTING CAP = 2,040 VPH
EXISTING VOL = 2,040 VPH

BRIDGE
EXISTING CAP = 4,500 VPH
EXISTING VOL = 4,830 VPH
MAX. CAP = 6,000 VPH

BRIDGEHEAD COMBINED EGRESS
EXISTING CAP = 6,320 VPH
EXISTING VOL = 4,830 VPH

BRIDGEHEAD COMBINED INGRESS
EXISTING CAP = 4,780 VPH
EXISTING VOL = 4,830 VPH

COMMERCIAL INGRESS
EXISTING CAP = 1,180 VPH
EXISTING VOL = 1,360 VPH

EDGEWATER EGRESS
EXISTING CAP = 280 VPH
EXISTING VOL = 240 VPH

HWY 22 EGRESS
EXISTING CAP = 4,000 VPH
EXISTING VOL = 2,550 VPH

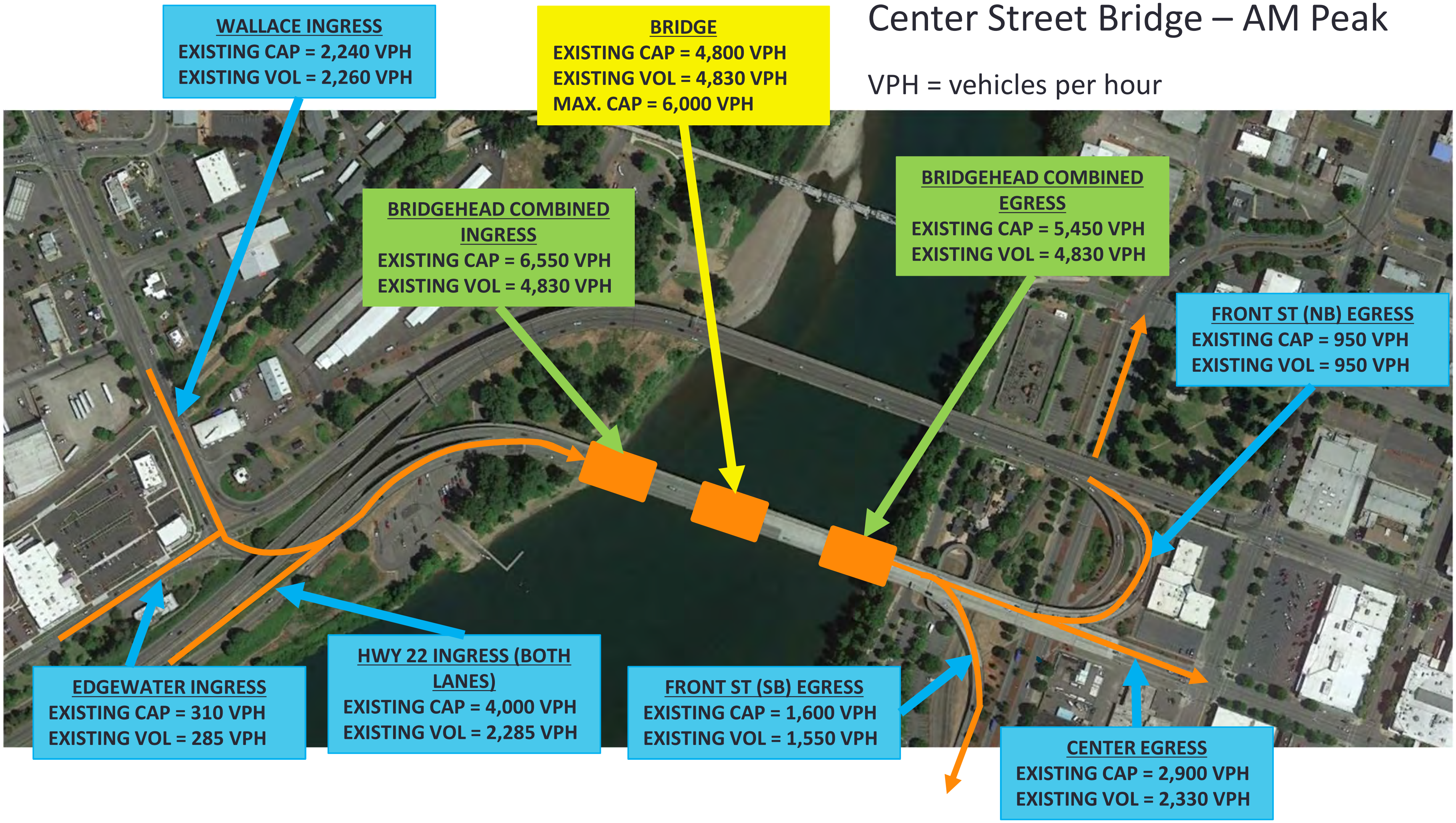
FRONT ST (NB) INGRESS
EXISTING CAP = 1,500 VPH
EXISTING VOL = 1,470 VPH

MARION INGRESS
EXISTING CAP = 2,100 VPH
EXISTING VOL = 2,000 VPH

Bridge and Bridgehead Capacity Summary

Center Street Bridge – AM Peak

VPH = vehicles per hour



WALLACE INGRESS
EXISTING CAP = 2,240 VPH
EXISTING VOL = 2,260 VPH

BRIDGE
EXISTING CAP = 4,800 VPH
EXISTING VOL = 4,830 VPH
MAX. CAP = 6,000 VPH

BRIDGEHEAD COMBINED INGRESS
EXISTING CAP = 6,550 VPH
EXISTING VOL = 4,830 VPH

BRIDGEHEAD COMBINED EGRESS
EXISTING CAP = 5,450 VPH
EXISTING VOL = 4,830 VPH

FRONT ST (NB) EGRESS
EXISTING CAP = 950 VPH
EXISTING VOL = 950 VPH

EDGEWATER INGRESS
EXISTING CAP = 310 VPH
EXISTING VOL = 285 VPH

HWY 22 INGRESS (BOTH LANES)
EXISTING CAP = 4,000 VPH
EXISTING VOL = 2,285 VPH

FRONT ST (SB) EGRESS
EXISTING CAP = 1,600 VPH
EXISTING VOL = 1,550 VPH

CENTER EGRESS
EXISTING CAP = 2,900 VPH
EXISTING VOL = 2,330 VPH

Solutions

Based on previous bridgehead/bridge capacity summary figures, we need solution “packages” rather than just one or two individual solutions. Only addressing one specific capacity issue will not solve overall congestion.

Marion Street Bridge

- Slides 12 – 16 are individual solutions identified at Marion St bridgeheads/bridges
- Slides 17 – 20 are Marion St Solution Packages (x4)
- Slides 21 is Marion St Bridge Solution Package Matrix

All solutions shown are high-level analysis.

Center Street Bridge

- Slides 22 – 28 are individual solutions identified at Center St bridgeheads/bridges
- Slides 29 – 31 are Center St Solution Packages (x3)
- Slides 32 is Center St Bridge Solution Package Matrix

Solution Package Evaluation – Marion Bridge

	Package #1	Package #2	Package #3	Package #4
Maximum Capacity of Package	Ingress: 900 vph Bridge: 2,000 vph Egress: 900 vph Package: 900 vph	Ingress: 850 vph Bridge: 2,000 vph Egress: 900 vph Package: 850 vph	Ingress: 1,400 vph Bridge: 2,000 vph Egress: 1,650 vph Package: 1,400 vph	Ingress: 900 vph Bridge: 1,000 vph Egress: 900 vph Package: 900 vph
Years of Capacity	Commercial St: 0 yrs Marion St: 9 yrs Front St: 20 yrs Bridge: 8 yrs -------------------------------- Marine Dr: 20 yrs OR Wallace Rd: 20 yrs	Commercial St: 0 yrs Marion St: 0 yrs Front St: 20 yrs Bridge: 7 yrs -------------------------------- Marine Dr: 20 yrs OR Wallace Rd: 20 yrs	Commercial St: 7 yrs Marion St: 0 yrs Front St: 20 yrs Bridge: 15 yrs Marine Dr: 20 yrs Wallace Rd: 20 yrs	Commercial St: 7 yrs Marion St: 9 yrs Front St: 0 yrs Bridge: 8 yrs -------------------------------- Marine Dr: 20 yrs OR Wallace Rd: 20 yrs
Cost ($ - $$$$)	$$	$$$	$$$$	$$
Park Impacts	Wallace Marine Park Marion Square Park	Wallace Marine Park Marion Square Park	Wallace Marine Park Marion Square Park	Wallace Marine Park
On-street Parking Impacts	Marion St	-	-	Marion St
Safety	(+) Removes weaving (-) Union-Commercial Bike/Ped conflicts	(+) Removes weaving (-) Union-Commercial Bike/Ped conflicts	(+) Removes weaving	(-) Weaving worsens with five lanes
Property Impacts	Wallace Rd	Wallace Rd	Wallace Rd	Wallace Rd
Key Issues	Worsens Commercial St	No improvements to Marion St	No improvements to Marion St	No improvements for Front St, (not endorsed by ODOT)

Solutions – Marion St Bridgehead

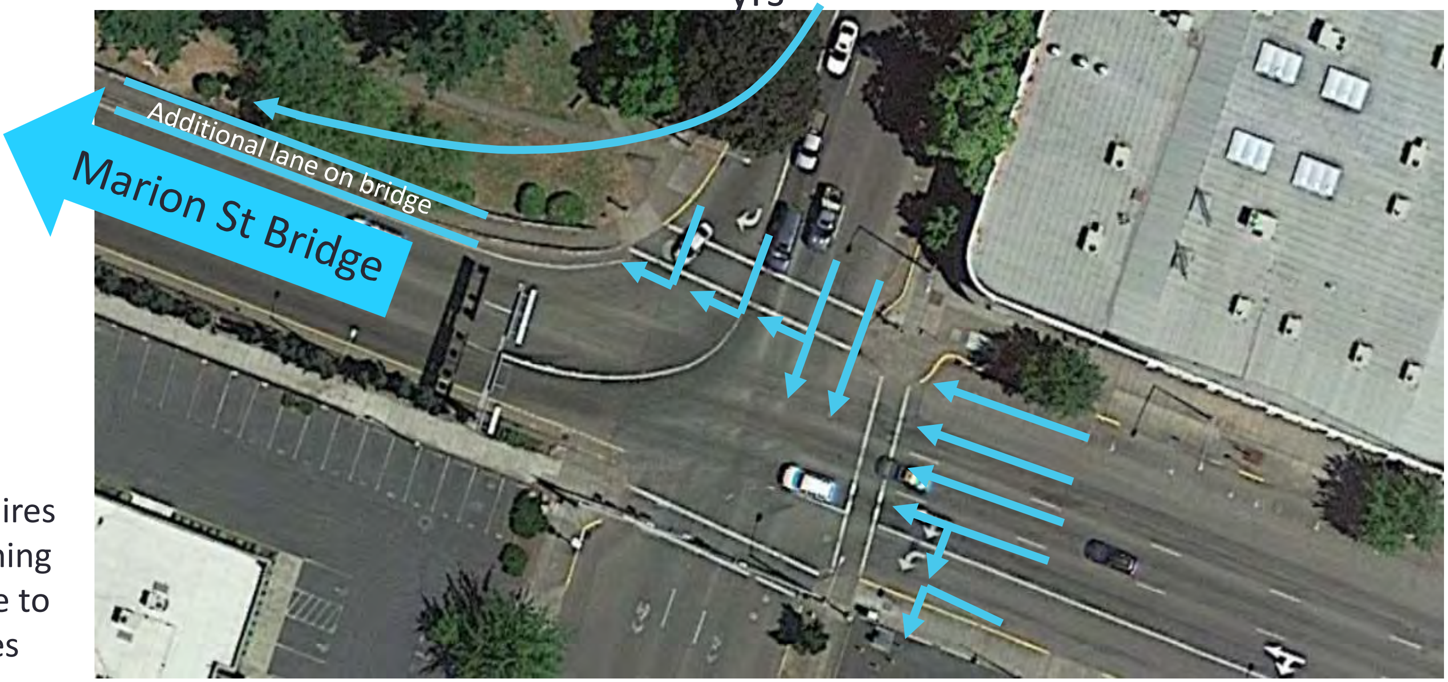
Commercial Street Ingress Solutions

1. Triple southbound right turn lanes onto Bridge (+400 vph or 34% increase)
2. Single free right turn ramp onto Bridge to Marine Drive only* (+850 vph)

Marion Street Ingress Solutions

1. Remove parking, add additional WB travel lane* (+500 vph or 24%)

yrs

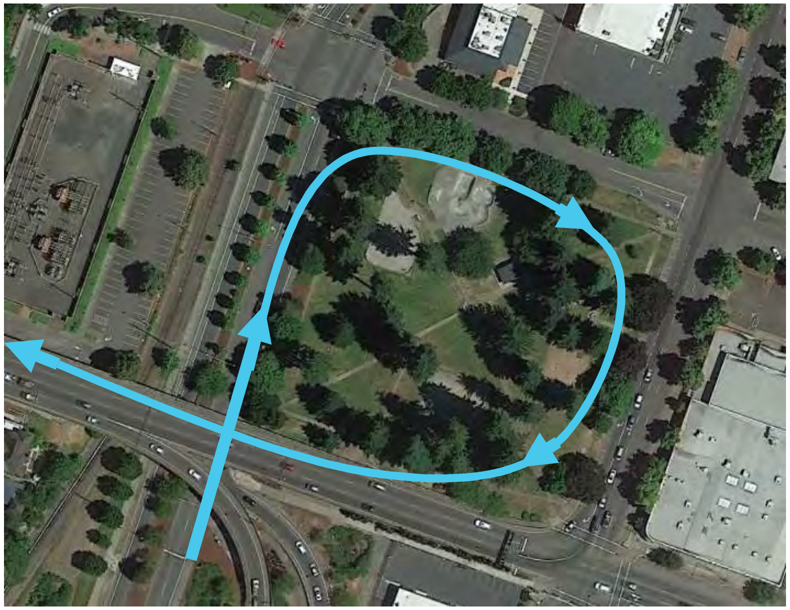


*requires widening bridge to 5 lanes

Solutions – Marion St Bridgehead

Front Street Ingress Solutions

1. Add a loop ramp from Front St (NB) over Marion Square Park on Marion St Bridge (+1,000 vph)
    - Requires 5th lane on bridge
    - Eliminates potential capacity improvements on Marion Street and Commercial Street as previously noted



Solutions – Marion St Bridgehead

Front Street Ingress Solutions

2. Remove weaving on bridge
   - No improvements, requires restricting Front Street on-ramp (red) to Hwy22 volumes only. Removed 600 vehicles headed to West Salem rerouted to Union St and Commercial St (green)

Solutions – Marion St Bridge

Marion Bridge Solutions

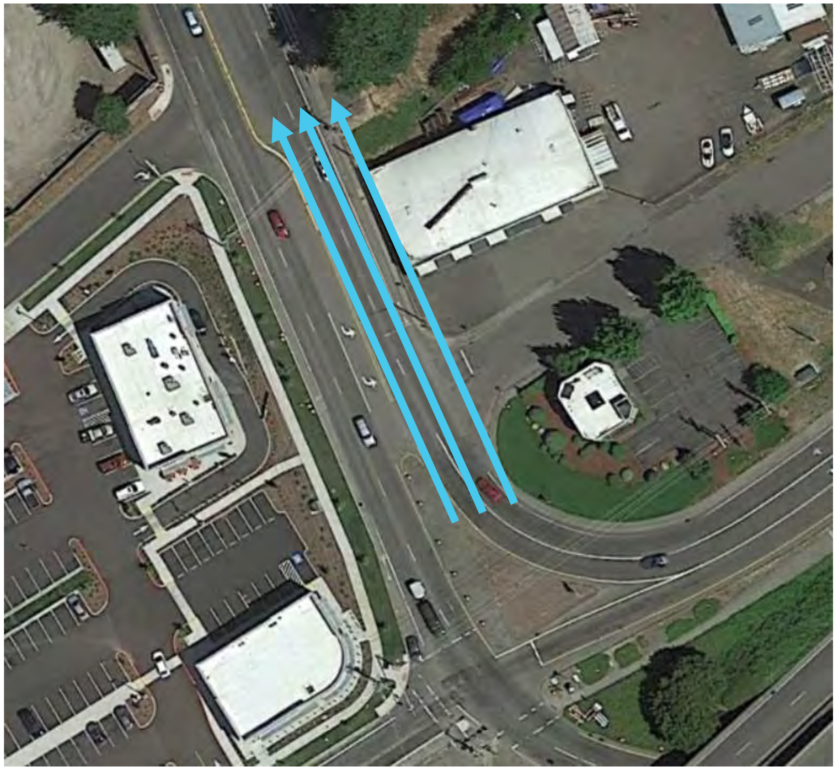
1. Remove weaving – requires restricting vehicles on Front St on-ramp to Hwy 22 Egress only as shown in previous slide (+800 vph or 18% increase on bridge)
2. Add 5th lane - combine with remove weaving (+2,000 vph or 44% increase) – figure below

To add 5th lane on bridge, remove jersey barrier and sidewalk on north side of bridge

Solutions – Marion St Bridge

Wallace Road Egress Solutions

1. Marine Drive off-ramp (+900 vph) – figure left
2. Widen Wallace Road to 3 three receiving lanes up to Glen Creek Road (+750 vph or 37% increase) – figure right



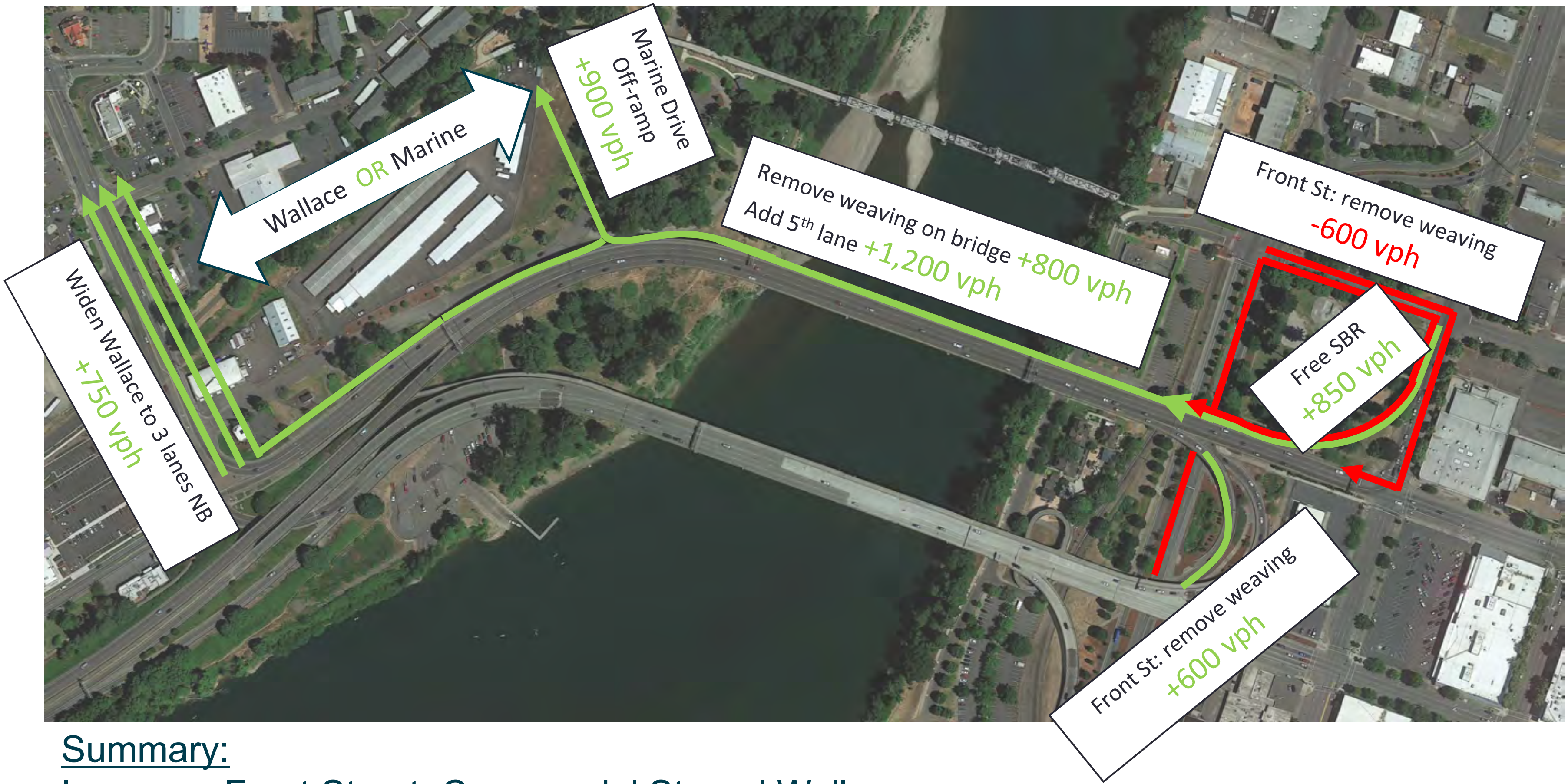
Solution Packages – Marion St Bridge

Package #1

<u>Summary:</u>
Improves Front Street, Marion St, and Wallace
Worsens Commercial St
Maximum capacity of package = 900 vph

Solution Packages – Marion St Bridge

Package #2



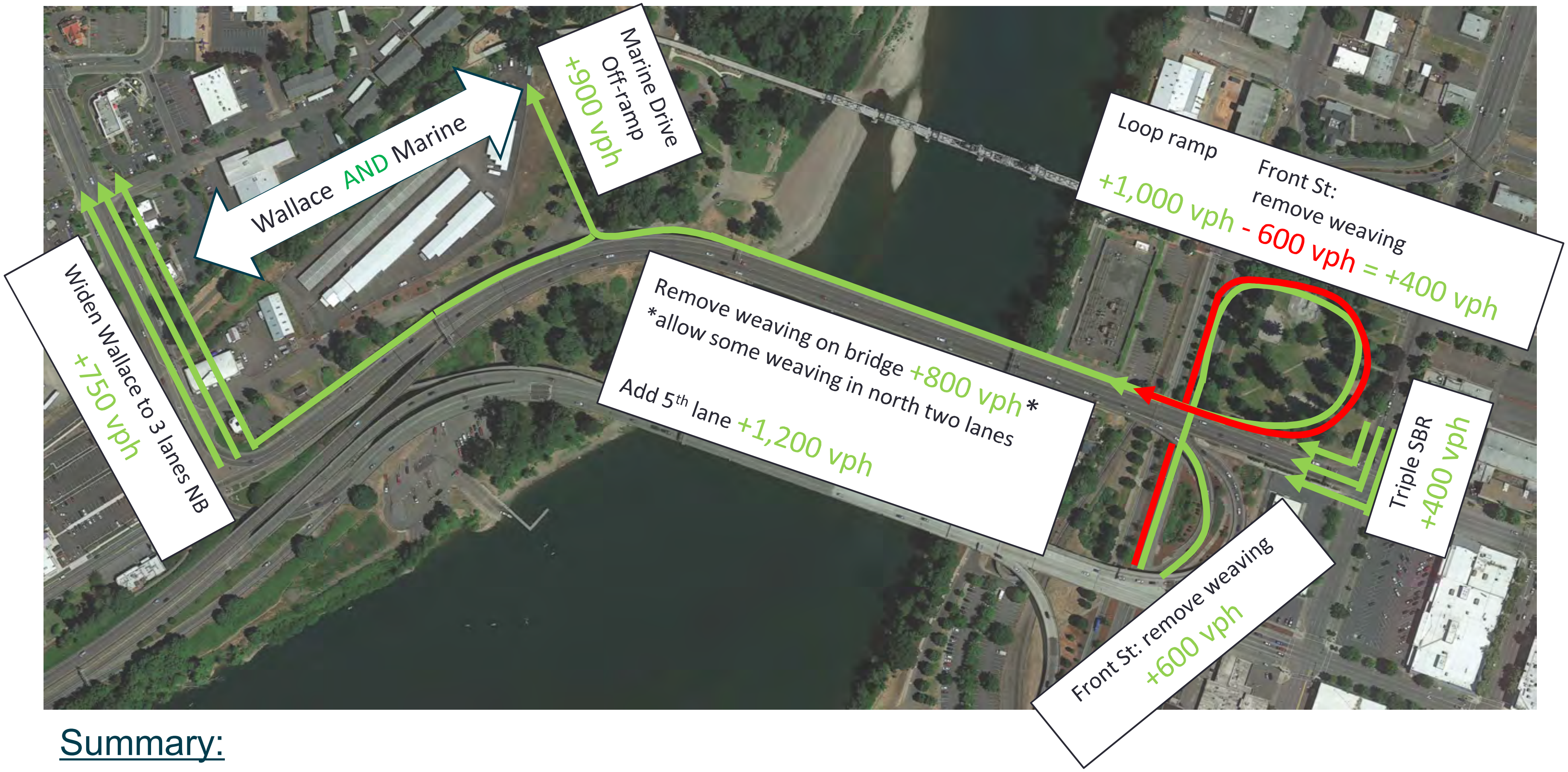
Summary:

Improves Front Street, Commercial St, and Wallace
No improvements for Marion St
Maximum capacity of package = 850 vph

CONGESTION RELIEF TASK FORCE
A Technical Review of Transportation Infrastructure Options

Solution Packages – Marion St Bridge

Package #3



Summary:

Improves Front Street, Commercial St, and Wallace

No improvements for Marion St

Maximum capacity of package = 1,400 vph

Solution Packages – Marion St Bridge

Package #4

Summary:
Improves Commercial St, Marion St, and Wallace
Weaving on bridge still occurs and with five lanes, **previously not endorsed by ODOT**
No improvements for Front St
Maximum capacity of package = 900 vph

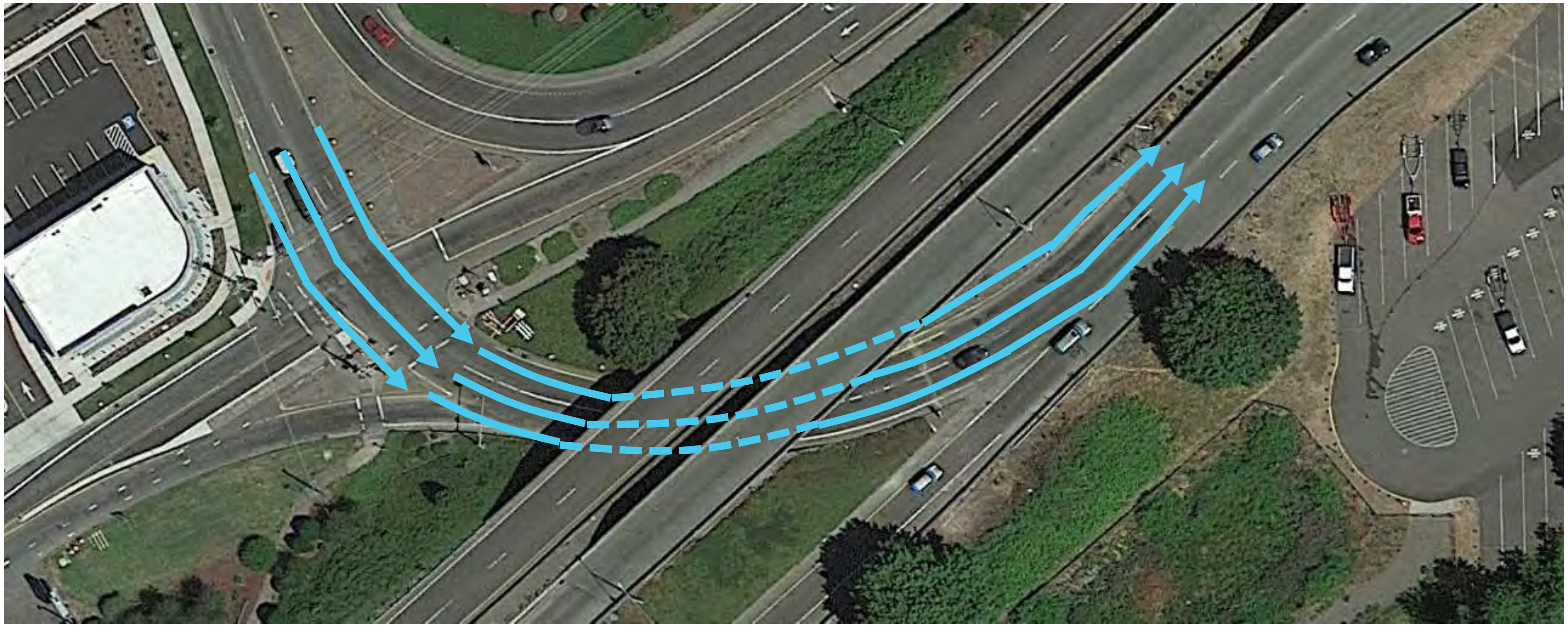
Solution Package Evaluation – Marion Bridge

	Package #1	Package #2	Package #3	Package #4
Maximum Capacity of Package	Ingress: 900 vph Bridge: 2,000 vph Egress: 900 vph Package: 900 vph	Ingress: 850 vph Bridge: 2,000 vph Egress: 900 vph Package: 850 vph	Ingress: 1,400 vph Bridge: 2,000 vph Egress: 1,650 vph Package: 1,400 vph	Ingress: 900 vph Bridge: 1,000 vph Egress: 900 vph Package: 900 vph
Years of Capacity	Commercial St: 0 yrs Marion St: 9 yrs Front St: 20 yrs Bridge: 8 yrs -------------------------------- Marine Dr: 20 yrs OR Wallace Rd: 20 yrs	Commercial St: 0 yrs Marion St: 0 yrs Front St: 20 yrs Bridge: 7 yrs -------------------------------- Marine Dr: 20 yrs OR Wallace Rd: 20 yrs	Commercial St: 7 yrs Marion St: 0 yrs Front St: 20 yrs Bridge: 15 yrs Marine Dr: 20 yrs Wallace Rd: 20 yrs	Commercial St: 7 yrs Marion St: 9 yrs Front St: 0 yrs Bridge: 8 yrs -------------------------------- Marine Dr: 20 yrs OR Wallace Rd: 20 yrs
Cost ($ - $$$$)	$$	$$$	$$$$	$$
Park Impacts	Wallace Marine Park Marion Square Park	Wallace Marine Park Marion Square Park	Wallace Marine Park Marion Square Park	Wallace Marine Park
On-street Parking Impacts	Marion St	-	-	Marion St
Safety	(+) Removes weaving (-) Union-Commercial Bike/Ped conflicts	(+) Removes weaving (-) Union-Commercial Bike/Ped conflicts	(+) Removes weaving	(-) Weaving worsens with five lanes
Property Impacts	Wallace Rd	Wallace Rd	Wallace Rd	Wallace Rd
Key Issues	Worsens Commercial St	No improvements to Marion St	No improvements to Marion St	No improvements for Front St, (not endorsed by ODOT)

Solutions – Center St Bridgehead

Wallace Road Ingress Solutions

1. Widen Wallace Road to 3 SB lanes and widen on-ramp to bridge to three lanes (+850 vph or 38% increase)
    - Requires widening bridge to 5 lanes



Solutions – Center St Bridge

Center Bridge Solutions

1. Remove weaving (+800 vph or 17% increase on bridge)
2. Add 5th lane - combine with remove weaving (+2,000 vph or 42% increase) – figure below

To add 5th lane on bridge, remove jersey barrier and sidewalk on north side of bridge

Solutions – Center St Bridgehead

Front Street (SB) Egress Solutions

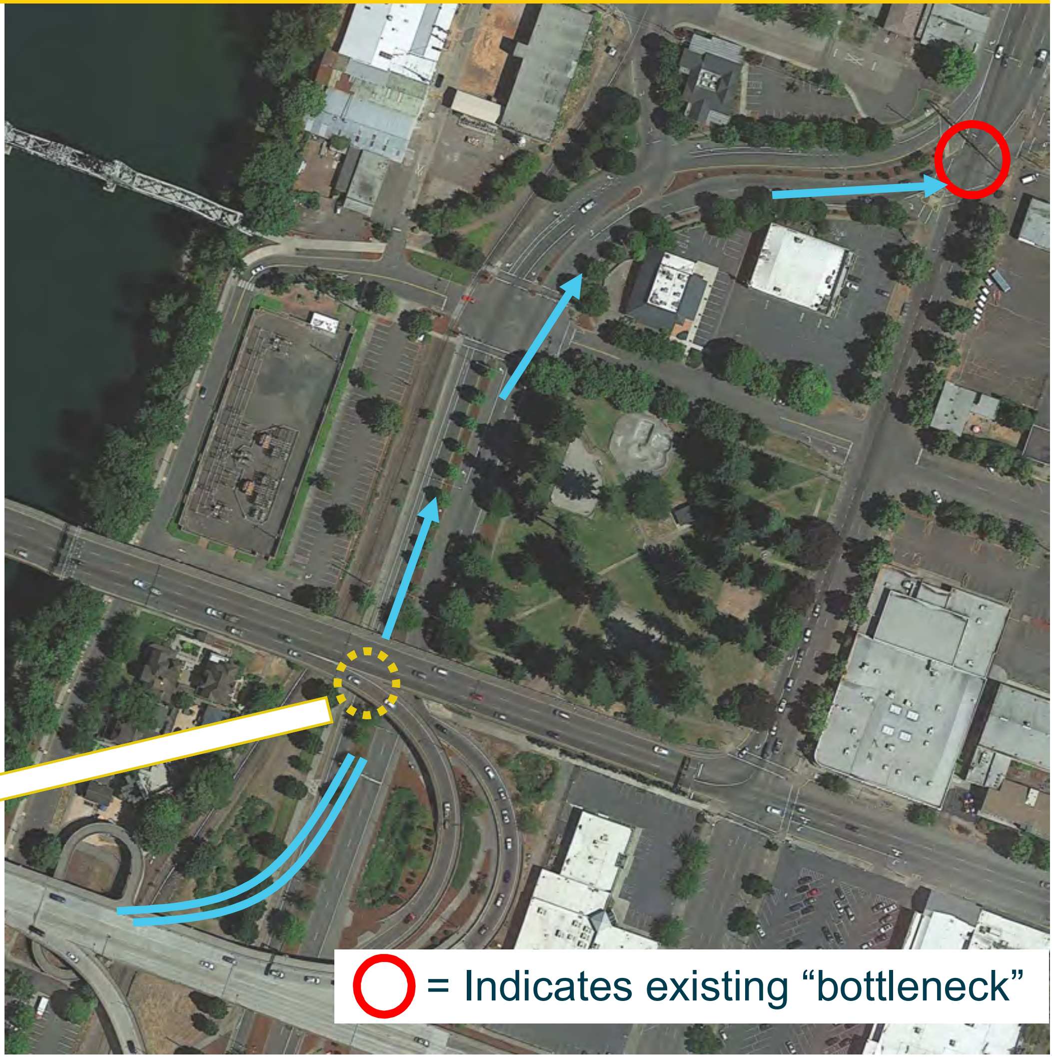
1. Widen to dual exit ramps
   - Improves weaving on bridge and adds ramp capacity
   - No net increase in capacity due to “bottleneck” at Front/Commercial/Trade intersection

○ = Indicates existing “bottleneck”

Solutions – Center St Bridgehead

Front Street (NB) Egress Solutions

1. Free right turn (remove signal)
2. Build new ramp that merges onto Front St NB
    - Improves off-ramp capacity
    - Limited increase in net capacity (100 vph) due to “bottleneck” at Commercial/Division/ Front intersection

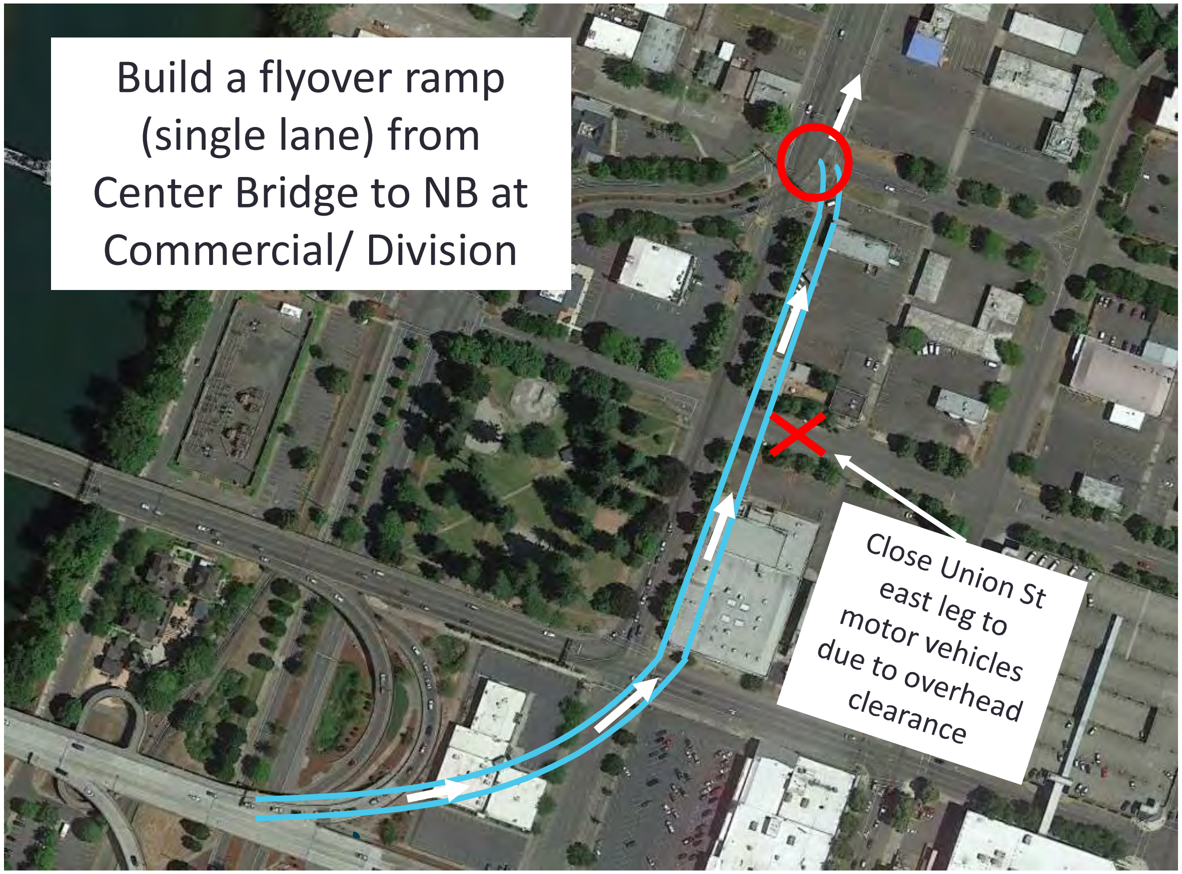


○ = Indicates existing “bottleneck”

Solutions – Center St Bridge

Front Street (NB) Egress Solutions

2. Flyover ramp to Commercial (+1,000 vph)
    - Would require improvements to Commercial/ Division intersection
    - Would create business, roadway, and visual impacts



Build a flyover ramp (single lane) from Center Bridge to NB at Commercial/ Division

Close Union St east leg to motor vehicles due to overhead clearance

○ = Indicates existing "bottleneck"

CONGESTION RELIEF TASK FORCE

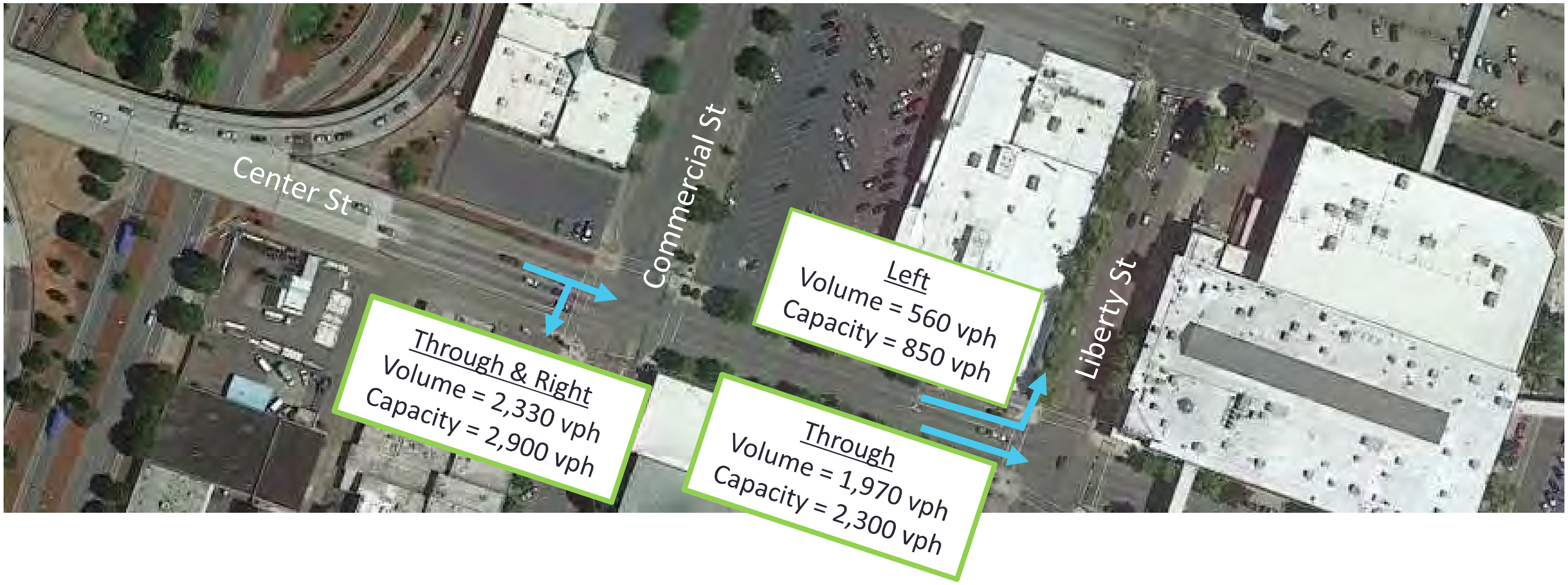
A Technical Review of Transportation Infrastructure Options

Center St Bridgehead

Center Street Egress

AM peak hour volumes and capacities on Center Street

- Existing, available capacity on Center St at Commercial St and Liberty St



Solutions – Marion Bridge Reversible Lane

Marine Dr Reversible Lane to Marion St

Added eastbound lane (between +900 vph and +1,200 vph)

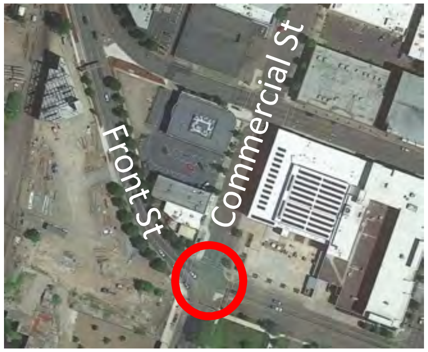
Marine Dr Ramp (reversible)

Fifth (reversible) lane on bridge

Remove parking to add additional lane on this block. EB traffic would be forced to go north at Liberty St

Solution Packages – Center St Bridge

Package #1



Summary:

Improves Wallace Rd and Front St

Bottlenecks still exist at both Commercial St/Front St intersections

Maximum capacity of package = 850 vph*

*assuming intersection "bottlenecks" are addressed

○ = Indicates existing "bottleneck"

Solution Packages – Center St Bridge

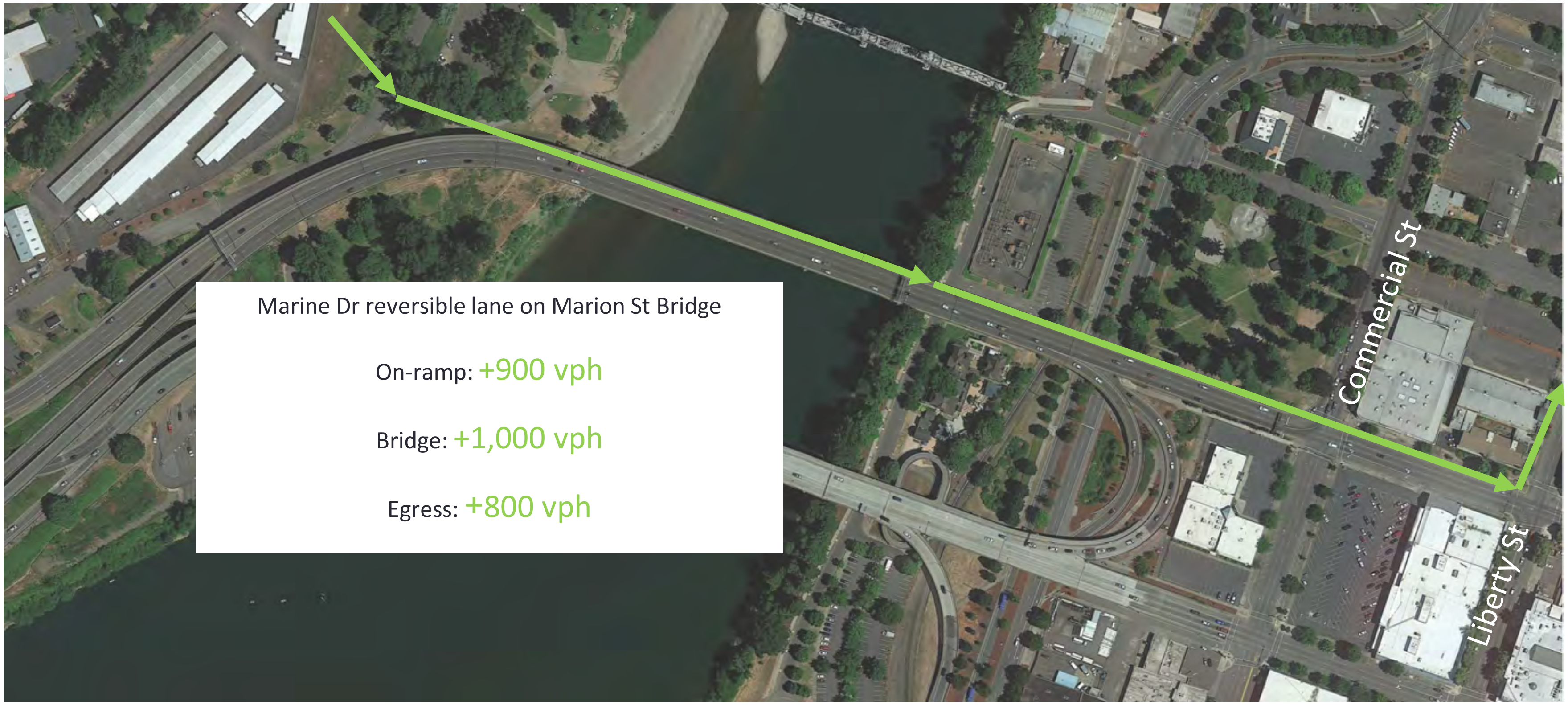
Package #2

Summary:
Improves Wallace Rd and Front St
Bottleneck still exists at Commercial St/Front St intersection
Flyover ramp creates visual, roadway, and building impacts
Maximum capacity of package = 850 vph

○ = Indicates existing “bottleneck”

Solution Packages – Center St Bridge

Package #3



Marine Dr reversible lane on Marion St Bridge

On-ramp: +900 vph

Bridge: +1,000 vph

Egress: +800 vph

Summary:
Improves Wallace Rd
Can be added to Center Solution Packages #1 or #2
Maximum capacity of package = 800 vph

Solution Package Evaluation – Center Bridge

	Package #1	Package #2	Package #3
Maximum Capacity of Package	Ingress: 850 vph Bridge: 2,000 vph Egress: 850* vph Package: 850 vph *assuming bottlenecks can be addressed	Ingress: 850 vph Bridge: 2,000 vph Egress: 1,850* vph Package: 850 vph *assuming "bottlenecks" can be addressed	Ingress: 900 vph Bridge: 1,000 vph Egress: 800 vph Package: 800 vph
Estimated Years of Capacity	Wallace Rd: 12 yrs Bridge: 10 yrs Front St (SB): 20 yrs* Front St (NB): 20 yrs* Center St: 14 yrs	Wallace Rd: 12 yrs Bridge: 10 yrs Front St (SB): 20 yrs* Flyover ramp: 20 yrs* Center St: 14 yrs	Marine Dr: 20 yrs Bridge: 10 years
Cost ($ - $$$$)	$$	$$$$	$$
Park Impacts	-	-	Wallace Marine Park
Safety	(+) Improves weaving	(+) Improves weaving	(-) Reversible lane
Property Impacts	Wallace Rd	Commercial offices, First Baptist Church, residential building, other businesses	-
Key Issues	"Bottlenecks" need to be addressed	"Bottlenecks" need to be addressed, Flyover ramp has property, visual and roadway impacts	Parking removal on Marion St, impacts PM peak hour capacity potential on Marion St

Solutions – To be considered later

The following list of solution ideas only provide congestion relief when built in conjunction with the bridgehead and bridge solutions identified.

- Add through lanes and right turn lanes on Wallace Road from Hwy 22 to Brush College Road
- Add lane(s) to Commercial St SB from Pine St down to Marion St Bridge
- Extend the two SB lanes on High St north from Union St up to Liberty St
- Improve signage on and leading up to both bridges
- Improve signal timing

Solutions – Removed

The following list of solution ideas were considered but will not be evaluated further. Evaluation determined these do not directly address the study area capacity deficiencies or was deemed infeasible.

- Widen Front Street to arterial standards (north of Division)
- Add an additional lane on Front Street (SB) from Commercial St to Ferry St
- Grade-separated pedestrian crossing of Front St between Riverfront Park and downtown
- Open Musgrave through Wallace Marine Park
- Roundabout at Edgewater Rd/Wallace Rd
- Install a signal at Edgewater/Patterson
- Murlark Ave connector road to Glen Creek Road
- Off-ramp from Marion St Bridge to 2nd St under existing bridges
- Remove signals at Commercial St/Union St and Edgewater Rd/Wallace Rd

H. TASK FORCE MEETING #4

AGENDA FOR JULY 20, 2018

MATERIAL FOR JULY 20, 2018

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

CITY OF Salem
AT YOUR SERVICE

July 20, 2018

MEETING GOALS

1. Agenda Review and Meeting #3 Recap ▶ **7:00**

2. ODOT Coordination on Solution Packages ▶ **7:10**

3. Additional Recommendations to Support Solution Packages ▶ **7:20**

4. Performance of Solution Packages ▶ **7:30**

5. Summary Matrix of Solution Packages ▶ **8:00**

Select Solution Package for each bridge
to advance for further analysis

6. Wrap-up and Next Steps ▶ **8:50**

DATE	MEETING TOPIC
Feb. 23	**1. Project Introduction** a. Task Force goals and process b. Key transportation issues c. Current policies and constraints
April 20	**2. Future Conditions, Transportation Ideas, Evaluation Criteria**
May 18	**3. Transportation Idea Results:** Tier 1 Screening (choose 3)
July 20	**4. Tier 2 Screening:** Select Solution Package for each bridge to advance for further analysis
Aug. 3	**5. Optional Discussion**
September	**6. Final Recommendations**

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Task Force Meeting #4, July 20, 2018

Prepared by DKS Associates

CITY OF Salem AT YOUR SERVICE

Agenda

- Meeting #3 Recap
- ODOT Coordination
- Additional Recommendations to Support Solution Packages
- Performance of Solution Packages
- Summary Matrix
- Wrap-up and Next Steps

Review of Solution Packages

	Marion Package #1	Marion Package #2	~~Marion Package #3~~	Marion Package #4	Center Package #1	~~Center Package #2~~	~~Center Package #3~~
Description	Triple SBR on Commercial St, Added lane on Marion St, 5th lane on Bridge, no weaving	Free flow SBR on Commercial St, 5th lane on Bridge, no weaving	Loop ramp over Marion Square Park, Added lane on Marion St, 5th lane on Bridge, no weaving	Triple SBR on Commercial St, Added lane on Marion St, 5th lane on Bridge	Widen Wallace Rd, 5th lane on Bridge, Free flow off-ramp to Front St NB	Widen Wallace Rd, 5th lane on Bridge, Flyover ramp to NB Commercial St	Marine Dr reversible lane on Marion St Bridge
Date of Removal			May 18 (Task Force Meeting #3)			May 18 (Task Force Meeting #3)	June 12 (ODOT coordination meeting)
Reason for Removal			Loop ramp over Marion Square Park would cause large impact to park			Flyover ramp from Center St Bridge would cause significant downtown business impacts	After meeting with ODOT, reversible lane on Marion St Bridge deemed fatal flaw

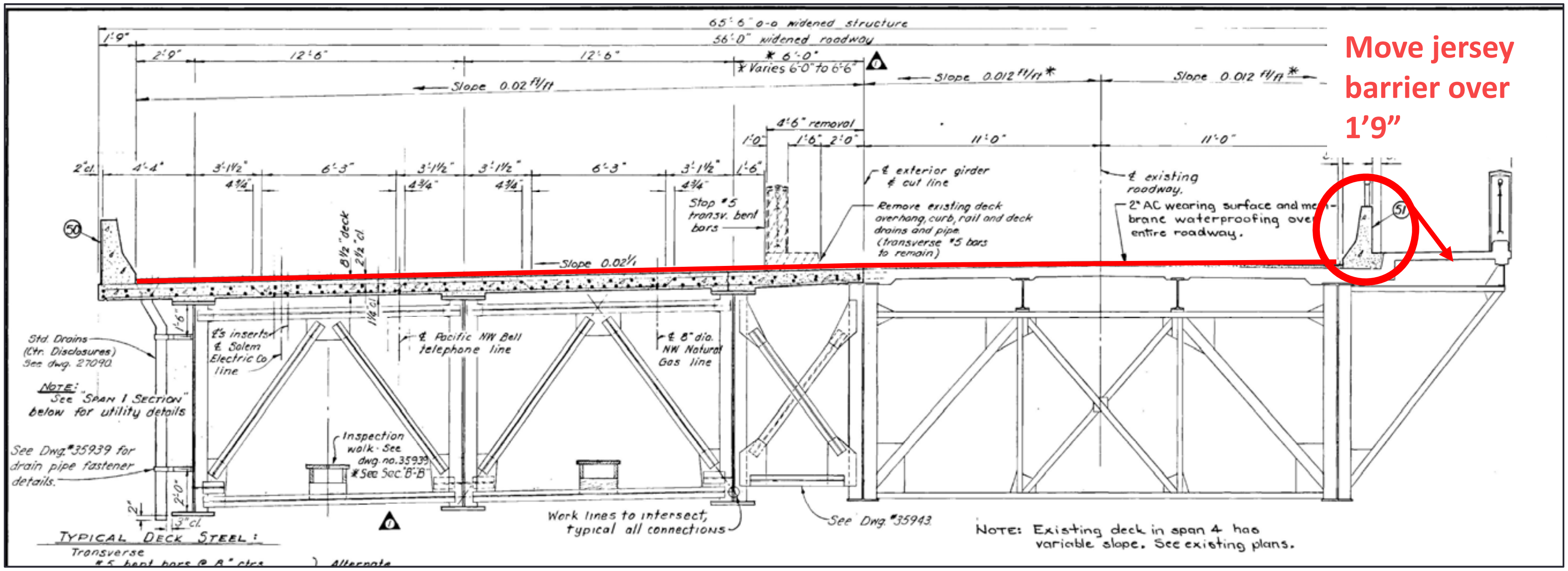
ODOT Coordination Meeting

DKS/City met with ODOT Region 2 Bridge, Traffic and Roadway staff

Date: June 12th, 2018

- Presented the current Marion and Center solution packages
- Reviewed the Marion St and Center St Bridge ODOT construction drawings
- **Confirmed Solution Packages were feasible for Marion Bridge #1, #2, and #4 (see handouts)**

Marion Bridge Construction Drawings



Move jersey barrier over 1'9"

- Existing roadway width = 56'
- Total new roadway width = 57' 9"
- Restripe bridge to have five 11' wide lanes plus 1' 4.5" of shy
- ODOT Design Exceptions will be required due to removal of sidewalk, narrow lanes, and less than 2' of shy distance between travel lanes and barrier

Marion Bridge Construction Drawings

Not enough width for a fifth reversible travel lane, would require physical barrier separating two-way traffic

Removed Center Bridge Solution Package #3

Marine Dr Ramp (reversible)

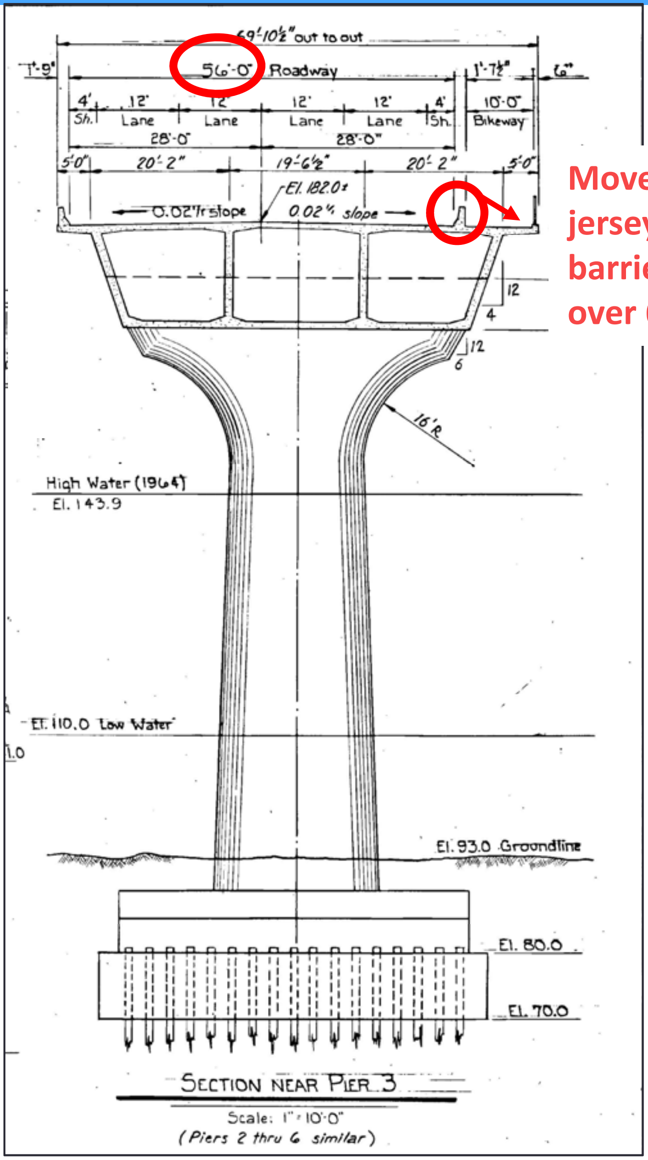
Fifth (reversible) lane on bridge

Remove parking to add additional lane on this block. EB traffic would be forced to go north at Liberty St

Center Bridge Construction Drawings

- Existing roadway width = 56’
- Total new roadway width = 62’ 7”
- Maintain 5’ ped walkway on Bridge
- Restripe bridge to have five travel lanes
- No fatal flaws
- ODOT Design Exception required for removal of bike facilities and narrow lanes

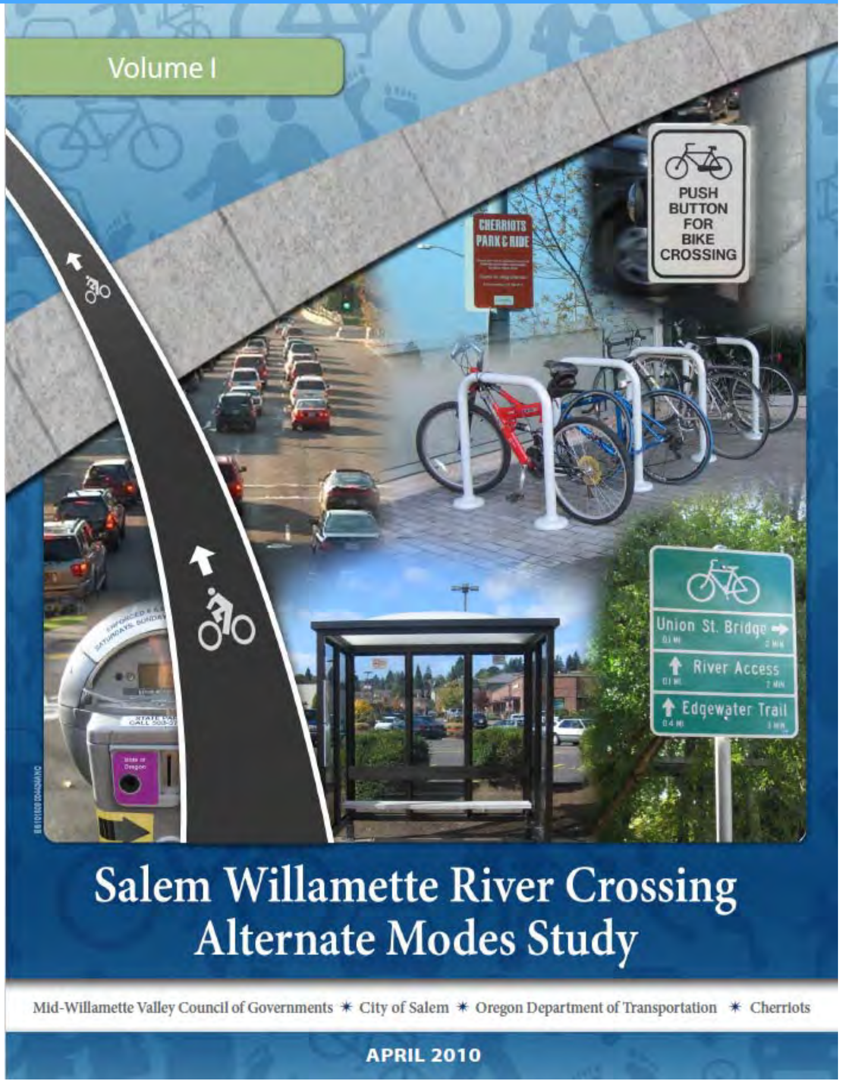
Confirmed Center Bridge Solution Package #1



Move jersey barrier over 6’7”

Additional Recommendations to Support Solution Packages

- Beyond Scope of Current Project
- Could form basis for future recommended action or study
- Reviewed:
  - Public Input
  - Salem River Crossing Alternate Modes Study (2010)
- Focus on Actions within City Control (mostly)



Volume I

Salem Willamette River Crossing
Alternate Modes Study

Mid-Willamette Valley Council of Governments ✶ City of Salem ✶ Oregon Department of Transportation ✶ Cherriots

APRIL 2010

Additional Recommendations to Support Solution Packages

- Wallace Marine Park – Park & Walk/Bike to Work
- Bike/pedestrian connections to Union Street Bridge
- Parking Management
- Invest in Downtown Circulator
- Pursue Local Gas Tax

Wallace Marine Park – Park and Walk/Bike

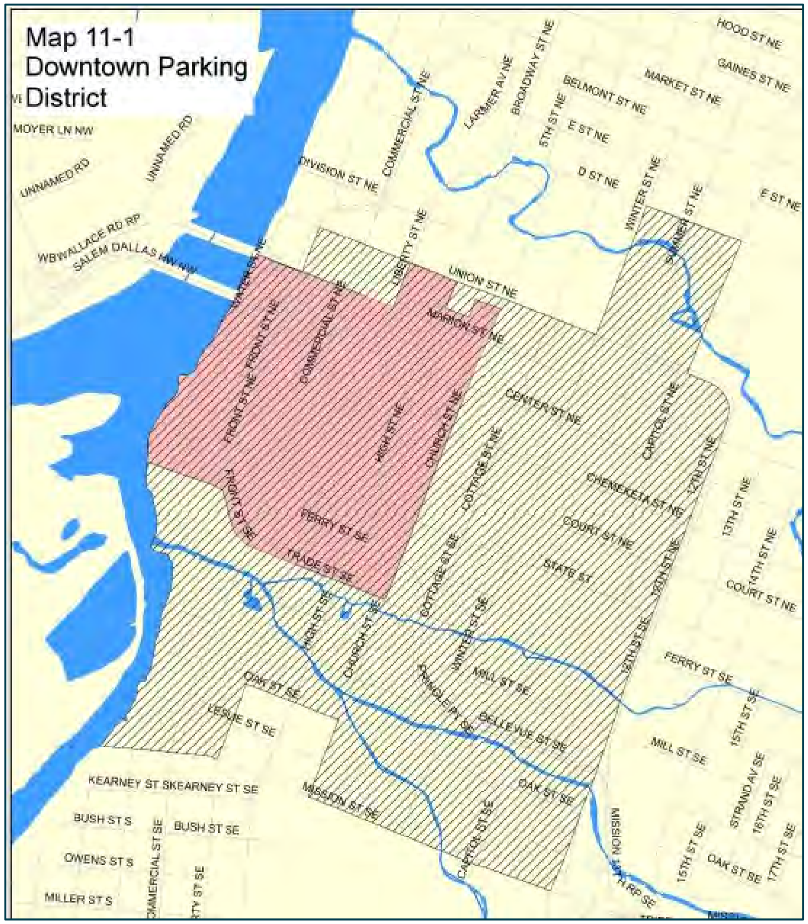
- Could accommodate 40-45 spaces
- Would need input from SPRAB, others
- Possible conflicts with recreational use
- Security, Lighting, Enforcement
- Permits?
- Funding?

Bike/Pedestrian Connections to Union St Bridge

- Continue Existing:
  - Union Street Bikeway
  - Winter Maple Greenway
  - Pringle Creek Path Connection
- Expand Connections:
  - 2nd Street Connection across Wallace Road
  - Marine Drive Multi-use Path
  - Front Street bike lanes and sidewalks
  - East Bank Multi-use Path
  - Other?

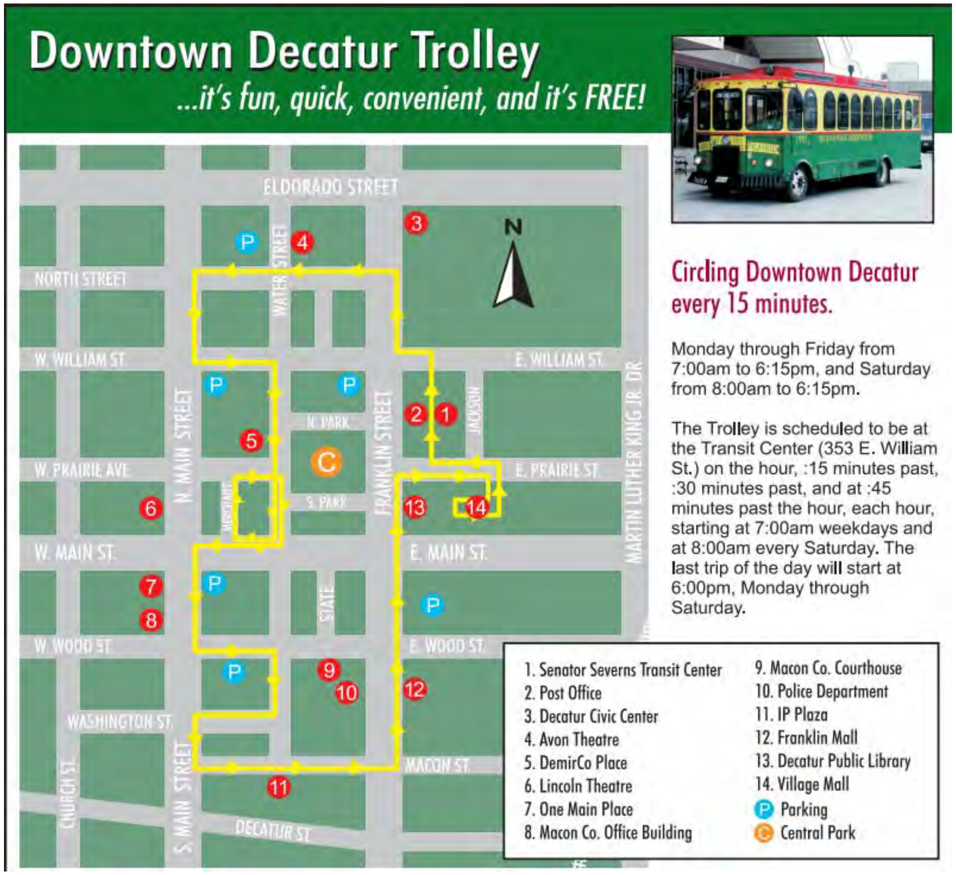
Parking Management

- Suggestions from 2010 Alternate Modes Study
  - Switch from Monthly to Daily Fee Parking
  - Discourage Parking at Peak Periods
    - Peak-period surcharge
    - Early-bird discount
  - Increase pricing for parking:
    - Structures
    - On-street
  - Tax parking spaces?
  - Parking Cash Out Programs



Downtown Circulator/Trolley

- Circulator route to connect major employers, bike parking, and carpool parking with common destinations downtown
  - Possible connections to west Salem?
- Ease of access to bank, restaurants, shopping during lunch may encourage more people to leave personal car at home
- Would likely be joint with Cherriots
- Requires feasibility study and funding



Downtown Decatur Trolley

...it's fun, quick, convenient, and it's FREE!

Circling Downtown Decatur every 15 minutes.

Monday through Friday from 7:00am to 6:15pm, and Saturday from 8:00am to 6:15pm.

The Trolley is scheduled to be at the Transit Center (353 E. William St.) on the hour, :15 minutes past, :30 minutes past, and at :45 minutes past the hour, each hour, starting at 7:00am weekdays and at 8:00am every Saturday. The last trip of the day will start at 6:00pm, Monday through Saturday.

1. Senator Severns Transit Center
2. Post Office
3. Decatur Civic Center
4. Avon Theatre
5. DemirCo Place
6. Lincoln Theatre
7. One Main Place
8. Macon Co. Office Building
9. Macon Co. Courthouse
10. Police Department
11. IP Plaza
12. Franklin Mall
13. Decatur Public Library
14. Village Mall

P Parking
C Central Park

Local Gas Tax

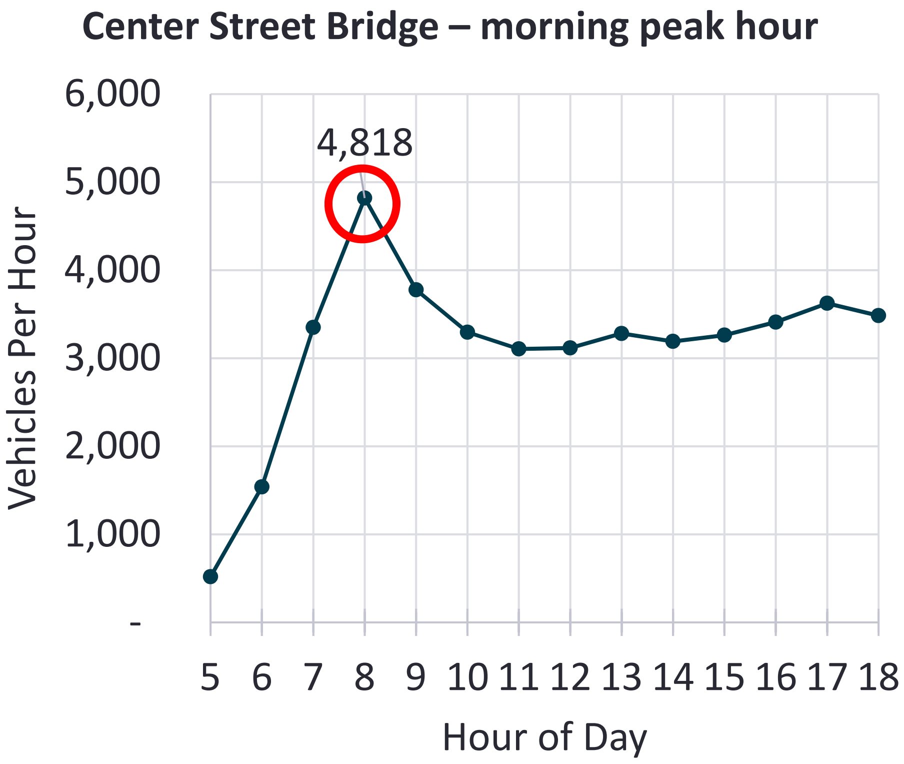
- 24 Cities have Local Gas Tax
- 1 – 5 cents per gallon
- Could support transportation projects – auto, bike, pedestrian
- Is restricted to use in Public right-of-way and can not be used for transit operations
- Requires voter approval (requirement in place since January 2014)

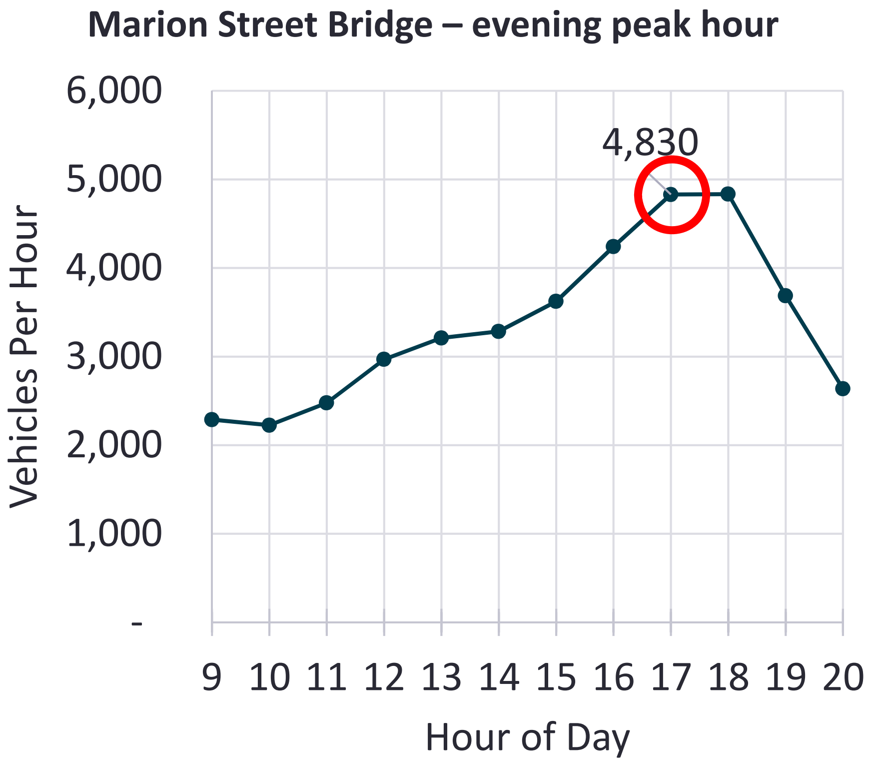
City	Passage Date	Tax Rate (cents/gal.)
Astoria	2007	3 cents
Brookings	2015	4 cents
Canby	2008	3 cents
Coburg	2007	3 cents
Coquille	2007	3 cents
Cornelius	2009	2 cents
Cottage Grove	2003	3 cents
Dundee	2003	2 cents
Eugene	2003	5 cents
Hood River	2009	3 cents
Milwaukie	2007	2 cents
Newport	2009	1 cent (Nov.-May) 3 cents (June-Oct.)
Oakridge	2004	3 cents
Phoenix	2015	2 cents
Sandy	2002	1 cent
Sisters	2009	3 cents
Springfield	2003	3 cents
The Dalles	1980	3 cents
Tigard	2006	3 cents
Troutdale	2015	3 cents
Tillamook	1982	1.5 cents
Veneta	2004	3 cents
Warrenton	2007	3 cents
Woodburn	1989	1 cent

- ODOT's Fuel Tax Disclosures

Solution Packages' Performance

Peak Hour for Travel Times and Queuing Represents:





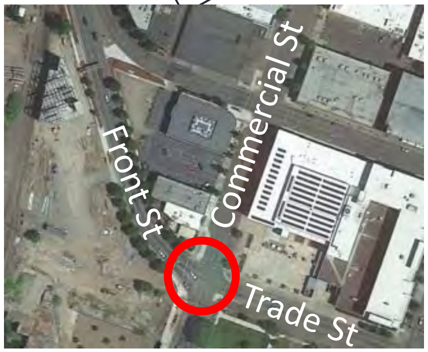
Solution Package – Center Bridge #1

Widen Wallace and bridge on-ramp to 3 lanes
+850 vph

Remove weaving on bridge +800 vph
Add 5th lane +1,200 vph

Front St dual lanes
No net increase

Free right turn at Front St NB off-ramp
No net increase



Summary:

Improves Wallace Rd and Front St

Bottlenecks still exist at both Commercial St/Front St intersections

Maximum capacity of package = 850 vph*

*assuming “bottleneck” intersections are improved (improvements shown on following slides)

○ = Indicates existing “bottleneck”

Solution Package – Center Bridge #1

"Bottleneck" Improvement at Commercial St/Front St

Assumptions:

- Widen to three northbound lanes on Front St and Commercial St
- Signal modifications at Commercial St/Front St/Division St
- Would require right-of-way

Solution Package – Center Bridge #1

"Bottleneck" Improvements at Commercial St/Trade St

Assumptions:

- Dual exclusive through lanes, dual exclusive right turn lanes
- Carry the outside EBR turn lane back 500 feet
- Would require right-of-way

Solution Package – Center Bridge #1

Travel Times (mins)

Start	End	AM Peak (Existing)	**AM Peak (Build 2018)**	**AM Peak (Build 2028)**
A	E	11 mins	**6 mins**	**10 min**
B	E	10 mins	**5 mins**	**9 min**
C	E	7 mins	**4 mins**	**7 min**
D	E	5 mins	**3 mins**	**5 min**

Solution Package – Center Bridge #1

Queuing – 2028 AM Peak

- Improves queuing and congestion on Wallace Rd
- Congestion would return to current conditions by approximately year 2030 (12 years of growth)
- Maintains similar operations for Highway 22

Solution Package – Center Bridge #1

Cost Estimate

Widen Wallace to 3 lanes SB
$28 - $30

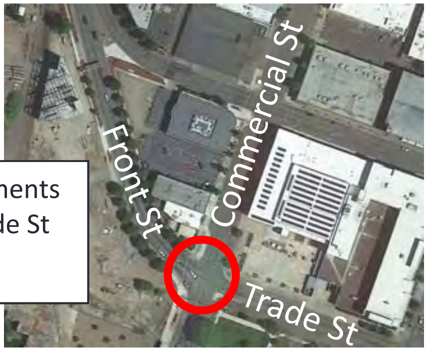
Add 5th lane **$3 - $5**

Free right turn at Front St NB off-ramp & 3 lanes NB to Commercial St/Front St
$30 - $32

Widen bridge on-ramp to 3 lanes
$25 - $30

Front St dual lanes
$7 - $9

All costs are shown in million dollars



"Bottleneck" improvements at Commercial St/Trade St
$7 - $9

Summary:

Total: $100 million - $115 million

Solution Packages – Marion St Bridge

Package #1a (Marine Dr) #1b (Wallace Rd)

Widen Wallace to 3 lanes NB
+750 vph

Wallace OR Marine

Marine Drive
Off-ramp
+900 vph

Remove weaving on bridge +800 vph
Add 5th lane +1,200 vph

Triple SBR
on Comm.
+400 vph

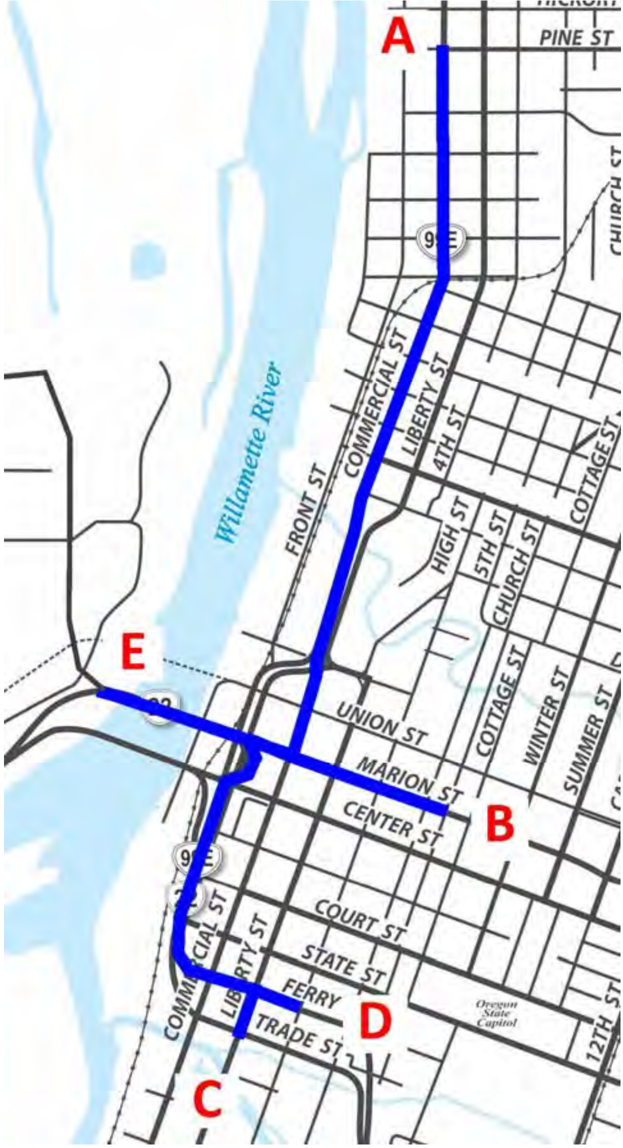
Front St:
remove weaving
- 600 vph = - 200 vph

Front St: remove weaving
+600 vph

Marion St
additional lane
(remove parking)
+500 vph

Summary:
Improves Front Street, Marion St, and Wallace
Worsens Commercial St
Maximum capacity of package = 900 vph

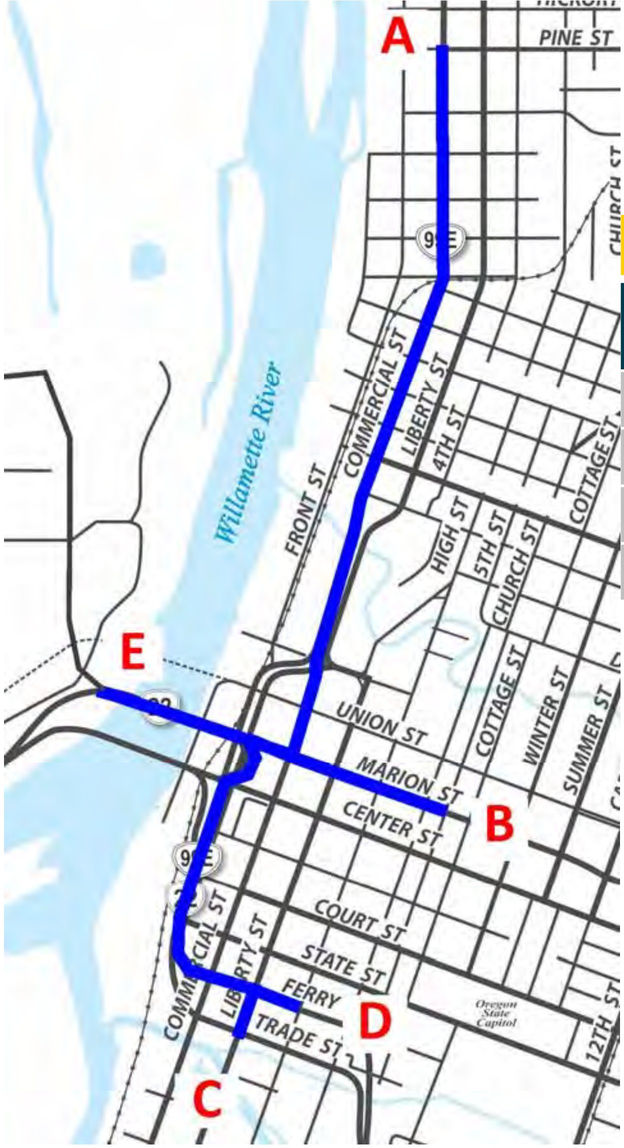
Solution Package – Marion Bridge #1a (Marine Drive)



Travel Times (mins)

Start	End	PM Peak (Existing)	**PM Peak (Build 2018)**	**PM Peak (Build 2028)**
A	E	12 mins	**22 mins**	**36 mins**
B	E	9 mins	**5 mins**	**10 mins**
C	E	8 mins	**15 mins**	**22 mins**
D	E	8 mins	**16 mins**	**23 mins**

Solution Package – Marion Bridge #1b (Wallace Rd)



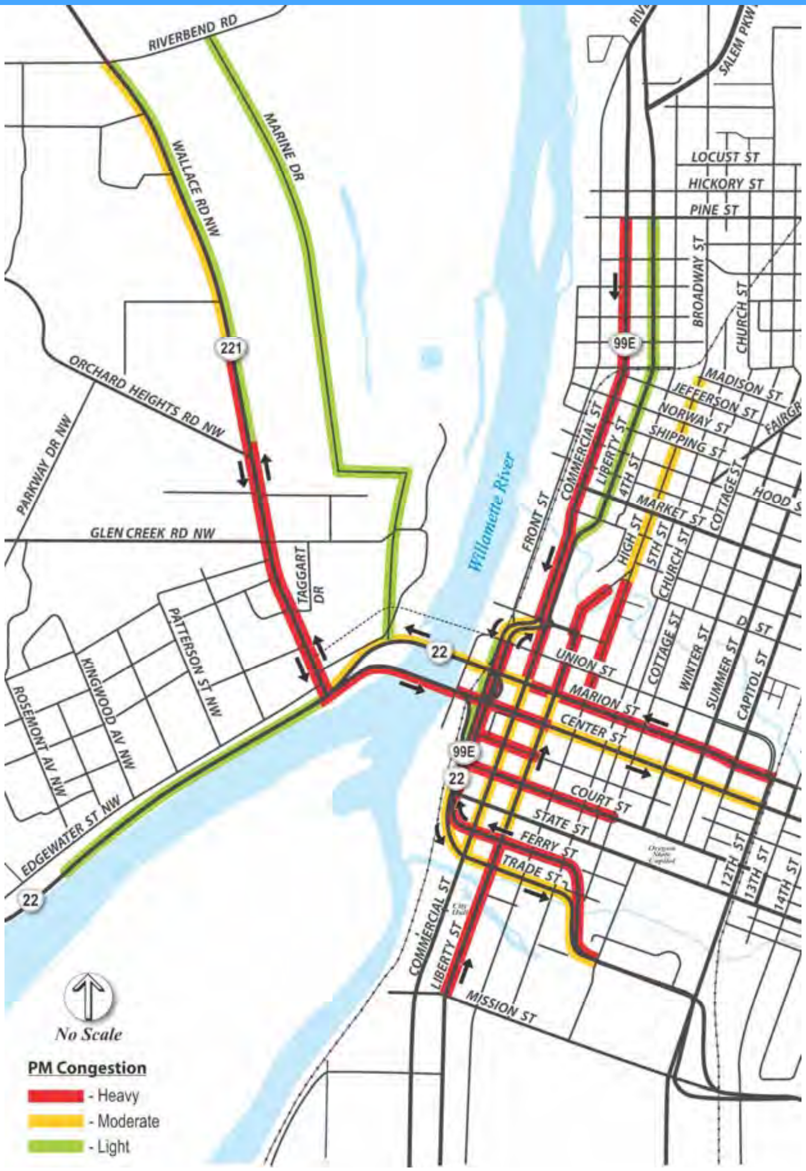
Travel Times (mins)

Start	End	PM Peak (Existing)	PM Peak (Build 2018)	PM Peak (Build 2028)
A	E	12 mins	**20 mins**	**32 mins**
B	E	9 mins	**4 mins**	**9 mins**
C	E	8 mins	**13 mins**	**20 mins**
D	E	8 mins	**16 mins**	**22 mins**

Solution Package – Marion Bridge #1

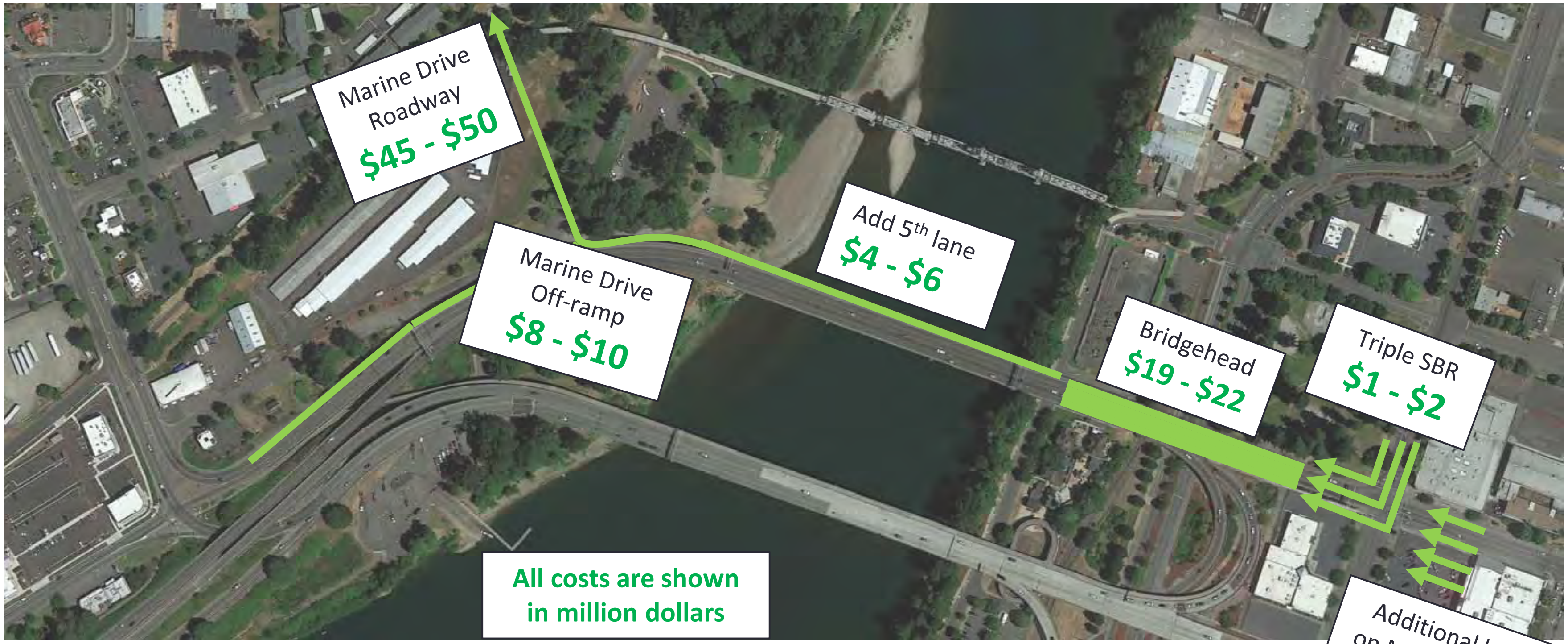
Queuing – 2028 PM Peak

- Rerouted Front St traffic causes additional delay on Center Bridge and backs up into west Salem
- Increases queuing and congestion on Front St NB, Liberty St, Ferry St, and Commercial St SB
- Marion St – only facility with short-term improvements



Solution Package – Marion Bridge #1a

Cost Estimate (with Marine Dr)



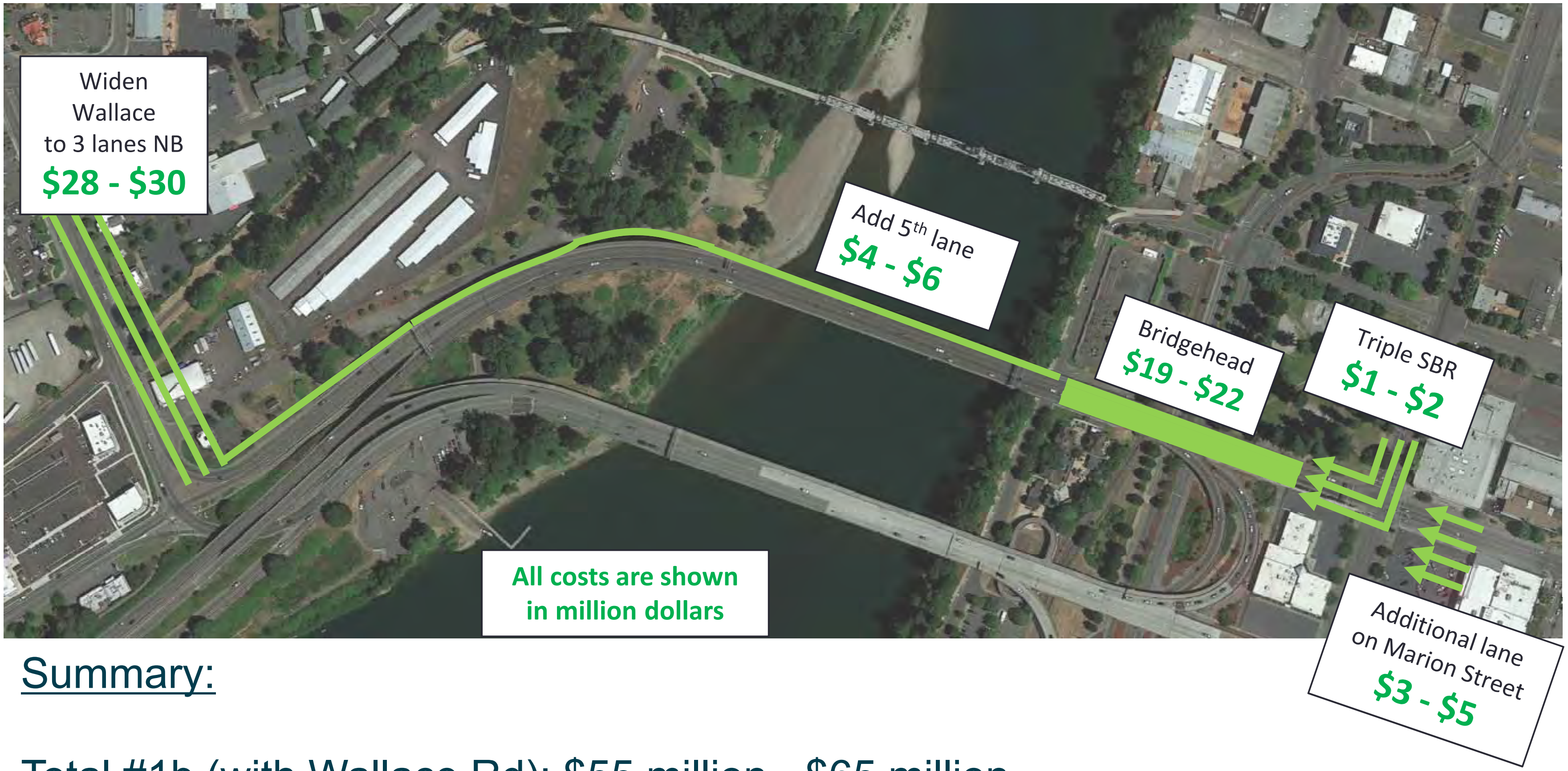
All costs are shown in million dollars

Summary:

Total #1a (with Marine Dr): $80 million - $95 million

Solution Package – Marion Bridge #1b

Cost Estimate (with Wallace Rd)



Summary:

Total #1b (with Wallace Rd): $55 million - $65 million

Solution Packages – Marion St Bridge

Package #2a (Marine Dr) and #2b (Wallace Rd)

Wallace OR Marine

Marine Drive
Off-ramp
+900 vph

Widen Wallace to 3 lanes NB
+750 vph

Remove weaving on bridge +800 vph
Add 5th lane +1,200 vph

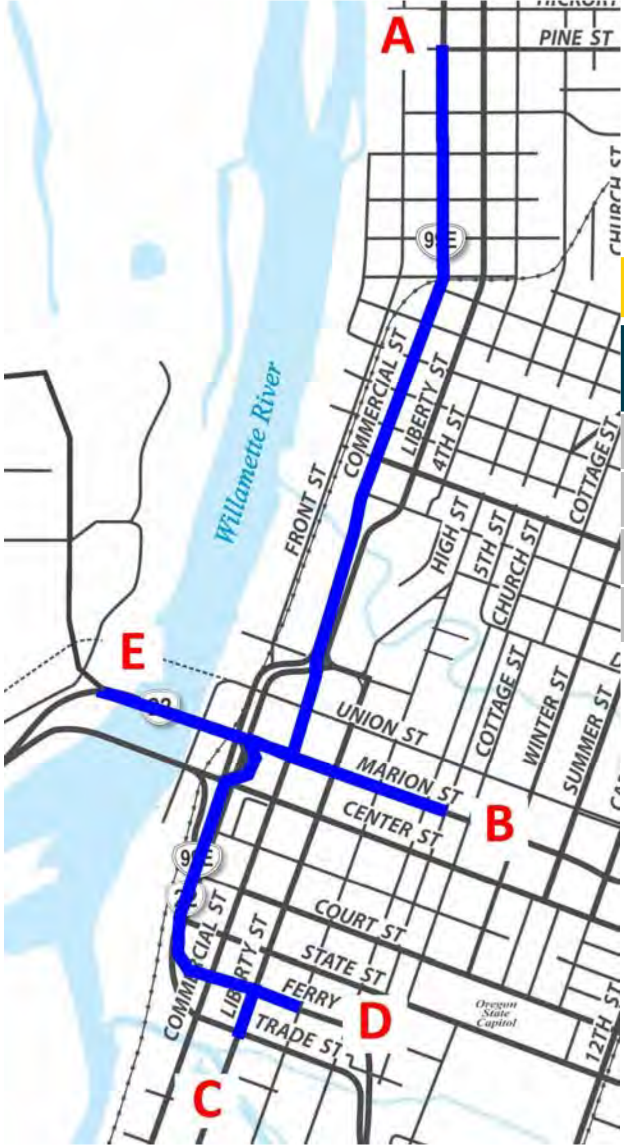
Front St: remove weaving
-600 vph

Free SBR
+850 vph

Front St: remove weaving
+600 vph

Summary:
Improves Front Street, Commercial St, and Wallace
No improvements for Marion St
Maximum capacity of package = 850 vph

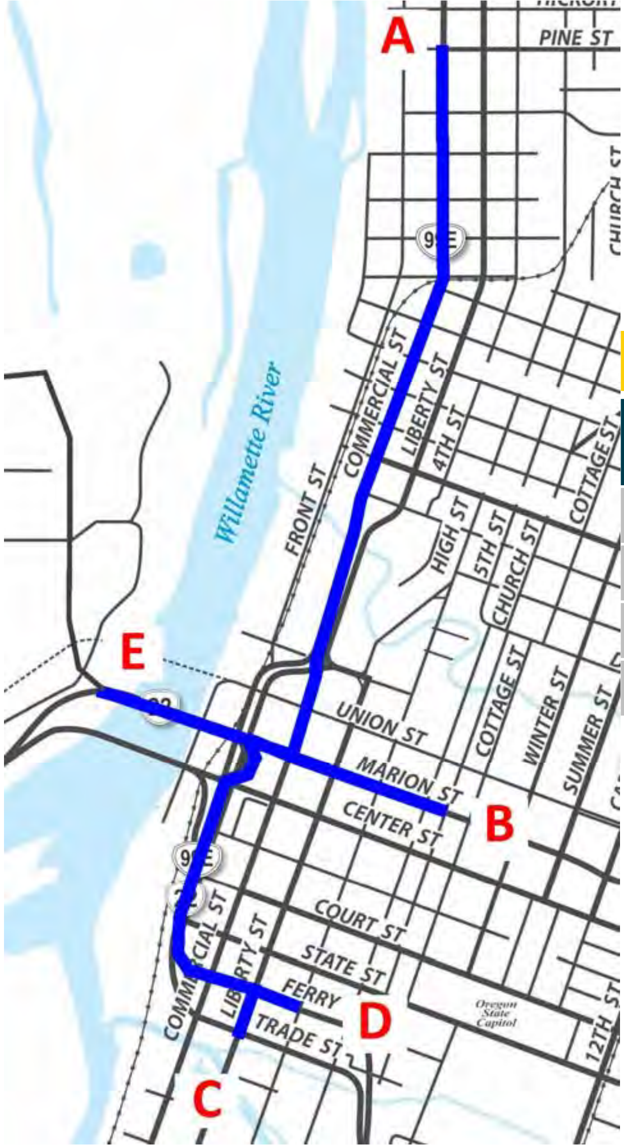
Solution Package – Marion Bridge #2a (Marine Dr)



Travel Times (mins)

Start	End	PM Peak (Existing)	**PM Peak (Build 2018)**	**PM Peak (Build 2028)**
A	E	12 mins	**20 mins**	**21 mins**
B	E	9 mins	**9 mins**	**13 mins**
C	E	8 mins	**13 mins**	**14 mins**
D	E	8 mins	**14 mins**	**15 mins**

Solution Package – Marion Bridge #2b (Wallace Rd)



Travel Times (mins)

Start	End	PM Peak (Existing)	**PM Peak (Build 2018)**	**PM Peak (Build 2028)**
A	E	12 mins	**18 mins**	**19 mins**
B	E	9 mins	**9 mins**	**13 mins**
C	E	8 mins	**13 mins**	**14 mins**
D	E	8 mins	**14 mins**	**15 mins**

Solution Package – Marion Bridge #2

Queuing – 2028 PM Peak

- Rerouted Front St traffic causes additional delay on Center Street Bridge and backs up into west Salem
- Increases queuing and congestion on Front St NB, Ferry St, Liberty St, Marion St, and Commercial St SB

Solution Package – Marion Bridge #2a

Cost Estimate (with Marine Dr)

Summary:

Total #2a (with Marine Dr): $85 million - $100 million

Solution Package – Marion Bridge #2b

Cost Estimate (with Wallace Road)

Summary:

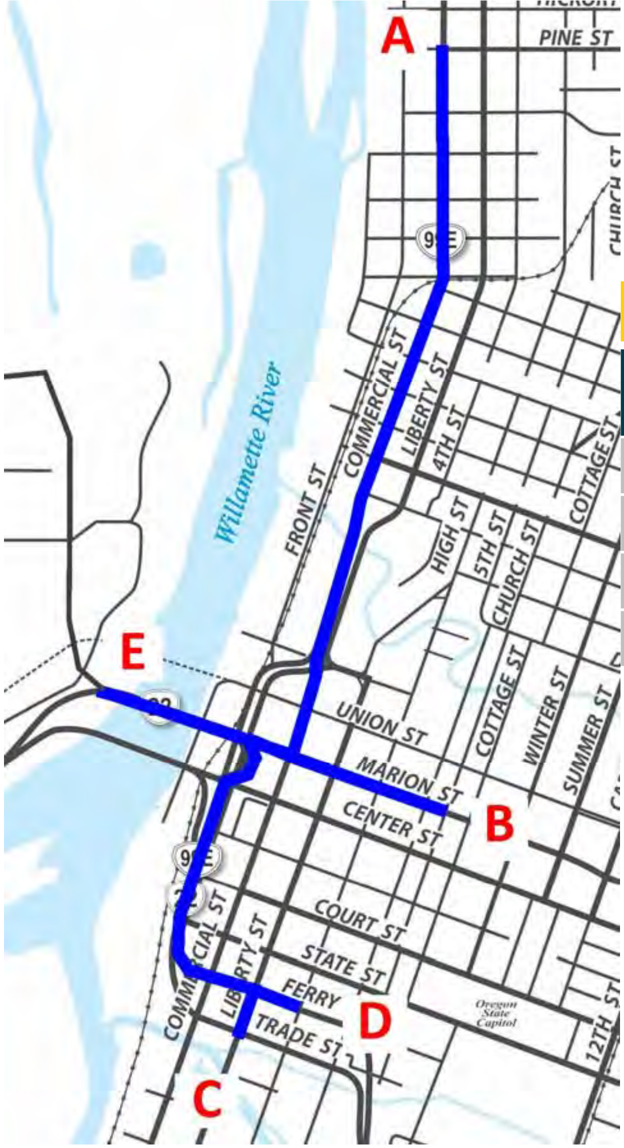
Total #2b (with Wallace Rd): $60 million - $70 million

Solution Packages – Marion St Bridge

Package #4a (Marine Drive) and #4b (Wallace Rd)

Summary:
Improves Commercial St, Marion St, and Wallace
Weaving on bridge still occurs and with five lanes, **previously not endorsed by ODOT**
No improvements for Front St
Maximum capacity of package = 900 vph

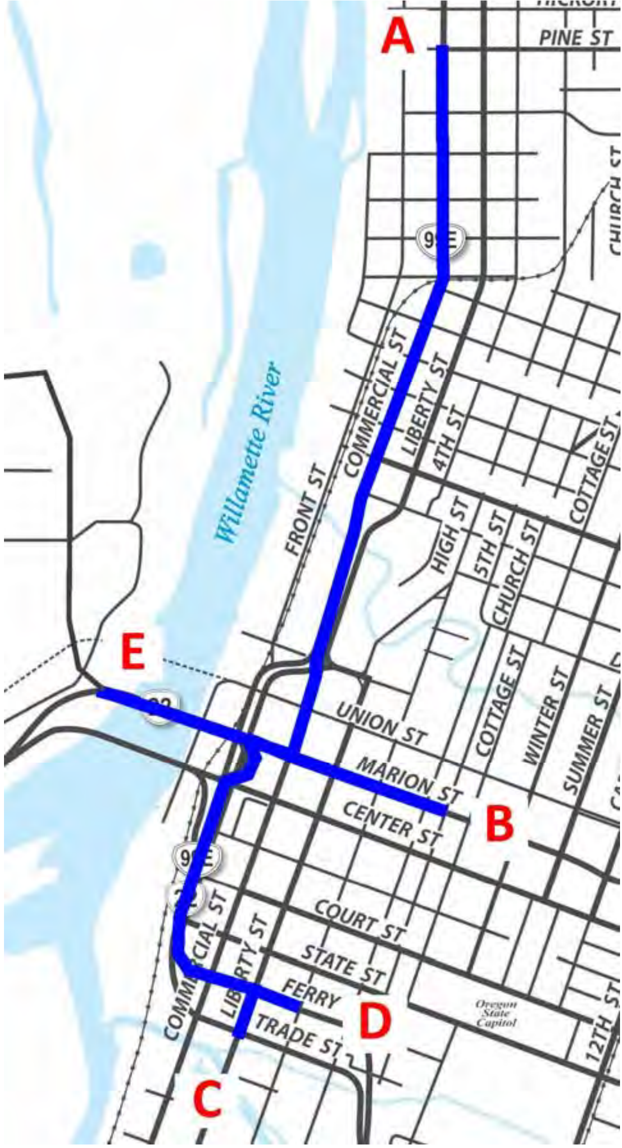
Solution Package – Marion Bridge #4a (Marine Dr)



Travel Times (mins)

Start	End	PM Peak (Existing)	**PM Peak (Build 2018)**	**PM Peak (Build 2028)**
A	E	12 mins	**9 mins**	**11 mins**
B	E	9 mins	**5 mins**	**13 mins**
C	E	8 mins	**8 mins**	**10 mins**
D	E	8 mins	**8 mins**	**10 mins**

Solution Package – Marion Bridge #4b (Wallace Rd)



Travel Times (mins)

Start	End	PM Peak (Existing)	**PM Peak (Build 2018)**	**PM Peak (Build 2028)**
A	E	12 mins	**8 mins**	**10 mins**
B	E	9 mins	**4 mins**	**12 mins**
C	E	8 mins	**8 mins**	**10 mins**
D	E	8 mins	**8 mins**	**10 mins**

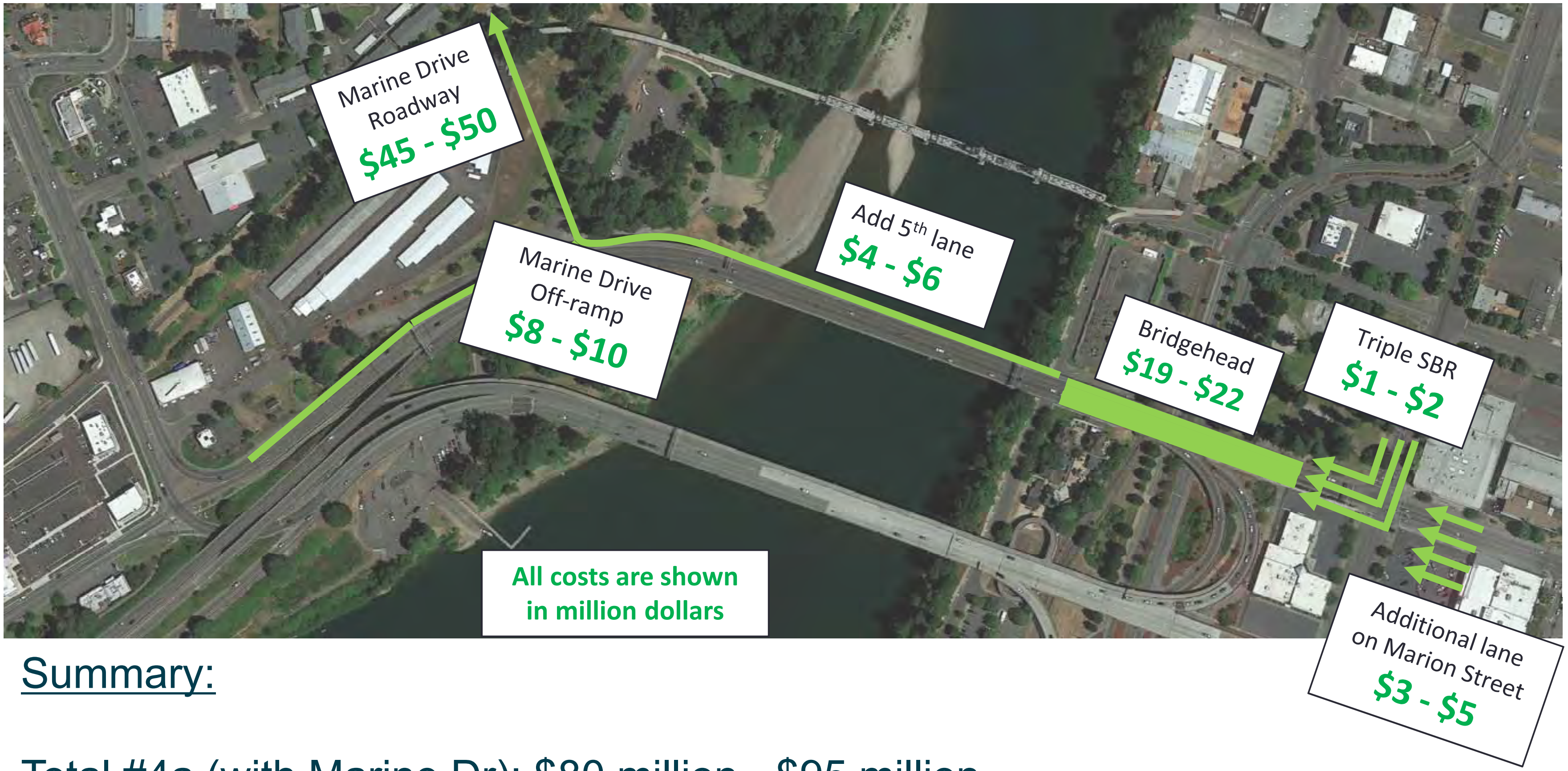
Solution Package – Marion Bridge #4

Queuing – 2028 PM Peak

- Commercial St – reduced queuing and congestion
- Marion St – short-term reduced queuing and congestion
- No improvement to Front St NB, Ferry St, or Liberty St

Solution Package – Marion Bridge #4a

Cost Estimate (with Marine Dr)

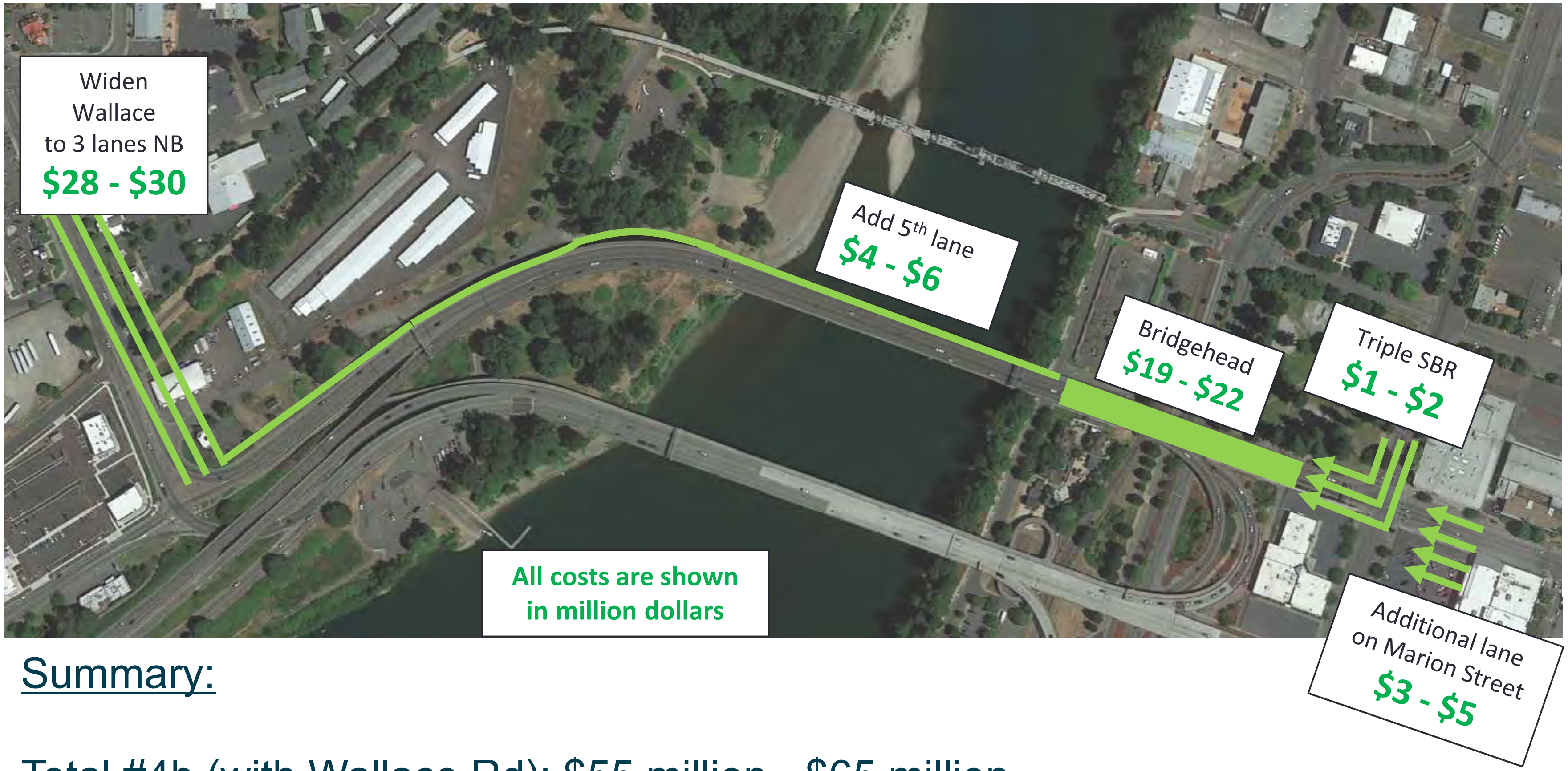


Summary:

Total #4a (with Marine Dr): $80 million - $95 million

Solution Package – Marion Bridge #4b

Cost Estimate (with Wallace Rd)



Widen Wallace to 3 lanes NB
$28 - $30

Add 5th lane
$4 - $6

Bridgehead
$19 - $22

Triple SBR
$1 - $2

Additional lane on Marion Street
$3 - $5

All costs are shown in million dollars

Summary:

Total #4b (with Wallace Rd): $55 million - $65 million

Solution Package Review Table

	Center Bridge #1	Marion Bridge #1a (Marine)	Marion Bridge #1b (Wallace)	Marion Bridge #2a (Marine)	Marion Bridge #2b (Wallace)	Marion Bridge #4a (Marine)	Marion Bridge #4b (Wallace)
Travel Times	**2018:** Improved from existing conditions **2028:** At or just better than existing conditions	**2018:** Worsened from existing conditions except Marion St **2028:** Worsened further	**2018:** Slight improvement to Marion Bridge #1a **2028:** Slight improvement to Marion Bridge #1a	**2018:** Worsened from existing conditions **2028:** Worsened further	**2018:** Slight improvement to Marion Bridge #2a **2028:** Slight improvement to Marion Bridge #2a	**2018:** At or better than existing conditions **2028:** At or just worse than existing conditions	**2018:** Slight improvement to Marion Bridge #4a **2028:** Slight improvement to Marion Bridge #4a
Queuing	**2028:** Reduced queuing on Wallace Rd SB and Front St	**2028:** Additional queuing on Liberty St NB, Trade St, Commercial St, Front St NB, and Wallace Rd NB	**2028:** Similar to Marion Bridge #1a	**2028:** Additional queuing on Liberty St NB, Trade St, Commercial St, Front St NB, and Wallace Rd NB	**2028:** Similar to Marion Bridge #2a	**2028:** Reduced queuing on Commercial St and Marion St	**2028:** Similar to Marion Bridge #4a
Cost Estimate	\$100 - \$115 million	\$80 - \$95 million	\$55 - \$65 million	\$85 - \$100 million	\$60 - \$70 million	\$80 - \$95 million	\$55 - \$65 million

Key Findings

- Center Bridge Solution Package
  - Center Bridge Package #1 was best option and had no fatal flaws.
- Marion Bridge Solution Package Selection
  - Marion Bridge Package #4 has similar or reduced travel times and queuing in short-term and mid-term.
  - Marion Bridge Packages #1 and #2 do not satisfy the project goal to relieve congestion in the study area.
- Wallace Road vs. Marine Drive
  - Building Marine Dr only provides increased capacity to Marion Bridge, widening Wallace Rd on both sides provides capacity for both bridges.
  - For all Marion Bridge Solution Packages, better travel times with Wallace Rd than Marine Dr because there is less weaving required.
  - Marine Dr requires environmental and park impacts.

Cost Estimate for Solution Package Combinations

Solution Package Combinations	Total Cost Estimate Range (million)
Marion Bridge #1a (Marine Dr) & Center Bridge #1	**$180 - $210**
Marion Bridge #1b (Wallace Rd) & Center Bridge #1	**$155 - $180**
Marion Bridge #2a (Marine Dr) & Center Bridge #1	**$185 - $215**
Marion Bridge #2b (Wallace Rd) & Center Bridge #1	**$160 - $185**
Marion Bridge #4a (Marine Dr) & Center Bridge #1	**$180 - $210**
Marion Bridge #4b (Wallace Rd) & Center Bridge #1	**$155 - $180**

I. TASK FORCE MEETING #5

AGENDA FOR AUGUST 3, 2018

MATERIAL FOR AUGUST 3, 2018

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

CITY OF Salem
AT YOUR SERVICE

August 3, 2018

MEETING GOALS

1. Agenda Review and Meeting #4 Recap ▶ 7:00

2. Review Project Goal, Data, and Solution Ideas ▶ 7:05

3. Recommendations and Reporting ▶ 7:30

From the Council-Adopted Work Scope:

a. Changes to adopted policies, practices, or projects?
b. Recommended projects: Short, intermediate, and long term?
c. Funding strategies?
d. Areas for further research?

4. Project Conclusions and Key Points ▶ 8:20

Review and approve conclusions

5. Next Steps ▶ 8:50

DATE	MEETING TOPIC
Feb. 23	**1. Project Introduction** a. Task Force goals and process b. Key transportation issues c. Current policies and constraints
April 20	**2. Future Conditions, Transportation Ideas, Evaluation Criteria**
May 18	**3. Transportation Idea Results:** Tier 1 Screening (choose 3)
July 20	**4. Tier 2 Screening:** Select Solution Package for each bridge to advance for further analysis
Aug. 3	**5. Draft Recommendations**
Sept. 14	**6. Optional Meeting**

CONGESTION RELIEF TASK FORCE

A Technical Review of Transportation Infrastructure Options

Task Force Meeting #5, August 3, 2018

DKS

Prepared by DKS Associates

CITY OF Salem AT YOUR SERVICE

Agenda

1. Agenda Review and Meeting #4 Recap
2. Review Project Goal, Data, and Project Ideas
3. Recommendations and Reporting
    a) Recommended Projects: short, medium, and long-term
    b) Changes to adopted policies, practices, and projects
    c) Funding Strategies
    d) Areas for further research
4. Project Conclusions and Key Points
5. Next Steps

Project Goal

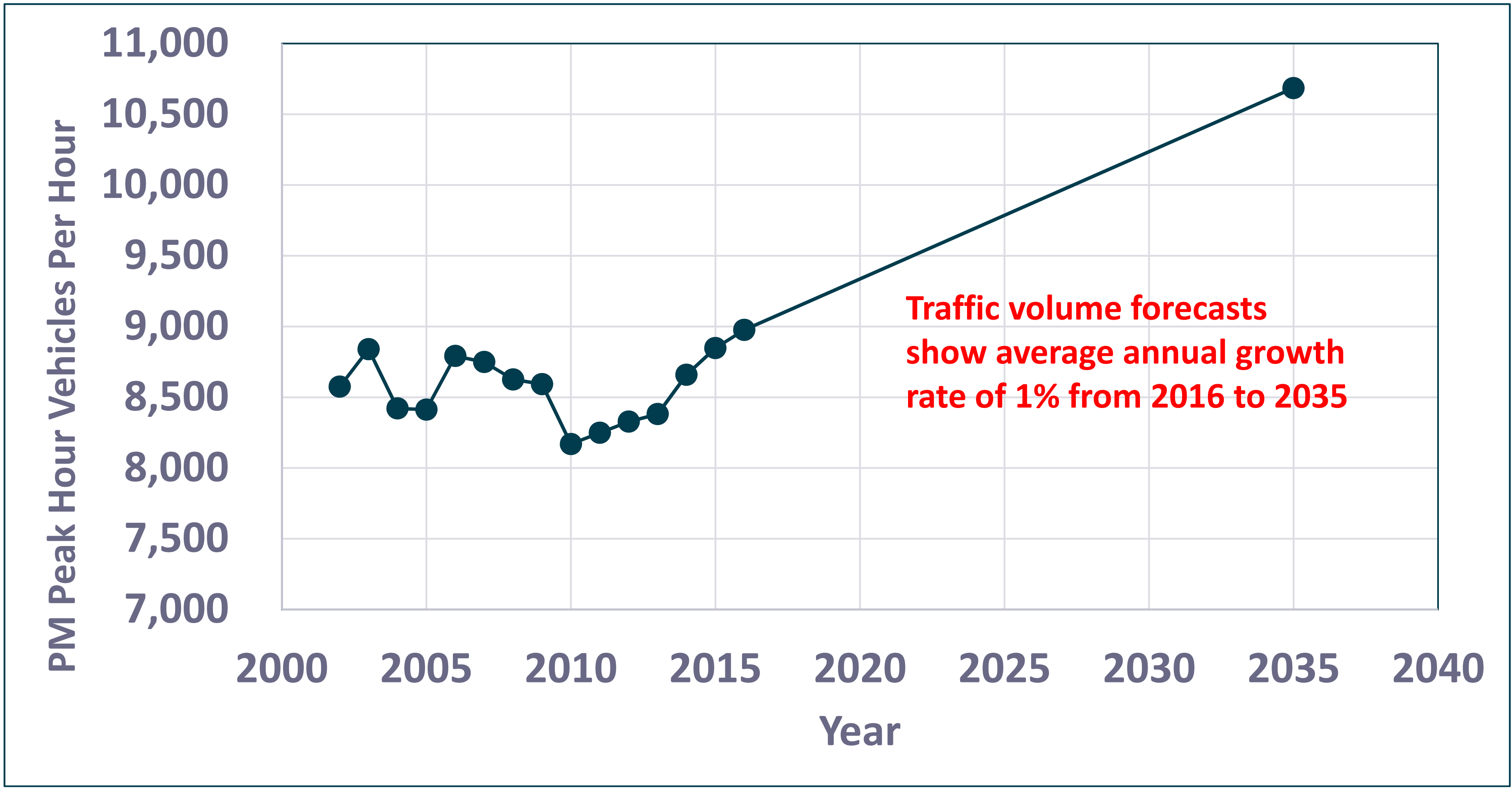
Identify options for reducing traffic congestion and improving vehicular mobility around the Marion and Center Street bridges

- Develop ideas to reduce traffic congestion and improve vehicular mobility in:
    - Short term (within 5 years)
    - Medium term (within 10 years)
    - Long term (longer than 10 years)

- Develop a list of recommendation(s) that includes the following:
    - Changes to adopted policies, practices, and projects
    - Projects that improve traffic congestion and vehicular mobility
    - A funding strategy
    - A prioritized listing of areas recommended for further research

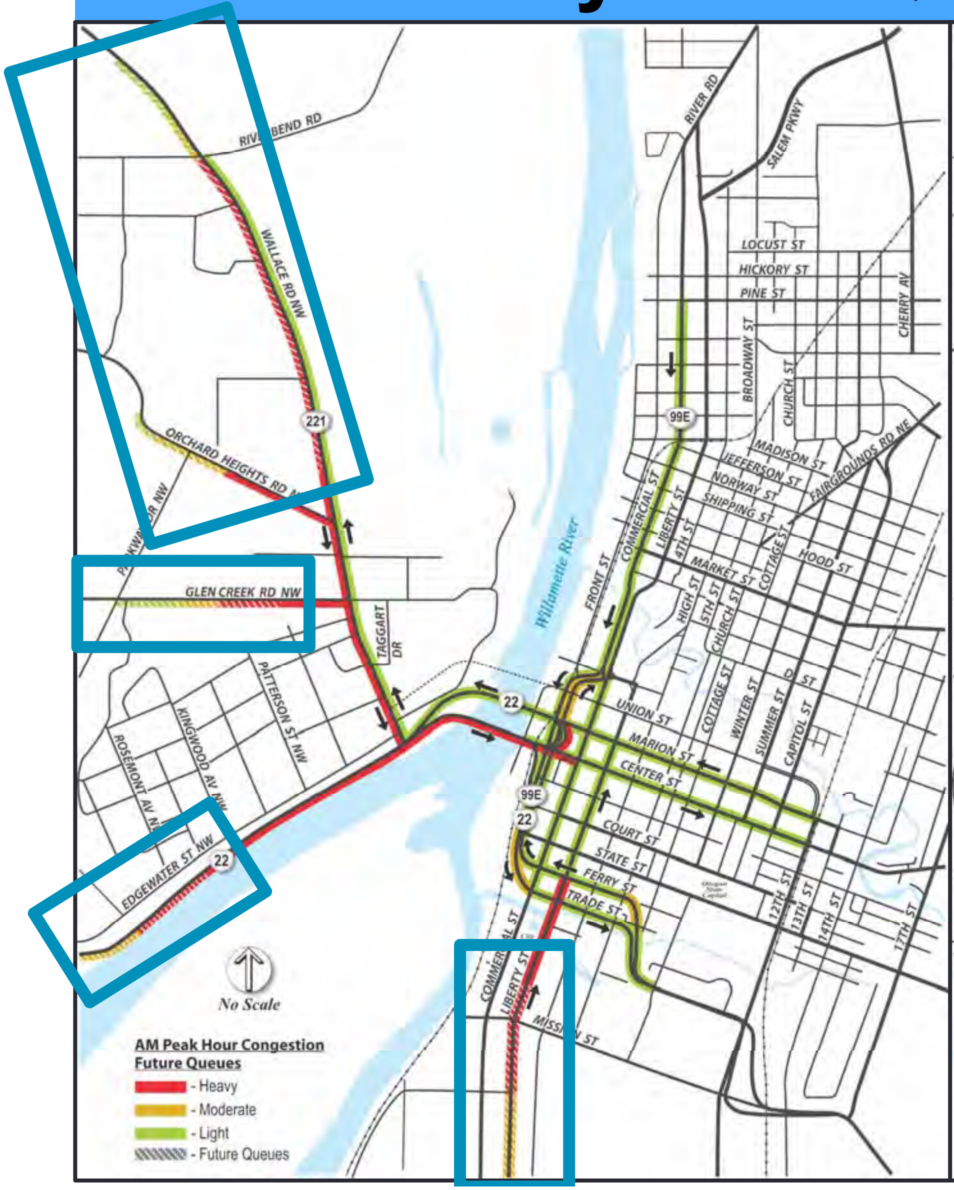
Projected Traffic Growth – PM Peak Hour

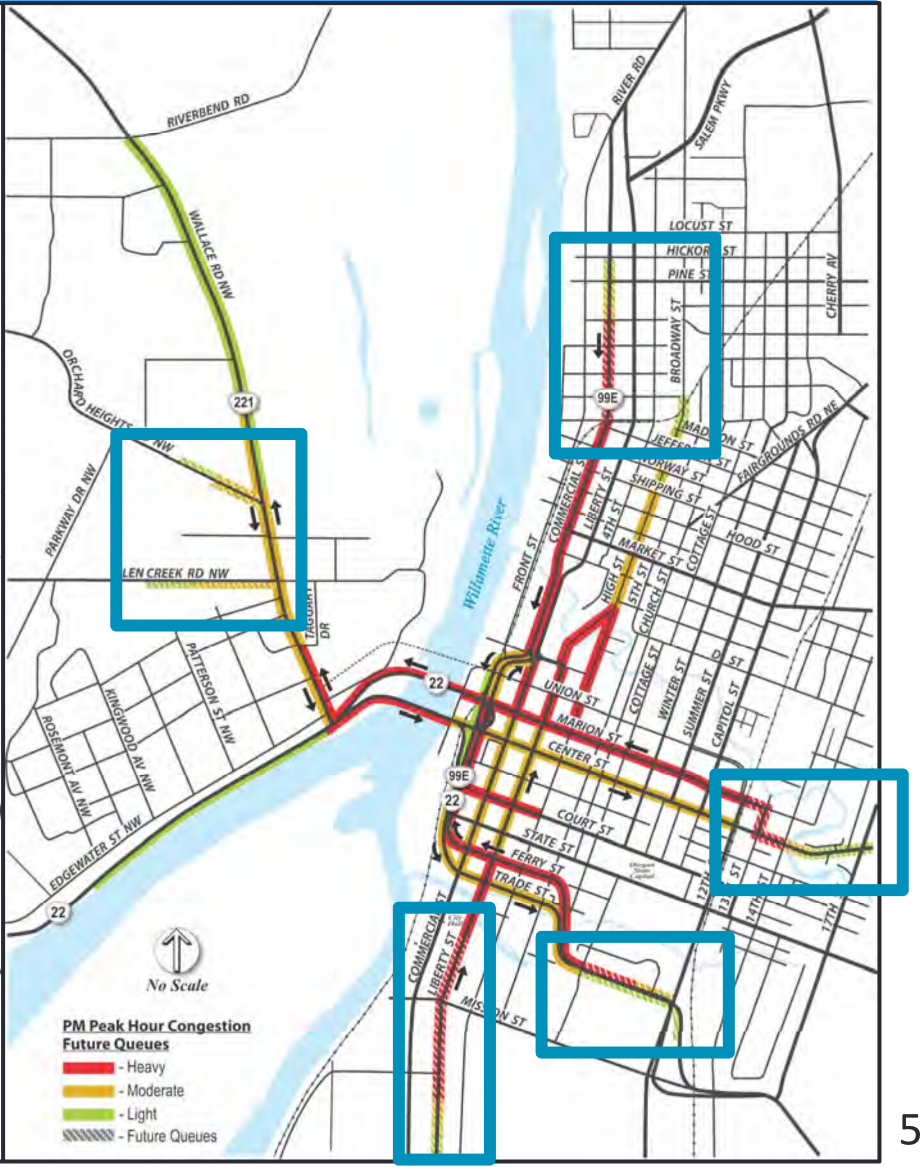
Using data from ODOT Traffic Recorders, traffic across both Salem Bridges is shown below from 2002 to 2016. The 2035 PM peak hour vehicular volume shown is based on data from the PSU Population Research Center forecasts.



Traffic volume forecasts show average annual growth rate of 1% from 2016 to 2035

Study Area Queuing in 2035



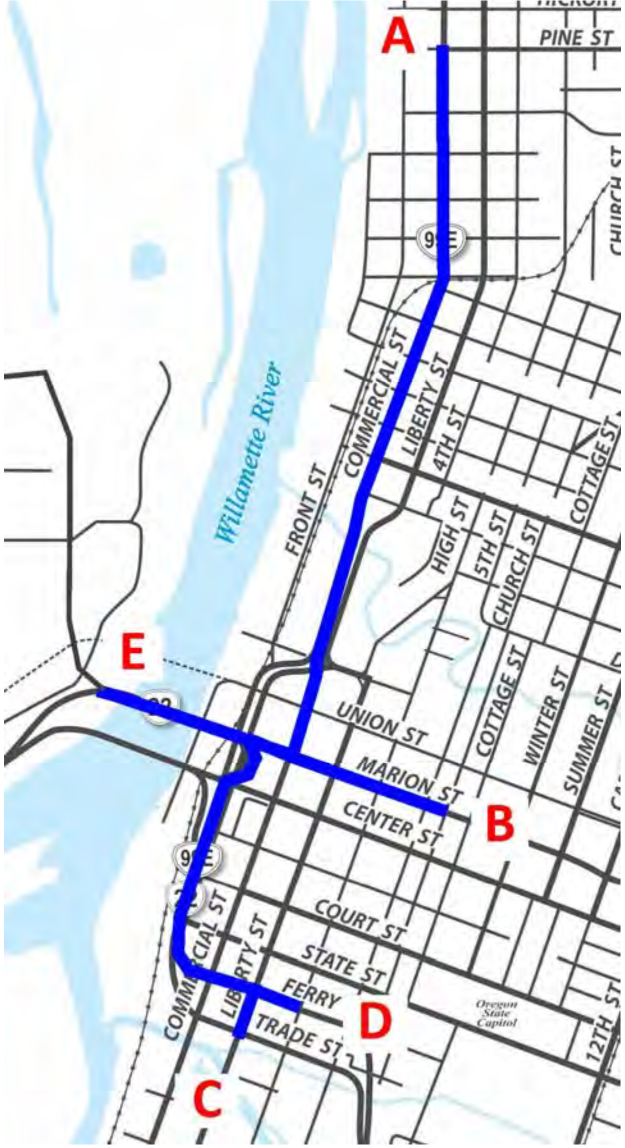


Solution Package – Center Bridge #1

AM Travel Times (mins)

Start	End	AM Peak (Existing)	**AM Peak (Build 2018)**	AM Peak (No Build 2028)	**AM Peak (Build 2028)**
A	E	11 mins	**6 mins**	15 mins	**10 mins**
B	E	10 mins	**5 mins**	14 mins	**9 mins**
C	E	7 mins	**4 mins**	10 mins	**7 mins**
D	E	5 mins	**3 mins**	7 mins	**5 mins**

Solution Package – Marion Bridge #4



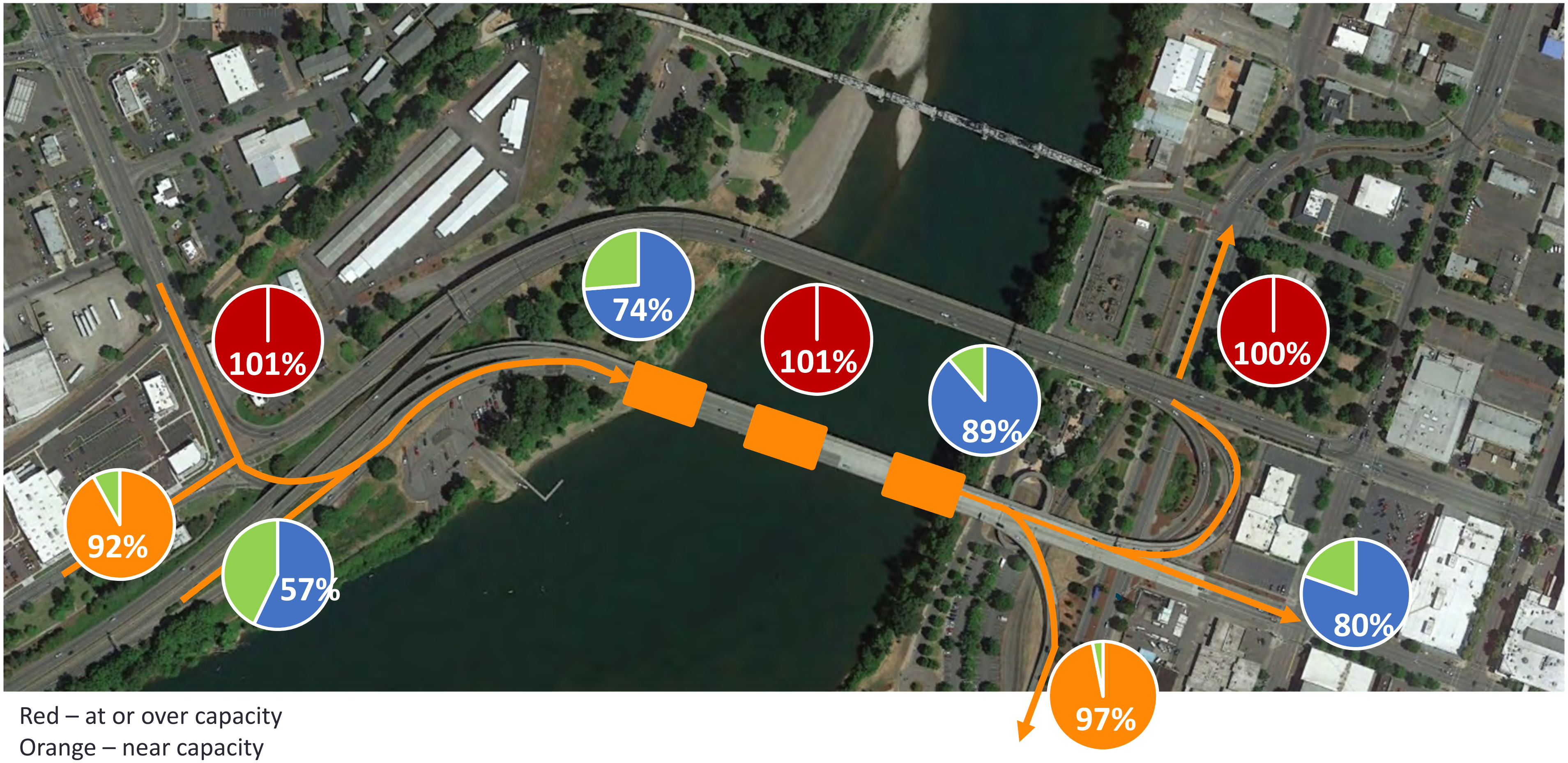
PM Travel Times (mins)

Start	End	PM Peak (Existing)	**PM Peak (Build 2018)**	PM Peak (No Build 2028)	**PM Peak (Build 2028)**
A	E	12 mins	**8 mins**	15 mins	**10 mins**
B	E	9 mins	**4 mins**	14 mins	**12 mins**
C	E	8 mins	**8 mins**	10 mins	**10 mins**
D	E	8 mins	**8 mins**	10 mins	**10 mins**

*Travel times provided for Wallace Road option (#4b)

Bridge and Bridgehead Capacity Summary

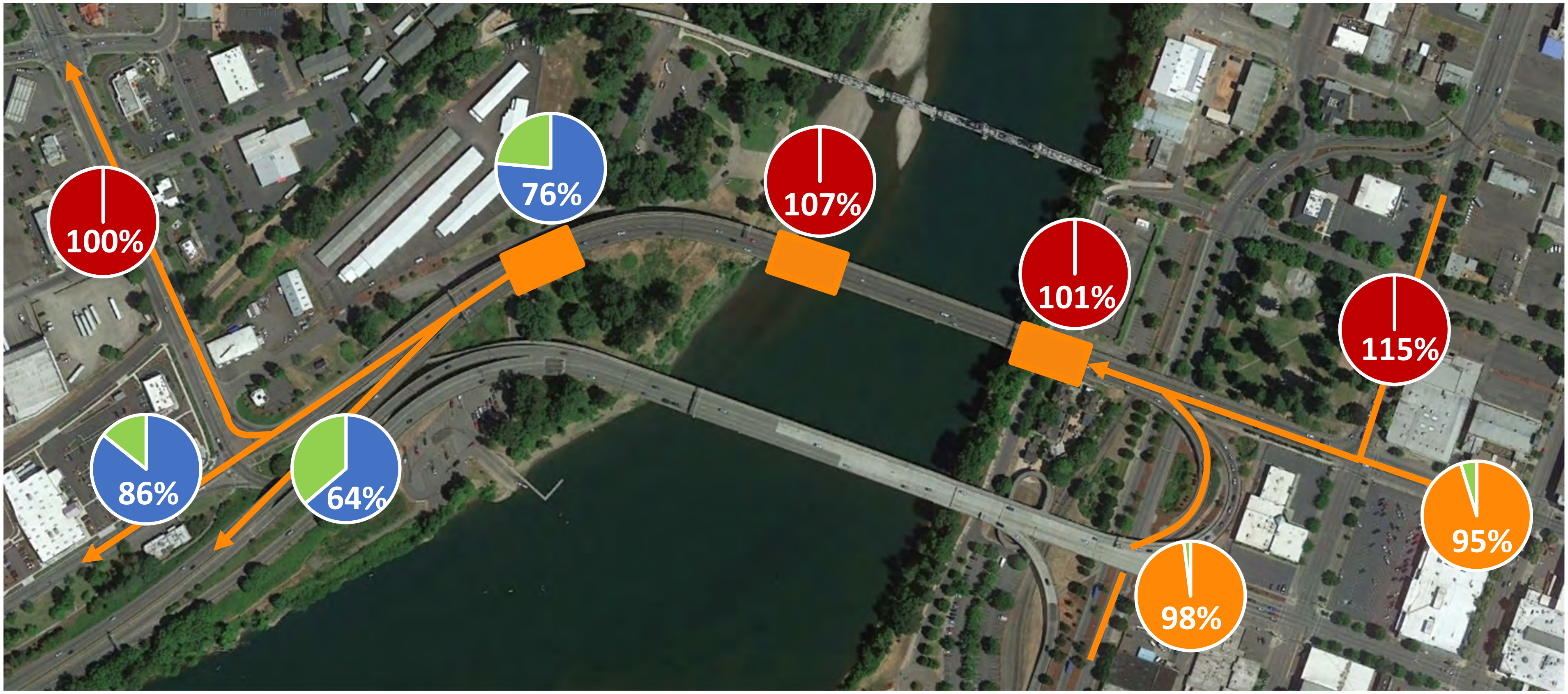
Center Street Bridge – AM Peak
Percentages of Capacity Used



Red – at or over capacity
Orange – near capacity
Blue – below capacity

Bridge and Bridgehead Capacity Summary

Marion Street Bridge – PM Peak
Percentages of Capacity Used



Red – at or over capacity
Orange – near capacity
Blue – below capacity

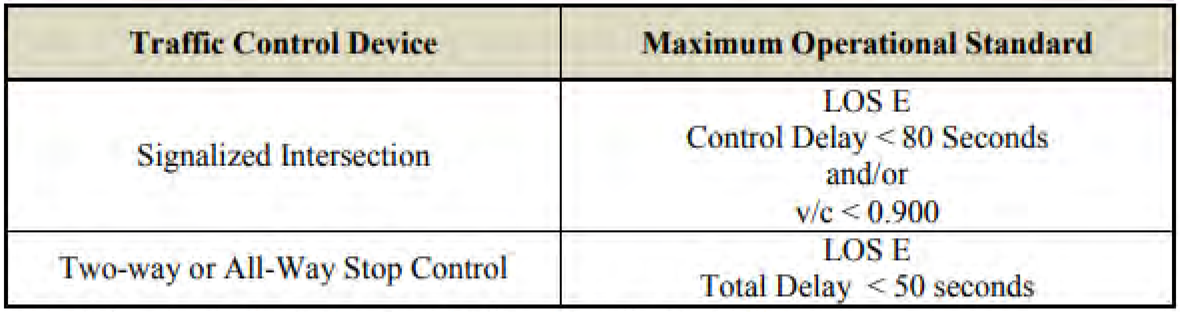
City & State Mobility Standards

- Level of Service (LOS): evaluated based upon average vehicle delay experienced by vehicles entering an intersection
- Volume-to-capacity ratio (v/c): A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 0.90, congestion increases and performance is reduced. At 1.0 the capacity is fully utilized.

LOS	Delay (secs.)
A	< 10
B	10 – 20
C	20 – 35
D	35 – 55
E	55 – 80
F	>80

ODOT Roadway	Mobility Standard
Bridges/ Hwy 22	(v/c < 0.85)
Commercial/ Liberty	(v/c < 0.95)
Wallace Road	(v/c < 0.95)

City of Salem Standards



Traffic Control Device	Maximum Operational Standard
Signalized Intersection	LOS E Control Delay < 80 Seconds and/or v/c < 0.900
Two-way or All-Way Stop Control	LOS E Total Delay < 50 seconds

Table 6-32. Level of Service Standards for Various Traffic Control Devices

AM Intersection Operations in Study Area

Figure shows intersection operations analysis and queuing in AM peak. As shown, many intersections fail to meet the City or State mobility standards.

🟡 - At or near standards

🔴 - Fails to meet standards

PM Intersection Operations in Study Area

Figure shows intersection operations analysis and queuing in PM peak. As shown, many intersections fail to meet the City or State mobility standards.

🟡 - At or near standards

🔴 - Fails to meet standards

CONGESTION RELIEF TASK FORCE
A Technical Review of Transportation Infrastructure Options

Project Ideas

These following project ideas came from many sources:

- Previous Studies
- Public Survey (1,300 participants)
- Task Force Committee
- Consultant Team

Project ideas:

- Were included in the Solution Packages or
- Provided spot benefits and are discussed later in agenda or
- Did not provide capacity benefits (next slide)

Project Ideas Not Advanced

	Ideas
1	Add lanes to Commercial Street/Liberty Street
2	Construct Union St bikeway (already funded)
3	Widen to two SB lanes on Front Street (from Commercial St to Court St)
4	Remove the traffic signal at Edgewater St/Wallace Rd
5	Roundabout at Edgewater St/Wallace Rd
6	Close Edgewater St at Wallace/Marion Street Bridge off-ramp; only accessible via Rosemont Ave
7	Install traffic signal at Edgewater St/Patterson St
8	Widen WB Rosemont exit on Highway 22
9	Remove the pedestrian crossing at Front St/Court St

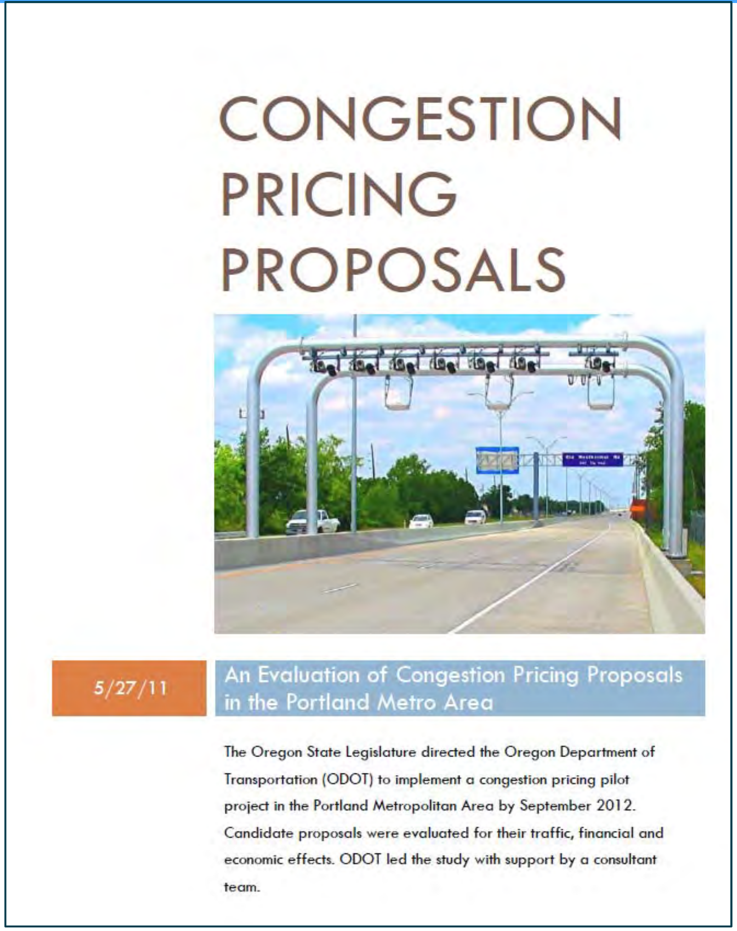
Policies, Practices, and Projects

Policies for Consideration

- Congestion Pricing – charging users for roadway or bridge trips during the peak periods to decrease demand and fund transportation improvements. Congestion Pricing project for Portland Metro Area pictured right.
- Parking Pricing – implement or increase parking costs to reduce peak hour vehicle demand and increase alternative modes
- Travel Time Standards - Identify acceptable travel time standards/levels of congestion for road users

Adopted Projects

- Central Salem Mobility Study – adopted projects that reduce vehicle capacity



CONGESTION
PRICING
PROPOSALS

5/27/11

An Evaluation of Congestion Pricing Proposals in the Portland Metro Area

The Oregon State Legislature directed the Oregon Department of Transportation (ODOT) to implement a congestion pricing pilot project in the Portland Metropolitan Area by September 2012. Candidate proposals were evaluated for their traffic, financial and economic effects. ODOT led the study with support by a consultant team.

Wallace Road/Taggart Drive Intersection Improvements

Improvements include widening Taggart Dr approaches to have dual, exclusive left turn lanes and exclusive right turn lanes.

Provides approximately 7% more capacity on Wallace Road for through traffic in both the AM and PM peak hour.

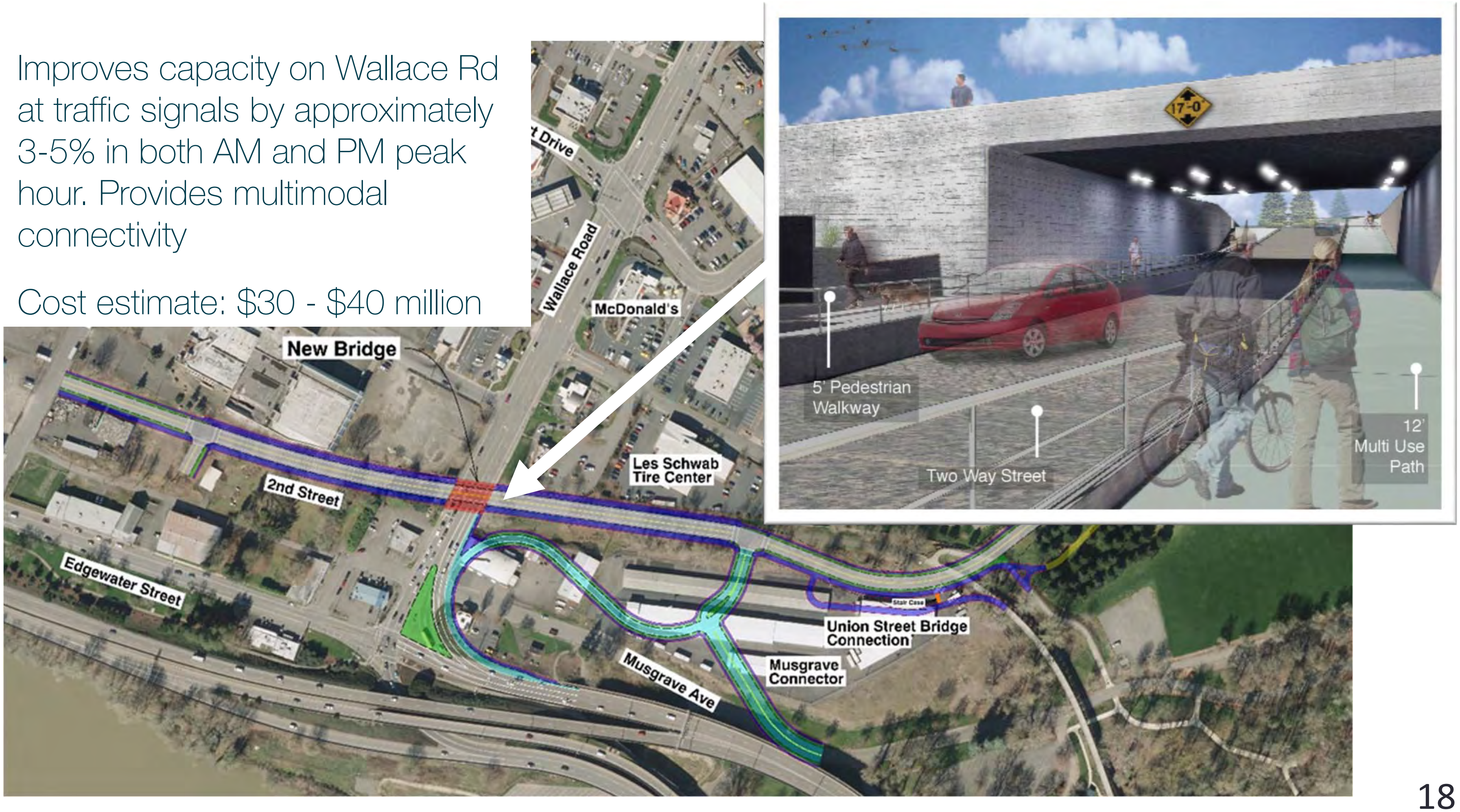
Cost estimate: $10 million

2nd Street Undercrossing

Connect 2nd Street under Wallace Road to the proposed Marine Drive roadway, build an additional off-ramp lane from Marion Street bridge to 2nd St/Marine Dr

Improves capacity on Wallace Rd at traffic signals by approximately 3-5% in both AM and PM peak hour. Provides multimodal connectivity

Cost estimate: $30 - $40 million



Grade-separated Pedestrian Crossing

Remove pedestrian crossings of Front St.

Reduces delays for traffic on Front St.

Remove Front Street pedestrian crossings at State St and Court St

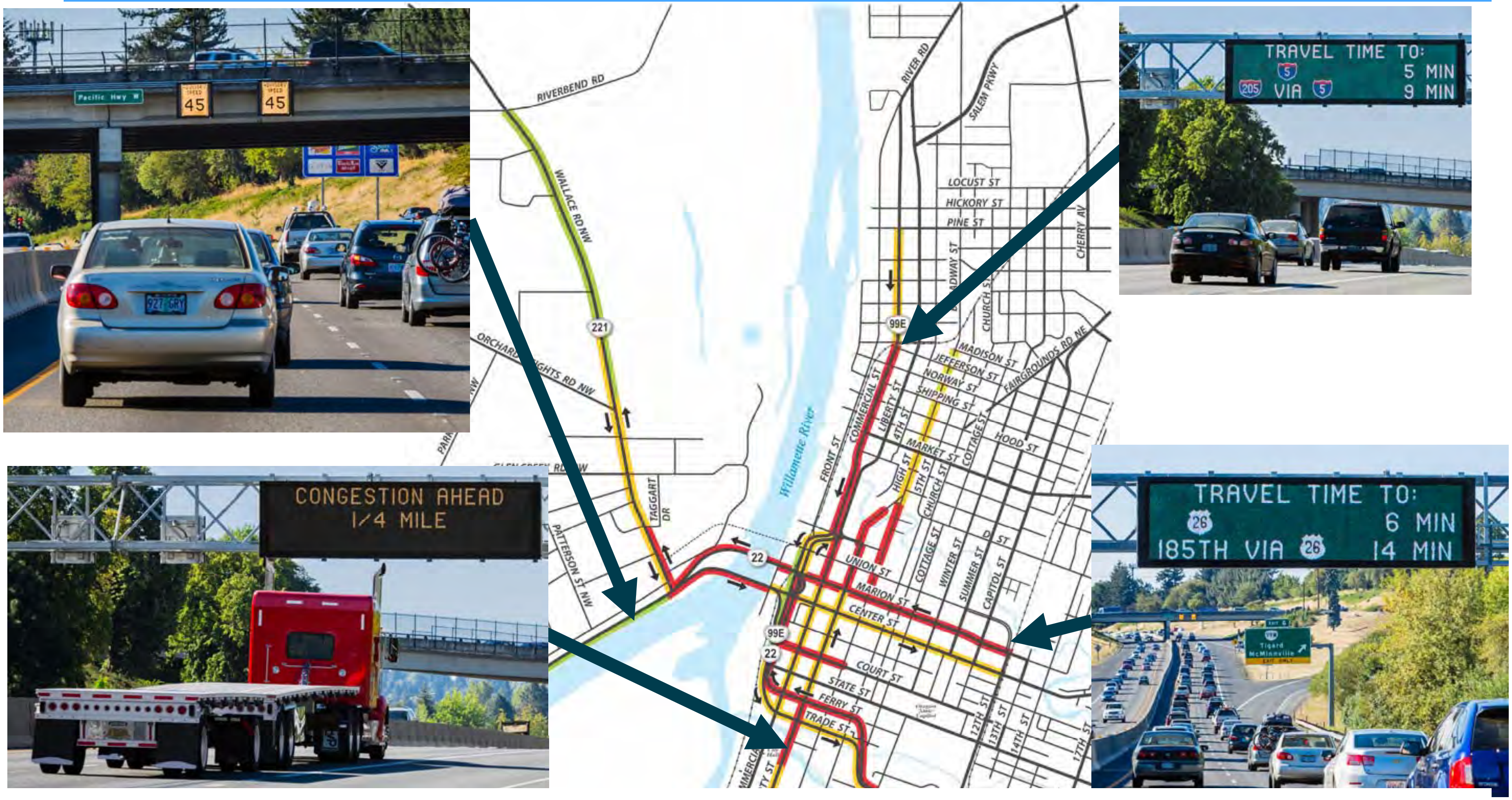
Build a grade-separated pedestrian crossing, reducing delay for traffic on Front Street.

Must get buy-off from ODOT to remove crossings.

Reduces access to Riverfront Park.

Negligible change in capacity due to bottleneck at Front/Trade/Commercial

ITS Driver Information Signage



Does not increase capacity but helps provide real time information to commuters.

Cost estimate: $500,000 - $1,000,000 for each variable message sign (VMS)

CONGESTION RELIEF TASK FORCE
A Technical Review of Transportation Infrastructure Options

Potential Short/Medium-term Projects

Cost Estimate: $0 - $5 million per project

1. Improve guide signage leading up to and on the bridges
2. Increase pedestrian delays at signalized intersections during peak periods
3. Open Musgrave Avenue through Wallace Marine Park
4. Variable speed limit signage on Hwy 22
5. Install travel time signage in study area
6. Expand bike/ped connections to Union Street Bridge
7. Parking Management
8. Invest in Downtown Circulator
9. Park and Walk/Bike/Shuttle in Wallace Marine Park
10. Turn restrictions on Wallace Road - Install center lane barrier and/or remove turns from Wallace Rd onto Taggart Dr

Potential Medium/Long-term Projects

Cost Estimate: $5 - $50 million per project

1. Add a grade-separated pedestrian crossing of Front Street between downtown and Riverfront Park and remove the existing pedestrian crossings of Front St
2. Extend two SB lanes on High St past Union Street (remove parking) and make SBRT free flow at Marion Street
3. Add grade-separated pedestrian crossing near Marion Street/High Street, remove existing pedestrian crossing at intersection
4. 2nd Street Undercrossing
5. Taggart Dr/Wallace Rd intersection improvements
6. Connect Murlark Avenue to Glen Creek Road
7. Add through and right turn lanes to Wallace Road from Hwy 22 to Brush College Rd
8. Widen Front Street (north of Division) to minor arterial standards

Potential Long-term Projects

1. Center St bridge Solution Package #1 (Cost estimate: \$100 - \$137 million)
2. Marion St bridge Solution Package #4a (Cost estimate: \$80 - \$95 million)
3. Marion St bridge Solution Package #4b (Cost estimate: \$55 - \$65 million)

Funding Strategies

Gas Tax – sales tax imposed on sale of gasoline to fund transportation or road projects. Requires voter approval

Bonds – issued by the City to fund capital projects such as building highways or road improvement projects. Requires voter approval

J. TASK FORCE MEETING #6

AGENDA FOR SEPTEMBER 14, 2018

MATERIAL FOR SEPTEMBER 14, 2018

CITY OF Salem
AT YOUR SERVICE
Public Works Department

Congestion Relief Task Force

Si necesita ayuda para comprender esta información, por favor llame 503-588-6211.
Disability-related modification or accommodation, including auxiliary aids or services, in order to participate in this meeting or event, are available upon request. Sign language and interpreters for languages other than English are also available on request. To request such an accommodation or interpretation, contact Judy Postier at 503-588-6008 or jpostier@cityofsalem.net at least two business days before meeting; or TTD/TTY telephone 503-588-6439, is also available 24/7.

MEMBERS

Mayor Bennett
Councilor Chris Hoy
Councilor Cara Kaser
Councilor Jim Lewis

CITY STAFF

Julie Warncke
Peter Fernandez
Kevin Hottmann
Robert Chandler

OTHER

Scott Mansur, DKS
Julie Fischer, Cogito
Terry Cole, ODOT
Mike Jaffe, MWVCOG

MEETING AGENDA

Friday, September 14, 2018
7:00-9:00 a.m.
Public Works Department
555 Liberty Street SE, Room 325

1. **Agenda Review and Meeting #5 Recap** **7:00**

2. **Final Project Documents** **7:05**

   Review and Approve:
   Project Handout
   Project Conclusions & Key Points
   Recommendations Table

3. **Next Steps** **8:50**

It is the City of Salem's policy to assure that no person shall be discriminated against on the grounds of race, religion, color, sex, marital status, familial status, national origin, age, mental or physical disability, sexual orientation, gender identity, and source of income, as provided by Salem Revised Code Chapter 97. The City also fully complies with Title VI of the Civil Rights Act of 1964, and related statutes and regulations, in all programs and activities.

The problem today

With traffic levels hampering downtown circulation, and long delays in west Salem, policy makers are evaluating potential transportation infrastructure.

Commercial St. at Division St. and Front St.

Wallace Rd. at Glen Creek

Court St. at Front St.

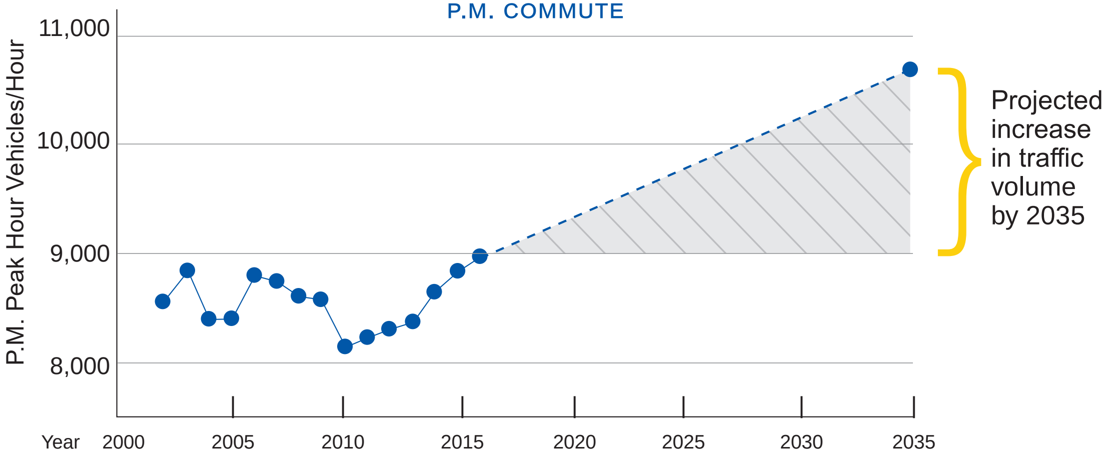
As the population of Salem increases, traffic and congestion will increase.

+20% ➔ +1% per year

GROWTH IN SALEM'S POPULATION
predicted, 2018 to 2038

AVERAGE GROWTH IN TRAFFIC VOLUME
predicted, 2016 to 2035**

Salem Bridges Traffic Volume
P.M. COMMUTE



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*2002-2016 data based on ODOT Traffic Recorders Data
**2035 PM peak hour volume based on data from the PSU Population Research Center forecasts

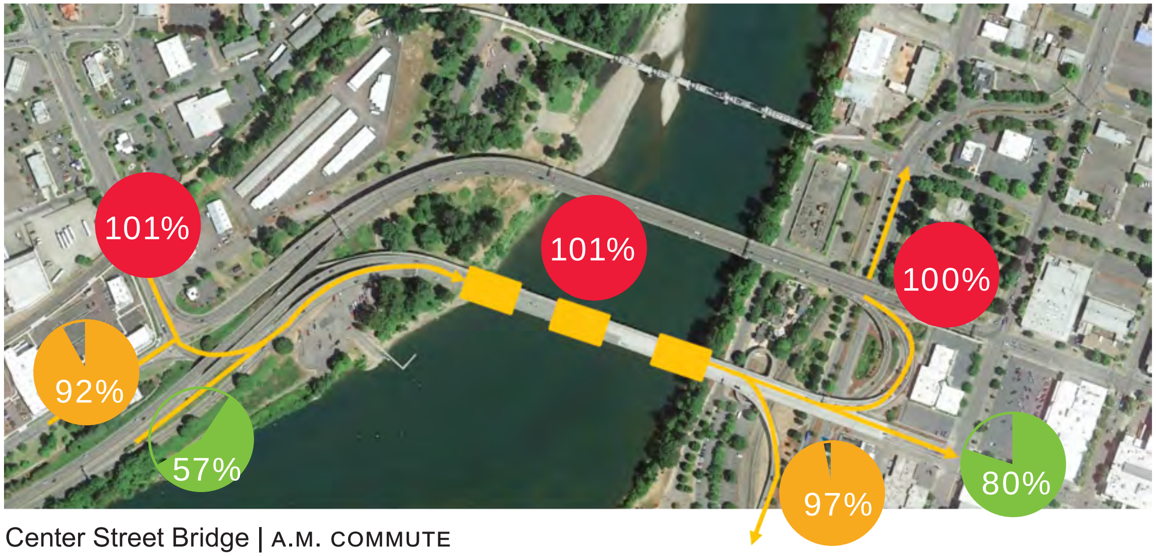
Composed of the Mayor and three City Councilors, the Salem Congestion Relief Task Force investigated potential ways for the City to relieve congestion and advise the City on policies and actions to improve traffic flow.

What causes morning and evening congestion?

Traffic jams in the morning and evening are caused by bottlenecks at the Center Street and Marion Street bridges. During morning and evening commutes, traffic on the bridges nears or exceeds capacity in many areas.

MORNING RUSH HOUR TRAFFIC CONGESTION

Measures Of Road Capacity Used During Morning Peak Traffic Hours



Center Street Bridge | A.M. COMMUTE

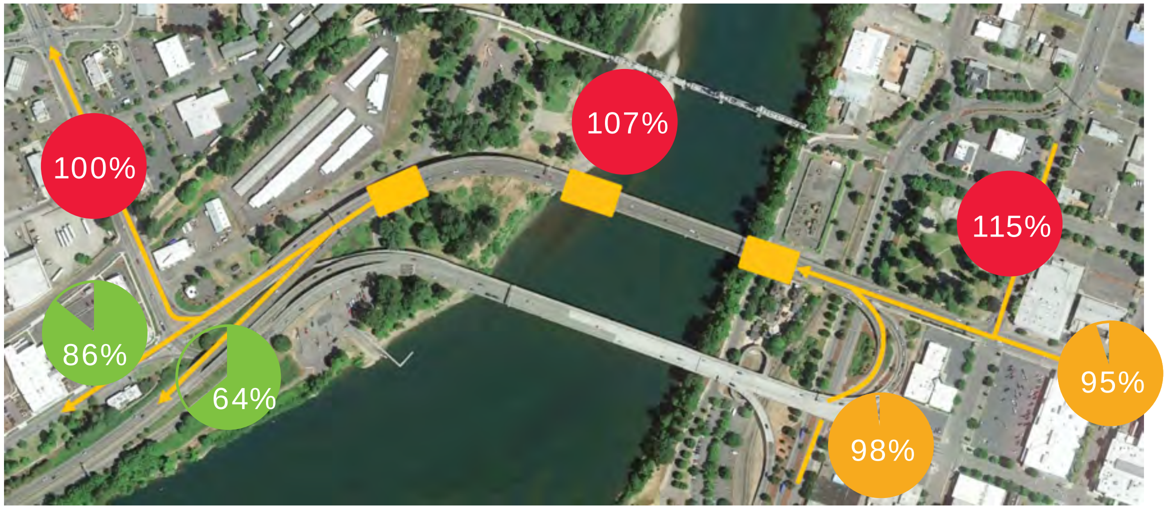
- 🟥 At or over capacity
- 🟧 Near capacity
- 🟩 Below capacity

Morning Intersection Operations

- ● Fails to meet standards
- ○ At or near standards
- ▬ Vehicle queuing (back-ups) during peak traffic hours

EVENING RUSH HOUR TRAFFIC CONGESTION

Measures Of Road Capacity Used During Evening Peak Traffic Hours



Marion Street Bridge | P.M. COMMUTE

🔴 At or over capacity
🟠 Near capacity
🟢 Below capacity

Evening Intersection Operations

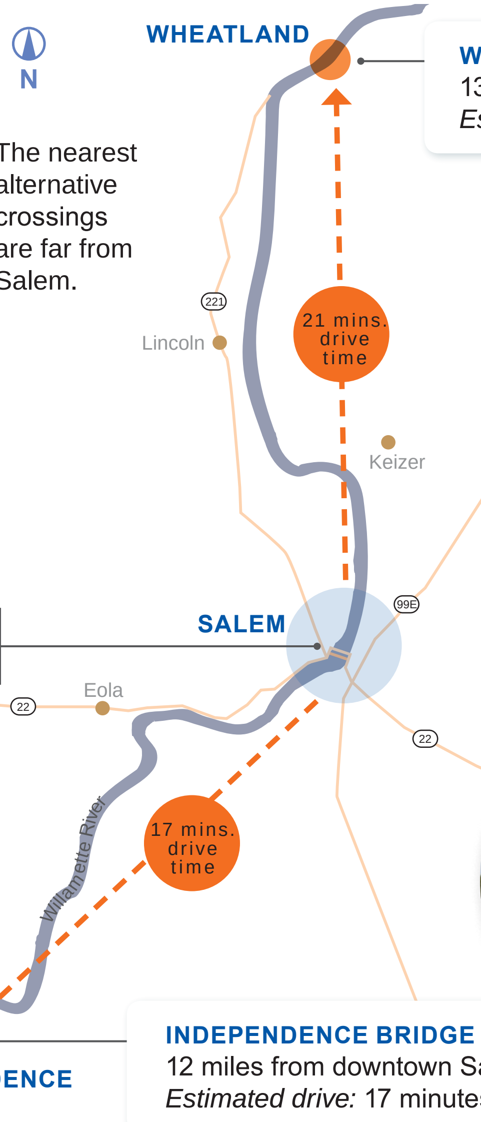
● Fails to meet standards
○ At or near standards
▬ Vehicle queuing (back-ups) during peak traffic hours

Salem Bridges: Key Connectors

Regional travelers, freight, and residents depend heavily on Salem bridges for daily travel, due to lack of alternative routes.

MARION STREET BRIDGE

CENTER STREET BRIDGE



The nearest alternative crossings are far from Salem.

WHEATLAND FERRY
13 miles from downtown Salem
Estimated drive: 21 minutes one way

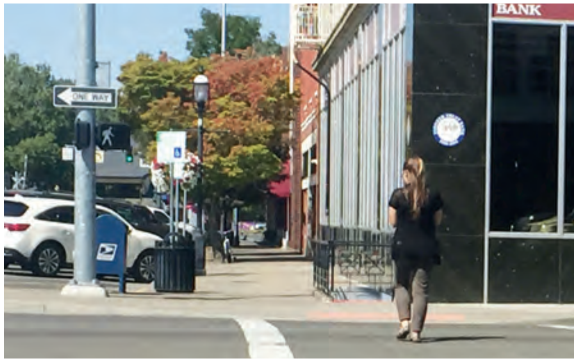
INDEPENDENCE BRIDGE
12 miles from downtown Salem
Estimated drive: 17 minutes one way

Photo credits: Marion St. and Center St. Bridges :M.O. Stevens - Own work, CC BY-SA 3.0, commons.wikimedia.org/w/index.php?curid=4706428 & commons.wikimedia.org/w/index.php?curid=4707249 Wheatland Ferry: Andrew Parodi at the English Wikipedia, CC BY-SA 3.0, commons.wikimedia.org/w/index.php?curid=9998081

Short-Term Actions

The Task Force recommends the following actions.

Guide signage
Improve guide signage leading up to and on the bridges



Increase pedestrian delays
Increase pedestrian delays at signalized intersections during peak periods

Travel time signage
Install travel time signage in the study area

Musgrave Avenue connector
Remove the barrier on Musgrave Avenue east of Wallace Road to allow traffic to access Wallace Marine Park

(Box available if Actions added)

(Box available if Actions added)

Longer-Term Options

The Task Force evaluated several packages of potential improvements. The most promising packages are described below. The Task Force did not reach consensus and therefore are not recommending these for further study.

Center Street Bridge Package

- Free right turn at Front St. north-bound off-ramp
- Widen Wallace Rd. and bridge on-ramp to 3 lanes southbound
- Add 5th lane
- Front St. south-bound dual lane off-ramp

Summary

- Improves Wallace Rd. and Front St.
- Bottlenecks still exist at both Commercial St./Front St. intersections
- Project Cost: $100–$137 million

Marion Street Bridge Package

- Widen Wallace Rd. to 3 lanes northbound
- Triple southbound right on Commercial St.
- Add 5th lane
- Note: Weaving is still present
- Additional lane on Marion St.

Summary

- Improves Commercial St., Marion St., and Wallace Rd.
- Weaving (lane-changing) on bridge still occurs, and with five lanes
- No improvements for Front St. on-ramp to bridge
- Project Cost: $55–$65 million

Considerations

- Solution packages are expensive.
- The benefits are not long-lived. Travel times initially would be reduced by as much as 50%, while some areas would not see any reduction. Travel times would return to preconstruction levels within 10 years (2028).
- Making a single improvement, rather than implementing the whole package, can help in the immediate area, but it will either move the problem to a different spot, or fail to relieve overall congestion in the area.

Project Conclusions

Increasing vehicular flows across the Marion Street and Center Street bridges during peak travel times will require an estimated $55-$65 million for the Marion Street Bridge area and $100 - $137 million for the Center Street Bridge area.

If the projects are completed, travel times in the peak hour(s) for both eastbound and westbound traffic across the bridges would be reduced by as much as 50 percent initially (some approaches to the bridge would have no travel time change); travel times would return to pre-construction levels within ten years or less after project completion.

The Task Force did not reach consensus on any long-term major capital improvements.

Key Points:

1. **The population of Salem and the region is projected to grow more than 20 percent over the next 20 years.** The majority of residential growth is expected to occur west and south of downtown.
2. **Vehicle congestion in the study area is projected to increase.** This will result in longer travel times and the duration of the morning and afternoon peak commutes on the two bridges.
3. **Congestion is directly related to vehicle flows to, from, and across the bridges.** To relieve vehicle congestion in the study area, the Task Force focused on options that would increase vehicular traffic flows across the Marion and Center Street bridges, including roads leading to and from the bridges.
4. **A congestion pricing (tolling) program could reduce vehicle congestion at peak hours.** ODOT has studied congestion pricing on I-5 and I-205 but has yet to implement it.
5. **New Transportation Demand Management (TDM) policies such as commuter reduction programs could create capacity.** Programs could include voluntary change in employment start and end times, incentives to use available ridesharing programs, and increased transit frequency during peak hours.
6. **There is no single project at a specific location that would significantly reduce congestion across the Marion Street and Center Street bridges.** To significantly reduce congestion, a set of capital projects must be packaged together. There are several lower-cost improvements that could provide benefits at specific locations or to a limited number of users. Examples include: intersection modifications; additional guide signage; enacting turn restrictions at certain times of day; providing a park and ride/walk/shuttle facility at Wallace-Marine Park; creating a circulator/trolley program, and implementing Intelligent Traffic System technologies.
7. **Improving the morning eastbound traffic flows (Center Street Bridge) costs over $100 million.** The set of capital projects that would improve eastbound traffic flows across the Center Street Bridge involves widening Wallace Road NW to three lanes southbound; widening the eastbound bridge approach structure; adding a fifth lane on the bridge; making modifications to the north and southbound off-ramps to Front Street NE and addressing downstream bottlenecks at intersections of Front/Commercial/Division streets and Front/Commercial/Trade streets. If constructed, this option is estimated to:

- Cost between $100 and $115 million if conducted in conjunction with projects to address westbound traffic (Marion Street Bridge). If not conducted in conjunction with Marion Street Bridge projects, the cost increases by approximately $19 to $22 million.
- Initially reduce peak travel times by approximately 50 percent. Travel times would return to pre-construction levels approximately ten years following project completion.

8. **Improving evening westbound traffic flows (Marion Street Bridge) costs over $55 million.** The set of capital projects that would improve westbound traffic flows across the Marion Street Bridge involves adding a third right turn lane on Commercial Street; adding an additional westbound lane on Marion Street NE by removing parking; widening the bridge approaches; adding a fifth lane on the bridge; removing the pedestrian sidewalk on the bridge and widening Wallace Road NW to three northbound lanes. If enacted, this option is estimated to:
    - Cost between $55M and $65 million.
    - Initially reduce peak travel times 30 and 50 percent for vehicular traffic originating from north and east of the Marion Street Bridge, respectively. Travel times for traffic originating from south of the bridge would remain unchanged. All travel times would return to pre-construction levels less than ten years following project completion.
9. **In addition to the capital costs of each of the project packages, there are also social, environmental, and economic costs.** For example, property acquisition and condemnation; business and travel disruption; impacts to public parks and recreation, and construction involving the regulated floodplain, over-water work, and the Willamette Greenway. Quantifying these costs was outside of the scope of the Task Force.
10. **Currently, Salem does not have adopted standards for travel times between points and has not established a threshold above which a travel time is considered unacceptable.** Salem does have adopted standards for roadways and intersections related to volumes and capacities. The preferred options would result in improvements to these standards, but traffic growth over time would erode these gains.
11. **Seismic retrofits are likely for the Center Street Bridge but unlikely for the Marion Street Bridge.** The Oregon Department of Transportation (ODOT) will be conducting a study to determine whether the Center Street Bridge needs to be seismically retrofitted and, if so, the cost for retrofitting. Depending on the results of the study, ODOT may retrofit the bridge; $60 million was identified in legislation towards this work. ODOT has determined it will not retrofit the Marion Street Bridge because doing so is not cost-effective.

R: Recommend **FR: Further Research** **NO: Do Not Recommend** **Blank: Space left blank**	**Potential Action/Project/Policy/Funding**	**Description**	**Yellow: Short-Medium Term** **Blue: Medium-Long Term** **Green: Long-Term** **Purple: Funding Strategy**	**Results/Cost Estimate**
R4	Guide signage	Improve guide signage leading up to and on the bridges	Short-term	$250,000 per location
R4	Increase pedestrian delays	Increase pedestrian delays at signalized intersections during peak periods	Short-term	Staff time only
R4	Musgrave Avenue connector	Remove the barrier on Musgrave Avenue east of Wallace Road to allow traffic to access Wallace Marine Park	Short-term	$50,000
R4	Travel time signage	Install travel time signage in the study area	Short-term/Medium-term	$500,000 - $1 million each sign
R2, FR2	Variable speed limit signs	Install variable speed limit signs on Highway 22	Short-term/Medium-term	$500,000 - $1 million each sign
R2, FR2	Parking Management	Switch from Monthly to Daily Fee Parking, Vary rates during day to discourage parking at peak periods, Increase pricing for parking at structures and on-street, tax parking spaces, offer parking cash-out programs	Short-term	To be determined
R2, FR2	Downtown circulator	Provide increased transit circulation in downtown area	Short-term/Medium-term	To be determined
R2, FR2	Park and Walk/Bike/Shuttle	Provide park and walk/bike/shuttle services at Wallace Marine Park	Short-term/Medium-term	To be determined
R2, FR2	Taggart Dr/Wallace Rd	Add additional through and/or right turn lane on the east and wesbound Taggart Dr approaches	Medium-term	$10 million
FR4	Parking Pricing	Implement or increase parking costs	Short-term	Reduces peak hour vehicle demand and increases alternative modes

R: Recommend FR: Further Research NO: Do Not Recommend Blank: Space left blank	Potential Action/Project/Policy/Funding	Description	Yellow: Short-Medium Term Blue: Medium-Long Term Green: Long-Term Purple: Funding Strategy	Results/Cost Estimate
FR4	Identify acceptable travel time standards	Research and conduct outreach to the public to assess perceptions and thresholds for levels of congestion for road users	Short-term	Increases public understanding of costs and benefits of projects
FR4	2nd Street Undercrossing	Connect 2nd Street under Wallace Road to the proposed Marine Drive roadway, build an additional off-ramp lane from Marion Street bridge to 2nd St/Marine Dr	Medium-term/Long-term	$30 - $40 million
FR4	Front Street minor arterial	Widen Front Street to a minor arterial standard	Medium-term/Long-term	To be determined
FR4	Murlark Avenue connector	Extend Murlark Avenue north to Glen Creek Road	Medium-term	$15 - $20 million
FR4	Gas Tax	Sales tax imposed on sale of gasoline to fund transportation or road projects. Requires voter approval.	Funding Strategy	
FR4	Bonds	Issued by the City to fund capital projects such as building highways or road improvement projects. Requires voter approval.	Funding Strategy	
R2, FR1, Blank1	Close north crosswalk at Front St/Court St	Close north crosswalk at Front St/Court St	Short-term	Decreases vehicle delay for vehicles turning right off Court St onto Front St
R2, FR1, Blank1	Improve signal timing/Adaptive signal timing	Study signal timing or look at intersections that could benefit from advanced traffic signal management	Short-term	Improve vehicle operations
R2, FR1, Blank1	Improve incident management	Improve response to emergencies on the bridges	Short-term	Improve vehicle operations by clearing roadways of accidents
R1, FR1, Blank2	Construct Marine Drive from Cameo to Harritt Drive	Construct Marine Drive from Cameo to Harritt Drive	Short-term/Medium-term	Provides alternate north-south route of Wallace Road
R1, FR1, Blank2	Flexible work hours	Work with State and major employers to develop and implement a commute trip reduction plan that includes flexible work hours	Short-term	Reduces peak hour vehicle volume
R1, FR1, Blank2	Multimodal/carpool incentives	Work with State and major employers to develop and implement incentives for employees to use other modes of transportation (bike, walk, transit, carpool)	Short-term	Reduces peak hour vehicle demand and increases alternative modes
R3, NO1	Bike/Ped connections to Union St Bridge	Continue to expand and build pedestrian and bicycle connections to the Union St Bridge	Short-term/Medium-term	To be determined

R: Recommend **FR: Further Research** **NO: Do Not Recommend** **Blank: Space left blank**	**Potential Action/Project/Policy/Funding**	**Description**	**Yellow: Short-Medium Term** **Blue: Medium-Long Term** **Green: Long-Term** **Purple: Funding Strategy**	**Results/Cost Estimate**
R3, NO1	Median/Turn restrictions on Wallace Road	Install a center lane barrier or prohibit turns from Wallace onto Taggart Drive	Short-term/Medium-term	To be determined
R2, NO2	Center St bridge Solution Package #1	Widen Wallace Rd to three lanes SB onto Center St bridge, add fifth lane on Center St bridge, remove signal at Center St bridge off-ramp to Front St NB, widen Front St NB to three lanes from Center St bridge off-ramp to Commercial St (up to Market St), widen the Front St approach to dual exclsuive right turn lanes and dual exclusive through lanes at Commercial St/Trade St	Long-term	$100 - $137 million
R2, NO2	Marion St bridge Solution Package #4b	Triple southbound right turn lanes on Commercial, four through lanes on Marion St, add fifth lane to Marion St bridge, three lane off-ramp to Wallace Road, widen Wallace Rd to 3 northbound lanes through Glen Creek Rd	Long-term	$55- $65 million
R2, NO2	Widen High St southbound	Extend two southbound lanes on High St from Union St to Liberty St (remove parking) and make southbound right turn free flow at Marion St	Medium-term	$500,000 - $1 million
FR3, NO1	Multi-modal grade-separated crossing of Front St	Install a grade-separated crossing of Front St between downtown and Riverfront Park and remove the existing pedestrian crossings of Front St	Medium-term	$10 - $20 million
FR3, NO1	Multi-modal grade-separated crossing near Marion St/High St	Install a grade-separated crossing near Marion St/High St and remove the existing pedestrian crossings at the intersection to reduce vehicle delay	Medium-term	$10 - $20 million
FR3, NO1	Wallace Road through and turn lanes	Add through and right turn lanes to Wallace Road (from Highway 22 to Brush College Rd)	Medium-term/Long-term	$120 - $150 million
FR2, NO2	Congestion Pricing	Implement a charge for roadway or bridge trips during the peak periods	Short-term/Medium-term	Decreases demand and funds transportation improvements.
NO3, Blank1	Central Salem Mobility Study	Revisit adopted projects from Central Salem Mobility Study that reduce vehicle capacity	Short-term	

R: Recommend FR: Further Research NO: Do Not Recommend Blank: Space left blank	Potential Action/Project/Policy/Funding	Description	Yellow: Short-Medium Term Blue: Medium-Long Term Green: Long-Term Purple: Funding Strategy	Results/Cost Estimate
NO3, Blank1	Marion St bridge Solution Package #4a	Triple southbound right turn lanes on Commercial, four through lanes on Marion St, add fifth lane to Marion St bridge, Off-ramp to Marine Dr which connects up to Riverbend Road	Long-term	$80 - $95 million