DATE: June, 20 2011

TO: Oregon Transportation Commission

FROM: Matthew L. Garrett
Director

SUBJECT: Adoption of Interstate 84, Troutdale Interchange Area Management Plan (IAMP)

Requested Action

Adopt the Interstate 84at Exit 27, Troutdale Interchange Area Management Plan (IAMP) in Multnomah County, which implements Policy 3C of the Oregon Highway Plan and is consistent with the IAMP requirements of the department's Access Management Rule (OAR 734-051-0155). Adoption of the IAMP will constitute an amendment to the 1999 Oregon Highway Plan.

Background

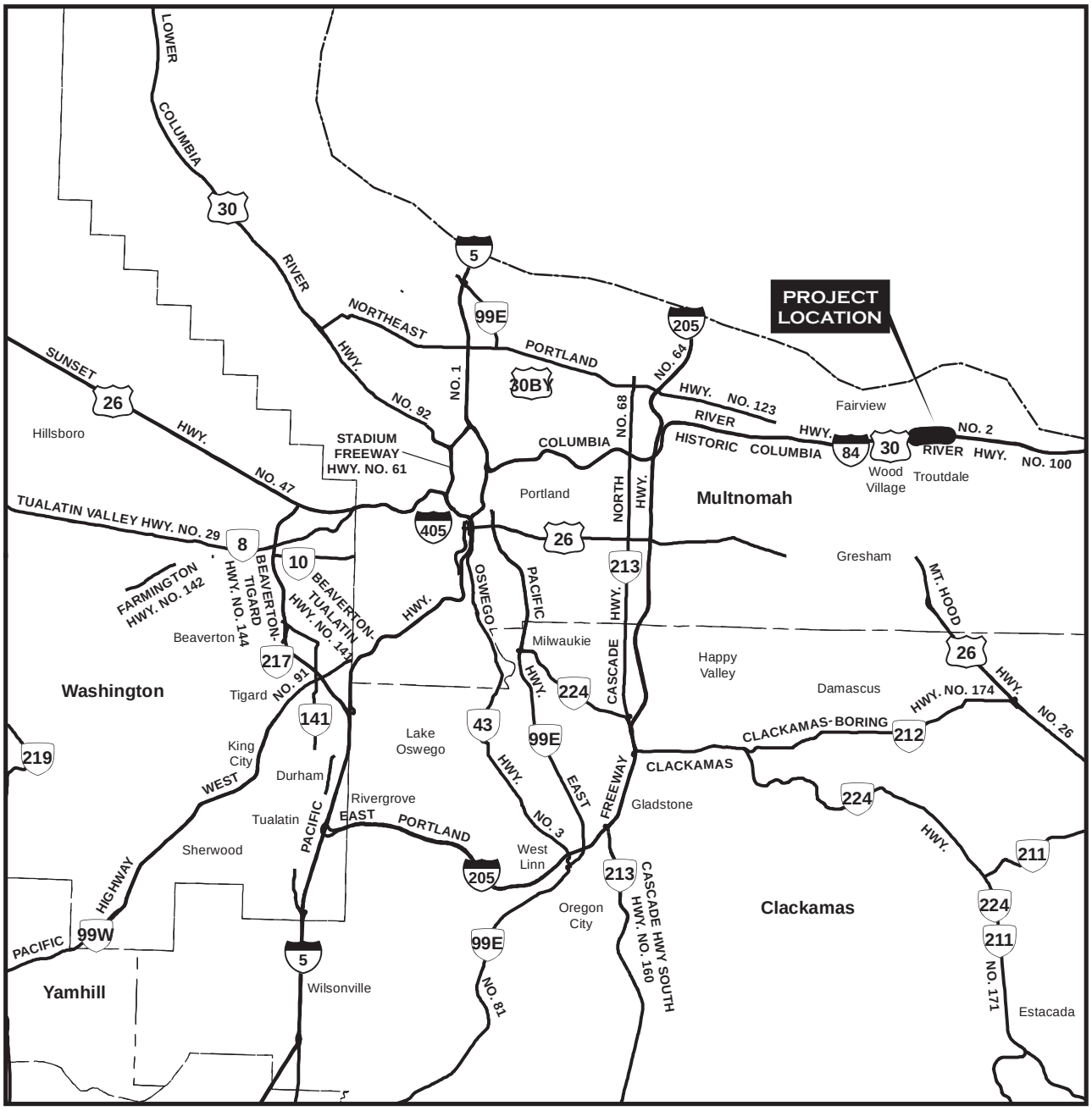
The IAMP was prepared in coordination with the City of Troutdale, Multnomah County, and the Port of Portland. The Oregon Department of Transportation worked with these jurisdictions to develop an IAMP that protects the function of the interchange and identifies needed improvements. The city has adopted the IAMP into its comprehensive plan and implemented ordinances into its land use code Region planning staff contacted the Department of Land Conservation and Development, which indicated support for the plan; however, the department received no written correspondence.

Copies (w/attachments) to:

Jerri Bohard	Joan Plank	Patrick Cooney	Clyde Saiki
Paul Mather	Barbara Fraser	Robert Maestre	Nancy Murphy
Frank Reading	Michael Baker		

STIP PROJECT VICINITY

ODOT REGION 1



I-84 TROUTDALE IAMP
KEY NO. to be assigned

LEGEND

- PROJECT LOCATION
- STATE HIGHWAY
- COUNTY BOUNDARY
- STATE BOUNDARY

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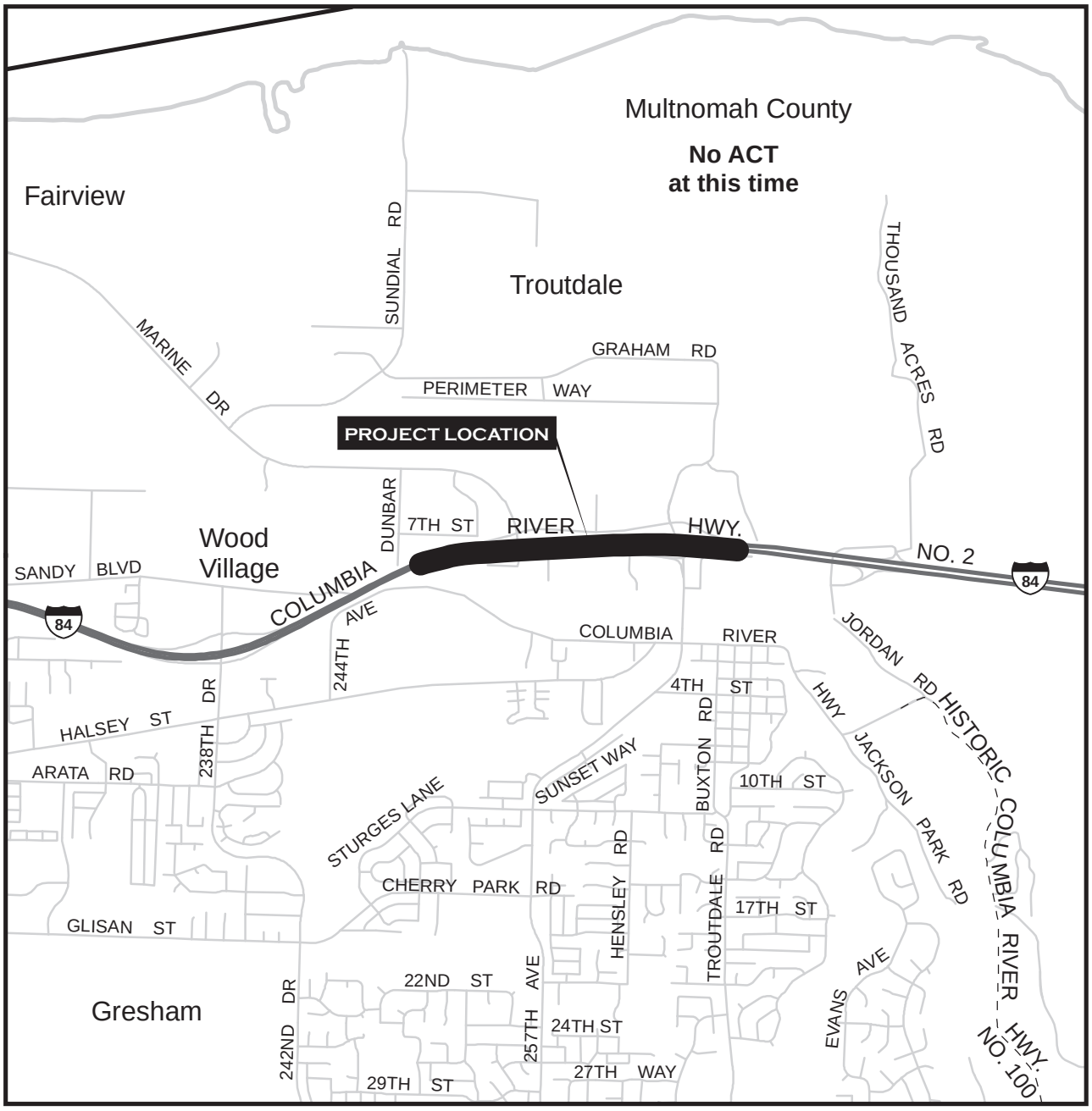
STIP PROJECT LOCATION

ODOT REGION 1



LEGEND

PROJECT LOCATION

STATE HIGHWAY CLASSIFICATION

- INTERSTATE
- STATEWIDE
- REGIONAL / DISTRICT

- REGIONAL BOUNDARY
- COUNTY BOUNDARY
- ACT BOUNDARY

I-84 TROUTDALE IAMP
KEY NO. to be assigned

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TO: Oregon Transportation Commission

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Adopt the Interstate 84at Exit 27, Troutdale Interchange Area Management Plan (IAMP) in Multnomah County, which implements Policy 3C of the Oregon Highway Plan and is consistent with the IAMP requirements of the department's Access Management Rule (OAR 734-051-0155). Adoption of the IAMP will constitute an amendment to the 1999 Oregon Highway Plan.

Background

The IAMP was prepared in coordination with the City of Troutdale, Multnomah County, and the Port of Portland. The Oregon Department of Transportation worked with these jurisdictions to develop an IAMP that protects the function of the interchange, identifies needed improvements, and outlines ways to coordinate our investments. The city has adopted the IAMP by resolution because no TSP amendments were identified. Region planning staff contacted the Department of Land Conservation and Development to review the draft plan via e-mail in late May; however, the department received no written correspondence. DLCD staff was not aware that it was scheduled for OTC adoption until the OTC agenda was distributed in early July.

Copies (w/attachments) to:

Jerri Bohard	Joan Plank	Patrick Cooney	Clyde Saiki
Paul Mather	Barbara Fraser	Robert Maestre	Nancy Murphy
Frank Reading	Michael Baker		

DKS Associates

1400 SW 5th Avenue
Suite 500
Portland, OR 97201
Phone: 503-243-3500

Interstate 84 TroutdaleInterchange Area Management Plan

Interstate 84 (Exit 17)
Troutdale, Oregon

May 2011

Study Participants

Oregon Department of Transportation
Andrew Johnson, ODOT, Major ProjectsManager
Todd Juhasz, ODOT, Senior Major Projects Planner
Simon Eng, ODOT, Senior Traffic Analyst
John Wolf, ODOT, Senior Roadway Designer

City of Troutdale
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Danella Whitt, Graphics

CH2M Hill
Brandy Steffen, Public Involvement Specialist

Angelo Planning Group
DJ Heffernan, AICP
Katie Prew, AICP

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Glossary of Terms

CIA	Cooperative Improvement Agreement
HCM	Highway Capacity Manual
HDM	Highway Design Manual
IAMP	Interchange Area Management Plan
LOS	Level of Service
MOU	Memorandum of Understanding
OAR	Oregon Administrative Rule
ODOT	Oregon Department of Transportation
OHP	Oregon Highway Plan
ORS	Oregon Revised Statutes
OTC	Oregon Transportation Commission
PAC	Project Advisory Committee
PMT	Project Management Team
TPR	Transportation Planning Rule
TSP	Transportation Systems Plan
TRIP	Troutdale Reynolds Industrial Park
UGB	Urban Growth Boundary
V/C	Volume-to-Capacity Ratio

Executive Summary

This Interchange Area Management Plan (IAMP) presents how the City of Troutdale and ODOT will improve the Interstate 84 (Exit 17) interchange to serve planned growth. The IAMP describes the extent of operational and access management solutions that are recommended, and the steps needed to implement the various improvements.

Background

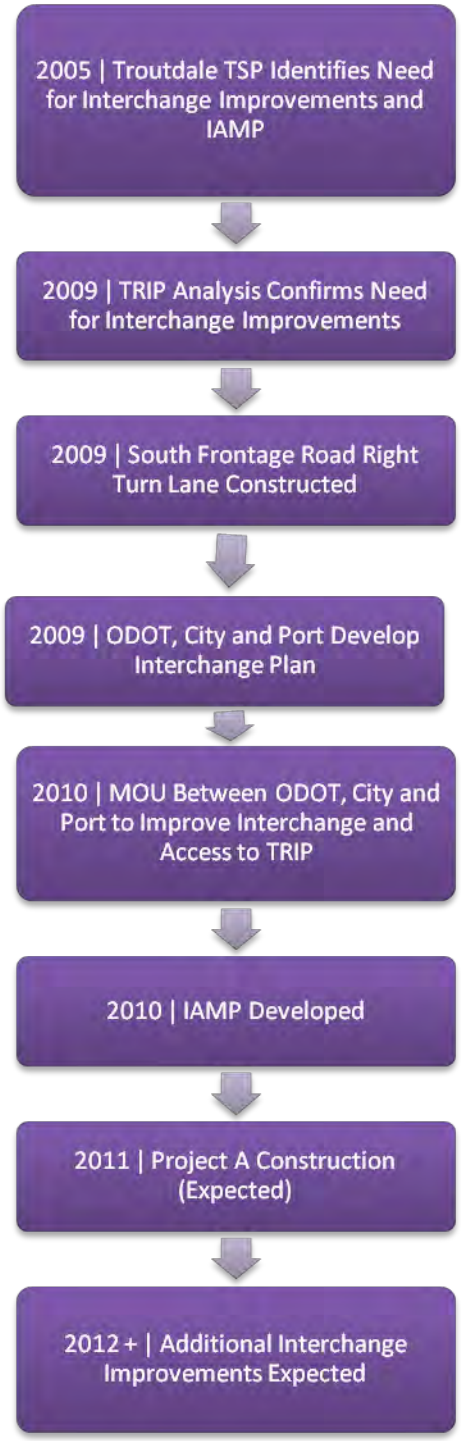
In 2005, The City of Troutdale adopted an update to its Transportation System Plan (TSP) that identified the need for improvements in the vicinity of the I-84 Troutdale Interchange as well as the need for an Interchange Area Management Plan (IAMP).

In 2009, traffic studies conducted for the Troutdale Reynolds Industrial Park (TRIP) development confirmed the need for improvements at the interchange in order to accommodate development associated with the Industrial Park.

Also that year, aproject funded by ODOT, Port of Portland, City of Troutdale and federal stimulus funds added an additional eastbound to southbound right turn lane for traffic headed east on South Frontage Road to 257th Avenue. The project was completed in December, 2009.

Also in 2009, the State Legislature passed the Jobs and Transportation Act which allocated $24 million to improve the interchange. ODOT, the City of Troutdale and Port of Portlanddeveloped a plan to improve the interchange. The plan was memorialized in a Memorandum of Understanding to obtain funding for the I-84 Troutdale interchange to improve safety in the vicinity of the interchange and improve freight access between I-84 and the industrial lands to the north of the interchange. The Memorandum of Understanding further states that the partners (ODOT, City of Troutdale and Port of Portland) participate jointly in planning refinement, the environmental permitting process, as well as construction oversight for the Project improvements identified, including an Interchange Area Management Plan (IAMP) for any significant improvements at the interchange.

The plan included the following elements:



1. Project A - Widening the eastbound off-ramp at the interchange to accommodate additional turn lanes and additional storage, and adding a third through lane to South Frontage Road. Adding intersection improvements at the northeast quadrant of the interchange to improve operations at the ramp terminal and provide storage

2. Project B - Widening the Marine Drive under crossing to five lanes for two-way traffic and improve vertical clearance, as well as improving the intersection in the NW quadrant of the interchange to improve operations and add storage

This IAMP assumes that improvements identified as "Project A" will be constructed in the near term (currently planned for 2011) and considers whether "Project B" improvements should be the next to be constructed should more funding become available.

The major objectives and outcomes of an IAMP include:

- The IAMP must be adopted by the City of Troutdale and the Oregon Transportation Commission before construction of the Project B interchange area improvements can begin.
- The IAMP must identify opportunities to improve operations and safety and adopt strategies and development standards to capture those opportunities.
- Short, medium and long-range actions must be developed to improve operations and safety in the interchange area.
- The City's Comprehensive Plan land use assumptions must be considered in the IAMP, and
- The IAMP must be consistent with any locally adopted plan, especially the City's Comprehensive Plan and Transportation System Plan as well as ODOT's 1999 Oregon Highway Plan.

Problem Statement

Recent traffic studies have shown that the I-84 Troutdale interchange is approaching capacity. Recurring safety issues at the eastbound exit ramp at Exit 17 have been observed during evening peak hours, as vehicle queues have been reported to back up onto the mainline freeway during this period. This condition is caused by a lack of capacity and storage at the I-84 Troutdale Eastbound exit ramp terminal, as well as operational issues along South Frontage Road. These issues include conflicts between truck and auto traffic at business accesses along South Frontage Road.

Plan Development

The IAMP was developed based on the City of Troutdale's Comprehensive Plan land use assumptions, with specific detail assumed for the Troutdale Reynolds Industrial Park area. Some of the land within the IAMP Management Area (illustrated in Figure 1) is already fully developed. Of the undeveloped lands within the Management Area, the areas that have the most potential to significantly impact the interchange are the undeveloped commercial land south of South Frontage Road and the undeveloped General and Light Industrial properties north of North Frontage Road adjacent to the Troutdale Airport. Additionally, the Troutdale Reynolds Industrial Park (TRIP) is located outside the Management Area, but within the IAMP Study Area, and is likely to contribute a significant amount of traffic to the interchange. All of these areas were fully accounted for in the trip generation assumed in developing the 2035 traffic volumes in the IAMP.

The I-84TroutdaleIAMP document consists of two major sections: the IAMP and the supporting technical appendices. The plan includes the IAMP purpose and objectives, a function statement, physical improvements, access management plans and the process used to implement, monitor and update the IAMP.

The appendices include the technical analysis performed to develop the IAMP, a summary of the public involvement process and findings of compliance.

Plan Actions

The IAMP calls for actions in three key areas: physical improvements, access management and implementation.

Physical Improvements
This action includes construction of the physical improvements required for the interchange to operate under acceptable standards through the year 2035. These improvements include the planned enhancement of the interchange, including the Project A improvements currently being designed and constructed by ODOT, along with additional improvements identified in this IAMP to provide for a functioning interchange into the future.

Access Management
A key plan element was developed to help protect capacity in the interchange once the physical improvements are constructed. An access management plan identifies key long-term (upon development or redevelopment) actions for improving access control in the vicinity of the interchange. This plan will help protect capacity in the interchange.

Introduction

The I-84/257th Interchange Area Management Plan (IAMP) has been prepared to implement plans and strategies for the planned reconstruction of an existing interchange on Interstate 84 at 257th Avenue. "Project A" improvements to the interchange will upgrade key elements, including ramp widening, widening on both South Frontage Road and North Frontage Road and improvements to the Graham Road/North Frontage Road intersection. Figure 1 shows the project area.

Purpose and Intent

An IAMP is required for any new or significantly reconstructed interchange by OAR 734-051-0155(6). More importantly, the purpose of an IAMP is to protect the function of the interchange and, consequently, the state's and local agency's investment in the facility. New interchanges and improvements to existing interchanges are very costly. State and local government and their citizens have an interest in ensuring that their interchanges function efficiently. Engineering design work is underway for the next phase of improvements to the I-84/257th interchange and this IAMP is being conducted to ensure that the ultimate design will effectively reflect the needs of the interchange for at least the next 25 years.

Problem Statement

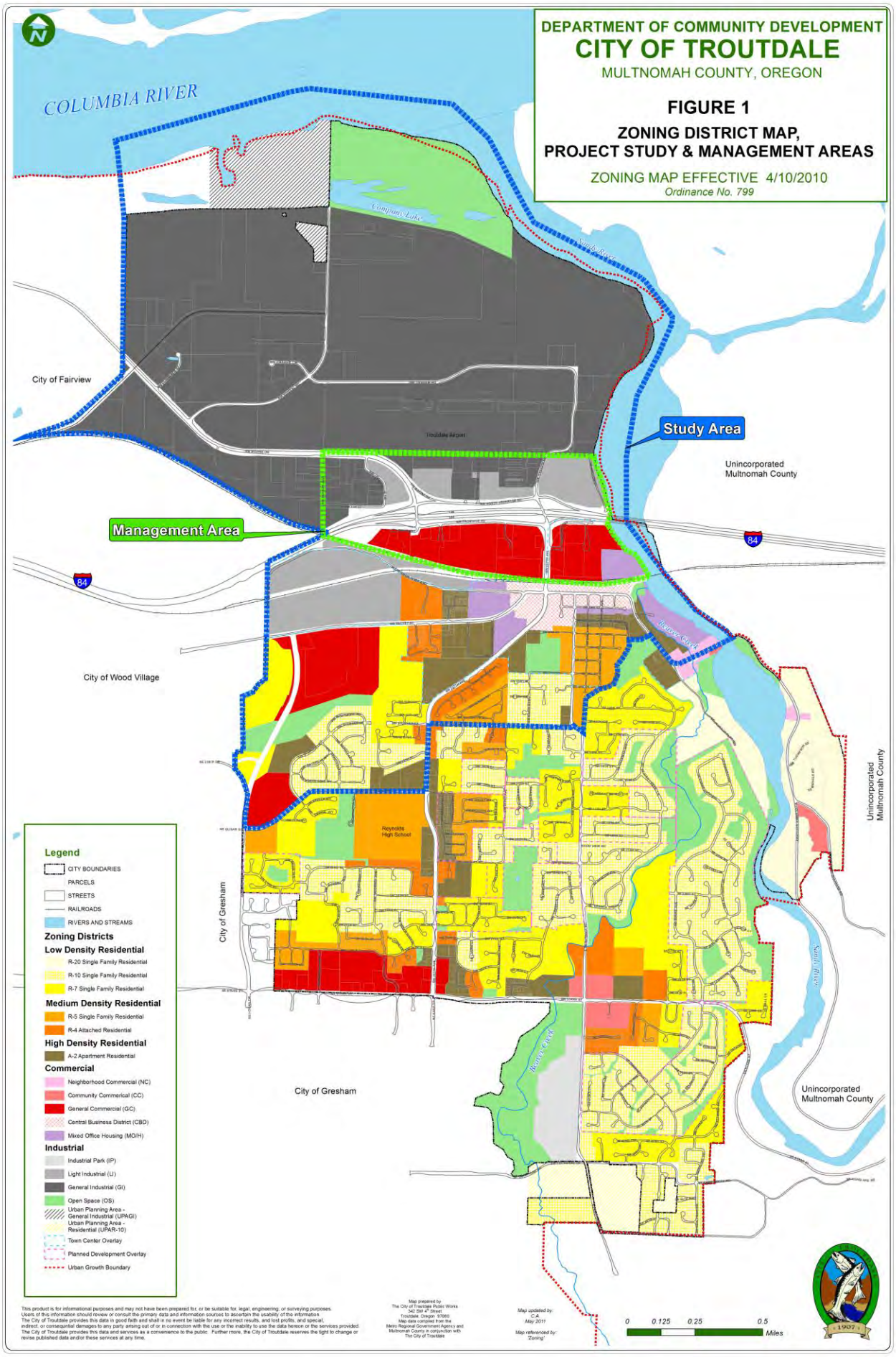
The I-84 257th Avenue (Exit 17) interchange has experienced congestion at several of its intersections and the eastbound off-ramp regularly backs up onto I-84 resulting in rear end collisions. Over the years, a number of improvements have been identified, some of which have been recently constructed and others for which funding is currently available or will be available in the near future. Funds have been allocated through the Governor's Jobs and Transportation Act (JTA) in 2009 to construct projects within the interchange area to support job growth and economic development in this area.

The Oregon Department of Transportation (ODOT), City of Troutdale and the Port of Portland have outlined a series of specific improvement projects that will address existing safety and mobility needs identified in past planning studies, as well as provide capacity enhancement to serve economic growth in the area.

In 2005, the City of Troutdale adopted an update to its Transportation System Plan (TSP). This TSP identified the need for improvements in the vicinity of the I-84/257th Avenue interchange as well as the need for an Interchange Area Management Plan (IAMP). Additionally, recent traffic studies associated with the Troutdale Reynolds Industrial Park (TRIP) have shown that the I-84 257th Avenue interchange will not meet performance standards in the future with development of the Industrial Park.

Based on the preceding analysis, a series of interchange improvements have been constructed, or are planned. In fall of 2009, ODOT partnered with the Port of Portland and City of Troutdale to complete construction on widening the South Frontage Road at Graham Road to include a second dedicated eastbound right turn lane.

JTA funded interchange improvements are in the design process and planned for construction in summer 2011 (see Table 1 for details).


DEPARTMENT OF COMMUNITY DEVELOPMENT
CITY OF TROUTDALE
MULTNOMAH COUNTY, OREGON
FIGURE 1
ZONING DISTRICT MAP,
PROJECT STUDY & MANAGEMENT AREAS
ZONING MAP EFFECTIVE 4/10/2010
Ordinance No. 799
COLUMBIA RIVER
Company Lake
Sandy River
City of Fairview
Troutdale Airport
Study Area
Unincorporated
Multnomah County
Management Area
84
Beaver Creek
City of Wood Village
Reynolds
High School
City of Gresham
Unincorporated
Multnomah County
Sandy River
Beaver Creek
Unincorporated
Multnomah County
Legend
CITY BOUNDARIES
PARCELS
STREETS
RAILROADS
RIVERS AND STREAMS
Zoning Districts
Low Density Residential
R-20 Single Family Residential
R-10 Single Family Residential
R-7 Single Family Residential
Medium Density Residential
R-5 Single Family Residential
R-4 Attached Residential
High Density Residential
A-2 Apartment Residential
Commercial
Neighborhood Commercial (NC)
Community Commerical (CC)
General Commercial (GC)
Central Business District (CBD)
Mixed Office Housing (MO/H)
Industrial
Industrial Park (IP)
Light Industrial (LI)
General Industrial (GI)
Open Space (OS)
Urban Planning Area - General Industrial (UPAGI)
Urban Planning Area - Residential (UPAR-10)
Town Center Overlay
Planned Development Overlay
Urban Growth Boundary
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Map prepared by:
The City of Troutdale Public Works
342 SW 4th Street
Troutdale, Oregon 97060
Map data compiled from the
Metro Regional Government Agency and
Multnomah County in conjunction with
The City of Troutdale
Map updated by:
C.A.
May 2011
Map referenced by:
'Zoning'
0 0.125 0.25 0.5
Miles
1907

Table 1: Current JTA Funded Project List of 257th Avenue Interchange Improvements

Location	Description
I-84 Eastbound off-ramp	Add third lane approach to ramp terminal to increase vehicle queue space.
South Frontage Road	Add third eastbound lane between Marine Drive and Graham Road
North Frontage Road	Add third westbound lane from Graham Road to Marine Drive. The third lane will become a right-turn only lane onto Marine Drive
Graham Road / North Frontage Road	Construct 2nd northbound left turn lane Add westbound right-turn lane Add southbound free flow right-turn lane which merges into new 3rd westbound lane
Various Intersections	Traffic signal upgrades

These improvements are needed because the I-84 eastbound off-ramp at Marine Drive is likely to back up onto the mainline freeway in the future, which is a serious safety concern. South Frontage Road is congested during morning and evening peak periods and heavy truck traffic further exacerbates the congestion. The intersection at Graham Road/North Frontage Road experiences a significant amount of congestion, particularly during the AM peak period. This congestion is due, in part, to vehicles heading northbound from Troutdale to westbound I-84 toward Portland conflicting with vehicles coming from the east on I-84 into Troutdale. This intersection will be further impacted as TRIP develops.

If additional JTA funding is available, ODOT, the City of Troutdale and the Port of Portland will work together to determine the best use of the funding. Potential future improvements are summarized in Table 2.

Table 2: Potential future JTA Funded Project List of 257th Avenue Interchange Improvements

Location	Description
Marine Drive	Extend south of the South Frontage Road, looping east to form a bypass road to the commercial uses and connect to Graham Road at 257th Way (opposite the Outlet Mall)
I-84 Underpass at Marine Drive	Reconstruct underpass between the North Frontage Road and South Frontage Road to allow for standard vertical and horizontal clearance, and provide two additional travel lanes. This construction would allow for two-way circulation as identified in the Troutdale TSP. Provide northbound left-turn lane, two northbound through lanes Widen I-84 Eastbound Off-Ramp to provide an eastbound left-turn lane onto Marine Drive
I-84 Eastbound Off-Ramp / Marine Drive	Widen approach to provide an additional eastbound through lane

IAMP Goals and Objectives

The goals and objectives of the I-84 Troutdale IAMP should reflect the intentions and interests of ODOT, the City of Troutdale, the Port of Portland, Multnomah County and other key stakeholders for the interchange and transportation operations in the area. The goals and objectives should be guided by, but not re-statements of, OHP policies and OAR language. The objectives need to be concrete statements that relate what the plan is trying to accomplish and should be achievable and measureable. The objectives serve as the basis for data collection and research and as alternative evaluation criteria to guide alternatives analysis and selection of the preferred alternative, and to guide management decisions. The goals developed for this IAMP are listed below and the goals and objectives together are listed in the appendix.

Goal 1: Protect the function and operation of the interchange and the state highway as follows:

I-84 is classified as an Interstate Highway. It is part of the National Highway System and is a designated freight route between Portland and points east. The operational objective for Interstate Highways is to provide safe and efficient high-speed travel in urban and rural areas.

Goal 2: Provide for an adequate system of local roads and streets for access and circulation within the interchange area that minimizes local traffic through the interchange and on the interchange cross roads.

Goal 3: Provide safe and efficient multi-modal travel between the connecting roadways (and the surface street network, if applicable).

Goal 4: Ensure future changes to the planned land use system are consistent with protecting the long-term function of the interchange and the surface street system and the integration of future transportation projects and land use changes.

Goal 5: Recognize the importance of the interchange function to support local and regional economic development goals and plans.

Goal 6: Ensure that the needs of regional through trips and the timeliness of freight movements are considered when developing and implementing the IAMP, in particular when planning for improvements that directly impact freight routes.

Interchange Management Area

Figure 1 illustrates the Interchange Management Area (IMA). The IMA delineates the area around the I-84 Troutdale interchange in which specific IAMP access and management regulations apply to land use decisions. The IMA includes those properties that currently have or are expected to have the greatest impact on operations at the interchange.

The management area is defined by tax lot parcel boundaries extending from the railroad tracks just north of the Historic Columbia River Highway to the south, just north of the airport to the north, approximately ½ mile to the west and approximately ½ mile to the east of the interchange ramp terminals.

Figure 1**Error! Reference source not found.** also illustrates the project Study Area. The Study Area extends from the Columbia River to the north, the Sandy River to the east, the Troutdale City Limits line to the west and Cherry Park Road to the south. The traffic analysis for the IAMP assumed development of much of the undeveloped land within the Study Area (more detail in Future Conditions memorandum in the appendix).

Existing Conditions

Existing Land Use

The selected geographic boundaries for the IAMP study area include the Columbia River to the north, the Sandy River to the east, City Limits to the west, and Cherry Park Avenue/Sandy Avenue/Historic Columbia River Highway to the south. The study area and proposed management area are both illustrated inthe appendix, which shows all existing streets and property zoning within the study area boundaries. The City's Comprehensive Plan is also shown in the appendix.

Within the study area, most lands are zoned for commercial, residential or industrial uses. The commercial lands tend to be located in the middle of the study area, near the interchange with residential lands adjacent to the south. Industrial land is located primarily on the north end of the study area, north of the interchange.

Table 3 provides total acreages for each zone type and identifies lands currently undeveloped. All of the land within the IAMP management area is zoned for industrial and commercial uses, while none of the land is zoned for residential use. A substantial portion of the land in both the Management Area and Study Area is currently vacant (24% and 50%, respectively).

Table 3: Land Use within the I-84 257th Avenue IAMP Study Area and Management Area

Land Use	Study Area		Management Area	
	Total Acres/ (Vacant)	Percentage/ (Vacant)	Total Acres/ (Vacant)	Percentage/ (Vacant)
Residential	285 (44)	14% (15%)	0 (0)	0% (0%)
Commercial	241 (36)	11% (15%)	107 (18)	39% (17%)
Industrial	1,580 (965)	75% (61%)	167 (48)	61% (29%)
Total	**2,106 (1,045)**	**100% (50%)**	**274 (66)**	**100% (24%)**

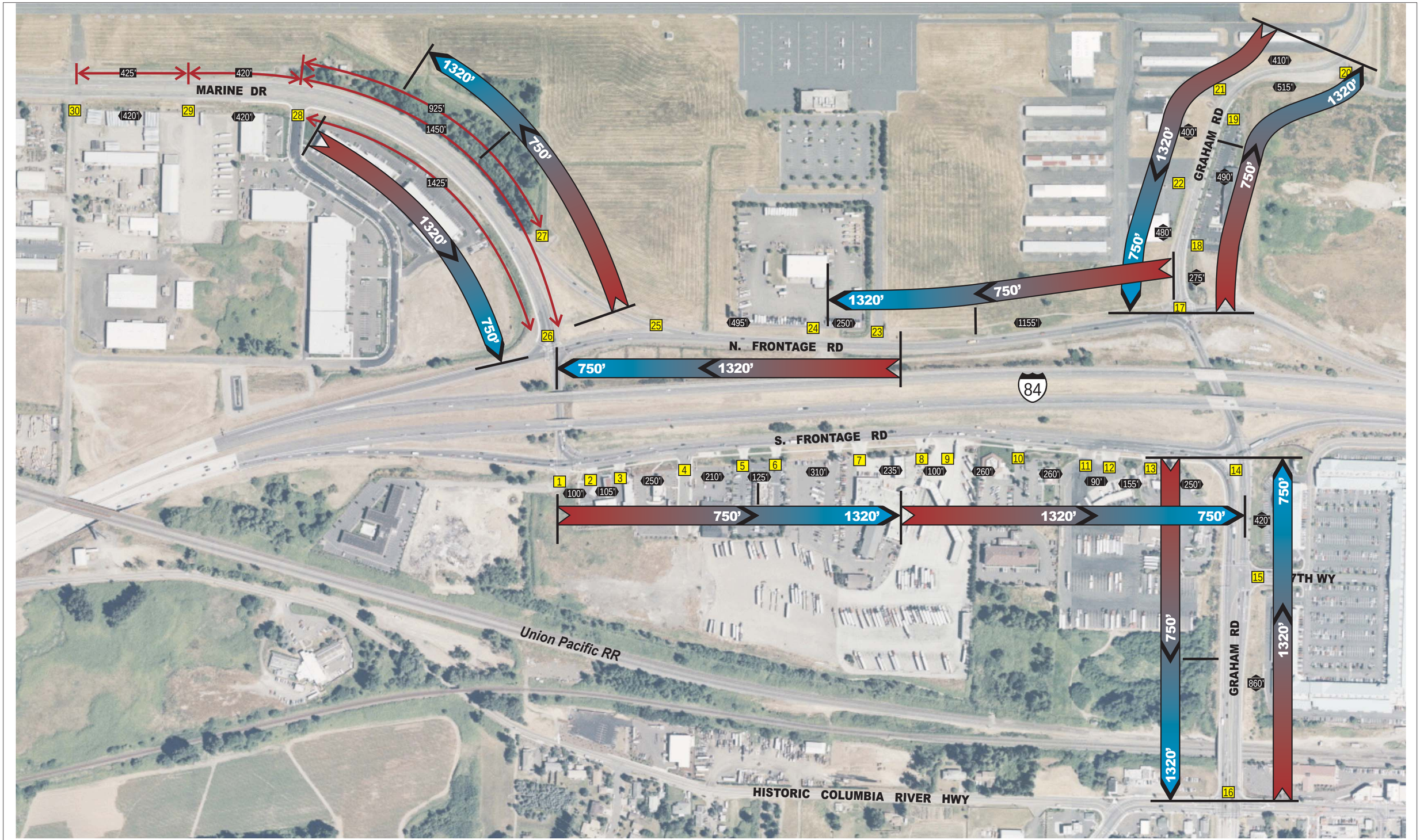
** Table includes parcel data only, areas dedicated to roads and right-of-way are not included*

Much of the land within the IAMP Study and Management areas is already fully developed, most of it at its highest and best use. Currently vacant lands are shown in the appendix. Of the undeveloped lands within the IAMP Management Area, the area that has the most potential to significantly impact the interchange is the industrial land to the north (Troutdale Reynolds Industrial Park – TRIP). Trip generation for the TRIP site has been specifically analyzed and its potential impact on the interchange previously determined. Metro works cooperatively with local governments to forecast future population, employment, and land use patterns within the tri-county metropolitan area. Metro's land use assumptions are summarized in the appendix. The transportation analysis for the IAMP is based on planned land uses; specifically, traffic modeling based on existing zoning (see appendix for more detail).

Existing Local Circulation

Interchange area roadways were examined to identify current access density in comparison to what the City and State access management guidelines recommend. The *City of Troutdale Transportation System Plan*and ODOT's *1999 Oregon Highway Plan* have adopted access management standards. These standards were applied to evaluate access and intersection spacing for South Frontage Road, Graham Road, North Frontage Road and Marine Drive which are all classified in the City's TSP as arterials in the vicinity of the intersection, with the exception of Marine Drive and Graham Road north of North Frontage Road, which are classified as a collector and local, respectively. The City's minimum access spacing on an arterial is 530 feet for roadways and driveways.ODOT's minimum access spacing standards are 1,320 feet to the first full-access intersection and 750 feet to the first right-in/right-out only access from the ramp terminal.

Figure 2shows the driveway and intersection spacing for these roadways within the management area and compares them with the adopted guidelines. There are many locations along South Frontage Road as well as locations along Graham Road, North Frontage Road and Marine Drive where desired access spacing is not met. It should be noted that the standards provided by ODOT and the City were not in existence when this area originally developed. More specific detail can be found in the appendix.



LEGEND

1 - Driveway/Access Location Number

(100') - Distance Between Driveway/Access Locations

750' - Desired Distance to 1st/Last Right In/Right Out Only Intersection

1320' - Desired Distance to 1st Full Intersection

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 2

APPROXIMATE DRIVEWAY LOCATIONS & DESIRED ODOT ACCESS SPACING

Existing Bicycle/Pedestrian Facilities

Figure 3 shows the existing bicycle and pedestrian facilities in the vicinity of the interchange. Generally, there are designated bicycle and pedestrian facilities along the south side of South Frontage Road, both sides of 257th Avenue south of the interchange and along the south side of Marine Drive (there are also bicycle lanes on the north side of Marine Drive, but no sidewalks since the adjacent property is undeveloped). There are also sidewalks on the east side of Graham Road north of the interchange. A new multi-use path is currently being constructed under the Sandy River Bridge, connecting the south and north sides of the interchange. Other than these facilities, designated sidewalks and bicycle lanes are generally lacking in the interchange area.

Existing Traffic Operations

The existing traffic operating conditions at the study intersections were determined for the PM peak hour based on the *2000 Highway Capacity Manual* methodology[1]. The conditions include the estimated average delay, level of service (LOS), and volume-to-capacity (V/C) ratio of each study intersection and are listed in Table 4. All study intersections currently comply with the City of Troutdale, Multnomah County LOS D operating standard, as well as with ODOT's volume to capacity standards.

The AM peak hour operations were previously analyzed as part of the Troutdale Reynolds Industrial Park (TRIP) transportation studies. These results have been reproduced in Table 4 below. Note that the conditions are similar between the two peak periods, although the PM peak period generally has higher delays than does the AM peak period.

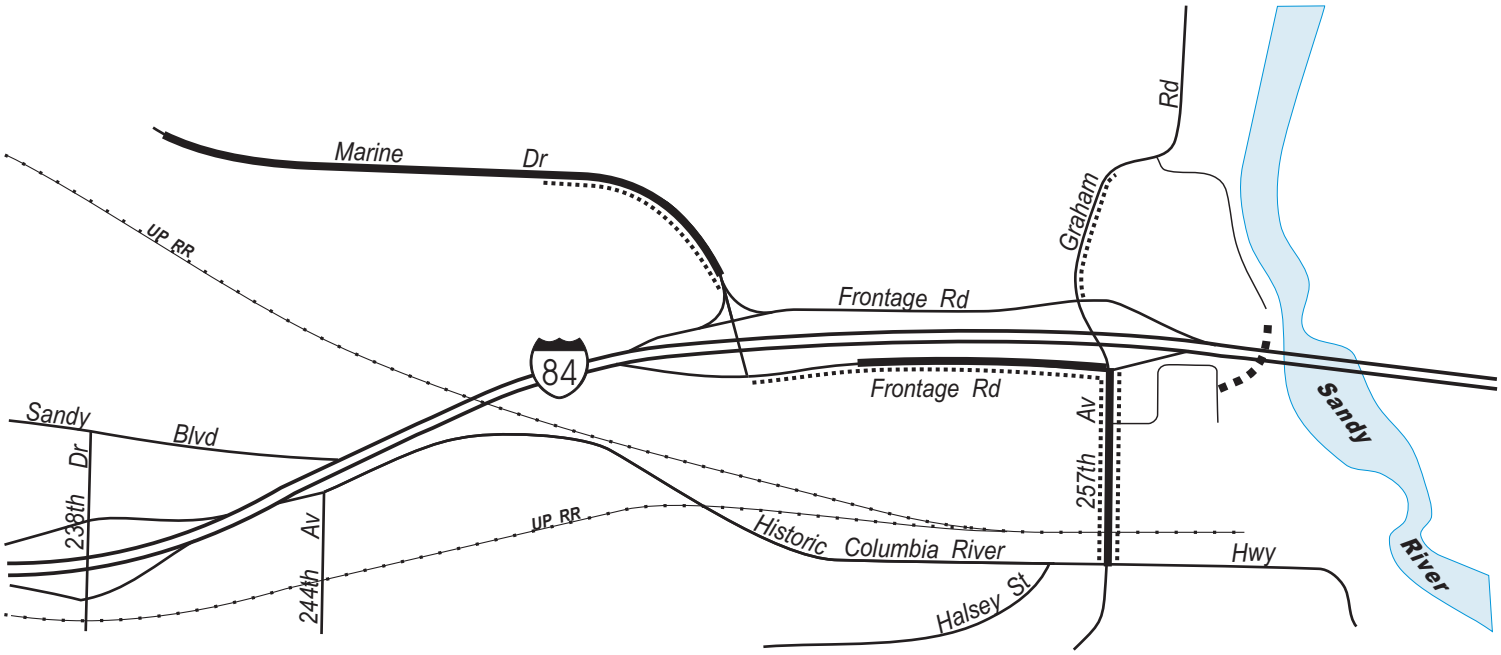
Future Conditions

Future Land Use/Modeling Assumptions

The appendix contains a description of the model assumptions that were used and the refinement that was undertaken to generate future 2035 traffic volumes as well as a figure showing the base (2005) and future (2035) street networks that were assumed in the model. Table 5 summarizes the household and employment growth assumptions that were used in the model.

The future analysis generally assumes that land within the Study Area will develop according to the City's Comprehensive Plan and has been adjusted to account for several known development projects that are currently in process. In particular, traffic from the planned Troutdale Reynolds Industrial Park (TRIP) site, located north of the interchange, has been specifically addressed. The analysis assumed development likely to occur by 2035 throughout the City of Troutdale as well as in the greater Metro area (see appendix for further discussion of the land use assumed).

[1] *2000 Highway Capacity Manual*, Transportation Research Board, 2003.



LEGEND

- On-Street Bicycle Lanes
- Sidewalks
- Multi-Use Path (Under Construction)

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 3

EXISTING BICYCLE & PEDESTRIAN FACILITIES

Table 4: Existing Operating Conditions during Peak Hours

Intersection	Minimum Operating Standard (City, ODOT)	Peak Hour	Operating Conditions		
			Average Stopped Delay per vehicle	Level of Service	Volume-to-Capacity Ratio
Traffic Signal Controls					
Marine Drive/ Sundial Road	LOS D	AM	9.3	A	0.52
		PM	9.6	A	0.43
I-84 WB On-Ramp/ Marine Drive	LOS D, 0.85 V/C	AM	9.3	A	0.54
		PM	15.8	B	0.51
I-84 EB Off-Ramp /Marine Drive	LOS D, 0.85 V/C	AM	8.1	A	0.28
		PM	30.3	C	0.60
I-84 EB On-Ramp/ Graham Road	LOS D, 0.85 V/C	AM	12.6	B	0.61
		PM	10.6	B	0.61
I-84 WB Off-Ramp/ Graham Road	LOS D, 0.85 V/C	AM	11.8	B	0.60
		PM	29.6	C	0.37
Graham Road/ 257th Way	LOS D	AM	4.5	A	0.52
		PM	12.3	B	0.55
257th Drive/ Historic Columbia River Hwy	LOS D	AM	22.7	C	0.49
		PM	28.0	C	0.70
STOP Sign Controls				Major / Minor	
Graham Road/ Sundial Road	LOS D	AM		A/A	
		PM		A/A	

Table 5: Assumed Household and Employment Quantities within IAMP Study Area

	Households	Retail Employees*	Service Employees*	Other Employees*	Total Employees*
Base Year 2005	1,750	1,763	322	1,842	3,927
Future Year 2035	2,842	3,176	1,378	4,694	9,248
Growth (2005 – 2035)	**+1,092**	**+1,413**	**+1,056**	**+2,852**	**+5,321**

*Note that these quantities represent Metro's forecasts for the IAMP Study Area – employment and trip generation forecasts for the Troutdale Reynolds Industrial Park (TRIP) were accounted for separately, since specific detail was available for that area (discussed below).

The base year 2005 and future year 2035 model scenarios included different street networks, with the base year network closely resembling the existing transportation system and the future year network reflecting conditions planned to exist according to the Regional Transportation Plan. A side-by-side comparison of the networks associated with these scenarios is shown in the appendix. The City of Troutdale's Capital

Improvements Plan and Multnomah County's Transportation Capital Improvement Plan and Program are generally consistent with the RTP. Lists of relevant projects in each of these plans are shown in the appendix.

Future 2035 No Build Traffic Operational Performance

Study intersections within the IAMP area were analyzed through the use of the Synchro model that was used to examine existing conditions, updated with the traffic volume and roadway geometry data shown in the appendix. From this analysis, intersection levels of service and volume to capacity ratios were obtained using Highway Capacity Manual2 methodologies for signalized intersections for comparison with the applicable jurisdiction's adopted performance standards. The results of this analysis are shown below in Table 6 and further illustrated in the appendix.

Table 6: 2035 No Build Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	17.7	B	**1.00**	**No**
		PM	44.3	D	**>1.0**	**No**
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	14.3	B	0.63	Yes
		PM	48.1	D	**0.96**	**No**
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	15.5	B	**0.98**	**No**
		PM	10.3	B	0.75	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	68.5	E	**>1.0**	**No**
		PM	40.6	D	**0.93**	**No**
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	5.7	A	0.76	Yes
		PM	17.5	B	0.87	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	90.6	**F**	>1.0	**No**
		PM	72.0	**E**	0.97	**No**

Bold – indicates intersections not meeting performance standard. Delay = Average Stopped Delay per Vehicle

When comparing this table to the comparable Existing Conditions table, it becomes clear that operations at almost all study intersections have substantially declined.

Marine Drive/Sundial Road would operate at an unacceptable level of service assuming forecasted 2035 traffic volumes. Much of the TRIP traffic will travel through this intersection, creating demand at the intersection that is

[2]*Highway Capacity Manual*, Transportation Research Board, Washington, D.C., 2000.

expected to exceed capacity during both the AM and PM peak hours. Additional improvements will be required at this intersection to meet City and County LOS standards.

The**I-84 Eastbound Off-Ramp/Marine Drive** intersection would decline substantially during both peak periods. However, during the morning peak period, when the majority of traffic in the interchange is headed west on I-84 away from Troutdale, the intersection would continue to operate acceptably. It would not operate acceptably during the PM peak period. Additional improvements will be necessary for this intersection to meet ODOT's performance standard, which requires a volume-to-capacity ratio of 0.85 or lower.

The **I-84 Westbound Ramps/Marine Drive** intersection would decline substantially during both peak periods and would not operate acceptably during either peak period. A third through lane is assumed on North Frontage Road between Graham Road and Marine Drive, terminating at the west end in a free-right turn onto northbound Marine Drive. Additional improvements will be necessary for this intersection to meet ODOT's performance standard, which requires a volume-to-capacity ratio of 0.85 or lower.

The **I-84 Westbound Ramps/Graham Road/North Frontage Road** intersection improvements include reconfiguration of the northbound approach to include a 50 foot northbound through pocket and two exclusive northbound left turn lanes. A 200 foot westbound right turn pocket on the I-84 westbound off-ramp is also added. The third through lane on North Frontage Road described above would begin at the east end as a free southbound right turn from Graham Road to westbound North Frontage Road. This intersection declines only slightly during the evening peak period, largely because of the improvements planned there. The biggest concern at this intersection is the AM peak hour, when the volume-to-capacity ratio is 0.98, exceeding ODOT's standard.

I-84 Eastbound On-Ramp/257th Avenue/South Frontage Road is expected to decline from LOS B during both the AM and PM peak hours to LOS E during the AM peak hour and LOS D during the PM peak hour. The volume-to-capacity ratio during both peak hours is also expected to exceed capacity during the AM peak and decline to 0.93 during the PM peak. Neither peak period would meet ODOT's level-of-service standard. Additional improvements will either be needed at this intersection, or elsewhere in the street network to redirect traffic away from this intersection.

257th Avenue/257th Way will decline from LOS A to LOS B during the morning peak hour, but will remain at the same level-of-service as existing conditions during the evening peak hour (LOS B). Performance will decline somewhat, but will still be well within City/County standards.

257th Avenue/ Historic Columbia River Highway is expected to decline substantially in the future. Level-of-service will decline from LOS C to LOS F during the AM peak hour and from LOS C to LOS E during the PM peak hour. Additional improvements will be needed at this intersection in order for it to meet City/County level-of-service standards.

Alternatives Analysis

A number of alternatives have been analyzed for the I-84 Troutdale Interchange starting with the 2005 Troutdale Transportation System Plan. A summary of the alternatives considered was prepared for the Policy Advisory Committee for this IAMP and is provided in the appendix under Public Involvement. Additionally, the alternatives specifically considered for this IAMP project are summarized in the appendix under South Frontage Road Access Study and Transportation Improvement Investment Study.

The South Frontage Road Access Study was conducted to developed short term, lower cost alternatives to specifically address access issues along South Frontage Road. The Transportation Improvement Investment Study addresses facility and access issues related to the interchange as a whole (i.e. Interchange Management Area).

Interchange Area Management Plan (IAMP)

This section presents access and land use decisions for maximizing the operational life of the I-84 Troutdale interchange while ensuring that the planned local land use can be supported. It describes the transportation improvements for the interchange and the associated improvements on South Frontage Road and North Frontage Road, identifies access management and policy actions, and reviews the process for state and local authorities to adopt the I-84 Troutdale IAMP. The decisions presented in this section serve as the basis for an agreement between ODOT and the City of Troutdale on the direction and principles that will guide the approval and implementation of the IAMP.

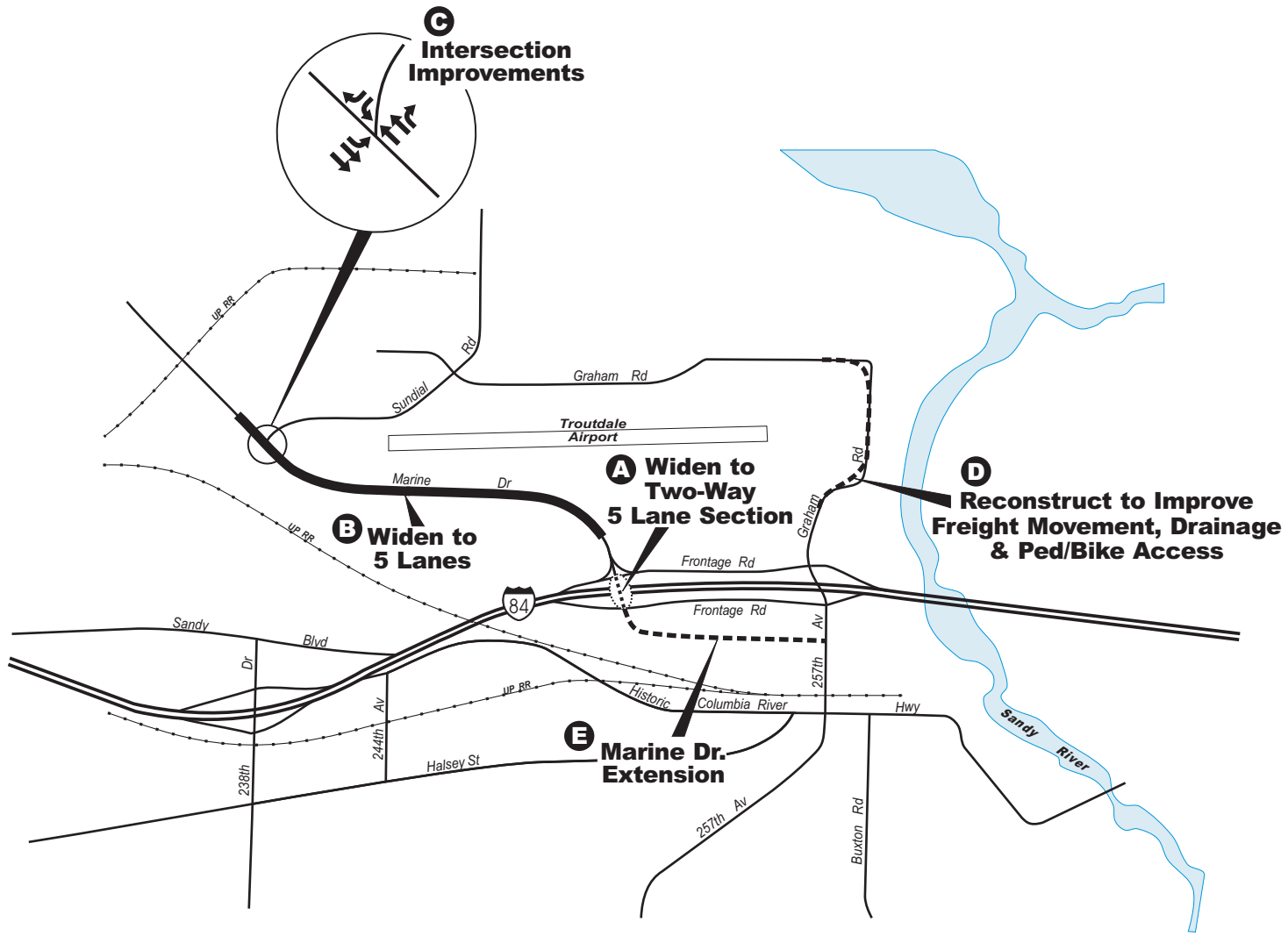
Project stakeholders and other members of the public have provided input on each of the project elements through two public open houses and four project advisory committee meetings. A full description of public involvement activities is included in the appendix.

The top priority for interchange improvements is to provide more direct access between I-84 and the Troutdale Reynolds Industrial Park (TRIP). The more direct and effective route is the 238th Extension that would provide a connection between I-84 and Marine Drive west of The I-84 Troutdale interchange. However, there are many unknowns technically, politically and financially. The Two-Way Marine Drive project has the potential to be constructed sooner and with fewer technical, political and financial risks.

Future 2035 IAMP Operational Performance

Future (2035) traffic conditions were analyzed at the I-84 Troutdale Interchange. Highway Capacity Manual[3] (HCM) level-of-service (LOS) and volume-to-capacity (V/C) ratios were used to evaluate the performance of the proposed interchange improvements.[4] ODOT's Highway Design Manual (HDM) maximum V/C threshold for new improvements on District/Local Interest Roads Inside the Urban Growth Boundary is 0.85[5]. This threshold would apply to the interchange ramp terminals (I-84 Eastbound Ramp/Marine Drive, I-84 Eastbound Ramp/257th Avenue, I-84 Westbound Ramp/Graham Road and I-84 Westbound Ramp/Marine Drive). The remaining study intersections would fall under the City of Troutdale or Multnomah County's jurisdiction and would be required to operate at LOS "D" or better. **Error! Reference source not found.**summarizes 2035 PM peak hour intersection performance with recommended IAMP improvements in place. The recommended improvements are shown in Table 7, with more specific detail available in the Transportation Improvement Investment Study Memorandum in the appendix.

[3] *Highway Capacity Manual*, Transportation Research Board, Washington, D. C., 2000.
[4] For "no-build" conditions, the *Oregon Highway Plan* volume-to-capacity ratio applies for planning purposes (0.85 or 0.90 for the ramp terminals in this case). However, since that threshold was not met (see appendix), a "build" condition is required, at which point the *Highway Design Manual* volume-to-capacity threshold applies.
[5] *Highway Design Manual*, Oregon Department of Transportation, 2003, p. 10-38.



LEGEND

A - Prioritized Improvements

----- - New Connector

DKS Associates
TRANSPORTATION SOLUTIONS

Figure 4

LONG TERM TRANSPORTATION IMPROVEMENTS MAP

NO SCALE

Table 7: Future PM Peak Hour 2035 Intersection Performance

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	12.1	B	0.77	Yes
		PM	25.0	C	**0.92**	**No**
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	12.7	B	0.53	Yes
		PM	26.2	C	0.84	Yes
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	9.1	A	**0.87**	**No**
		PM	9.5	A	0.68	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	30.9	C	**>1.0**	**No**
		PM	61.7	E	0.84	Yes
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	12.7	B	0.78	Yes
		PM	49.9	D	>1.0	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	77.1	**E**	>1.0	**No**
		PM	75.0	**E**	1.00	**No**

Bold – indicates intersections not meeting performance standard
[1] Average Stopped Delay per Vehicle

As shown in Table 7 above, only one of the City/County intersections would operate at acceptable levels, operating at LOS "D" or better for the 2035 "Build" condition. And even though 257th Avenue/257th Way would technically operate acceptably, its projected volume would slightly exceed its capacity. It was determined that both the 257th Avenue/257th Way and the 257th Avenue/Historic Columbia River Highway intersections are already built to their maximum reasonable capacities (or are assumed to be in the analysis summarized above) and that additional improvements at these intersections would not make sense technically or financially, even though they will operate at or near capacity during one or both peak hours in 2035.

The demand for the Marine Drive/Sundial Road intersection would substantially exceed capacity, however. Improvements at this intersection will be required and include the following:

- Improve Marine Drive to five-lanes between the existing five-lane section east of Sundial Road to approximately 500 feet west of Sundial Road
- Add a right turn lane westbound on Marine Drive at Sundial Road
- Add a southbound right turn lane on Sundial Road if and when the 238th Extension is built
- Improve Graham Road to facilitate truck use so some truck traffic will divert away from the Marine Drive/Sundial Road intersection.

Improvements at Marine Drive/Sundial Road should be pursued as opportunities arise. The intersection should be monitored as growth in the TRIP area occurs.

Three interchange ramp terminals would operate at volume-to-capacity ratios worse (higher) than ODOT's allowable 0.85 as defined in the Highway Design Manual. The I-84 Westbound On-Ramp/Marine Drive intersection operates at a V/C=0.92, somewhat higher than ODOT's threshold, the I-84 Westbound Off-Ramp/Graham Road intersection operates at a V/C=0.87, slightly higher than ODOT's threshold, and the I-84 Eastbound On-Ramp/257th Avenue operates at a V/C>1.0, substantially higher than ODOT's threshold. Future (2035) traffic volumes are shown in the appendix

Based on the results summarized above, the I-84 Troutdale Interchange will generally operate at an acceptable level in 2035, assuming the Two-Way Marine Drive and Marine Drive Extension projects are constructed, although design exceptions will need to be requested for the volume-to-capacity ratio at the following locations:

- I-84 Westbound On-Ramp/Marine Drive (0.07 over the HDM standard of 0.85 - PM)
- I-84 Westbound Off-Ramp/Graham Road (0.02 over the HDM standard of 0.85 - AM)
- I-84 Eastbound On-Ramp/257th Avenue (>0.15 over the HDM standard of 0.85 – AM)

Planned Facility

Short- and Mid- Term Actions

- Widen Marine Drive to a two-way five-lane cross-section under I-84 (ODOT). Specifically, the following improvements are planned:
    - Widen Marine Drive between the I-84 Eastbound Off-Ramp and the I-84 Westbound On-Ramp to include two through lanes and a 50 foot left turn lanes in the northbound direction and two through lanes in the southbound direction, which become a left and a through/left at South Frontage Road (5-lanes in total)
    - Widen the I-84 eastbound exit ramp to include one left turn lane, two through lanes and a through/right turn lane (4-lanes total)
    - Widen the I-84 eastbound exit ramp
    - Add a westbound left turn lane on North Frontage Road at Marine Drive
- Intersection improvements at Marine Drive/Sundial Road (County/Port):
    a) Widen to a five-lane section on Marine Drive from approximately 500 feet west of intersection to existing five-lane section approximately 2,150feet east of intersection.
    b) Add westbound right turn lane
    c) Add southbound right turn lane (if/when 238th Extension is constructed)
- Reconstruct Graham Road
    d) Reconstruct Graham Road between access road (approximately 900 feet west of northeast corner)and North Frontage Road intersection. Widen to improve freight movement, add storm drainage and pedestrian and bicycle facilities.

Long- Term Actions

- Construct the Marine Drive Extension, essentially a bypass to South Frontage Road, connecting I-84 eastbound and Marine Drive with 257th Avenue:
    - Construct a new one-way. Two lane, high speed, limited access roadway extending south from the Marine Drive/I-84 Eastbound Off-Ramp/South Frontage Road intersection and curving east to meet 257th Avenue at 257th Way (Outlet Mall access).

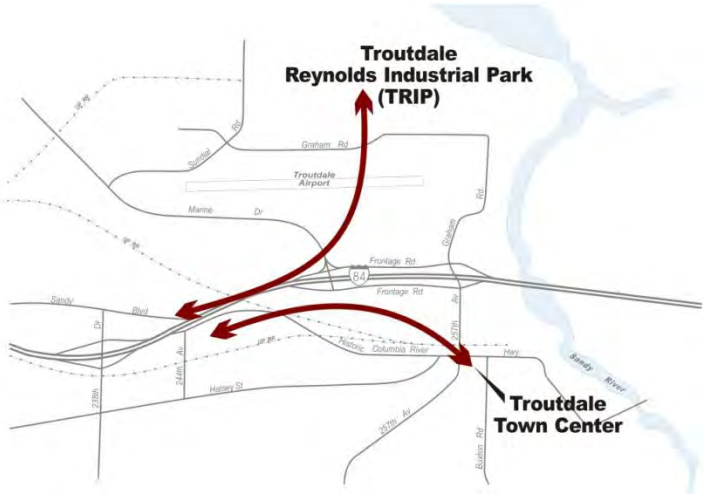
Interchange Function

Generally, an interchange is defined as the junction of two or more roads at different elevations through a system of connections that separate the roads to permit movements to occur without crossing the streams of traffic. The

functions of the interchange are established by the functions of the connecting roads. The I-84 Troutdale interchange is a component of Interstate 84, an Interstate Highway and freight route.

The Oregon Highway Plan (OHP) classifies I-84 as an interstate highway. According to OHP, the primary function of an interstate freeway is to "provide connections to major cities, regions of the state, and other states. A secondary function in urban areas is to provide connections for regional trips within the metropolitan area." (OHP, p. 41)

The primary function of this interchange is to provide access to industrial land between I-84 and the Columbia River, as well as serve goods movement and access to the Troutdale Town Center.



North Frontage Road and South Frontage Road and the free right turn from North Frontage Road onto Marine Drive are owned and maintained by ODOT. Marine Drive is owned and maintained by Multnomah County from the north City Limits to North Frontage Road and Graham Road is owned and maintained by the City of Troutdale, north of North Frontage.. ODOT owns and maintains Graham Road and Marine Drive between the North and South Frontage Roads. The Troutdale Transportation System Plan (TSP) classifies North Frontage Road and South Frontage Road and Marine Drive and Graham Road (between the North and South Frontage Roads) as arterials within the vicinity of the interchange. Marine Drive north of North Frontage Road is classified as a Collector and Graham Road north of North Frontage Road is classified as a local street. Graham Road south of South Frontage Road is classified as an arterial. North Frontage Road, South Frontage Road, Marine Drive and Graham Road all provide both a connection to the interstate freeway system and access to local services in town.

Much of the land surrounding the I-84 Troutdale interchange is already developed, especially to the south. The interchange provides access to Troutdale's Town Center area as well as industrial and residential areas in the City. Many accesses are provided along the South Frontage Road to a number of businesses, most of them commercial, many serving truck traffic that passes through as it heads between Portland and the Columbia River Gorge. Many of the accesses are not in compliance with OHP standards within a ¼ mile of the interchange. Most accesses along South Frontage Road are private driveways rather than public roadways. There are only two accesses located along the North Frontage Road, midway between Graham Road and Marine Drive, serving the Troutdale Airport and an office building. There are no accesses on Marine Drive or Graham Road within the interchange area.

Future alternatives in this IAMP assume that undeveloped lands within the Study Area will be developed in a manner consistent with what is allowed under the City of Troutdale Comprehensive Plan and existing zoning.

Circulation and Access Management Plan

Access Management/Local Connectivity Plans

A key element of the IAMP related to the long-range preservation of operational efficiency and safety of the proposed interchange improvement is the management of access to the interchange crossroads (Marine Drive and Graham Road/257th Avenue), parallel roads between the interchange crossroads (South Frontage Road and North Frontage Road) as well as to the mainline (Interstate 84). Access points introduce a number of potential vehicular conflicts on a roadway and are frequently the cause of slowing or stopping vehicles, and they can significantly degrade the flow of traffic and reduce the efficiency of the transportation system. However, by reducing the overall number of access

points and providing greater separation between them, the impacts of these conflicts can be minimized. The approximate locations of the existing access locations in the interchange management area are shown in Figure 5 as well as ODOT's desired access spacing.

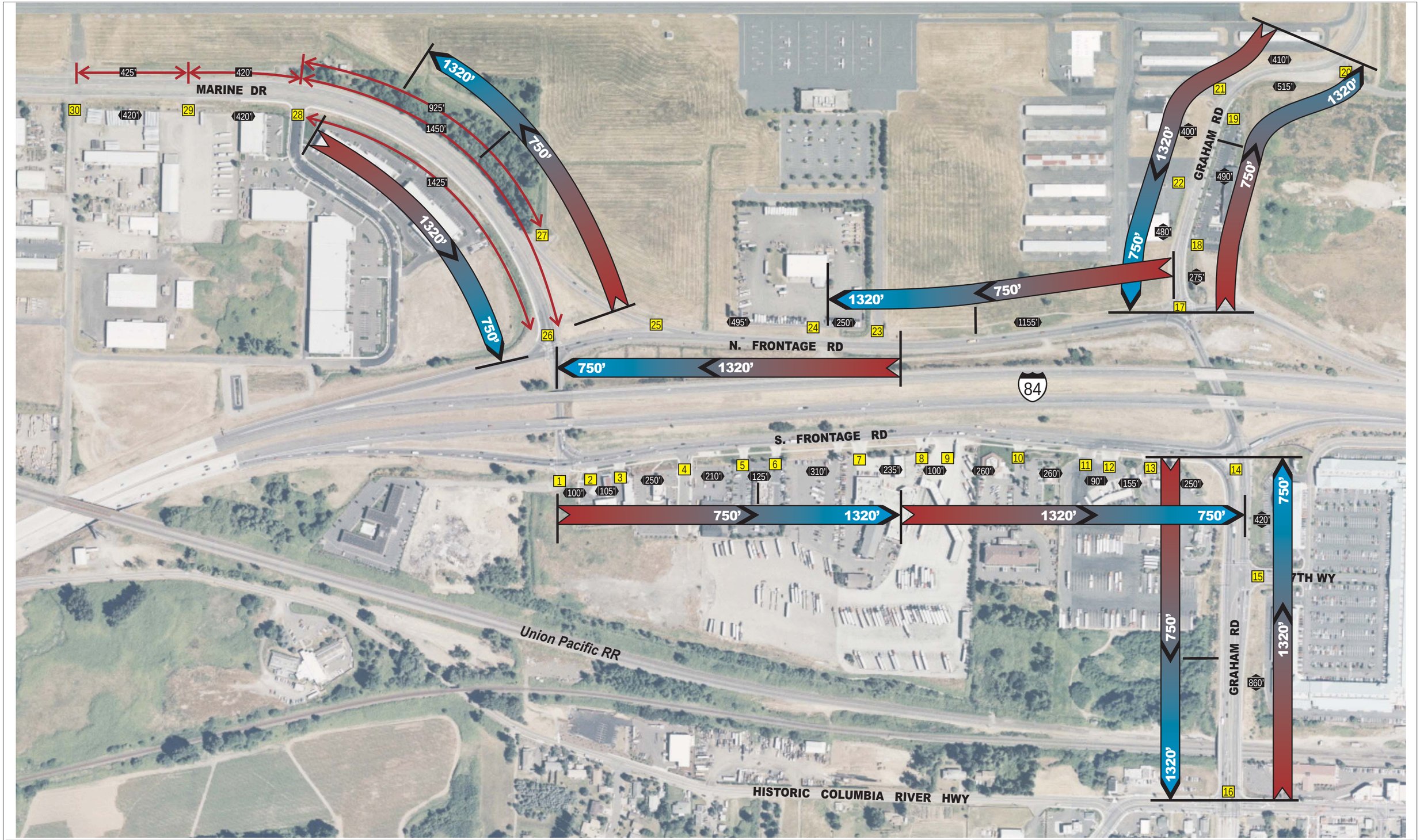
The Project Management Team (PMT) was used to develop and evaluate an access management plan. The general Access Management Plan is summarized below:

General Access Management Plan

To provide a basis for decision-making during the development of the IAMP, a general access management plan was established. The objectives of this plan are listed below.

1. Restrict all access from abutting properties to the interchange and interchange ramps.
2. Meet, or move in the direction of meeting, ODOT adopted access management spacing standards for access to interchange crossroads. Figure 5 illustrates how these standards apply to the I-84 Troutdale Interchange.
3. Meet, or move in the direction of meeting, the City of Troutdale's adopted access management guidelines on Management Area roadways maintained by the city. This would require access spacing of at least 530 feet between adjacent driveways and/or streets on the same side of the roadway on arterials and 150 feet on collectors[6].
4. In attempting to meet access management spacing standards, exceptions may be allowed to take advantage of existing property boundaries and existing or planned public streets, and to accommodate environmental constraints.
5. Relocate private approaches on South Frontage Road onto other public streets, where feasible, to provide consolidated access to multiple properties.
6. Align approaches on opposite sides of roadways where feasible to reduce turning conflicts.
7. Short-range actions shall accommodate existing development needs.

[6]*Troutdale Transportation System Plan*, 2005, Table 4-15: Recommended Access Spacing Standards for City Street Facilities.



LEGEND

1 - Driveway/Access Location Number

100' - Distance Between Driveway/Access Locations

750' / 1320' - Desired Distance to 1st/Last Right In/Right Out Only Intersection / Desired Distance to 1st Full Intersection

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 5

APPROXIMATE DRIVEWAY LOCATIONS & DESIRED ODOT ACCESS SPACING

Adoption and Implementation

ODOT and the City of Troutdale have jointly prepared the I-84 Troutdale IAMP in recognition of the importance of Interstate 84 and this interchange in the movement of people and goods to and from the region. It is anticipated that both ODOT and the City will adopt the IAMP, thereby codifying the joint commitment to protecting the function of the interchange as defined in the IAMP. Separate adoption processes and implementing actions exist for each agency.

This section summarizes the implementation roles and responsibilities for the respective jurisdictions.

ODOT/State of Oregon Implementing Actions

Project Construction and Access Management

- Develop needed transportation system improvements.
    - This work is underway as the I-84 Troutdale Interchange Project A improvements are currently being designed, with construction planned for 2011.
    - Pursue funding and development of physical improvements identified in this IAMP, particularly the following two projects:
        - Marine Drive Two-Way
        - Marine Drive Extension

Agency Coordination

- ODOT will continue to coordinate with the City of Troutdale and applicable state agencies, through the plan amendment and development review process, to keep land use protections in place. ODOT will also monitor and comment on any future actions that would amend the urban growth boundary.
- If future circumstances in the IAMP management area result in the need for changes to the IAMP, the City of Troutdale and ODOT shall jointly prepare amendments to the IAMP management actions and an accompanying funding plan to implement those actions.

Policy Actions

- Adopt the IAMP.

City of Troutdale Implementing Actions

Project Construction and Access Management

- The City of Troutdale will participate in the design and construction of the I-84 Troutdale Interchange that is currently underway
- The City of Troutdale will participate in the design and construction of any future improvements to the I-84/257th Interchange, in particular those identified previously in this IAMP
- The City will modify regulations pertaining to access to South Frontage Road, North Frontage Road, Marine Drive and 257th Avenue, consistent with the Access Management Plan identified in this IAMP
- The City will seek funding for identified improvement needs

Policy Actions

- The City will approve development proposals only after it is demonstrated that proposed access is consistent with the Access Management Plan in the IAMP
- The City will support land uses in the vicinity of the interchange, consistent with the land use assumptions in the IAMP. To ensure consistency with the planned transportation improvements, the City will require that any party initiating changes to the land use designations or uses allowed in the IAMP management area must also amend the IAMP.

Agency Coordination

- The City of Troutdale will coordinate with ODOT in evaluating land use actions that could affect the function of the interchange
- The City of Troutdale will coordinate with ODOT prior to amending its comprehensive plan (including the transportation system plan), land development ordinances, or urban growth boundary, or proposing transportation improvements that could affect the function of the interchange. The City of Troutdale will ensure that any such amendments are consistent with the function of the interchange as defined in the IAMP.
- If future circumstances in the IAMP management area result in the need for changes to the IAMP, the City of Troutdale and ODOT shall jointly prepare amendments to the IAMP management actions and an accompanying funding plan to implement those actions.

IAMP Adoption

Troutdale's City Council passed a resolution in support of the plan in April; 2011. approved the IAMP and forwarded it to City Council on XX, 2011.

The Oregon Transportation Commission reviewed the document in July, 2011.

Monitoring and Updates

This section discusses the need to update the IAMP, and those changes that may trigger an update over time. Conditions that would trigger such an update:

1. When the City of Troutdale's Transportation System Plan is updated, the IAMP should be reviewed and updated if necessary.

2. If the proposed land use is inconsistent with the current Comprehensive Plan Map or Zoning Map land use designation the applicant will be required to undertake a legislative process to amend and update the I-84 Troutdale Interchange Area Management Plan in order to demonstrate that the proposed amendment will be consistent with the planned improvements in. .

3. Access Management Plan Modifications
   Recommended actions in the Access Management Plan (AMP) are based on property configurations, development application approvals, and ownership existing at the time of the I-84 Troutdale Interchange Area Management Plan's adoption. Lot consolidation and other land use actions may necessitate an amendment to the AMP. Modifications to the AMP may occur through agreement by the City of Troutdale and ODOT and require an amendment to the I-84 Troutdale Interchange Area Management Plan. Such modifications will be allowed only if the proposed modifications meet, or move in the direction of meeting, the adopted access management spacing requirements in the I-84/257th Interchange Area Management Plan.

Interstate 84/Troutdale Road IAMP

Appendix A:Public Involvement

Appendix B: IAMP Boundaries, Goals & Objectives, and Evaluation Criteria

Goals and Objectives

The goals and objectives for the I-84 257th Avenue IAMP reflect the intentions and interests of ODOT, the City of Troutdale, the Port of Portland, Multnomah County and other key stakeholders for the interchange and transportation operations in the area. The goals and objectives are guided by, but not re-statements of, OHP policies and OAR language. The objectives need to be concrete statements that relate what the plan is trying to accomplish and should be achievable and measurable. The objectives serve as the basis for data collection and research and as alternative evaluation criteria to guide alternatives analysis and selection of the preferred alternative, and to guide management decisions.

Goal 1: Protect the function and operation of the interchange and the state highway as follows:
I-84 is classified as an Interstate Highway. It is part of the National Highway System and is a designated freight route between Portland and points east. The operational objective for Interstate Highways is to provide safe and efficient high-speed travel in urban and rural areas.

Objective 1a: The preferred IAMP will consider FHWA Interchange design requirements and will address design-year (2035) traffic demands.

Objective 1b: The IAMP alternatives developed for consideration address the OHP requirement that the maximum volume-to-capacity (V/C) ratio for the ramp terminals of interchange ramps be either 0.85 or 0.90 (as defined in the OHP).

Objective 1c: The preferred IAMP alternative will meet or move in the direction of ODOT access management spacing standards for access along interchange crossroads.

Goal 2: Provide for an adequate system of local roads and streets for access and circulation within the interchange area that minimizes local traffic through the interchange and on the interchange cross roads.

Objective 2a: The preferred IAMP alternative will include necessary supporting improvements to the surface street system in the vicinity of the interchange. Improvements to the local street network will be adopted into the local comprehensive plan, including identified funding sources, as part of the City of Troutdale's actions to implement the IAMP.

Objective 2b: The IAMP alternatives will propose surface street improvements that either meet the ODOT established access management standards or improve on the current conditions.

Objective 2c: The IAMP alternatives will propose surface street improvements that will operate in conformance with applicable standards over the 20-year planning horizon.

Goal 3: Provide safe and efficient multi-modal travel between the connecting roadways (and the surface street network, if applicable).

Objective 3a: While recognizing existing capacity constraints, the IAMP alternatives will improve safety by adding capacity to reduce congestion and/or correcting geometric conditions that do not meet current applicable standards.

Objective 3b: The IAMP alternatives will improve bicycle and pedestrian safety by providing upgraded bikeways and walkways that meet current applicable standards and include facility infill and extensions where needed to provide a continuous network.

Goal 4: Ensure future changes to the planned land use system are consistent with protecting the long-term function of the interchange and the surface street system and the integration of future transportation projects and land use changes.

Objective 4a: The IAMP alternatives will be developed in partnership with affected property owners in the interchange area, the City of Troutdale, the Port of Portland, Multnomah County, and the Oregon Department of Transportation (ODOT), as well as other stakeholders, including interchange users.

Objective 4b: The City and County Comprehensive Plans and/or Transportation System Plans will be found consistent, or amendments will be proposed to ensure consistency, with the preferred IAMP alternative.

Objective 4c: The City and County will adopt land use policies that ensure future land use actions in the IAMP Management Area, including requests for comprehensive plan amendments and/or zoning amendments, and promote land development that is compatible with the planned interchange capacity for the IAMP planning horizon.

Goal 5: Recognize the importance of the interchange function to support local and regional economic development goals and plans.

Objective 5a: The IAMP alternatives are expected to reduce delay for vehicles, including commercial vehicles, accessing the freeway and to increase safety.

Objective 5b: The IAMP alternatives will facilitate access to, through, and from businesses in Troutdale.

Goal 6: Ensure that the needs of regional through trips and the timeliness of freight movements are considered when developing and implementing the IAMP, in particular when planning for improvements that directly impact freight routes.

Objective 6a: The IAMP alternatives will facilitate freight access to and from the many industrialfreight destinations in the interchange study area.

Consistency with Goals and Objectives

Below, Table B-1, demonstrates how the physical improvements, access management plan and interchange area management policies address the IAMP goals and objectives described at the beginning of the IAMP.

Table B-1: How IAMP Goals and Objectives are Addressed by the IAMP

Goals and Objectives	How Goals are Addressed by Plan
Protect the function and operation of the interchange and state highway	All City intersections will operate at an acceptable level of service (LOS "D" or better) in 2035. However, both the Troutdale Road/I-5 Southbound Ramps intersection and the Troutdale Road/I-5 Northbound Ramps intersection will require design exceptions. The operation of these two intersections will be substantially improved compared to a future no-build scenario. An access management plan will be implemented as part of this IAMP to move in the direction of meeting ODOT's access spacing standards along interchange crossroads.

Provide for an adequate system of local roads and streets for access and circulation within the interchange area that minimizes local traffic through the interchange and on the interchange cross road	A Local Connectivity Plan was not specifically developed. However, the City will pursue improved connectivity as part of the access management plan and as opportunities arise (funding, development, redevelopment, etc.) over the 25-year planning period.
Provide safe and efficient multi-modal travel between the connecting roadways (and the surface street network, if applicable)	Improved bicycle and pedestrian facilities are incorporated into the design for the interchange reconstruction. Any new roadway projects (including local streets) will meet current applicable standards.
Ensure future changes to the planned land use system are consistent with protecting the long-term function of the interchange and the surface street system and the integration of future transportation projects and land use changes	To ensure that any changes in the planned land use system are consistent with the long-term function of the interchange and local street system, the IAMP proposes that any proposed changes in these designations within the Management Area (as defined by the overlay district for the I-84/257th IAMP area) require an update of the IAMP.
Recognize the importance of the interchange function to support local and regional economic development goals and plans	The proposed IAMP provides a system that facilitates travel through the interchange by reducing delay, improving level of service and increasing safety.
Ensure that the needs of regional through trips and the timeliness of freight movements are considered when developing and implementing the IAMP, in particular when planning for improvements that directly impact freight routes	Regional through trips and freight movements will be improved by implementation of this IAMP. By improving level of service, reducing delay and increasing safety for all vehicles, through traffic and freight movements are improved as well.

Interstate 84/Troutdale Road IAMP

Appendix C: Existing Conditions

Interstate 84/Troutdale Road IAMP

Appendix D:South Frontage Road Access Study

Appendix E: Transportation Improvement Investment Study

Appendix F:Findings of Compliance

Appendix G:ODOT Adoptions

Appendix H: City of Troutdale Final Ordinances

I-84 257th Ave. IAMP Public Involvement Plan

PREPARED FOR: Andy Johnson, ODOT

Rich Faith , City of Troutdale

PREPARED BY: Kristin Hull and Brandy Steffen, CH2M HILL

DATE: July 6, 2010

Introduction

The I-84 257th Ave. interchange in Troutdale is being modified to improve traffic flow, access and mobility. Improvements at interchanges trigger the need for ODOT and the local jurisdiction to develop an Interchange Area Management Plan (IAMP).

This memo describes the proposed public involvement plan for developing and adopting the I-84 257th Ave. IAMP. This plan will involve the City of Troutdale, Oregon Department of Transportation (ODOT), Multnomah County, and the Port of Portland. Public outreach will take place prior to the finalization of the IAMP documentation. Effective documentation of public input will make it easier for the project team to incorporate community concerns and for community members to make a connection between their input and decisions.

ODOT is engaged in a separate outreach effort around the current Troutdale Interchange improvement project. This other effort will provide the forum for community members to voice concerns about construction impacts and will not be part of this IAMP process.

Goals of the Public Involvement Plan

The Oregon Department of Transportation (ODOT) is committed to an approach that:

- Provides early and ongoing opportunities for stakeholders to raise issues and concerns that can be considered through equitable and constructive two-way communication between the project team and the public.
- Provides complete and timely information to the public about ways to comment and help develop the IAMP.
- Encourage the participation of all stakeholders regardless of race, ethnicity, age, disability, income, or primary language by offering alternative accommodations (e.g. translation services, transportation, or other services).

Target Audiences/Stakeholders

Stakeholders of the process include the City of Troutdale, transportation system users including freight/cargo carriers, industry and business system users, media, neighborhood/community groups and the general traveling public. This location is a gateway to the Portland metropolitan region with westbound travelers just arriving from the Columbia River Gorge National Scenic Area and the major freight corridor of I-84. In

2000, US Census data reported that the City of Troutdale had 13,777 residents. That number was estimated to have risen to 15,535 by 2009.

Table 1
Stakeholder Categories and Organizations

Stakeholder category	Examples
City of Troutdale	City Council, Community Development Department, Planning Commission
Transportation stakeholders	Oregon Trucking Association, Port of Portland (planning staff), TriMet, Swift Trucking, Interstate Distribution, Walsh and Sons Trucking
Businesses	All businesses along Frontage Road Couplet, Columbia Gorge Premium Outlets, FedEx, Troutdale Aircraft Services, Troutdale Transfer Station, West Columbia Gorge Chamber of Commerce, Woodpecker Truck and Equipment
Media	Oregonian, El Hispanic News, Gresham Outlook, Troutdale Champion (City Newsletter)
Traveling public	People who do or will drive I-84
Residents	Residents near the management area

Environmental Justice Outreach and Compliance

A review of area demographics has been conducted to understand the concentrations of low-income, disabled, elderly and limited-English proficient residents. The analysis of demographics will be used to refine the Public Involvement Plan (PI Plan) as needed. However, regardless of concentration, members of all of these groups will be invited to participate in the planning process and accommodations will be made (e.g. translation services and transportation) to encourage their participation. To engage these communities, the PI team will employ the following strategies:

- **Community group briefings (optional):** include groups that advocate for or serve as networking places for these traditionally under-served communities in the community group briefings.
- **Community open houses and workshops (optional):** identify partner organizations that can co-host or promote open house events to traditionally underserved communities. Advertise events in ethnic newspapers such as *El Hispanic News* or inquire with local churches and community service providers.

Further, translation services and other special accommodations, such as provisions for the sight or hearing impaired, will be provided at all meetings upon request.

Below is demographic information from the 2000 Census for the area. This information will help to get a better idea of the populations living in the Troutdale area.

Table 2

Percentage of Population in Poverty by Block Group (BG)

Tract 102, BG 1	Tract 103.03, BG 1*	Tract 103.05, BG 1	Troutdale
11.85	5.56	8.86	4.79

* Tract 103.03 BG 1 is located east of 257th Ave and south of I-84 (which is not inside the management area)

Source: *2000 Decennial Census Summary File 3 Table 88: Ratio of Income in 1999 to Poverty Level*

Figure 1

2000 Census Tracts (rough project area shown within circle)

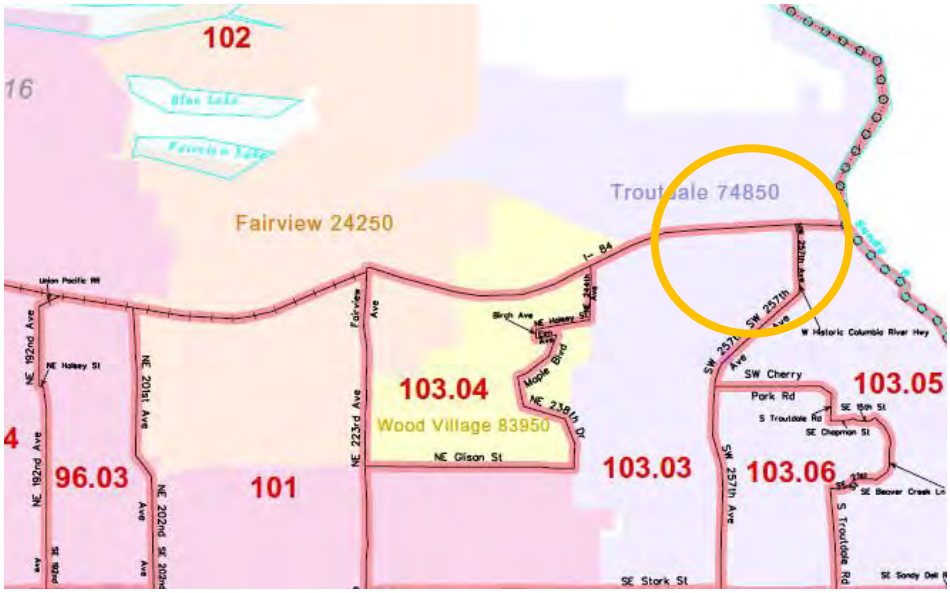


Table 3

Percentage of Population by Race by Block Group (BG)

	Tract 102, BG 1	Tract 103.03, BG 1*	Tract 103.05, BG 1	Troutdale
White	86.95	78.32	90.80	87.54
Black or African American	1.61	3.61	1.33	1.90
American Indian and Alaska Native	1.26	1.16	0.88	0.92
Asian	4.20	9.06	1.84	4.14
Native Hawaiian and Other Pacific Islander	0.17	0.09	0.15	0.25
Some other race	2.39	3.61	0.81	1.71
Two or more races	3.42	4.16	4.20	3.53

* Tract 103.03 BG 1 is located east of 257th Ave and south of I-84 (which is not inside the management area)

Source: *2000 Decennial Census Summary File 1 Table 3: Race.*

Public Involvement Tools and Methods

This portion of the memo identifies key public involvement activities that will be conducted during the Plan development by the consultant team or agency staff members.

Public Information

The IAMP development will include two project mailers (postcards) and two press releases to inform the public about the project and answer common questions. Press releases will be posted on the ODOT Region 1 web page and transmitted to area news outlets, as suggested in the stakeholder list. A standard template will be used for the Plan to help keep all messaging consistent. Press releases will be in advance of public events. A contact list of interested parties will be developed, including USPS mailing and email address for distribution of mailers and announcements. This list will not be publicly distributed. Email communication will also be used to inform stakeholder groups.

Task	Responsibility	Schedule	Review
Create project mailing list (1,000 addresses)	CH2M HILL	At project start (from tax lot data) and then prior to information distribution	ODOT
Create project email contact list	CH2M HILL	At start (from existing interested parties from ODOT and City of Troutdale)	ODOT
Project mailers (2)	CH2M HILL to design	Before public events	ODOT
Press releases	CH2M HILL to draft	Before public events	ODOT

Media Outreach and Advertising

CH2M HILL staff will write press releases, which ODOT will distribute to all local media outlets (suggested in the stakeholder list). Media will be invited to attend all major public meetings in the hope that the media outlets will advertise the events, both before and after they occur.

Stakeholder Mailing List

CH2M HILL will maintain a list of stakeholders; based on tax lot information of businesses and residents near the project area. Before mailings, the list will be updated with any new addresses collected by, or submitted to, the project team.

Task	Responsibility	Schedule	Review
Stakeholder mailing list updates	CH2M HILL	Before mailings	ODOT

Open Houses

Two open houses will be held for the Plan development. The general goals for both events will be to inform the public and interested stakeholders about the plan's process and related IAMP activity in the area. Specifically the first event (October 2010) will discuss the project

purpose, alternatives, and draft solutions. The second event (December 2010) will allow the public to review and comment on the design and construction options.

ODOT will conduct outreach on the current interchange project (improvements to eastbound off-ramp, south frontage road, north frontage road); including an open house which was held on July 21, 2010.

Open houses can be held at many locations; a traditional open house venue could be held at the newly opened Multnomah County Library or City Hall. The project team may alternatively decide to host a booth at the farmers' market where people can learn about the project and provide input. If possible, either open house format should coordinate with other similar projects in the area to attract a larger public representation.

Task	Lead	Support	Schedule
Schedule dates and locations of open houses. Produce an Open House Plan.	CH2M HILL		To be determined
Design and produce displays, comment form, and other materials	CH2M HILL	ODOT	To be determined
Summary of event and comments gathered	CH2M HILL	ODOT	Within one week of last open house

Project Advisory Committee

The structure of the plan development will be as transparent as possible, to enable the team to explain to stakeholders where we are in the process, what we've accomplished, and what lies ahead. Defining the decision structure – which groups will be involved and how they will participate – provides a level playing field for all stakeholders and answers questions typically asked by stakeholders:

- Who will make decisions?
- How can I influence decisions? How will my recommendation be considered?
- When will I have an opportunity to participate?
- Who will consider my input?
- Who is the final decision maker?

The Project Advisory Committee (PAC) will aim to provide a balanced representation of stakeholder interest, affected communities, and geographic areas as a communication link with those interests and communities. Members will include those appointed by ODOT and the City of Troutdale.

Chartering protocols and responsibilities will be determined during the first meeting, but are expected to include that each member will:

- Represent their constituents' perspectives during group deliberations.
- Communicate the project progress with their group.

- Prepare and participate in four meetings, in addition to attending the two open houses.

Other Outreach Activities

In addition to the above, ODOT and the City of Troutdale will conduct additional public outreach opportunities as necessary. These activities are expected to include the following, but could include other items as the plan progresses:

- Project Website (ODOT will host)
- Brief elected officials
- Provide handouts/material about the plan to other events conducted by the City of Troutdale or in the general area

Interchange Area Management Plan

Project Advisory Committee Membership Candidates

1. Troutdale Planning Commission/Troutdale Citizens Advisory Committee --
   Carl Tebbens, Les Perry, or Marv Woidyla

2. Factory Outlet Mall
   Ema Harvey, Management Office Administrative Assistant

3. Troutdale Airport
   Steve Nagy

4. Food Outlets (McDonalds, Arby's, Wendy's, Shari's)

5. Motels (Holiday Express, Comfort Suites Inn, Motel 6)

6. Truck Stops/Gas Stations (Travel Centers of America, Loves, Chevron)

7. Trucking Companies (Swift Trucking, Walsh Trucking, Interstate Distribution, Waste Management)

8. City of Gresham
   John Dorst

Troutdale I-84 Interchange Area Management Plan

Project Advisory Committee Roster

	Individual	*Organization*	*Title*	*Phone*	*Email*	*Mailing Address*
1	City of Troutdale					
	Carl Tebbens	Citizen Advisory Committee	Member	(503) 665-5175		
	Les Perry	Citizen Advisory Committee	Member	(503) 665-5175		
	Marv Woidyla	Planning Commission	Member	(503) 665-5175		
2	Factory Outlet Mall					
	Ema Harvey	Columbia Gorge Premium Outlets	Management Office Administrative Assistant	(503) 669-8060		450 NW 257th Way, Troutdale, O
3	Troutdale Airport					
	Steve Nagy	Port of Portland	Manager	503-460-4119		Box 3529, Portland, Or 97208
4	Food Outlets (McDonalds, Arby's, Wendy's, Shari's)					
5	Motels (Holiday Express, Comfort Suites Inn, Motel 6)					
6	Truck Stops/Gas Stations (Travel Centers of America, Loves, Chevron)					
7	Trucking Companies (Swift Trucking, Walsh Trucking, Interstate Distribution, Waste Management)					
	Walsh Trucking Co., Ltd.			(503) 667-1912		1650 NW Sundial Rd, Troutdale, OR 97
	Swift Transportation			(503) 661-3031		2021 Northwest Sundial Road, Troutdale, OR
	Interstate Distribution			(503) 492-3417		2747 Nw Rogers Circle Troutdale, OR 970
	Waste Management			503-249-8078		7227 NE 55th Avenue, Portland, OR 97
8	City of Gresham					
	John Dorst	City of Gresham, Transportation Department	Transportation Manager and Deputy Director, Environmental Services	503-618-2525	DesInfo@GreshamOregon.gov	Gresham City Hall, 2nd Floor

PAC Member?

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50-9543
7218

Troutdale I-84 Interchange Area Management Plan

Project Advisory Committee Roster

	Individual	*Organization*	*Phone*	*Email*	*Mailing Address*	*PAC Member?*
1	City of Troutdale					
	Les Perry	Citizen Advisory Committee	503-669-9023/5	sawbonespet@comcast.net		Agreed
2	Factory Outlet Mall					
	Erna Harvey	Columbia Gorge Premium Outlets	(503) 669-8060 x	eharvey@simon.com	450 NW 257th Way, Troutdale, (	LM and sent email 9/9/10
3	Troutdale Airport					
	Steve Nagy	Port of Portland	503-460-4119		Box 3529, Portland, Or 97208	LM 9/9/10, 9/24/10
4	Food Outlets (McDonalds, Arby's, Wendy's, Shari's)					
	Ken McKinney	Shari's	503-605-4140	kmckinney@sharis.com	557 Northwest Phoenix Drive, Tı	Agreed
5	Motels (Holiday Express, Comfort Suites Inn, Motel 6)					
	Malcolm McCann	Comfort Inn	(503) 317-5067	mmccann@gorgehotels.com	477 Northwest Phoenix Drive, Tı	Agreed
6	Truck Stops/Gas Stations (Travel Centers of America, Loves, Chevron)					
	William Roper	Troutdale Chevron	(503) 666-1182	wcroper@mac.com	1260 Northwest Frontage Road,	Agreed
7	Trucking Companies (Swift Trucking, Walsh Trucking, Interstate Distribution, Waste Management)					
	Dan Walsh	Walsh Trucking Co., Ltd.	(503) 667-1912	danw@walshtruckingco.com	1650 NW Sundial Rd, Troutdale,	Agreed
8	City of Gresham					
	John Dorst	City of Gresham, Transportation Department	503-618-2402	john.dorst@greshamoregon.gov	Gresham City Hall, 2nd Floor	Agreed

Project Advisory Committee

Meeting #1 - Summary
October 11, 2010 5:30 to 7:30 pm
City Hall – 104 SE Kibling, Troutdale

Attendees:

- Andrew Johnson /ODOT
- Todd Juhasz /ODOT
- Carl Springer/DKS
- Les Perry/ General Citizen
- Rich Faith/ City of Troutdale
- Kathryn Kelly/City of Gresham
- Malcolm McCann/ Comfort Suites Inn
- William Roper /Chevron
- Dan Walsh/ Walsh Trucking Company
- Brandy Steffen/CH2M HILL
- Dawn Parker/CH2M HILL

Not in attendance: Steve Nagy/Port of Portland and Erna Harvey/Factory Outlet Mall

Welcome & Introductions

- Andy introduced the team members and their roles:
    - Andy is the current ODOT Major Projects Manager, and is representing ODOT in this effort.
    - Todd is taking over for the former senior planner as Project Manager for this project.
    - Carl is the Project Manager with DKS.
    - CH2M is the Public Involvement consultant for DKS.
    - Rich is representing the City of Troutdale.
    - Kathryn Kelly is representing the City of Gresham.
    - Malcolm, William, Dan, and Les are representing the local businesses and citizens.

- Brandy reviewed the agenda items *(see attached agenda)* and desired outcomes of this meeting:
    - Build common understanding of PAC's purpose, roles, and responsibilities.
    - Review project purpose and schedule.
    - Discuss issues along South Frontage Road.
    - Review goals and objectives.

Committee Goals & Protocols

- Brandy reviewed committee protocols *(see attached PAC Purpose & Protocols):*
    - The group did not have edits and approved the document.

Project Overview and Q&A

- Andy reviewed project background:
    - The previous TSP process resulted in:
        - Impacts which were too great.

        - Options that were feasible, but did not have enough public support.
        - A good partnership between the City, Port, and ODOT.
    - We are not looking at a replacement of the existing interchange, which would be too expensive.
    - We are doing this IAMP (Interchange Area Management Plan) to avoid an interchange failure; so that money set aside for these improvements will be protected.
    - There have been multiple changes to this intersection (S. Frontage Road & 257th).
    - We have many options but we will need to weigh the benefits and impacts, as well as costs of improvements, for each.
    - Focus of this committee is on South Frontage Road. North Frontage operates better because it has fewer driveways.
- The purpose of the Advisory Committee:
    - Advise ODOT and the City of Troutdale on how to proceed with improvements in the area.
    - Avoid a failure of interchange; create short and long term improvements.
    - Help form a plan (IAMP) for the next 20 years, with short and long term improvements.
- The group discussed South Frontage Road issues:
    - A new Fed-Ex facility is built and more capacity is planned in the future.
    - Each facility on S. Frontage Road is self-contained, without other entrances/exits. Will look to see if it is possible to connect lots on S. Frontage Road.
    - Traffic generally stays in the right lanes, causing blocked entrances/exits and back up.
- Question & Answer:
    - Multiple projects have been identified in this area. Are there funds that would remain after these earmarked projects are finished? Yes. The Marine Drive project (with lengthening off ramps, turn lane extensions, and lane widening is a possible project that would result after the identified and funded projects are completed. However, more information is needed).
    - We heard at the last open house that this will coincide with an overpass rebuild. The two projects were designed together for a short time to ensure that they were coordinated for construction, but they are no longer on the same schedule.
    - What percentage of traffic is freight vs. auto? We guess it to be about 15% freight.
    - To clarify, the stakeholders in this process, who use the S. Frontage Road are:
        - People who live and work here (commuters)
        - The N. Frontage Rd operators/businesses
        - The S. Frontage Rd operators/businesses and customers

Project Goals for S. Frontage Road

- Needs and Objectives
    - We need a 2-way turn onto Marine Drive that also addresses the problem of traffic back up on the highway.
    - We are hoping for a 25% reduction in delay.
    - Re-route trucks to Marine Drive. A comfortable turn will be important.
    - Widen S. Frontage Road to alleviate congestion under the highway (onto 257th).
    - Lengthen and widen the ramp for left turns off the highway.
- Goals for addressing the issues
    - Identify 5-20 years of needs and objectives.
    - Advise ODOT and the City how to move forward.

Existing Conditions

- The group discussed Problems/Opportunities:
    - Switchbacks near the airport and Wendy's is dangerous for freight trucks.
    - No room to turn left onto 84E split.
    - Commuters are getting caught in the right lane closest to the driveways and get in the way of the freight trucks and customers trying to enter driveways.
    - Trucks have to go either North or East to get to companies/destinations.
    - Left lane remains open, while the right lane is congested blocking trucks from exiting (S. Frontage Road).
    - Hotel guests have to keep circling and cannot enter.
    - Bike/Ped route has inadequate access to the 40 mile trail. There is no shoulder or sidewalk and people have to walk their bikes on 257th under highway.
    - The Sandy River bridge will be widened to include pedestrian and bike facilities.
    - The weaving of cars and trucks accessing driveways is the biggest problem on S. Frontage Road. Cars have traveled under freight trucks (highly dangerous).
    - Cars are not making the tight left turns on North frontage road (near the fence). The island confuses drivers and some have tipped over or driven off the road.
    - Long wait to go left onto N. Frontage Rd, causing drivers to run the light.
    - Low ground drainage issues on the North side (and in the whole area) make it impossible to move the truck facilities and gas stations to N. Frontage Road.

Next steps

- Actions
    - We will take these issues to the project team.
    - Email PAC the summary from this meeting.
- Actions for Next Meeting
    - Discuss past options and their impacts.
    - Draw on maps to brainstorm ideas for short and long term solutions.
    - Dan and Malcolm both offered rooms for future meetings.
    - Next meeting will likely be in early November.
    - Afternoon meetings are best for the group.
    - Tuesday, Wednesday, and Friday evenings are conflicted.
    - Malcolm is out the first week of November and Les is out the first week of January.
    - Report on the number of accidents, causes and locations.
    - Information on what the costs of the southern bypass (that was looked at 1 ½ years ago) and what it would do. What were the property impacts?
    - Show funded projects on the maps (which we will use to collect new ideas and solutions during the next meeting).
    - Need to see more of the map to the North.
    - Andy will bring past project work options and saved models.
    - Materials for the next meeting will be sent out one week ahead of the meeting.

Close

- Brandy thanked the group for attending, and asked them to call her or email with any questions or comments.
- Meeting adjourned at 7:00pm

Project Advisory Committee

Meeting #1
October 11, 2010 5:30 to 7:30 pm
City Hall – 104 SE Kibling, Troutdale

Meeting Goals:

- Build common understanding of PAC's purpose, roles, and responsibilities
- Review project purpose and schedule
- Discuss issues along South Frontage Road
- Review goals and objectives

5:30 p.m.	**Welcome & Introductions** • Introductions • Review desired outcomes • Review agenda	Andrew Johnson, ODOT Brandy Steffen, CH2M HILL
5:35 p.m.	**Committee Goals** • Establish a common understanding of the group's goals. **Committee Protocols** • Meeting ground rules • How group recommendations will be made • Communication protocols • Process for public input	Brandy Steffen
6:00 p.m.	**Project Overview and Q&A** • Purpose of project • South Frontage Road issues	Todd Juhasz, ODOT Carl Springer, DKS Associates
6:30 p.m.	**Project Goals for South Frontage Road** • Needs and Objectives • Goals for addressing the issues	Brandy Steffen
7:00 p.m.	**Existing Conditions** • Problems/Opportunities	Brandy Steffen
7:25 p.m.	**Next steps** • Actions • Next Meeting	Brandy Steffen
7:30 p.m.	**Close**	Andrew Johnson

PROJECT ADVISORY COMMITTEE
PURPOSE AND PROTOCOLS

Group Purpose

The purpose of the Project Advisory Committee (PAC) is to offer community-based input to the Project Management Team (PMT) on key topics related to the I-84 257th Avenue Interchange Amera Management Plan; specifically the issues along South Frontage Road.

Role

- The role of the PAC is to learn about, discuss, review, and offer written and verbal feedback to the PMT.
- PAC members will not make group recommendations based on consensus or a majority vote; rather, the product of the meetings will be a record of discussion that includes all points of view and documents any general points of agreement.

Structure

- The PAC is structured as an informal advisory committee.
- Members were invited to attend the meetings.
- The PAC will meet four (4) times during the project to provide advice to the PMT.
    - The first meeting will focus on the long-term solutions, prioritization questions, issues on South Frontage Road, and problems/opportunities for the area.
    - The second meeting will focus on alternative ideas for the South Frontage Road, that are less expensive solutions to the problems identified in the first meeting.
    - The third meeting will discuss the evaluation of the ideas from the second meeting and discuss how this information will be shared with the public at the first open house (tentatively scheduled for December).
    - The final meeting will review the draft IAMP and cover any outstanding issues.
- PAC meetings may be structured as group discussions.
- The general public will be provided 10 minutes of each meeting to make comments to the group.

Meeting Guidelines

- Meetings will be announced by email at least 3 weeks in advance. Meeting materials will be emailed to members one week in advance of the meeting. If a member cannot attend the meeting, a representative from the same organization/company can attend in their place.
- Meeting outcomes will be a documentation of discussion. All individual opinions and input will be documented.
- Meetings will begin and end on time. If agenda items cannot be completed on time, the group will decide if the meeting should be extended or if an additional meeting should be scheduled.
- Meeting summaries will be prepared and distributed to participants by email one week after the meeting.

- By participating in the meetings, PAC members indicate their agreement to:
    - Share the available speaking time
    - Be respectful of a range of opinions
    - Focus on successfully completing the agreed upon agenda
    - Put cell phones on silent
    - Avoid side discussions when others are speaking
    - Voice concerns and complaints at the meeting, rather than outside the meeting
    - Work inside and outside of the meetings in ways that are supportive of the process of designing a project that meets community needs
    - Direct media and public inquires to Andy Johnson, ODOT.

Project Advisory Committee

Meeting #2
December 2, 2010 4:00 to 6:00 pm
City Hall – 104 SE Kibling, Troutdale

Meeting Goals:

- Review previous ideas for South Frontage Road
- Brainstorm new ideas

4:00 p.m.	**Welcome & Introductions** • Introductions • Review desired outcomes • Review agenda	Andrew Johnson, ODOT Brandy Steffen, CH2M HILL
4:05 p.m.	**Previous ideas for South Frontage Road**	Andrew Johnson
5:00 p.m.	**Map Exercise and Brainstorm**	Brandy Steffen
5:55 p.m.	**Next steps** • Actions • Next Meeting	Brandy Steffen
6:00 p.m.	**Close**	Andrew Johnson

Project Advisory Committee

Meeting #2 - Summary
December 2, 2010 4:00 to 6:00 pm
City Hall – 104 SE Kibling, Troutdale

Attendees:

- Andrew Johnson /ODOT
- John Wolf/ODOT
- Todd Juhasz /ODOT
- Carl Springer/DKS
- Rich Faith/ City of Troutdale
- Malcolm McCann/ Comfort Suites Inn
- Les Perry/ General Citizen
- William Roper /Chevron
- Brandy Steffen/CH2M HILL
- Dawn Parker/CH2M HILL

Not in attendance:

- Dan Walsh/ Walsh Trucking Company
- Kathryn Kelly/City of Gresham
- Steve Nagy/Port of Portland
- Erna Harvey/Factory Outlet Mall

Welcome & Introductions

- Introductions
  - John Wolf/ODOT is a new attendee and one of the primary designers currently working on this intersection.
  - Andy welcomed the team and mentioned the open house for Troutdale's current construction process happening the same night at 6:30pm at the Comfort Suites Inn.
- Review agenda
  - Brandy asked for any revisions needed to the summary from the last meeting.
    - None were requested
    - Notes will be posted to the JTA website.
  - Review alternatives considered in the past and their feasibility
  - Map Exercise and Brainstorming ideas
    - Andy reminded the team there will be an opportunity to submit ideas throughout the process, not just this evening.
    - We will look at the maps to layout ideas and draw ideas on the maps.
    - Review current design plans and look at proposed past, short-term and long-term improvements. We have drawings from 5 yrs ago with Carl, last 2 years with John & Traffic and all drawings from the past 10 years.
  - Review crash data report

Alternatives Considered

- Alternative 1 – Marine Drive extension to 257th Way.
  - This was the initial list calling for changes at 257th & Graham. This has changed since then to take traffic off Frontage Rd. Modeling showed improvements well up to 20-30 years out and cost was estimated at $14M. Impact includes reducing the Flying J/Love's Truck stop parking lot. Changes at the Outlet Mall were estimated to have a high cost ($20M).

        - This is currently included in the Troutdale TSP. We should consider if this is still a good project?
    - Alternative 2 – Backage Road for Truck Stops.
        - There is a lack of connectivity between sites. This option would redirect and connect only the trucking companies on the south side of Frontage Road. It did not have much impact on the commuter/visitor traffic. Modeling showed that this will cause truck to enter Frontage Road all at once.
        - There would have to be a change of fueling sites for this alternative to function.
        - This alternative was dismissed as it was too costly and not enough impact.
    - Alternative 3 – Graham Road Fly-over.
        - The exit off the freeway, the road splits to by-pass Frontage Road, cross over it then touch down on Graham Road. There were issues at the touch down. The traffic model looked good, but it was potentially dangerous because the changes happen too quickly for drivers exiting freeway.
        - Cost was very high. A retaining wall would also cause a problem for businesses.
        - There are similar traffic results to Alternative 1 but this would be more expensive. A full analysis was done for this alternative.
    - Alternative 4 – Marine Drive Extension to Halsey Street.
        - Drivers exit to Halsey. They would, punch Marine Drive up to Halsey, connect to the Historic Highway.
        - The cost was high. This was not analyzed due to the cost.
        - Traffic impact to Halsey would need to be looked at as well. All intersections had issues handling the amount of traffic expected. This alternative was dismissed.
    - Alternative 5 – Relocate Truck Stops to North Side of I-84.
        - Move trucks to other side of the highway.
        - This was not looked at because of the potential legal issues. This was expected to cause the same traffic problems currently experienced on South Frontage Road, so it was dismissed.
    - Alternative 6 – Historic Columbia River Highway Exit from I-84 Eastbound, West of Marine Drive.
        - This alternative would add a 16B exit. Past projects between ODOT and FHWA agreed to close this exit.
        - It caused drivers to drive the wrong direction on Columbia River Highway. This alternative would also cause some weaving on the Freeway similar to Frontage Road. ODOT also avoids any interchanges with less than 4 exits/partial ramps.
        - In addition, this caused high traffic volumes exiting Halsey, Columbia River Highway, and Marine Drive.
        - This was looked at, but approval would not be granted so it was dismissed.
    - Alternative 8 – Two-Way Marine Drive under I-84.
        - This alternative is in the current TSP and JTA funding but it did not do much for traffic. There will be some intersection improvements with JTA.
        - This avoids loop driving and could be done in 5-8 years. With minor improvements at the intersections. It might help traffic.
        - Currently, two trucks single trailer side-by-side interior left turn (inside) hits curb most of the time. Private vehicles not a problem.
    - Alternative 9 – Two Exclusive Eastbound Right Turn Lanes from South Frontage Road.

        - Already constructed. ODOT/Port/City funded in combination. Was cost effective over $1M. Has helped and was an immediate improvement.
    - Alternative 10 – Not shown/discussed.
    - Alternative 11 – Dual Westbound Left Turn Lanes from North Frontage Road.
        - Doesn't address access improvements to Frontage Road. Purchasing Right-Of-Way would be difficult, so this was dismissed.

Map Exercise and Brainstorm New Ideas

- Review Current Design Plans and layout ideas with City/Port/ODOT map.
    - Route traffic out of Love's or a signal at this location didn't work well. This stopped all traffic with light and backed up sometimes back to the freeway. The high volume of trucks would be slow. Trucks would back up more than the queue has room for. If routed to Backage Road this would help but was too costly. This will lead to some good design ideas and to the truck lot design.
    - How many trucks will be heading East vs. West? Data shows 90% or more of commuter traffic is going east in the morning and west in the afternoon & evening.
    - Will Fed-Ex have their own fueling station? Yes.
    - John reviewed the current plan with the team
        - The current plan will tie into the current route with intersection improvements. Going into construction next year, 4.5 or 5 lanes are going under the freeway. The signal timing will be improved to handle under the ramp. Signing will direct traffic to the left lane for Marine Drive. Some details are still to be determined.
- Mapping Mark ups
    - On the corner of Love's, Backage Road could be extended to Graham Road, entering Graham south of the Comfort Inn lot.
    - The railroad on Backage Road would be difficult to change. The railroad would need easement access.
    - Frontage and Graham corner could be modified to give the trucks an interior route South on Graham to the signal at 257th. This would eliminate the weaving on Frontage Road.
    - Adding signage at the freeway exit, directing through traffic to the left lane, visitors to Troutdale to middle lane, and entrance to food/hotels in right lane. This would avoid short merging lanes at Graham.
        - Is there more benefit from reducing truck traffic on Frontage Road or commuter traffic? There may be some effect either way. Using signage would be a good option to direct traffic to the correct lanes instead. This would separate the traffic early and be very cost effective. Also a good short-term goal.
    - Opening the turn lanes at Marine Drive to widen the lanes will ease traffic, especially for wide truck turns.
    - As a long-term solution, a two-way Backage Road extending to Marine Drive would create a loop. Signs to Troutdale via Backage Road would help ease traffic too.
    - Ideally extending Backage Road to and existing intersection is the easiest option.
    - An intersection closer to the railroad would mean there is no need for dual right lanes off of Frontage Road onto Graham Road allowing for less traffic demand on Frontage Road.
    - The greatest conflicts on Frontage Road are at TA and beyond. Coming out of Love's near the corner of Graham backs up.

- Add a divider on the SW Frontage Road to separate through traffic from the business access traffic. The divider would extend on the east past the Travel America exit driveway, allowing trucks to turn out without battling 'through' traffic. An internal connection would be made so Love's trucks could also use the TA exit. The end of the divided frontage road section would be controlled with dual traffic signals, like on Macadam Avenue at SW Curry Street.
- A barrier option creates a "Frontage-Frontage Road" for a lane only for the hotels and trucks. This seems too complicated without a lot of benefit.
- There could be a signalized entrance/exit for trucks on Frontage with dual signaling for commuters in the left lane and trucks in the right lane.
- The old underpass on South Frontage Road was filled in. Could be a possible Pedestrian access.
- An overpass on South Frontage over to Graham intersection would be too expensive and there is not enough space.
- Ped/Bike improvements are under way with the Sandy Bridge but are far away. A 5th lane on Marine Drive might allow a bike/ped and sidewalk on one side.
    - Ideas that have been looked at for bike/ped have been very expensive ($5M) because they would require a retaining wall and cut back. We would be better to improve bike/ped with another project.
    - JTA is not including bike/ped now because of the structure changes needed.

Review Crash Data.

- Andy presented the crash data.
    - Most accidents were people driving off of the road.
    - There were also a high number of rear-end crashes.
        - Unexpected congestion caused drivers stop when exiting the freeway.
    - Almost all accidents were on South Frontage Road even though both South and North have the same traffic counts during peak traffic hours.
    - North Frontage Road had some rear-end and some swipes crashes.
    - 18 accidents at North Frontage and Graham North of the freeway and turning left from Graham to North Frontage. Appears to be a free left turn, may be a signage issue.

Next steps

- Actions
    - We will take drawing ideas to the project team.
    - Andy will find the article on free left turns on a one way street
    - John will bring a rough draft of these new ideas to the next meeting.
- Actions for Next Meeting
    - Review drawing ideas added to the maps.
    - Next meeting will likely be in January.
    - Bring Bike/Ped Issues to the next meeting.
    - Information on what the costs of the southern bypass (that was looked at 1 ½ years ago) and what it would do. What were the property impacts?

Close

- Brandy thanked the group for attending, and asked them to call her or email with any questions or comments.
- Meeting adjourned at 6:00 pm.

Project Advisory Committee

Meeting #3

RESCHEDULED: March 15, 2011 4:00 to 6:00 pm

Small Conference Room, City Hall (104 SE Kibling, Troutdale)

Meeting Goals:

- Review ideas for South Frontage Road from Meeting #2
- Decide if there are any other ideas to consider
- Brainstorm ideas for sharing this information with the general public

4:00 p.m.	**Welcome & Introductions** • Introductions • Review desired outcomes • Review agenda	Andrew Johnson, ODOT Brandy Steffen, CH2M HILL
4:05 p.m.	**Ideas for South Frontage Road from Meeting #2** • Any new ideas to consider?	Andrew Johnson DKS Associates
5:00 p.m.	**Brainstorm public outreach** • How can we share ideas developed with the general public? • How can we get new ideas to consider, from the public?	Brandy Steffen
5:55 p.m.	**Next steps** • Actions • Next Meeting (March or combine with Public Event?) • Public Event (combine with next PAC meeting?)	Brandy Steffen
6:00 p.m.	**Close**	Andrew Johnson

I-84/257th Interchange
Summary of Alternatives Considered

DKS Associates
TRANSPORTATION SOLUTIONS

Issue #1: South Frontage Road Access

Alternatives Considered	Figure	Serves Eastbound to Southbound Demand	Reduces Auto / Truck Conflicts	Improves Access Management within Interchange Area	Feasible Construction / Implementation	Anticipated Cost of Improvement	Compatible w/Potential Long-Range Improvement	Likely Avoids EA or EIS	Able to Meet Design Standards	Potential for Public Acceptance	Minimal Property Impacts	Facilitates Alternate Travel Modes	Outcome
Marine Drive extension to 257th Way	1	√	+	—	+	H	√	√	√	+	—	+	Under consideration
Backage Road for Truck Stops	2	Eliminated without Scoring											Rejected
Relocate Truck Stops to North Side of I-84	3	Eliminated without Scoring											Rejected
Connection between TA and Marine Drive/I-84 EB Off-Ramp Intersection	4	—	+	+	√	M	√	+	√	+	—	√	Under consideration
Construct fourth lane on south side of S Frontage Rd to serve local traffic only (terminates prior to 257th Ave)	5	+	+	+	√	M	√	+	√	+	—	√	Under consideration
Redirect Love's traffic to egress at TA driveway at new traffic signal (signal to serve only curbside lane(s)/business traffic)	6	+	+	+	√	M	√	+	√	+	—	√	Under consideration
Construct two new roads for business egress onto South Frontage Road (one at TA driveway and one along Culpepper Dr). Signal at TA driveway	7	+	+	+	+	M	√	+	√	+	—	√	Under consideration
Redirect Love's traffic to egress at TA driveway at new "ramp metering" type traffic signal on S Frontage Road	8	+	+	+	+	M	√	+	√	+	—	—	Under consideration

Scoring:
+ = Meets Criteria or Provides Substantial Benefit
√ = Might Meet Criteria or Provides Partial Benefit
— = Does Not Meet Criteria

H = High
M = Medium
L = Low

Issue #2: Access between Portland and Troutdale Reynolds Industrial Park (TRIP)

Alternatives Considered	Figure	Facilitates Demand between Portland and TRIP Area	Reduces Out-of-Direction Travel	Improves Operations within Interchange Area	Feasible Construction/ Implementation	Anticipated Cost of Improvement	Compatible w /Potential Long-Range Improvement	Likely Avoids EA or EIS	Able to Meet Design Standards	Potential for Public Acceptance	Minimal Property Impacts	Facilitates Alternate Travel Modes	Outcome
Marine Drive Two-Way Under I-84	9 & 10A	+	+	√	+	H	+	+	+	+	+	+	Under consideration
238th Avenue Extension	10B	+	+	+	√	H+	+	–	+	√	–	+	Under consideration
Improve Marine Drive/Sundial Intersection	10C	+	√	√	+	M	+	+	+	+	√	+	Will likely recommend
Improve Graham Road	10D	+	+	√	+	M	+	+	+	+	+	+	Will likely recommend
Construct I-84/Marine Drive Flyover (Eastbound to Northbound)	10E	+	+	+	√	H+	+	√	√	√	–	–	Further Analysis Required
Widen Marine Drive to 5 lanes between I-84 and Sundial Rd	10F	+	√	√	+	M	+	+	+	+	√	+	Planned
Dual WB Left Turns from N Frontage Rd	None	+	+	√	+	L	+	+	+	+	√	√	Under consideration

Scoring:
+ = Meets Criteria or Provides Substantial Benefit
✓ = Might Meet Criteria or Provides Partial Benefit
– = Does Not Meet Criteria

H = High
M = Medium
L = Low

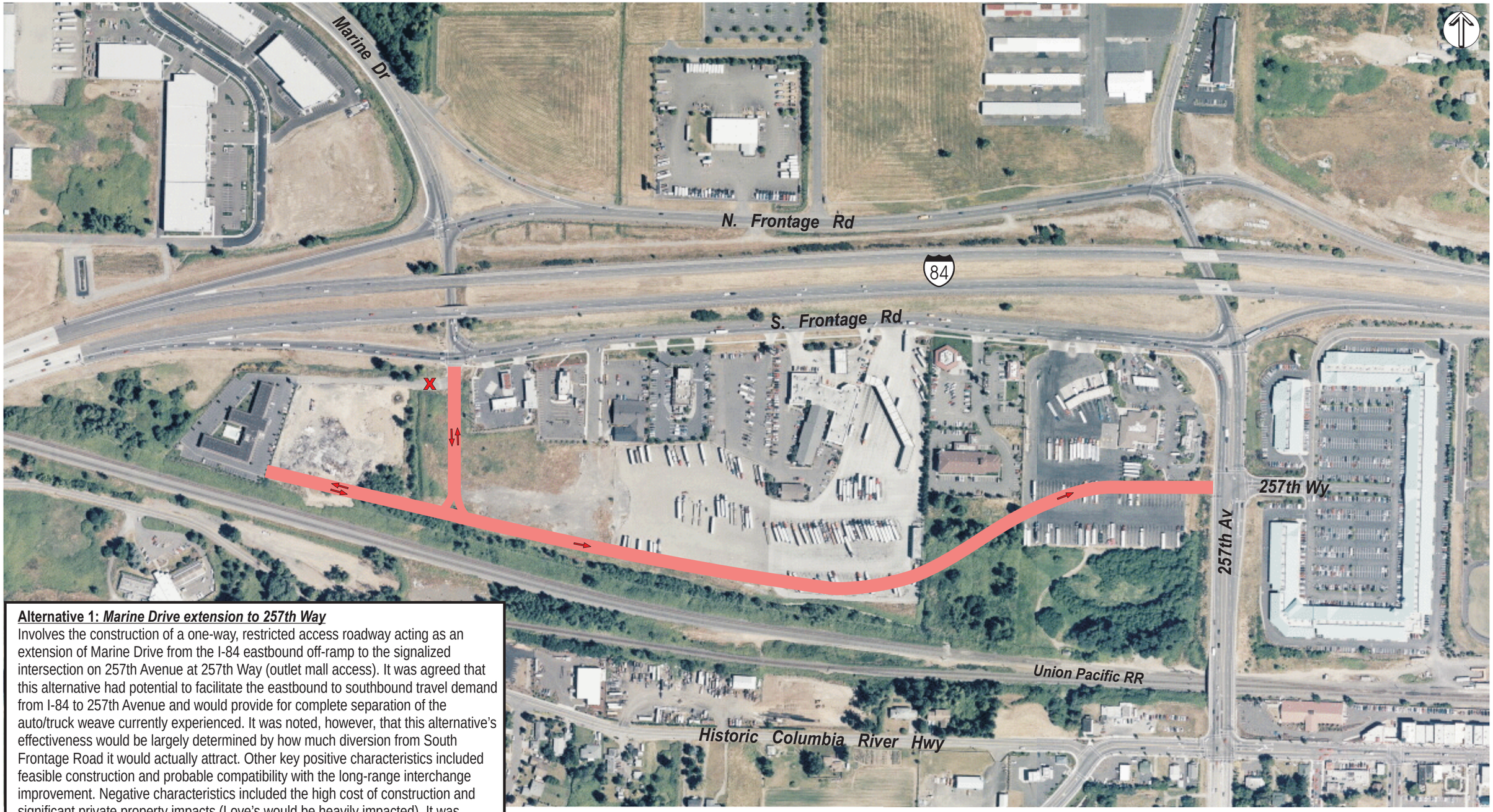
Issue #3: Access between Portland and Troutdale (Northwest to Southeast Connectivity)

Alternatives Considered	Figure	Facilitates EB to SB Demand	Reduces Auto/Truck Conflicts/Improves Safety	Improves Access Management within Interchange Area	Feasible Construction/Implementation	Anticipated Cost of Improvement	Compatible w/Potential Long-Range Improvement	Likely Avoids EA or EIS	Able to Meet Design Standards	Potential for Public Acceptance	Minimal Property Impacts	Facilitates Alternate Travel Modes	Outcome
Marine Drive Extension to 257th Way	1	+	+	+	√	H	+	–	+	+	–	+	Under consideration
Improve signage for through versus local / business traffic	None	+	√	√	+	L	√	+	+	+	+	√	Under consideration
Separate local/business traffic via positive separation and/or signal control	5-8	+	+	+	+	M	√	+	√	√	√	√	Under consideration
Flyover from I-84 to 257th Avenue	11	Eliminated without scoring											Rejected
Marine Dr extension to Halsey Street	12	Eliminated Without Scoring											Rejected
HCRH exit from I-84 EB, west of Marine Drive	13	Eliminated Without Scoring											Rejected

Scoring:
+ = Meets Criteria or Provides Substantial Benefit
√ = Might Meet Criteria or Provides Partial Benefit
– = Does Not Meet Criteria

H = High
M = Medium
L = Low

I-84/Troutdale Frontage Road System Refinement Study



Alternative 1: *Marine Drive extension to 257th Way*

Involves the construction of a one-way, restricted access roadway acting as an extension of Marine Drive from the I-84 eastbound off-ramp to the signalized intersection on 257th Avenue at 257th Way (outlet mall access). It was agreed that this alternative had potential to facilitate the eastbound to southbound travel demand from I-84 to 257th Avenue and would provide for complete separation of the auto/truck weave currently experienced. It was noted, however, that this alternative's effectiveness would be largely determined by how much diversion from South Frontage Road it would actually attract. Other key positive characteristics included feasible construction and probable compatibility with the long-range interchange improvement. Negative characteristics included the high cost of construction and significant private property impacts (Love's would be heavily impacted). It was agreed that this alternative should be retained for further analysis.

LEGEND

- Proposed Improvement
- X - Close Approach

Preliminary Alternative 1
Marine Drive Extension to 257th Way
Figure 1

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I-84/Troutdale Frontage Road System Refinement Study

Alternative 2: *Backage Road for Truck Stops*

Includes constructing an access road for TravelCenters and Love's properties with a single connection to South Frontage Road. Upon review, it appeared this alternative would provide only a minor improvement to interchange area access management and would do little to improve the auto/truck weaving or facilitate the eastbound to southbound travel demand. There was a common concern that consolidating all truck ingress and egress to a point even closer to the I-84 eastbound off-ramp had the potential to impact the freeway even more severely than it is under existing conditions. It was agreed that this alternative had little value and should not be carried forward.

LEGEND

- Proposed Improvement
- X - Close Approach

Preliminary Alternative 2
Backage Road for Truck Stops

Figure 2

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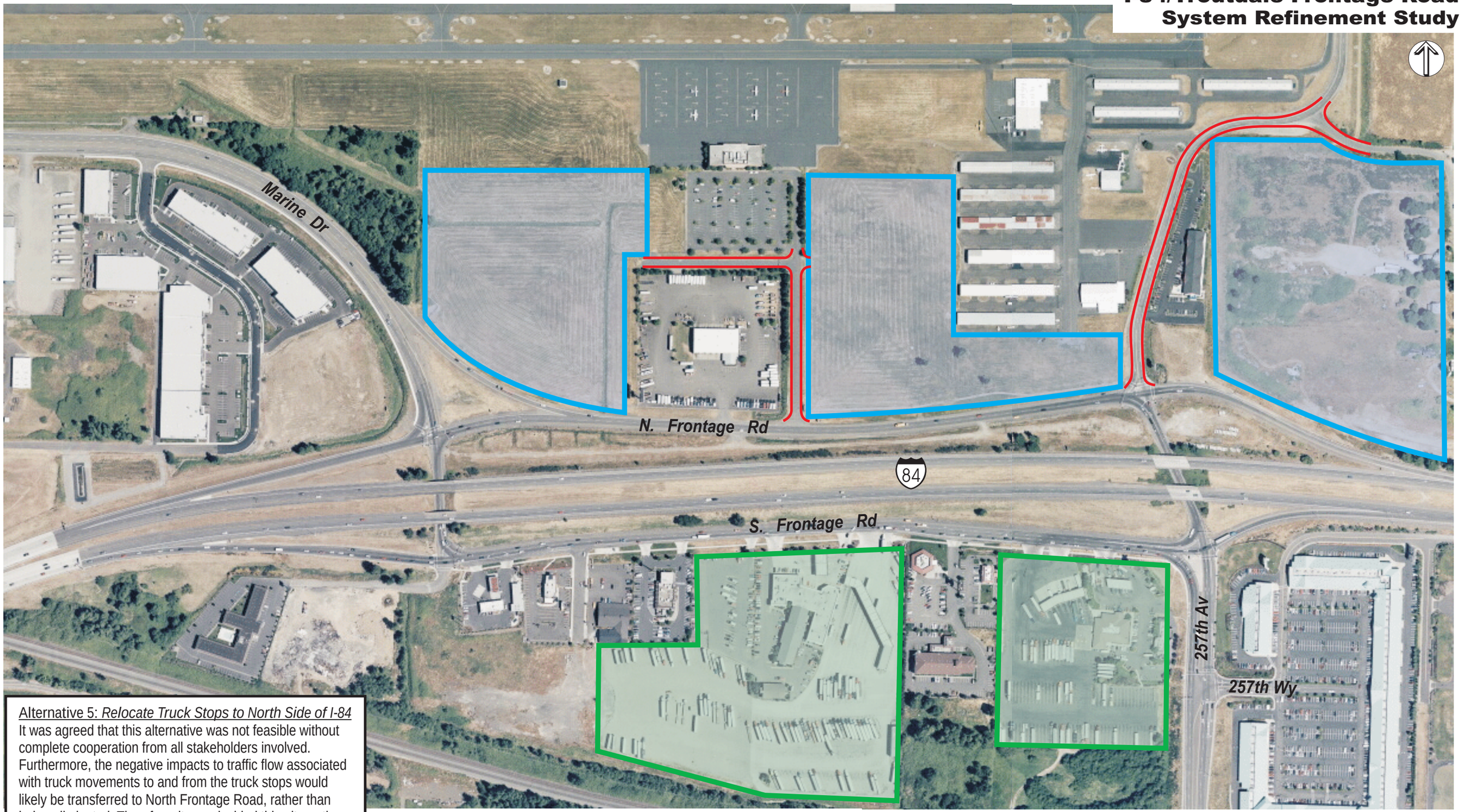
I-84/Troutdale Frontage Road System Refinement Study



Alternative 5: *Relocate Truck Stops to North Side of I-84*
It was agreed that this alternative was not feasible without complete cooperation from all stakeholders involved. Furthermore, the negative impacts to traffic flow associated with truck movements to and from the truck stops would likely be transferred to North Frontage Road, rather than being eliminated. Therefore, it was decided this alternative should not be carried forward for further analysis.

LEGEND
- Relocation Property Access
- Relocate Businesses
- Potential Relocation Properties

Preliminary Alternative 5
Relocate Truck Stops to North Side of I-84
Figure 3

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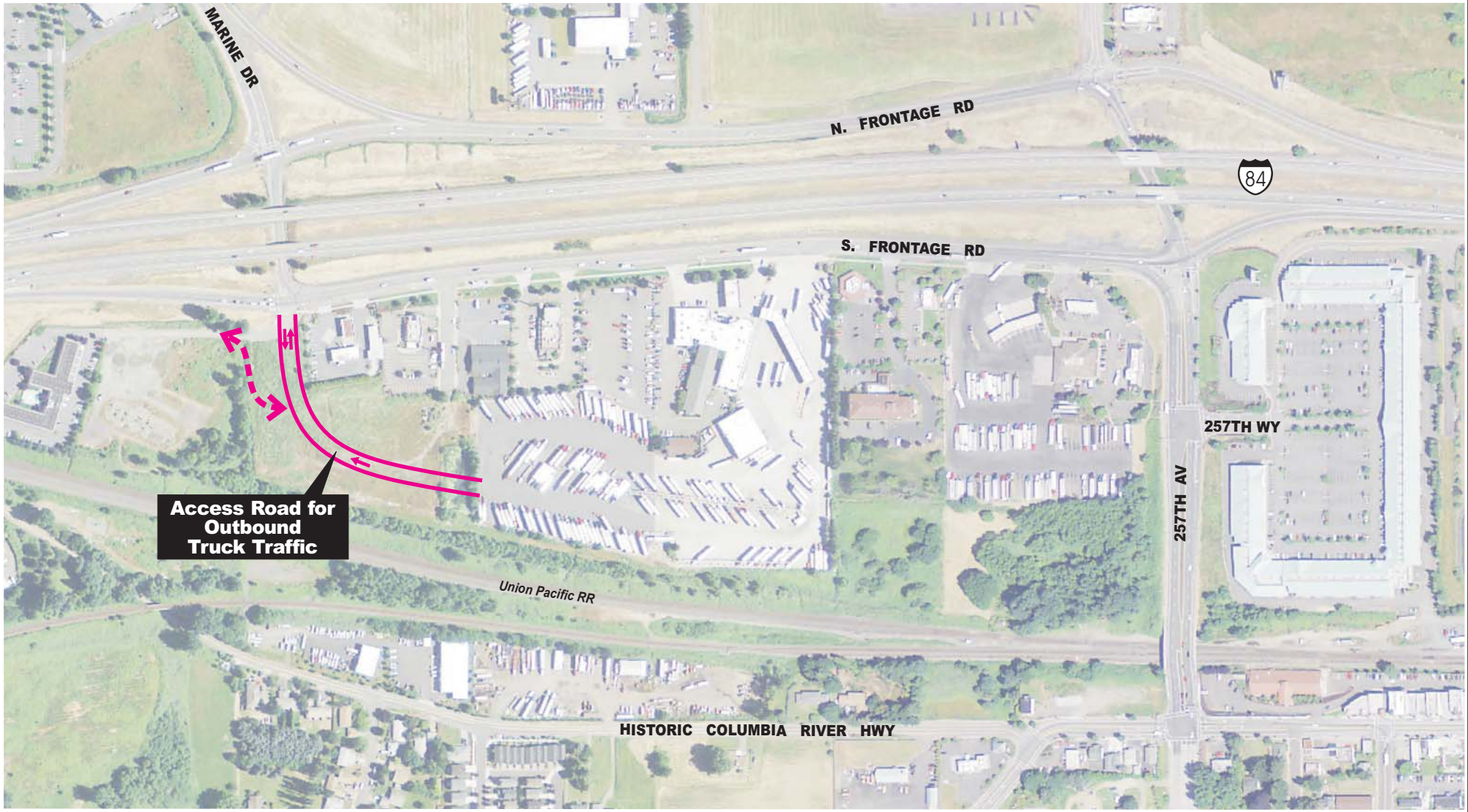

New Egress from TA to Marine Dr/S. Frontage Rd. The intent of this option is to provide truck traffic using the TA site a signalized egress point onto South Frontage Road. It focuses TA truck traffic at a single signalized access, provides circular flow of truck traffic through the TA side and reduces conflicts between trucks entering and exiting the site. It would require property acquisition and may constrain adjacent property. It would likely worsen signal operations at Marine Drive/S. Frontage Road and signalized access for trucks may not be efficient given the time it takes for them to get up to speed within the limited green time they could be assigned.

LEGEND

- Proposed Access
- New Connection

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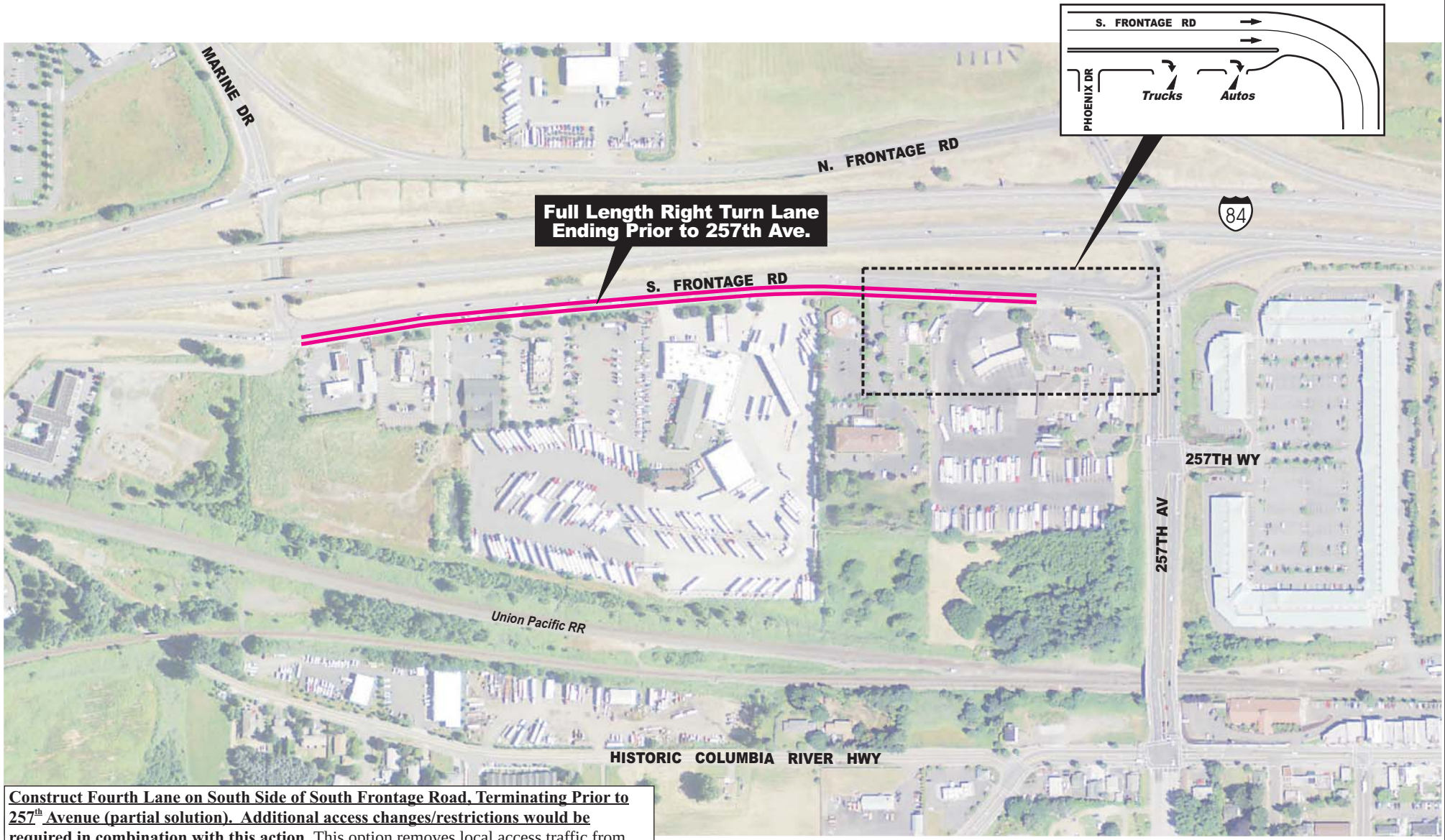
NO SCALE

Figure 4

OPTION A
Troutdale Interchange



Construct Fourth Lane on South Side of South Frontage Road, Terminating Prior to 257th Avenue (partial solution). Additional access changes/restrictions would be required in combination with this action. This option removes local access traffic from through traffic destined to either 257th Avenue south or to the north side of the interchange. It is critical that this lane terminate prior to 257th Avenue to keep through traffic out of it as much as possible. Signage would be provided to direct through traffic to avoid the southernmost lane. It would separates some local access traffic from through traffic, improving conflicts between trucks exiting south Frontage Road businesses and through traffic. However, it would have significant right-of-way impacts to businesses along S. Frontage Rd. It would also create an additional lane of weaving for vehicles headed from S. Frontage Rd. businesses to eastbound left or through lanes at 257th Avenue. It also fails to remove all conflicts between trucks exiting south Frontage Road businesses and through traffic

LEGEND

- Proposed Access

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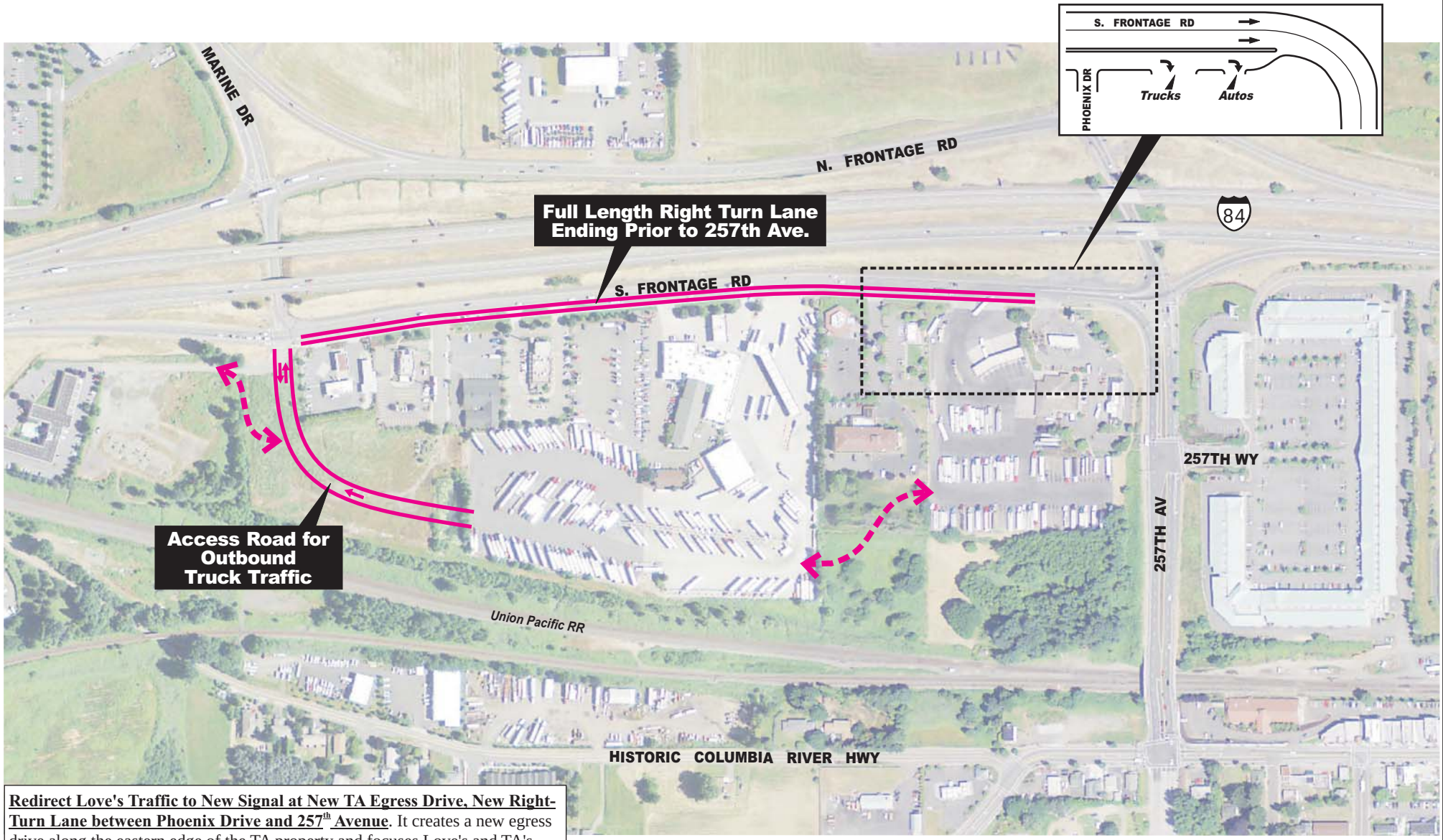
NO SCALE

Figure 5

OPTION B
Troutdale Interchange



Redirect Love's Traffic to New Signal at New TA Egress Drive, New Right-Turn Lane between Phoenix Drive and 257th Avenue. It creates a new egress drive along the eastern edge of the TA property and focuses Love's and TA's exiting traffic to one signalized location, while adding a new lane on the south side of south Frontage Road for ingress traffic. It separates Love's ingress traffic from through traffic on S. Frontage Road, however it has significant impacts including right-of-way, traffic signal and new roadway costs. It also requires mixing of auto and truck traffic as well as access between Love's and TA properties.

A major consideration of this traffic control configuration would be the weaving that would occur between the new signalized intersection and the intersection at 257th Avenue/South Frontage Road.

LEGEND

- Proposed Access
- New Connection

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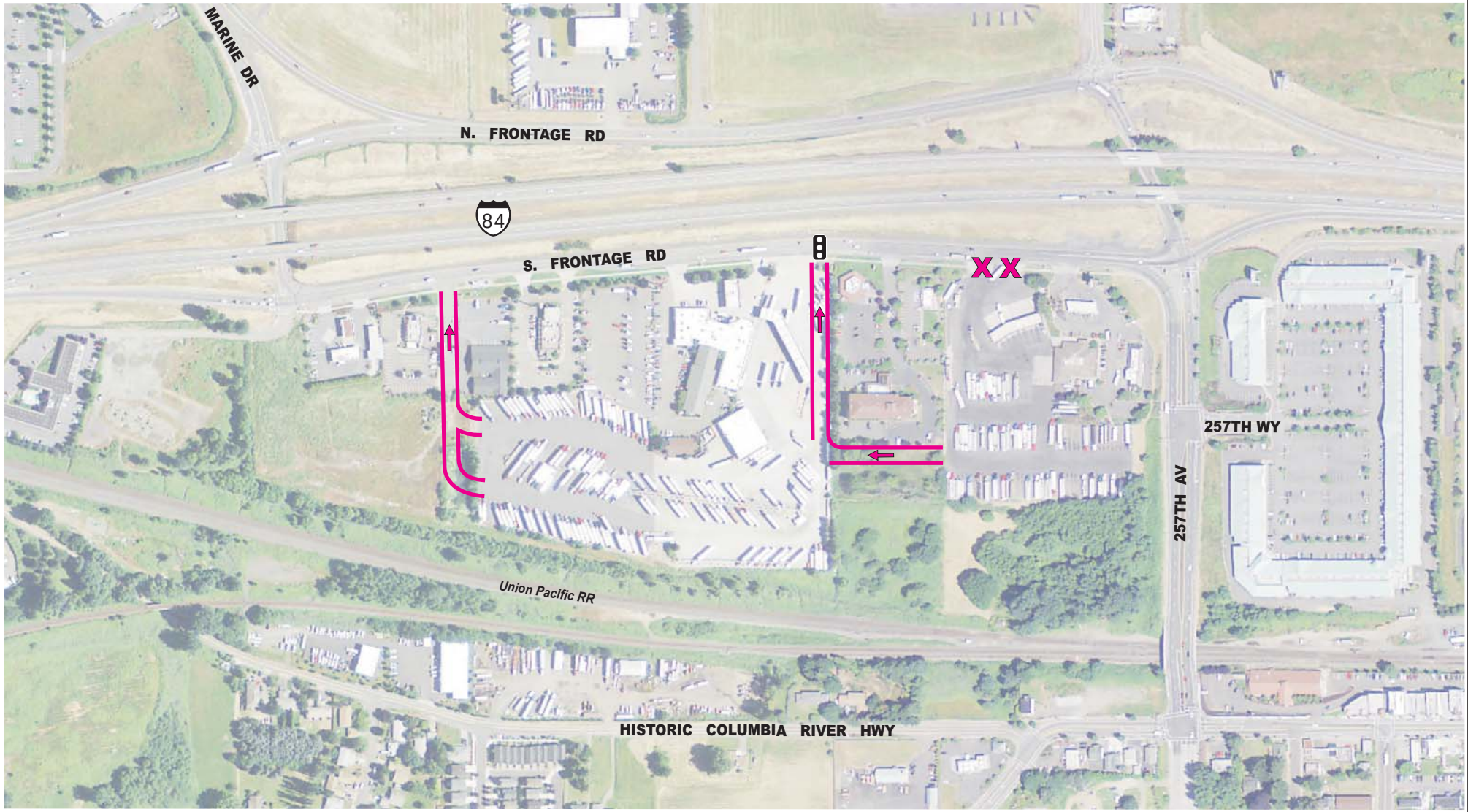
NO SCALE

Figure 6

OPTION C
(Combination of Options A & B)
Troutdale Interchange



Construct Two New Egress Roadways to support S. Frontage Rd. businesses (primarily Love's and TA), providing focused truck and vehicular egress along TA's eastern property line and along Culpepper Drive. A new traffic signal would be constructed at the new TA egress. While focusing conflicts at only two points, and providing gaps (due to new signal) for traffic entering S. Frontage Rd. via Culpepper Drive, it requires some right-of-way (minimal), construction of a signal, and requires mixing of auto and truck traffic on Love's site.

LEGEND

- Proposed Access
- Traffic Signal
- X - Close Driveway

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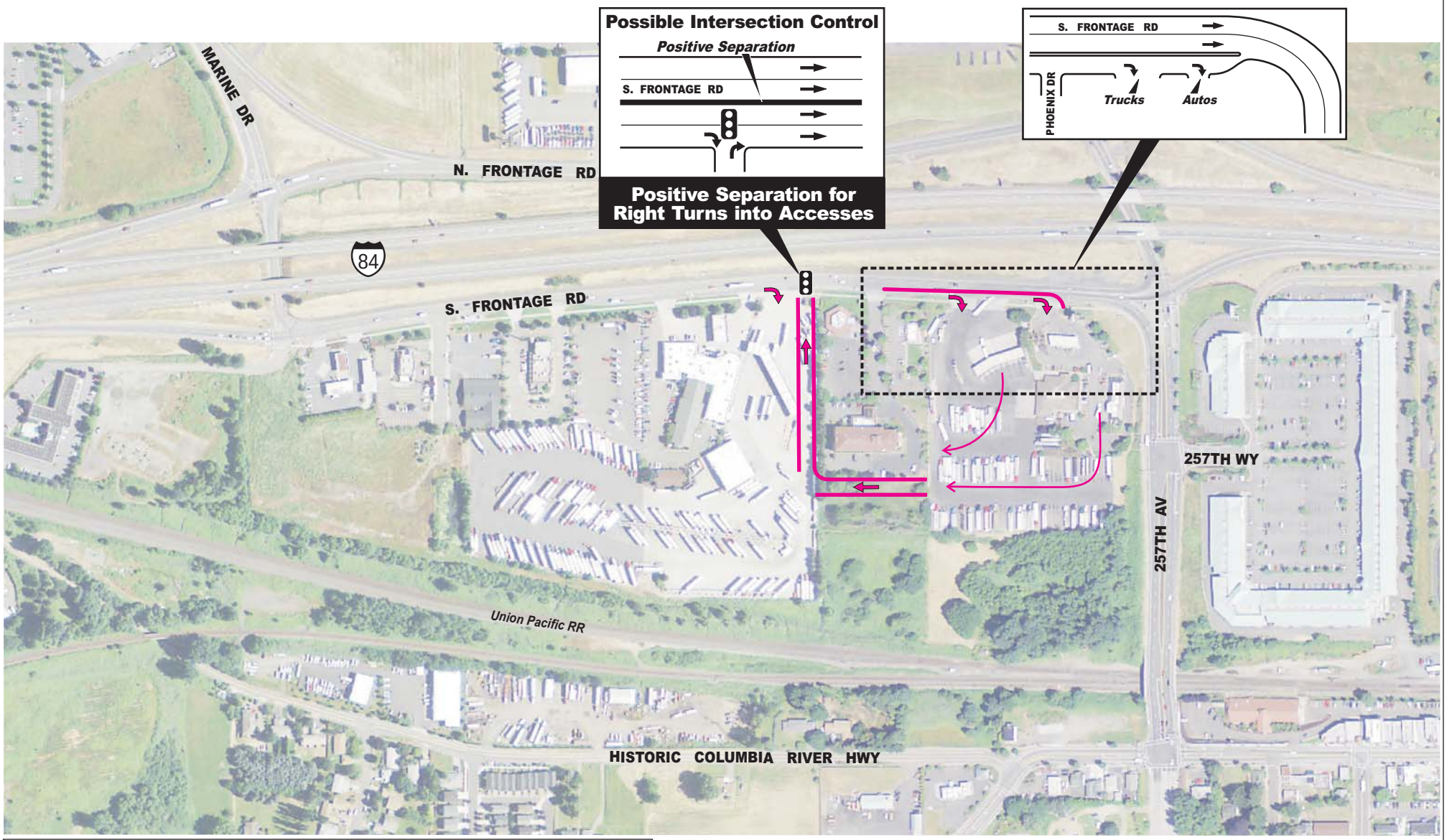
NO SCALE

Figure 7

OPTION E
Troutdale Interchange



Modifies Figure 7 to include new "Ramp Metering" type traffic signal on S. Frontage Rd. approximately 400-500 feet in advance of the 257th Avenue intersection. This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road and regulates traffic approximately 400-500 feet in advance of the 257th Avenue intersection. It requires minimal right-of-way acquisition and addresses the weaving concern between "through" and "local" traffic in advance of 257th Avenue intersection. However, the impacts include right-of-way, traffic signal and positive separation costs, as well as the mixing of auto and truck traffic on Love's site.

LEGEND

- Proposed Access
- Traffic Signal

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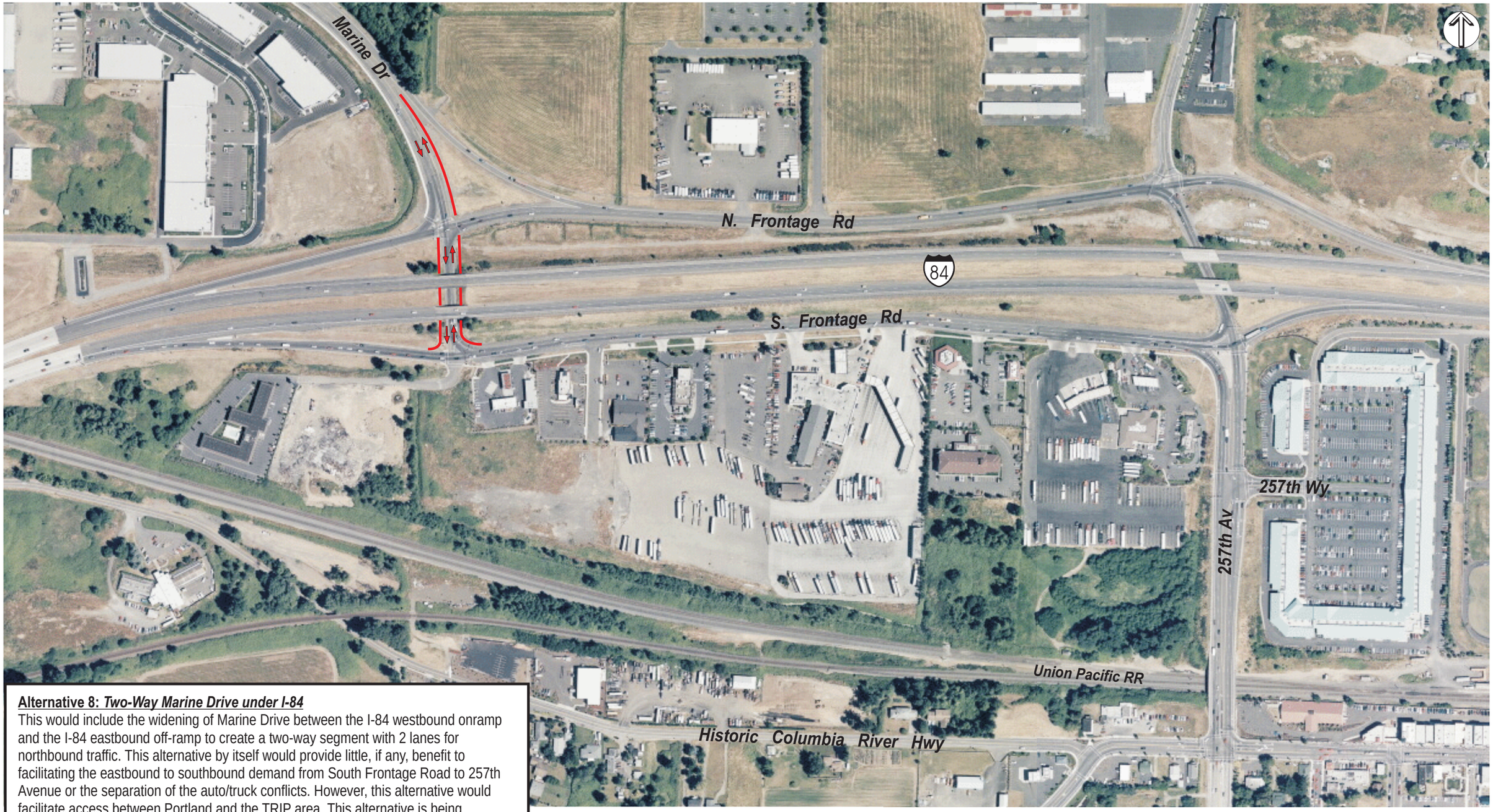
NO SCALE

Figure 8

OPTION D
Troutdale Interchange

I-84/Troutdale Frontage Road System Refinement Study



Alternative 8: *Two-Way Marine Drive under I-84*

This would include the widening of Marine Drive between the I-84 westbound onramp and the I-84 eastbound off-ramp to create a two-way segment with 2 lanes for northbound traffic. This alternative by itself would provide little, if any, benefit to facilitating the eastbound to southbound demand from South Frontage Road to 257th Avenue or the separation of the auto/truck conflicts. However, this alternative would facilitate access between Portland and the TRIP area. This alternative is being seriously considered.

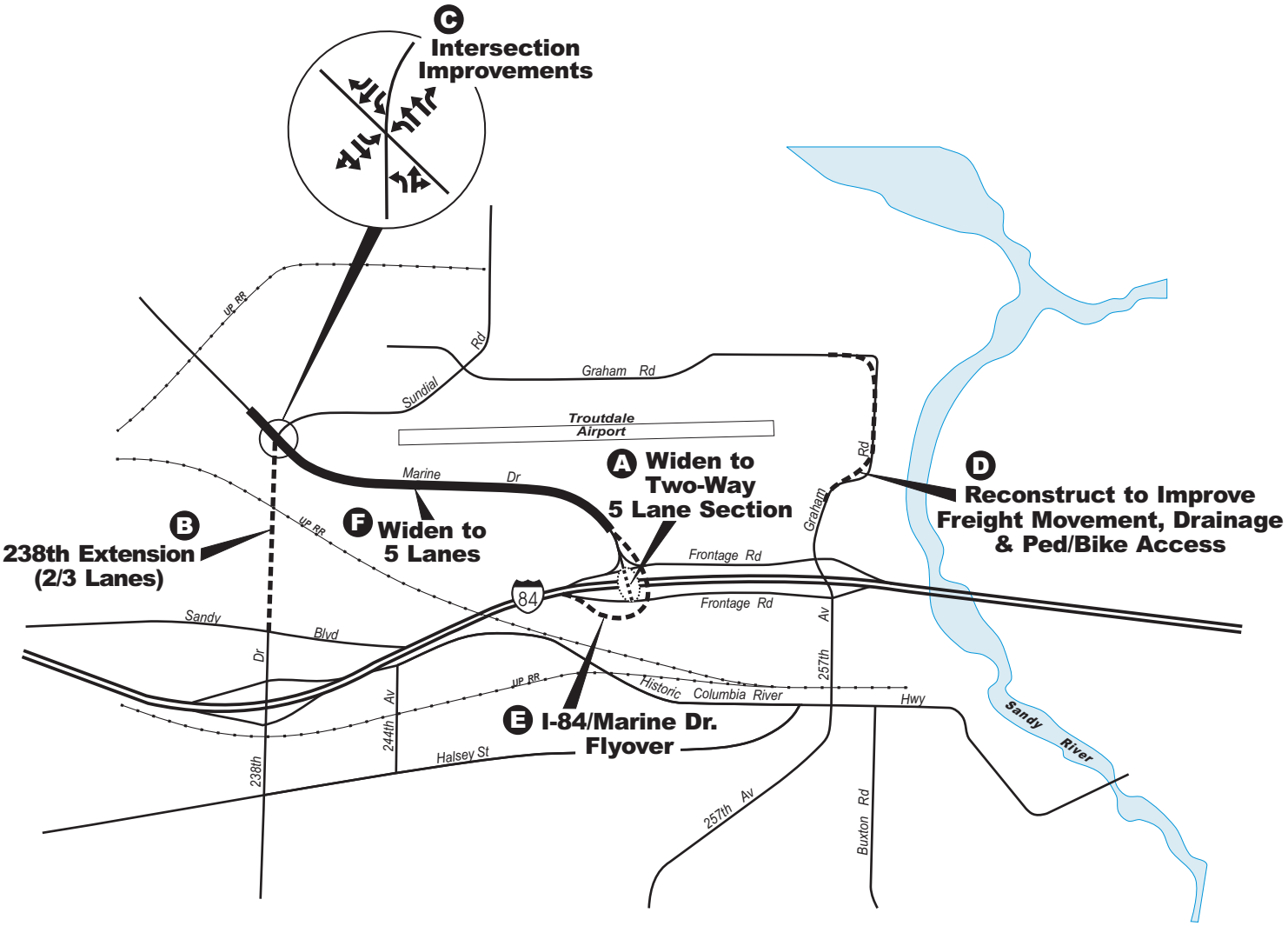
LEGEND

- Proposed Improvement

Preliminary Alternative 8
TWO-WAY MARINE DRIVE UNDER I-84

Figure 9

DKS Associates
TRANSPORTATION SOLUTIONS



LEGEND

- (#) - Prioritized Improvements
- (A) - As Opportunities Arise
- ----- - New Connector

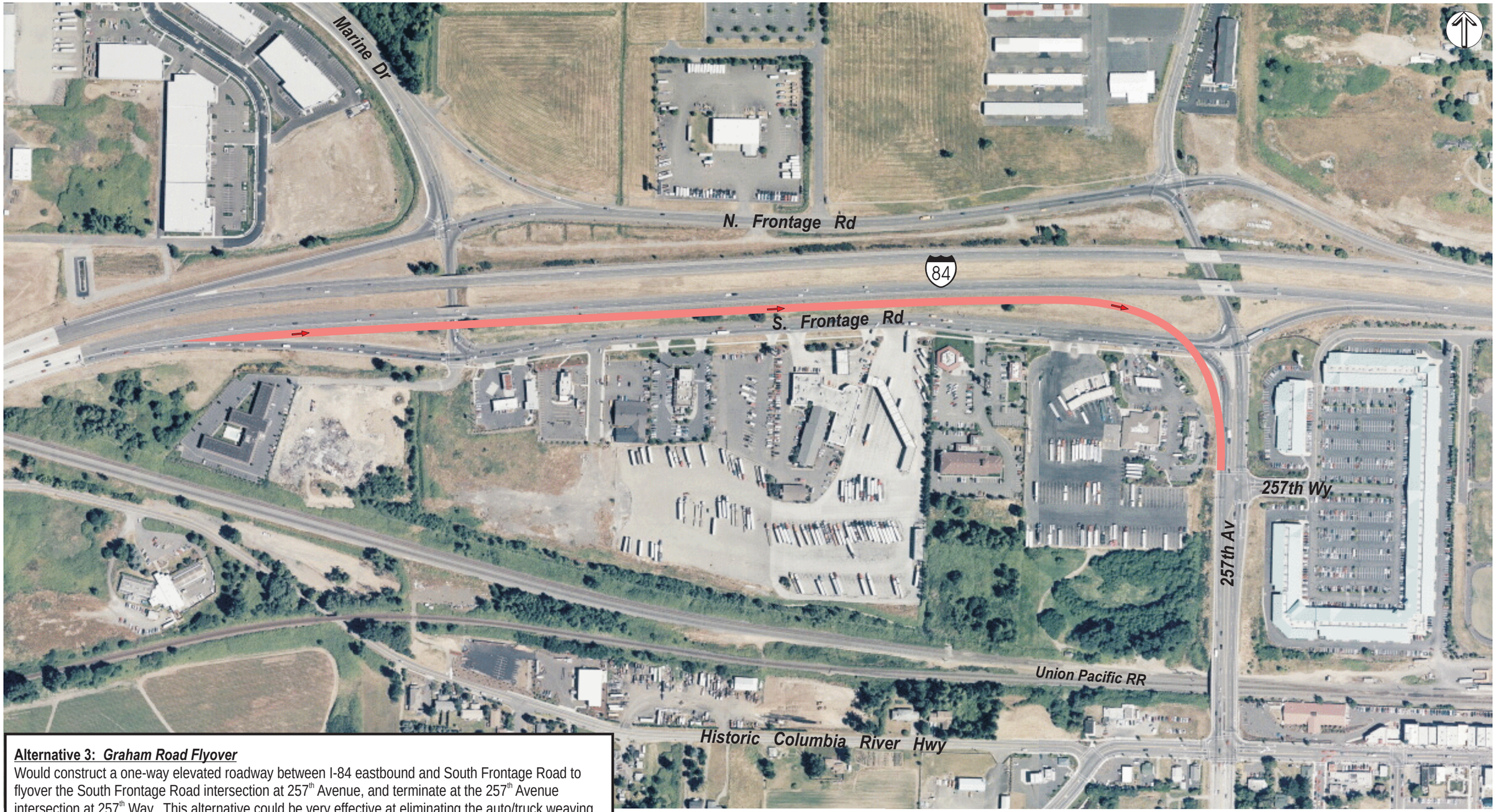
DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 10

TRANSPORTATION IMPROVEMENTS MAP

I-84/Troutdale Frontage Road System Refinement Study



Alternative 3: *Graham Road Flyover*

Would construct a one-way elevated roadway between I-84 eastbound and South Frontage Road to flyover the South Frontage Road intersection at 257th Avenue, and terminate at the 257th Avenue intersection at 257th Way. This alternative could be very effective at eliminating the auto/truck weaving.

LEGEND

- Proposed Improvement

Preliminary Alternative 3
Graham Road Flyover
Figure 11

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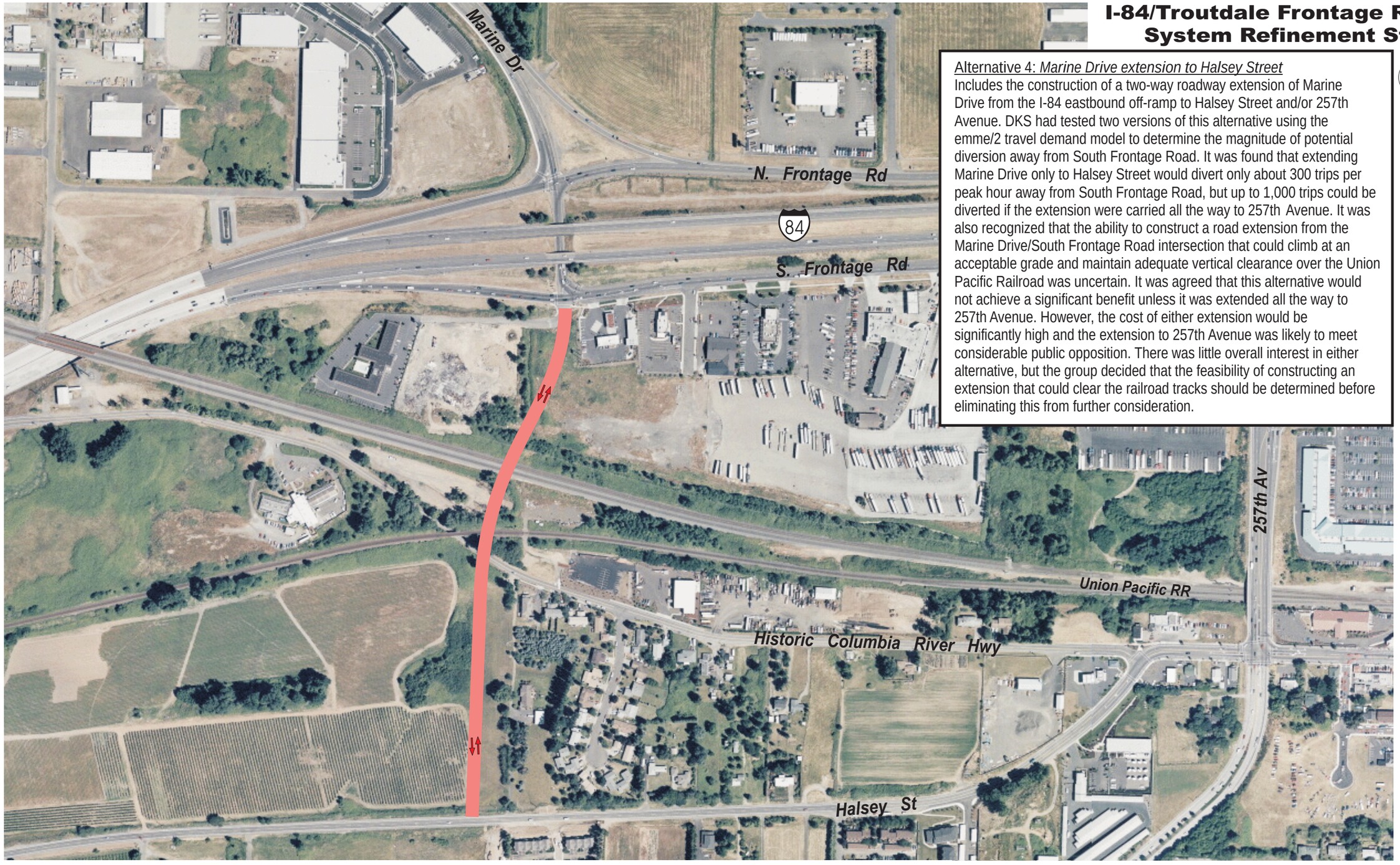
I-84/Troutdale Frontage Road System Refinement Study

Alternative 4: *Marine Drive extension to Halsey Street*
Includes the construction of a two-way roadway extension of Marine Drive from the I-84 eastbound off-ramp to Halsey Street and/or 257th Avenue. DKS had tested two versions of this alternative using the emme/2 travel demand model to determine the magnitude of potential diversion away from South Frontage Road. It was found that extending Marine Drive only to Halsey Street would divert only about 300 trips per peak hour away from South Frontage Road, but up to 1,000 trips could be diverted if the extension were carried all the way to 257th Avenue. It was also recognized that the ability to construct a road extension from the Marine Drive/South Frontage Road intersection that could climb at an acceptable grade and maintain adequate vertical clearance over the Union Pacific Railroad was uncertain. It was agreed that this alternative would not achieve a significant benefit unless it was extended all the way to 257th Avenue. However, the cost of either extension would be significantly high and the extension to 257th Avenue was likely to meet considerable public opposition. There was little overall interest in either alternative, but the group decided that the feasibility of constructing an extension that could clear the railroad tracks should be determined before eliminating this from further consideration.



LEGEND
- Proposed Improvement

Preliminary Alternative 4
Marine Drive Extension to Halsey Street
Figure 12

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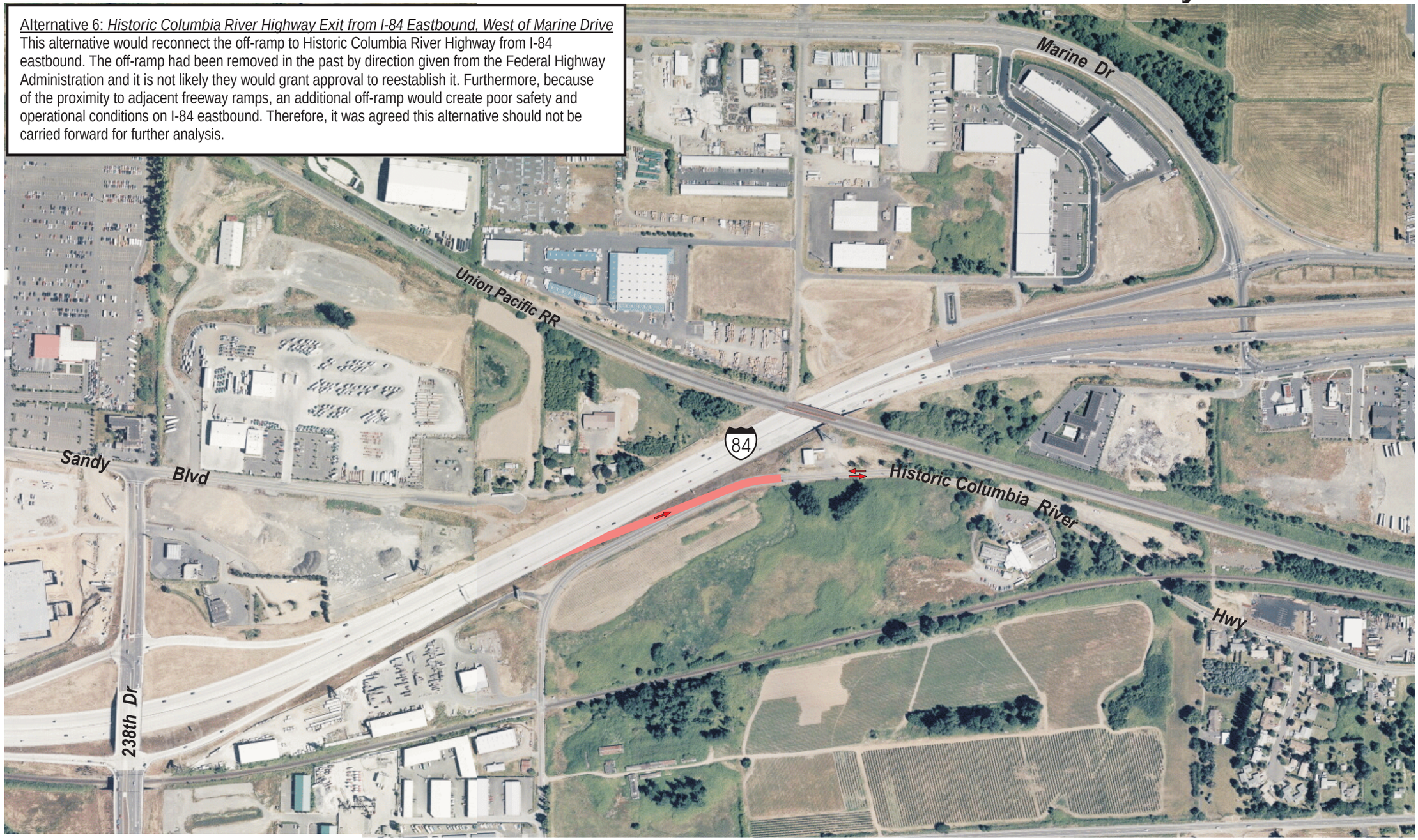
I-84/Troutdale Frontage Road System Refinement Study

Alternative 6: *Historic Columbia River Highway Exit from I-84 Eastbound, West of Marine Drive*
This alternative would reconnect the off-ramp to Historic Columbia River Highway from I-84 eastbound. The off-ramp had been removed in the past by direction given from the Federal Highway Administration and it is not likely they would grant approval to reestablish it. Furthermore, because of the proximity to adjacent freeway ramps, an additional off-ramp would create poor safety and operational conditions on I-84 eastbound. Therefore, it was agreed this alternative should not be carried forward for further analysis.



LEGEND

- Proposed Improvement

Preliminary Alternative 6
Historic Columbia River Highway Exit from I-84 EB, West of Marine Drive
Figure 13

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Project Advisory Committee

Meeting #3 - Summary
March 15, 2010 4:00 to 6:00 pm
City Hall – 104 SE Kibling, Troutdale

Attendees:

- Erna Harvey/Factory Outlet Mall
- Malcolm McCann/ Comfort Suites Inn
- Dan Walsh/ Walsh Trucking Company
- William Roper /Chevron
- Phil Healy/Port of Portland
- Rich Faith/ City of Troutdale
- Andrew Johnson /ODOT
- Todd Juhasz /ODOT
- Carl Springer/DKS
- Brandy Steffen/CH2M HILL
- Dawn Parker/CH2M HILL

Not in attendance:

- Kathryn Kelly/City of Gresham
- Les Perry/ General Citizen

Welcome & Introductions

The group introduced themselves and Brandy reviewed the agenda. There were no revisions to Meeting #2 summary. All notes will be posted to the JTA website.

Review Desired Outcomes

The group then reviewed the Matrix of Alternatives (handout), which outlined the pros and cons of each alternative suggested throughout the process; including the ideas suggested during PAC meeting #2. There are three main issues that the interchange area management plan (IAMP) will address are listed below. Each issue was explained by Carl and discussed by the PAC.

- **Issue #1 - South Frontage Road Access**
  - No clear winners in this first group.
  - Figure 1: Marine Dr extension to 257th
    - Used to be referred to as "Backage Rd"
  - Figures 2 and 3: were rejected because of TSP (Transportation System Plan) study.
  - Figures 4 and 5: are partial fixes, but not enough alone (Connection between TA and Marine Drive and Construct 4th lane on south side of S Frontage Road for local traffic).
  - Figure 6: (Redirect Love's traffic out the TA driveway at a new signal) might work but would need modifications.
  - Figure 7: (two new roads for business exit onto S Frontage Road) would probably not work.
  - Figures 6, 7 & 8: These figures are new from our last meeting.

There was a question about ODOT extending the right lane through to a right turn lane on S. Frontage Rd. Andy mentioned that this will likely be in the next JTA improvement, which will start construction during the summer. Signage, as suggested in PAC meeting #2, will also be examined and updated at that time. Andy agreed to follow up with the JTA project to ensure that these recommendations were considered.

- **Issue #2 – Access between Portland and Troutdale Reynolds Industrial Park (TRIP).** This is from the Interchange and North.
    - The undercrossing alternative looked at was too small for truck turns.
    - Figures 9 & 10A: show "Under Consideration" meaning these figures are partially funded (Marine Drive two-way under I-84).
    - Figure 10B: (238th Avenue extension) also part of the East Metro Connection Plan study.
    - Figures 10C & 10D: (Improve Marine Drive/Sundial Intersection and Improve Graham Road) are two that we "Will Likely Recommend."
    - Figure 10F: (widen Marine Drive to 5 lanes) shows "Planned" and will be captured with East Metro's Connection Plan.
    - Figure 10E: (construct I-84/Marine Drive Flyover) shows "Further Analysis Required". This is very high dollar and may not be buildable with space allowable.
    - Figure 9: (Marine Drive two-way under I-84) has been studied extensively and traffic data was updated so it is very current and accurate. This may be an alternate to the 238th alternative.
- **Issue #3 – Access between Portland and Troutdale (NW to SE Connectivity).** This is through the Interchange to the South.
    - Figure 1: (Marine Drive Extension to 257th Way) is under consideration. Reduces weaving.
    - Improving signage will be recommended (no figure).
    - Figures 5, 6, 7, & 8: Separate local/business traffic via positive separation and/or signal control.
    - Figures 11, 12, & 13 were eliminated without scoring in the TSP.

The PAC then discussed narrowing the alternatives to a single best choice or a list of recommendations that will be forwarded to the project management team. The PAC decided to recommend a prioritized list. Below is the discussion surrounding the figures, listing concerns and benefits for each of the alternatives.

- Figure 1 – Marine Drive extension to 257th Way
    - Impact to Love's Trucking is a problem
    - Reduces traffic on Frontage Rd by half so it does meet the volume requirements.
    - We can recommend this alternative with contingency to avoid impacting Love's.
    - May affect businesses.
    - Use for commuters/residents.

- Figure 4 – Connection between TA And Marine Drive/I-84 Eastbound off-ramp intersection
    - Doesn't meet traffic volume demand and makes the interchange back up worse.
    - This is only a partial fix.

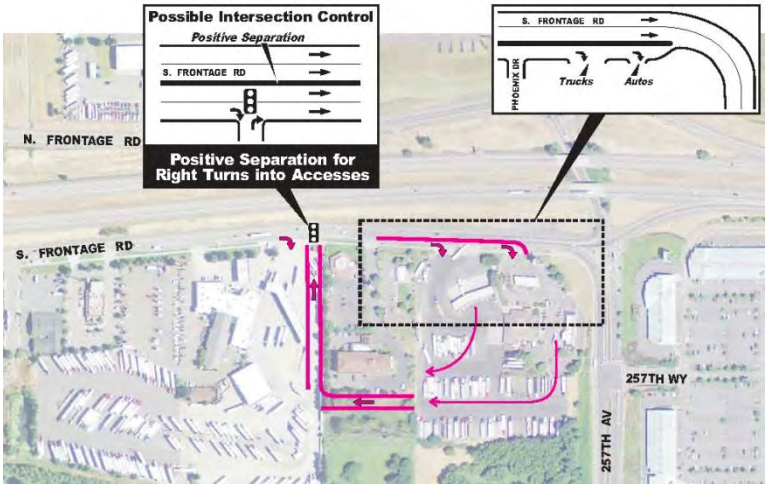
- Figure 5 – Construct 4th lane on south side of S Frontage Road (local traffic only)
    - This is a lane for businesses only with a barrier between lanes.
    - It is too tight of a turn for trucks.
    - If drivers miss the entrance to the right lane where would they go?
    - Maybe shortening the barrier on the east end would be better.
    - Figures 4 & 5 won't work by themselves.

- Figure 6 – Redirect Love's traffic to egress at TA driveway at new traffic signal (signal to curbside lane(s)/business traffic.
    - These are the signalized lanes.
    - Would be better to shorten the barrier on the east end also.
    - Would need to tie the backside truck access (partial segment of Figure 1 or combine with Figure 1).
    - Add a lane through at Culpepper (next road east of Marine Dr)
    - Shorten barrier and combine with Figures 2 & 5.

- Figure 7 – Construct two new roads for business egress onto South Frontage Road (one at TA driveway and one along Culpepper Dr with signal at TA driveway)
    - This signal won't meet warrants but may be possible if modified
    - Once traffic is congested this will cause a back up past the ramp

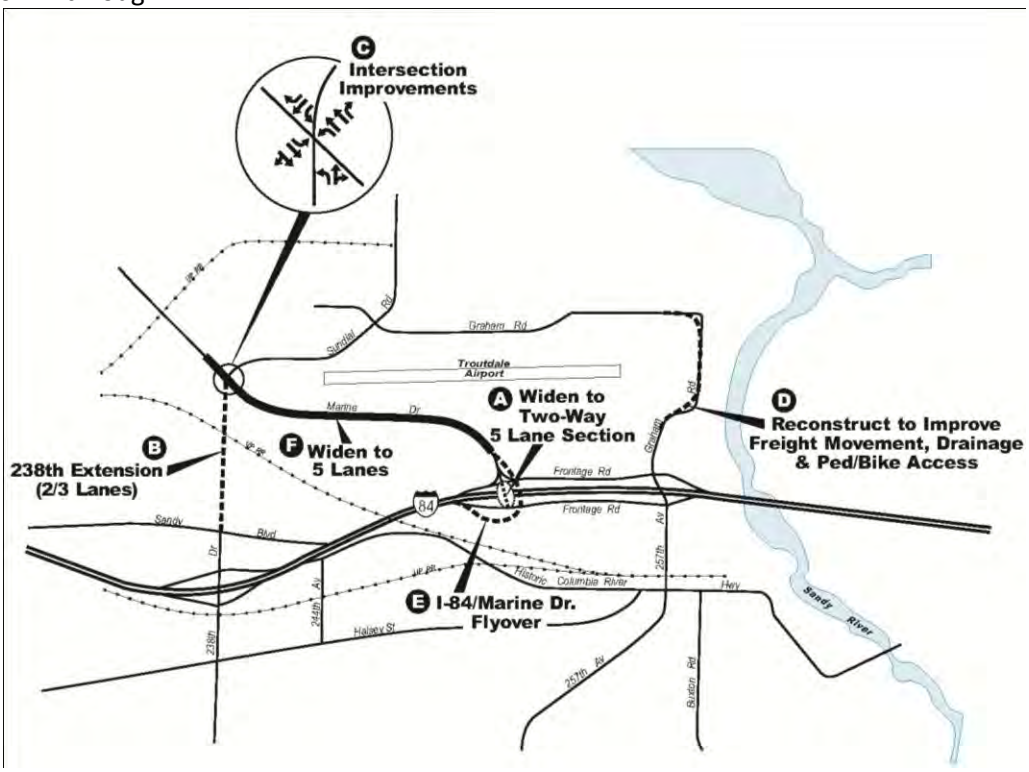
- Maybe using this signal part time would work.

- Figure 8– Redirect Love's traffic to egress at TA driveway at new "ramp metering" type signal on South Frontage Road.
  - This is a phased signal in the two right lanes for letting trucks exit.
  - Doesn't solve the scrambling of drivers between lanes.
  - This would also have the barrier between lanes.
  - We could propose this with further analysis.
  - Signals are more likely to be warranted than Figure 7.



- Figure 9 – Two-way Marine Drive under I-84

- Figure 10 – A through F



- **What Figures do we love/hate, or want to eliminate from consideration.**
  - Figure 1 (Marine Drive extension to 257th) is a fallback, if it included more study to reduce the impact to Love's property.
  - Figures 6 & 8 (redirect Love's traffic to exit at TA driveway) would be good with more study or some combination.
  - Figure 9 (Marine Drive two-way under I-84) is good, but has a high cost. There is concern about space for the left turn onto Marine Dr.
    - This is currently in the TSP with potential funding already.
    - Recommend with addition of 10C (Marine/Sundial intersection improvement), 10D (improve Graham Road), and 10F (widen Marine Drive to 5 lanes): prioritized list.
    - Figure 10 A is part of Figure 9 (Two-way widen Marine Drive under I-84).
    - Figure 10B (238th extension) serves a similar function to Figure 9 (Marine Drive two-way under I-84) and could be recommended with further study.
      - Andy will recommend further study of Figure 10B by the East Metro Connection team (may be outside of their study area).
  - Figure 10C (Marine/Sundial intersection) should be on the list of recommendations.
    - It shows a leg of the 238th.
    - The proper traffic modeling on this alternative has already been done.
  - Figure 10D (improve Graham Road) should be on the list of recommendations.
    - It is safer and better for the trucking companies.
  - Figure 10E (flyover) should not be on the list of recommendations.
    - It is too expensive and probably not feasible to build.
  - Figure 10F (widen Marine Drive) should be on the list of recommendations.
    - Ideally combined with Figure 9 (Marine Drive two-way under I-84).

- Prioritization of these Figures would be 9, 10F, 10C then 10D.
- There are some mutually beneficial figures for both issues 1 and 2.

The group decided upon the following draft recommendations. The group decided to meet for a fourth meeting to finalize these recommendations before presenting them to the general public.

> "To address the three issues along the South and North Frontage Roads, the PAC recommends a series of recommendations as funding is available. For South Frontage Road, Figures 6 and 8 (redirect Love's traffic to exit at TA driveway) were preferable with some modification and may include a combination of the two (provides a backage road for the trucks). Figure 1 (Marine Drive extension to 257th) would be a fallback option, with greater study on ways to reduce property impacts; if there are fatal flaws with the other two options. These options address the first and third issues (see above).
>
> For issues one and two, the PAC recommends (in order of priority) Figures 9 (Marine Drive two-way under I-84), 10F (widen Marine Drive), 10C (Maine/Sundial intersection), and 10D (improve Graham Road). Ideally Figures 9 and 10F would be completed together, but if funding is not available for both, the PAC recommends proceeding with option 9 first. Figure 10C (the intersection improvements at Marine/Sundial) needs more study.
>
> Signage improvements are recommended as soon as possible (no figure for this recommendation)."

The group decided to finalize their recommendations before presenting them to the general public. Brandy asked each member to invite his or her friends, family, and business colleagues to attend the meeting. The group will focus on inviting those who may be most affected by the IAMP, including the owners of Love's. Brandy will send an invitation to the group, after polling each PAC member about their availability for the internal meeting. We will try to schedule the public meeting with an already scheduled meeting, to increase attendance. A revised graphic showing the recommendations from the PAC will be presented at the public meeting. Comments will be collected to make sure that all ideas are considered and to ensure that the group hasn't missed any suggestions for improving the area.

Next steps

Brandy will send out a meeting request to determine the best time for the final PAC meeting. During that meeting the group will review an updated map with the recommendations displayed and finalize their recommendations. A general public meeting will be scheduled about a week after the last PAC meeting, to allow time for any changes to the recommendations and figures.

Actions for Next Meetings

- Andy will propose the signage improvement recommendation and the continuation of the right lane & right turn to the JTA team.
- Andy will recommend further study of Figure 10B to the East Metro Connection team.
- Carl will revise drawing ideas to combine figures added to the maps (and include property line overlays).
- Brandy will poll Rich for local events to possibly piggyback the public outreach meeting.
- Brandy will poll the group on dates available for the next meeting and the public outreach meeting.
- Brandy will send out the Recommendations Memo draft to the group.

- Brandy will send out the meeting summary.
- Malcolm offered meeting space at the Comfort Inn for the next meeting.

Close

- Brandy thanked the group for attending, and asked them to call her or email with any questions or comments.
- Meeting adjourned at 6:00 pm.

Project Advisory Committee

Meeting #4
April 14, 2011 5:00 to 7:00 pm
Comfort Inn (477 NW Phoenix Drive, Troutdale)

Meeting Goals:

- Finalize recommendations
- Brainstorm ideas for sharing this information with the general public

5:00 p.m.	**Welcome & Introductions** • Introductions • Review desired outcomes • Review agenda	Andrew Johnson, ODOT Brandy Steffen, CH2M HILL
5:05 p.m.	**Review draft recommendations** • Finalize language that the group feels comfortable recommending to ODOT for solutions in the area, including both short- and long-term solutions.	Andrew Johnson
6:00 p.m.	**Brainstorm public outreach** • Possible public events • Email/ask friends, family, and co-workers to attend	Brandy Steffen
6:55 p.m.	**Next steps** • Public Event (late April to early May) • JTA Open House on May 2, 2011 (4:30 – 6:30 pm, Comfort Inn)	Brandy Steffen
7:00 p.m.	**Close**	Andrew Johnson

I-84/257th Interchange
Summary of Alternatives Considered

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Issue #1: South Frontage Road Access

Alternatives Considered	Figure	Serves Eastbound to Southbound Demand	Reduces Auto / Truck Conflicts	Improves Access Management within Interchange Area	Feasible Construction / Implementation	Anticipated Cost of Improvement	Compatible w/Potential Long-Range Improvement	Likely Avoids EA or EIS	Able to Meet Design Standards	Potential for Public Acceptance	Minimal Property Impacts	Facilitates Alternate Travel Modes	Outcome
Marine Drive extension to 257th Avenue	1	√	+	—	+	H	√	√	√	+	—	+	Under consideration
Backage Road for Truck Stops	2	Eliminated without Scoring											Rejected
Relocate Truck Stops to North Side of I-84	3	Eliminated without Scoring											Rejected
Connection between TA and Marine Drive/I-84 EB Off-Ramp Intersection	4	—	+	+	√	M	√	+	√	+	—	√	Under consideration
Construct fourth lane on south side of S Frontage Rd to serve local traffic only (terminates prior to 257th Ave)	5	+	+	+	√	M	√	+	√	+	—	√	Under consideration
Redirect Love's traffic to egress at TA driveway at new traffic signal (signal to serve only curbside lane(s)/business traffic)	6	+	+	+	√	M	√	+	√	+	—	√	Under consideration
Construct two new roads for business egress onto South Frontage Road (one at TA driveway and one along Culpepper Dr). Signal at TA driveway	7	+	+	+	+	M	√	+	√	+	—	√	Under consideration
Redirect Love's traffic to egress at TA driveway at new "ramp metering" type traffic signal on S Frontage Road	8	+	+	+	+	M	√	+	√	+	—	—	Under consideration
Combination of Options C & D (Figures 6 & 8)	8a	+	+	+	√	M	√	+	√	+	—	√	Likely to recommend
Marine Drive Two-Way Under I-84	9 & 10A	+	+	√	+	H	+	+	+	+	+	+	Partially Funded

Scoring: + = Meets Criteria or Provides Substantial Benefit
√ = Might Meet Criteria or Provides Partial Benefit
— = Does Not Meet Criteria

H = High
M = Medium
L = Low

Changes shaded

I-84/257th Interchange

Summary of Alternatives Considered

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Issue #2: Access between Portland and Troutdale Reynolds Industrial Park (TRIP)

Alternatives Considered	Figure	Facilitates Demand between Portland and TRIP Area	Reduces Out-of-Direction Travel	Improves Operations within Interchange Area	Feasible Construction/ Implementation	Anticipated Cost of Improvement	Compatible w /Potential Long-Range Improvement	Likely Avoids EA or EIS	Able to Meet Design Standards	Potential for Public Acceptance	Minimal Property Impacts	Facilitates Alternate Travel Modes	Outcome
Marine Drive Two-Way Under I-84	9 & 10A	+	+	√	+	H	+	+	+	+	+	+	Partially Funded
238th Avenue Extension	10B	+	+	+	√	H+	+	–	+	√	–	–	Under consideration
Improve Marine Drive/Sundial Intersection	10C	+	√	√	+	M	+	+	+	+	√	+	Will likely recommend
Improve Graham Road	10D	+	+	√	+	M	+	+	+	+	+	+	Will likely recommend
Construct I-84/Marine Drive Flyover (Eastbound to Northbound)	10E	+	+	+	√	H+	+	√	√	√	–	–	Eliminated due to grade issue
Widen Marine Drive to 5 lanes between I-84 and Sundial Rd	10F	+	√	√	+	M	+	+	+	+	√	+	Planned
Dual WB Left Turns from N Frontage Rd	None	+	+	√	+	L	+	+	+	+	√	√	Under consideration

Scoring:
+ = Meets Criteria or Provides Substantial Benefit
√ = Might Meet Criteria or Provides Partial Benefit
– = Does Not Meet Criteria

H = High
M = Medium
L = Low

Changes shaded

Alternatives rejected by PAC

Issue #3: Access between Portland and Troutdale (Northwest to Southeast Connectivity)

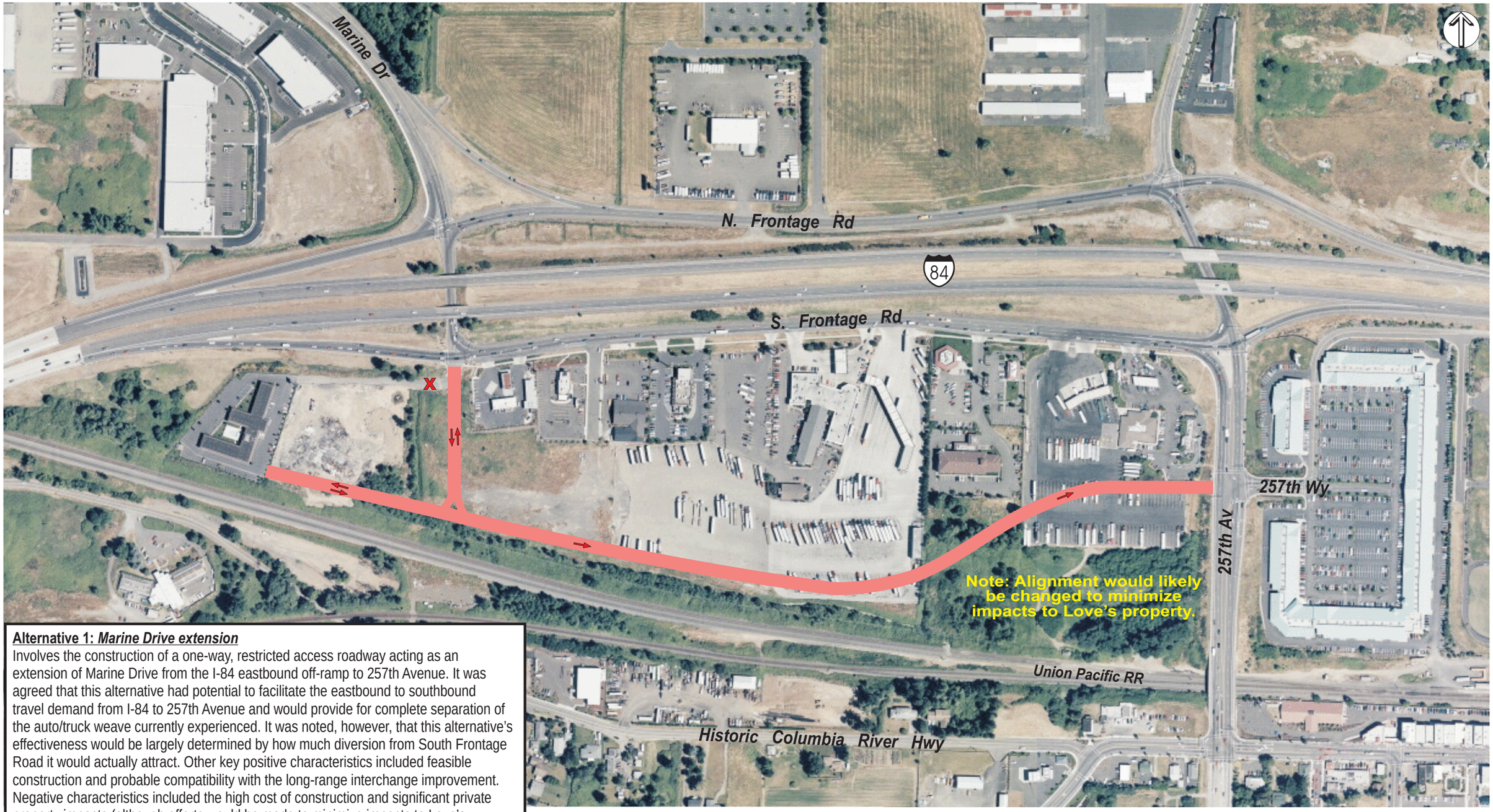
Alternatives Considered	Figure	Facilitates EB to SB Demand	Reduces Auto/Truck Conflicts/Improves Safety	Improves Access Management within Interchange Area	Feasible Construction/Implementation	Anticipated Cost of Improvement	Compatible w/Potential Long-Range Improvement	Likely Avoids EA or EIS	Able to Meet Design Standards	Potential for Public Acceptance	Minimal Property Impacts	Facilitates Alternate Travel Modes	Outcome
Marine Drive Extension to 257th Way	1	+	+	+	√	H	+	–	+	+	–	+	Under consideration
Improve signage for through versus local / business traffic	None	+	√	√	+	L	√	+	+	+	+	√	May be added to JTA project this summer
Separate local/business traffic via positive separation and/or signal control	5-8	+	+	+	+	M	√	+	√	√	√	√	Under consideration
New Alternative F (Combination of Figures 6 & 8)	8a	+	+	+	+	M	√	+	√	√	√	√	Preferred by PAC
Flyover from I-84 to 257th Avenue	11	Eliminated without scoring											Rejected
Marine Dr extension to Halsey Street	12	Eliminated Without Scoring											Rejected
HCRH exit from I-84 EB, west of Marine Drive	13	Eliminated Without Scoring											Rejected

Scoring:
+ = Meets Criteria or Provides Substantial Benefit
✓ = Might Meet Criteria or Provides Partial Benefit
– = Does Not Meet Criteria

H = High
M = Medium
L = Low

Changes shaded

I-84/Troutdale Frontage Road System Refinement Study



Alternative 1: ***Marine Drive extension***

Involves the construction of a one-way, restricted access roadway acting as an extension of Marine Drive from the I-84 eastbound off-ramp to 257th Avenue. It was agreed that this alternative had potential to facilitate the eastbound to southbound travel demand from I-84 to 257th Avenue and would provide for complete separation of the auto/truck weave currently experienced. It was noted, however, that this alternative's effectiveness would be largely determined by how much diversion from South Frontage Road it would actually attract. Other key positive characteristics included feasible construction and probable compatibility with the long-range interchange improvement. Negative characteristics included the high cost of construction and significant private property impacts (although efforts would be made to minimize impacts to Love's property). It was agreed that this alternative should be retained for further analysis.

LEGEND

- Proposed Improvement
- X - Close Approach

Preliminary Alternative 1

Marine Drive Extension to 257th Way

Figure 1

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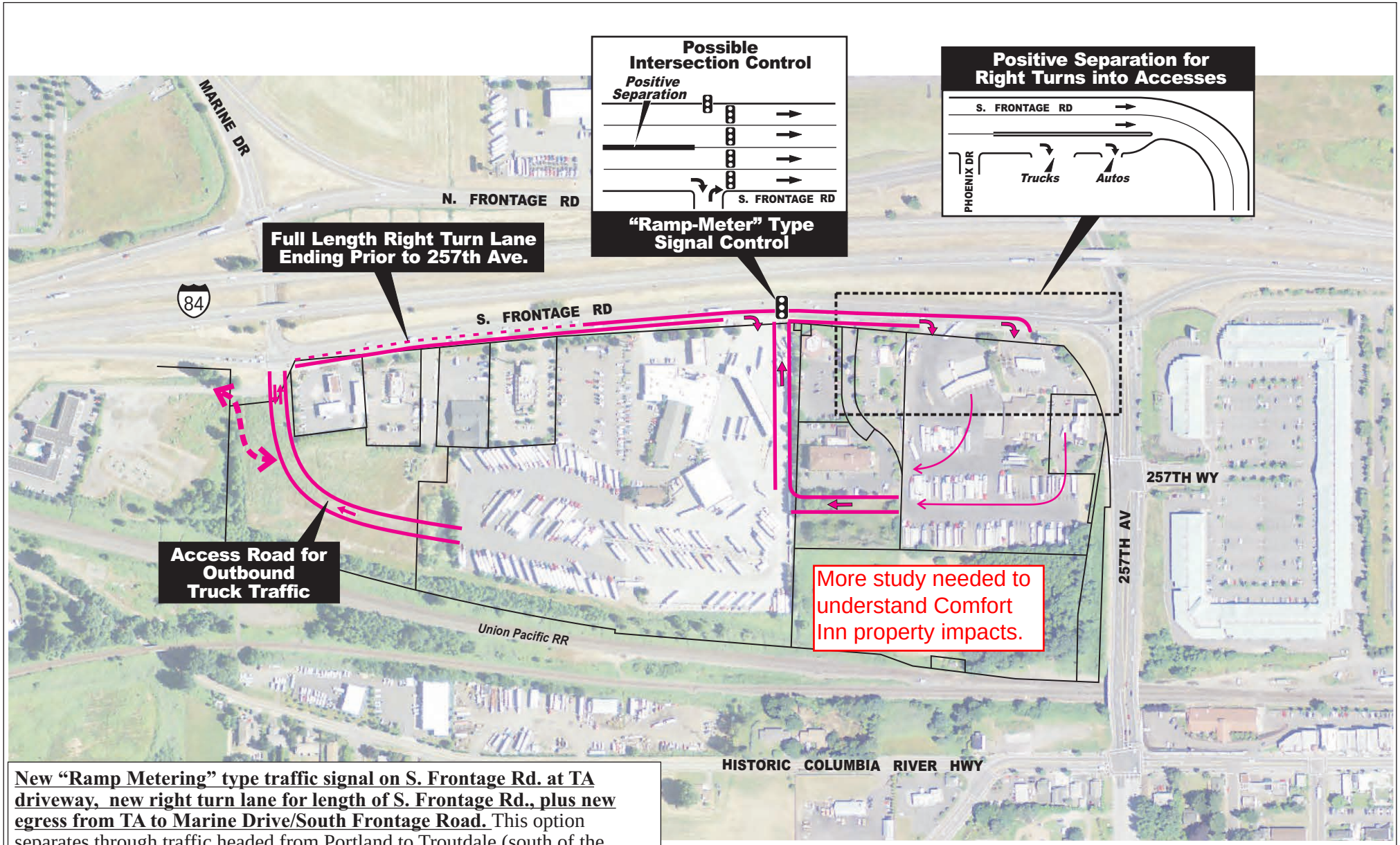

New "Ramp Metering" type traffic signal on S. Frontage Rd. at TA driveway, new right turn lane for length of S. Frontage Rd., plus new egress from TA to Marine Drive/South Frontage Road. This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road and regulates traffic at TA's existing driveway. It includes construction of a right turn lane for the length of S. Frontage Rd. Impacts include right-of-way (including cross-access easement on Comfort Inn property), traffic signal and positive separation costs, the mixing of auto and truck traffic on Love's site, and worsened signal operation at Marine Drive/S. Frontage Rd. Benefits include focusing TA truck traffic at two signalized accesses, allowing circular flow of truck traffic through the TA site and reducing conflicts between trucks entering and exiting the site.

LEGEND

- Proposed Access
- New Connection
- Approximate Property Lines
- Traffic Signal

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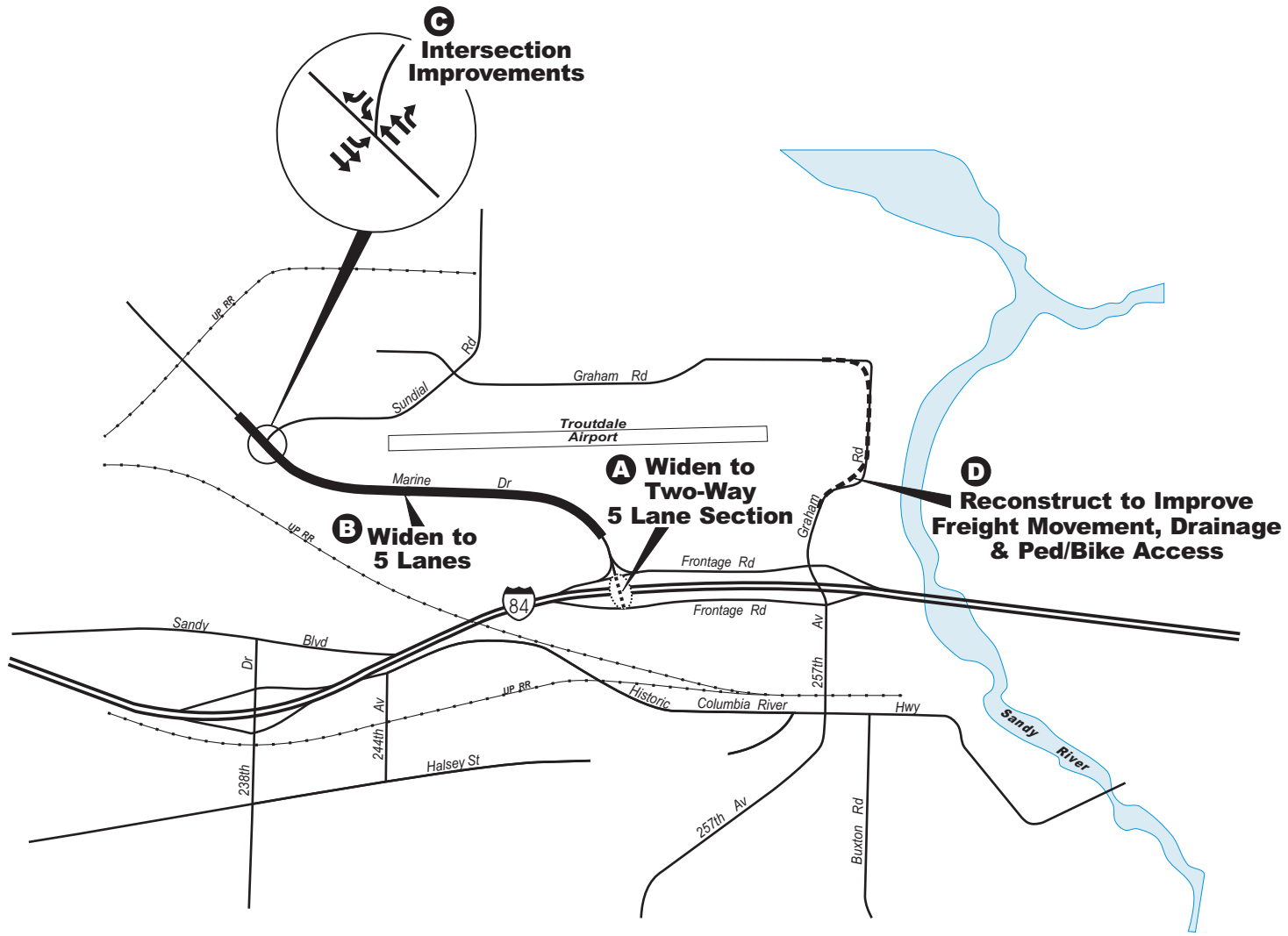
NO SCALE

Figure 8a

OPTION F
Troutdale Interchange



LEGEND

- (#) - Prioritized Improvements
- (A) - As Opportunities Arise
- ----- - New Connector

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NO SCALE

Figure 4

TRANSPORTATION IMPROVEMENTS MAP

Project Advisory Committee

Meeting #4 - Summary
April 14, 2010 5:00 to 6:00 pm
Comfort Inn (477 NW Phoenix Drive, Troutdale)

Attendees:

- Les Perry/ General Citizen
- Malcolm McCann/ Comfort Suites Inn
- Dan Walsh/ Walsh Trucking Company
- Phil Healy/Port of Portland
- Rich Faith/ City of Troutdale
- Todd Juhasz /ODOT
- Carl Springer/DKS
- Brandy Steffen/CH2M HILL
- Dawn Parker/CH2M HILL

Not in attendance:

- Kathryn Kelly/City of Gresham
- Erna Harvey/Factory Outlet Mall
- William Roper /Chevron
- Andrew Johnson /ODOT

Welcome & Introductions

Brandy reviewed the agenda. There were no revisions to Meeting #3 summary. All notes will be posted to the JTA website.

Review Draft Recommendations

The group then reviewed the draft recommendation that was included in the meeting summary from PAC meeting #3. Todd told the group that the Metro expects that the future population growth will be less than what was previously expected. That means that smaller changes, such as those recommended by the group, will have a larger impact to improving the current situation. Carl reviewed the updated graphics of the recommendations with the group, which included:

- Figure 1: The lines on the figure were not changed, but a note was added that says, "Alignment would likely be changed to minimize impact to Love's property." The group agreed that it was fine to leave this figure as is, with this note. Figure 1 would work in combination with Figure 8a or would be a fall back option to Figure 8a.
- Figure 8a: To improve the issues on S Frontage Road, this figure combines the previous recommended figures of 6 and 8 (redirecting Love's traffic to exit at TA driveway, also connecting a backage road to the Marine Drive intersection), adding a physical barrier on S Frontage Road to separate commute traffic from truck traffic, and adding a "ramp-meter" signal control for the exit at TA. This signal would allow commuting traffic to move freely most of the time, but when a truck would pull up to the signal to exit, it would trigger a stop light for all four lanes of traffic. This would reduce the back up of cars, to prevent them from backing up onto Highway 84. There needs to be more study to understand and minimize the impact to Comfort Inn's property with the addition of a backage road connecting Love's to TA exit. A slough exists at the property line behind Comfort Inn and additional parking behind Comfort Inn will need to be implemented. Figure 8a is the primary recommendation and would be ideal in combination with Figure 1.
- Figure 4: This figure was updated to show the recommendations for improving the issues along the N Frontage Road. In order of importance, the group recommends widening the I-84 under-crossing at Marine Drive and widening Marine Drive to 5 lanes (between I-84 and Sundial). The

group recommends these two moving forward as one project, though if funding is limited, they suggest moving forward with the undercrossing, then widening Marine Drive. Third priority is improving the intersection at Marine and Sundial, then fourth is reconstructing Graham Road to improve freight movement, drainage, and pedestrian/bike access. The group decided to remove the reference to the "Marine Drive extension" since it is the same as is shown in figure 8a.

Brandy will write up a more detailed memo of the group's recommendations, which Rich will present to the Troutdale City Council on April 26th. The group is welcome to attend the City Council meeting. Brandy reminded the group that the final recommendation memo may have different names or numbers for each of the recommendations (for ease of reference for people new to the project), but that only the group's recommendations will be represented.

Public Outreach

The group discussed thought that the Art walk would be more effective at reaching the general public with the recommendations. So the outreach will include:

- **April 26th City Council presentation** of recommendations (Council will not take action on recommendations)
- **May 2nd JTA Open House**, Comfort Inn, 4:30 to 6:30 pm: There will be a table at this open house (staffed by ODOT and the City of Troutdale) to discuss the recommendations.
- **May 6th Art Walk**, 5:00 to 7:00 pm: ODOT and City staff will set up a table to talk to the general public about the recommendations.
- The **group** was asked to announce these dates to their friends and colleagues.

The group then had a discussion about the next steps for the project and the relationship between the IAMP (Interchange Area Management Plan) and the Transportation System Plan (TSP) that the City has developed. Todd said that the IAMP will be referenced in the TSP, but that the TSP document will not need to go through an amendment. The city will use the IAMP as a guide for the future plans for the area. Rich said he uses this when talking to potential developers and it helps to keep all development "on the same page" with the expectations of future road improvements and developments.

Remaining Actions

- Rich will post these events and the recommendation memo to the City of Troutdale's website.
- Brandy will post these events and the recommendation memo to the JTA website.
- Brandy will send the group the recommendation memo for their final review and approval.
- Brandy will send the dates/times for the public events to the group for their distribution (via email or word of mouth).
- Brandy will try again to contact Love's to invite them to the public events and explain about the project.

Close

- Brandy thanked the group for attending, and asked them to call her or email with any questions or comments.
- Meeting adjourned at 6:00 pm.

Troutdale Interchange Area Management Plan
Project Advisory Committee Recommendations

April 19, 2011

Overview

Over the course of four meetings, the Project Advisory Committee (PAC) for the Troutdale (I-84/257th) Interchange Area Management Plan (IAMP) reviewed the existing conditions along S and N Frontage Road, prioritized the problems and opportunities for the area, discussed potential solutions that had been studied before and suggested new ideas, then finally made a set of recommendations to the Project Management Team (PMT) to implement in the final IAMP document. The PMT is made up of representatives from the City of Troutdale and the Oregon Department of Transportation (ODOT). The PAC is made up of representatives of the business interests along S and N Frontage Roads

The following recommendations will be presented to Troutdale City Council for their review and approval but formal adoption is not required. The recommendations will be included in the final IAMP document, which will guide the City of Troutdale in understanding ODOT's approach to future improvements along S and N Frontage Roads. The below recommendations and priorities will also be presented to the general public during two events.

Recommendations

The following recommendations were finalized during the fourth and final PAC meeting, held on April 14, 2011. These recommendations are listed in order of importance, to help ODOT and the City of Troutdale understand the group's interest in making interim improvements that will improve the situation and congestion in the area, as funding becomes available. All PAC members in attendance at this final meeting were in agreement with the recommendations. Opportunity for review of the recommendations was given to PAC members that could not attend the final meeting. No objections were expressed.

1. **Signage**: Lane control and wayfinding signage should be installed on S Frontage Road closer to the I-84/257th eastbound off-ramp, to help direct traffic movement under the current conditions.
    a. Local/business traffic would be directed to the right, through traffic headed south to Troutdale would be directed to the middle lanes and traffic headed north to Marine Drive and/or TRIP (Troutdale Reynolds Industrial Park) area would be directed to left lanes.
2. **Short Term Improvements to S Frontage Road**: To improve the issues on S Frontage Road, the PAC recommends Figure 1 as their preferred interim solution. This will include the following improvements:
    a. A new right turn lane for the length of S Frontage Road, from Marine Drive to 257th Avenue. A physical barrier to provide a positive separation between the right turn lane and through traffic for a portion of the length, limiting local traffic to right turns only from S Frontage Road into the businesses to the south.

b. A new traffic signal, primarily for trucks, to ease their exiting movement from the Love's and TA truck stops, while also allowing most through/commuter traffic to travel smoothly through the interchange.

c. A fourth leg would be added at the Marine Drive/I-84 EB Ramp/S Frontage Road signal, allowing truck traffic to exit there as well.

d. Traffic from Love's and TA would access these signals via new "cross-access easements" between the Love's and the TA site, as well as between TA and the new fourth leg of the Marine Drive/S Frontage Road intersection. These dedicated driveways between the existing properties would allow trucks to exit onto S Frontage Road at a signal and to prevent vehicles from backing up onto I-84.

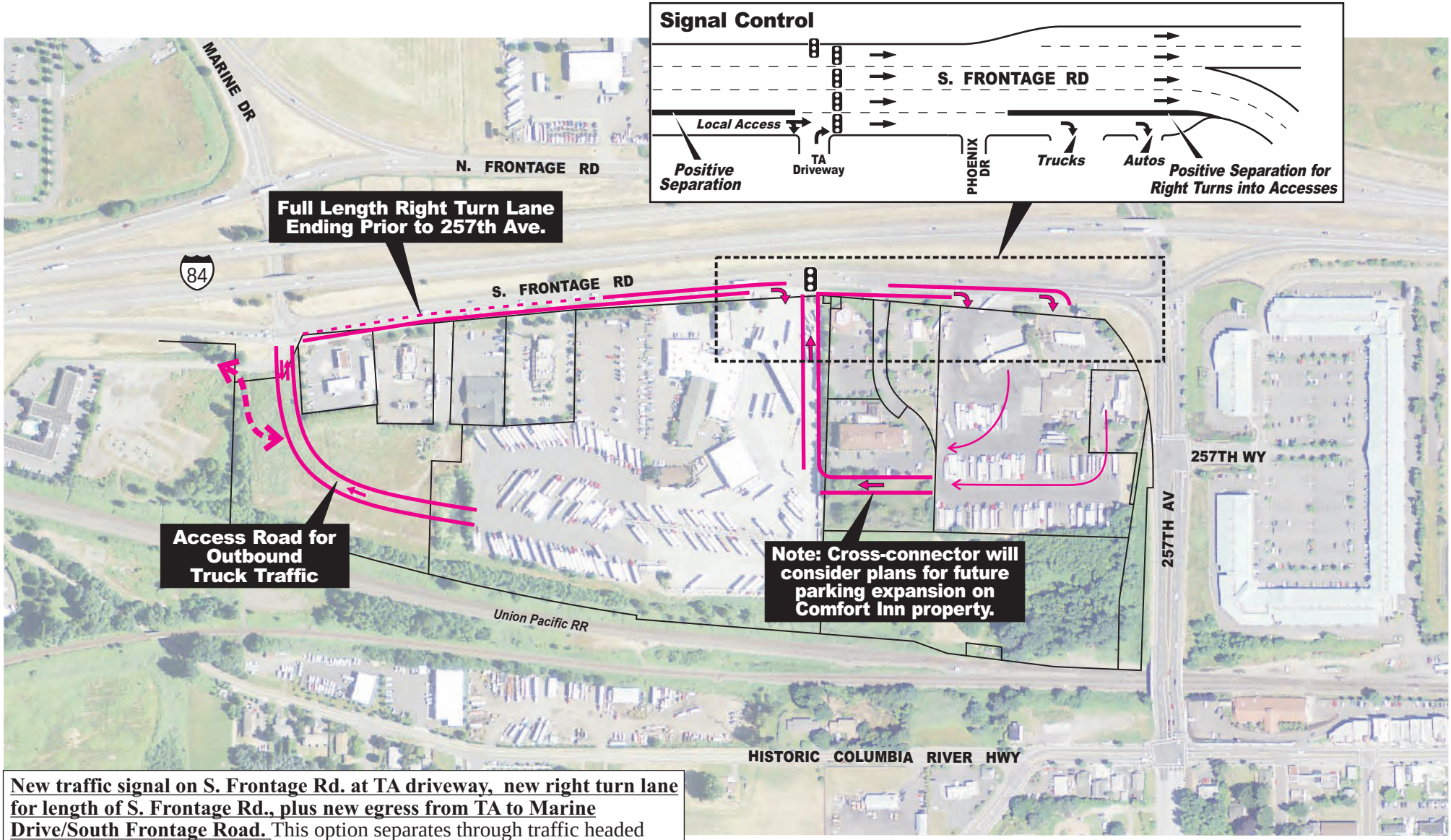
    i. More study would be needed to understand and minimize the impact of these easements, or "backage roads," to all property owners, particularly Comfort Inn which has plans to expand parking in the rear of the building.

3. **Improved Access between Portland and TRIP (Troutdale Reynolds Industrial Park) Area**: Figure 2 shows the recommendations for improving access to the TRIP area. In order of importance, the group recommends:

    a. Widening the I-84 under-crossing at Marine Drive (Figure 2A) to allow two-way traffic and widening Marine Drive to 5 lanes, between I-84 and Sundial (Figure 2B). The group recommends that these two move forward as one project, though if funding is limited, they suggest moving forward with the undercrossing first and then widening Marine Drive.

    b. As funding becomes available, the group recommends improving the intersection at Marine and Sundial (Figure 2C) and then reconstructing Graham Road to improve freight movement, drainage, and pedestrian/bike access (Figure 2D).

4. **Improved Access between Portland and Troutdale:** Figure 2E is recommended as a long-term solution to the issues along S Frontage Road, only if study indicates that it is needed after the previous improvements have been implemented. If the improvements shown in Figure 2E will not add other benefits for the area, it should not be implemented.



New traffic signal on S. Frontage Rd. at TA driveway, new right turn lane for length of S. Frontage Rd., plus new egress from TA to Marine Drive/South Frontage Road. This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road and regulates traffic at TA's existing driveway. It includes construction of a right turn lane for the length of S. Frontage Rd. Impacts include right-of-way (including cross-access easement on Comfort Inn property), traffic signal and positive separation costs, the mixing of auto and truck traffic on Love's site, and worsened signal operation at Marine Drive/S. Frontage Rd. Benefits include focusing TA truck traffic at two signalized accesses, allowing circular flow of truck traffic through the TA site and reducing conflicts between trucks entering and exiting the site.

LEGEND

- Proposed Access
- New Connection
- Approximate Property Lines
- Traffic Signal

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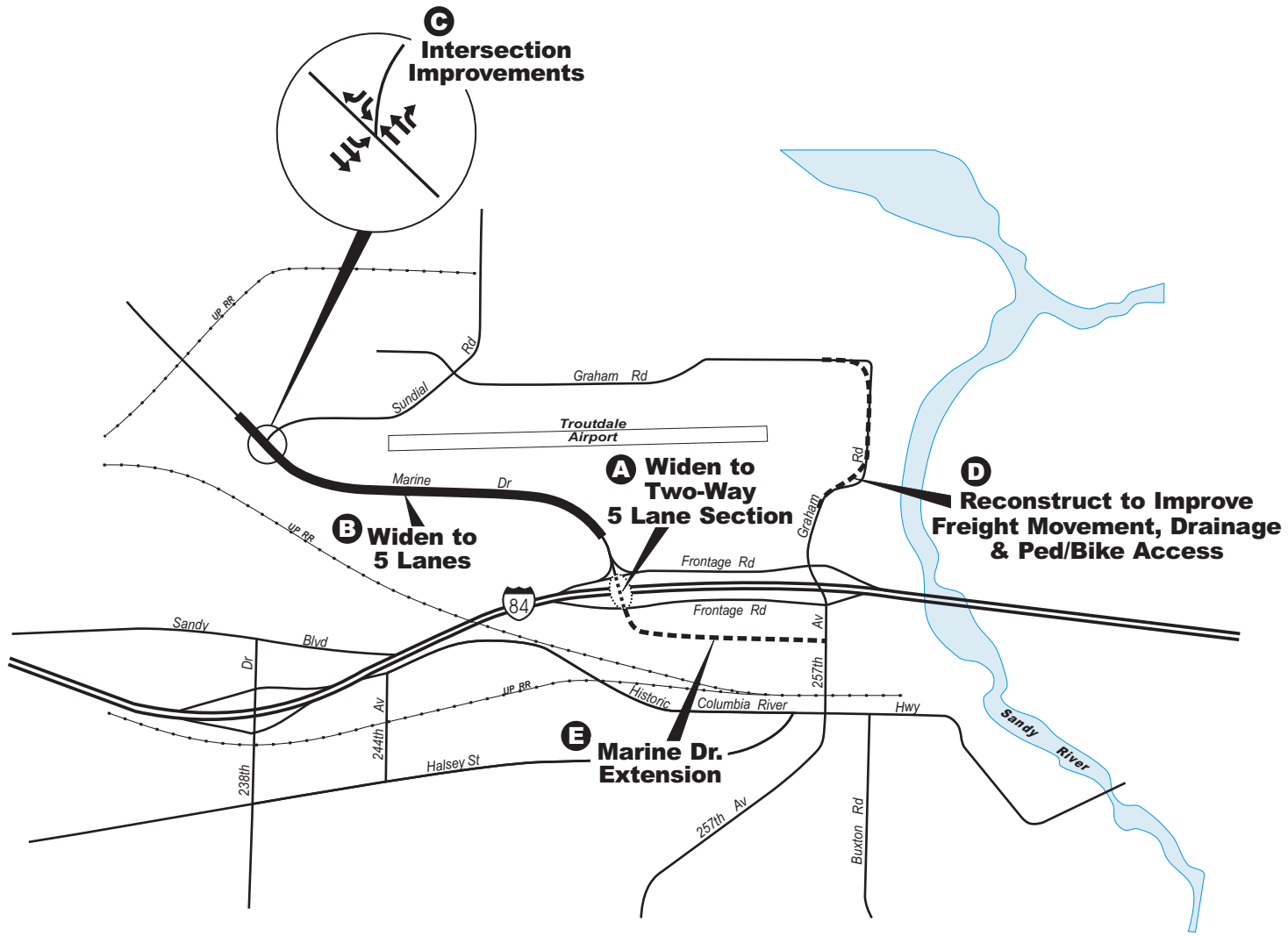
NO SCALE

Figure 1

OPTION F
Troutdale Interchange



LEGEND

A - Prioritized Improvements

----- - New Connector

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NO SCALE

Figure 2

LONG TERM TRANSPORTATION IMPROVEMENTS MAP

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TECHNICAL MEMORANDUM #1

May 3, 2011

To: Project Management Team

From: Carl Springer, PE, Julie Sosnovske, PE

Subject: **I-84 257th Avenue IAMP, Task 3: Problem Identification, Boundaries and Maps** P09042-011

This memorandum identifies the project purpose, problem statement, interchange function, and expectations for the IAMP. In addition, it summarizes draft Management Area and Study Area boundaries, project goals and objectives, and alternative evaluation criteria.

PURPOSE AND BACKGROUND

An IAMP is required for any new or significantly reconstructed interchange by OAR 734-051-0155(6). More importantly, the purpose of an IAMP is to protect the function of the interchange and, consequently, the state's investment in the facility. New interchanges and improvements to existing interchanges are very costly. State and local government and their citizens have an interest in ensuring that their interchanges function efficiently. Design work is currently underway for improvements to the I-84 257th Avenue interchange and this IAMP is being conducted to ensure that the design will effectively reflect the needs of the interchange for at least the next 20 years.

PROBLEM STATEMENT

The I-84 257th Avenue (Exit 17) interchange has experienced congestion at several of its intersections and the eastbound off-ramp regularly backs up onto I-84. Over the years, a number of improvements have been identified, some of which have been recently constructed and others for which funding is currently available or will be available in the near future.

Funds have been allocated through the Governor's Jobs and Transportation Act (JTA) in 2009 to construct projects within the interchange area to support job growth and economic development in this area.

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The Oregon Department of Transportation (ODOT), City of Troutdale and the Port of Portland have outlined a series of specific improvement projects that will address existing safety and mobility needs identified in past planning studies, as well as provide capacity enhancement to serve economic growth in the area.

In 2005, the City of Troutdale adopted an update to its Transportation System Plan (TSP). This TSP identified the need for improvements in the vicinity of the I-84 257th Avenue interchange as well as the need for an Interchange Area Management Plan (IAMP). Additionally, recent traffic studies associated with the Troutdale Reynolds Industrial Park (TRIP) have shown that the I-84 257th Avenue interchange will not meet performance standards in the future with development of the Industrial Park.

Based on the preceding analysis, a series of interchange improvements have been constructed, or are planned. In fall of 2009, ODOT partnered with the Port of Portland and City of Troutdale to complete construction on widening the South Frontage Road at Graham Road to include a second dedicated eastbound right turn lane.

JTA funded interchange improvements are in the design process and planned for construction in summer 2011 (see Table 1 for details).

Table 1: Current JTA Funded Project List of 257th Avenue Interchange Improvements

Location	Description
I-84 Eastbound off-ramp	Add third lane approach to ramp terminal to increase vehicle queue space.
South Frontage Road	Add third eastbound lane between Marine Drive and Graham Road
North Frontage Road	Add third westbound lane from Graham Road to Marine Drive. The third lane will become a right-turn only lane onto Marine Drive
Graham Road / North Frontage Road	Construct 2nd northbound left turn lane Add westbound right-turn lane Add southbound free flow right-turn lane which merges into new 3rd westbound lane
Various Intersections	Traffic signal upgrades

These improvements are needed because the I-84 eastbound off-ramp at Marine Drive is likely to back up onto the mainline freeway in the future, which is a serious safety concern. South Frontage Road is congested during morning and evening peak periods and heavy truck traffic further exacerbates the congestion. The intersection at Graham Road/North Frontage Road experiences a significant amount of congestion, particularly during the AM peak period. This congestion is due, in part, to vehicles heading northbound from Troutdale to westbound I-84 toward Portland conflicting with vehicles coming from the east on I-84 into Troutdale. This intersection will be further impacted as TRIP develops.

If additional JTA funding is available, ODOT, the City of Troutdale and the Port of Portland will work together to determine the best use of the funding. Potential future improvements are summarized in Table 2.

Table 2: Potential future JTA Funded Project List of 257th Avenue Interchange Improvements

Location	Description
Marine Drive	Extend south of the South Frontage Road, looping east to form a 'backage' road to the commercial uses and connect to Graham Road at 257th Way (opposite the Outlet Mall)
I-84 Underpass at Marine Drive	Reconstruct underpass between the North Frontage Road and South Frontage Road to allow for standard vertical and horizontal clearance, and provide two additional travel lanes. This construction would allow for two-way circulation as identified in the Troutdale TSP. Provide northbound left-turn lane, two northbound through lanes Widen I-84 Eastbound Off-Ramp to provide an eastbound left-turn lane onto Marine Drive
I-84 Eastbound Off-Ramp / Marine Drive	Widen approach to provide an additional eastbound through lane

INTERCHANGE FUNCTION, MODE AND GENERAL LOCATION

Generally, an interchange is defined as the junction of two or more roads at different elevations through a system of connections that separate the roads to permit movements to occur without crossing the streams of traffic. The functions of the interchange are established by the functions of the connecting roads. The I-84 257th Avenue interchange is a component of Interstate 84, an Interstate Highway and freight route.

The primary function of this interchange is to provide access to industrial land between I-84 and the Columbia River, as well as serve goods movement and Troutdale Town Center.

The Oregon Highway Plan (OHP) classifies I-84 as an interstate highway. According to OHP, the primary function of an interstate freeway is to "provide connections to major cities, regions of the state, and other states. A secondary function in urban areas is to provide connections for regional trips within the metropolitan area." (OHP, p. 41)

North Frontage Road and South Frontage Road and the free right turn from North Frontage Road onto Marine Drive are owned and maintained by ODOT. Marine Drive is owned and maintained by Multnomah County from the north City Limits to North Frontage Road and Graham Road is owned and maintained by the City of Troutdale, north of North Frontage Road and south of South Frontage Road. ODOT owns and maintains Graham Road and Marine Drive between the North and South Frontage

Roads. The Troutdale Transportation System Plan (TSP) classifies North Frontage Road and South Frontage Road and Marine Drive and Graham Road (between the North and South Frontage Roads) as arterials within the vicinity of the interchange. Marine Drive north of North Frontage Road is classified as a Collector and Graham Road north of North Frontage Road is classified as a local street. Graham Road south of South Frontage Road is classified as an arterial. North Frontage Road, South Frontage Road, Marine Drive and Graham Road all provide both a connection to the interstate freeway system and access to local services in town.

Much of the land surrounding the I-84 257th Avenue interchange is already developed, especially to the south. The interchange provides access to Troutdale's Town Center area as well as industrial and residential areas in the City. Many accesses are provided along the South Frontage Road to a number of businesses, most of them commercial, many serving truck traffic that passes through as it heads between Portland and the Columbia River Gorge. Many of the accesses are not in compliance with OHP standards within a ¼ mile of the interchange. Most accesses along South Frontage Road are private driveways rather than public roadways. There are only two accesses located along the North Frontage Road, midway between Graham Road and Marine Drive, serving the Troutdale Airport and another use. There are no accesses on Marine Drive or Graham Road within the interchange area.

Future alternatives in this IAMP assume that undeveloped lands within the Study Area will be developed in a manner consistent with what is allowed under the City of Troutdale Comprehensive Plan and existing zoning, except for the "Pig Farm" property (located north of Halsey Street between NE 244th Avenue and west of SW Edgefield Meadows Avenue) which is expected to be rezoned sometime in the future. The chapter on Future Travel Forecasts and Needs Analysis details the assumptions for this development.

EXPECTATIONS FOR THE IAMP

The City of Troutdale and the Port of Portland have been working with ODOT to identify improvements to the interchange that would protect existing capacity. The City of Troutdale, the Port of Portland and ODOT are currently in the design phase of the improvements to the Troutdale I-84 257th Avenue Interchange described in Table 1.

The expectation of the Troutdale I-84 257th Avenue IAMP is that it will provide a framework for the design of future improvements as part of the interchange reconstruction project.

Reconstruction of the I-84 257th Avenue interchange will improve connections between I-84 and the City of Troutdale. The improved interchange will support the development that is authorized in the Troutdale Comprehensive Plan and is not intended as a basis to encourage rezoning of property for uses that will generate greater volumes of traffic than is already planned based on land use designations in Troutdale's Comprehensive Plan. The IAMP provides land use and transportation management policies that ensure that future demand on the interchange will be consistent with planned land uses and will not outpace the improvements that have been designed.

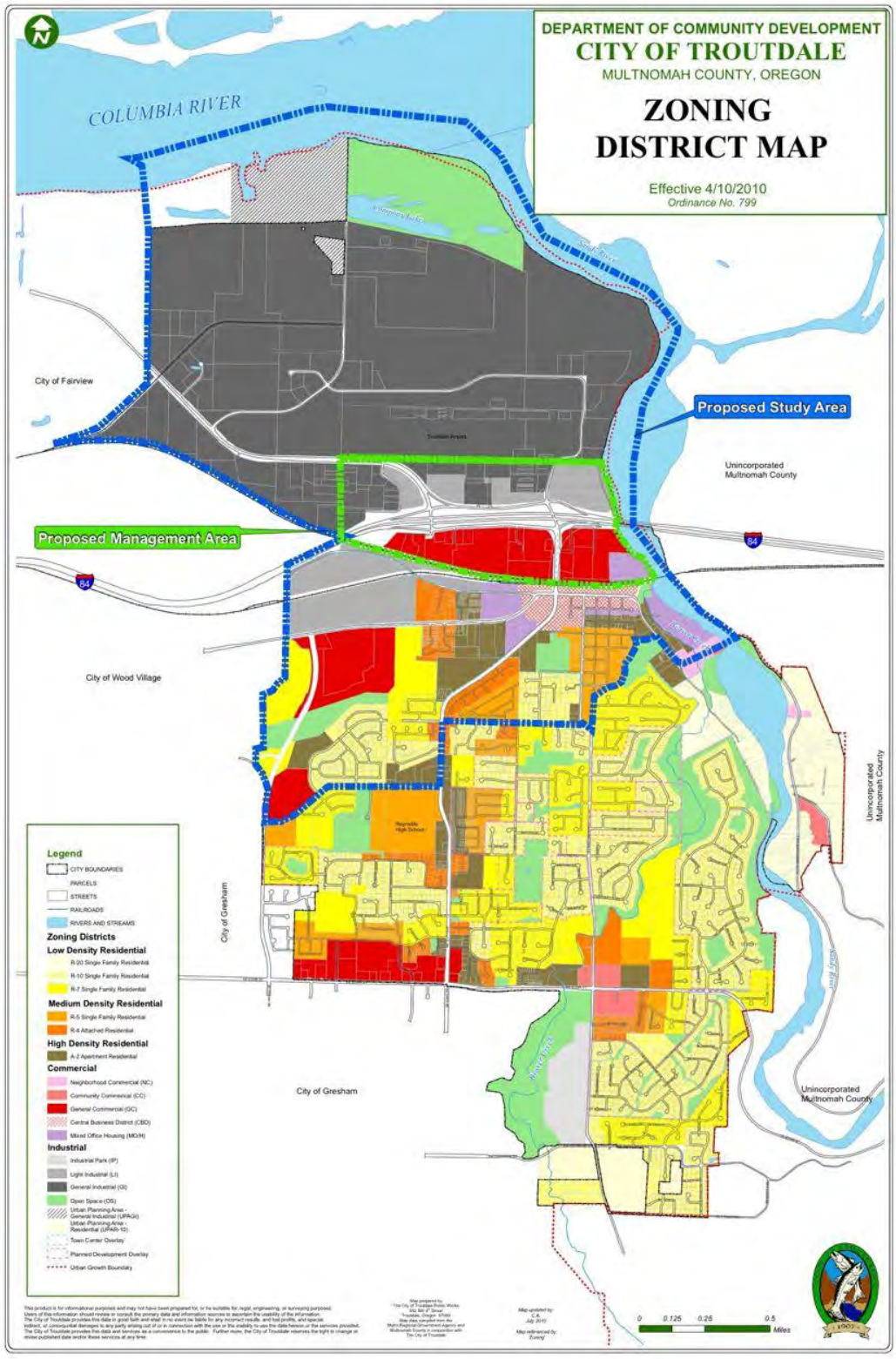
MANAGEMENT AREA/STUDY AREA RECOMMENDATIONS

Figure 1 illustrates the proposed Interchange Management Area (IMA). The IMA delineates the area around the I-84 257th Avenue interchange in which specific IAMP access and management regulations apply to land use decisions. The IMA includes those properties that currently have or are expected to have the greatest impact on operations at the interchange.

The management area is defined by tax lot parcel boundaries extending from the railroad tracks just north of the Historic Columbia River Highway to the south, just north of the airport to the north, approximately ½ mile to the west and approximately ½ mile to the east of the interchange ramp terminals.

Figure 1 also illustrates the project Study Area. The Study Area extends from the Columbia River to the north, the Sandy River to the east, the Troutdale City Limits line to the west and Cherry Park Road to the south. The traffic analysis for the IAMP assumed development of much of the undeveloped land within the Study Area (more detail in Future Conditions).

Figure 1: Proposed Management Area/Study Area



GOALS AND OBJECTIVES

The goals and objectives for the I-84 257th Avenue IAMP should reflect the intentions and interests of ODOT, the City of Troutdale, the Port of Portland, Multnomah County and other key stakeholders for the interchange and transportation operations in the area. The goals and objectives should be guided by, but not re-statements of, OHP policies and OAR language. The objectives need to be concrete statements that relate what the plan is trying to accomplish and should be achievable and measurable. The objectives serve as the basis for data collection and research and as alternative evaluation criteria to guide alternatives analysis and selection of the preferred alternative, and to guide management decisions.

GOAL 1: PROTECT THE FUNCTION AND OPERATION OF THE INTERCHANGE AND THE STATE HIGHWAY AS FOLLOWS:

I-84 is classified as an Interstate Highway. It is part of the National Highway System and is a designated freight route between Portland and points east. The operational objective for Interstate Highways is to provide safe and efficient high-speed travel in urban and rural areas.

Objective 1a: The preferred IAMP will consider FHWA Interchange design requirements and will address design-year (2035) traffic demands.

Objective 1b: The IAMP alternatives developed for consideration address the OHP requirement that the maximum volume-to-capacity (V/C) ratio for the ramp terminals of interchange ramps be either 0.85 or 0.90 (as defined in the OHP).

Objective 1c: The preferred IAMP alternative will meet or move in the direction of ODOT access management spacing standards for access along interchange crossroads.

GOAL 2: PROVIDE FOR AN ADEQUATE SYSTEM OF LOCAL ROADS AND STREETS FOR ACCESS AND CIRCULATION WITHIN THE INTERCHANGE AREA THAT MINIMIZES LOCAL TRAFFIC THROUGH THE INTERCHANGE AND ON THE INTERCHANGE CROSS ROADS.

Objective 2a: The preferred IAMP alternative will include necessary supporting improvements to the surface street system in the vicinity of the interchange. Improvements to the local street network will be adopted into the local comprehensive plan, including identified funding sources, as part of the City of Troutdale's actions to implement the IAMP.

Objective 2b: The IAMP alternatives will propose surface street improvements that either meet the ODOT established access management standards or improve on the current conditions.

Objective 2c: The IAMP alternatives will propose surface street improvements that will operate in conformance with applicable standards over the 20-year planning horizon.

GOAL 3: PROVIDE SAFE AND EFFICIENT MULTI-MODAL TRAVEL BETWEEN THE CONNECTING ROADWAYS (AND THE SURFACE STREET NETWORK, IF APPLICABLE).

Objective 3a: While recognizing existing capacity constraints, the IAMP alternatives will improve safety by adding capacity to reduce congestion and/or correcting geometric conditions that do not meet current applicable standards.

Objective 3b: The IAMP alternatives will improve bicycle and pedestrian safety by providing upgraded bikeways and walkways that meet current applicable standards and include facility infill and extensions where needed to provide a continuous network.

GOAL 4: ENSURE FUTURE CHANGES TO THE PLANNED LAND USE SYSTEM ARE CONSISTENT WITH PROTECTING THE LONG-TERM FUNCTION OF THE INTERCHANGE AND THE SURFACE STREET SYSTEM AND THE INTEGRATION OF FUTURE TRANSPORTATION PROJECTS AND LAND USE CHANGES.

Objective 4a: The IAMP alternatives will be developed in partnership with affected property owners in the interchange area, the City of Troutdale, the Port of Portland, Multnomah County, and the Oregon Department of Transportation (ODOT), as well as other stakeholders, including interchange users.

Objective 4b: The City and County Comprehensive Plans and/or Transportation System Plans will be found consistent, or amendments will be proposed to ensure consistency, with the preferred IAMP alternative.

Objective 4c: The City and County will adopt land use policies that ensure future land use actions in the IAMP Management Area, including requests for comprehensive plan amendments and/or zoning amendments, and promote land development that is compatible with the planned interchange capacity for the IAMP planning horizon.

GOAL 5: RECOGNIZE THE IMPORTANCE OF THE INTERCHANGE FUNCTION TO SUPPORT LOCAL AND REGIONAL ECONOMIC DEVELOPMENT GOALS AND PLANS.

Objective 5a: The IAMP alternatives are expected to reduce delay for vehicles, including commercial vehicles, accessing the freeway and to increase safety.

Objective 5b: The IAMP alternatives will facilitate access to, through, and from businesses in Troutdale.

GOAL 6: ENSURE THAT THE NEEDS OF REGIONAL THROUGH TRIPS AND THE TIMELINESS OF FREIGHT MOVEMENTS ARE CONSIDERED WHEN DEVELOPING AND IMPLEMENTING THE IAMP, IN PARTICULAR WHEN PLANNING FOR IMPROVEMENTS THAT DIRECTLY IMPACT FREIGHT ROUTES.

Objective 6a: The IAMP alternatives will facilitate freight access to and from the many industrial freight destinations in the interchange study area.

ALTERNATIVE EVALUATION CRITERIA

To rank potential improvement alternatives, evaluation criteria were created and focus on compliance with state and local plans and policies, engineering design requirements, and a desire to maximize positive (and minimize negative) economic, social (livability), and environmental impacts. The evaluation criteria and scoring developed are presented in Table 3.

Table 3: I-84 257th Avenue IAMP Technical Evaluation Scoring

Measure of Effectiveness	Evaluation Score
Safety	***-1 to +1***
Reduce Vehicular Conflict Points Reductions in conflicts through better access management, roadway design, or other means are essential for enhanced safety.	+1 Reduction in conflict points 0 Same number of vehicular conflict points -1 Increase in vehicular conflict points
Geometric Design/Driver Expectations Predictable routing and roadway designs contribute to driver safety.	+1 No geometric design or routing problems 0 Same geometric design or routing problems -1 Increase in quantity of geometric design or routing problems.
Livability	***-1 to +1***
Quality of Life While quality of life can be difficult to quantify, Troutdale's quality of life is dependent on sustaining and preserving the qualities that make it a cohesive community and a desirable place to live. Alternatives should support Troutdale's small town character and lifestyle with access to larger urban areas and amenities, attractive downtown, and community pride.	+1 Positive impact on current quality of live 0 Neutral impact on current quality of life -1 Negative impact on current quality of life
Increase Economic Vitality of City of Troutdale The wellbeing of a city is dependent upon its ability to meet the economic needs of its citizens. These needs primarily include employment opportunities and commercial services/products. Alternatives should provide good access to and mobility between the I-84 freight corridor and industrial/commercial areas	+1 Good access and mobility to and from I-84 0 Marginal access and mobility to and from I-84 -1 Poor access and mobility to and from I-84
Balance Service to All Users The ability of the transportation system to serve the needs of the users of all transportation modes is an	+1 Pedestrians, cyclists, transit users, and vehicles all accommodated 0 At a minimum, pedestrians and vehicles

important element for the wellbeing of the community. Alternatives should incorporate basic serviceability elements (e.g. a sufficient number of traffic lanes, pedestrian crossings and sidewalks, transit stops, bike lanes and paths, etc.) for all transportation modes.	accommodated -1 Only vehicles accommodated
Low Environmental Impact A healthy and well-cared for environment, including natural resources, contributes to a community's wellbeing. Those alternatives that have a lower impact on the environment and associated natural resources should be given preference.	+1 Reduced environmental impact compared to current conditions 0 Insignificant environmental impact compared to current conditions -1 Increased environmental impact compared to current conditions
Mobility	***-1 to +1***
Meet V/C Mobility Standards All study intersections are required to meet the following ODOT V/C standard: **0.85**	+1 Intersections well within standards 0 Intersections meet standards -1 Intersections do not meet standards
Facilitate Pedestrian and Bicycle Movements Proposed alternatives should accommodate pedestrian and bicycle needs.	+1 Significant increase in pedestrian and/or bicycle facilities 0 Minor increase in pedestrian and/or bicycle facilities -1 No increase in pedestrian and/or bicycle facilities
Facilitate Truck Movements Trucks are a principal method for transporting freight to and from the City of Troutdale. Where applicable (e.g. at interchange ramp terminals and major intersections) facilities should accommodate truck movements through adequate turning radii and turn lane storage capacity.	+1 Truck movements accommodated at all intersections 0 Truck movements accommodated at only major intersections -1 Not all truck movements at major intersections are accommodated
Feasibility	***-1 to +1***
Meet Adopted Policies or Plans Alternatives considered should not conflict with adopted policies or planned improvements in the City of Troutdale TSP unless it is reasonable to assume that adopted plans would be amended by the City to remove such conflicts.	+1 Meets adopted policies and plans 0 Would require deviation or probable amendment -1 Does not meet adopted policies and plans
Minimize Costs To accommodate budget and spending priorities, low cost solutions should be given preference	+1 Low cost 0 Moderate cost -1 High cost
Minimize Private Property Impacts Alternatives with no private property impacts would be the most desirable. While private property impacts	+1 No private property impact 0 Minor private property impact

should be minimized where feasible, impacts that would not require purchasing the entire property and would allow current development to continue operating are preferable.	-1 Significant private property impact
<u>Minimize Impact During Construction Stage</u> Alternatives that can be constructed or implemented with little impact to traffic flow should be rated higher than those that would require the elimination of travel lanes during construction.	+1 No construction impact 0 Minor construction impact -1 Significant construction impact

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TECHNICAL MEMORANDUM #2 | 16 SEP 2010

To: Project Management Team

From: Carl Springer, PE, Julie Sosnovske, PE

Subject: I-84 257th Avenue IAMP**, Task 4: Existing Transportation Conditions** P09042-011

This memorandum provides an inventory and evaluation of existing land uses and transportation facilities within the IAMP study area, which can be used to identify areas needing improvement and can act as a baseline for assessment of future conditions. This includes identification and description of existing land use, area streets, traffic controls, and property access, as well as an analysis of the crash history, access management deficiencies, intersection capacity, and potential land development.

STUDY AREA LAND USES

The selected geographic boundaries for the IAMP study area include the Columbia River to the north, the Sandy River to the east, City Limits to the west, and Cherry Park Avenue/Sandy Avenue/Historic Columbia River Highway to the south. The study area and proposed management area are both illustrated in Appendix Figure A-1, which shows all existing streets and property zoning within the study area boundaries. The City's Comprehensive Plan is shown in Appendix Figure A-2.

Within the study area, most lands are zoned for commercial, residential or industrial uses. The commercial lands tend to be located in the middle of the study area, near the interchange with residential lands adjacent to the south. Industrial land is located primarily on the north end of the study area, north of the interchange.

Figure A-1 displays the locations of different land use zones in the study area. Table 1 provides total acreages for each zone type and identifies lands currently undeveloped. All of the land within the IAMP management area is zoned for industrial and commercial uses, while none of the land is zoned for residential use. A substantial portion of the land in both the Management Area and Study Area is currently vacant (24% and 50%, respectively).

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Table 1: Land Use within the I-84 257th Avenue IAMP Study Area and Management Area

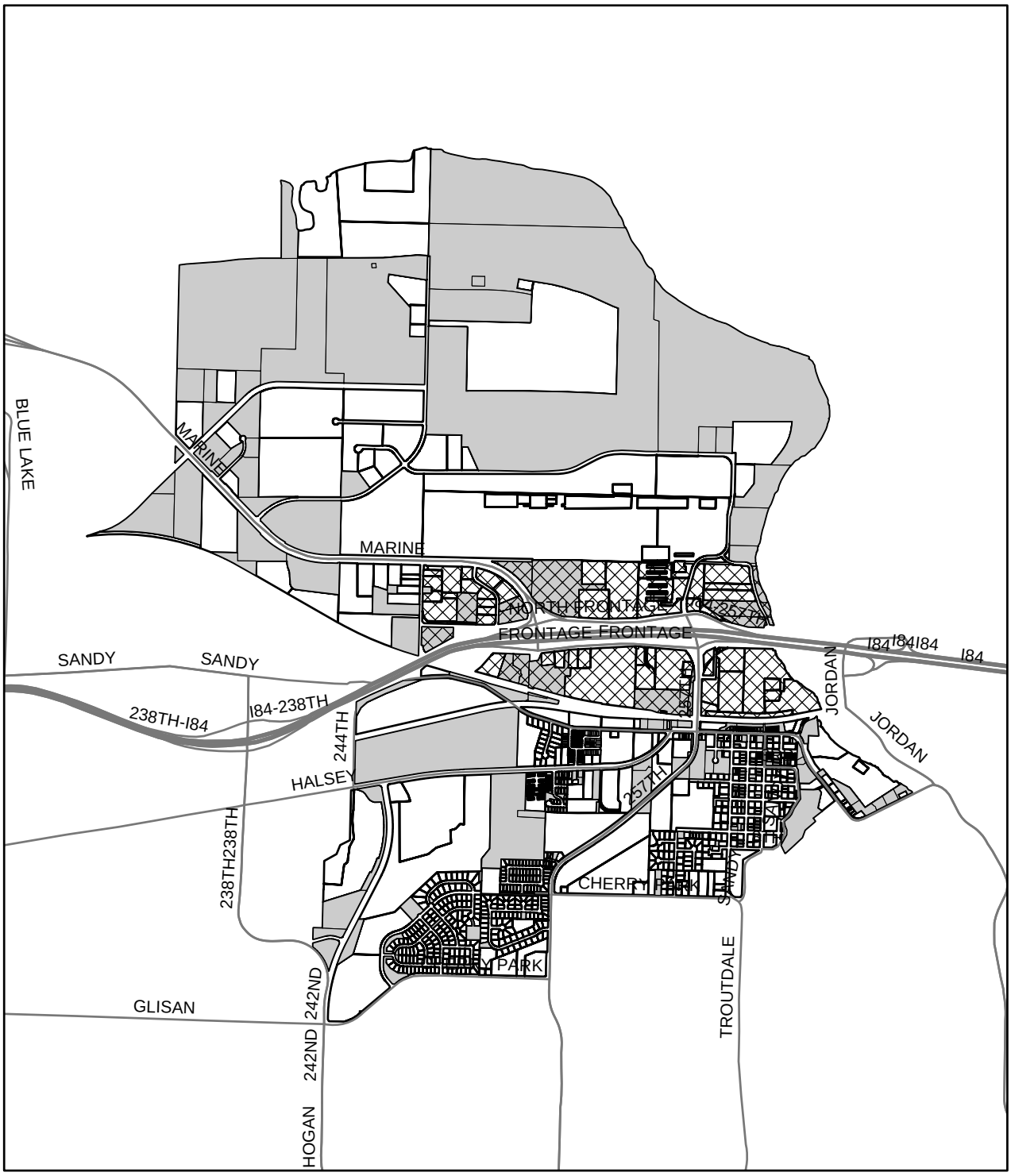
Land Use	Study Area		Management Area	
	Total Acres/ (Vacant)	Percentage/ (Vacant)	Total Acres/ (Vacant)	Percentage/ (Vacant)
Residential	285 (44)	14% (15%)	0 (0)	0% (0%)
Commercial	241 (36)	11% (15%)	107 (18)	39% (17%)
Industrial	1,580 (965)	75% (61%)	167 (48)	61% (29%)
Total	**2,106 (1,045)**	**100% (50%)**	**274 (66)**	**100% (24%)**

** Table includes parcel data only, areas dedicated to roads and right-of-way are not included*

LAND USES WITH SIGNIFICANT IMPACTS TO STATE FACILITIES

Much of the land within the IAMP Study and Management areas is already fully developed, most of it at its highest and best use. Currently vacant lands are shown in Figure 1. There are approved or in-process projects on some of these properties. Of the undeveloped lands within the IAMP Management Area, the areas that have the most potential to significantly impact the interchange are the industrial land to the north (Troutdale Reynolds Industrial Park – TRIP) and the Pig Farm site, located north of Halsey Street just east of NE 244th Avenue. Trip generation for the TRIP site has been specifically analyzed and its potential impact on the interchange previously determined. The impact of the Pig Farm site will also be incorporated into the future needs analysis. Metro works cooperatively with local governments to forecast future population, employment, and land use patterns within the tri-county metropolitan area. Metro's Base Year (2005) land use assumptions are summarized by TAZ (Transportation Analysis Zone) in Figure 2 and Figure 3. The transportation analysis for the IAMP will be based on planned land uses; specifically, traffic modeling will be based on existing zoning (Figure A-1).[1] Future traffic forecasts based on development scenarios consistent with the planned land uses will be discussed in subsequent chapters of this IAMP.

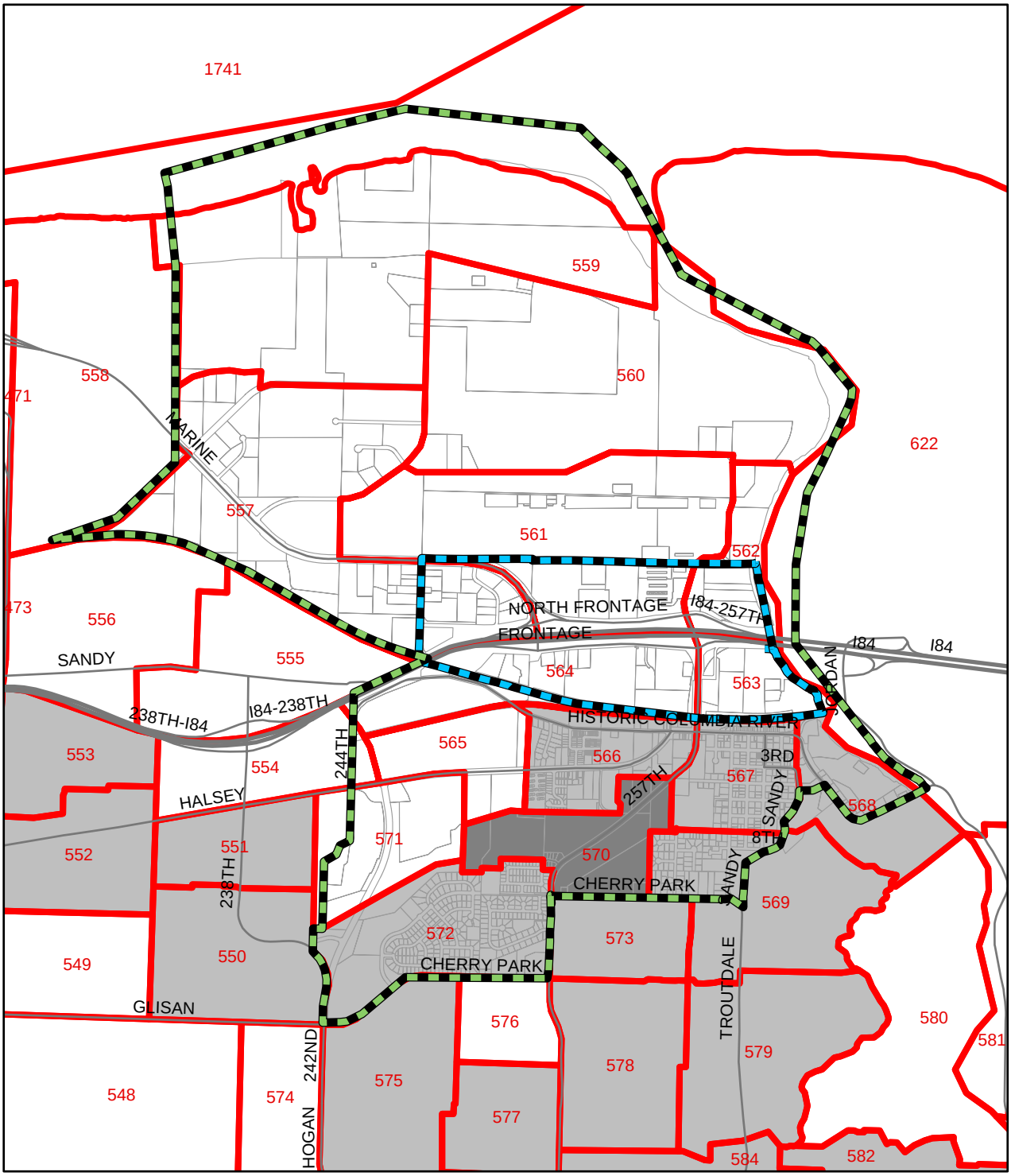
[1] Any proposed amendments to the comprehensive plan land use designations or zoning in the IAMP Study and Management areas will need to be analyzed for compliance with the Transportation Planning Rule prior to local adoption.



Legend

- Management Area Tax Lots
- Vacant Lands
- Study Area Tax Lots

Figure 1: Study Area Vacant Lands



Legend

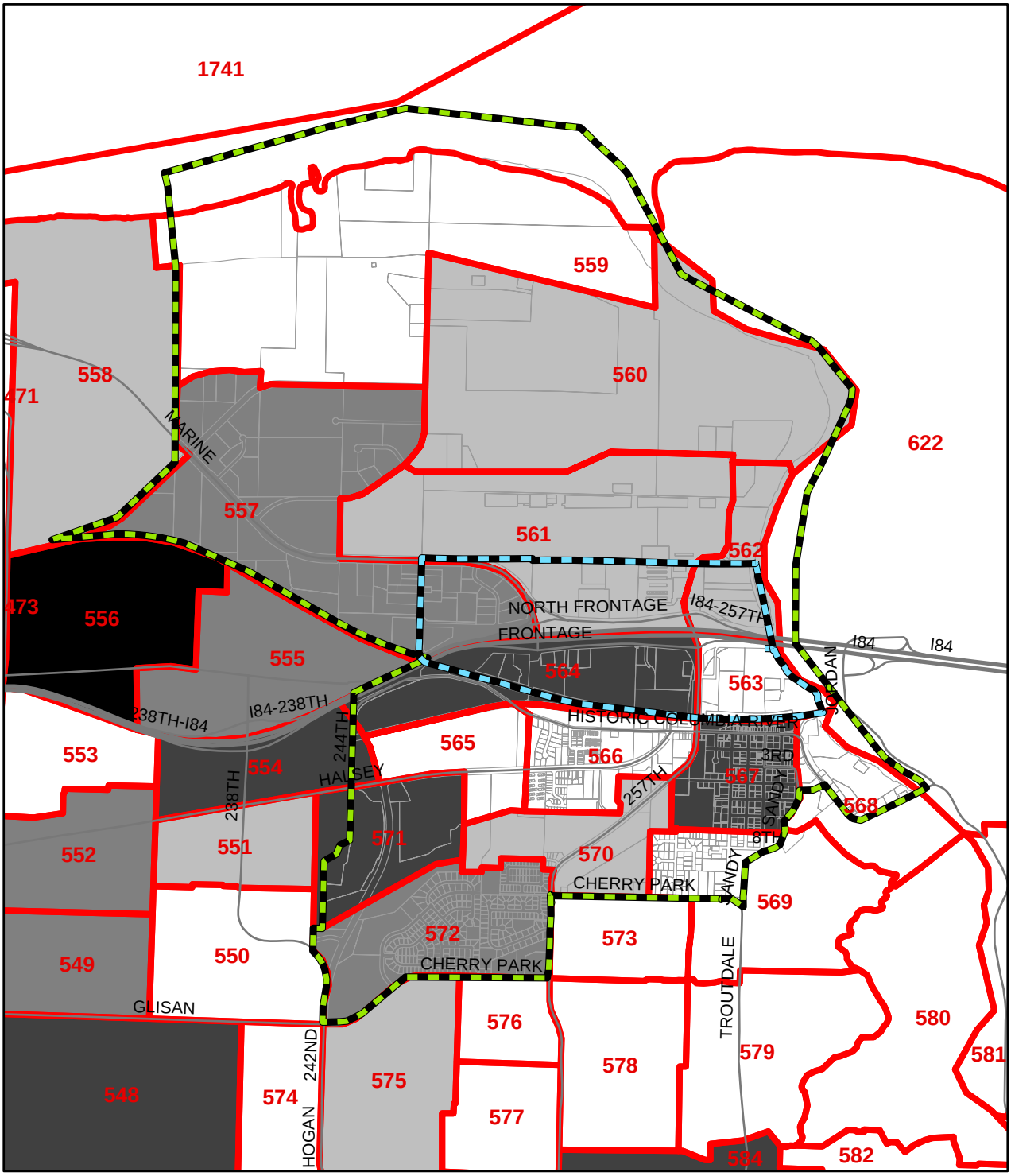
- Management Area
- Study Area
- Metro TAZ

Households Per Acre

- Less than 1
- 1-5
- 6-15
- 16 - 35
- 36 - 60

N
W E
S

Figure 2: 2005 Total Households by TAZ (Transportation Analysis Zone)



Legend

- Study Area
- Management Area
- Metro TAZ

Total Employment per Acre

- 0
- 1
- 2
- 3 - 5
- 6 - 10

N
W E
S

Figure 3: 2005 Total Employment by TAZ (Transportation Analysis Zone)

MANAGEMENT AREA STREET NETWORK

Within the management area, all roadways in the immediate vicinity of the interchange are owned and maintained by ODOT, including I-84 and ramps to and from I-84, South Frontage Road, North Frontage Road, Graham Road (between North and South Frontage Roads), Marine Drive (between North and South Frontage Roads) and the free right turn from North Frontage Road to Marine Drive. Marine Drive north of North Frontage Road is owned and maintained by Multnomah County and all remaining streets in the Management Area are within the jurisdiction of the City of Troutdale. Roadway functional classifications range from arterials to local streets (South and North Frontage Roads and Graham Road south of North Frontage Road are arterials, Marine Drive is a collector, and all remaining streets in the Management Area are local streets). Appendix Figures A-3 and A-4 display the study area street network and identifies the jurisdictional ownership and assigned functional classification of each roadway. These roadways are listed below in Table 2, along with some of their key characteristics.

Table 2: Study Area Roadway Network Summary

Roadway *	Owned By	City Function Class	Cross Section	Posted Speed	Sidewalks	Bike Lanes
Interstate-84 (I-84)	ODOT	Freeway	4 Lanes	60 mph 55 mph/ Trucks	No	Shoulders
South Frontage Road	ODOT	Arterial	2+ Lanes	35 mph	Yes	Partial
North Frontage Road	ODOT	Arterial	2 Lanes	40 mph	No	Yes
Marine Drive (between North and South Frontage Rd.)	ODOT	Arterial	2 Lanes	Not Posted	One Side	Yes
Marine Drive (North of North Frontage Road)	Multnomah County	Collector	5 Lanes	55 mph	Partial	Yes
Graham Road (between North and South Frontage Roads)	ODOT	Arterial	2 Lanes	Not Posted	One Side	Yes
Graham Road (North of North Frontage Road)	Troutdale	Local	2 Lanes	35 mph	One Side	Yes
Graham Road (South of South Frontage Road	Troutdale	Arterial	5 Lanes	Not Posted	Yes	Yes

* On-street parking is not allowed on any of the named streets and roadways within the study area.

With these roadways identified as the primary means of circulation through the area, key intersections along these routes were selected for capacity analysis. Through a field inventory, the existing lane configurations and traffic controls at each intersection were documented and have been displayed in Appendix Figure A-5. From this figure, it can be seen that the South Frontage Road is generally two lanes eastbound, with right turn lanes at key driveways and three lanes closer to NW Graham Road. The North Frontage Road is generally two lanes westbound, with additional turn lanes at key intersections, where needed, including four signalized intersections located at the “corners” of the interchange. Marine Drive

is two lanes in each direction, plus a continuous center turn lane, from just north of North Frontage Road to just past NW Dunbar Avenue, two lanes north of NW Dunbar Avenue with additional turn lanes at key intersections (i.e. NW Sundial Road), and two lanes southbound between North Frontage Road and South Frontage Road. Graham Road is one lane in each direction north of the North Frontage Road, two lanes northbound between South Frontage Road and North Frontage Road, and two lanes in each direction south of the South Frontage Road, with additional turn lanes at intersections.

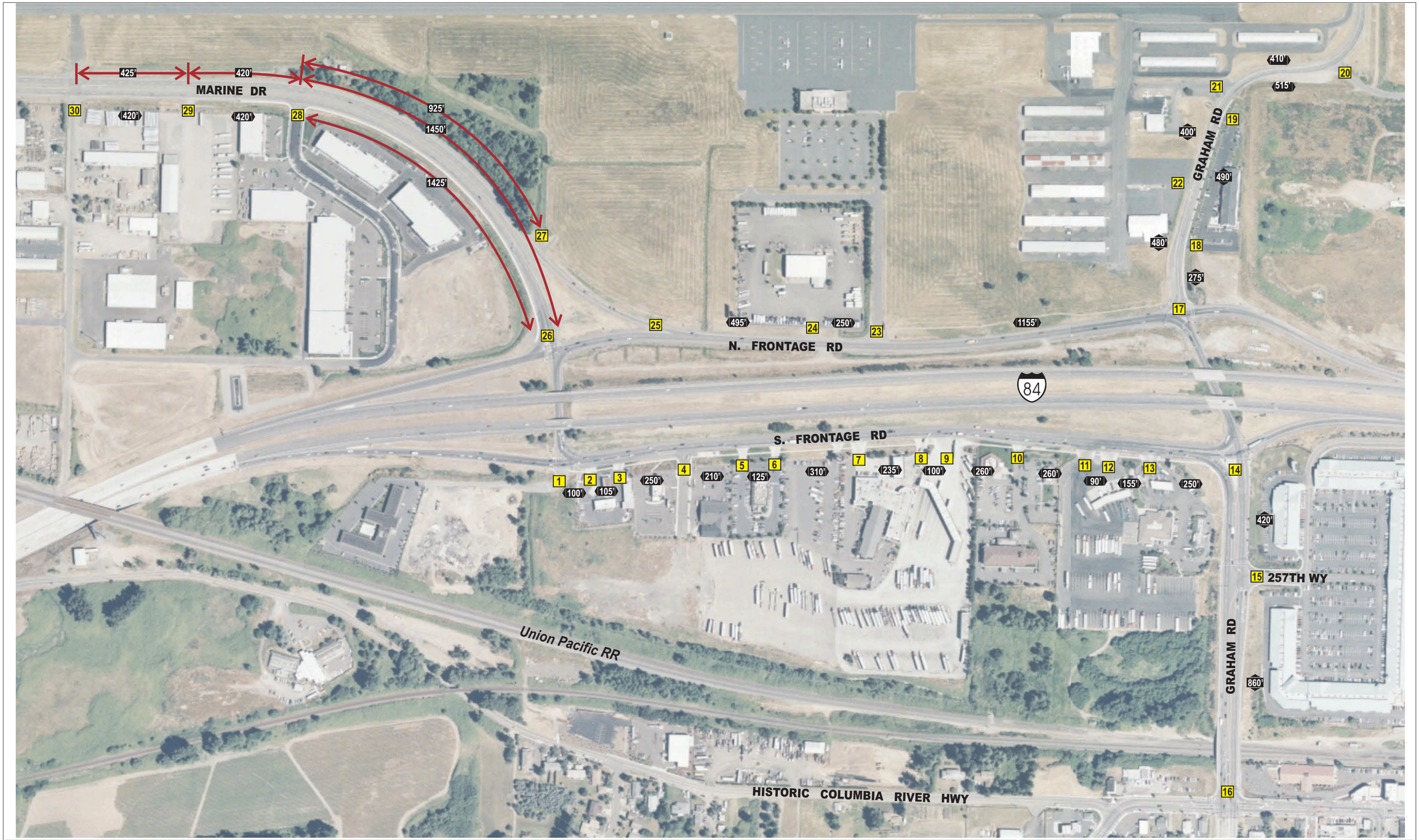
EXISTING INTERSTATE ACCESS CONDITIONS

Interstate 84 is an interstate highway with interchanges providing its only access. The I-84 257th Avenue interchange is located between the I-84/Wood Village/238th interchange and the I-84/Jordan interchange. The I-84/Wood Village/238th interchange is about 1/2 mile west of the I-84 257th Avenue interchange and the I-84/Jordan interchange is less than 1/3 mile to the east. The access spacing standard is based on the distance from the end of the acceleration lane taper to the beginning of the deceleration lane taper. ODOT's freeway access spacing for "urban" or "fully developed urban" interchanges is 1 mile or 5,280 feet. The I-84 257th Avenue interchange does not meet this spacing either to the west or to the east. The I-84/Jordan interchange carries significantly lower traffic volume at the interchange than the I-84 257th Avenue interchange since it serves a largely rural area.

ACCESS TO ROADWAYS WITHIN ¼-MILE OF INTERCHANGE RAMP TERMINALS

Interchange area roadways were examined as well to identify current access density in comparison to what the City and State access management guidelines recommend. The *City of Troutdale Transportation System Plan* and ODOT's *1999 Oregon Highway Plan* have adopted access management standards. These standards were applied to evaluate access and intersection spacing for South Frontage Road, Graham Road, North Frontage Road and Marine Drive which are all classified in the City's TSP as arterials in the vicinity of the intersection, with the exception of Marine Drive and Graham Road north of North Frontage Road, which are classified as a collector and local, respectively. The City's minimum access spacing on an arterial is 530 feet for roadways and driveways. ODOT's minimum access spacing standards are 1,320 feet to the first full-access intersection and 750 feet to the first right-in/right-out only access from the ramp terminal.

Figure 4 shows the driveway and intersection spacing for these roadways within the management area and compares them with the adopted guidelines. This access spacing is summarized in Table 3. As can be seen from this table, there are many locations along South Frontage Road as well as locations along Graham Road, North Frontage Road and Marine Drive where desired access spacing is not met. It should be noted that the standards provided by ODOT and the City were not in existence when this area originally developed.



LEGEND

1 - Driveway/Access Location Number

100' - Distance Between Driveway/Access Locations

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 4

APPROXIMATE DRIVEWAY LOCATIONS

Table 3: Intersection/Access Spacing in Interchange Area

From	*To*	*Distance – Stop Bar to Stop Bar (Feet)*	*Distance – Center to Center (Feet)*	*City/County Desired Access Spacing (Feet)*[2]	*Meets City/County Standards?*	*ODOT's Desired Access Spacing (Feet)*[3]	*Meets ODOT Standards?*
South Frontage Road - Eastbound							
Marine Drive	**Culpepper Drive**	**465**	**460**	**530**	**No**	**750**	**No**
Accesses	Marine Drive – 1st Chevron Driveway	65	100	530	No	750	No
	1st Chevron Dwy – 2nd Chevron Dwy	60	105	530	No		
	2nd Chevron Dwy – Culpepper Drive	195	250	530	No		
Culpepper Drive	**Phoenix Drive**	**1265**	**1265**	**530**	**Yes**		
Accesses	Culpepper Drive --1st McDonalds Dwy	165	210	530	No		
	1st McDonalds – 2nd McDonalds Dwy	65	125	530	No		
	2nd McDonalds Dwy – 1st TA Dwy	245	310	530	No		
	1st TA Dwy – 2nd TA Dwy	175	235	530	No		
	2nd TA Dwy – 3rd TA Dwy	5	100	530	No		
	3rd TA Dwy – Phoenix Drive	185	260	530	No		
Phoenix Drive	**Graham Road**	**840**	**840**	**530**	**Yes**		
Accesses	Phoenix Drive – 1st Flying J Dwy	185	260	530	No		
	1st Flying J Dwy – 2nd Flying J Dwy	10	90	530	No		
	2nd Flying J Dwy – 3rd Flying J Dwy	75	155	530	No		
	3rd Flying J Dwy – Graham Rd	205	250	530	No		
Graham Rd (South) – Southbound							
South Frontage Rd	**257th Way**	**370**	**420**	**530**	**No**	**1320**	**No**
257th Way	**Historic Columbia River Highway**	**770**	**860**	**530**	**Yes**		

[2] Source: City of Troutdale Transportation System Plan, 2005. Multnomah County Design Standards, Part I – Design Manual, Table 1.2.3: Minimum Public Intersection Spacing Standards.

[3] Source: ODOT's Highway Design Manual, 2003, Table 6-4.

From	*To*	*Distance – Stop Bar to Stop Bar (Feet)*	*Distance – Center to Center (Feet)*	*City/County Desired Access Spacing (Feet)*[2]	*Meets City/County Standards?*	*ODOT's Desired Access Spacing (Feet)*[3]	*Meets ODOT Standards?*
Graham Road (North) – Northbound							
North Frontage Rd	**Harlow Place**	**1270**	**1270**	**N/A**	**Yes**	**1320**	**No**
Accesses	N. Front Rd - 1st Hotel Dwy	215	275	N/A	Yes	750	No
	1st Hotel Dwy – 2nd Hotel Dwy	455	490	N/A	Yes		
	2nd Hotel Dwy – Harlow Place	450	515	N/A	Yes		
Graham Road (North) – Southbound							
Harlow Place	**North Frontage Road**	**1255**	**1290**	**N/A**	**Yes**	**1320**	**No**
Accesses	Harlow Place - Airport Dwy	325	410	N/A	Yes		
	Airport Dwy - Driveway	345	400	N/A	Yes		
	Driveway – North Frontage Road	435	480	N/A	Yes	**1320**	**No**
North Frontage Road – Westbound							
Graham Road	**S. Entrance Road**	**1105**	**1155**	**530**	**Yes**	**750**	**Yes**
S. Entrance Road	**Marine Drive Intersection**	**1155**	**1220**	**530**	**Yes**		
Accesses	S. Entrance Rd – Truck Center Dwy	200	250				
	Truck Center Dwy – Marine Drive Free Right	450	495				
	Truck Center Dwy – Marine Drive Int	925	980				
Marine Drive – Northbound							
Marine Drive Free Right Merge	**NW 7th Street**	**890**	**925**	**328 (100 m)**	**Yes**		
North Frontage Road	**NW 7th Street**	**1385**	**1450**	**328**	**Yes**	**1320**	**Yes**
NW 7th Street	**Dunbar Avenue**	**850**	**850**	**328**	Yes		
Accesses	NW 7th Street - Driveway	370	420	328	Yes		
	Driveway – Dunbar Avenue	375	425	328	Yes		
Marine Drive – Southbound							
Dunbar Avenue	**NW 7th Street**	**850**	**850**	**328**	**Yes**		
	Dunbar Avenue – Driveway	385	420	328	Yes		
	Driveway – NW 7th Street	380	425	328	Yes		
NW 7th Street	**North Frontage Road**	**1370**	**1425**	**328**	**Yes**	**1320**	**Yes**

* **Bold** type indicates actual intersections (versus driveways)

CRASH ANALYSIS

The collision histories of the study intersections were obtained for 2006 through 2008 from the Oregon Department of Transportation (ODOT) Crash Analysis and Reporting Unit.[4] Based on the collision data and peak hour traffic counts, collision rates were estimated at the study intersections. A rate greater than or equal to 1.0 collision per million entering vehicles (MEV) generally indicates a higher than average collision rate, is generally indicative of a safety related problem and should be evaluated further. As shown in **Table 4**, the intersection at Graham Road/I-84 westbound off-ramp has the highest crash rates, at 1.51. The remaining intersections have crash rates of 0.73 or less. As shown, between 2006 and 2008, most collisions caused property damage only, and there were no fatal collisions reported.

Table 4: Study Area Intersection Collisions (Three Year Period between 2006-2008)

Intersection	Collisions (by Severity)				Annual Average Collisions	Collision Rate[a]
	Fatal	*Injury*	*Property Damage Only*	***Total***		
Signalized Intersections						
Marine Drive/Sundial Rd	0	0	1	**1**	0.33	**0.13**
Marine Dr / I-84 WB On-Ramp	0	2	8	**10**	3.33	**0.73**
Marine Dr / I-84 EB Off-Ramp	0	2	10	**12**	4.0	**0.65**
Graham Rd / I-84 EB On-Ramp	0	8	6	**15**	5.0	**0.58**
Graham Rd / I-84 WB Off-Ramp	0	7	11	**18**	6.0	**1.51**
Graham Rd/Historic Columbia River Hwy	0	7	4	**11**	3.67	**0.40**
Graham Rd / 257th Way	0	1	0	**1**	0.33	**0.04**

[a] Collision rate = average annual collisions per million entering vehicles (MEV); MEV estimates based on PM peak-hour traffic count.

OBSERVATIONS OF INTERSECTION CRASH DATA

At the Graham Road/I-84 westbound off-ramp intersection, nine of the crashes were from northbound vehicles turning left onto the North Frontage Road and another five were northbound through vehicles. The most common driver error cited on the crash reports included: "driving too fast", "failed to maintain lane", "ran off the road", and "turned into the wrong lane." These causes indicate that the

[4] Crash data for Marine Drive/Sundial Road includes records from January 1, 2006 and December 31, 2008. Crash data for the remaining intersections includes records from October 1, 2006 and September 30, 2009.

northbound movements should be monitored. Out of the remaining four crashes, three occurred on the westbound ramp at the traffic signal, and one occurred on the southbound approach at the traffic signal. The three on the westbound ramp included two rear end crashes, and a "backing improperly" crash. While this intersection did register the highest number of crashes over the three year history, it also had a lower entering vehicle count than several of the other intersections, which contributed to a high crash rate.

OPERATIONAL ANALYSIS

Manual turn movement counts were collected during the weekday PM peak period (4:00 – 6:00 PM).[5] Traffic volumes at study area intersections are displayed in Figure 5.

EXISTING TRAFFIC OPERATING CONDITIONS

Existing traffic operating conditions were analyzed at the existing study intersections. Intersections are the focus of the traffic analysis because they are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinity. Before the analysis results of the study intersections are presented, discussion is provided for two important analysis issues: (1) intersection performance measures (definitions of typical measures) and (2) required operating standards (per roadway, as specified by the agency with roadway jurisdiction).

INTERSECTION PERFORMANCE MEASURES

Level of service (LOS) ratings and volume-to-capacity (V/C) ratios are two commonly used performance measures that provide a good picture of intersection operations. In addition, they are often incorporated into agency mobility standards. Descriptions are given below:

- **Level of service (LOS):** A "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection.[6] LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity. This condition is typically evident in long queues and delays.

- **Volume-to-capacity (V/C) ratio:** A decimal representation (typically between 0.00 and 1.00) of the proportion of capacity that is being used (i.e., the saturation) at a turn movement, approach

[5] PM peak hour turn movement counts were collected at the study intersections from 4:00 p.m. to 6:00 p.m. on January 29, 2008; June 24, 2008; or July 1, 2008. Count dates are shown in detailed turn movement count sheets in appendix. Traffic volumes were balanced to represent the worst-case impacts based on the multiple count dates.

[6] A description of Level of Service (LOS) is provided in the appendix and includes a list of the delay values (in seconds) that correspond to each LOS designation.

leg, or intersection. It is determined by dividing the peak hour traffic volume by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 1.00, congestion increases and performance is reduced. If the ratio is greater than 1.00, the turn movement, approach leg, or intersection is oversaturated and usually results in excessive queues and long delays.

REQUIRED OPERATING STANDARDS

The I-84 freeway ramps and their terminals with city and county facilities are under Oregon Department of Transportation (ODOT) jurisdiction. The performance standards for these intersections vary depending on if new construction is planned or not. The minimum acceptable volume-to-capacity (v/c) ratio is 0.85 or better during each of the two peak hours[7], as provided by the Oregon Highway Plan. However, the Highway Design Manual standards, which are stricter, apply when improvements at the interchange are being evaluated. In the Troutdale area, I-84 is classified as a national highway system (NHS) a freight route (FR) and federally designated truck route (TR) and it is within the urban growth boundary of the Portland Region.

Given these criteria, the ODOT standard for future analysis of the I-84 interchange intersections when considering improvements that will be constructed is v/c of 0.75 or less. The stricter standards provide more capacity to allow for better operations in the future. The other intersections in the study area are under Multnomah County or City of Troutdale jurisdiction. Both agencies have a performance standard of LOS D or better for the peak hour of traffic.[8] Table 5 lists the jurisdictional standards for study intersections.

[7] Oregon Highway Plan Mobility Standard Guidelines. August 7, 2009. Oregon Department of Transportation

[8] Multnomah County Design Standards, Part I – Design Manual.

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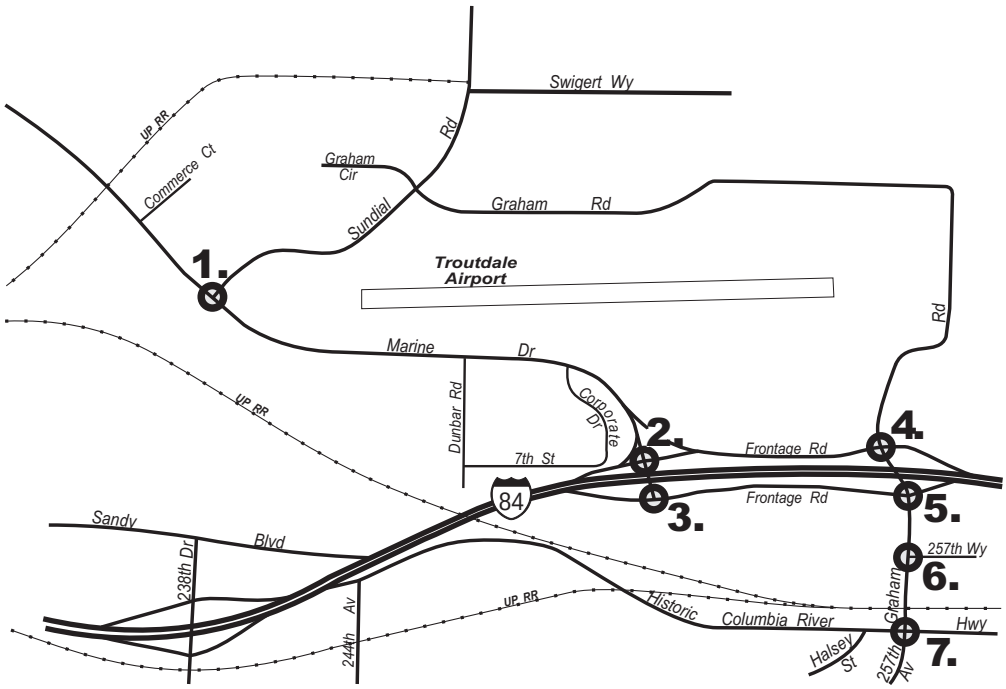
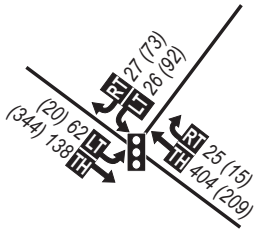
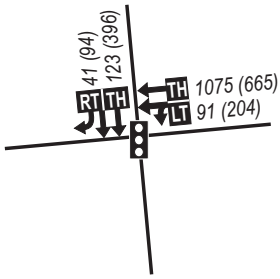
NO SCALE



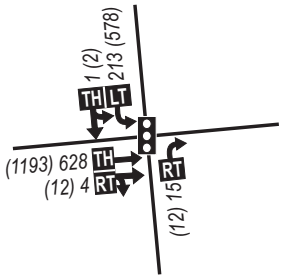
1. Marine Dr. @ Sundial Rd.



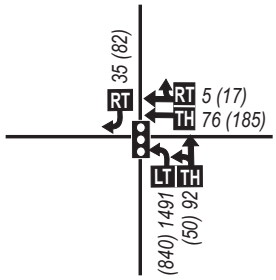
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



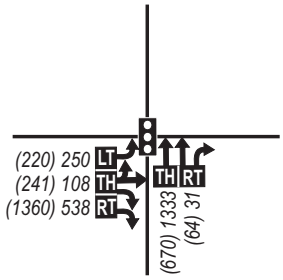
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



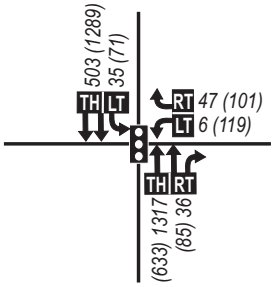
4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



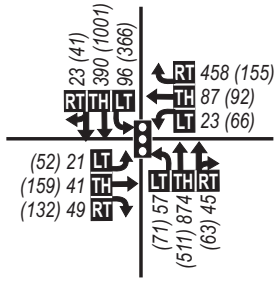
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

1.0 - Study Intersection & Number

- Traffic Signal

STOP - Stop Sign

← - Lane Configuration

AM (PM) - Peak Hour Traffic Volume

LT TH RT - Volume Turn Movement (Left • Thru • Right)

Figure 5

2010 EXISTING AM/PM PEAK HOUR TRAFFIC VOLUMES

Table 5: Jurisdictional Operational Standards

Facility	Existing Standard	Future Year Standard (No additional improvements)	Future Year Standard (with improvements)
I-84 Interchange Ramps (ODOT)	v/c = 0.85 (OHP)	v/c = 0.85 (OHP)	v/c = 0.75 (HDM)
Other study intersections (Multnomah County and City of Troutdale)	LOS D	LOS D	LOS D

Source: Oregon Highway Plan Mobility Standard Guidelines, August 7, 2009 (page 14); 2003 Oregon Highway Design Manual, Table 10-1 (page 10-38)

EXISTING OPERATING CONDITIONS

The existing traffic operating conditions at the study intersections were determined for the PM peak hour based on the *2000 Highway Capacity Manual* methodology[9]. The conditions include the estimated average delay, level of service (LOS), and volume-to-capacity (V/C) ratio of each study intersection and are listed in Table 6. All study intersections currently comply with the City of Troutdale, Multnomah County LOS D operating standard, as well as with ODOT's volume to capacity standards.

The AM peak hour operations were previously analyzed as part of the Troutdale Reynolds Industrial Park (TRIP) transportation studies. These results have been reproduced in Table 6 below. Note that the conditions are similar between the two peak periods, although the PM peak period generally has higher delays than does the AM peak period.

Table 6: Existing Operating Conditions during Peak Hours

Intersection	Minimum Operating Standard (City, ODOT)	Peak Hour	Operating Conditions		
			Average Stopped Delay per vehicle	*Level of Service*	*Volume-to-Capacity Ratio*
Traffic Signal Controls					
Marine Drive/ Sundial Road	LOS D	AM	9.3	A	0.52
		PM	9.6	A	0.43
I-84 WB On-Ramp/ Marine Drive	LOS D, 0.85 V/C	AM	9.3	A	0.54
		PM	15.8	B	0.51
I-84 EB Off-Ramp /Marine Drive	LOS D, 0.85 V/C	AM	8.1	A	0.28
		PM	30.3	C	0.60

[9] *2000 Highway Capacity Manual*, Transportation Research Board, 2003.

Intersection	Minimum Operating Standard (City, ODOT)	Peak Hour	Operating Conditions		
			Average Stopped Delay per vehicle	*Level of Service*	*Volume-to-Capacity Ratio*
I-84 EB On-Ramp/ Graham Road	LOS D, 0.85 V/C	AM	12.6	B	0.61
		PM	10.6	B	0.61
I-84 WB Off-Ramp/ Graham Road	LOS D, 0.85 V/C	AM	11.8	B	0.60
		PM	29.6	C	0.37
Graham Road/ 257th Way	LOS D	AM	4.5	A	0.52
		PM	12.3	B	0.55
257th Drive/ Historic Columbia River Hwy	LOS D	AM	22.7	C	0.49
		PM	28.0	C	0.70
STOP Sign Controls				Major / Minor	
Graham Road/ Sundial Road	LOS D	AM		A/A	
		PM		A/A	

EXISTING QUEUING OBSERVATIONS

The vehicle queues in the eastbound through lanes on South Frontage Road at the I-84 eastbound off-ramp have not been observed to exceed the available storage during the PM peak hour,[10] however it has been reported by citizens and others that it routinely does exceed available storage and backs up onto I-84. It is reported that when the queues do back up onto I-84, it creates a serious safety concern because it occurs at a location with inadequate sight distance due to a horizontal curve in I-84 and a railroad trestle crossing I-84 that disrupts sight distance.

During the AM peak hour, the concern is that queues on the I-84 westbound exit ramp could spill back onto the mainline freeway impacting freeway operations, however, this has not been observed to be the case. It should, however, be monitored in the future. The condition is exacerbated by traffic headed from Troutdale to I-84 westbound toward Portland, creating substantial congestion at the Graham Road/I-84 WB off-ramp.

EXISTING QUEUING ANALYSIS (SIGNALIZED INTERSECTIONS)

Vehicle queuing analysis was completed for all signalized study intersections based on the ODOT Analysis Procedures Manual.[11] All vehicle queues at the I-84 interchange intersections, as well as Marine Drive/Sundial Road and 257th/Historic Columbia River Highway remain within available storage. Three turn movements at 257th Avenue/Historic Columbia River Highway exceed the available storage

[10] Field observations by DKS Associates, September 2008.

[11] ODOT Analysis Procedures Manual (Chapter 8), Transportation Planning Analysis Unit (TPAU), April 2006

during either the a.m. or p.m. peak hours. However, the turn movements at 257th Avenue/Historic Columbia River Highway that exceed available turn lane storage, simply spill back to the through movements and do not interfere with adjacent signalized intersections. Table 7 lists all of the vehicle queues for the signalized study intersections.

Table 7: I-84 257th Avenue Interchange Existing 95th Percentile Queuing Summary (AM/PM Peak Hours)

Intersection	Intersection Approach	Available Vehicle Storage (feet)	Existing 95th Percentile Queue (feet) AM Peak Hour	Existing 95th Percentile Queue (feet) PM Peak Hour
Marine Drive / Sundial Road	EB Left	150	100	75
	EB Through	>2,500	75	200
	WB Th/Right	>2,500	200	150
	SB Left	125	75	100
	SB Right	>2,500	75	75
Marine Drive / I-84 WB On Ramp	WB Left	2,200	200	225
	SB Through	>2,500	125	225
	SB Right	150	75	150
Marine Drive / I-84 EB Off Ramp	EB Th/Right	1,100	100	375
	SB Left	350	125	325
Graham Road / I-84 WB Off Ramp	WB Th/Right	1,100	100	200
	NB Left	475	150	125
	SB Right	>2,500	75	75
Graham Road / I-84 EB On Ramp	EB Th/Left	2,400	200	225
	EB Right	2,400	25	50
	NB Through	375	175	125
	NB Right	125	25	50
Graham Road / 257th Way	WB Left	200	75	175
	NT Through	750	150	225
	NB Right	125	25	125
	SB Left	225	75	125
	SB Through	375	75	225
257th Avenue / Historic Columbia River Highway	EB Left	125	75	125
	EB Through	350	75	250
	EB Right	125	75	**150**
	WB Left	125	75	125
	WB	500	350	150
	WB Right	125	**175**	100
	NB Left	175	150	125

Intersection	Intersection Approach	Available Vehicle Storage (feet)	Existing 95th Percentile Queue (feet)	Existing 95th Percentile Queue (feet)
			AM Peak Hour	PM Peak Hour
	NB Th/Right	>2,500	400	275
	SB Left	125	**150**	**200**
	SB Th/Right	775	150	475

Available vehicle storage = distance from stop bar to upstream intersection crosswalk/stop bar
EB=Eastbound; WB=Westbound; NB=Northbound; SB=Southbound; Th=Through
95th percentile queues rounded to nearest 20-feet
Shaded/Bolded values indicate queues that would exceed available vehicle storage.

FREEWAY MERGE / DIVERGE OPERATIONS ANALYSIS

The I-84 257th Avenue interchange features four ramp junctions, two of which are defined as merge and diverge junctions. The maneuver of a vehicle exiting the freeway at a junction is referred to as a diverge, while the maneuver of a vehicle entering the freeway at a junction is referred to as a merge. Interstate-84 consists of three lanes in both the eastbound and westbound directions west of the interchange and two lanes in both the eastbound and westbound directions through the interchange and to the east. Since I-84 drops an eastbound travel lane at the I-84 257th Avenue interchange, no diverge occurs, traffic exiting at the interchange simply has its own lane. Similarly, I-84 adds a westbound travel lane at the I-84 257th Avenue interchange, so no merge occurs, traffic entering at the interchange simply has its own lane. Both remaining merge and diverge junctions are single lane. Both merge and diverge junctions located at the I-84 257th Avenue interchange are located on the right side of the freeway.

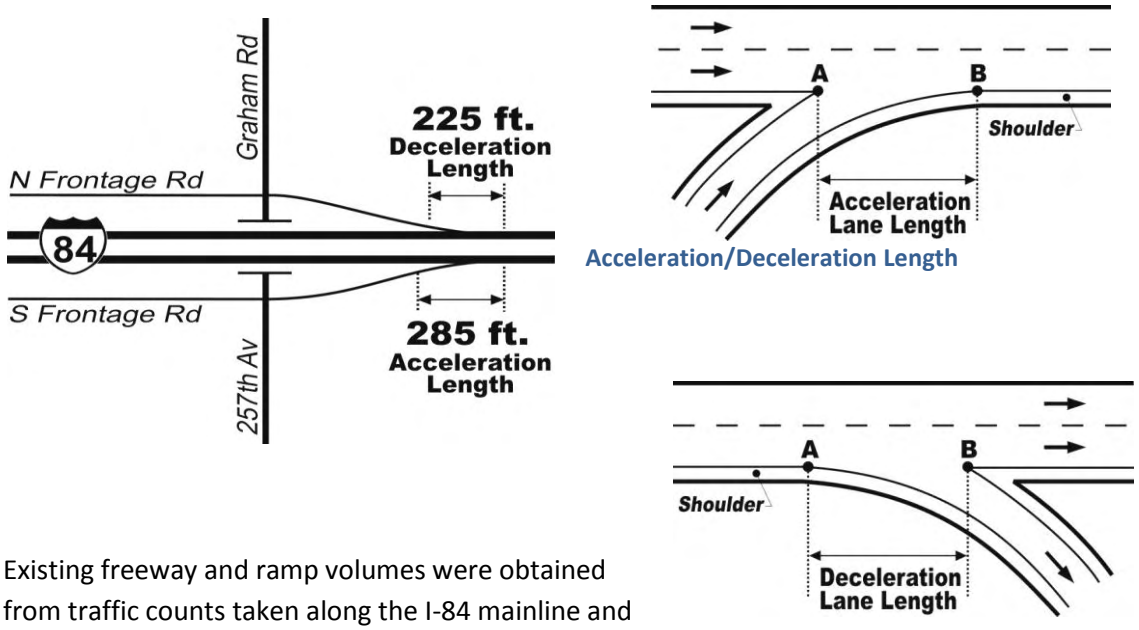
Analysis of the I-84 257th Avenue interchange ramp junctions focused on level-of-service (LOS) and density based on 2000 Highway Capacity Manual procedures. The LOS of a ramp junction (merge and diverge) is defined by the density of the influence area and the capacity of both the ramp and the freeway. The influence area for merge and diverge junctions is defined to be 1,500 feet downstream (merge) or upstream (diverge) of the physical merge/diverge point. Ramp junction LOS and density were determined using the HCS 2000 Highway Capacity Software.

A freeway free flow speed of 60 miles-per-hour (mph) and ramp free flow speed of 35 mph was used in this analysis. Heavy vehicle percentages for the freeway mainline were determined via ODOT's automatic traffic data recorder (ATDR) located along I-84 east of Troutdale and west of the Sandy River[12] while heavy vehicle percentages for ramps were based on traffic counts conducted at the I-84 Graham

[12] Heavy vehicle percentage of 21% was used based on 2008 traffic data.

Road ramp junctions.[13] Critical components of freeway merge and diverge junctions are the acceleration and deceleration length. The respective acceleration and deceleration length is the distance between the gore point between the freeway traveled way and the ramp junction to the intersecting point of the traveled way. The length of these segments is critical because this is where either vehicle acceleration or deceleration takes place. These segments should be long enough to prevent vehicles accelerating or decelerating on the freeway mainline. The acceleration and deceleration distances for the I-84 257th Avenue ramp junctions are shown in Figure 6.

Figure 6: Troutdale I-84 257th Avenue Interchange Ramp Junction (East End)

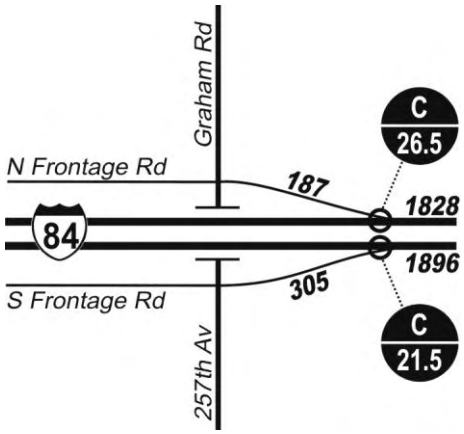


Existing freeway and ramp volumes were obtained from traffic counts taken along the I-84 mainline and at the interchange ramp terminals.[14] Figure 7 documents the results of the merge and diverge analysis at each of the I-84 257th Avenue eastbound and westbound ramp junctions under existing PM peak hour conditions. Currently, both the I-84 westbound diverge and I-84 eastbound merge operate at HCM LOS "C" conditions. HCM LOS "C" is generally considered an acceptable operating condition. The I-84 eastbound diverge occur simultaneously with a lane drop from I-84, so it has its own lane, making the diverge insignificant. Additionally, the I-84 westbound merge occur simultaneously with the addition of a westbound lane to I-84, making the merge insignificant.

[13] Heavy vehicle percentage of 28% (WB ramps) and 5% (EB ramps) were used based on traffic counts.

[14] Intersection turn movement counts taken at Graham Road/I-84 EB ramps on June 7, 2010, Graham Road/I-84 WB Ramps on May 11, 2010 and 2008 ATR (automated traffic recorder) collected along I-84 between the Troutdale Interchange and the Sandy River, factored to the 30th highest hour.

Figure 7: I-84 257th Avenue Interchange Ramps (East End) Merge/Diverge Volumes (2010 PM Peak Hour) and Level-of-Service



PEDESTRIAN FACILITIES

A figure showing Existing Sidewalks and Trails can be found in the Appendix Figure A-7.[15] Sidewalks exist along the south side of South Frontage Road and on both sides of Graham Road (south of South Frontage Road). A walking area is available on the east side of Graham Road between South Frontage Road and North Frontage Road. Sidewalks or a walking area are available on the east side of Marine Drive between South Frontage Road and North Frontage Road, as well as on the west side of Marine Drive between North Frontage Road and Dunbar Avenue. No sidewalks or pedestrian facilities are available on North Frontage Road.

BICYCLE FACILITIES

A figure showing existing bicycle lanes can be found in Appendix Figure A-8.[16] The majority of the collector and arterial routes within Troutdale do provide bike lanes. There are existing on-street bicycle lanes on South Frontage Road and North Frontage Road between Marine Drive and Graham Road. There are also existing on-street bicycle lanes on Marine Drive from South Frontage Road to the north/west city limits. There are existing on-street bicycle lanes on graham road between Historic Columbia River Highway (south of the interchange) and Harlow Place (north of the interchange). There is also an existing regional multi-use path along Marine Drive from just south of Sundial Road heading toward the north/west city limits and beyond.

[15] Existing Pedestrian Facilities, City of Troutdale Transportation System Plan.

[16] Existing Bicycle Facilities, City of Troutdale Transportation System Plan.

EXISTING TRANSIT SYSTEM

Transit service to Troutdale is provided by the Tri-County Metropolitan District of Oregon (TriMet). TriMet currently provides four fixed routes that serve the City of Troutdale. Appendix Figure A-9 shows current TriMet bus routes serving Troutdale, including routes 20, 77, 80 and 81. These routes connect downtown Troutdale, the Interstate 84 access roads and the outlet mall to Downtown Portland and other regional centers, such as downtown Gresham and I-205 Mall regional center. There are no park-and-ride lots in the City of Troutdale, but there is one at the Reynolds School District offices, located at 201st and Halsey Street on route #77, which could serve Troutdale residents. Table 8 lists the average route headways and corresponding level of service (based on the Highway Capacity Manual methodology[17]) for each of the routes serving Troutdale.

Table 8: TriMet Service Routes and Weekday Peak Period Level of Service

	Weekday Peak Average Headways (Minutes)			Level of Service		
Route	AM	Midday	PM	AM	Midday	PM
#20 Burnside/Stark	15	15	15	C	C	C
#77 Broadway/Halsey	15	20	15	C	D	C
#80 Kane Road/Troutdale Road	25	30	25	E	E	E
#81 Kane Road/257th Avenue	60	60	60	F	F	F

EXISTING ISSUES PERTAINING TO EXISTING PLANS AND POLICIES

This section discusses issues discovered in Existing Conditions that will need to be addressed in the IAMP.

- Maximum volume-to-capacity ratios from the 1999 Oregon Highway Plan (Inside Metro) are met. The criteria is v/c=0.99 or less for both first and second hours, except at the ramp terminals, where the criteria is v/c=0.85 or less. All study intersections operate at v/c=0.99 or less, and the ramp terminals operate at conditions better than 0.85.

[17] *2000 Highway Capacity Manual*, Transportation Research Board, 2000, Chapter 27.

MARINE DR

N. FRONTAGE RD

S. FRONTAGE RD

GRAHAM RD

GRAHAM RD

7TH WY

Union Pacific RR

HISTORIC COLUMBIA RIVER HWY

84

LEGEND

1 - Driveway/Access Location Number

100' - Distance Between Driveway/Access Locations

750' 1320' - Desired Distance to 1st/Last Right In/Right Out Only Intersection - Desired Distance to 1st Full Intersection

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NO SCALE

Figure 8

APPROXIMATE DRIVEWAY LOCATIONS & DESIRED ODOT ACCESS SPACING

- Access spacing requirements are displayed in Figure 8 and summarized below:
  - ODOT's minimum spacing standards applicable to freeway interchanges with two-lane crossroads.

Access spacing between interchanges is required to be 1 mile under urban conditions. This spacing is not met between the I-84/257th Avenue interchange and either the I-84/Jordan interchange or I-84/238th/Wood Village interchange.

- The distance from the off-ramp terminal to the first right-in/right-out only intersection (distance X) is required to be at least 750 feet in a "fully developed urban" situation.
  - The distance between the I-84 eastbound off-ramp and the first access point (driveway) on South Frontage Road is approximately 100 feet, much less than required by ODOT standards. There are a number of additional access points within the 750 feet on South Frontage Road.
  - The distance between the I-84 westbound off-ramp and the first access point (driveway) north on Graham Road is approximately 275 feet, much less than required by ODOT standards.
- The distance from the ramp terminal to the first intersections where left turns are allowed (distance Y) is required to be at least 1,320 feet in a "fully developed urban" situation.
  - The distance between the I-84 westbound off-ramp and the first driveway to the north on Graham Road is about 275 feet, much less than required by ODOT standards. There is one additional access within the 1,320 foot requirement.
  - The distance between the I-84 westbound off-ramp and the South Entrance Road is about 1,155 feet, less than required by ODOT standards.
- The distance between the last right-in/right-out approach road and the start of the taper for the on-ramp (distance Z) is required to be at least 750 feet in a "fully developed urban" situation.
  - The distance between the I-84 eastbound on-ramp at Graham Road/South Frontage Road and Graham Road/257th Way is about 420 feet, less than required by ODOT standards.
  - The distance between the I-84 westbound off-ramp at Graham Road/North Frontage Road and the first driveway to the north (in the southbound Graham Road direction) is about 480 feet, less than that required by ODOT standards.

- The City of Troutdale's minimum access spacing on arterials such as South Frontage Road and North Frontage Road, is 530 feet. As shown in Table 4, previously, many driveways and/or intersections along South Frontage Road and North Frontage Road are not in compliance with this requirement.

One of the main objectives of the IAMP is to work toward achieving desired spacing standards, while recognizing that full compliance may not be feasible or practical.

SUMMARY OF KEY INTERCHANGE ISSUES

The I-84 257th Avenue (Exit 17) interchange has experienced congestion at several of its intersections and the I-84 eastbound ramp is reported to regularly back up onto I-84. Over the years, a number of improvements have been identified, some of which have been recently constructed and others for which funding is currently available or will be available in the near future.

- Funds have been allocated through the Governor's Jobs and Transportation Act (JTA), in 2009, to construct projects within the interchange area to support job growth and economic development in this area.
- The Oregon Department of Transportation (ODOT), City of Troutdale and the Port of Portland have outlined a series of specific improvement projects that will address existing safety and mobility needs identified in past planning studies, as well as provide capacity enhancement to serve economic growth in the area.
- In 2005, the City of Troutdale adopted an update to its Transportation System Plan (TSP). This TSP identified the need for improvements in the vicinity of the I-84 257th Avenue interchange as well as the need for an Interchange Area Management Plan (IAMP). Additionally, recent traffic studies associated with the Troutdale Reynolds Industrial Park (TRIP) have shown that the I-84 257th Avenue interchange will not meet performance standards in the future with full development of the Industrial Park.

Based on the preceding analysis, a series of interchange improvements have been constructed, or are planned. In fall of 2009, ODOT partnered with the Port of Portland and City of Troutdale to complete work on a project to widen the South Frontage Road at Graham Road to include a left, through/left and a second dedicated eastbound right turn lane.

The current series of JTA funded interchange improvements is in the design process and is planned for construction in summer 2011 (see Table 1 for details).

Table 9: Current JTA Funded Project List of 257th Avenue Interchange Improvements

Location	Description
I-84 Eastbound off-ramp	Add third lane approach to ramp terminal to increase vehicle queue space.
South Frontage Road	Add third eastbound lane between Marine Drive and Graham Road
North Frontage Road	Add third westbound lane from Graham Road to Marine Drive. The third lane will become a right-turn only lane onto Marine Drive
Graham Road / North Frontage Road	Construct 2nd northbound left turn lane Add westbound right-turn lane Add southbound free flow right-turn lane which merges into new 3rd westbound lane
Various Intersections	Traffic signal upgrades

These improvements are needed because the I-84 eastbound off-ramp at Marine Drive backs up onto the mainline freeway on occasion today (although not observed in field studies or count data) and is expected to do so more frequently in the future, which is a serious safety concern. South Frontage Road is congested during morning and evening peak periods and heavy truck traffic further exacerbates the congestion. The intersection at Graham Road/North Frontage Road experiences a significant amount of congestion, particularly during the AM peak period. This congestion is due, in part, to vehicles heading northbound from Troutdale to westbound I-84 toward Portland conflicting with vehicles coming from the east on I-84 into Troutdale. This intersection will be further impacted when the TRIP develops.

If additional JTA funding is available, ODOT, the City of Troutdale and the Port of Portland will work together to determine the best use of the funding. Potential future improvements are summarized in Table 10.

Table 10: Potential future JTA Funded Project List of 257th Avenue Interchange Improvements

Location	Description
Marine Drive	Extend south of the South Frontage Road, looping east to form a 'backage' road to the commercial uses and connect to Graham Road at 257th Way (opposite the Outlet Mall)
I-84 Underpass at Marine Drive	Reconstruct underpass between the North Frontage Road and South Frontage Road to allow for standard vertical and horizontal clearance, and provide two additional travel lanes. This construction would allow for two-way circulation as identified in the Troutdale TSP. Provide northbound left-turn lane, two northbound through lanes Widen I-84 Eastbound Off-Ramp to provide an eastbound left-turn lane onto Marine Drive
I-84 Eastbound Off-Ramp/Marine Drive	Widen approach to provide an additional eastbound through lane

APPENDIX

DEPARTMENT OF COMMUNITY DEVELOPMENT

CITY OF TROUTDALE

MULTNOMAH COUNTY, OREGON

COMPREHENSIVE LAND USE PLAN MAP

Effective 4/10/2010

Ordinance No. 799

Figure A-1: City of Troutdale Comprehensive Plan

COLUMBIA RIVER

Company Lake

Sandy River

Beaver Creek

City of Fairview

Unincorporated Multnomah County

City of Wood Village

City of Gresham

Legend

- CITY BOUNDARIES
- PARCELS
- STREETS
- RAILROADS

Land Use Designations

- LOW DENSITY RESIDENTIAL (LDR)
- MEDIUM DENSITY RESIDENTIAL (MDR)
- HIGH DENSITY RESIDENTIAL (HDR)
- COMMERCIAL (C)
- INDUSTRIAL (I)
- OPEN SPACE (OS)
- URBAN PLANNING AREA LOW DENSITY RESIDENTIAL (UPALDR)
- MASTER PLANNED MIXED USE (MPMU)
- URBAN PLANNING AREA INDUSTRIAL (UPAI)
- TOWN CENTER OVERLAY
- URBAN GROWTH BOUNDARY
- CR — COMMUNITY RESOURCES (CR)

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The City of Troutdale provides this data in good faith and shall in no event be liable for any incorrect results, and lost profits, and special, indirect, or consequntial damages to any party arising out of or in connection with the use or the inability to use the data hereon or the services provided.
The City of Troutdale provides this data and services as a convenience to the public. Further more, the City of Troutdale reserves the tight to change or revise published data and/or these services at any time.

Map prepared by
The City of Troutdale Public Works
342 SW 4th Street
Troutdale, Oregon 97060
Map data compiled from the
Metro Regional Government Agency and
Multnomah County in conjunction with
The City of Troutdale

Map updated by:
S.D.
February, 2010

Map referenced by:
'Compplan'

0 0.125 0.25 0.5 0.75 1 *Miles*

DEPARTMENT OF COMMUNITY DEVELOPMENT

CITY OF TROUTDALE

MULTNOMAH COUNTY, OREGON

ZONING DISTRICT MAP

Effective 4/10/2010

Ordinance No. 799

Figure A-2: City of Troutdale Zoning Map and IAMP Boundaries

COLUMBIA RIVER

Company Lake

Sandy River

City of Fairview

Troutdale Airport

Unincorporated
Multnomah County

Proposed Study Area

Proposed Management Area

84

City of Wood Village

Beaver Creek

Reynolds
High School

City of Gresham

Unincorporated
Multnomah County

Legend

- CITY BOUNDARIES
- PARCELS
- STREETS
- RAILROADS
- RIVERS AND STREAMS

Zoning Districts

Low Density Residential

- R-20 Single Family Residential
- R-10 Single Family Residential
- R-7 Single Family Residential

Medium Density Residential

- R-5 Single Family Residential
- R-4 Attached Residential

High Density Residential

- A-2 Apartment Residential

Commercial

- Neighborhood Commercial (NC)
- Community Commerical (CC)
- General Commercial (GC)
- Central Business District (CBD)
- Mixed Office Housing (MO/H)

Industrial

- Industrial Park (IP)
- Light Industrial (LI)
- General Industrial (GI)
- Open Space (OS)
- Urban Planning Area - General Industrial (UPAGI)
- Urban Planning Area - Residential (UPAR-10)
- Town Center Overlay
- Planned Development Overlay
- Urban Growth Boundary

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Map updated by:
C.A.
July 2010

Map referenced by:
'Zoning'

0 0.125 0.25 0.5 *Miles*

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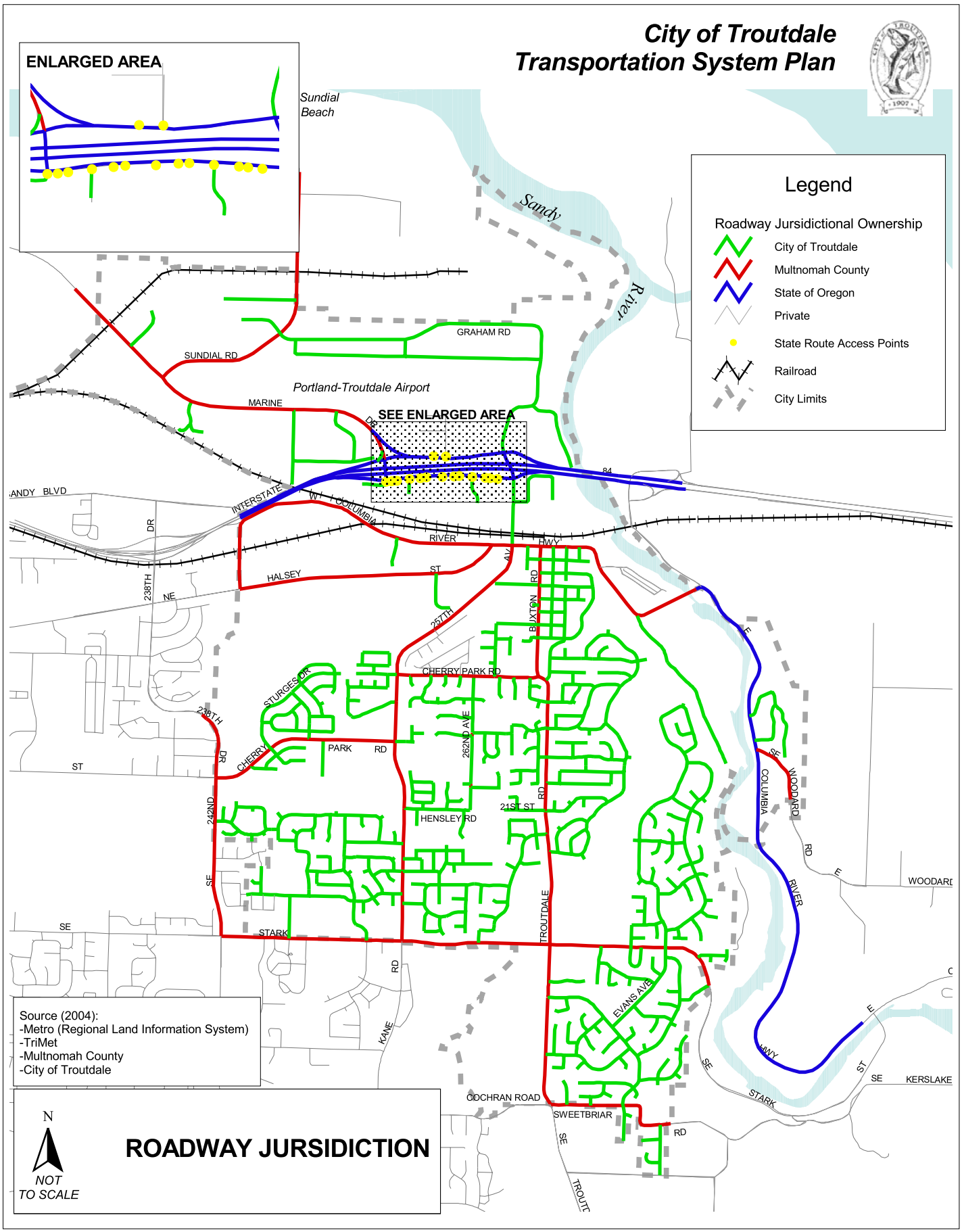

Figure A-3: Jurisdictional Ownership

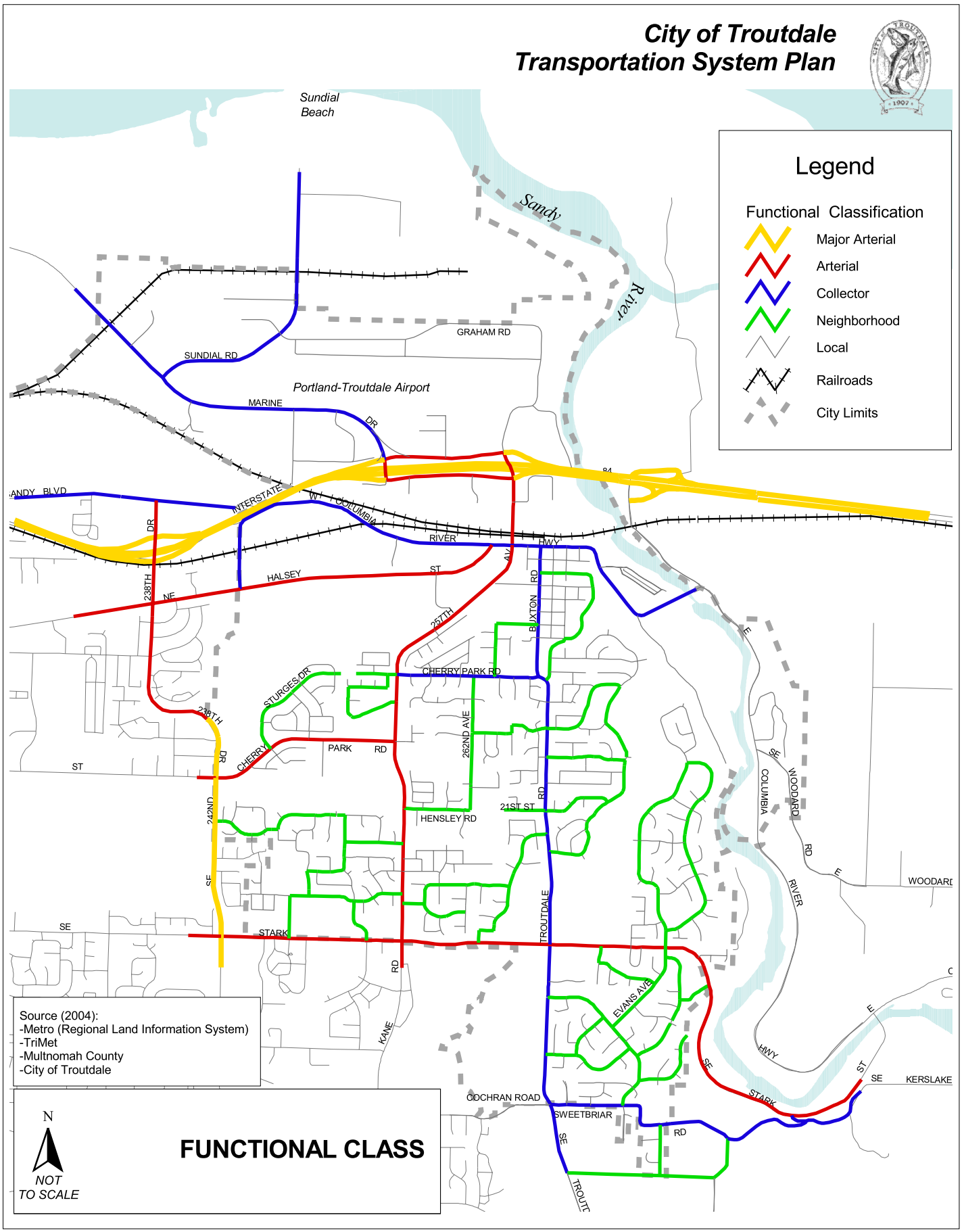

Figure A-4: Street Functional Class

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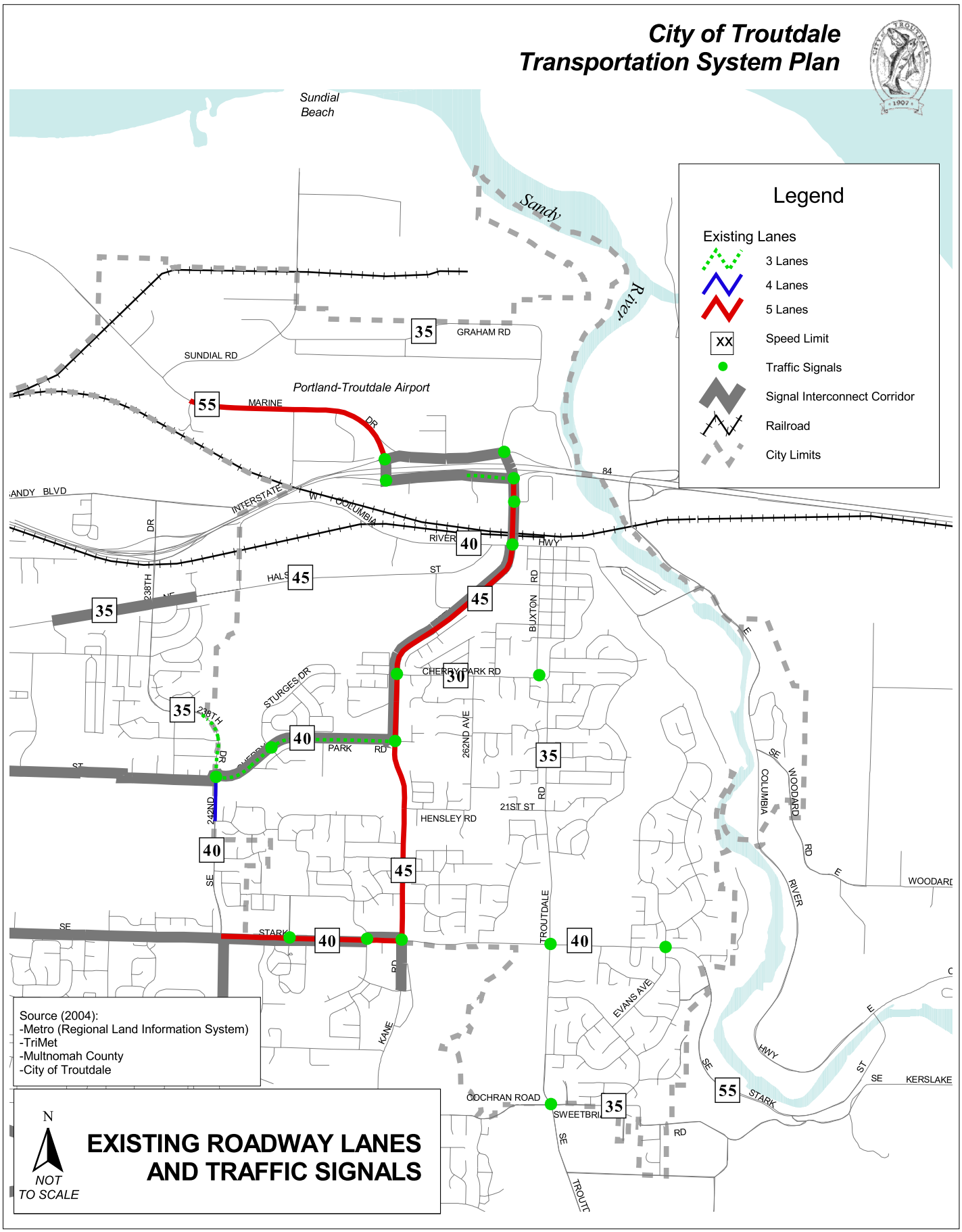

* Along roads that are 35 mph or less, the speed limit drops to 20 mph 24 hours a day in front of schools.

Figure A-5: Existing Lane Configurations

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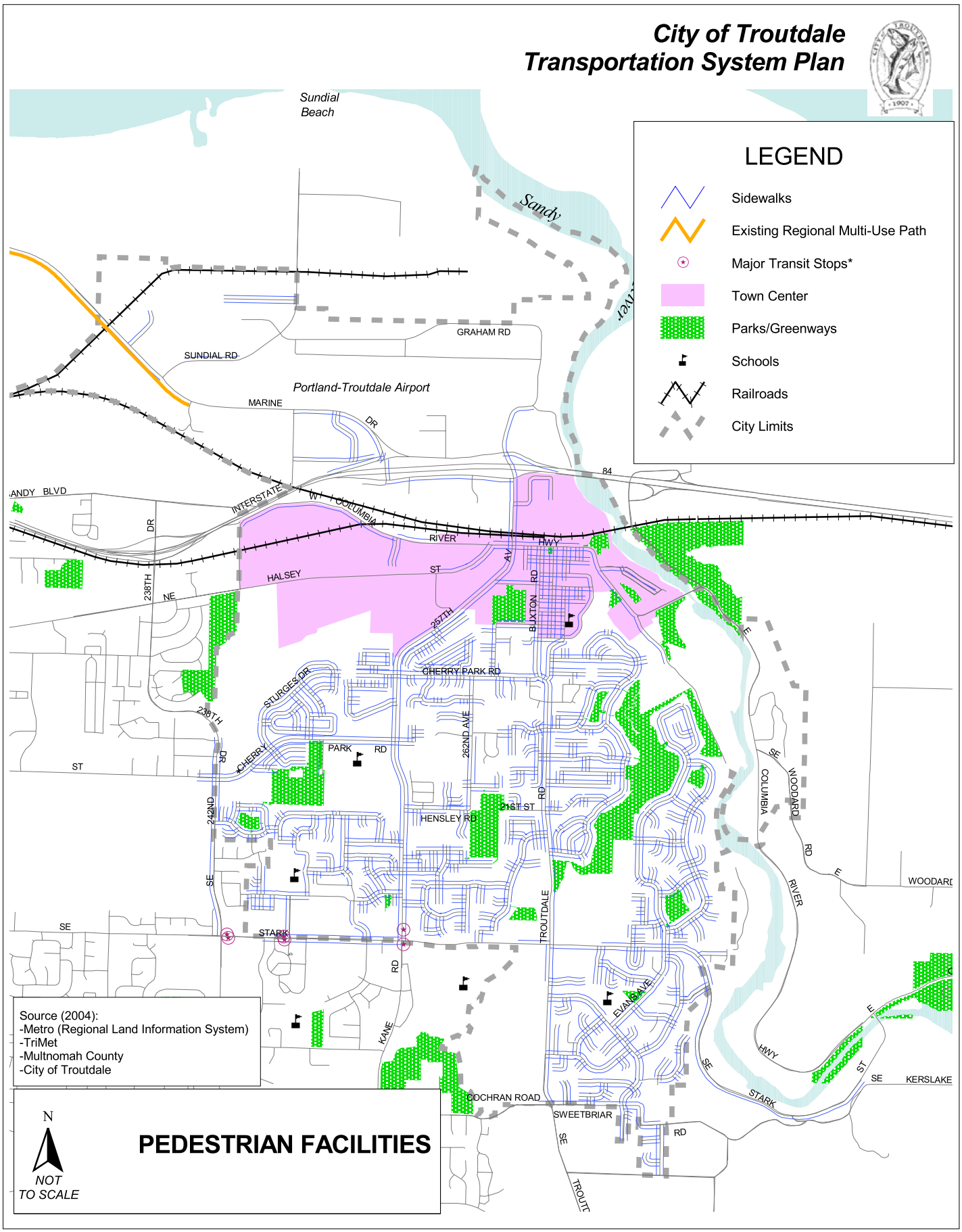

* Major Transit Stops are defined as major bus stops, transit centers and light-rail stations on the regional transit network. They provide schedual information, lighting, benches, shelters and trash cans.

Figure A-6: Existing Pedestrian System

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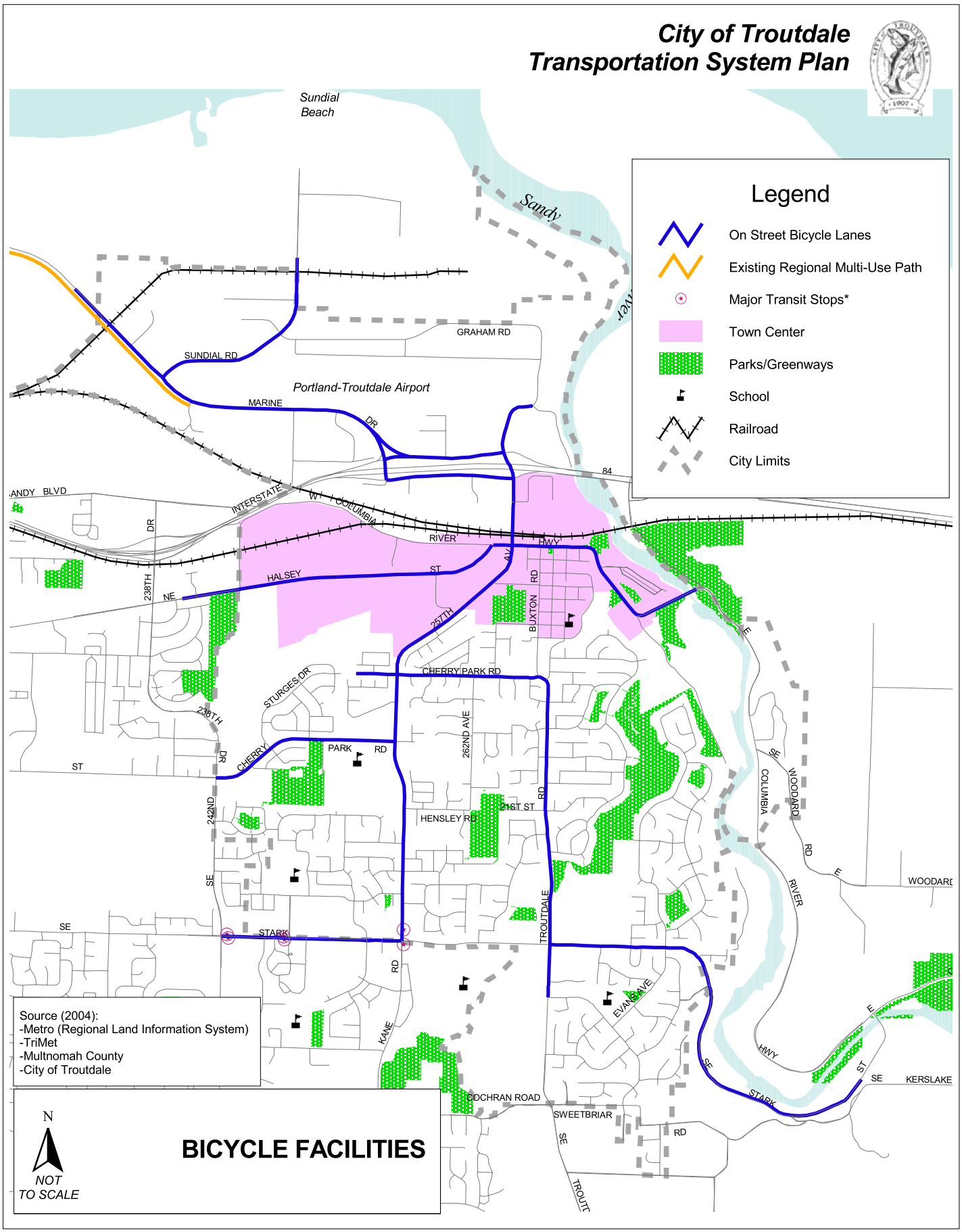

* Major Transit Stops are defined as major bus stops, transit centers and light-rail stations on the regional transit network. They provide schedual information, lighting, benches, shelters and trash cans.

Figure A-7: Existing Bicycle System

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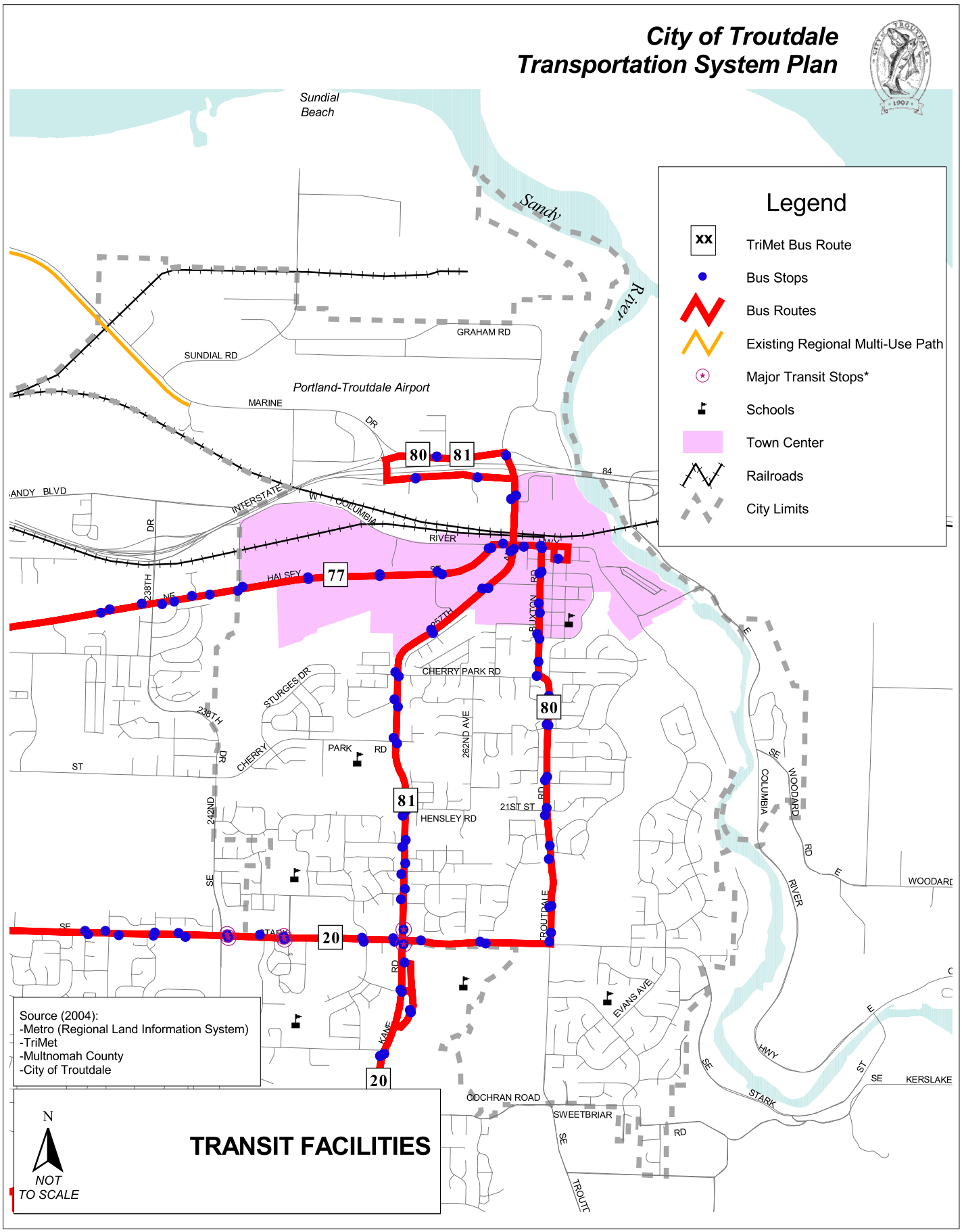


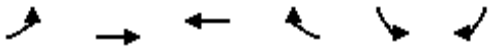
* Major Transit Stops are defined as major bus stops, transit centers and light-rail stations on the regional transit network. They provide schedule information, lighting, benches, shelters and trash cans.

Figure A-8: Existing Transit System

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	6	8	11	15	12	47	15	4	32	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	7	9	12	17	13	52	17	4	36	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	146	140	36	138	132	61	36			69		
vC1, stage 1 conf vol	44	44		87	87							
vC2, stage 2 conf vol	102	96		51	44							
vCu, unblocked vol	146	140	36	138	132	61	36			69		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	99	98	98	99			100		
cM capacity (veh/h)	836	776	1037	868	782	1005	1575			1532		

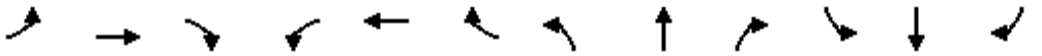
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	7	38	13	69	4	36
Volume Left	0	9	13	0	4	0
Volume Right	7	17	0	17	0	0
cSH	1037	890	1575	1700	1532	1700
Volume to Capacity	0.01	0.04	0.01	0.04	0.00	0.02
Queue Length 95th (ft)	0	3	1	0	0	0
Control Delay (s)	8.5	9.2	7.3	0.0	7.4	0.0
Lane LOS	A	A	A		A	
Approach Delay (s)	8.5	9.2	1.2		0.8	
Approach LOS	A	A				

Intersection Summary				
Average Delay	3.2			
Intersection Capacity Utilization	22.7%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	62	138	404	25	26	27
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1765	1765	1500	1676	1500
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1765	1765	1500	1676	1500
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	69	153	449	28	29	30
RTOR Reduction (vph)	0	0	0	14	0	29
Lane Group Flow (vph)	69	153	449	14	29	1
Turn Type	Prot			Perm		Prot
Protected Phases	5	2	6		4	4
Permitted Phases				6		
Actuated Green, G (s)	3.1	26.4	19.3	19.3	1.9	1.9
Effective Green, g (s)	3.1	26.4	19.3	19.3	1.9	1.9
Actuated g/C Ratio	0.08	0.66	0.48	0.48	0.05	0.05
Clearance Time (s)	4.0	7.0	7.0	7.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	129	1156	845	718	79	71
v/s Ratio Prot	c0.04	0.09	c0.25		c0.02	0.00
v/s Ratio Perm				0.01		
v/c Ratio	0.53	0.13	0.53	0.02	0.37	0.02
Uniform Delay, d1	17.9	2.6	7.3	5.5	18.6	18.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	0.1	1.5	0.0	1.1	0.0
Delay (s)	20.0	2.8	8.9	5.6	19.7	18.4
Level of Service	C	A	A	A	B	B
Approach Delay (s)		8.1	8.7		19.0	
Approach LOS		A	A		B	

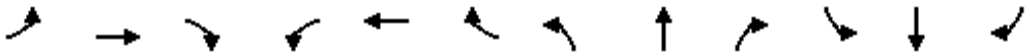
Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	40.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	91	1075	0	0	0	0	0	123	41
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.5						4.5	4.5
Lane Util. Factor					0.95						0.95	1.00
Frt					1.00						1.00	0.85
Flt Protected					1.00						1.00	1.00
Satd. Flow (prot)					2880						3079	1377
Flt Permitted					1.00						1.00	1.00
Satd. Flow (perm)					2880						3079	1377
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	100	1181	0	0	0	0	0	135	45
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	40
Lane Group Flow (vph)	0	0	0	0	1276	0	0	0	0	0	135	6
Heavy Vehicles (%)	0%	0%	0%	15%	15%	15%	0%	0%	0%	8%	8%	8%
Turn Type				Split								Perm
Protected Phases				4	4						2	
Permitted Phases												2
Actuated Green, G (s)					70.0						11.0	11.0
Effective Green, g (s)					70.0						11.0	11.0
Actuated g/C Ratio					0.78						0.12	0.12
Clearance Time (s)					4.5						4.5	4.5
Vehicle Extension (s)					2.3						4.2	4.2
Lane Grp Cap (vph)					2240						376	168
v/s Ratio Prot					c0.44						c0.04	
v/s Ratio Perm												0.00
v/c Ratio					0.57						0.36	0.03
Uniform Delay, d1					4.0						36.3	34.8
Progression Factor					0.82						1.00	1.00
Incremental Delay, d2					0.9						0.9	0.1
Delay (s)					4.1						37.2	34.9
Level of Service					A						D	C
Approach Delay (s)		0.0			4.1			0.0			36.6	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	8.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

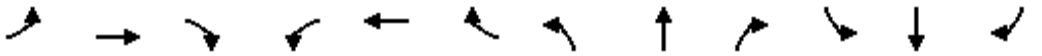
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	628	4	0	0	0	0	0	15	213	1	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.5							4.0	4.5	4.5	
Lane Util. Factor		0.95							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		3048							1402	1398	1402	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		3048							1402	1398	1402	
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)	0	654	4	0	0	0	0	0	16	222	1	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	101	101	0
Lane Group Flow (vph)	0	658	0	0	0	0	0	0	16	10	11	0
Heavy Vehicles (%)	9%	9%	9%	0%	0%	0%	8%	8%	8%	13%	13%	13%
Turn Type									custom	Split		
Protected Phases		8								2	2	
Permitted Phases									1			
Actuated Green, G (s)		66.9							1.6	8.5	8.5	
Effective Green, g (s)		66.9							1.6	8.5	8.5	
Actuated g/C Ratio		0.74							0.02	0.09	0.09	
Clearance Time (s)		4.5							4.0	4.5	4.5	
Vehicle Extension (s)		2.3							2.3	2.3	2.3	
Lane Grp Cap (vph)		2266							25	132	132	
v/s Ratio Prot		c0.22								0.01	c0.01	
v/s Ratio Perm									c0.01			
v/c Ratio		0.29							0.64	0.08	0.09	
Uniform Delay, d1		3.8							43.9	37.2	37.2	
Progression Factor		1.00							1.00	0.48	0.48	
Incremental Delay, d2		0.3							38.1	0.1	0.2	
Delay (s)		4.1							82.0	18.2	18.2	
Level of Service		A							F	B	B	
Approach Delay (s)		4.1			0.0			82.0			18.2	
Approach LOS		A			A			F			B	

Intersection Summary			
HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

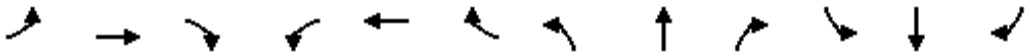
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	76	5	1491	92	0	0	0	35
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					5.5		4.5	4.5				4.5
Lane Util. Factor					0.95		0.95	0.95				1.00
Frt					0.99		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.96				1.00
Satd. Flow (prot)					2392		1476	1483				1484
Flt Permitted					1.00		0.95	0.96				1.00
Satd. Flow (perm)					2392		1476	1483				1484
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	0	81	5	1586	98	0	0	0	37
RTOR Reduction (vph)	0	0	0	0	5	0	194	154	0	0	0	36
Lane Group Flow (vph)	0	0	0	0	81	0	647	689	0	0	0	1
Heavy Vehicles (%)	2%	2%	2%	2%	40%	2%	7%	10%	2%	2%	2%	2%
Turn Type							Split					custom
Protected Phases					4		6	6				5
Permitted Phases												
Actuated Green, G (s)					6.7		65.9	65.9				2.9
Effective Green, g (s)					6.7		65.9	65.9				2.9
Actuated g/C Ratio					0.07		0.73	0.73				0.03
Clearance Time (s)					5.5		4.5	4.5				4.5
Vehicle Extension (s)					2.3		2.3	2.3				2.3
Lane Grp Cap (vph)					178		1081	1086				48
v/s Ratio Prot					c0.03		0.44	c0.46				c0.00
v/s Ratio Perm												
v/c Ratio					0.46		0.60	0.63				0.02
Uniform Delay, d1					39.9		5.7	6.0				42.2
Progression Factor					1.00		1.61	0.95				1.00
Incremental Delay, d2					1.1		2.0	2.3				0.1
Delay (s)					41.0		11.3	8.1				42.3
Level of Service					D		B	A				D
Approach Delay (s)		0.0			41.0			9.7			42.3	
Approach LOS		A			D			A			D	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

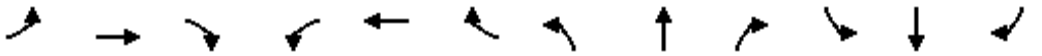


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	108	538	0	0	0	0	1333	31	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5					4.5	4.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frpb, ped/bikes	1.00	1.00	1.00					1.00	1.00			
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1264	1343	2592					3260	1458			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1264	1343	2592					3260	1458			
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)	263	114	566	0	0	0	0	1403	33	0	0	0
RTOR Reduction (vph)	48	30	345	0	0	0	0	0	8	0	0	0
Lane Group Flow (vph)	139	160	221	0	0	0	0	1403	25	0	0	0
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	25%	19%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8					6 1	6 1			
Permitted Phases			1									
Actuated Green, G (s)	15.2	15.2	35.1					65.8	65.8			
Effective Green, g (s)	15.2	15.2	35.1					65.8	65.8			
Actuated g/C Ratio	0.17	0.17	0.39					0.73	0.73			
Clearance Time (s)	4.5	4.5	4.5									
Vehicle Extension (s)	2.3	2.3	2.3									
Lane Grp Cap (vph)	213	227	1140					2383	1066			
v/s Ratio Prot	0.11	c0.12	0.03					c0.43	0.02			
v/s Ratio Perm			0.05									
v/c Ratio	0.65	0.71	0.19					0.59	0.02			
Uniform Delay, d1	34.9	35.3	18.1					5.7	3.3			
Progression Factor	1.00	1.00	1.00					0.43	0.19			
Incremental Delay, d2	5.9	8.5	0.0					0.2	0.0			
Delay (s)	40.8	43.8	18.2					2.7	0.6			
Level of Service	D	D	B					A	A			
Approach Delay (s)		27.8			0.0			2.7			0.0	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	6	47	1317	36	35	503
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	6	51	1416	39	38	541
RTOR Reduction (vph)	0	49	0	6	0	0
Lane Group Flow (vph)	6	2	1416	33	38	541
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	4.1	4.1	66.3	66.3	6.6	75.9
Effective Green, g (s)	4.1	4.1	66.3	66.3	6.6	75.9
Actuated g/C Ratio	0.05	0.05	0.74	0.74	0.07	0.84
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	2.0	6.3
Lane Grp Cap (vph)	76	68	2470	1105	123	2828
v/s Ratio Prot	c0.00	0.00	c0.42		c0.02	0.16
v/s Ratio Perm				0.02		
v/c Ratio	0.08	0.03	0.57	0.03	0.31	0.19
Uniform Delay, d1	41.1	41.1	5.4	3.2	39.5	1.3
Progression Factor	1.00	1.00	0.47	0.29	1.11	0.82
Incremental Delay, d2	0.3	0.1	0.8	0.0	0.5	0.1
Delay (s)	41.4	41.2	3.4	1.0	44.3	1.2
Level of Service	D	D	A	A	D	A
Approach Delay (s)	41.2		3.3			4.1
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	4.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	41	49	23	87	458	57	874	45	96	390	23
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3329		1644	3325	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3329		1644	3325	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	23	45	54	25	96	503	63	960	49	105	429	25
RTOR Reduction (vph)	0	0	46	0	0	407	0	3	0	0	3	0
Lane Group Flow (vph)	23	45	8	25	96	96	63	1006	0	105	451	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	2.8	13.2	13.2	2.9	13.3	13.3	6.9	48.9		9.0	51.0	
Effective Green, g (s)	2.8	13.2	13.2	2.9	13.3	13.3	6.9	48.9		9.0	51.0	
Actuated g/C Ratio	0.03	0.15	0.15	0.03	0.15	0.15	0.08	0.54		0.10	0.57	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	52	259	220	54	261	222	128	1809		164	1884	
v/s Ratio Prot	0.01	0.03		c0.01	0.05		0.04	c0.30		c0.06	0.14	
v/s Ratio Perm			0.01			c0.06						
v/c Ratio	0.44	0.17	0.04	0.46	0.37	0.43	0.49	0.56		0.64	0.24	
Uniform Delay, d1	42.8	33.6	32.9	42.8	34.6	34.9	39.9	13.4		38.9	9.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.15	0.88	
Incremental Delay, d2	2.2	0.3	0.1	2.3	0.9	1.3	1.1	1.2		6.2	0.3	
Delay (s)	45.0	33.9	33.0	45.1	35.4	36.2	41.0	14.7		51.1	8.9	
Level of Service	D	C	C	D	D	D	D	B		D	A	
Approach Delay (s)		35.6			36.5			16.2			16.8	
Approach LOS		D			D			B			B	

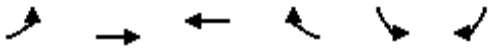
Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1	33	28	2	11	2	25	8	2	72	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	1	37	31	2	12	2	28	9	2	80	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	130	126	80	158	121	32	80			37		
vC1, stage 1 conf vol	84	84		37	37							
vC2, stage 2 conf vol	46	41		122	84							
vCu, unblocked vol	130	126	80	158	121	32	80			37		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	96	96	100	99	100			100		
cM capacity (veh/h)	878	792	980	819	793	1042	1518			1574		

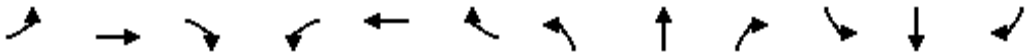
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	38	46	2	37	2	80
Volume Left	0	31	2	0	2	0
Volume Right	37	12	0	9	0	0
cSH	973	868	1518	1700	1574	1700
Volume to Capacity	0.04	0.05	0.00	0.02	0.00	0.05
Queue Length 95th (ft)	3	4	0	0	0	0
Control Delay (s)	8.8	9.4	7.4	0.0	7.3	0.0
Lane LOS	A	A	A		A	
Approach Delay (s)	8.8	9.4	0.4		0.2	
Approach LOS	A	A				

Intersection Summary				
Average Delay	3.9			
Intersection Capacity Utilization	19.8%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	20	344	209	15	92	73
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1765	1765	1500	1676	1500
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1765	1765	1500	1676	1500
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	382	232	17	102	81
RTOR Reduction (vph)	0	0	0	11	0	69
Lane Group Flow (vph)	22	382	232	6	102	12
Turn Type	Prot			Perm		Prot
Protected Phases	5	2	6		4	4
Permitted Phases				6		
Actuated Green, G (s)	0.7	16.5	11.8	11.8	5.2	5.2
Effective Green, g (s)	0.7	16.5	11.8	11.8	5.2	5.2
Actuated g/C Ratio	0.02	0.49	0.35	0.35	0.15	0.15
Clearance Time (s)	4.0	7.0	7.0	7.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	35	864	618	525	259	231
v/s Ratio Prot	0.01	c0.22	0.13		c0.06	0.01
v/s Ratio Perm				0.00		
v/c Ratio	0.63	0.44	0.38	0.01	0.39	0.05
Uniform Delay, d1	16.4	5.6	8.2	7.1	12.8	12.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.7	1.0	1.1	0.0	0.4	0.0
Delay (s)	39.1	6.6	9.3	7.2	13.2	12.2
Level of Service	D	A	A	A	B	B
Approach Delay (s)		8.4	9.1		12.7	
Approach LOS		A	A		B	

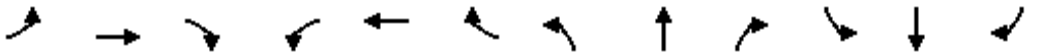
Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	33.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	34.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	204	665	0	0	0	0	0	376	94
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					4.5						4.5	4.5
Lane Util. Factor					0.95						0.95	1.00
Frt					1.00						1.00	0.85
Flt Protected					0.99						1.00	1.00
Satd. Flow (prot)					2858						3079	1377
Flt Permitted					0.99						1.00	1.00
Satd. Flow (perm)					2858						3079	1377
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	224	731	0	0	0	0	0	413	103
RTOR Reduction (vph)	0	0	0	0	21	0	0	0	0	0	0	82
Lane Group Flow (vph)	0	0	0	0	934	0	0	0	0	0	413	21
Heavy Vehicles (%)	0%	0%	0%	15%	15%	15%	0%	0%	0%	8%	8%	8%
Turn Type				Split								Perm
Protected Phases				4	4						2	
Permitted Phases												2
Actuated Green, G (s)					62.5						18.5	18.5
Effective Green, g (s)					62.5						18.5	18.5
Actuated g/C Ratio					0.69						0.21	0.21
Clearance Time (s)					4.5						4.5	4.5
Vehicle Extension (s)					2.3						4.2	4.2
Lane Grp Cap (vph)					1985						633	283
v/s Ratio Prot					c0.33						c0.13	
v/s Ratio Perm												0.02
v/c Ratio					0.47						0.65	0.07
Uniform Delay, d1					6.2						32.8	28.8
Progression Factor					0.81						1.00	1.00
Incremental Delay, d2					0.8						2.8	0.2
Delay (s)					5.8						35.6	29.0
Level of Service					A						D	C
Approach Delay (s)		0.0			5.8			0.0			34.3	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

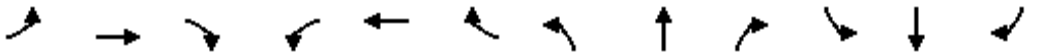
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1193	12	0	0	0	0	0	12	578	2	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.5							4.0	4.5	4.5	
Lane Util. Factor		0.95							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		3046							1402	1398	1402	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		3046							1402	1398	1402	
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)	0	1243	12	0	0	0	0	0	12	602	2	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	177	177	0
Lane Group Flow (vph)	0	1255	0	0	0	0	0	0	12	124	126	0
Heavy Vehicles (%)	9%	9%	9%	0%	0%	0%	8%	8%	8%	13%	13%	13%
Turn Type									custom	Split		
Protected Phases		8								2	2	
Permitted Phases									1			
Actuated Green, G (s)		62.2							1.5	13.3	13.3	
Effective Green, g (s)		62.2							1.5	13.3	13.3	
Actuated g/C Ratio		0.69							0.02	0.15	0.15	
Clearance Time (s)		4.5							4.0	4.5	4.5	
Vehicle Extension (s)		2.3							2.3	2.3	2.3	
Lane Grp Cap (vph)		2105							23	207	207	
v/s Ratio Prot		c0.41								0.09	c0.09	
v/s Ratio Perm									c0.01			
v/c Ratio		0.60							0.52	0.60	0.61	
Uniform Delay, d1		7.3							43.9	35.8	35.9	
Progression Factor		1.00							1.00	2.00	1.99	
Incremental Delay, d2		1.3							13.0	3.3	3.6	
Delay (s)		8.6							56.9	75.0	75.2	
Level of Service		A							E	E	E	
Approach Delay (s)		8.6			0.0			56.9			75.1	
Approach LOS		A			A			E			E	

Intersection Summary			
HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

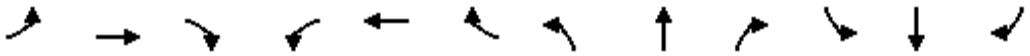
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	185	17	840	50	0	0	0	82
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					5.5		4.5	4.5				4.5
Lane Util. Factor					0.95		0.95	0.95				1.00
Frt					0.99		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.96				1.00
Satd. Flow (prot)					2400		1476	1483				1484
Flt Permitted					1.00		0.95	0.96				1.00
Satd. Flow (perm)					2400		1476	1483				1484
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	0	197	18	894	53	0	0	0	87
RTOR Reduction (vph)	0	0	0	0	9	0	155	143	0	0	0	83
Lane Group Flow (vph)	0	0	0	0	206	0	319	330	0	0	0	4
Heavy Vehicles (%)	2%	2%	2%	2%	40%	2%	7%	10%	2%	2%	2%	2%
Turn Type							Split					custom
Protected Phases					4		6	6				5
Permitted Phases												
Actuated Green, G (s)					12.4		59.3	59.3				3.8
Effective Green, g (s)					12.4		59.3	59.3				3.8
Actuated g/C Ratio					0.14		0.66	0.66				0.04
Clearance Time (s)					5.5		4.5	4.5				4.5
Vehicle Extension (s)					2.3		2.3	2.3				2.3
Lane Grp Cap (vph)					331		973	977				63
v/s Ratio Prot					c0.09		0.22	c0.22				c0.00
v/s Ratio Perm												
v/c Ratio					0.62		0.33	0.34				0.06
Uniform Delay, d1					36.6		6.7	6.7				41.4
Progression Factor					1.00		4.21	3.35				1.00
Incremental Delay, d2					2.9		0.9	0.9				0.2
Delay (s)					39.5		29.0	23.4				41.6
Level of Service					D		C	C				D
Approach Delay (s)		0.0			39.5			26.2			41.6	
Approach LOS		A			D			C			D	

Intersection Summary			
HCM Average Control Delay	29.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

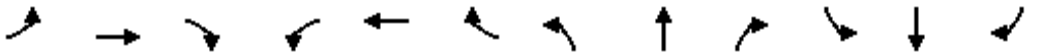


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	220	241	1360	0	0	0	0	670	64	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.0					4.5	4.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frpb, ped/bikes	1.00	1.00	1.00					1.00	1.00			
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1264	1385	2592					3260	1458			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1264	1385	2592					3260	1458			
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)	232	254	1432	0	0	0	0	705	67	0	0	0
RTOR Reduction (vph)	103	5	0	0	0	0	0	0	24	0	0	0
Lane Group Flow (vph)	106	272	1432	0	0	0	0	705	43	0	0	0
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	25%	19%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Split		Free						Prot			
Protected Phases	8	8						6	6			
Permitted Phases			Free									
Actuated Green, G (s)	23.0	23.0	90.0					58.0	58.0			
Effective Green, g (s)	23.0	23.0	90.0					58.0	58.0			
Actuated g/C Ratio	0.26	0.26	1.00					0.64	0.64			
Clearance Time (s)	4.5	4.5						4.5	4.5			
Vehicle Extension (s)	2.3	2.3						4.2	4.2			
Lane Grp Cap (vph)	323	354	2592					2101	940			
v/s Ratio Prot	0.08	c0.20						0.22	0.03			
v/s Ratio Perm			c0.55									
v/c Ratio	0.33	0.77	0.55					0.34	0.05			
Uniform Delay, d1	27.2	31.0	0.0					7.3	5.9			
Progression Factor	1.00	1.00	1.00					1.70	3.88			
Incremental Delay, d2	0.3	9.0	0.9					0.4	0.1			
Delay (s)	27.6	40.0	0.9					12.8	22.8			
Level of Service	C	D	A					B	C			
Approach Delay (s)		9.4			0.0			13.6			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.5
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	119	101	633	85	71	1289
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	128	109	681	91	76	1386
RTOR Reduction (vph)	0	95	0	33	0	0
Lane Group Flow (vph)	128	14	681	58	76	1386
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	11.6	11.6	57.0	57.0	8.4	68.4
Effective Green, g (s)	11.6	11.6	57.0	57.0	8.4	68.4
Actuated g/C Ratio	0.13	0.13	0.63	0.63	0.09	0.76
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	2.0	6.3
Lane Grp Cap (vph)	216	193	2124	950	156	2548
v/s Ratio Prot	c0.08	0.01	0.20		0.05	c0.41
v/s Ratio Perm				0.04		
v/c Ratio	0.59	0.07	0.32	0.06	0.49	0.54
Uniform Delay, d1	37.0	34.5	7.6	6.3	38.8	4.4
Progression Factor	1.00	1.00	1.70	4.19	1.00	1.00
Incremental Delay, d2	3.3	0.1	0.3	0.1	0.7	0.7
Delay (s)	40.3	34.6	13.3	26.5	39.5	5.1
Level of Service	D	C	B	C	D	A
Approach Delay (s)	37.7		14.8			6.9
Approach LOS	D		B			A

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	52	159	132	66	92	155	71	511	63	366	1001	41
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3298		1644	3333	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3298		1644	3333	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	57	175	145	73	101	170	78	562	69	402	1100	45
RTOR Reduction (vph)	0	0	123	0	0	143	0	9	0	0	2	0
Lane Group Flow (vph)	57	175	22	73	101	27	78	622	0	402	1143	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	6.5	13.6	13.6	7.0	14.1	14.1	7.6	28.3		25.1	45.8	
Effective Green, g (s)	6.5	13.6	13.6	7.0	14.1	14.1	7.6	28.3		25.1	45.8	
Actuated g/C Ratio	0.07	0.15	0.15	0.08	0.16	0.16	0.08	0.31		0.28	0.51	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	121	267	227	130	277	235	142	1037		458	1696	
v/s Ratio Prot	0.03	c0.10		c0.04	0.06		0.05	0.19		c0.24	c0.34	
v/s Ratio Perm			0.01			0.02						
v/c Ratio	0.47	0.66	0.10	0.56	0.36	0.11	0.55	0.60		0.88	0.67	
Uniform Delay, d1	40.1	36.0	32.9	40.0	33.9	32.6	39.6	26.1		31.0	16.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.92	0.83	
Incremental Delay, d2	1.1	5.7	0.2	3.3	0.8	0.2	2.3	2.6		14.9	1.9	
Delay (s)	41.2	41.7	33.1	43.3	34.8	32.8	41.9	28.6		43.3	15.5	
Level of Service	D	D	C	D	C	C	D	C		D	B	
Approach Delay (s)		38.3			35.6			30.1			22.7	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	28.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 1: WB Marine Drive Ramp & 223rd

Movement	WB	NB
Directions Served	LR	LT
Maximum Queue (ft)	52	30
Average Queue (ft)	21	2
95th Queue (ft)	49	17
Link Distance (ft)	661	242
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: EB Marine Drive Ramp & 223rd

Movement	EB	SB
Directions Served	LR	LT
Maximum Queue (ft)	57	4
Average Queue (ft)	28	0
95th Queue (ft)	53	4
Link Distance (ft)	679	242
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Graham Rd & Sundial Rd

Movement	EB	WB	NB
Directions Served	LR	LTR	L
Maximum Queue (ft)	34	59	7
Average Queue (ft)	7	23	0
95th Queue (ft)	29	52	5
Link Distance (ft)	252	2333	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			100
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Marine Drive & Sundial Rd

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	106	79	230	68	52	60
Average Queue (ft)	45	16	92	3	22	21
95th Queue (ft)	84	56	181	38	52	53
Link Distance (ft)		3716	1604		676	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150			120		150
Storage Blk Time (%)	0		3	0		
Queuing Penalty (veh)	0		1	0		

Intersection: 5: I-84 WB On Ramp & Marine Dr

Movement	WB	WB	SB	SB	SB
Directions Served	LT	T	T	T	R
Maximum Queue (ft)	198	224	107	145	106
Average Queue (ft)	81	100	40	57	9
95th Queue (ft)	167	191	85	112	53
Link Distance (ft)	394	394	392	392	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					150
Storage Blk Time (%)				0	0
Queuing Penalty (veh)				0	0

Intersection: 6: I-84 EB Off Ramp & Marine Dr

Movement	EB	EB	NB	SB	SB
Directions Served	T	TR	R	L	LT
Maximum Queue (ft)	88	108	57	103	137
Average Queue (ft)	17	25	14	40	59
95th Queue (ft)	62	82	45	77	102
Link Distance (ft)	991		238	396	396
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		375			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 7: N Frontage Rd. & 257th Ave.

Movement	WB	WB	NB	NB	SB
Directions Served	T	TR	L	LT	R
Maximum Queue (ft)	108	116	118	197	77
Average Queue (ft)	41	43	41	62	23
95th Queue (ft)	87	88	89	139	56
Link Distance (ft)	1007		396	396	459
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		150			
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

Intersection: 8: S Frontage Rd. & 257th Ave.

Movement	EB	EB	EB	NB	NB	NB
Directions Served	L	LT	R	T	T	R
Maximum Queue (ft)	164	180	31	147	182	40
Average Queue (ft)	78	127	2	47	66	3
95th Queue (ft)	150	187	25	119	152	21
Link Distance (ft)	164	164	164	376	376	
Upstream Blk Time (%)	0	5				
Queuing Penalty (veh)	1	10				
Storage Bay Dist (ft)						121
Storage Blk Time (%)					1	0
Queuing Penalty (veh)					0	0

Intersection: 9: CG Outlet Mall & 257th Ave. #1

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	T	T	R	L	T	T
Maximum Queue (ft)	33	77	140	163	39	94	81	69
Average Queue (ft)	5	28	49	77	4	31	15	14
95th Queue (ft)	23	59	117	140	22	74	57	50
Link Distance (ft)	398	398	777	777			376	376
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)					125	223		
Storage Blk Time (%)				1				
Queuing Penalty (veh)				0				

Intersection: 10: CRHH & 257th Ave. #1

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	TR
Maximum Queue (ft)	64	89	68	63	401	145	195	366	371	155	156	158
Average Queue (ft)	21	31	24	22	146	126	52	213	229	75	57	78
95th Queue (ft)	54	70	55	55	344	173	131	367	377	141	117	137
Link Distance (ft)		632			545			351	351		777	777
Upstream Blk Time (%)								2	3			
Queuing Penalty (veh)								0	0			
Storage Bay Dist (ft)	120		120	120		120	180			140		
Storage Blk Time (%)		0			0	16	0	13		2	0	
Queuing Penalty (veh)		0			2	17	0	7		4	0	

Zone Summary

Zone wide Queuing Penalty: 43

Intersection: 1: WB Marine Drive Ramp & 223rd

Movement	WB	NB
Directions Served	LTR	LT
Maximum Queue (ft)	101	16
Average Queue (ft)	44	1
95th Queue (ft)	75	8
Link Distance (ft)	661	242
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: EB Marine Drive Ramp & 223rd

Movement	EB
Directions Served	LR
Maximum Queue (ft)	108
Average Queue (ft)	60
95th Queue (ft)	97
Link Distance (ft)	679
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Graham Rd & Sundial Rd

Movement	EB	WB	NB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	55	65	4
Average Queue (ft)	24	26	0
95th Queue (ft)	52	55	6
Link Distance (ft)	252	2333	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			100
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Marine Drive & Sundial Rd

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	85	231	173	34	132	90
Average Queue (ft)	23	79	67	1	56	33
95th Queue (ft)	61	179	136	22	101	67
Link Distance (ft)		3716	1604		676	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150			120		150
Storage Blk Time (%)	0	1	1	0	0	0
Queuing Penalty (veh)	0	0	0	0	0	0

Intersection: 5: I-84 WB On Ramp & Marine Dr

Movement	WB	WB	SB	SB	SB
Directions Served	LT	T	T	T	R
Maximum Queue (ft)	250	255	236	252	174
Average Queue (ft)	110	119	108	128	35
95th Queue (ft)	209	216	192	216	131
Link Distance (ft)	394	394	392	392	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					150
Storage Blk Time (%)				5	0
Queuing Penalty (veh)				4	0

Intersection: 6: I-84 EB Off Ramp & Marine Dr

Movement	EB	EB	NB	SB	SB
Directions Served	T	TR	R	L	LT
Maximum Queue (ft)	499	379	60	322	333
Average Queue (ft)	166	187	13	173	193
95th Queue (ft)	353	342	41	286	302
Link Distance (ft)	777		241	397	397
Upstream Blk Time (%)	0			0	0
Queuing Penalty (veh)	0			0	0
Storage Bay Dist (ft)		375			
Storage Blk Time (%)	0	0			
Queuing Penalty (veh)	1	1			

Intersection: 7: N Frontage Road & 257th Ave.

Movement	WB	WB	NB	NB	SB
Directions Served	T	TR	L	LT	R
Maximum Queue (ft)	259	173	110	132	93
Average Queue (ft)	96	85	42	53	34
95th Queue (ft)	188	154	84	105	68
Link Distance (ft)	1007		396	396	459
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		150			
Storage Blk Time (%)	2	1			
Queuing Penalty (veh)	3	1			

Intersection: 8: S Frontage Rd. & 257th Ave. #2

Movement	EB	EB	EB	NB	NB	NB
Directions Served	L	LT	R	T	T	R
Maximum Queue (ft)	168	186	38	116	153	66
Average Queue (ft)	55	150	1	28	46	12
95th Queue (ft)	127	202	25	77	103	41
Link Distance (ft)	164	164	164	376	376	
Upstream Blk Time (%)	0	16	0			
Queuing Penalty (veh)	1	72	0			
Storage Bay Dist (ft)						121
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 9: CG Outlet Mall & 257th Ave. #1

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	T	T	R	L	T	T
Maximum Queue (ft)	216	80	219	235	150	143	254	223
Average Queue (ft)	87	32	105	124	44	56	111	109
95th Queue (ft)	163	60	199	221	121	109	204	190
Link Distance (ft)	398	398	777	777			376	376
Upstream Blk Time (%)							0	
Queuing Penalty (veh)							0	
Storage Bay Dist (ft)					125	223		
Storage Blk Time (%)				7	0		0	
Queuing Penalty (veh)				6	0		0	

Intersection: 10: CRHH & 257th Ave. #1

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	TR
Maximum Queue (ft)	137	309	144	126	213	142	150	268	289	165	531	480
Average Queue (ft)	52	112	70	56	65	53	50	125	159	158	270	214
95th Queue (ft)	112	232	137	105	136	100	106	228	258	181	462	394
Link Distance (ft)		632			545			351	351		777	777
Upstream Blk Time (%)									0			
Queuing Penalty (veh)									0			
Storage Bay Dist (ft)	120		120	120		120	180			140		
Storage Blk Time (%)	0	7	1	0	1	0	0	2		34	2	
Queuing Penalty (veh)	1	14	1	1	3	0	0	2		170	8	

Zone Summary

Zone wide Queuing Penalty: 292

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TRANSPORTATION SOLUTIONS

TECHNICAL MEMORANDUM #3

May 25, 2011

To: Project Management Team

From: Carl Springer, PE, Julie Sosnovske, PE

Subject: **I-84 257th Avenue IAMP, Task 5: South Frontage Road Access Study** P09042-011

This memorandum addresses several options for improving the South Frontage Road access and circulation patterns. While there are some major roadway improvements being considered in the Troutdale area to improve circulation and flow in the interchange area (explored later in Tech Memo #4), the intent of this memo is to look at some shorter term, less expensive improvements to South Frontage Road. This study specifically analyzes local circulation and access options to reduce trucking travel conflicts and improve mobility for through traffic.

BACKGROUND AND PURPOSE

The South Frontage Road has been identified as a critical operational bottleneck that limits the safety and effectiveness of facilities throughout the interchange management area. Conflicts between trucks and autos and between local and through traffic are prevalent along South Frontage Road. Operational characteristics of trucks are significantly different than automobiles and conflicts due to these characteristics are escalated due to the sheer number of trucks that use the businesses along South Frontage Road. The primary challenges fall into the following categories:

- Through circulation to vehicles destined to land uses north of I-84
- Through circulation for vehicles destined to land uses south on 257th Avenue
- Immediate ingress/egress to/from businesses along South Frontage Road

An example of one type of conflict that occurs on this roadway is where one truck will exit one of the truck stops, blocking all three lanes of traffic, allowing several other trucks to exit in front of it. This is neither safe, nor efficient. The purpose of this memorandum is to explore ideas for interim, cost effective improvements that will minimize the number of conflicts that occur on this roadway.

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ACCESS MANAGEMENT OPTIONS CONSIDERED

Several options were considered and evaluated, as summarized below:

- Option A: Provide local truck access road from Travel Centers of America (TA) parking lot to signalized intersection at Marine Drive/South Frontage Road/I-84 EB Off-Ramp. This access would primarily serve outbound truck traffic since most trucks would enter the site via South Frontage Road where the fuel pumps are located.

- Option B: Construct fourth lane (the third lane, to be constructed on the north side of South Frontage Road is currently in the design process) on south side of South Frontage Road (partially exists today) to serve only traffic accessing South Frontage Road businesses. This lane would terminate prior to the 257th Avenue/South Frontage Road intersection so that it would not be used for through traffic destined for 257th Avenue.

- Option C: Combination of Option A and Option B.

- Option D: Redirect Love's Travel Stops and Country Stores (Love's) and traffic from the retail pad (formerly Burger King) to exit onto South Frontage Road via a new egress roadway (along the eastern edge of the TA parking lot) and traffic signal. In conjunction, add a fourth lane on South Frontage Road between Phoenix Drive and the last Love's driveway before 257th Avenue to provide ingress only to Love's and the former Burger King site. A potential intersection control scenario might include a raised median between the northernmost eastbound through travel lane and the two southernmost eastbound travel lanes.

- Option E: Construct two egress roads to support South Frontage Road businesses (primarily Love's Travel Stop and TA Truck Stop), one along the eastern edge of the TA parking lot and one along Culpepper Drive, just west of the TA property. In conjunction with this, add a new traffic signal at the TA driveway and close Love's driveways for the truck portion of their site. The auto access to the Love's site would remain.

- Option F: Redirect Love's Traffic to New TA Egress Drive, Positive Separation between South Frontage Road Through Lanes and Business Access Lane (between TA Auto Access and Love's Truck Access), New Traffic Signal on South Frontage Road at New TA Egress Drive.

ANALYSIS OF OPTIONS

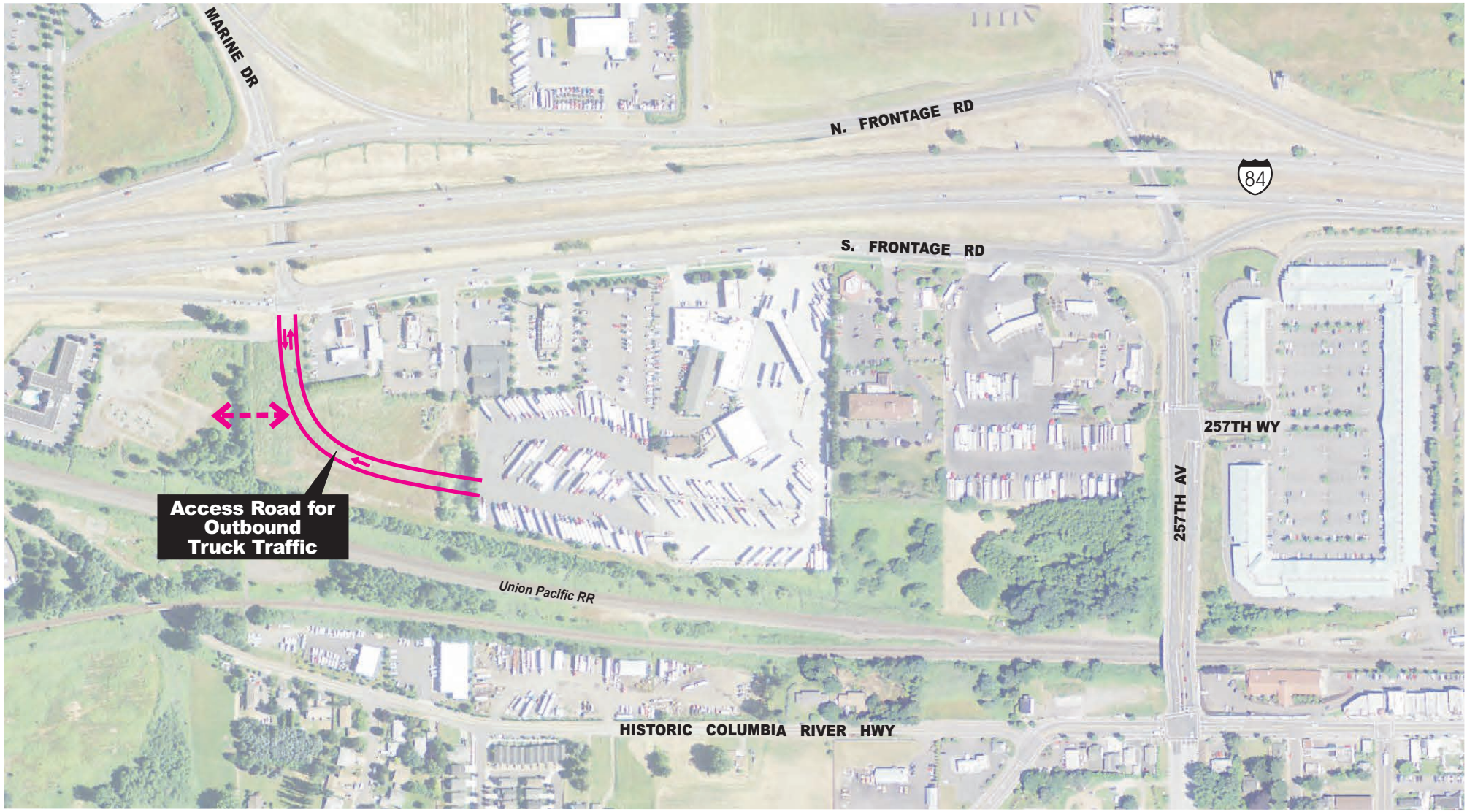
Each of the options is described in more detail below with a sketch showing what is proposed as well as a discussion of positive and negative impacts each option creates.

Option A: New Egress from TA Truck Parking Area to Marine Drive/South Frontage Road

The intent of this option is to provide truck traffic using the TA site a signalized egress point onto South Frontage Road. This option is shown in Figure 1. Benefits and costs are detailed below:

- Benefits
    - Signalized access to South Frontage Road for TA truck traffic
    - Could be built on ultimate alignment of proposed Marine Drive Extension
    - Reduced TA truck traffic exiting the TA site from TA driveways on South Frontage Road
    - Circular flow of truck traffic through the TA site
    - Reduction of on-site conflicts between trucks entering/exiting the site
- Costs
    - Requires acquisition of property to west of existing TA Truck Stop
    - May constrain adjacent property making it less usable for future development
    - Impacts to Marine Drive/South Frontage Road/I-84 EB Off-Ramp are unknown – intersection may not be able to handle additional traffic without improvements
    - Signalized egress for truck traffic may not be very efficient. Trucks take more time to get up to speed and side street traffic would likely have limited green time assigned to it by the traffic signal because of the high volume of eastbound through traffic on South Frontage Road
    - Requires some out-of-direction travel for trucks leaving the TA site
    - Requires some trucks to travel through the already congested I-84 Eastbound Ramps/Marine Drive/South Frontage Road intersection twice
    - May require some reconfiguration of the existing truck parking at the TA site to accommodate the new access roadway
    - Requires reconfiguration of access from properties southwest of the I-84 Eastbound Ramps/Marine Drive/South Frontage Road intersection to the egress roadway

Analysis was conducted to determine whether the traffic signal at Marine Drive/South Frontage Road/I-84 EB Off-Ramp can handle the additional traffic this option would generate. The results of this analysis indicate that the intersection would work well under existing conditions (level of service B, volume-to-capacity ratio 0.55) and would operate right at capacity under future base conditions (2035 No Build) (level of service D, volume-to-capacity ratio ~1.0). While the future operating conditions are not ideal, this could be a viable short term improvement.



LEGEND

- Proposed Access
- New Connection

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NO SCALE

Figure 1

OPTION A
Troutdale Interchange

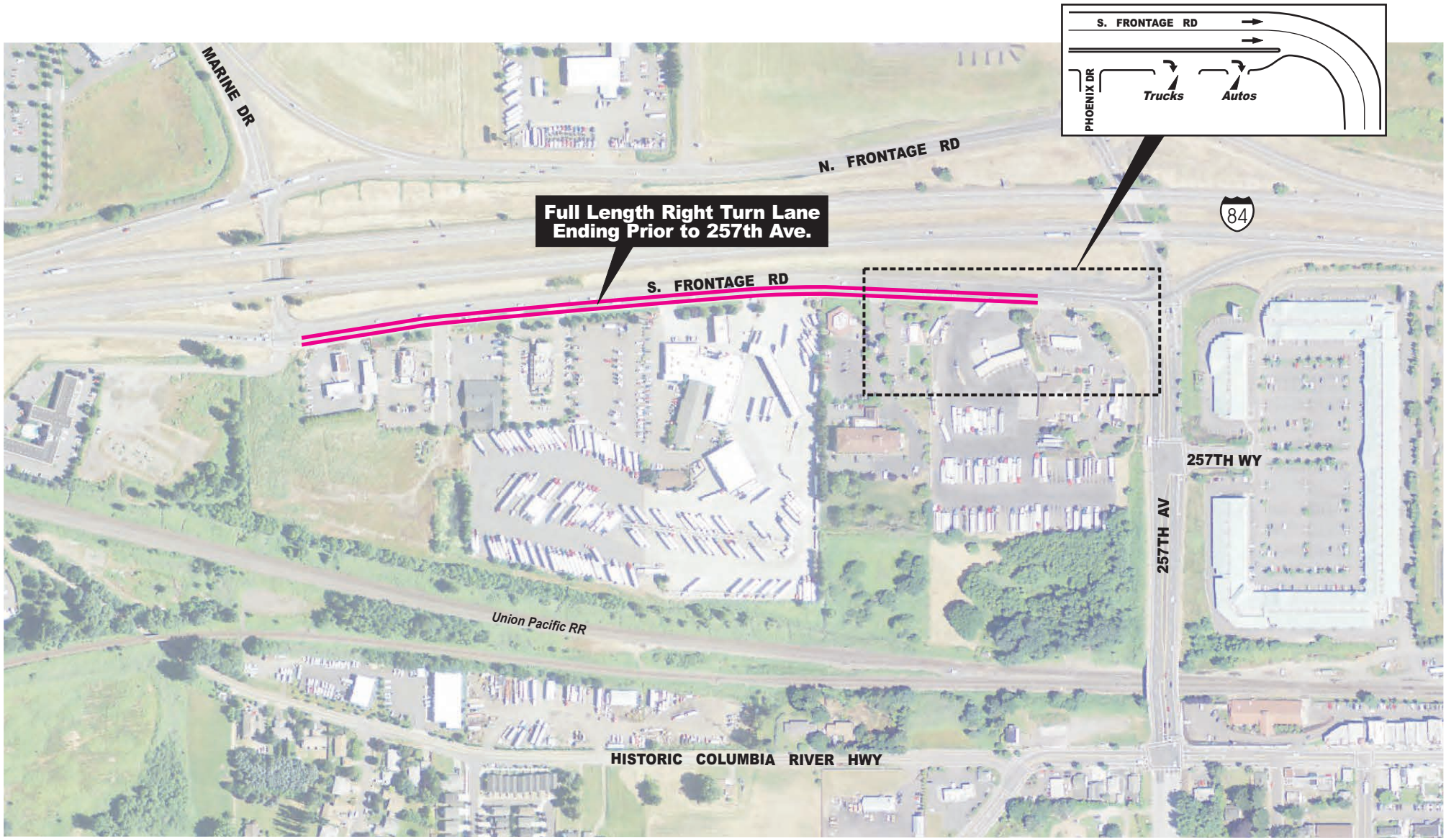
Option B: Construct Fourth Lane on South Side of South Frontage Road, Terminating Prior to 257th Avenue (PARTIAL SOLUTION).

This option was developed to try to remove local access traffic from through traffic destined to either 257th Avenue south or to the north side of the interchange. It is critical that this lane terminate prior to 257th Avenue to keep through traffic out of it as much as possible. Signage would be provided to direct through traffic to avoid the southernmost lane. Option B is shown in Figure 2. Benefits and costs are detailed below:

- Benefits
    - Separates some local access traffic from through traffic
    - Improves conflicts between trucks exiting South Frontage Road businesses and through traffic
- Costs
    - Significant right-of-way impacts to businesses along South Frontage Road
    - Creates additional lane of weaving for vehicles heading from South Frontage Road businesses to eastbound left turn or through lane on South Frontage Road at 257th Avenue
    - Does not remove all conflicts between trucks exiting South Frontage Road businesses and through traffic

This option could help reduce conflicts between truck traffic and through traffic along South Frontage Road. Truck traffic will use more than one lane to maneuver and many trucks will still need to head north on 257th Avenue and may still block traffic to allow fellow truckers easier egress.

This option should be considered a partial solution since egress needs to be provided to patrons of Love's, Days Inn and Shari's. As shown in Figure 2, these vehicles would be trapped, without access to South Frontage Road. Even if the positive separation does not extend as far west as Phoenix Drive, it would still be very difficult for vehicles turning from northbound Phoenix Drive to eastbound South Frontage Road to maneuver into the appropriate lane between Phoenix Drive and 257th Avenue.



LEGEND

- Proposed Access

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NO SCALE

Figure 2

OPTION B
Troutdale Interchange

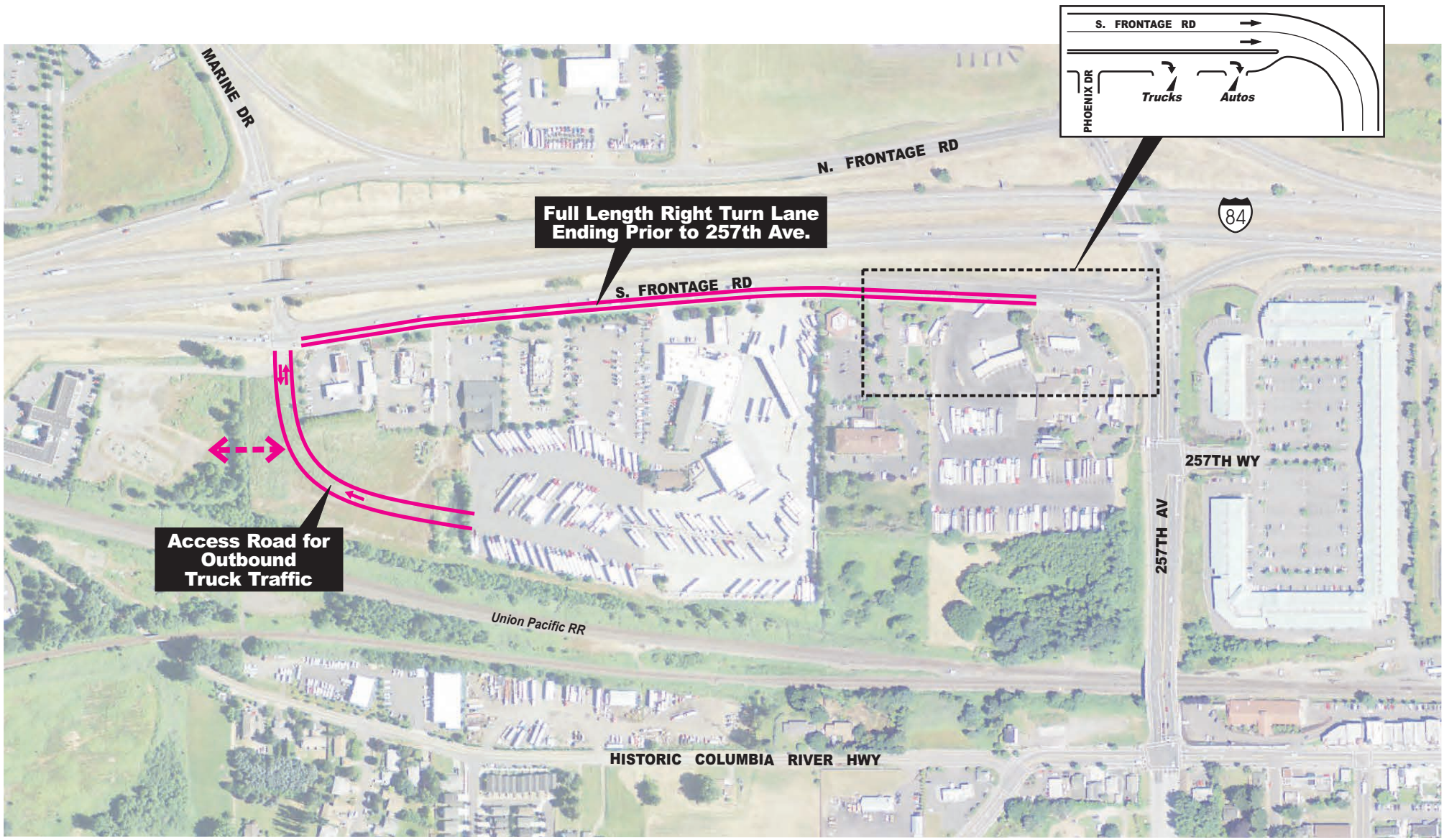
Option C: Combination of Option A and Option B.

This option was developed because it was thought that the first two options would complement each other. The additional lane on the south side of South Frontage Road would be much more effective if many of the trucks that are now exiting the TA Truck Center would exit via the Marine Drive/South Frontage Road/I-84 EB Off-Ramp traffic signal. With this large number of trucks (about 30 during the PM peak hour) now in the lane heading toward their ultimate destination, the new lane to the south can be used primarily for entering traffic and autos. The conflicts should be much less and the condition where one truck blocks all lanes for other trucks would be eliminated, at least at the TA site. This option is shown in Figure 3. Benefits and costs associated with this option are described below:

- Benefits
    - Removing exiting truck traffic from TA Truck Center makes the additional "local access" lane even more effective since one key conflict is removed (this conflict would still remain at the Love's site)
    - Same additional benefits described above for Option A and Option B
- Costs
    - No additional costs beyond those already described in Option A and Option B, above

This option could make a difference in the short term along South Frontage Road. While truck/auto conflicts will still remain on the east end of South Frontage Road, many of the major truck/auto conflicts at the TA driveways would be reduced. Option A and Option B would work together to help separate key conflicts (trucks/autos, local/through traffic) with more impacts than either would individually.

Without some connection between the Love's property and the TA property, this option would create the same problem as Option B, trapping Love's, Days Inn and Shari's patrons without an exit onto South Frontage Road. A potential connection is shown in Figure 3, which would alleviate this problem. However, this would focus more traffic at the TA access without providing any better control.



LEGEND

- Proposed Access
- New Connection

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NO SCALE

Figure 3

OPTION C
(Combination of Options A & B)
Troutdale Interchange

Option D: Redirect Love's Traffic to New Signal at New TA Egress Drive, New Right-Turn Lane between Phoenix Drive and 257th Avenue

This option would create a new egress drive along the eastern edge of the TA property. It would also focus Love's and TA's exiting traffic to one signalized location, while adding a new lane on the south side of South Frontage Road for ingress traffic. This option is shown in Figure 4 and benefits and costs are described below:

- Benefits
  - Focuses Love's and TA's egress truck traffic at one signalized location
  - Separates Love's ingress traffic from through traffic on South Frontage Road
- Costs
  - Right-of-way adjacent to Love's site
  - Traffic signal installation
  - New egress roadway along east edge of TA parking lot
  - Not clear whether signalized access for trucks will provide substantial benefit due to the large amount of green time required for a meaningful number of trucks to be able to egress onto South Frontage Road
  - Requires provision of access between auto and truck portions of Love's site
  - Requires access between Love's and TA's properties
  - Brings additional truck and vehicular traffic to TA property
  - Requires mixing of auto and truck traffic on Love's site

Intersection Analysis and Control

Analysis was conducted to determine how a new traffic signal at the TA driveway would operate (Table 1). While this intersection would fail in the future (v/c > 0.85) when all South Frontage Road lanes are under traffic signal control, another option could be considered which separates through traffic from turning traffic, as described below (partial intersection control).

Table 1: New Traffic Signal at TA Access

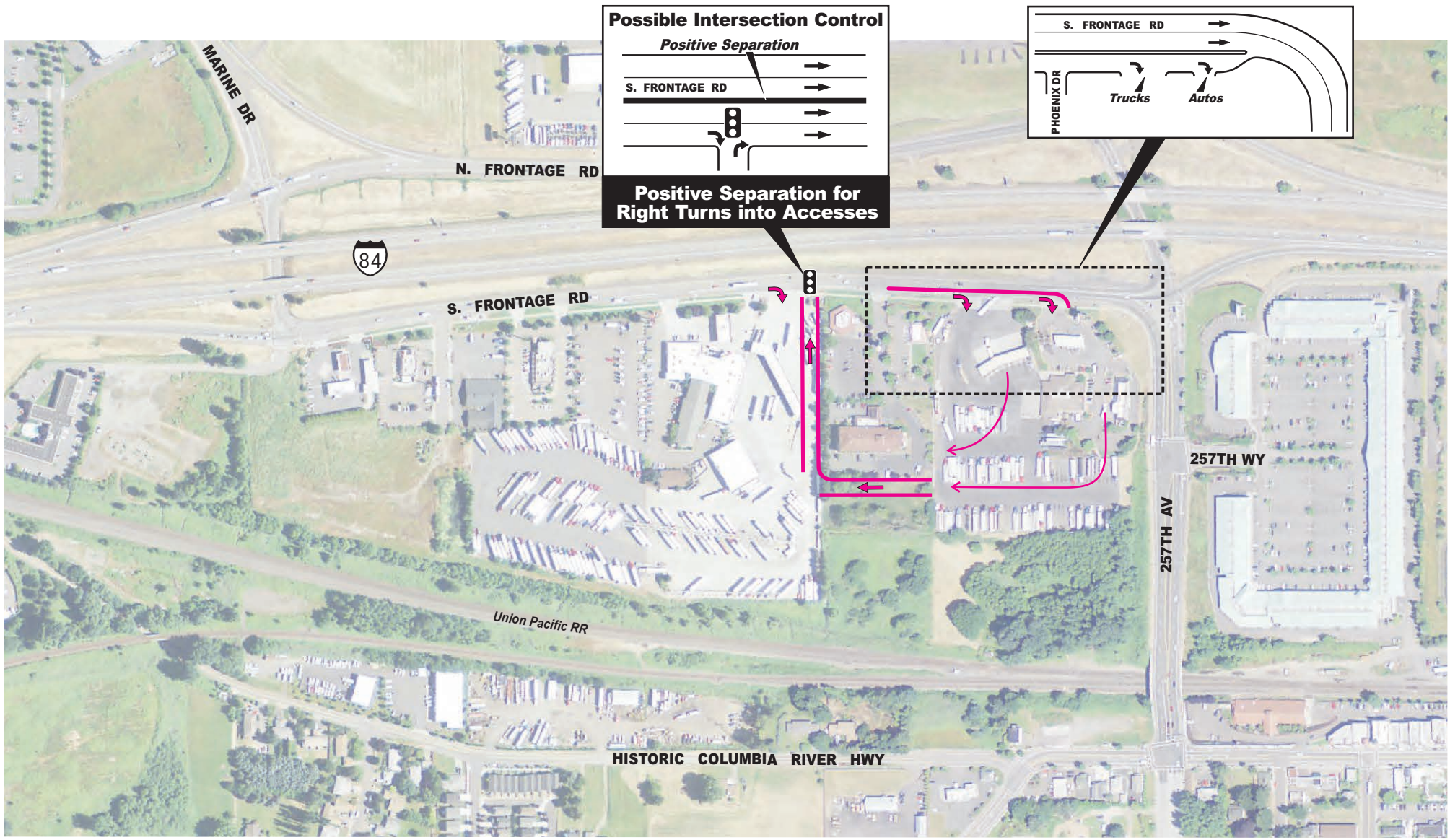
Intersection Configuration	Existing PM Peak		Future (2035) PM Peak	
	LOS	V/C	LOS	V/C
Full Intersection Control	B	0.62	C	0.96
Partial Intersection Control* (Through lanes separated)	C	0.41	B**	0.57

* Does not address weaving between New Signal and 257th Avenue.

** Note that improved level of service for Partial Intersection control scenario is a result of increase through traffic on South Frontage Road, which does not stop and therefore does not experience delay. The volume-to-capacity ratio is, however, higher in the future.

One possible configuration for a traffic signal at the potential TA egress roadway would include positive separation between the northern two eastbound through lanes on South Frontage Road and the two southernmost eastbound through lanes (one would be new). The benefit of separating two lanes would be to allow through traffic to continue unimpeded while providing signalized egress for truck and vehicular traffic.

A major consideration of this traffic control configuration would be the weaving that would occur between the new signalized intersection and the intersection at 257th Avenue/South Frontage Road. Not considering the effect of the weaving to the east, a traffic signal with the intersection control described above would work well under both Existing and 2035 No Build conditions.



LEGEND

- Proposed Access
- Traffic Signal

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TRANSPORTATION SOLUTIONS

NO SCALE

Figure 4

OPTION D
Troutdale Interchange

Option E: Construct Two New Egress Roadways to support South Frontage Road businesses (primarily Love's and TA). The Roadways would provide focused truck and vehicular egress along the eastern edge of the TA property and along Culpepper Drive. A New Traffic Signal would be constructed at the newly configured TA egress.

This option focuses egress for much of the Love's and TA truck traffic at two locations, one signalized. This option is shown in Figure 5. Benefits and costs associated with this option are described below:

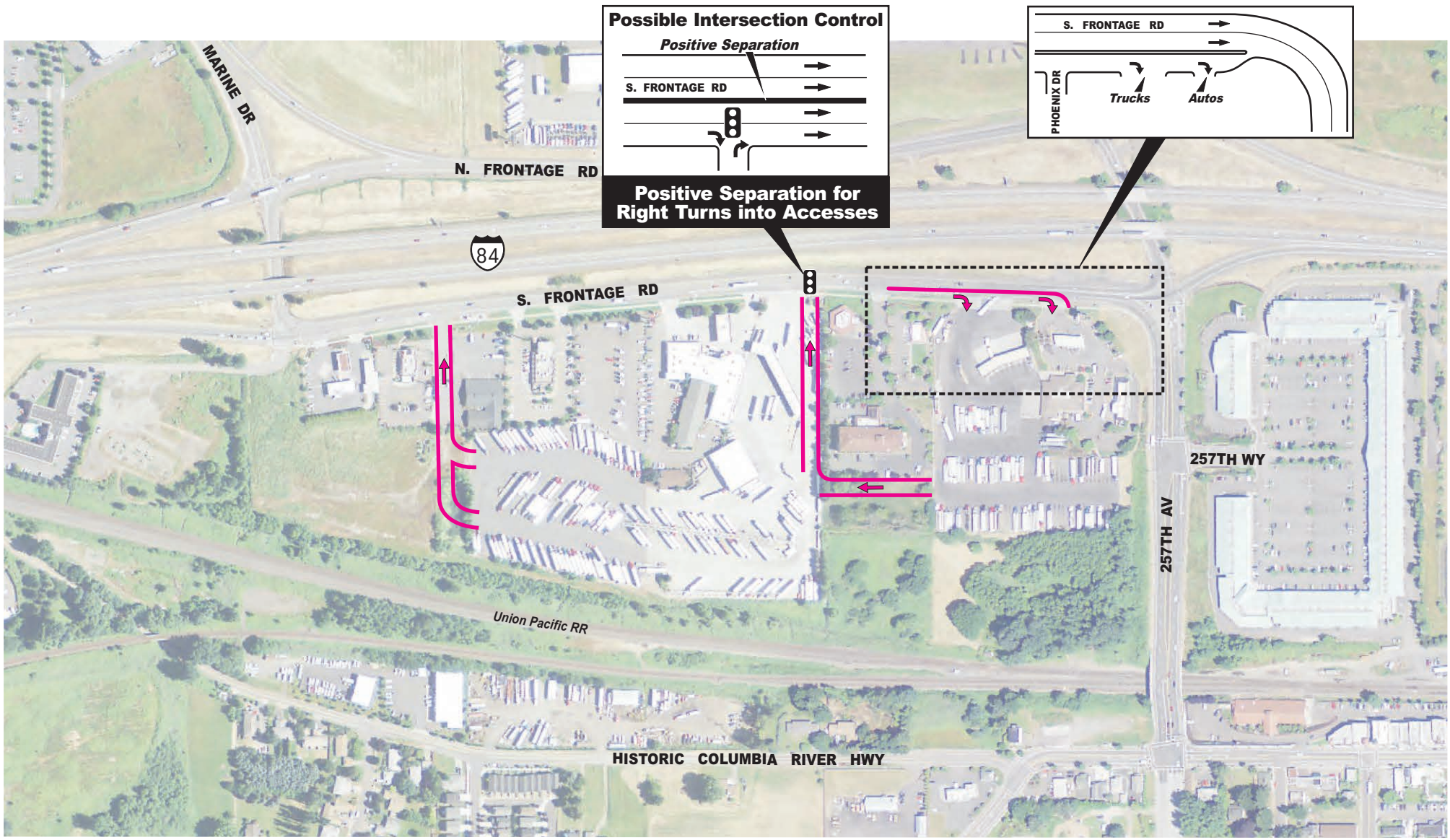
- Benefits
  - Provides one signalized access to South Frontage Road
  - Focuses access to South Frontage Road at two points
  - Focuses some of the conflicts on South Frontage Road
    - Local vs. through traffic
    - Truck vs. auto traffic
  - Requires minimal right-of-way acquisition
  - Traffic entering South Frontage Road from Culpepper Drive may benefit somewhat from traffic gaps created by the traffic signal at I-84 Eastbound Ramps/Marine Drive/South Frontage Road
- Costs
  - Requires some right-of-way acquisition
    - Connection between Love's and TA properties
    - Connection between TA property and Culpepper Drive (through undeveloped property currently owned by TA)
  - Requires installation of traffic signal
  - Not clear whether signalized access for trucks will provide substantial benefit due to the large amount of green time required for a meaningful number of trucks to be able to egress onto South Frontage Road
  - Brings additional traffic to TA property
  - Requires mixing of auto and truck traffic on Love's site – which is not possible today due to physical separation between the two areas of the site

Intersection Analysis and Control

Intersection analysis was conducted to determine how a traffic signal at this location would operate under the Option E access configuration. Table 2 summarizes these results under full and partial intersection control (similar to Option D).

Table 2: New Traffic Signal at TA Access

Intersection Configuration	Existing PM Peak		Future (2035) PM Peak	
	LOS	V/C	LOS	V/C
Full Intersection Control	B	0.60	B	0.94
Partial Intersection Control* (Through lanes separated)	B	0.40	B	0.57



LEGEND

- Proposed Access
- Traffic Signal

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NO SCALE

Figure 5

OPTION E
Troutdale Interchange

Similar to Option D, one possible configuration for a traffic signal at the TA egress roadway would include positive separation between the northern two eastbound through lanes on South Frontage Road and the two southernmost eastbound through lanes (one would be new). Benefits and costs of this configuration would be the same as described previously, with serious consideration required due to the weaving potential between the potential new traffic signal and 257th Avenue.

It was assumed that 25% of the TA trucks would use the Culpepper access and the remainder would use the new signal. All Love's trucks would use the new signal as would all Love's auto traffic. TA autos were assumed to continue to use the driveways they use currently.

Based on these assumptions, the Culpepper/South Frontage Road access would remain unsignalized and would operate acceptably under both Existing conditions (LOS A) and under 2035 No Build conditions (LOS D). The new signal at the TA driveway would fail under full intersection control in the future (v/c >0.85), but under partial intersection control, it would operate at level of service B under both Existing and 2035 No Build conditions, with the volume-to-capacity ratio declining slightly from 0.40 to 0.57 under the partial intersection control configuration described above. Again, this does not consider the effects of weaving east of the signal, which could be a serious concern.

Option F: Combination of Option A and Option D - Redirect Love's Traffic to New TA Egress Drive, Positive Separation between South Frontage Road Through Lanes and Business Access Lane (between TA Auto Access and Love's Truck Access), New Traffic Signal on South Frontage Road at TA Egress Drive. Also, add one-way egress connection from TA parking lot to Marine Drive/South Frontage Road (two-way for a short distance at South Frontage Road to allow access to properties to west). New right-turn lane for length of South Frontage Road, including positive separation from approximately 600 feet west of new TA Egress Drive (gap in positive separation between signal and Phoenix Drive).

This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road. It also focuses egress for much of the Love's and TA truck traffic at two locations, one along the eastern border of TA's property and one at Marine Drive. Since weaving between through and local traffic is a concern east of the TA access/egress, a new signal is proposed to regulate traffic at the new TA egress drive, approximately 1,000 feet in advance of the 257th Avenue intersection. This option is shown in Figure 6. Benefits and costs associated with this option are described below:

- Benefits
    - Focuses truck access to South Frontage Road at two locations
    - Separates TA's and Love's ingress and egress traffic from through traffic on South Frontage Road
    - Addresses weaving concern between "through" and "local" traffic in advance of 257th Avenue intersection
    - Promotes circular flow of truck traffic through TA site and reduces conflicts between trucks entering and exiting the site
- Costs
    - Requires right-of-way acquisition and construction of additional right turn lane for length of South Frontage Road
    - Requires right-of-way acquisition—connection between Love's and TA properties
    - Requires right-of-way acquisition –connection between TA property and Marine Drive (may be owned by TA)
    - Requires installation of traffic signal (New TA Egress Drive)
    - Requires modification of traffic signal (Marine Drive/S. Frontage Road)
    - Requires installation of positive separation
    - Brings additional traffic to TA property
    - Requires mixing of auto and truck traffic on Love's site – which is not possible today due to physical separation between the two areas of the site

This option has the benefit of separating local/truck traffic from through traffic by using positive separation between through traffic lanes and a local traffic lane wide enough to accommodate truck maneuvering. A traffic signal approximately 1,000 feet in advance of the 257th Avenue intersection would predominately serve through traffic, but would provide better access to the intersection for trucks as well. It would eliminate the weaving concern noted in Options D and E, however, the access at Phoenix Drive will not be restricted and would remain a possible conflict.

This option will require additional study to determine its feasibility, including specific right-of-way requirements, capacity requirements (i.e. number of lanes for through versus local/truck traffic),

positive separation start and end points and construction costs. Preliminary traffic signal capacity analysis was conducted at the Marine Drive/South Frontage Road and New TA Egress/South Frontage Road intersections and is summarized in Table 3.

Table 3: Option F Intersection Analysis Summary

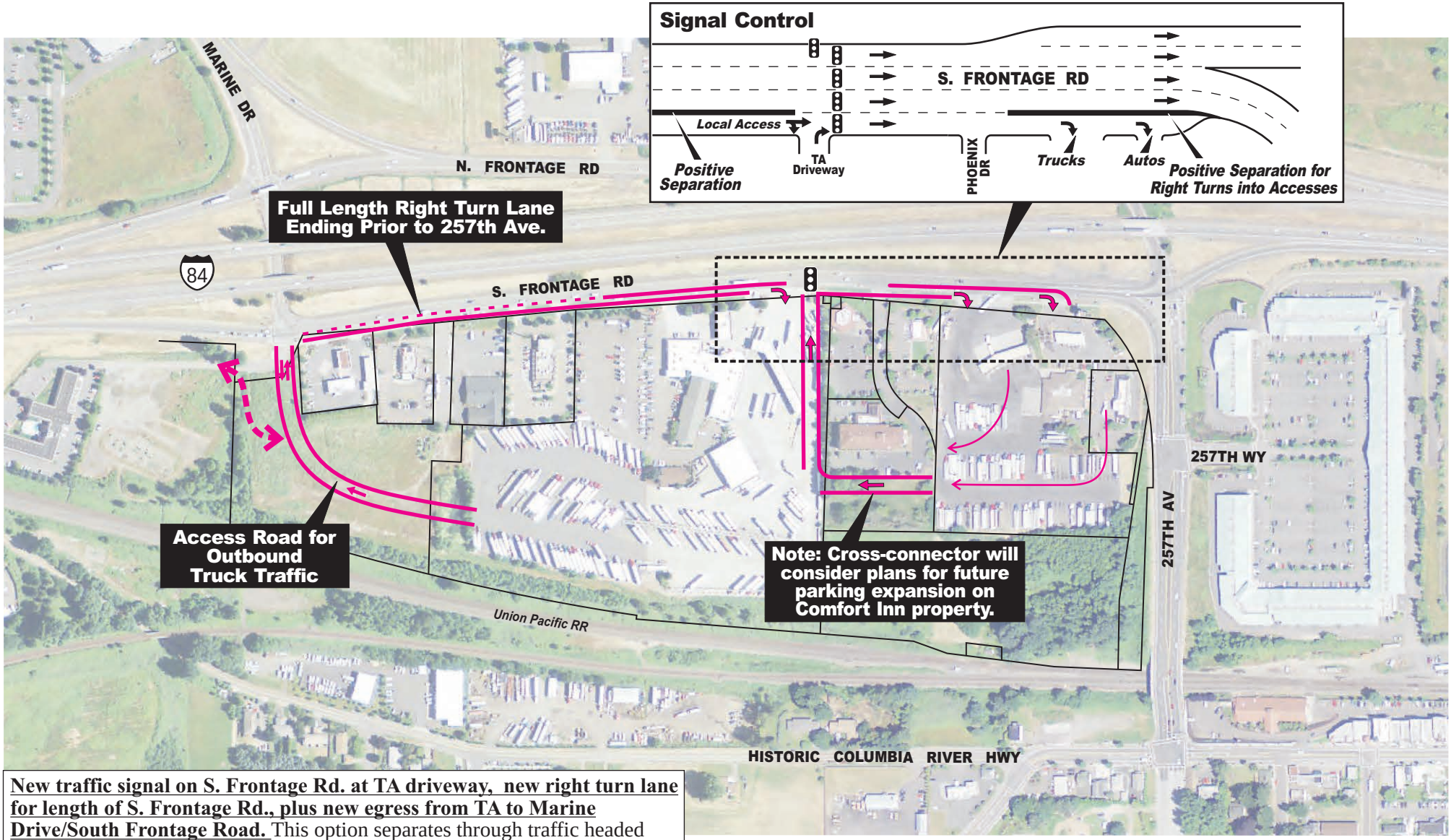
Intersection Configuration	Existing PM Peak LOS V/C	Future (2035) PM Peak[1] LOS V/C
Marine Drive/S. Frontage Rd.	B 0.55	D 0.99
New TA Egress/S. Frontage Rd.	B 0.61	B 0.88

As shown in Table 3, both intersections would operate acceptably in the near term. However, in the future, the Marine Drive/South Frontage Road intersection will operate nearly at capacity. Both Existing and Future analysis assumes the existing configuration at the Marine Drive/South Frontage Road intersection (i.e. Marine Drive remains one-way southbound). Since this is intended to be a short term solution, preliminary analysis indicates that it would operate acceptably.

Since there is a good chance that the I-84 bridge over Marine Drive will be widened to accommodate two-way traffic on Marine Drive in the near future (possibly within 5 years), future (2035) intersection level of service analysis was run at the Marine Drive/South Frontage Road intersection, assuming the improvement was in place.[2] Based on these assumptions, the Marine Drive/South Frontage Road intersection would operate acceptably (LOS D, V/C=0.94).

[1] Note that future volumes assume growth on South Frontage Road, but no growth for South Frontage Road land uses. This analysis scenario was run simply as a sensitivity test to determine how well these intersections would work as traffic on South Frontage Road grows. Metro is currently updating 2035 growth forecasts to adjust for recession impacts. As a result, the 2035 conditions described above would likely occur well after 2035.

[2] See note 1 above: Again, no growth assumed for South Frontage Road land uses.



New traffic signal on S. Frontage Rd. at TA driveway, new right turn lane for length of S. Frontage Rd., plus new egress from TA to Marine Drive/South Frontage Road. This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road and regulates traffic at TA's existing driveway. It includes construction of a right turn lane for the length of S. Frontage Rd. Impacts include right-of-way (including cross-access easement on Comfort Inn property), traffic signal and positive separation costs, the mixing of auto and truck traffic on Love's site, and worsened signal operation at Marine Drive/S. Frontage Rd. Benefits include focusing TA truck traffic at two signalized accesses, allowing circular flow of truck traffic through the TA site and reducing conflicts between trucks entering and exiting the site.

LEGEND
- Proposed Access
- New Connection
- Approximate Property Lines
- Traffic Signal

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Figure 6

OPTION F
Troutdale Interchange

SUMMARY/RECOMMENDATIONS

Any of these options would provide an improvement to operations along South Frontage Road. Option B should be considered a partial solution since it would "trap" vehicles entering the Love's, Comfort Inn and Shari's sites without providing them a feasible egress. Options A, C and F would require the most right-of-way acquisition, but Options C, D, E and F would require some sort of cross-access easement between the Love's and TA properties and with Options D, E and F also requiring an easement along the east side of the TA property providing egress for properties to the east. Operationally, none of the options meet ODOT's volume-to-capacity standard under Future traffic volume conditions, except Option F, however, each of them could be feasible short term solutions.

Option A, C and F would put additional pressure on the Marine Drive/I-84 Eastbound Off-Ramp traffic signal and the consequences of exceeding capacity at this location are high, since the Eastbound Off-ramp could back up onto I-84. A traffic signal at the TA access (Options D, E and F) would be less likely to create such a safety concern on I-84, however, any option that adds a traffic signal midway on South Frontage Road and does not fully control all approach lanes will introduce a weaving conflict that could be very significant. Further study is required to better understand the feasibility of that element.

Input from the Policy Advisory Committee indicates interest in Option F. However, this option has been removed from consideration for technical/legal reasons since it lacks support from affected property owners.

If this option were to be considered, additional analysis will be necessary to determine how specific elements of Option F will be designed, for example how far back the positive separation is carried west of the new TA Egress driveway, where cross-access easements should be located between the TA property and Marine Drive and between the Love's property and the new TA Egress drive. It was the committee's desire that the Comfort Inn property be impacted as little as possible, with consideration given to their plans for parking lot expansion in the future.

The purpose of this study was to determine whether there were any short term, lower cost, options to improve access and circulation on South Frontage Road. Since the preferred option has been removed from consideration, the Marine Drive Extension, as recommended in the Troutdale TSP, would again become an important project for the City and ODOT to pursue.

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TECHNICAL MEMORANDUM #4

November 24, 2010

To: Project Management Team

From: Carl Springer, PE, Julie Sosnovske, PE

Subject: **Task 6 – Transportation Improvement Investment Study** P09042-011

The purpose of this memorandum is to determine the best value improvements beyond ODOT's currently planned and funded Project A improvements. The following process was followed to determine the best value improvements:

- Prepare future travel forecasts for 2035 – this was not done in any prior local studies (aside from the RTP), and our forecasts represent new information for evaluating long-term needs
- Evaluate operational conditions that are expected with programmed and funded improvements (Project A) – this will determine where the system will break down without additional investments beyond those in Project A
- Alternatives Evaluation – this section characterizes the trade-offs between a variety of solutions for connectivity and circulation in the study area

FUTURE CONDITIONS ANALYSIS

Metro's Regional travel demand forecast model is generally used for transportation planning projects in the Portland metropolitan area. Using volumes developed during Metro's model, along with the future street network resulting from planned projects through 2035, the transportation system was evaluated and deficiencies were identified through the use of the same analysis procedures previously employed for the existing conditions.

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MODEL ASSUMPTIONS/REFINEMENT

Appendix A contains a description of the model assumptions that were used and the refinement that was undertaken to generate future 2035 traffic volumes as well as a figure showing the base (2005) and future (2035) street networks that were assumed in the model. Table 1 summarizes the household and employment growth assumptions that were used in the model.

Table 1: Assumed Household and Employment Quantities within IAMP Study Area

	Households	Retail Employees*	Service Employees*	Other Employees*	Total Employees*
Base Year 2005	1,750	1,763	322	1,842	3,927
Future Year 2035	2,842	3,176	1,378	4,694	9,248
Growth (2005 – 2035)	**+1,092**	**+1,413**	**+1,056**	**+2,852**	**+5,321**

* Note that these quantities represent Metro's forecasts for the IAMP Study Area – employment and trip generation forecasts for the Troutdale Reynolds Industrial Park (TRIP) were accounted for separately, since specific detail was available for that area (discussed below).

The base year 2005 and future year 2035 model scenarios included different street networks, with the base year network closely resembling the existing transportation system and the future year network reflecting conditions planned to exist according to the Regional Transportation Plan. A side-by-side comparison of the networks associated with these scenarios is shown in the appendix. The City of Troutdale's Capital Improvements Plan and Multnomah County's Transportation Capital Improvement Plan and Program are generally consistent with the RTP. Lists of relevant projects in each of these plans are shown in the Appendix A.

It was decided that some of the key projects listed in the RTP should not be included in the 2035 no-build scenario since their presence or absence may impact the need for some of the projects we are specifically considering as part of this IAMP. The three main projects that are listed in the Financially Constrained RTP, that were not assumed in the 2035 No-Build scenario are:

1. 238th Extension between Sandy Boulevard and Marine Drive
2. Marine Drive Extension from South Frontage Road to Graham Road/257th Way
3. Marine Drive Two-Way between South Frontage Road and North Frontage Road

FUTURE YEAR FORECASTS

Using the travel demand model described above, future year traffic volumes were forecast for streets within the study area. Generally, turn movement volumes at study area intersections were obtained through application of a post-processing technique where the incremental differences between the future and base year volumes from the model were added to the existing p.m. peak hour volumes collected in the field. The Troutdale Reynolds Industrial Park (TRIP) area was not included in the modeling (trip generation in TAZ's associated with those areas was reduced to 2005 levels in the model) and trips associated with that area were added in separately (see Appendix B). The TRIP area has been thoroughly studied recently, so specific trip generation and distribution information has been developed for this key area. It was determined that the detailed work done in this area would better reflect anticipated traffic patterns than the more generalized travel demand model.

Compared to the traffic volumes collected in 2010 (displayed in Tech Memo #3), the most significant changes in the IAMP area occur at the Marine Drive/Sundial Road intersection where a a substantial volume of traffic is added due to industrial development that is expected to the northeast (TRIP – Troutdale Reynolds Industrial Park). Growth at the Marine Drive/Sundial Road intersection is anticipated to increase by almost four times during both AM and PM peak hours between 2010 and 2035. Some of the additional traffic at the Marine Drive/Sundial Road intersection is also expected to impact the Marine Drive/I-84 Westbound Ramps/North Frontage Road intersection, where traffic volumes are expected to almost triple during both the AM and PM peak periods. In the immediate vicinity of the interchange, traffic volumes are expected to grow about 70-80 percent, with the Graham Road/I-84 Westbound Ramp/North Frontage Road intersection about doubling during the PM peak hour. Most of the other improvements assumed are capacity and safety improvements to existing roadways that will not substantially change travel patterns in the area.

ASSUMED FUTURE STREET NETWORK

As previously described, the future year 2035 travel demand model was refined to account for planned transportation projects in the area that would influence travel choices and change system capacity. To analyze system operations under this scenario, the Synchro™ analysis software (that utilizes Highway Capacity Manual Methodology) that was used to perform the operational analysis of study area intersections was updated to account for these projects and included several additional refinements of smaller scale that would not have impacted the route choice provided by the travel demand model. Such refinements typically included modifying lane configurations for streets and intersections undergoing improvements. An illustration of assumed traffic controls and lane configurations at study intersections is provided in Appendix B.

FUTURE 2035 OPERATIONS

An operational analysis of the study area intersections for the design hour (p.m. peak hour) in 2035 was conducted for the IAMP area using the assumed lane configurations, traffic controls and forecasted volumes shown in the Appendix. The analysis methodologies employed and corresponding results are discussed below. It should be noted that the City and ODOT have short term improvements identified and planned. Those improvements are referred to as "Project A" and include the following:

- Third through lane on I-84 EB Off-Ramp
- Third through lane on South Frontage Road
- Third through lane on North Frontage Road
- Add 2nd NB left turn lane at Graham Road / North Frontage Road/I-84 WB Off-Ramp
- Add WB right turn lane on I-84 WB Off-Ramp
- Convert SB right turn lane to free right (into new 3rd lane on North Frontage Road on Graham Road at North Frontage Road
- Add WB right turn lane at Marine Drive/North Frontage Road (free right turn from North Frontage Road to Marine Drive is eliminated)

PERFORMANCE STANDARDS

ODOT has designated Interstate 84 as an Interstate Highway, with an additional Freight Route designation. North Frontage Road, South Frontage Road, Graham Road/257th Avenue (between the frontage roads) and Marine Drive (between the frontage roads) are also ODOT facilities. ODOT has adopted standards for mobility for state facilities through the *1999 Oregon Highway Plan* (OHP) and the *Highway Design Manual.*[1] The OHP mobility standards are to be used for identifying needs, while the *Highway Design Manual* standards represent the level of operation for which state facilities are to be designed. For this study, the OHP standards will be applied to existing and future no-build analysis, while the future build alternatives will be compared to the standards in the *Highway Design Manual*. The *Highway Design Manual* indicates that 20 year design-mobility standards (v/c ratio) should be 0.85 for District/Local Interest Roads within an MPO inside the Urban Growth Boundary.

Table 7 in Policy 1F of the OHP displays the maximum allowable volume-to-capacity ratios for areas inside of the Portland Metropolitan Area. Sections from that table relevant to the study area are presented below in Table 2. Note that, while the table states that the acceptable volume-to-capacity ratio is 0.99, the text of Policy 1F states that ramp terminals are an exception, where the maximum volume-to-capacity ratio is 0.85 or 0.90 (0.85 in this case since the conditions required to use the 0.90

[1] Highway Design Manual, Oregon Department of Transportation, 2003, Table 10-1, p. 10-38.

standard are not met[2]). So, in this case, the acceptable volume-to-capacity standard is the same for both the OHP and the HDM, 0.85 at the ramp terminals.

Table 2: Maximum Volume to Capacity Ratios Inside Metro*

Highway Category/Location	Standard	
	1st hour	2nd hour
Other Principal Arterial Routes I-84 (east of I-205)	0.99**	0.99

* Source: 1999 Oregon Highway Plan, Table 7 (Policy 1F).

** The exception is at ramp terminals, where the maximum volume-to-capacity ratio is 0.85 or 0.90. **In this case, 0.85 at all ramp terminals.**

All non-state roadways within the study area are under the jurisdiction of the City of Troutdale or Multnomah County. The County has adopted standards for performance of City streets requiring operation of level of service "D" or better during the weekday evening peak hour and the City typically follows the County's standards.[3]

INTERSECTION OPERATIONS

Study intersections within the IAMP area were analyzed through the use of the Synchro model that was used to examine existing conditions, updated with the traffic volume and roadway geometry data shown in Appendix B. From this analysis, intersection levels of service and volume to capacity ratios were obtained using Highway Capacity Manual[4] methodologies for signalized intersections for comparison with the applicable jurisdiction's adopted performance standards. The results of this analysis are shown below in Table 3 and further illustrated in Figure 1.

When comparing this table to the comparable Existing Conditions table (see Tech Memo #3, Table 6), it becomes clear that operations at almost all study intersections have substantially declined.

[2] The following conditions would be required to use the 0.90 standard: A majority of the interchange access management area of the interchange is developed and 1) it can be determined, with a probability equal to or greater than 95 percent, that vehicles queues would not extend into the portion of the ramp needed to accommodate deceleration from freeway speed; and 2) the interchange access management area is retrofitted to comply, as much as possible, with the standards contained in Policy 3C of the Oregon Highway Plan.

[3] The City of Troutdale does not have an adopted Level of Service standard.

[4] *Highway Capacity Manual*, Transportation Research Board, Washington, D.C., 2000.

Table 3: 2035 No Build
Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	17.7	B	**1.00**	**No**
		PM	44.3	D	**>1.0**	**No**
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	14.3	B	0.63	Yes
		PM	48.1	D	**0.96**	**No**
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	15.5	B	**0.98**	**No**
		PM	10.3	B	0.75	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	68.5	E	**>1.0**	**No**
		PM	40.6	D	**0.93**	**No**
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	5.7	A	0.76	Yes
		PM	17.5	B	0.87	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	90.6	**F**	>1.0	**No**
		PM	72.0	**E**	0.97	**No**

Bold – indicates intersections not meeting performance standard. Delay = Average Stopped Delay per Vehicle

Marine Drive/Sundial Road would operate at an unacceptable level of service assuming forecasted 2035 traffic volumes. Much of the TRIP traffic will travel through this intersection, creating demand at the intersection that is expected to exceed capacity during both the AM and PM peak hours. Additional improvements will be required at this intersection to meet City and County LOS standards.

The **I-84 Eastbound Off-Ramp/Marine Drive** intersection would decline substantially during both peak periods. However, during the morning peak period, when the majority of traffic in the interchange is headed west on I-84 away from Troutdale, the intersection would continue to operate acceptably. It would not operate acceptably during the PM peak period. Additional improvements will be necessary for this intersection to meet ODOT's performance standard, which requires a volume-to-capacity ratio of 0.85 or lower.

The **I-84 Westbound Ramps/Marine Drive** intersection would decline substantially during both peak periods and would not operate acceptably during either peak period. A third through lane is assumed on North Frontage Road between Graham Road and Marine Drive, terminating at the west end in a free-

right turn onto northbound Marine Drive. Additional improvements will be necessary for this intersection to meet ODOT's performance standard, which requires a volume-to-capacity ratio of 0.85 or lower.

The **I-84 Westbound Ramps/Graham Road/North Frontage Road** intersection improvements include reconfiguration of the northbound approach to include a 50 foot northbound through pocket and two exclusive northbound left turn lanes. A 200 foot westbound right turn pocket on the I-84 westbound off-ramp is also added. The third through lane on North Frontage Road described above would begin at the east end as a free southbound right turn from Graham Road to westbound North Frontage Road. This intersection declines only slightly during the evening peak period, largely because of the improvements planned there. The biggest concern at this intersection is the AM peak hour, when the volume-to-capacity ratio is 0.98, exceeding ODOT's standard.

I-84 Eastbound On-Ramp/257th Avenue/South Frontage Road is expected to decline from LOS B during both the AM and PM peak hours to LOS E during the AM peak hour and LOS D during the PM peak hour. The volume-to-capacity ratio during both peak hours is also expected to exceed capacity during the AM peak and decline to 0.93 during the PM peak. Neither peak period would meet ODOT's level-of-service standard. Additional improvements will either be needed at this intersection, or elsewhere in the street network to redirect traffic away from this intersection.

257th Avenue/257th Way will decline from LOS A to LOS B during the morning peak hour, but will remain at the same level-of-service as existing conditions during the evening peak hour (LOS B). Performance will decline somewhat, but will still be well within City/County standards.

257th Avenue/ Historic Columbia River Highway is expected to decline substantially in the future. Level-of-service will decline from LOS C to LOS F during the AM peak hour and from LOS C to LOS E during the PM peak hour. Additional improvements will be needed at this intersection in order for it to meet City/County level-of-service standards.

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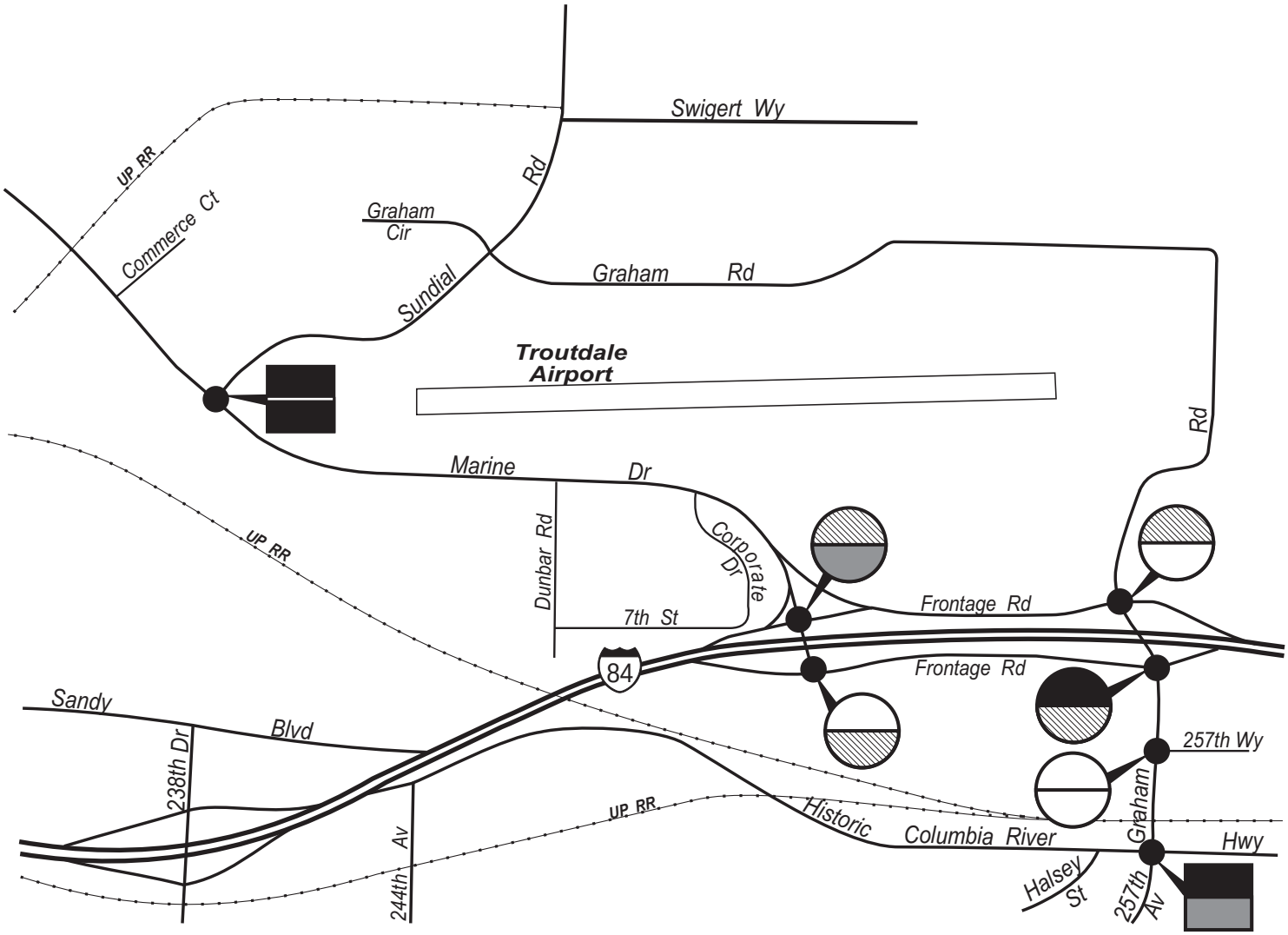

LEGEND

- Study Intersection

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 1

2035 NO-BUILD

IAMP Intersections Failing To Meet Adopted Performance Measures

FUTURE 2035 DEFICIENCIES

TRAFFIC OPERATIONS

As previously discussed, and illustrated in Figure 1, the study area intersections nearest the interchange are not projected to operate within adopted performance standards in 2035 without additional improvements. In focusing on the operational deficiencies, six locations are identified:

- I-84 Eastbound Ramp/Marine Drive
- I-84 Westbound Ramp/Marine Drive
- I-84 Eastbound Ramp/257th Avenue
- I-84 Westbound Ramp/Graham Road
- Marine Drive/Sundial Road
- 257th Drive/Historic Columbia River Highway

The "Future Transportation Alternatives" section below will address potential solutions to these operational deficiencies.

ACCESS / INTERSECTION SPACING

In Chapter 3, the existing access spacing on the area street network was compared to adopted access management spacing standards. It was found that on South Frontage Road, the number of approaches to the roadway is greater than would be allowed under both ODOT's and the City's spacing standards.

General access/intersection spacing considerations will be discussed relative to five areas surrounding the I-84/257th Avenue interchange.

South Frontage Road: This area includes the properties adjacent to South Frontage Road between Marine Drive and Graham Road/257th Avenue, including a number of hotels, fast food restaurants, truck stops, gas/fueling stations and other commercial businesses. The access points on South Frontage Road are numerous and are generally not in compliance with City and ODOT standards (which would require the first full access to be located east of the first TA driveway). In addition, the businesses in this area are not served by an internal local street system. Access along this roadway is a concern with regard to safety and congestion. A separate South Frontage Road Access Study is being conducted as a part of this IAMP.

Recommendation: Refer to South Frontage Road Access Study for recommendations.

North Frontage Road: This area includes The Portland-Troutdale Airport, a couple of truck-related businesses, possibly other commercial businesses, and approximately 25 acres of vacant land owned by the Port of Portland. The existing access onto North Frontage Road (South Entrance Road) conforms to ODOT access spacing, which requires 750 feet from the interchange ramp terminal to the first right-

in/right-out only access. This access is over 1,100 feet from the I-84 westbound interchange ramp terminal. The distance between South Entrance Road and the Truck Center access is 200-250 feet, less than the City's desired 530 foot access spacing on arterial roadways. It is assumed that if and when the additional Port of Portland property is developed, it will take access to North Frontage Road via South Entrance Road. Since North Frontage Road is one-way, the South Entrance Road access is a de facto right-in/right-out only access and adequate spacing is provided between South Entrance Road and each of the I-84 westbound ramp terminals (at Graham Road and at Marine Drive). If the spacing between South Entrance Road and the Truck Center becomes a safety or congestion issue in the future, access to the Truck Center via South Entrance Road could be considered.

> **Recommendation**: No changes recommended in the near term. It is recommended that, should the additional Port of Portland property be developed, access to North Frontage Road be taken via South Entrance Road. Additionally, should the access spacing between South Entrance Road and the Truck Center become problematic, access to the Truck Center via South Entrance Road should be considered.

Marine Drive (north of interchange): This area includes the industrial property between I-84 and Marine Drive as well as the property owned by the Port of Portland to the east of Marine Drive and north of North Frontage Road. Access in this area is generally acceptable, meeting both Multnomah County and ODOT's desired access spacing. There is, however, a substantial amount of undeveloped property adjacent to Marine Drive in this area. As properties develop, access should be taken from existing roadways as much as possible, or new access point should be developed consistent with Multnomah County and ODOT's access spacing standards.

> **Recommendation**: Any development or redevelopment should access existing roadways as much as possible. Any new accesses should be developed consistent with Multnomah County and ODOT's access spacing standards.

Graham Road (north of interchange): This area includes a fast-food restaurant, a hotel, some airport-related businesses and a large storage facility. Graham Road is a City street and, since it is classified by Troutdale as a local street, City access spacing standards are met. It is adjacent to an interchange ramp terminal, however, and ODOT's desired access spacing standards are not met. Upon development or redevelopment along Graham Road, consolidation of access should be considered and any new access points should be developed consistent with ODOT's desired access spacing as much as possible.

> **Recommendation**: Upon development or redevelopment along Graham Road, consolidation of access should be considered and any new access points should be developed consistent with ODOT's desired access spacing as much as possible.

Graham Road/257th Avenue (south of interchange): There is only one access along Graham Road/257th Avenue between the I-84 interchange (South Frontage Road) and Historic Columbia River Highway.

While this access does not meet City or ODOT access spacing standards, it is a major signalized access to a regional outlet mall (257th Way) and any change to this access is unlikely. There is some undeveloped property adjacent to Graham Road/257th Avenue on the west side. When this property develops, attempts should be made to provide access opposite the outlet mall at 257th Way. This would require either a new roadway (such as the potential Marine Drive Extension discussed in Tech Memo #3) or joint access through the existing "Flying J" property to the north.

> **Recommendation:** No additional access point should be developed along Graham Road/257th Avenue between South Frontage Road and Historic Columbia River Highway. Any additional access granted along this stretch should line up opposite 257th Way at the outlet mall entrance.

From the discussion above, it can be seen that there are a number of access points that will require closure if compliance with spacing standards is to be attained. Options to explore for moving in the direction of the applicable access management spacing standards that should be considered during the development of preliminary improvement alternatives should include:

- The construction of new local roads to provide alternate access;
- The establishment of shared access points by creating easements; and
- The purchase of access rights for long-range protection.

SIGNAL SPACING

ODOT's desired traffic signal spacing is ½-mile. Under existing conditions, there are two signals on Graham Road/257th Avenue within ½-mile of the I-84 ramp terminals. In addition to the signals on Graham Road/257th Avenue at both the I-84 eastbound and westbound ramp terminals, there are signals at the intersections with 257th Way and Historic Columbia River Highway. Currently, no additional traffic signals are planned in the IAMP Management Area.

It should be noted that signals spaced at least ½-mile (2,640 feet) apart generally do not impact each other and can operate without need for coordination. When closer than ½-mile, coordination of adjacent signals is typically recommended, especially on the state system, but the ability of the signals to operate well together is usually very good if spacing of at least ¼-mile (1,320 feet) is maintained. Under ¼-mile, coordination of adjacent signals is strongly recommended, with the ability of these signals to function without impacting each other degrading as spacing decreases. The City of Gresham and ODOT currently operate the traffic signals along 257th Avenue/Graham Road as part of a coordinated system.

Figure 2 illustrates the study area and identifies the locations of the existing traffic signals. As shown, the signals on Graham Road/257th Avenue do not maintain spacing of at least 1,000 feet, therefore, it will be critical for the signals on this roadway to have continued traffic signal coordination. Given the resulting signal spacing on Graham Road/257th Avenue from these existing signals, it is recommended that no additional signals be constructed in the IAMP Management Area.

Recommendation: Within the IAMP Management Area, no additional signals should be approved on Graham Road/257th Avenue south of the interchange.

LOCAL CONNECTIVITY

When planning for future streets to enhance local connectivity in the IAMP management area, consideration should be given to deficiencies in the following geographic areas:

- **South of South Frontage Road:** There are a number of intersections and driveways that are not in compliance with ODOT and City access spacing standards along South Frontage Road. Consideration should be given to eliminating or consolidating individual driveways within the interchange area at the time that individual properties develop or redevelop. Tech Memo #5 consists of a South Frontage Road Access Study that addresses access management issues in this area.

- **Southeastern Quadrant (Outlet Mall Area):** While improved circulation in this quadrant would be desirable, there are substantial constraints to making any changes in this area. The area is bounded by Interstate 84 to the north, the Sandy River to the east, a railroad track to the south, and a single access to a shopping mall with only one additional egress (257th Way curves around to parallel I-84 north of the mall). 257th Way provides the only access to properties located behind the outlet mall to the east. While this does not provide desirable connectivity, no reasonable alternate access is feasible.

- **Northeastern Quadrant:** This area is bounded by Interstate 84 to the south and the Sandy River to the east. There are several vacant or underdeveloped parcels in the eastern portion of this quadrant. These parcels are provided access via Harlow Place. While a connection between Harlow Place and Graham Road could be desirable, it would not be desirable to focus additional traffic near the interchange. As the vacant parcels developed, they will likely gain access from Harlow Place, which is about 1,300 feet from the interchange.

- **Airport Area:** There are two accesses to North Frontage Road from this area, one is South Entrance Road and the other is a private access to a trucking business. There are several undeveloped parcels in this area. Those parcels to the east of South Entrance Road could easily obtain access from it. Those parcels to the west of the airport and trucking business could also gain access from South Entrance Road via a "flag" connection to it. However, a plan should be developed to provide secondary access to those parcels to the west of the airport/trucking business, likely via Marine Drive.

- **Northwestern Quadrant (Marine Drive Business Park Area):** This area is almost fully developed, with few vacant parcels. Those parcels that are not yet developed have access to the local street system already in place. While an additional connection between Dunbar Avenue and Eastwind Drive (approximately 2,000 feet west of Dunbar Avenue) would be desirable, it will not provide sufficient benefit to warrant the redevelopment that would be required in order to provide it.

In addition, the following overarching concerns should be evaluated and addressed:

- **Lack of north-south capacity.** The only north-south arterial route to Interstate 84 in Troutdale is via 257th Avenue. The lack of parallel routes for travel to and from the freeway system is a very significant constraint for the existing transportation system.

- **Frontage Road Congestion.** The existing configuration of the Troutdale interchange and the adjoining access provisions for fronting commercial properties is far below the capacity required to support peak period demands today and in the future. The interaction between truck traffic and motor vehicles significantly reduces the frontage road capacities.

- **Lack of direct access to the north-industrial area.** Access to the north-industrial area is provided through the congested I-84/257th interchange, which includes out-of-direction travel to Graham Road. Construction of the planned 238th Avenue extension to Marine Drive would substantially improve access to this area.

- **Lack of east-west capacity.** There are really only two east-west corridors passing through Troutdale. The Stark Street corridor will be significantly congested in 2035. The only other route passing east-west through Troutdale is the Halsey Street/Historic Columbia River Highway corridor, which is also very congested, today and in the future.

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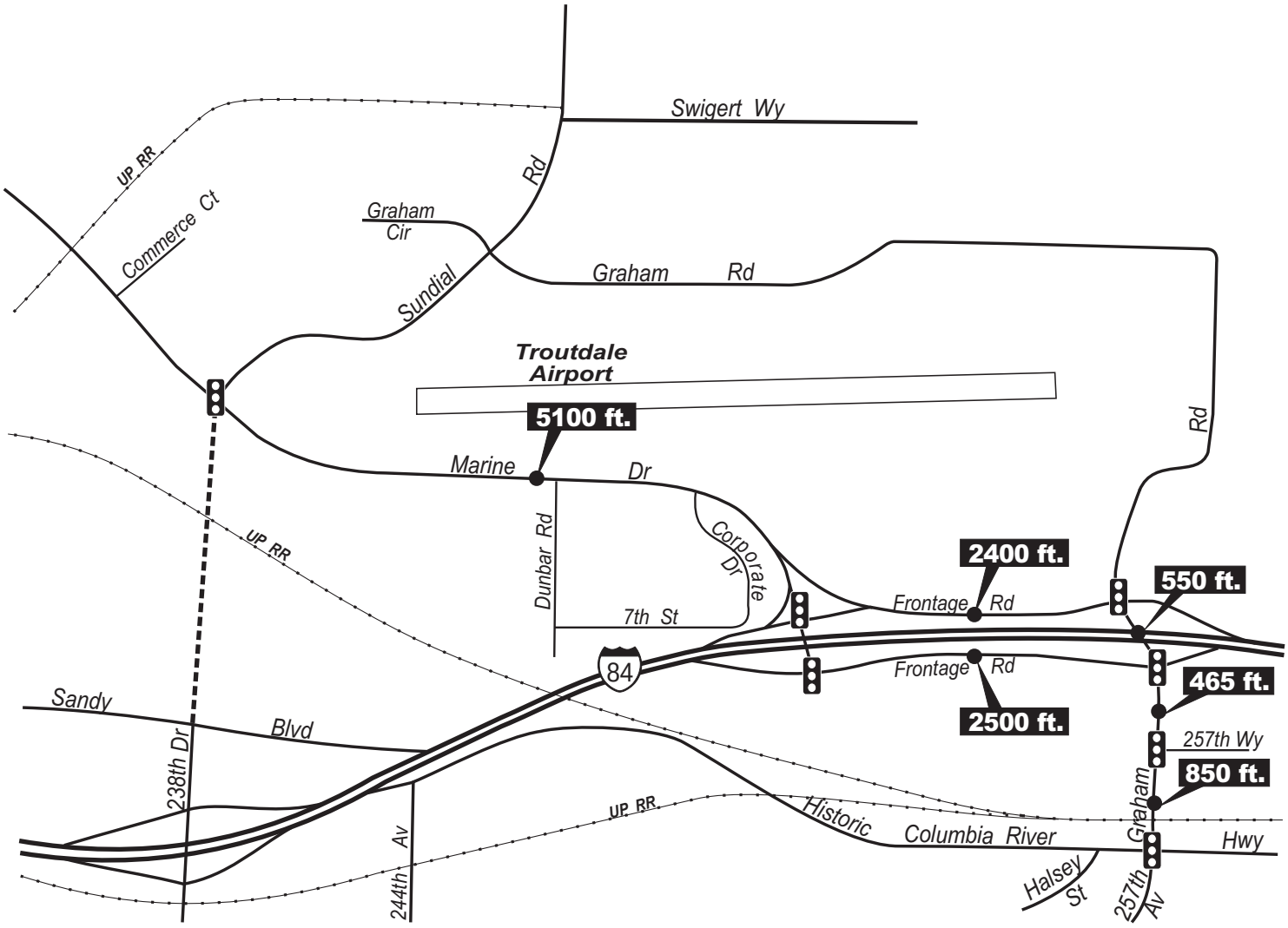
NO SCALE



LEGEND

- Signalized Study Intersections
- **000 ft.** - Distance Between Traffic Signals
- ----- - Planned Roadway

Figure 2

TRAFFIC SIGNAL SPACING

FREIGHT MOBILITY

As noted in Chapter 3, the current land use zoning in the IAMP area includes commercial zoning in the immediate vicinity of the interchange, with industrial zoning generally the next closest (primarily on the north side) and residential zoning of various densities further to the south.

The 257th Avenue Interchange carries a substantial amount of truck traffic, moving freight through and within the City, but the trips are primarily associated with origins or destinations outside the City (i.e. through traffic). For those trips with origins and destinations in Troutdale, considering the zoning surrounding this area, most local truck trips are anticipated to be traveling to and from the commercial and industrial developments within the interchange area or in the north industrial area. Therefore, the routes most heavily relied upon for freight movement in the IAMP area would include South Frontage Road, Graham Road/257th Avenue, North Frontage Road and Marine Drive.

All of these routes are currently constructed to accommodate normal truck traffic. Any future projects in the area will also be constructed to accommodate normal freight movement requirements and will comply with the City of Troutdale Transportation Systems Plan[5] for City streets, the Multnomah County Design Manual for County roadways or ODOT's Highway Design Manual for state facilities. There is a project in the Troutdale Capital Improvements Program to widen Graham Road specifically to accommodate truck traffic.

I-84 is designated as an NHS (National Highway System) route,[6] however, none of the other roads in the interchange area are. More stringent freight standards that would apply to NHS routes, do not apply to South Frontage Road, North Frontage Road, Graham Road or Marine Drive. Due to the relatively high volume of freight travel in Troutdale, design standards used for "over-wide" and "over-high" freight traffic should be applied on Troutdale City streets in the vicinity of the interchange.

BICYCLE AND PEDESTRIAN FACILITIES

Bicycle and pedestrian facilities exist for the most of the arterial and collector streets within the IAMP Management Area. The exception is North Frontage Road, which does not have designated bicycle or pedestrian facilities. The City of Troutdale Transportation Capital Improvement Plan (CIP) contains several projects including bike lane construction, sidewalk construction, and complete street modernization/ reconstruction. The following CIP projects will improve bicycle/pedestrian facilities in the Study Area:

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[5] *City of Troutdale Transportation Systems Plan,2005*.

[6] State of Oregon – NHS Route Detail, 13, February, 2003.

- Improve Graham Road (would include sidewalks and possibly bike lanes)
- Widen SW 21st Street (would presumably improve either bike or pedestrian facilities)
- Transportation Improvements in North Industrial Area (would include pedestrian facilities and possibly bike facilities)
- Construct pedestrian accessways in various locations in the City
- Traffic Signal at Buxton/Historic Columbia River Highway
- Marine Drive Extension would include pedestrian and possible bicycle facilities
- Improve Dunbar Avenue to include sidewalks

Some remaining gaps will be filled by land development. Additionally, there are a number of key bicycle/pedestrian projects identified in the City's Transportation System Plan[7] that, if funded, would improve bicycle and pedestrian connectivity in the vicinity of the interchange:

- Marine Drive sidewalks to complete gaps between interchange and City Limits to the north
- Sundial Road sidewalks to complete gaps between Marine Drive and City Limits to the north
- Regional Multi-Use Path along Sandy and Columbia Rivers on periphery of north industrial area
- Historic Columbia River Highway sidewalks to complete gaps between west City Limits and east City Limits
- Halsey Street sidewalks to complete gaps between west City Limits and Historic Columbia River Highway
- Historic Columbia River Highway bike lanes (west of Halsey Street)
- Sandy Avenue/Buxton Road bike lanes (connecting Troutdale Road to Historic Columbia River Highway)
- Multi-Use Trail system connecting 257th Avenue, Halsey Street, Historic Columbia River Highway (west of Halsey) and Sturges Drive

MULTI-MODAL CONSTRAINTS

The major modes of transportation existing within the IAMP area include motor vehicles (passenger cars and trucks), freight trains, bicycles, and pedestrians. With the construction of planned improvements listed in the City's Transportation CIP and the interchange reconstruction project, the area street network will provide for adequate facilities for motor vehicle, bicycle, and pedestrian travel.

POTENTIAL MODE CONFLICTS

With the completion of the planned improvement projects in the City's Transportation CIP and Transportation System Plan Bicycle and Pedestrian Master Plans, most of the arterial and collector streets within the IAMP area will maintain separate bicycle lanes and sidewalks to minimize motor vehicle, bicycle, and pedestrian conflicts.

[7] Transportation System Plan, City of Troutdale, DKS Associates, August, 2005.

POTENTIAL RIGHT OF WAY CONSTRAINTS

While some vacant or underdeveloped land remains in the IAMP area, there are a number of potential constraints to the purchase of additional right of way for future roadway alignments. In addition to existing developments, other features impacting potential roadway alignments include Interstate 84 and the Union Pacific railroad.

FUTURE TRANSPORTATION ALTERNATIVES

This section addresses potential solutions to future operational deficiencies identified in the previous Future Conditions Analysis section. While land use alternatives are not planned, a range of facility improvements for providing adequate operation of the proposed interchange improvements and surrounding transportation system were developed and evaluated. This chapter summarizes the alternatives considered, including cost estimates, and provides prioritization for the implementation of these alternatives through recommended short and long-range actions.

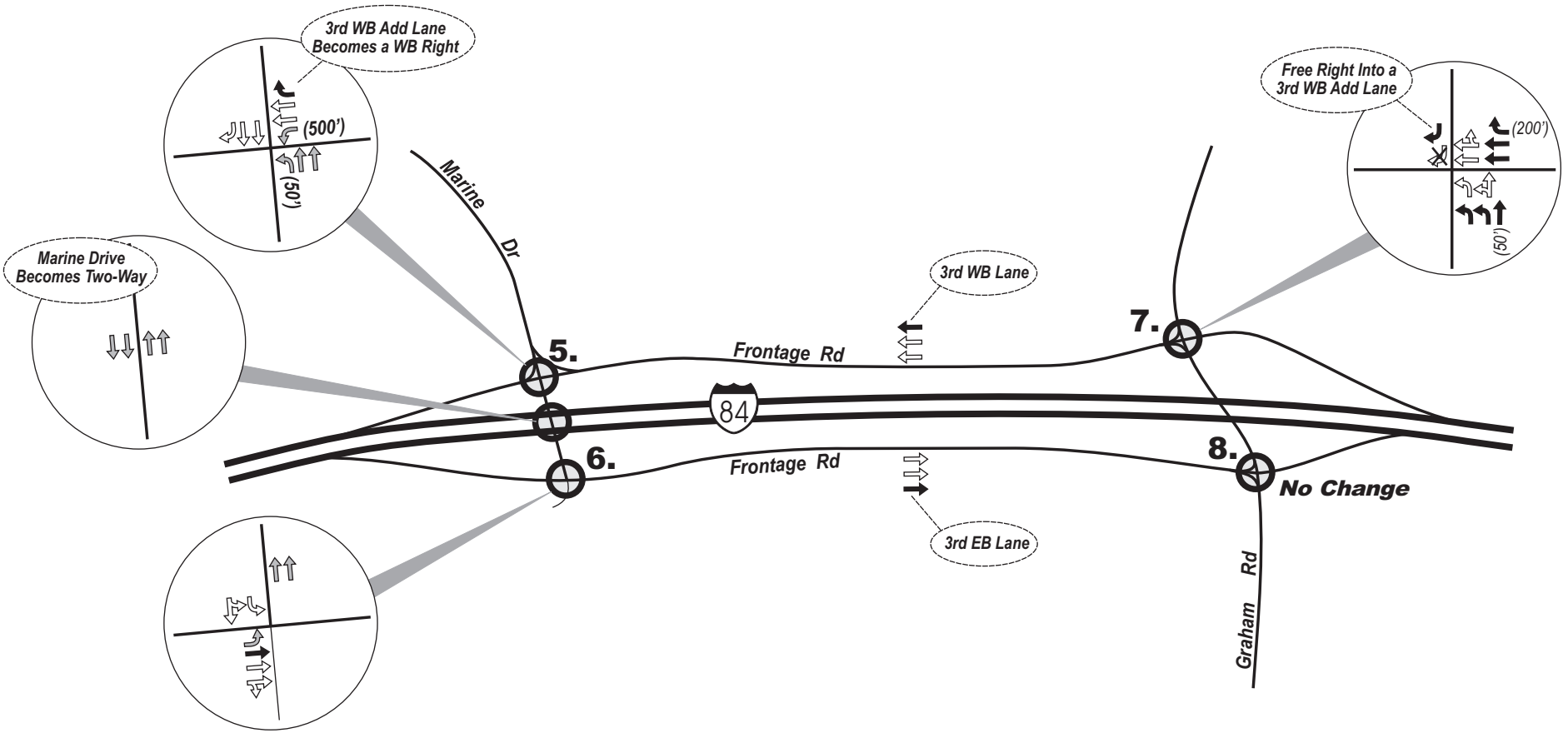
Future Land Use Alternatives

This IAMP is based on the City of Troutdale's Comprehensive Plan and associated Zoning Map[8] that is currently adopted, as shown in Appendix C. Much of the land in the vicinity of the interchange is already developed and land that has not yet been developed has been accounted for in future land use estimates as described in the previous section of this memorandum. Therefore, no land use alternatives have been developed as a part of this IAMP project.

TRANSPORTATION FACILITY IMPROVEMENTS

Transportation alternatives are aimed at improving capacity and safety through measures such as traffic controls, turn lanes, enhanced street connectivity, and system management techniques. Previous studies have identified a number of interchange alternatives and two phases of improvements (Project A and Project B) have previously been identified by ODOT (see Figure 3) This IAMP will document the analysis and decision process that was previously conducted and summarize the Project A alternative, which is currently funded. It will go further to explore and analyze improvements beyond Project A. Previously considered alternatives are described and summarized in Appendix D.

[8] City of Troutdale Comprehensive Plan Map, dated April 10, 2010. City of Troutdale Zoning Map, dated April 10, 2010.



LEGEND

0. - Study Intersection & Number

⇦ - Existing Lane Configuration

⬅ - Phase 1 - Interchange Improvements

⇦ - Phase 2 - Interchange Improvements
(These are in addition to Phase 1 Improvements)

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NO SCALE

Figure 3

Phase I & II - INTERCHANGE IMPROVEMENTS

FUTURE TRANSPORTATION ALTERNATIVES

ODOT has obtained funding for some improvements at the I-84/257th Interchange. Based on the previous analysis that had been conducted in the vicinity of the interchange, it was determined that "Project A" should be constructed. There will be some funding remaining once the "Project A" improvements have been constructed. One purpose of this IAMP is to determine which transportation improvements should come next for the interchange. The following sections address three key improvements that have been proposed at the interchange and combinations therein. Each of these alternatives is additive to the 2035 No-Build base alternative.

- **Alternative 1: 238th Avenue Extension.** This would add a three lane extension of 238th Avenue between Sandy Boulevard and Marine Drive, to intersect at Sundial Road. The intent of this project is to reduce traffic through the I-84/257th Interchange and the reduce out-of-direction travel for vehicles traveling between the Portland metropolitan area and the Troutdale industrial area.
- **Alternative 2: Two-Way Marine Drive Under I-84 without 238th Avenue Extension.** The freeway overcrossing would be rebuilt to accommodate a five-lane section of Marine Drive between South Frontage Road and North Frontage Road. Left turn lanes from the I-84 eastbound off-ramp onto Marine Drive, Marine Drive onto the I-84 westbound on-ramp and westbound North Frontage Road onto Marine Drive would be included in this alternative.
- **Alternative 3: Two-Way Marine Drive Under I-84 with 238th Avenue Extension.** This alternative combines Alternative 1 and Alternative 2.
- **Alternative 4: Marine Drive Extension without 238th Avenue Extension.** This would consist of a limited access, moderately high-speed roadway connecting South Frontage Road with Graham Road/257th Drive at 257th Way (Outlet Mall Entrance). This would be a two-lane, one-way roadway that would be constructed along the back side of the commercial development along South Frontage Road as sort of a bypass to South Frontage Road, with no access to the commercial properties along South Frontage Road, with the exception of the properties immediately southwest of the Marine Drive/South Frontage Road intersection. The first few hundred feet of the roadway would actually be constructed as a two-way roadway, with two lanes southbound and one lane northbound. The properties that currently access South Frontage Road at this location would access the new roadway via a stop controlled intersection. Marine Drive Extension traffic would not be stopped. It is anticipated that during the evening peak period, due to the expected high volume of traffic on the extension, the access would serve as a de facto right-in/right-out only access since it would be very difficult to turn left.
- **Alternative 5: Marine Drive Extension with 238th Avenue Extension.** This adds the 238th Avenue Extension to Alternative 4.
- **Alternative 6: Two-Way Marine Drive Under I-84 with Marine Drive Extension.** This combines Alternative 2 and Alternative 4, assuming the 238th Avenue Extension would not be built.

- **Alternative 7: 238th Extension with Two-Way Marine Drive Under I-84 and Marine Drive Extension.** This combines Alternative 3 and Alternative 5, essentially combine all three of the improvements being considered.

PERFORMANCE MEASURES

Operational Performance was evaluated for each alternative. Analysis of the I-84/257th Interchange alternatives focus on several measures of effectiveness (MOE's) used to quantify operating conditions during peak periods. The MOE's were calculated using the following method:

Isolated Intersection Level of Service evaluation (based on 2000 Highway Capacity Manual intersection capacity procedures)Table 4 summarizes the MOE's used as part of this additional analysis and the method used to quantify each MOE.

Table 4: Measures of Effectiveness

Measures of Effectiveness	Method Used
HCM average intersection vehicle delay	Isolated intersection evaluation
HCM intersection level-of-service	Isolated intersection evaluation
HCM intersection volume-to-capacity ratio	Isolated intersection evaluation

ISOLATED INTERSECTION EVALUATION (HCM PROCEDURES)

Highway Capacity Manual intersection capacity procedures were used to estimate the average intersection vehicle delay, intersection volume-to-capacity (V/C) ratio, and intersection level-of-service (LOS) for signalized intersections during peak hour operations. This methodology assumes each intersection operates in isolation and does not account for impacts associated with adjacent traffic signals within the corridor that could influence the actual operations such as queuing into upstream intersections. Detailed analysis worksheets for all alternatives are provided in the Technical Appendix.

INTERSECTION OPERATIONS REQUIREMENTS

The City of Troutdale's and Multnomah County's operational threshold for signalized intersections is LOS "D" during peak hour operations.[9] For design purposes, ODOT operational requirements demand an intersection volume-to-capacity ratio (V/C) of 0.85 or less during peak hour operations.[10] For planning purposes, the four corners of the interchange at South Frontage Road and North Frontage Road are

[9] Multnomah County Design Standards, Part I – Design Manual.

[10] *2003 Highway Design Manual,* Table 10-1: 20 Year Design-Mobility Standards (Volume/Capacity [V/C]) Ratio, District/Local Interest Road in MPO.

subject to ODOT's intersection operation criteria while the remaining intersections (Marine Drive/Sundial Road, Graham Road/257th Drive/257th Way and 257th Drive/Historic Columbia River Highway) are subject to meet City and County intersection operation criteria.

ALTERNATIVE 1: 2035 NO-BUILD PLUS 238TH AVENUE EXTENSION

This alternative adds the 238th Avenue extension (3 lane roadway) between Sandy Boulevard and Marine Drive to the 2035 No-Build base scenario. The extension would connect to Marine Drive at Sundial Road. Assumed traffic volumes, lane geometries and traffic control devices for Alternative 1 are shown in the Appendix. Performance for Alternative 1 is summarized in Table 5 and Figure 4.

Table 5: Alternative 1 - 2035 No Build Plus 238th Extension
Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	10.1	B	0.68	Yes
		PM	21.0	C	0.81	Yes
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	12.7	B	0.54	Yes
		PM	29.1	C	0.85	Yes
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	7.8	A	0.85	Yes
		PM	9.6	A	0.65	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	18.6	B	**0.97**	**No**
		PM	55.8	E	**0.89**	**No**
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	5.0	A	0.73	Yes
		PM	29.5	C	0.85	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	68.1	**E**	0.97	**No**
		PM	64.1	**E**	0.97	**No**

Bold – indicates intersections not meeting performance standard; Average Stopped Delay per Vehicle

Relative to the 2035 No-Build condition, most study intersections would improve with the addition of the 238th Avenue Extension, especially the ODOT intersections. Some improve enough that they now meet ODOT's standards, however, the intersection at I-84 EB On-Ramp/257th Avenue would not improve enough to meet ODOT's standard. The Marine Drive/Sundial Road intersection declines since this alternative adds a fourth approach and a substantial volume of traffic to the intersection. The 257th Avenue/Historic Columbia River Highway intersection worsens to LOS F during the AM peak.

Alternative 1 will provide enough capacity at most of the I-84/257th interchange intersections during both the AM and PM peak hours through 2035 based on HCM isolated intersection capacity analysis methodology. The 257th Avenue/I-84 EB On-Ramp intersection would not meet desired operating standards during either peak period, however, due to the large volume of traffic traveling through the intersection from Troutdale toward Portland in the morning and due to the large volume of traffic returning to Troutdale from Portland in the evening. The intersection at 257th Avenue/I-84 EB Ramps would not meet ODOT's Highway Design Manual standard, which requires that these intersections be designed to operate at a volume-to-capacity ratio of 0.85 or lower. A design exception would be required for this intersection under this Alternative. The two City/County study intersections, Marine Drive/Sundial Road and 257th Avenue/Historic Columbia River Highway, would operate worse than HCM LOS "D" during both the AM and PM peak periods and would not meet City of Troutdale/Multnomah County peak hour operational requirements.

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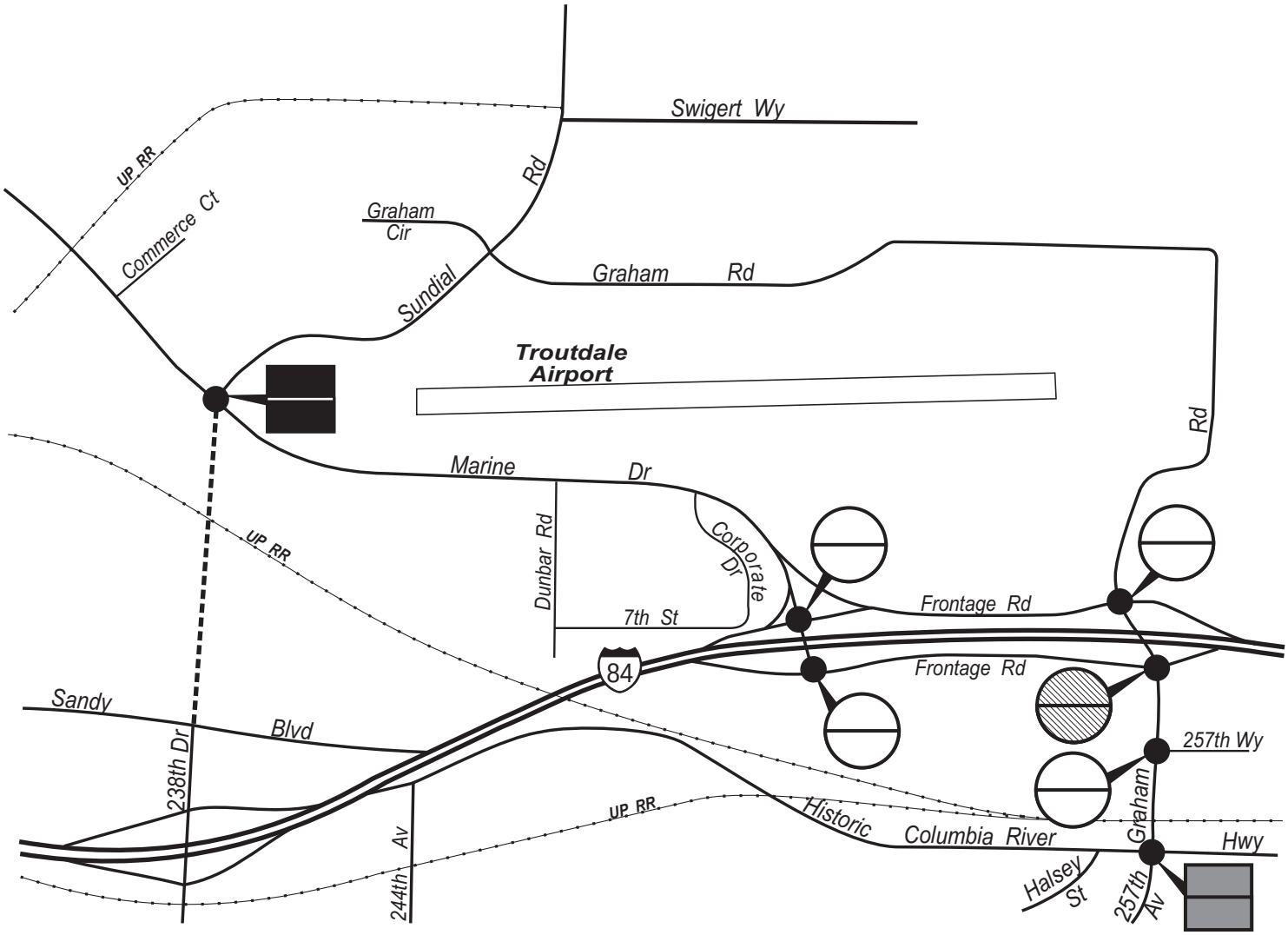
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour / Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 4

Alternative 1 - 2035 BASE + 238TH EXTENSION

IAMP Intersections Failing To Meet Adopted Performance Measures

ALTERNATIVE 2: TWO-WAY MARINE DRIVE UNDER I-84

This alternative creates a two-way connection on Marine Drive under I-84. Performance for Alternative 2 is summarized in Table 6 and Figure 5 (refer to appendix for detailed worksheets). All ODOT intersections operate at the same or slightly better operating conditions, however, the only intersection to meet ODOT's standard that did not under 2035 No Build conditions is the I-84 WB On-Ramp / Marine Drive intersection that would meet ODOT's standard during the AM peak hour with Alternative 2 improvements.

Table 6: Alternative 2 - 2035 No Build Plus Two Way Marine Drive Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	18.0	B	0.81	Yes
		PM	28.3	C	**0.91**	**No**
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	19.4	B	0.52	Yes
		PM	36.8	D	**0.92**	**No**
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	7.8	A	**0.88**	**No**
		PM	9.8	A	0.67	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	33.8	C	**>1.0**	**No**
		PM	49.1	D	**0.92**	**No**
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	5.5	A	0.75	Yes
		PM	18.5	B	0.86	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	78.9	**E**	>1.0	**No**
		PM	68.8	**E**	0.98	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

While volume-to-capacity ratios improve very slightly at 257th Avenue/257th Way, no study intersections would meet the City of Troutdale/Multnomah County peak hour intersection operating criteria that didn't under the 2035 No Build alternative. All four ODOT intersections will operate with volume-to-capacity ratios worse than the Oregon Highway Plan standard of 0.85 as well as the Highway Design

Manual[11] threshold of 0.85 for at least one peak period. A design exception would be required for the Highway Design Manual volume-to-capacity standard for each of these intersections.

Alternative 2 will not provide the necessary capacity in the I-84/257th interchange area during either peak period through 2035 based on HCM isolated intersection capacity analysis methodology. Each study area intersection would exceed ODOT's Highway Design Manual Standard during at least one of the peak periods. Therefore, each of the intersections in the interchange area would require a design exception. The only City/County study intersection that would operate at HCM LOS "D" or better during both the AM and PM peak periods is 257th Avenue/257th Way and would meet City of Troutdale/Multnomah County peak hour operational requirements. The intersections at Marine Drive/Sundial Road and 257th Avenue/Historic Columbia River Highway would not meet City/County level of service standards.

[11] *2003 Highway Design Manual*, Table 10-1: 20 Year Design-Mobility Standards (V/C [Volume/Capacity] Ratio, District/Local Interest Road.

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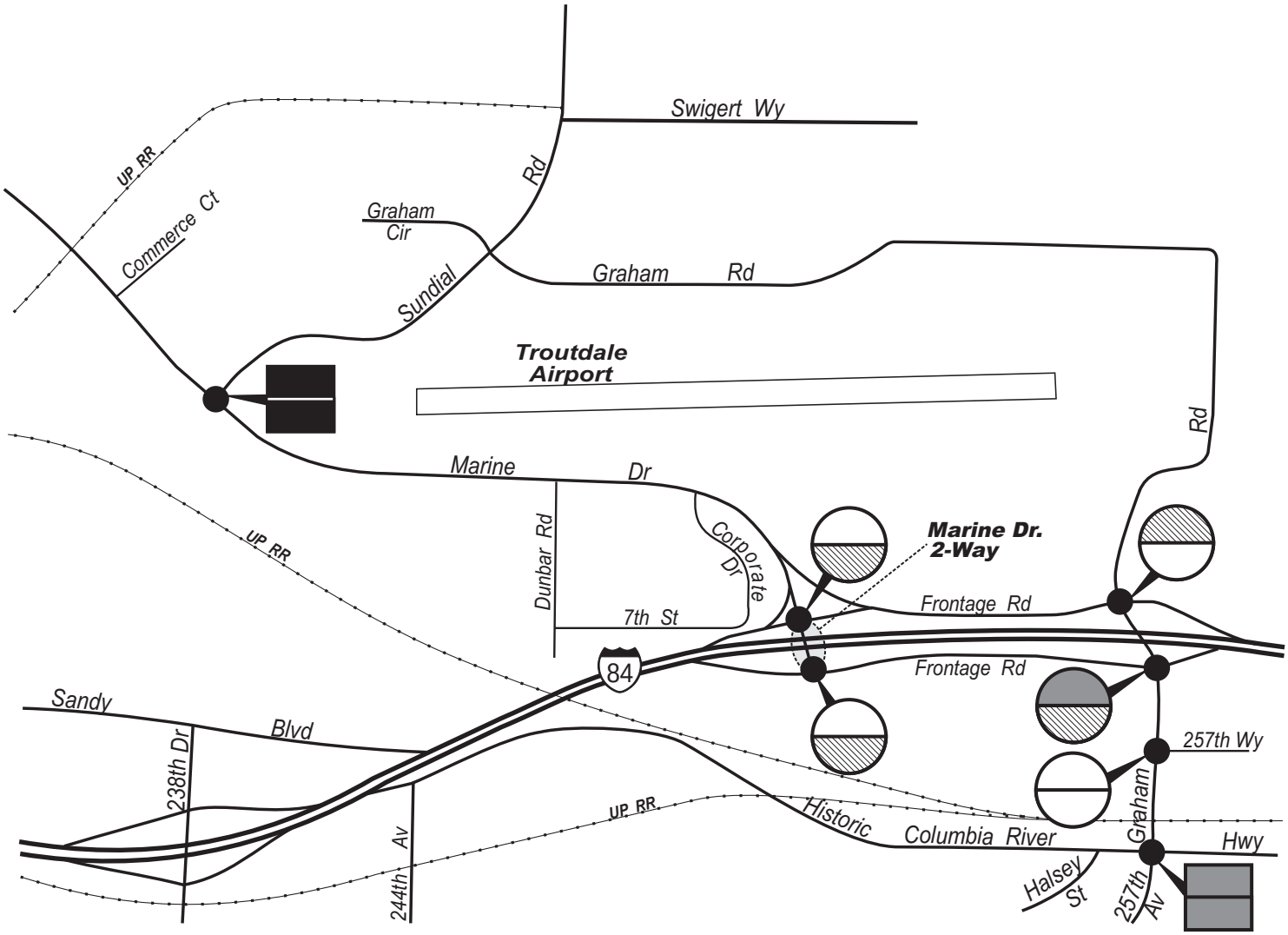
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 5

Alternative 2 - 2035 BASE + 2-WAY MARINE DRIVE

IAMP Intersections Failing To Meet Adopted Performance Measures

ALTERNATIVE 3: TWO-WAY MARINE DRIVE UNDER I-84 WITH 238TH EXTENSION

This alternative has both a two-way connection on Marine Drive under I-84 (Alt. 2) plus the planned 238th Extension between NE Sandy Boulevard and NE Marine Drive. Performance is summarized in Table 7 and Figure 6. During the 2035 peak hours, all ODOT study intersections would meet ODOT's intersection operating standards under the Two-Way Marine Drive with 238th Extension alternative, except for the I-84 EB On-Ramp/257th Avenue, which would not meet ODOT standards during either peak period. Marine Drive/Sundial Road and 257th Avenue/Historic Columbia River Highway would continue to not meet City/County standards at either intersection during either peak period. 257th Avenue/257th Way would meet City/County standards during both peak periods.

Table 7: Alternative 3 - 2035 No Build Plus 238th Extension and Two Way Marine Drive Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	10.4	B	0.68	Yes
		PM	23.2	C	0.82	Yes
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	12.7	B	0.54	Yes
		PM	27.6	C	0.85	Yes
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	7.8	A	0.85	Yes
		PM	10.5	B	0.65	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	18.6	B	**0.97**	**No**
		PM	56.7	D	**0.89**	**No**
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	5.0	A	0.73	Yes
		PM	19.8	B	0.85	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	68.1	**E**	0.97	**No**
		PM	62.7	**E**	0.93	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

The intersection at I-84 EB On-Ramp/257th Avenue will operate with a volume-to-capacity of 0.89 during the AM peak and 0.97 during that PM peak. The intersection would not meet the Oregon Highway Plan standard of 0.85 or the Highway Design Manual[12] threshold of 0.85 during either peak hour. A design exception would be required for the Highway Design Manual volume-to-capacity standard for this intersection.

The Two-Way Marine Drive Plus 238th Extension alternative will provide some of the necessary capacity at the I-84/257th interchange during both peak hours through 2035 based on HCM isolated intersection capacity analysis methodology. However, during both the AM and PM peak hours, one intersection would not meet ODOT's Highway Design Manual Standard. The intersection at the I-84 eastbound on-ramp/257th Avenue would not meet ODOT's Highway Design Manual standard, which requires that these intersections be designed to operate at a volume-to-capacity ratio of 0.85 or lower. A design exception will be required for this intersection. The City/County study intersections at Marine Drive/Sundial Road and 257th Avenue/Historic Columbia River Highway would not operate at HCM LOS "D" or better during either the AM or PM peak period and would not meet City of Troutdale/Multnomah County peak hour operational requirements.

[12] *2003 Highway Design Manual*, Table 10-1: 20 Year Design-Mobility Standards (V/C [Volume/Capacity] Ratio, District/Local Interest Road.

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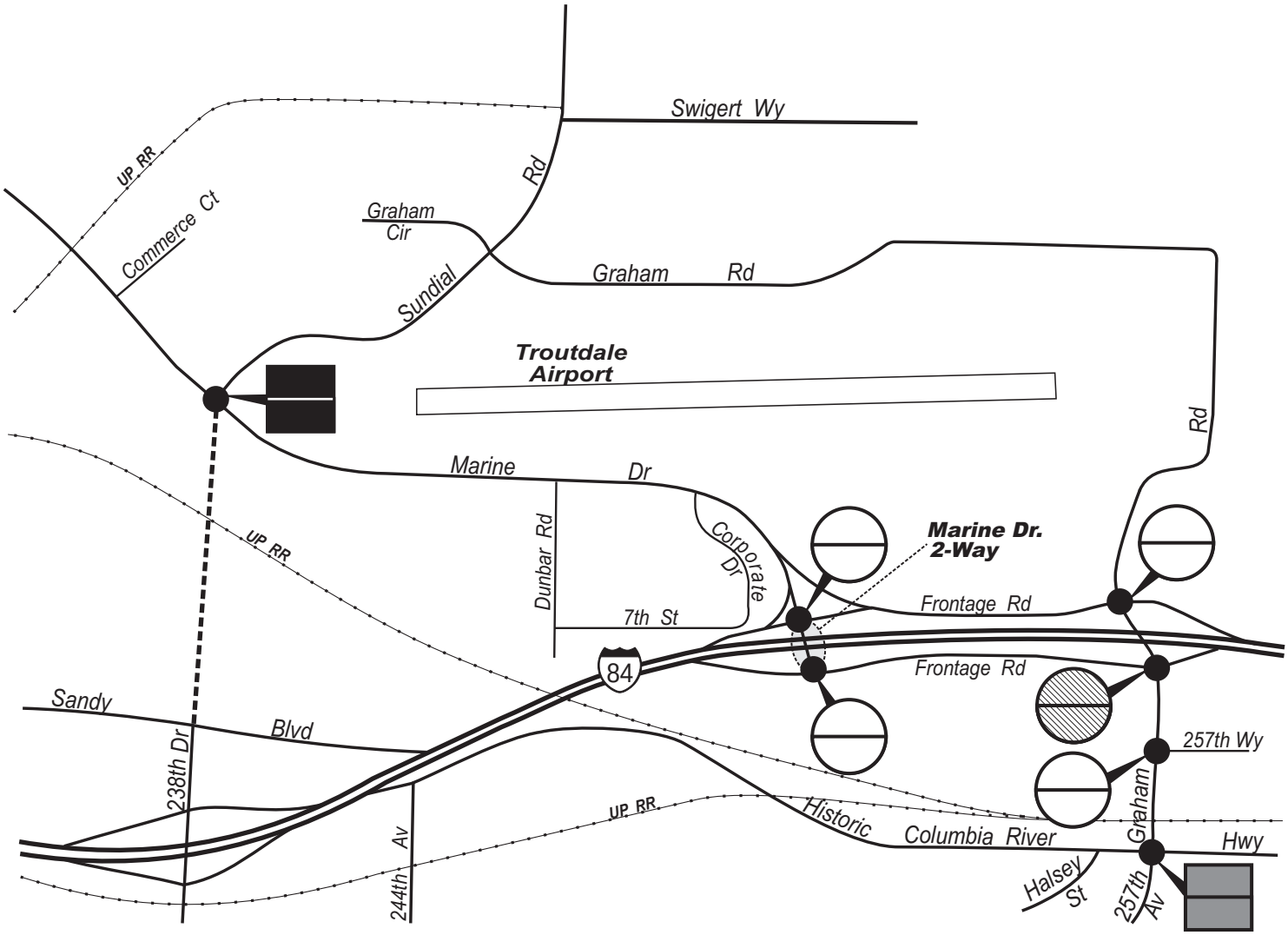
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 6

Alternative 3 - 2035 BASE + 2-WAY MARINE DRIVE + 238TH EXTENSION

IAMP Intersections Failing To Meet Adopted Performance Measures

ALTERNATIVE 4: MARINE DRIVE EXTENSION FROM SOUTH FRONTAGE ROAD TO SW 257TH AVENUE

Alternative 4 would continue Marine Drive from its present terminus at South Frontage Road along the back side of businesses to connect with SW 257th Avenue near the Outlet Mall traffic signal. Performance for Alternative 4 is summarized in Table 8 and Figure 7. During the 2035 AM peak hour, the only study intersections that would meet either the City/County or ODOT intersection operating standards would be the I-84 eastbound off-ramp/Marine Drive (ODOT) and 257th Avenue/257th Way (City) intersections.

The only study intersections that would meet either the City of Troutdale/Multnomah County or ODOT peak hour intersection operating criteria during the 2035 PM peak hour under this alternative is the I-84 westbound off-ramp/Graham Road and the 257th Avenue/257th Way (City) intersections. All of the remaining intersections will operate with a volume-to-capacity worse than the Oregon Highway Plan standard of 0.85 as well as the Highway Design Manual[13] threshold of 0.85, worse than LOS D for City/County intersections.

A design exception would be required for the Highway Design Manual volume-to-capacity standard for each of the intersections under ODOT's jurisdiction for either one or both peak periods. In addition, the Marine Drive/Sundial Road and 257th Avenue/Historic Columbia River Highway intersections within the City/County jurisdiction would not meet the standard for one or both peak periods.

This alternative does not perform well since only only three intersections meet standards during the AM peak hour and only one intersection meets standards during the PM peak hour under 2035 operating conditions. None of the four intersections under ODOT's jurisdiction would meet ODOT's Highway Design Manual standard for both peak periods, which requires that these intersections be designed to operate at a volume-to-capacity ratio of 0.85 or lower. A design exception will be required for each of these intersections. In addition, only one of the City/County study intersections would operate at HCM LOS "D" or better during both the AM and PM peak periods and the other two would therefore not meet City of Troutdale and/or Multnomah County peak hour operational requirements.

[13] *2003 Highway Design Manual*, Table 10-1: 20 Year Design-Mobility Standards (V/C [Volume/Capacity] Ratio, District/Local Interest Road.

Table 8: Alternative 4 - 2035 No Build Plus Marine Drive Extension Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	16.2	B	**1.00**	**No**
		PM	24.6	C	**0.91**	**No**
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	12.1	B	0.57	Yes
		PM	27.9	C	**0.87**	**No**
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	15.5	B	**0.98**	**No**
		PM	11.0	B	0.75	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	71.9	E	**>1.0**	**No**
		PM	60.6	E	**0.89**	**No**
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	11.5	B	0.79	Yes
		PM	47.5	D	>1.0	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	91.3	**F**	>1.0	**No**
		PM	79.1	**E**	>1.0	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

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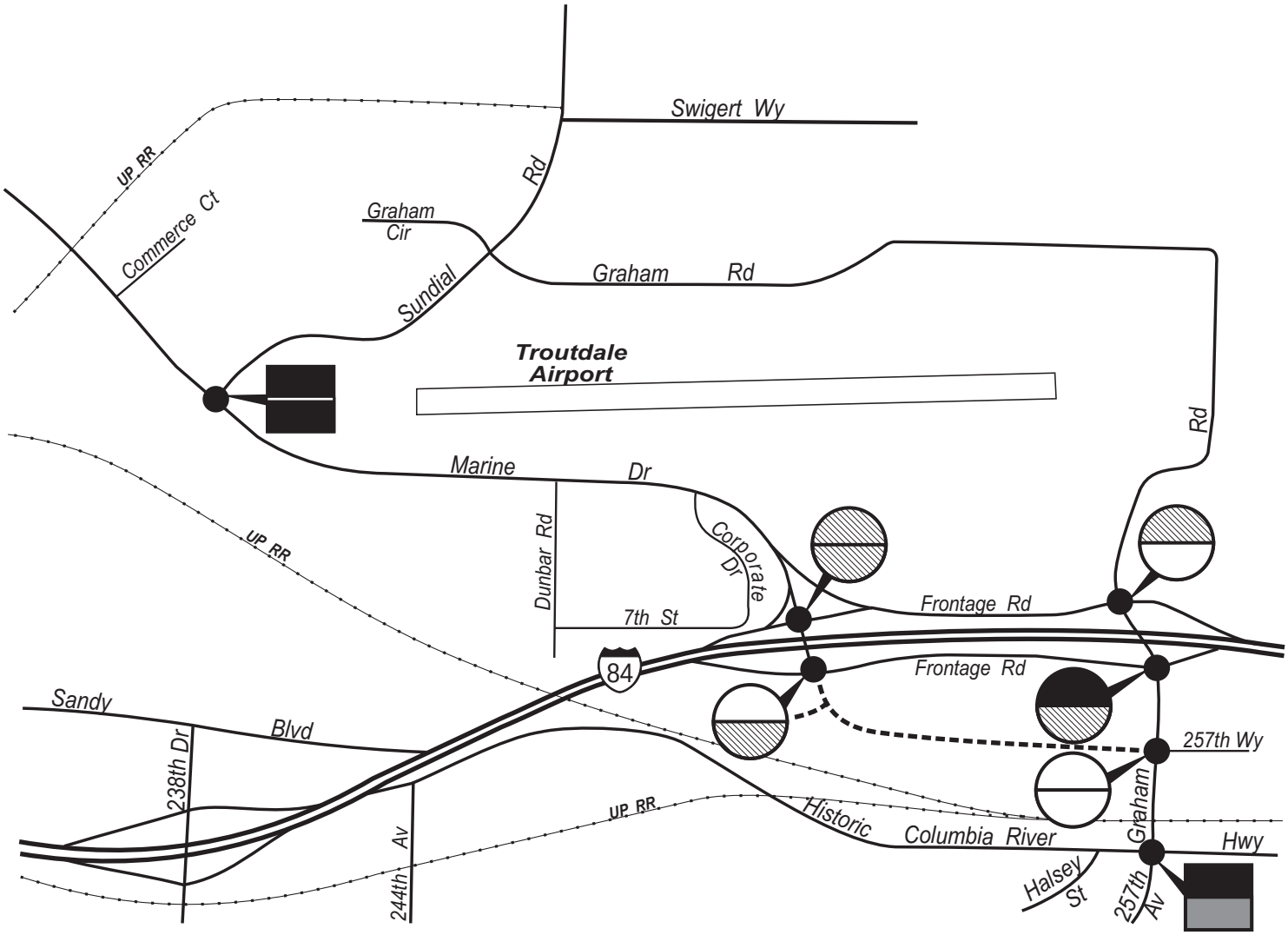
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 7

Alternative 4 - 2035 BASE + MARINE DRIVE EXTENSION

IAMP Intersections Failing To Meet Adopted Performance Measures

ALTERNATIVE 5: NO BUILD PLUS 238TH EXTENSION AND MARINE DRIVE EXTENSION

This section summarizes future 2035 AM and PM peak hour intersection operations at the I-84/257th interchange area study intersections for the 238th Extension and Marine Drive Extension alternative.

Isolated Intersection Evaluation (HCM Procedures)Table 9 summarizes 2035 AM and PM peak hour isolated intersection operations at study intersections. Assumed traffic volumes, lane geometries and traffic control for Alternative 5 are summarized in the Appendix. Performance for Alternative 5 is summarized in Figure 8. During the 2035 AM peak hour, all ODOT study intersections would meet ODOT intersection operating standards under the Marine Drive Extension with 238th Extension alternative, except for the I-84 eastbound on-ramp/257th Avenue intersection. This intersection would require a design exception since it would not meet ODOT's Highway Design Manual threshold of 0.85. The only City/County study intersection that would operate at an acceptable LOS "D" or better during the AM peak hour based on HCM isolated capacity analysis is 257th Avenue/257th Way.

Table 9: Alternative 5 - 2035 No Build Plus 238th Extension and Marine Drive Extension Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	10.5	B	0.68	Yes
		PM	20.1	C	0.81	Yes
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	10.2	B	0.49	Yes
		PM	20.4	C	0.76	Yes
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	7.8	A	0.85	Yes
		PM	9.7	A	0.65	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	19.4	B	**0.97**	**No**
		PM	94.8	F	0.79	Yes
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	14.4	B	0.77	Yes
		PM	45.7	D	>1.0	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	69.6	**E**	0.97	**No**
		PM	69.9	**E**	1.00	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

All ODOT study intersections would meet ODOT peak hour intersection operating criteria during the 2035 PM peak hour under this alternative. However, the only City/County intersection that would meet LOS "D" during the PM peak hour is 257th Avenue/257th Way.

While the only design exception that would be required is for the I-84 eastbound on-ramp/257th Avenue during the AM peak hour, the City and County intersections would all operate poorly, with the exception of 257th Avenue/257th Way during the AM peak hour.

Under this alternative, all ODOT study intersections would operate acceptably during both the AM and PM peak hours, with the exception of the I-84 eastbound on-ramp/257th Avenue during the AM peak hour. A design exception would be required at this intersection since it would not meet ODOT's Highway Design Manual standard, which requires the intersection to be designed to operate at a volume-to-capacity ratio of 0.85 or lower. While, the need for only one design exception during one peak hour at the interchange is reasonably good, two of the City/County intersections would operate poorly during both peak hours. Two City/County study intersections would operate at worse than HCM LOS "D" during both of the AM and PM peak periods, with the only City/County intersection to meet City of Troutdale peak hour operational requirements being 257th Avenue/257th Way during both the AM and PM peak hours.

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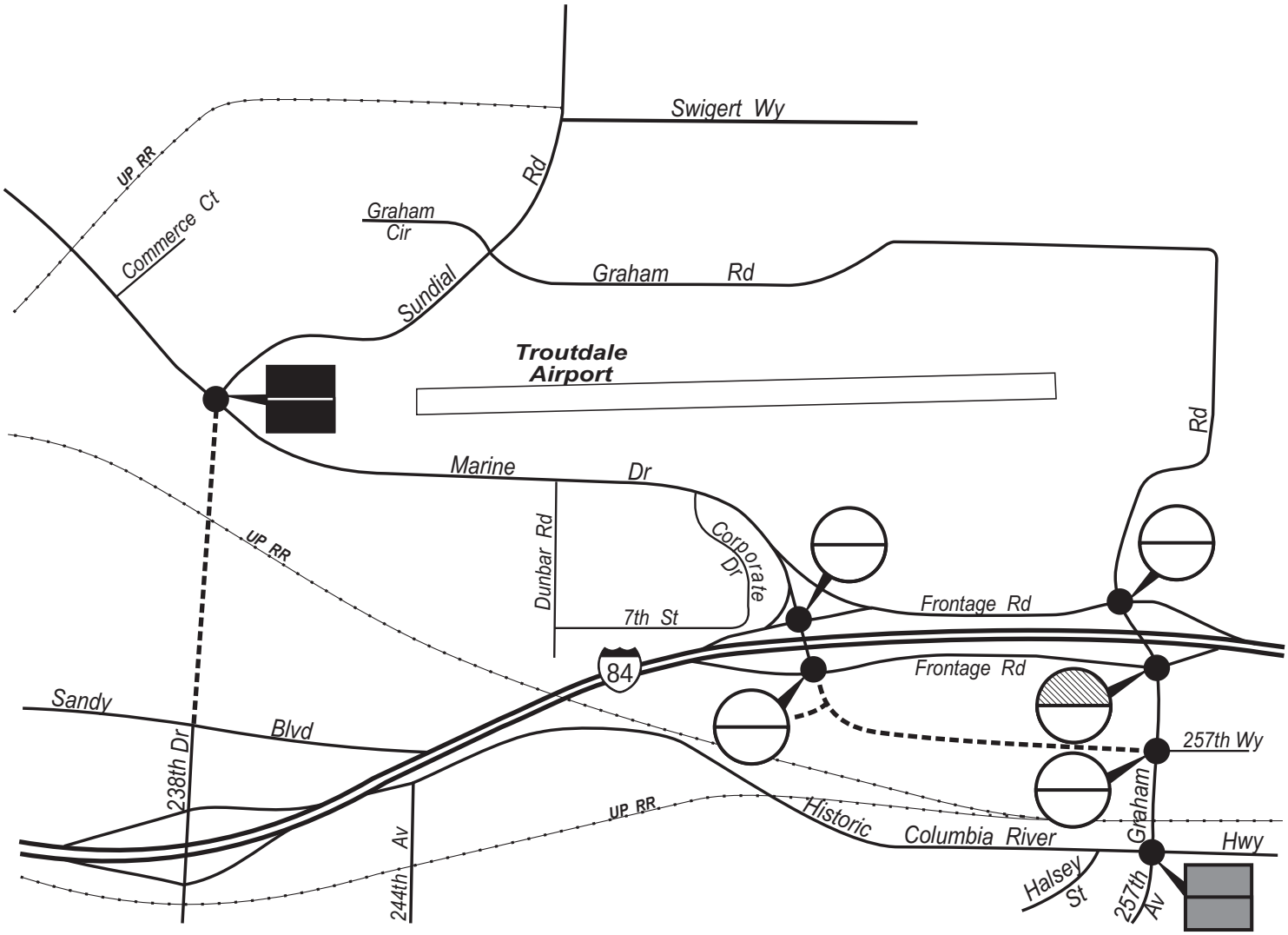
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 8

Alternative 5 - 2035 BASE + MARINE DRIVE EXTENSION + 238TH EXTENSION

IAMP Intersections Failing To Meet Adopted Performance Measures

ALTERNATIVE 6: MARINE DRIVE TWO-WAY AND MARINE DRIVE EXTENSION

The next alternative combines the 2035 No Build plus Marine Drive Two-Way and Marine Drive Extension. The resulting performance shows two of the ODOT study intersections would meet ODOT intersection operating standards under the Marine Drive Two-Way plus Marine Drive Extension alternative and two intersections would not. The intersections at the I-84 westbound off-ramp/Graham Road and at the I-84 eastbound on-ramp/257th Avenue would require design exceptions since they would not meet ODOT's Highway Design Manual threshold of 0.85 during the AM peak hour. In fact, the intersection at I-84 eastbound one-ramp/257th Avenue is expected to have a demand higher than its capacity. Additional improvements would be required at this intersection. The only City/County study intersection that would operate at an acceptable LOS "D" or better during the AM peak hour based on HCM isolated capacity analysis is 257th Avenue/257th Way.

Table 10: Alternative 6 - 2035 No Build Plus Marine Drive Two Way and Marine Drive Extension Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	12.1	B	0.77	Yes
		PM	25.0	C	**0.92**	**No**
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	12.7	B	0.53	Yes
		PM	26.2	C	0.84	Yes
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	9.1	A	**0.87**	**No**
		PM	9.5	A	0.68	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	30.9	C	**>1.0**	**No**
		PM	61.7	E	0.84	Yes
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	12.7	B	0.78	Yes
		PM	49.9	D	>1.0	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	77.1	**E**	>1.0	**No**
		PM	75.0	**E**	1.00	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

All but one ODOT study intersection would meet ODOT peak hour intersection operating criteria during the 2035 PM peak hour under this alternative. The intersection that would not meet ODOT's operating criteria is the I-84 westbound on-ramp at Marine Drive. This intersection would require additional improvements or a design exception. Again, the only City/County intersection that would meet LOS "D" during the PM peak hour is 257th Avenue/257th Way.

Under this alternative, all ODOT study intersections would operate acceptably during both the AM and PM peak hours, with the exception of the I-84 eastbound on-ramp/257th Avenue and I-84 westbound off-ramp/Graham Road intersections during the AM peak hour and the I-84 westbound on-ramp/Marine Drive intersection during the PM peak hour. A design exception would be required at each of these intersections since they would not meet ODOT's Highway Design Manual standard, which requires the intersection to be designed to operate at a volume-to-capacity ratio of 0.85 or lower. Two City/County study intersections would operate at worse than HCM LOS "D" during both of the AM and PM peak periods, with the only City/County intersection to meet City of Troutdale peak hour operational requirements being 257th Avenue/257th Way during both peak hours.

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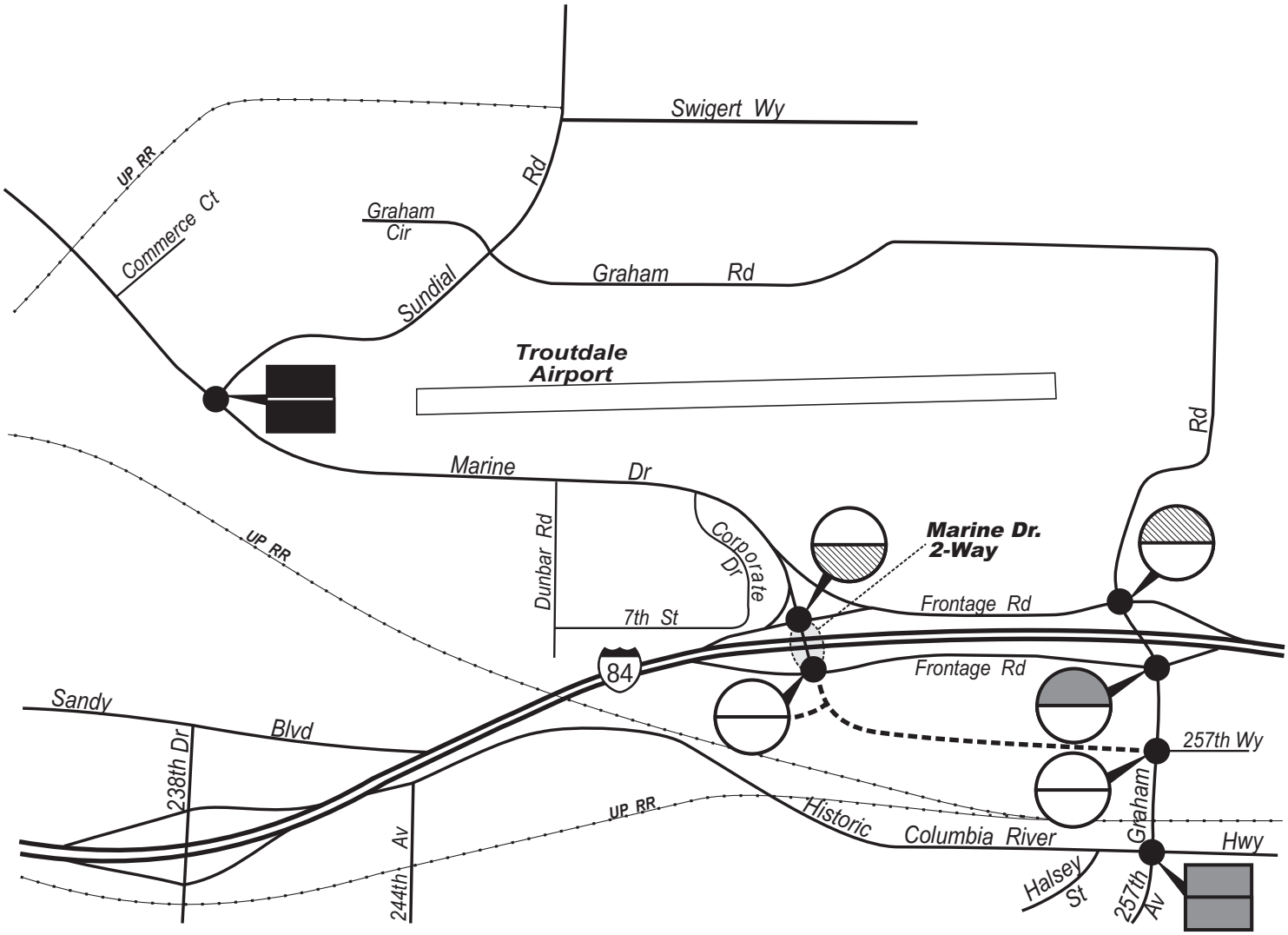
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 9

Alternative 6 - 2035 BASE + 2-Way MARINE DRIVE + MARINE DRIVE EXTENSION

IAMP Intersections Failing To Meet Adopted Performance Measures

ALTERNATIVE 7: 238TH EXTENSION AND MARINE DRIVE EXTENSION

The final alternative combines the 238th Extension (Alt. 1) and the Marine Drive Extension (Alt. 5). We found that all ODOT study intersections would meet ODOT intersection operating standards under this alternative, except for the I-84 eastbound on-ramp/257th Avenue intersection. This intersection would require a design exception since it would not meet ODOT's Highway Design Manual threshold of 0.85. The only City/County study intersection that would operate at an acceptable LOS "D" or better during the AM peak hour based on HCM isolated capacity analysis is 257th Avenue/257th Way.

All ODOT study intersections would meet ODOT peak hour intersection operating criteria during the 2035 PM peak hour under this alternative. However, the only City/County intersection that would meet LOS "D" during the PM peak hour is 257th Avenue/257th Way.

Table 11: Alternative 7 - 2035 No Build Plus 238th Extension, Marine Drive Two Way and Marine Drive Extension Design Hour Intersection Operations (AM/PM Peak Hours)

Intersection	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Traffic Signal Control						
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
I-84 WB On-Ramp/Marine Drive	0.85 V/C	AM	10.6	B	0.68	Yes
		PM	20.7	C	0.82	Yes
I-84 EB Off-Ramp/Marine Drive	0.85 V/C	AM	11.5	B	0.49	Yes
		PM	20.3	C	0.76	Yes
I-84 WB Off-Ramp/Graham Road	0.85 V/C	AM	8.2	A	0.85	Yes
		PM	9.7	A	0.65	Yes
I-84 EB On-Ramp/257th Avenue	0.85 V/C	AM	21.4	C	**0.97**	**No**
		PM	95.7	F	0.79	Yes
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
Marine Dr/ Sundial Road	LOS D	AM	>80.0	**F**	>1.0	**No**
		PM	>80.0	**F**	>1.0	**No**
257th Avenue/257th Way	LOS D	AM	14.8	B	0.77	Yes
		PM	45.7	D	>1.0	Yes
257th Avenue/Historic Columbia River Highway	LOS D	AM	69.1	**E**	0.97	**No**
		PM	71.1	**E**	1.00	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

While the only design exception that would be required is for the I-84 eastbound on-ramp/257th Avenue during the AM peak hour, the City and County intersections would all operate poorly, with the exception of 257th Avenue/257th Way during the AM peak hour.

Under this alternative, all ODOT study intersections would operate acceptably during both the AM and PM peak hours, with the exception of the I-84 eastbound on-ramp/257th Avenue during the AM peak hour. A design exception would be required at this intersection since it would not meet ODOT's Highway Design Manual standard, which requires the intersection to be designed to operate at a volume-to-capacity ratio of 0.85 or lower. While, the need for only one design exception during one peak hour at the interchange is reasonably good, two of the City/County intersections would operate poorly during both peak hours. The only City/County intersection that would meet City of Troutdale peak hour operational requirements is 257th Avenue/257th Way during both peak hours.

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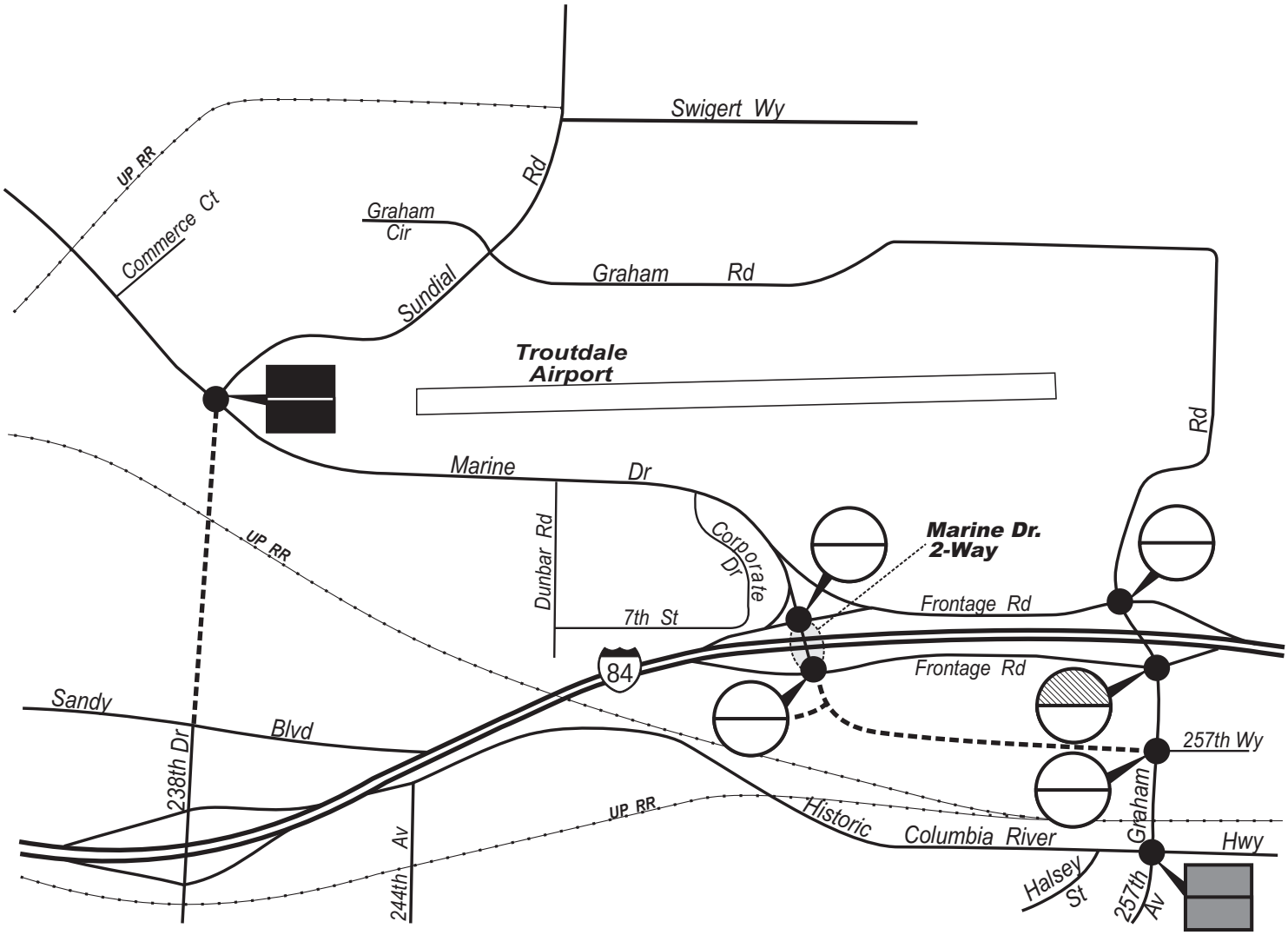
NO SCALE



LEGEND

- Study Intersection
- Planned Roadway

Intersection V/C

- **≤ 0.85** - *Meets V/C Standard*
- **0.85-1.0** - *Approaching Capacity*
- **1.01-1.10** - *Heavily Congested*
- **>1.10** - *Excessive Congestion*
- **AM** / **PM** - Peak Hour

Intersection LOS

- **A-D** - *Meets LOS Standard*
- **E** - *Approaching Capacity*
- **F** - *Exceeding Capacity*
- **AM** - Peak Hour
- **PM** - Peak Hour

Figure 10

Alternative 7 - 2035 BASE + 2-Way MARINE DRIVE + MARINE DRIVE EXTENSION + 238TH EXTENSION

IAMP Intersections Failing To Meet Adopted Performance Measures

MARINE DRIVE/SUNDIAL ROAD

The intersection of Marine Drive/Sundial Road is problematic (LOS F) in all future alternative scenarios for both AM and PM peak hours. Based on Multnomah County's operating standard, the intersection would need to operate at level of service D to function acceptably. Previous analysis (Troutdale Reynolds Industrial Park – Phase II Analysis) did not indicate as much of a problem at this intersection because that study assumed an improved connection to the interchange via Graham Road and because that study did not consider growth out to 2035. The improvements required on Graham Road to accommodate truck traffic are not funded and, therefore, this study assumes that all truck traffic will access TRIP via Marine Drive/Sundial Road.

Analysis was conducted to determine what improvements would be required at this intersection for it to operate acceptably. Even with two through lanes, a left turn lane and a right turn lane on every approach, the intersection would not meet the County's standard during the AM or PM peak hour in 2035. It was determined that the intersection could reasonably be expected to be constructed to include the following:

- Two through lanes each direction on Marine Drive (one new through lane each direction)
- Left turn lanes each direction on Marine Drive (existing)
- Westbound right turn lane on Marine Drive at Sundial Road (existing, may need to be extended)
- One through lane each direction on Sundial Road/238th Extension (238th approach would be new)
- Left turn lanes each direction on Sundial Road/238th Extension (238th approach would be new)
- Right Turn lane on Sundial Road southbound (new – only needed for alternative that includes the 238th Extension)

Table 12 summarizes intersection level of service conditions for four key alternatives, assuming the geometry described above. Since the Marine Drive Extension has no bearing on traffic volumes at this intersection, traffic volumes for the No Build Alternative are identical to Alternative 4. Similarly, Alternatives 1 and 5, 2 and 6, and 3 and 7 have identical traffic volumes.

Since the ultimate planned geometry described above is as big as this intersection can reasonably be built, it is recommended that improvements be made to the east end of Graham Road to safely accommodate truck traffic between the TRIP area and the east end of the interchange. Specifically, the two sharp curves should be straightened so that trucks can safely maneuver.

Table 12: Marine Drive/Sundial Road Intersection Level-of-Service (AM/PM Peak Hours)

Alternative	Minimum Operating Standard (City/County, ODOT)	Peak Hour	Operating Conditions			Minimum Standard Met?
			Delay[1]	*Level of Service*	*Volume-to-Capacity Ratio*	
Multnomah County/City of Troutdale Facilities – Level of Service Determines Performance Standard						
No Build (Same as Alt. 4)	LOS D	AM	92.4	**F**	1.14	**No**
		PM	58.0	**E**	1.05	**No**
Alternative 1 (Same as Alt. 5)	LOS D	AM	107.0	**F**	1.13	**No**
		PM	78.1	**E**	0.99	**No**
Alternative 2 (Same as Alt. 6)	LOS D	AM	92.8	**F**	1.14	**No**
		PM	58.0	**E**	1.05	**No**
Alternative 3 (Same as Alt. 7)	LOS D	AM	103.5	**F**	1.13	**No**
		PM	75.4	**E**	0.94	**No**

Bold – indicates intersections not meeting performance standard

[1] Average Stopped Delay per Vehicle

MARINE DRIVE/SUNDIAL ROAD ROUNDABOUT ALTERNATIVE

A roundabout was considered at Marine Drive/Sundial Road for the 2035 No Build condition and Alternative 1. The other alternatives don't vary significantly, in terms of volume at this intersection, from these two alternatives. Due to the forecasted traffic volumes, it would need to be at least a two lane roundabout. Even as a two-lane roundabout, and especially considering the percentage of truck traffic that would use the intersection, a roundabout would not operate acceptably at this location. This is primarily due to the conflict between westbound through traffic on Marine Drive and eastbound traffic turning north onto Sundial Road.

SUMMARY OF FUTURE ALTERNATIVES

Seven alternatives were considered, with the primary components including the following improvements:

- 238th Extension (new three lane connection extending the existing 238th Avenue north from Sandy Boulevard to Marine Drive)
- Marine Drive Two-Way (widens Marine Drive under I-84 to accommodate two-way traffic between South Frontage Road and North Frontage Road)
- Marine Drive Extension (new connection south east from Marine Drive/South Frontage Road to 257th Avenue at 257th Way)

Each of these improvements provides some benefit to the interchange area. In all cases, the intersections at Sundial Road/Marine Drive and 257th Avenue/Historic Columbia River Highway did not fare well. Additional capacity would be required at the Sundial Road/Marine Drive intersection. However, it was determined that it would not be reasonable to expand the intersection to accommodate all forecasted traffic volumes. It is recommended that the intersection be built to accommodate a five-lane section on Marine Drive, plus a westbound right turn lane and a three lane section on Sundial Road and the 238th Extension if and when it is built. In addition, it is recommended that Graham Road be improved to the east so that truck traffic could use it as an alternative access the east end of the interchange. If and when the 238th Extension is built, a southbound right turn lane on Sundial Road would likely be needed.

It was determined that the 257th Avenue/Historic Columbia River Highway intersection is already built to its ultimate configuration. Any additional improvements to that intersection would not be feasible or would be unreasonably expensive. While the intersection is expected to operate at or near capacity during both peak periods in 2035, no additional improvements were identified there.

The alternatives that perform the best are those that include the 238th Extension (Alternatives 1, 3, 5 and 7). In fact, the alternative that performs the best overall is Alternative 5, which includes the 238th Extension and the Marine Drive Extension. While the 238th Extension is included in Metro's 2035 RTP, the project faces many obstacles. It is both politically and technically challenging as well as expensive.

The Marine Drive Two-Way project (Alternatives 2, 3, 6 and 7) provides benefits similar to the 238th Extension project, especially for vehicles headed to or from the Troutdale Reynolds Industrial Park (TRIP) area. Both provide a more direct connection to and from the west (Portland), eliminating the need for traffic to travel through all four of the I-84/257th Interchange intersections. While the benefits of the Marine Drive Two-Way project are not as good, in terms of intersection performance at the interchange, the project is politically and technically simpler and probably less expensive than the 238th Extension. It was found that the Marine Drive Two-Way and 238th Extension projects are redundant in some ways

(both offering a more direct route to and from the west) and should not be considered in parallel (eliminating Alternative 3) for the near term.

While the Marine Drive Extension (Alternatives 4, 5, 6 and7) really only provides relief to the 257th Avenue/South Frontage Road/I-84 EB On-Ramp intersection during the PM peak hour, it does serve an important function. It removes some of the local traffic/through traffic conflicts and some of the auto/truck conflicts along South Frontage Road. This improvement does improve interchange performance very much on its own (eliminate Alternative 4), but it does work well in conjunction with either the 238th Extension or Marine Drive Two-Way improvements.

Considering the complexities of the 238th Extension and the more tangible interchange intersection benefits of the Marine Drive Two-Way project compared to the Marine Drive Extension project, it is recommended that Alternative 6 be pursued with the Marine Drive Two-Way project taking precedent over the Marine Drive Extension project. Improvements at Marine Drive/Sundial should be made as funding and or other opportunities (i.e. development) become available.

Ultimately, the 238th Extension does provide an important linkage in the area. It provides a more direct route between the TRIP area and the Portland metropolitan area. This important connection should continue to be pursued as a long term solution.

ACCESS MANAGEMENT PLAN

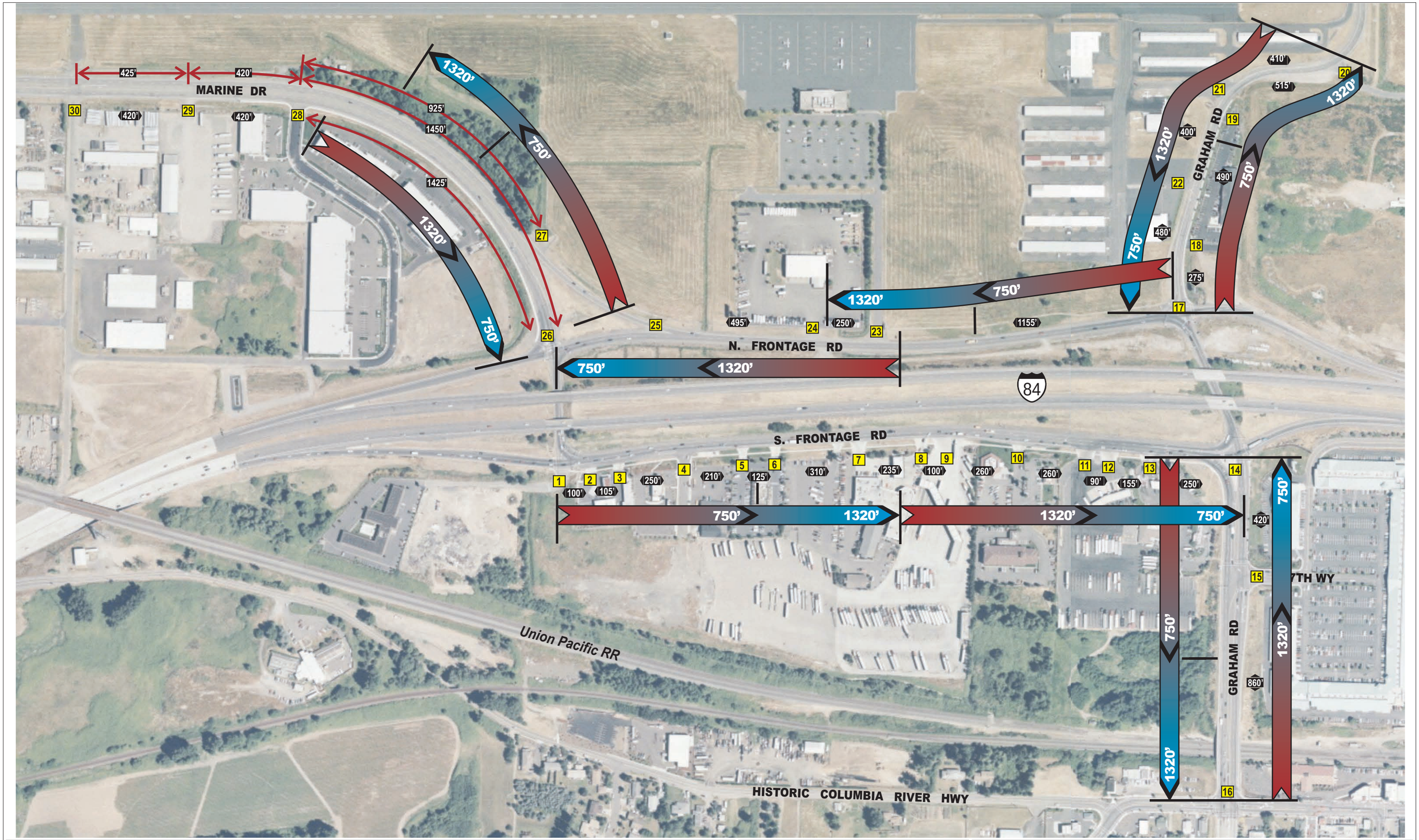
A key element of the IAMP related to the long-range preservation of operational efficiency and safety of the proposed interchange improvement is the management of access to the interchange crossroads (Marine Drive and Graham Road / 257th Drive), as well as to the mainline (Interstate 84). Because access points introduce a number of potential vehicular conflicts on a roadway and are frequently the causes of slowing or stopping vehicles, they can significantly degrade the flow of traffic and reduce the efficiency of the transportation system. However, by reducing the overall number of access points and providing greater separation between them, the impacts of these conflicts can be minimized.

No specific access changes are recommended as part of this plan. However, additional access points should not be allowed where they would result from future land partitions or subdivisions.

To provide a basis for decision-making when properties within the IAMP area develop or redevelop, an access management strategy was established. The objectives of this plan are listed below.

1. Restrict all access from abutting properties to the interchange and interchange ramps.
2. Meet, or move in the direction of meeting, ODOT adopted access management spacing standards for access to interchange crossroads. Figure 11 illustrates how these standards apply to the I-84/257th Interchange.
3. A maximum v/c ratio of 0.85 at the ramp terminals as per Policy 1F.1 of the Oregon Highway Plan.
4. Meet, or move in the direction of meeting, the City of Troutdale's adopted access management guidelines on Management Area roadways maintained by the city. This would require access spacing of at least 530 feet between adjacent driveways and/or streets on the same side of the roadway on arterials and 150 feet on collectors[14].
5. In attempting to meet access management spacing standards, exceptions may be allowed to take advantage of existing property boundaries and existing or planned public streets, and to accommodate environmental constraints.
6. Relocate private approaches on South Frontage Road onto other public streets, where feasible, to provide consolidated access to multiple properties.
7. Ensure all properties impacted by the project are provided reasonable access to the transportation system.
8. Align approaches on opposite sides of roadways where feasible to reduce turning conflicts.
9. Short-range actions shall accommodate existing development needs, unless property is to be purchased by ODOT.

[14] *Troutdale Transportation System Plan*, 2005, Table 4-15: Recommended Access Spacing Standards for City Street Facilities.


MARINE DR
N. FRONTAGE RD
S. FRONTAGE RD
GRAHAM RD
GRAHAM RD
7TH WY
Union Pacific RR
HISTORIC COLUMBIA RIVER HWY
84
425'
420'
420'
420'
925'
1450'
1425'
1320'
750'
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750'
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1320

ALTERNATIVE EVALUATION AND PRIORITIZATION

With improvement alternatives identified, an evaluation of their ability to achieve the project goals will be provided, followed by a prioritization of successful alternatives to guide implementation.

ALTERNATIVE EVALUATION

Using the evaluation criteria developed for the I-84/257th IAMP outlined previously (see Tech Memo #2), the alternatives proposed were evaluated to ensure the goals established at the outset of the project would be met. The objectives used included criteria related to safety, livability, mobility, and feasibility. The results of this evaluation have been provided in the Appendix.

PRIORITIZATION OF IMPROVEMENTS

The improvement alternatives recommended as part of this IAMP have been categorized, as shown in Table 13, to provide guidance for future implementation and funding. Committed/Short-Term improvements represent immediate needs and are currently being planned and implemented or should be in the next 1-5 years. Priority improvements represent those longer-term improvements that should be pursued next. These projects typically represent improvements of less immediate priority or requiring higher levels of funding. These improvements should be planned for construction within 5 to 20 years. Another group of improvements is listed that should be pursued "as Opportunities Arise." These projects are not needed immediately, but should be pursued as development and/or redevelopment occur. The improvements listed in Table 13 have also been illustrated in a Transportation Improvements Map (Figure 12) for the IAMP area.

It should be recognized that this prioritization of projects is not intended to imply that projects of higher priority must be implemented before projects of lower priority. Should opportunities arise, through private land development or other means, to construct specific projects earlier than the estimated time frame provided by this list, those resources should used.

Table 13: Transportation Improvement Prioritization

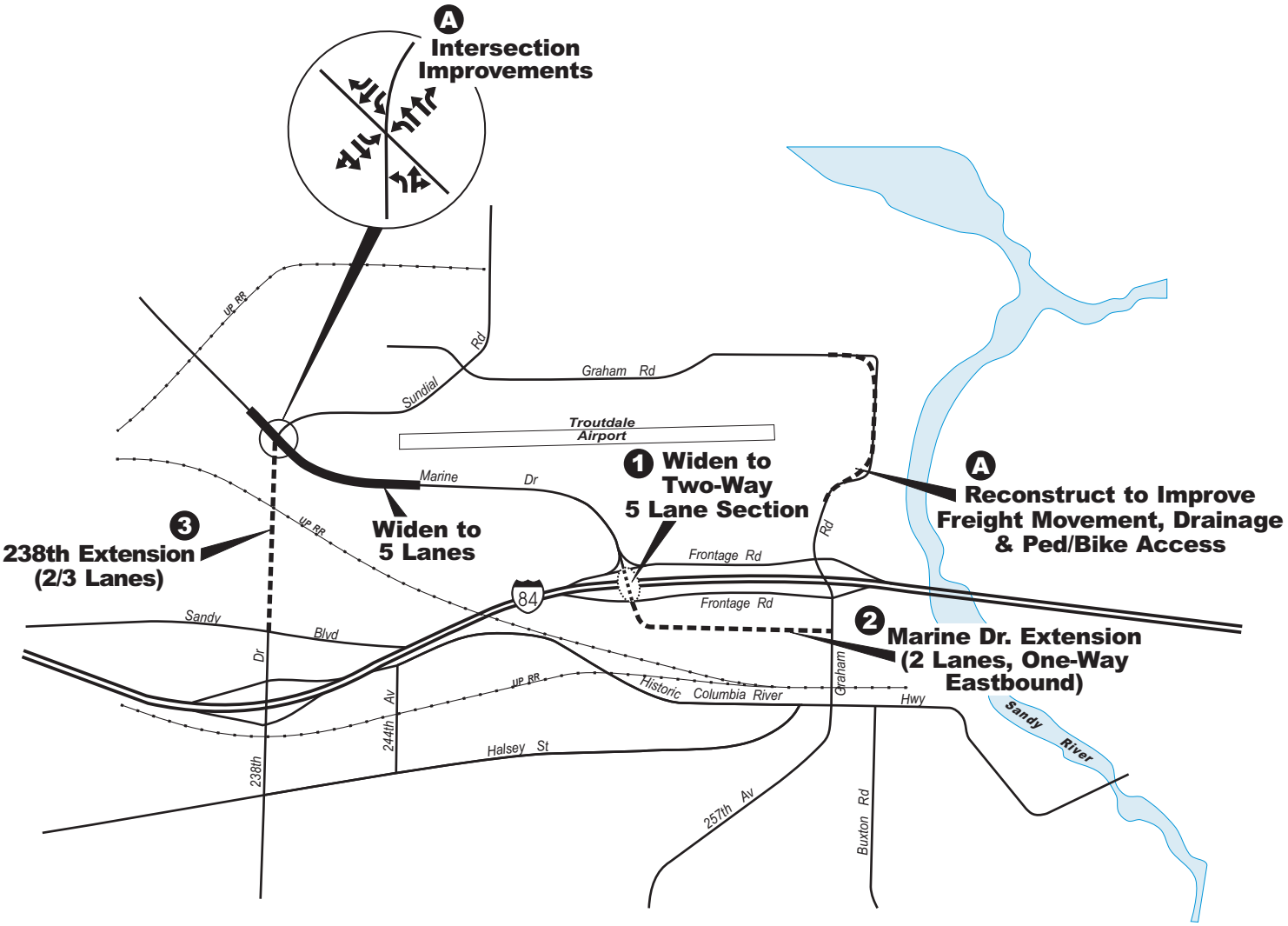
Committed/Short-Term Improvements
• Planned reconstruction of I-84/257th interchange (Project A) • Recommendations from South Frontage Road Access Management Plan   ○ To be determined
Priority Improvements

• Highest Priority - Project B (Marine Drive Two-Way) Improvements:
  ○ EB left turn lane at Marine Drive/I-84 Eastbound Off-Ramp
  ○ Reconstruct I-84 structure to accommodate 5-lane Marine Drive between South Frontage Road and North Frontage Road
  ○ WB left turn lane at Marine Drive/North Frontage Road
• Second Priority - Marine Drive Extension
• Third Priority - Construct 238th Extension

Other Improvements (as Opportunities Arise)

• Additional capacity at Marine Drive/Sundial Road
  ○ Widen Marine Drive to five lanes between existing five lane section east of Sundial Road to Sundial Road (~2,150 feet)
  ○ Dedicated right turn lane westbound on Marine Drive
  ○ Construct five lane section on Marine Drive to 500 feet west of Sundial Road (plus taper)
  ○ Add southbound right turn lane on Sundial Road (if/when 238th Extension built)
• Improve Graham Road east end curves
• Work toward Access Management Plan (Figure 11) as opportunities arise via development and/or redevelopment

Note: Any improvements could be constructed sooner than anticipated as opportunities arise through private property development or other means.



LEGEND

- # - Prioritized Improvements
- A - As Opportunities Arise
- ----- - New Connector

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NO SCALE

Figure 12

TRANSPORTATION IMPROVEMENTS MAP

COST ESTIMATES

Planning-level cost estimates for the components of the recommended improvement alternative are listed in Table 14 to aid in the identification of needed funding. Cost estimates generally include the fundamental elements of roadway construction projects, such as the roadway structure, bridge structures, curb and sidewalk, earthwork, retaining walls, right of way, pavement removal, and traffic signals. The estimated costs shown below are based on information provided by ODOT or the RTP, where available.[15] When considering needed funding to construct the identified improvements below, it should be recognized that local streets are typically constructed by land owners as development occurs.

Table 14: Planning-level cost estimates for recommended improvement alternatives

Component		Estimated Cost
Committed/Short Range Improvements		
	Project A Improvements (JTA funded)	$7,000,000
	South Frontage Road Access Management Plan	TBD
	Subtotal	**$7,000,000**
Priority Improvements		
	Project B Improvements (Marine Drive Two-Way)	$28,000,000
	Marine Drive Extension	$8,200,000
	238th Avenue Extension[16]	$14,500,000
	Subtotal	**$50,700,000**
Other Improvements		
	Marine Drive/Sundial Road Improvements	$8,100,000
	Graham Road Improvements	$4,600,000
	Subtotal	**$12,700,000**
	Total	***$70,400,000***

[15] Project A and Project B Improvement cost information provided by ODOT. Marine Drive Extension and 238th Avenue Extension costs obtained from the 2035 RTP Financially Constrained list, amended 05/19/08. South Frontage Access Management Plan and Marine Drive/Sundial Road Improvements provided by DKS Associates and should be considered very preliminary.

[16] Cost estimate obtained from Metro's Regional Transportation Plan. Cost estimate should be considered very preliminary and could be substantially higher due to significant issues including railroad crossing, environmental issues/mitigation and property acquisition.

SUMMARY AND CONCLUSIONS

The I-84/257th interchange will fail in 2035 without added improvements. Analysis has been conducted to determine the best sequence of projects based on interchange needs, feasibility and cost. The following summarizes a set of Committed Improvements, a set of Prioritized Improvements and a set of improvements to be pursued As Opportunities Arise. The Committed Improvements are being planned and implemented in the near term to provide immediate relief to the interchange. The Prioritized Improvements will be needed soon and should be pursued in the order recommended as funding and other opportunities arise and as part of a longer term strategy for projects in the area.

COMMITTED/SHORT TERM IMPROVEMENTS

The current Jobs and Transportation Act (JTA) has provided funding for what ODOT has called "Project A" improvements. These are expected to be constructed in the very near term (next 1-2 years) and include the following specific projects:

- "Project A" Improvements:
  - Third through lane on I-84 Eastbound Off-Ramp at Marine Drive
  - Third eastbound through lane on South Frontage Road between Marine Drive and 257th Avenue
  - Conversion of existing northbound through lane to 2nd northbound left turn lane at Graham Road/North Frontage Road
  - Northbound through lane at Graham Road/North Frontage Road (50')
  - Westbound right turn lane on I-84 westbound off-ramp at Graham Road (200')
  - Conversion of southbound right turn lane on Graham Road at North Frontage Road to "free right" into new third westbound through lane on North Frontage Road
  - Third westbound through lane on North Frontage Road
  - Westbound right turn lane on North Frontage Road at Marine Drive (replaces existing "free right" onto Marine Drive

The South Frontage Road Access Study was conducted to determine some short term improvements that could be constructed to improve operation of South Frontage Road in the near term. These improvements would be the first priority for implementation. However, a range of improvements were identified with a specific plan yet to be identified.

- South Frontage Road Access Management Plan Recommendations
  - To be determined

PRIORITIZED IMPROVEMENTS

Based on the analysis presented above, it was determined that providing more direct access between the Portland metropolitan area and the TRIP area improves interchange intersection operation more than the Marine Drive Extension. Considering information available regarding the feasibility of the 238th Avenue Extension project, it was determined that, the next major project to be built should be the Marine Drive Two-Way conversion project. This is the same as ODOT's "Project B."

- "Project B" Improvements:
  - Eastbound left turn lane on I-84 Eastbound Off-Ramp at Marine Drive
  - Two through lanes in each direction on Marine Drive between South Frontage Road and North Frontage Road
  - Northbound left turn lane on Marine Drive at North Frontage Road (50')
  - Westbound left turn lane on North Frontage Road at Marine Drive (500')
  - These improvements require the reconstruction of the I-84 eastbound and westbound bridge structures over Marine Drive

The next priority would then be to build the Marine Drive Extension to facilitate access for through traffic traveling from the Portland metropolitan area to Troutdale and areas south in the evening peak period.

- Marine Drive Extension
  - Construct two-lane, access controlled, high-speed roadway between Marine Drive/I-84 Eastbound Off-Ramp/South Frontage Road and 257th Avenue/257th Way

The 238th Extension project provides an important and direct connection between the Portland metropolitan area and the TRIP area. It would reduce out-of-direction travel for many trucks and other vehicles. It does, however, have a number of technical, political and cost constraints and is not likely to be constructed in the near future. Regardless of its constraints, it does provide benefit to the area and its feasibility should continue to be explored.

- 238th Extension
  - Construct two to three-lane roadway extending north from 238th Avenue between Sandy Boulevard and Marine Drive, creating a fourth approach to the Marine Drive/Sundial Road intersection

AS OPPORTUNITIES ARISE

Another key issue is the intersection at Marine Drive/Sundial Road. With growth in the TRIP area as well as background traffic growth, this intersection will fail in the future. This intersection should be monitored as growth occurs in the TRIP area. The following improvements could be considered long term improvements, but opportunities for building components of these improvements should be sought as the area develops.

- Marine Drive/Sundial Road Improvements:
  - 2nd through lane eastbound and westbound on Marine Drive (500' to east, ~2,150' to west to match existing 5-lane section)
  - Improved westbound right turn lane on Marine Drive at Sundial Road
  - Southbound right turn lane on Sundial Road (if/when the 238th Extension is built)
  - Improve Graham Road connection to east end of interchange by straightening curves so trucks can enter/exit TRIP area via this route

Appendix

Technical Memorandum #4: Transportation Improvement Investment Study

Appendix A

Model Assumptions/Model Network Refinement

Model Assumptions

Metro's regional travel demand model is divided into 2,013 small, internal geographic areas called Transportation Analysis Zones (TAZs) containing information related to base and future year households and employment. TAZs represent locations where individual trips begin or end (origins and destinations). There are also 15 external stations, which are similar to TAZs, but are located around the perimeter of the model area and represent origins and destinations associated with large geographic areas beyond the limits of the model. Figure 1 displays the model TAZ network against the existing transportation system through the City of Troutdale and the IAMP Study Area.

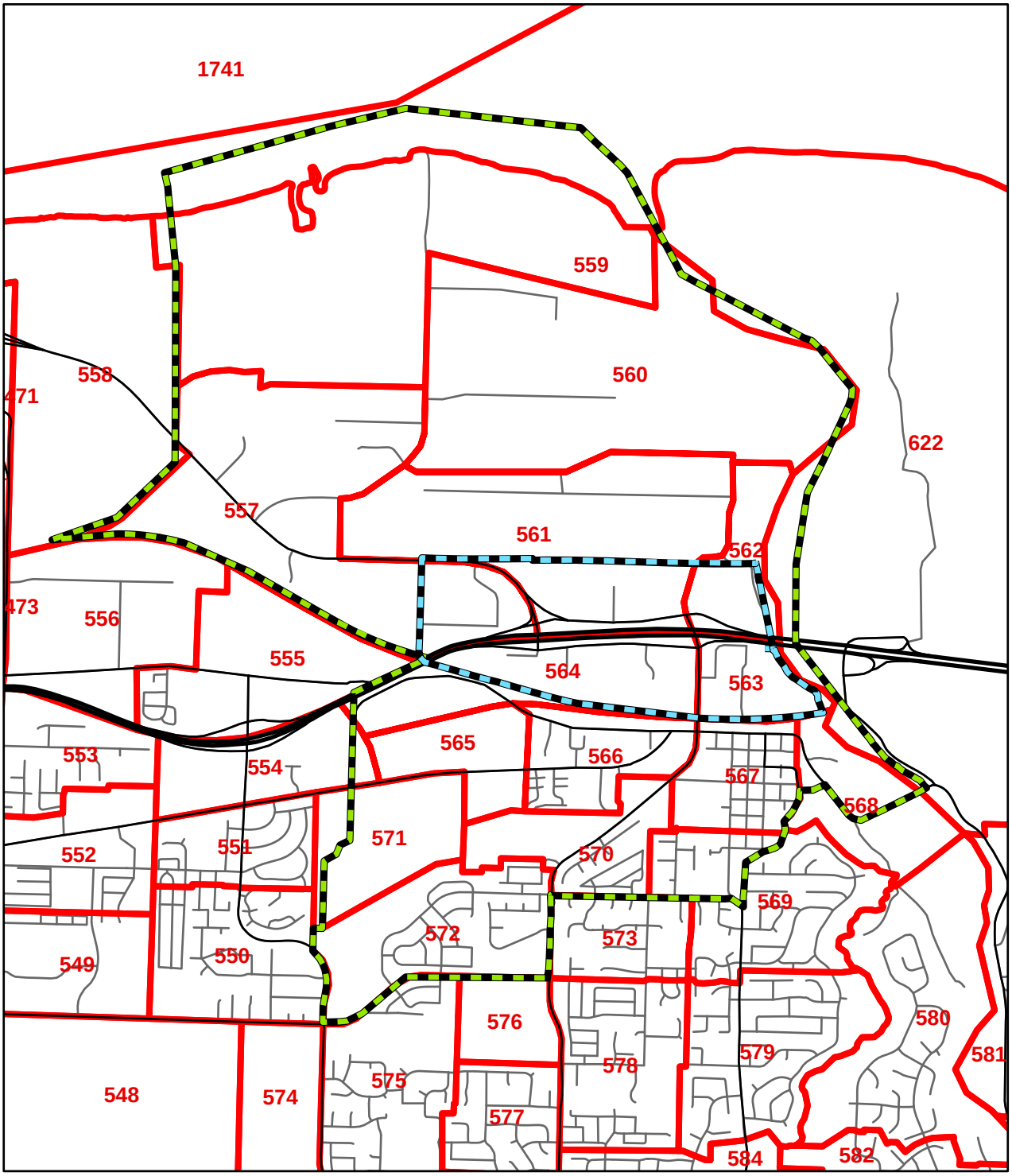
Trip generation associated with each TAZ is based on household characteristics, such as household size and number of workers, and trip purposes, such as home-based trips (e.g. home to work, school, shopping, and recreation) or non-home-based trips. Therefore, the number of trips generated during a given scenario is primarily dependent on the assumed quantity and locations of housing and employment. Table 1 presents the total number of households and employees (separated into retail and other) assumed to be present within the study area for the base year 2005 and future year 2035 scenarios. It also compares them to show the growth expected over this planning period. Also, Figure 2, Figure 3, and Table 1 show the growth in housing and employment by TAZ within the study area.

Table 1: Assumed Household and Employment Quantities within Study Area

	Households	Retail Employees*	Service Employees*	Other Employees*	Total Employees*
Base Year 2005	1,750	1,763	322	1,842	3,927
Future Year 2035	2,842	3,176	1,378	4,694	9,248
Growth (2005 – 2035)	***+1,092***	***+1,413***	***+1,056***	***+2,852***	***+5,321***
Growth (% increase)	***(+62%)***	***(+80%)***	***(+328%)***	***(+155%)***	***(+135%)***

* Note that these quantities represent Metro's forecasts for the IAMP Study Area – employment and trip generation forecasts for the Troutdale Reynolds Industrial Park (TRIP) were accounted for separately, since specific detail was available for that area (discussed below).

The generated trips calculated from this information are distributed between TAZs in consideration of each TAZ's trip production and relative attractiveness. The attractiveness of a TAZ as a destination is determined by travel times from origin TAZs and the types of employment and number of households contained within the potential destination TAZ. Origins and destinations can be associated with either TAZs or external stations.



Legend

- Management Area
- Study Area
- Metro TAZ
- streets

N
W E
S

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Sources: Metro (TAZ's)
Regional Land Information System (RLIS)

Figure 1
Model Transportation Analysis Zone System (TAZ's)

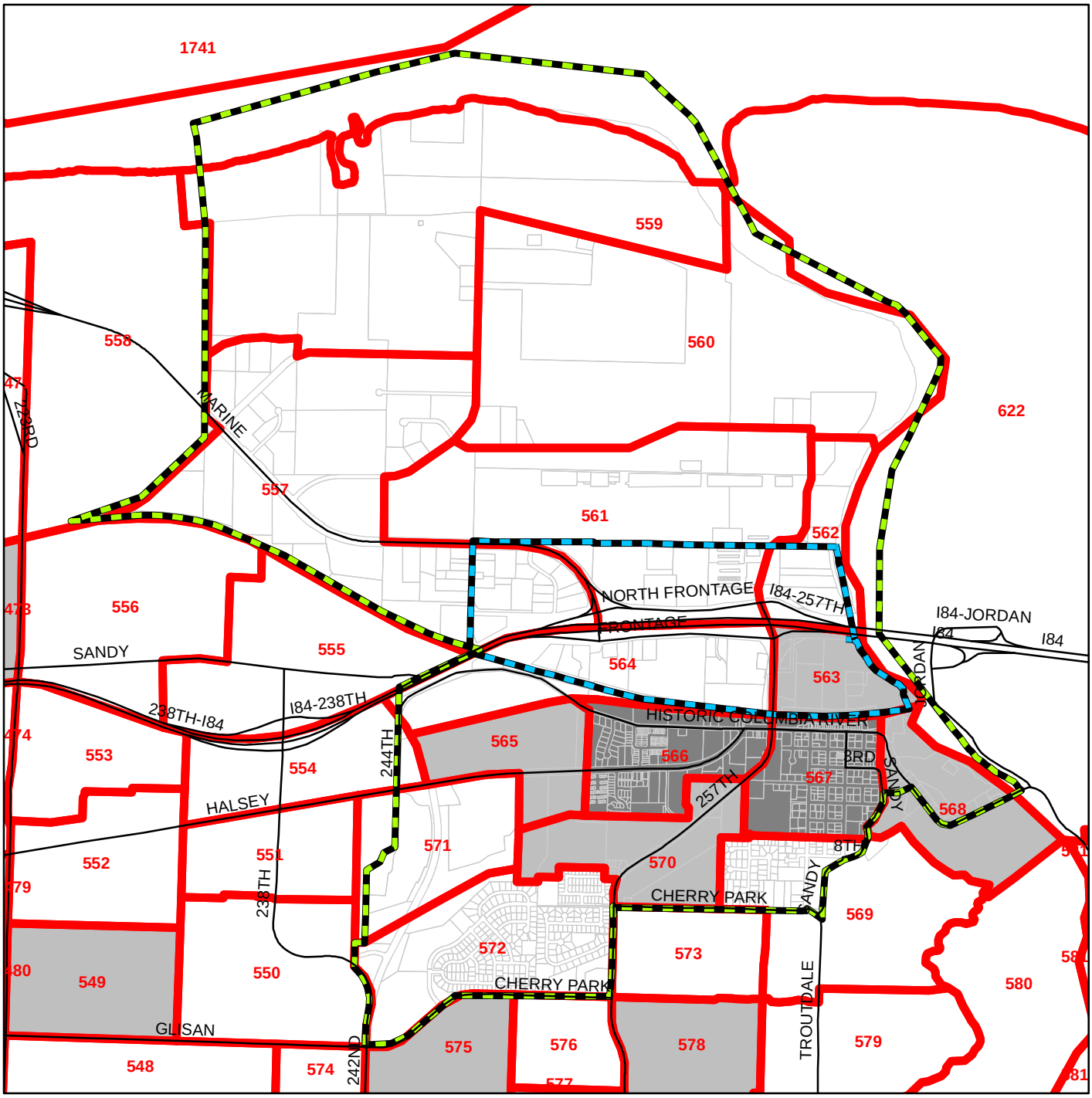

Figure 2: Household Growth per Acre by TAZ (Transportation Analysis Zone)

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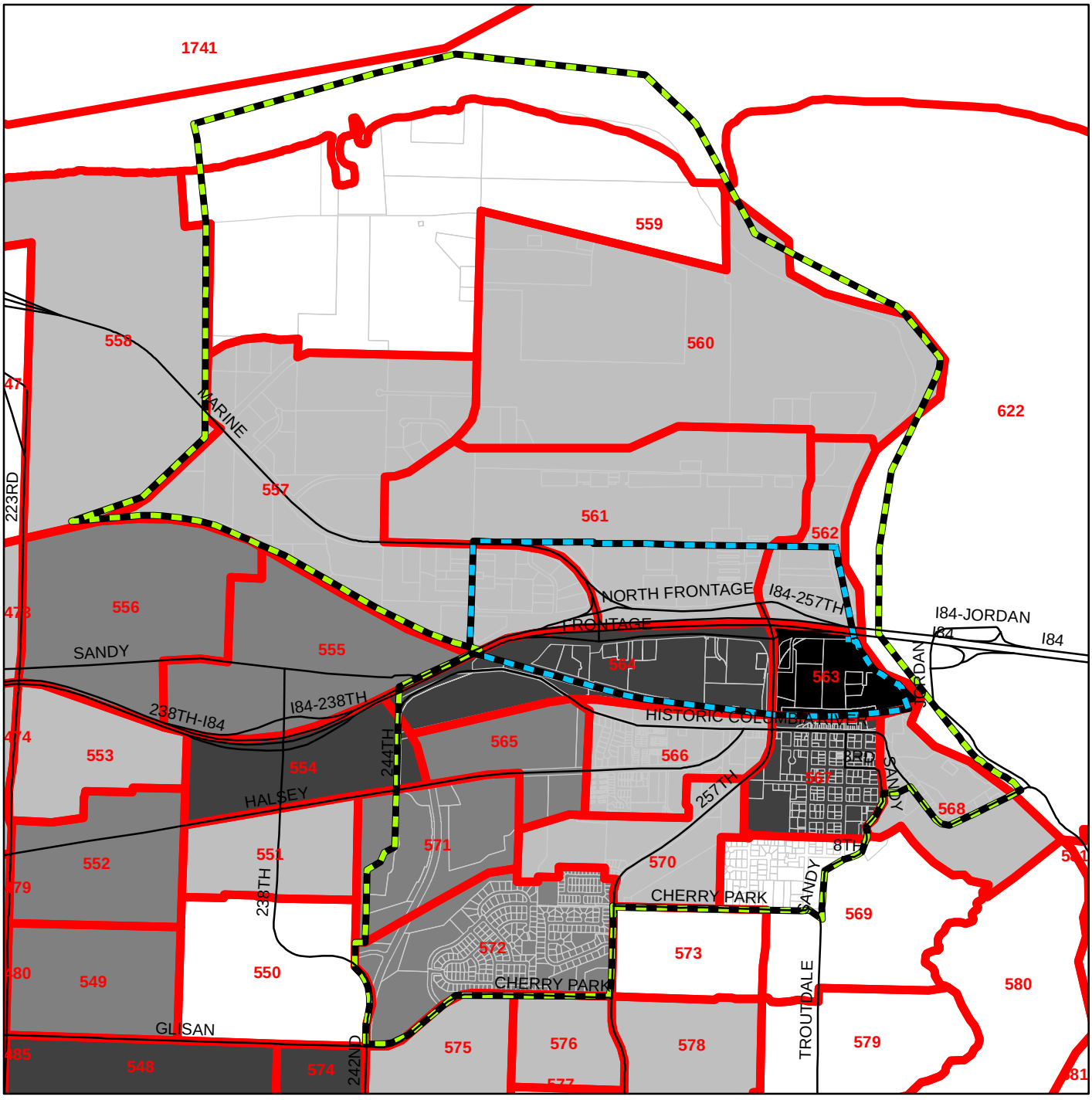

Legend

- Study Area
- Management Area
- Metro TAZ

Employment Growth (2005-2035) per Acre

- Little/No Growth
- 1 - 2 Emp/Acre
- 3 - 5 Emp/Acre
- 6 - 10 Emp/Acre
- Over 10 Emp/Acre

N
W E
S

Figure 3: Employment Growth per Acre by TAZ (Transportation Analysis Zone)

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Model Network Refinement

The base year 2005 and future year 2035 model scenarios included different street networks, with the base year network closely resembling the existing transportation system and the future year network reflecting conditions planned to exist according to the Regional Transportation Plan. Figure 4 provides a side-by-side comparison of the networks associated with these scenarios. The City of Troutdale's Capital Improvements Plan and Multnomah County's Transportation Capital Improvement Plan and Program are generally consistent with the RTP. Lists of relevant projects in each of these plans are shown in

Table 2.[1] The future year 2035 no-build (RTP Financially Constrained[2]) network included a number of arterial and collector roadway projects to better provide for the needs of the study area traffic. Refinements included in the network are listed in

Table 2 (RTP) and are also shown in Figure 4.

It was decided that some of the key projects listed in the RTP should not be included in the 2035 no-build scenario since their presence or absence may impact the need for some of the projects we are specifically considering as part of this RTP. The three main projects that are listed in the Financially Constrained RTP, that were not assumed in the 2035 No-Build scenario are:

1. 238th Extension between Sandy Boulevard and Marine Drive
2. Marine Drive Extension from South Frontage Road to Graham Road/257th Way
3. Marine Drive Two-Way between South Frontage Road and North Frontage Road

Table 2: Financially Constrained Capital Improvements Relevant to IAMP Study Area

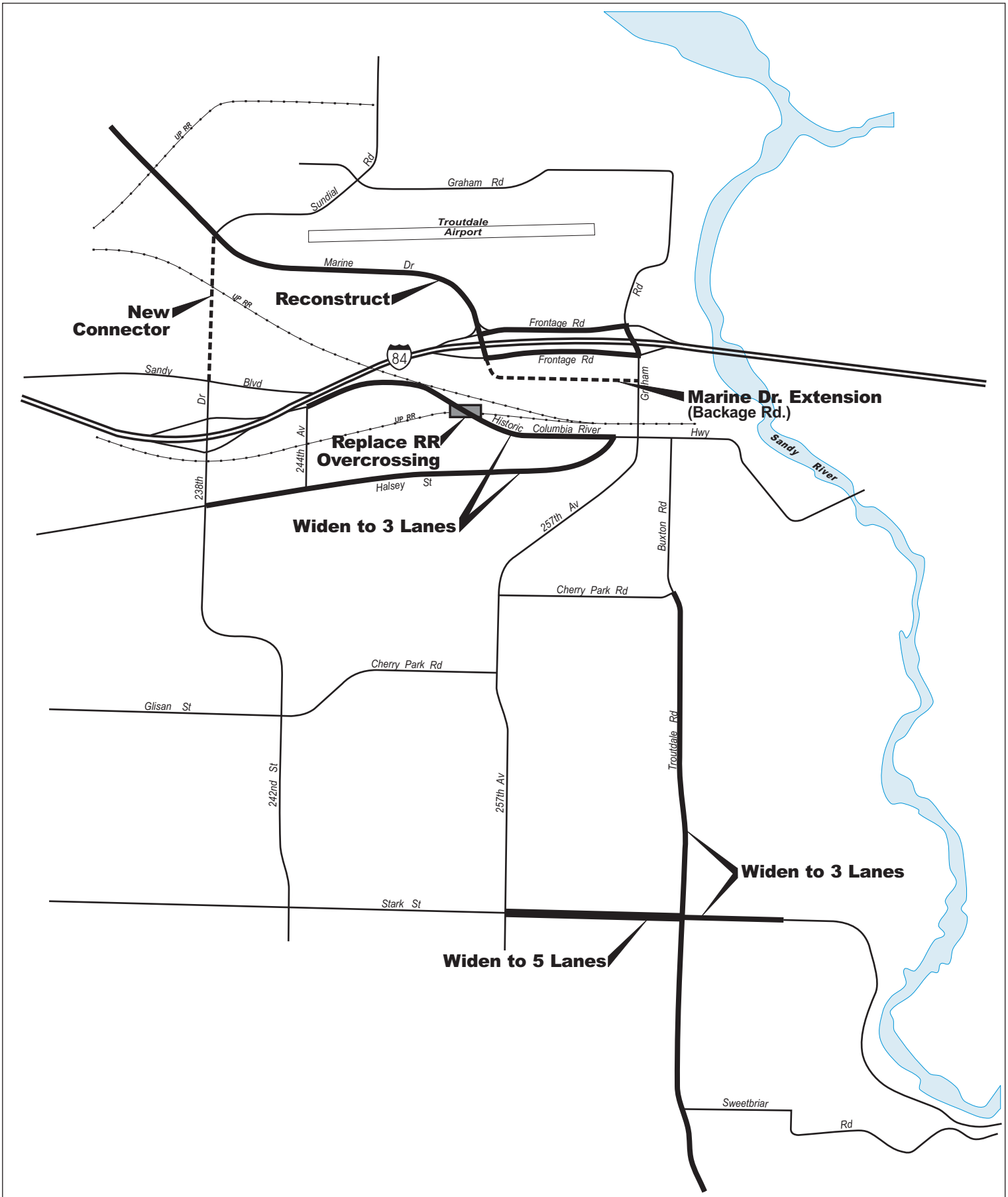
Project	*RTP*	*Troutdale CIP*	*Multnomah County CIPP*
Marine Drive reconstruction between Interlachen and I-84	√		√
238th Avenue Extension north from 238th Avenue to Marine Drive	√		√
Marine Drive Extension south from South Frontage Road ("backage" road), curving east to meet Graham Road/257th Avenue at 257th Way	√	√	
Replace railroad overcrossing approximately one-half mile east of 244th Avenue over Historic Columbia River Highway (accommodates wider travel lanes, sidewalks and bike lanes)	√		√
Reconstruct Historic Columbia River Highway to three lanes between 244th Avenue and Halsey Street	√		√
Reconstruct Halsey Street to three lanes between 238th Avenue and Historic Columbia River Highway	√		√
Reconstruct Troutdale Road to three lanes between Strebin Road and Cherry Park Road	√		Partial (see below)

[1] 2035 RTP Financially Constrained System Project List, Appendix 1.1, Approved by Metro Resolution No. 07-3831B on 12/13/07. Amended by Metro Resolution No. 08-3934 on 4/24/08. City of Troutdale Public Works Department Capital Improvement Plan, May, 2009. Multnomah County Transportation Capital Improvement Plan and Program, Fiscal Years 2010-2014, April, 2010.

[2] 2035 RTP Financially Constrained System Project List, Appendix 1.1, Approved by Metro Resolution No. 07-3831B on 12/13/07. Amended by Metro Resolution No. 08-3934 on 4/24/08.

Project	*RTP*	*Troutdale CIP*	*Multnomah County CIPP*
Widen Stark Street to five lanes, including intersection improvements, between 257th Avenue/Kane Road and Troutdale Road	√	√	√
Reconstruct Stark Street to three lanes between Troutdale Road and Hampton Road	√		√
Convert Marine Drive one-way southbound to two-way under I-84 and widen to five lanes	√		
Improve NW Graham Road (widen to accommodate truck traffic)		√	
Widen SW 21st Street		√	
Transportation Improvements in North Industrial Area		√	
Improve SW Hensley Road		√	
Improve 242nd Avenue from Stark Street to Cherry Park Road		√	
Traffic Signal at Buxton Avenue/Historic Columbia River Highway		√	
Improve NW Dunbar Avenue (widen to standard and add sidewalks)		√	
Implement I-84/US26 Corridor Refinement Plan			√
Reconstruct Troutdale Road between Stark Street and 1700 feet to the north of Stark Street (widen to three lanes)			√ (part of RTP improvement listed above)
Reconstruct Troutdale Road between Strebin Road and Stark Street (widen to three lanes)			√ (part of RTP improvement listed above)
Cochran Drive between Troutdale Road and 2,175 feet to the west of Troutdale Road (widen to three lanes)			√
Reconstruct Troutdale Road between 19th Street and Cherry Park Road (widen to three lanes)			√ (part of RTP improvement listed above)
Sweetbriar Road between Troutdale Road and East City Limit (widen to neighborhood collector standards – two lanes)			√
Reconstruct Troutdale Road between Stark Street and Strebin Road (widen to three lanes), includes reconstruction of Troutdale Road/Division Drive intersection			√ (a portion of this project overlaps with RTP project listed above)
257th Avenue/Kane Drive – Arterial Corridor Management (ACM) with Adaptive Signal Timing			√

It should be noted that all projects include pedestrian and bicycle facilities as called for in the design standards to which each project will be built. Additional pedestrian and trail improvements are planned and funded throughout the Study Area, however, it is not anticipated that these projects will substantially affect vehicular capacity in the vicinity of the interchange, so they were not included in this table.



LEGEND

- Widen to 3 Lanes
- Widen to 5 Lanes
- New Connector

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NO SCALE

Figure 4

TRAVEL DEMAND MODEL BASE+FUTURE YEAR NETWORKS

Appendix B

Future Year Forecasts

Future Year Forecasts

Using the travel demand model described above, future year traffic volumes were forecast for streets within the study area. Generally, turn movement volumes at study area intersections were obtained through application of a post-processing technique where the incremental differences between the future and base year volumes from the model were added to the existing p.m. peak hour volumes collected in the field. The Troutdale Reynolds Industrial Park (TRIP) area was not included in the modeling (trip generation in TAZ's associated with those areas [TAZ 560 in Figure 1[3]] was reduced to 2005 levels in the model) and trips associated with that area were added in separately (see Table 3 below – all three phases were included in 2035 forecasts). The TRIP area has been heavily studied recently, so specific trip generation and distribution information has been developed for this key area. It was determined that the detailed work done in this area would better reflect anticipated traffic patterns than the more generalized travel demand model.

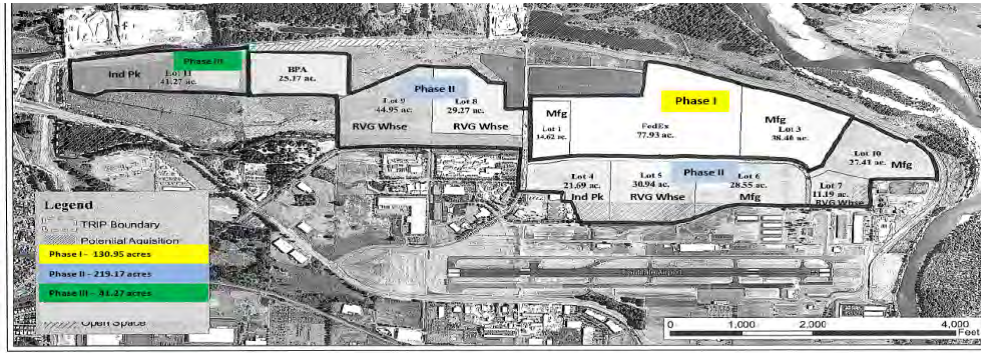
Figure 5 displays the forecasted turning movement volumes at study intersections for the year 2035. In addition to the post-processing procedure described above, these values have been balanced to produce reasonable volume fluctuations between adjacent study intersections. The degree of change allowed in traffic volumes between intersections was dependent on the distance between intersections and the quantity and quality of potential destinations and origins located between them.

Compared to the traffic volumes collected in 2010 (displayed in Chapter 1), the most significant changes in the IAMP area occur at the Marine Drive/Sundial Road intersection where a a substantial volume of traffic is added due to industrial development that is expected to the northeast (TRIP – Troutdale Reynolds Industrial Park). Growth at the Marine Drive/Sundial Road intersection is anticipated to increase by almost four times during both AM and PM peak hours between 2010 and 2035. Some of the additional traffic at the Marine Drive/Sundial Road intersection is also expected to impact the Marine Drive/I-84 Westbound Ramps/North Frontage Road intersection, where traffic volumes are expected to almost triple during both the AM and PM peak periods. In the immediate vicinity of the interchange, traffic volumes are expected to grow about 70-80 percent, with the Graham Road/I-84 Westbound Ramp/North Frontage Road intersection about doubling during the PM peak hour. Most of the other improvements assumed are capacity and safety improvements to existing roadways that will not substantially change travel patterns in the area.

[3] While some of the TRIP area is located in TAZ 559, almost no growth was assumed for that TAZ, therefore no "double counting" has occurred.

Table 3: TRIP II Land Use and Trip Generation Assumptions

				Bldg. Area	Trip Rates			Daily Trips	AM Peak Hour Trips			PM Peak Hour Trips		
Phase	Lot	Acres	Land Use	ksf	Daily	AM	PM		in	out	total	in	out	total
1	1	14.62	Manufacturing	191	3.77	0.68	0.71	720	100	30	130	49	87	136
	2	77.93	Fed Ex					4180	45	327	372	361	62	423
	3	38.40	Manufacturing	502	3.84	0.77	0.75	1927	298	89	388	136	242	379
Totals								**6827**	**443**	**446**	**889**	**546**	**391**	**938**
2	4	21.69	Industrial Park	331	7.22	0.78	0.90	2388	212	47	259	62	234	297
	5	30.94	RVG Warehouse	539	2.46	0.11	0.11	1326	38	21	59	17	43	59
	6	28.55	Manufacturing	373	3.82	0.75	0.75	1427	216	65	281	100	178	278
	7	11.19	RVG Warehouse	195	2.46	0.11	0.11	480	14	8	21	6	15	21
	8	29.27	RVG Warehouse	510	2.46	0.11	0.11	1255	36	20	56	16	40	56
	9	44.95	RVG Warehouse	783	2.46	0.11	0.11	1927	55	31	86	24	62	86
	10	27.41	Manufacturing	358	3.82	0.75	0.74	1368	207	62	268	96	171	267
	BPA	25.17	Utility	0				0			0			0
Totals								**10170**	**778**	**253**	**1031**	**321**	**744**	**1064**
			Phases 1 + 2 Totals					**16997**	**1221**	**699**	**1921**	**867**	**1135**	**2002**
3	11	41.27	Industrial Park	629	6.15	0.68	0.84	3869	349	77	425	111	416	527
Totals		391.39						**20866**	**1570**	**776**	**2346**	**978**	**1551**	**2529**



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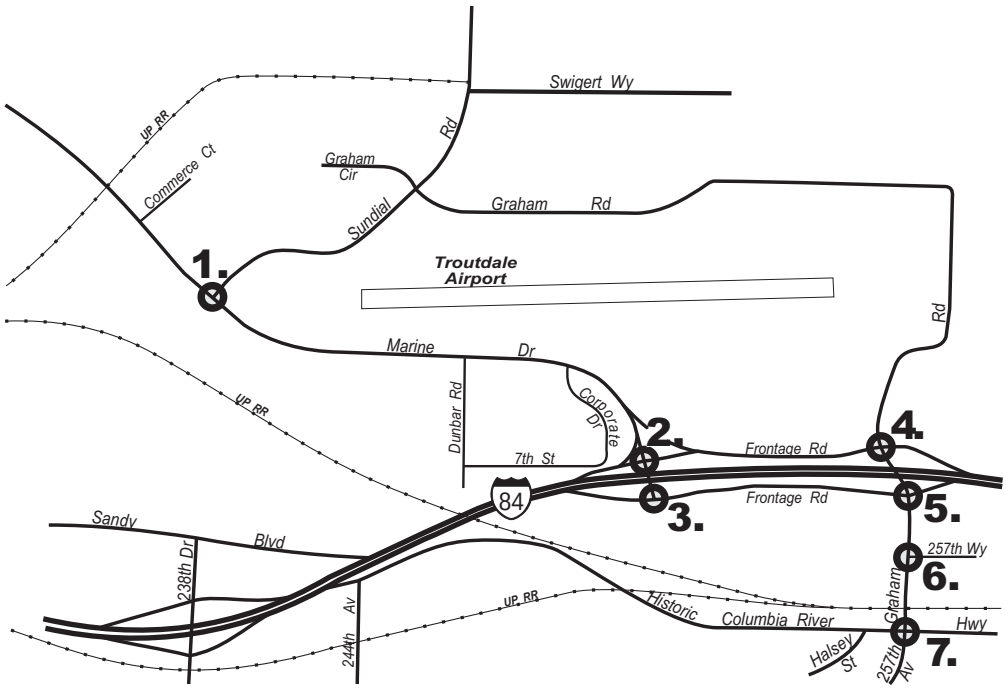
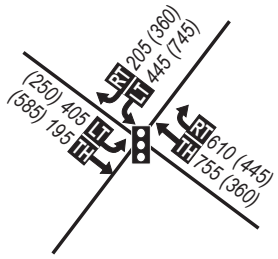
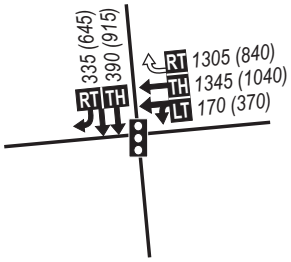
NO SCALE



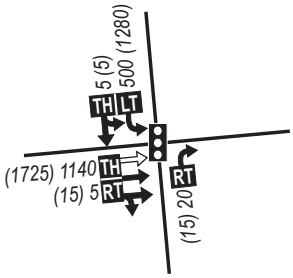
1. Marine Dr. @ Sundial Rd.



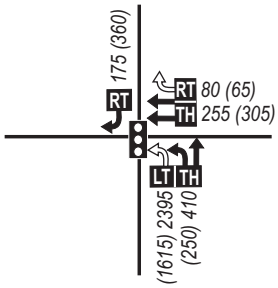
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



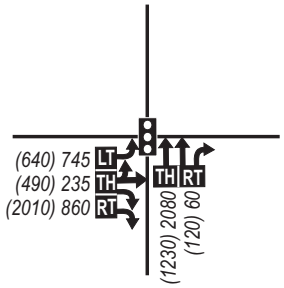
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



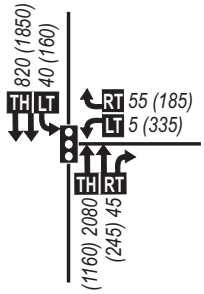
4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



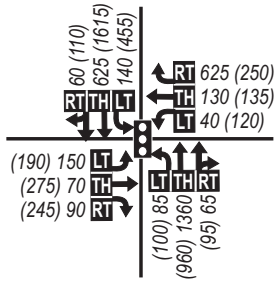
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT - Volume Turn Movement (Left•Thru•Right)

Figure 5

2035 NO-BUILD (Base) AM/PM PEAK HOUR TRAFFIC VOLUMES

Appendix C

City of Troutdale Zoning Map

DEPARTMENT OF COMMUNITY DEVELOPMENT

CITY OF TROUTDALE

MULTNOMAH COUNTY, OREGON

ZONING DISTRICT MAP

Effective 4/10/2010

Ordinance No. 799

COLUMBIA RIVER

Company Lake

Sandy River

Beaver Creek

City of Fairview

Troutdale Airport

Unincorporated
Multnomah County

Proposed Study Area

Proposed Management Area

City of Wood Village

Reynolds
High School

City of Gresham

84

SE STARK ST

SW STARK ST

Legend

- CITY BOUNDARIES
- PARCELS
- STREETS
- RAILROADS
- RIVERS AND STREAMS

Zoning Districts

Low Density Residential

- R-20 Single Family Residential
- R-10 Single Family Residential
- R-7 Single Family Residential

Medium Density Residential

- R-5 Single Family Residential
- R-4 Attached Residential

High Density Residential

- A-2 Apartment Residential

Commercial

- Neighborhood Commercial (NC)
- Community Commerical (CC)
- General Commercial (GC)
- Central Business District (CBD)
- Mixed Office Housing (MO/H)

Industrial

- Industrial Park (IP)
- Light Industrial (LI)
- General Industrial (GI)
- Open Space (OS)
- Urban Planning Area - General Industrial (UPAGI)
- Urban Planning Area - Residential (UPAR-10)
- Town Center Overlay
- Planned Development Overlay
- Urban Growth Boundary

0 0.125 0.25 0.5 Miles

This product is for informational purposes and may not have been prepared for, or be suitable for, legal, engineering, or surveying purposes.
Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.
The City of Troutdale provides this data in good faith and shall in no event be liable for any incorrect results, and lost profits, and special, indirect, or consequntial damages to any party arising out of or in connection with the use or the inability to use the data hereon or the services provided.
The City of Troutdale provides this data and services as a convenience to the public. Further more, the City of Troutdale reserves the tight to change or revise published data and/or these services at any time.

Map prepared by
The City of Troutdale Public Works
342 SW 4th Street
Troutdale, Oregon 97060
Map data compiled from the
Metro Regional Government Agency and
Multnomah County in conjunction with
The City of Troutdale

Map updated by:
C.A.
July 2010

Map referenced by:
'Zoning'

Appendix D

Previously Considered Alternatives

Previously Considered Alternatives

A number of alternatives and improvements have been considered for the I-84/257th interchange as part of several traffic studies that have been conducted in the area going back to 2004, including the following:

- ***Troutdale Annexation Traffic Study (2004)*** *This study was conducted to determine potential transportation impacts of annexing and developing over 600 acres of industrial land in the central and northern parts of Troutdale. A number of intersection improvements were identified throughout the study area, but the most significant recommendation was to build a Marine Drive extension (or "backage" road) south from Marine Drive/I-84 Eastbound Off-Ramp, curving east behind the commercial development along South Frontage Road to tie in with Graham Road/257th Drive at 257th Way/Outlet Mall access.*
- ***Troutdale Transportation Systems Plan (2005)*** *The Troutdale Transportation Systems Plan was developed in 2005 in order to determine transportation needs in the City until 2025. Key improvements that were identified as a part of this plan included the "backage" road previously identified, a 238th extension connecting the I-84/238th interchange with Marine Drive and the north Troutdale industrial area, some interchange area roadway widening (Marine Drive, Sundial Road) and to "reconstruct the I-84 interchange." Presumably, the vague recommendation to "reconstruct the interchange" was the motivation for the Troutdale Frontage road System Refinement Study (described below).*
- ***Troutdale Frontage Road System Refinement Study (2005)*** *This study was conducted as an extension of the Troutdale Transportation Systems Plan to specifically address concerns at the I-84/257th Interchange. Eleven alternatives (some with variations) were considered with the key outcome a recommendation to build the "backage" road described above as well as widen Marine Drive through the interchange and to the north and to improve the key intersection at Graham Road/257th Avenue/South Frontage road.*
- ***Troutdale Reynolds Industrial Park – Phase II Analysis (TRIP II) (2010)*** *This analysis addressed partial build out of the Troutdale Reynolds Industrial Park (Phases I and II), identifying transportation related improvements needed in 2015, assuming buildout of the first two phases would occur by that time. Improvements identified to address TRIP II need are related to Project A and Project B improvements that were identified as part of the ODOT – Interchange Project analysis described below. These two projects were conducted concurrently and outcomes are interrelated. This analysis recommended that Marine Drive be converted to a two-way street between South Frontage Road and North Frontage Road. While this would be a great improvement to the interchange overall, a number of design exceptions would be required. This was thought to be an acceptable course of action, knowing that Project B recommendations would mitigate any outstanding issues. The 238th extension was not assumed to be built for this 2015 analysis.*
- ***ODOT – Interchange Project (Project A and Project B with full TRIP development – Phases I, II and III) (2010)*** *This analysis was conducted in conjunction with the TRIP II work discussed previously, however, the third phase of TRIP development was considered and horizon years of 2018 (when TRIP Phase III is expected to be built out) and 2035 were evaluated. Also, Project A and Project B (see* ***Figure 7****), which had*

been developed by ODOT in December, 2009, were considered in conjunction with full TRIP development traffic. Various combinations of Project A and Project B improvements were assumed, as described below. The 238th Avenue Extension project was assumed only for the 2035 analysis period, but only for background traffic. It was not assumed that TRIP area projects would use this planned roadway.

- 2018 with Project A Improvements – none of the four interchange intersections (four corners) would meet required level of service standards for this scenario, either during the AM or PM peak period. However, most intersection would operate reasonably well, with the exception of Graham Road/I-84 EB On-Ramp during the morning peak period, where the volume-to-capacity ratio is expected to be greater than 1.0. Queuing results indicate that several movements would exceed available storage, including at least one movement at each intersection, during either the AM or PM peak hour.
- 2035 with Project A Improvements – none of the four interchange intersections would meet operational standards during either the AM or PM peak hour or both. Volume-to-capacity ratios are creeping closer to 1.0, with Marine Drive/I-84 WB On-Ramp (PM peak) and Graham Road/I-84 EB On-Ramp (AM peak), exceeding 1.0. Queuing results indicate that conditions worsen throughout the interchange during both AM and PM peak hours.
- 2035 with Project A and Project B Improvements – none of the four interchange intersections would meet operational standards during the PM peak hour and the Graham Road/I-84 EB On-Ramp intersection would not meet standards during the morning. However, all intersections would operate with a volume-to-capacity ratio lower than 1.0 during both AM and PM peak hours.

The improvements recommended in these previous studies are summarized in Table 4.

Table 4: Improvement Recommendation History

Intersection/ Roadway	Improvement	Troutdale Annexation Traffic Study	Troutdale Transportation Systems Plan	Troutdale Frontage Road System Refinement Study	Troutdale Reynolds Industrial Park – Phase II (TRIP II – 2015)	ODOT Interchange Project (Project A with Full TRIP Development – 2018) Assumes 238th Extension for background traffic only	ODOT Interchange Project (Project B – with Full TRIP Development – 2035) Assumes 238th Extension for background traffic only
Study Conducted		**2004**	**2005**	**2005**	**2010**	**2010**	**2010**
Marine Drive/ Sundial Road	Install Traffic Signal	√	√ (include protected left turn phasing)				
	Add WB RT Lane	√					
	Add 2nd SB LT Lane	√					
Sundial Road	Widen to three lanes between Marine Drive and Rogers Street	√	√ (widen to North City Limits)				
	Widen to five lanes between Marine Drive and Rogers Street	√					
Marine Drive/ I-84 WB On-Ramp	Add WB LT Lane	√					√
	Third WB Through Lane on North Frontage Road becomes a WB RT					√	

DRAFT

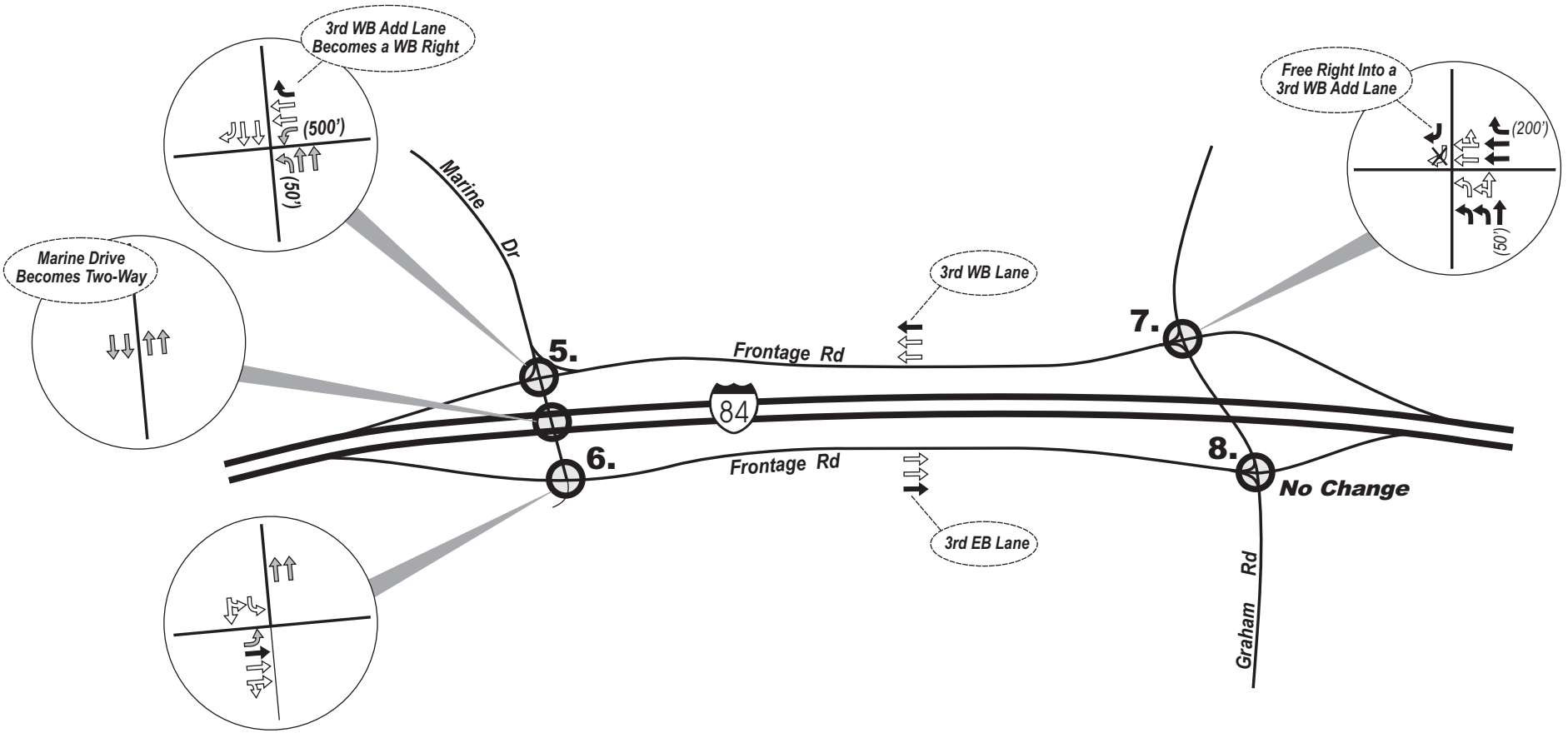
Intersection/ Roadway	Improvement	Troutdale Annexation Traffic Study	Troutdale Transportation Systems Plan	Troutdale Frontage Road System Refinement Study	Troutdale Reynolds Industrial Park – Phase II (TRIP II – 2015)	ODOT Interchange Project (Project A with Full TRIP Development – 2018) Assumes 238th Extension for background traffic only	ODOT Interchange Project (Project B – with Full TRIP Development – 2035) Assumes 238th Extension for background traffic only
	Lane						
	Add 2 NB Through Lanes						√
	Add NB LT Lane						√
Marine Drive/ I-84 EB Off-Ramp	Extend south to intersect Graham Road at 257th Way ("Backage" Road – 2 lane connection)	√	√	√			
	Add EB LT Lane	√					√
	Add third EB Through Lane					√	
	Add two NB Through Lanes (Two-Way)						√

DRAFT

Intersection/ Roadway	Improvement	Troutdale Annexation Traffic Study	Troutdale Transportation Systems Plan	Troutdale Frontage Road System Refinement Study	Troutdale Reynolds Industrial Park – Phase II (TRIP II – 2015)	ODOT Interchange Project (Project A with Full TRIP Development – 2018) Assumes 238th Extension for background traffic only	ODOT Interchange Project (Project B – with Full TRIP Development – 2035) Assumes 238th Extension for background traffic only
South Frontage Road	Add third Through Lane					√	
Marine Drive	Widen to five lanes between I-84 EB Off-Ramp and Sundial Road	√	√	√ (from S. Frontage Rd north to match existing 5-lane section)			
	Convert to 2-Way Street between South Frontage Road and North Frontage Road				√		
Graham Road/ I-84 WB Off-Ramp	Reconfigure NB approach to have 2 LT Lanes and exclusive Through Lane	√				√	
	Add 2nd WB Through Lane					√	

DRAFT

Intersection/ Roadway	Improvement	Troutdale Annexation Traffic Study	Troutdale Transportation Systems Plan	Troutdale Frontage Road System Refinement Study	Troutdale Reynolds Industrial Park – Phase II (TRIP II – 2015)	ODOT Interchange Project (Project A with Full TRIP Development – 2018) Assumes 238th Extension for background traffic only	ODOT Interchange Project (Project B – with Full TRIP Development – 2035) Assumes 238th Extension for background traffic only
	SB RT becomes Free Right					√	
North Frontage Road	Add 3rd Through Lane					√	
Graham Road/ I-84 EB On-Ramp	Reconfigure EB approach to have 2 RT Lanes, Through Lane and LT Lane	√		√			
	Extend EB RT Lanes		√				
Graham Road/ 257th Way	Build EB approach to include LT, Through, 2 RT Lanes						
257th Avenue/ Historic Columbia River Highway	Add WB Right Turn Overlap Phase	√					
238th Extension	Construct 3-lane roadway between Sandy and Marine Drive		√				
I-84 Interchange	Reconstruct		√				



LEGEND

0. - Study Intersection & Number

⇦ - Existing Lane Configuration

⬅ - Phase 1 - Interchange Improvements

⇦ - Phase 2 - Interchange Improvements
(These are in addition to Phase 1 Improvements)

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 7

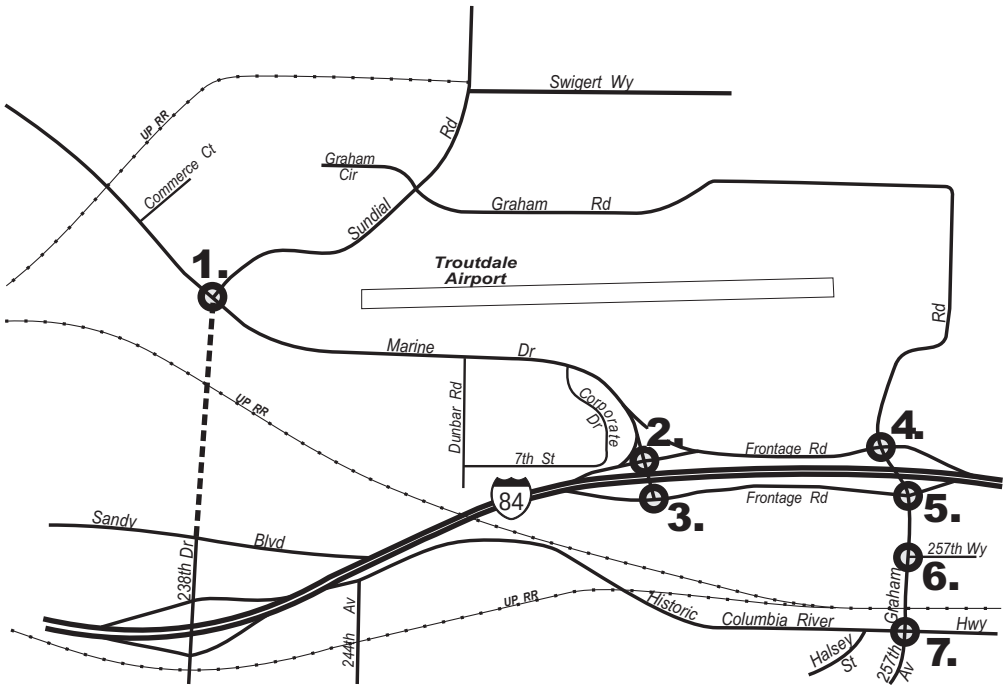
Phase I & II - INTERCHANGE IMPROVEMENTS

Appendix E

Assumed Lane Geometries, Traffic Control, Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE



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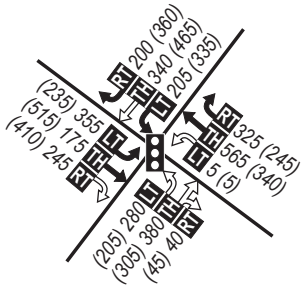
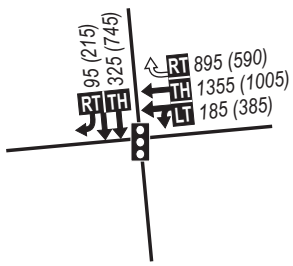
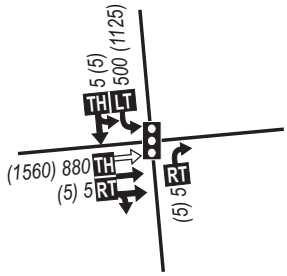


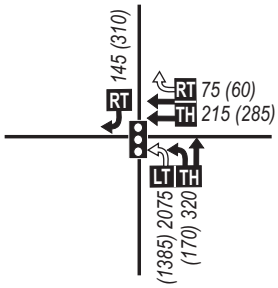
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



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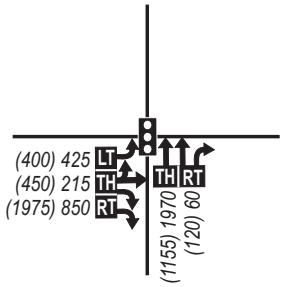
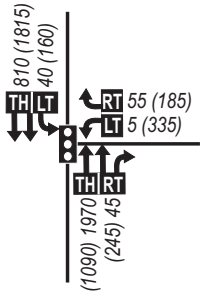
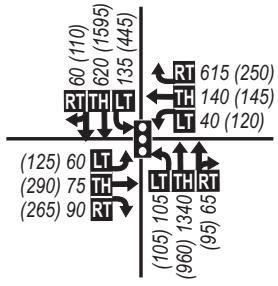


6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

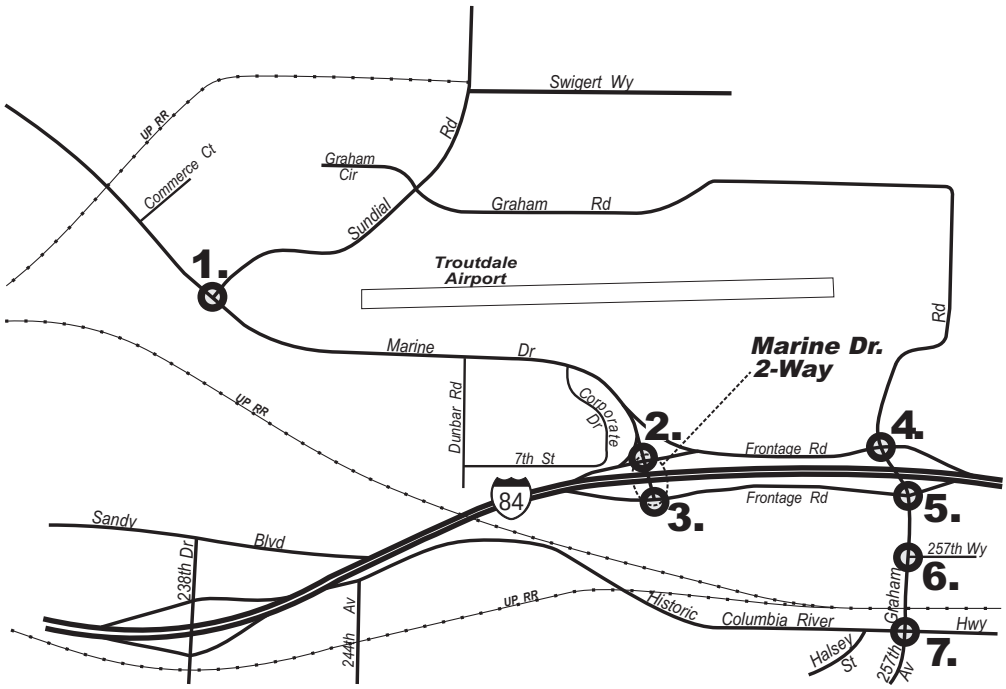
Figure 8

Alternative 1 - 2035 BASE + 238TH EXTENSION

AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE



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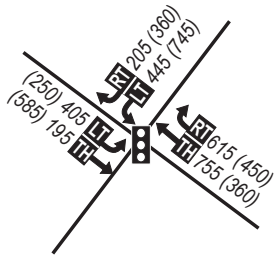
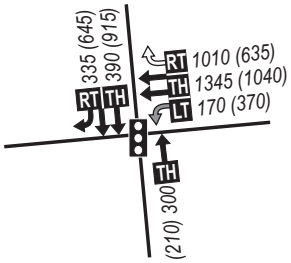
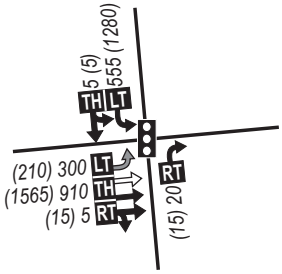


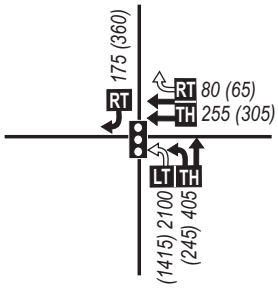
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



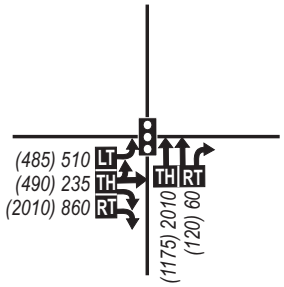
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



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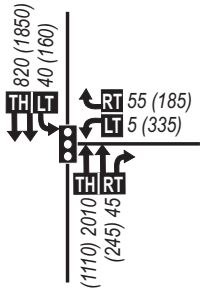

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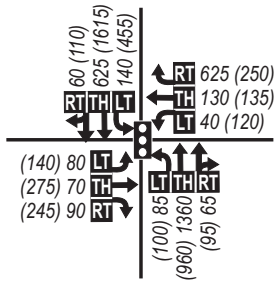


LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- ⇐ - Alternative 2
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left • Thru • Right) - Volume Turn Movement

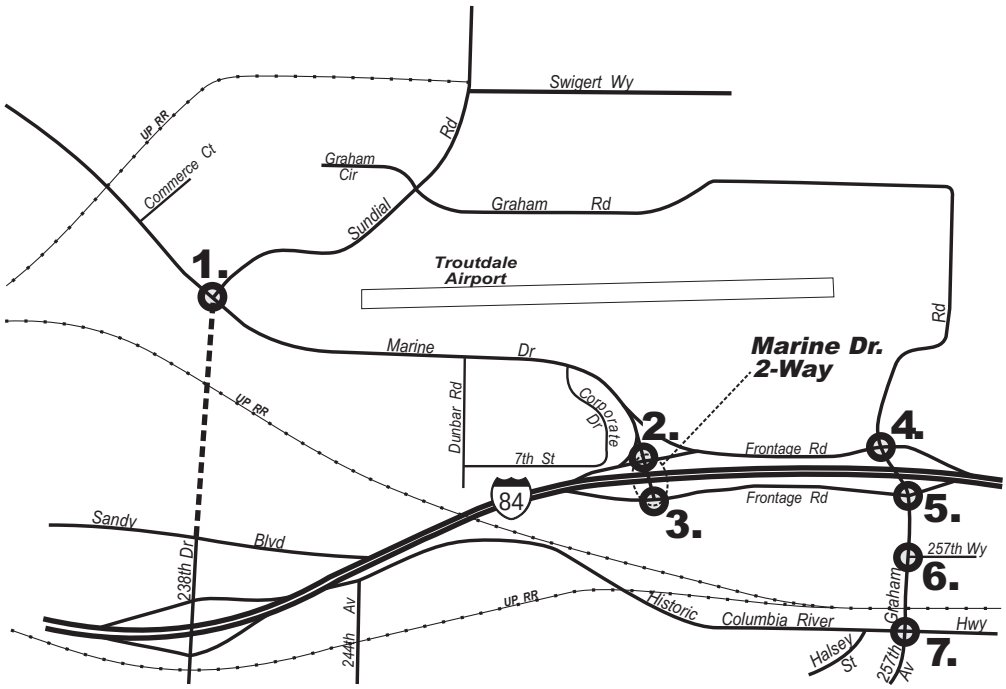
Figure 9

Alternative 2 - 2035 BASE + 2-WAY MARINE DRIVE WITHOUT 238TH EXTENSION

AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE



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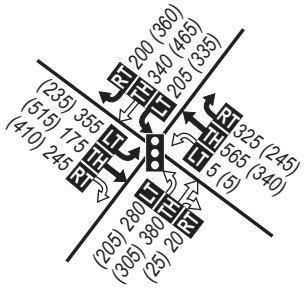
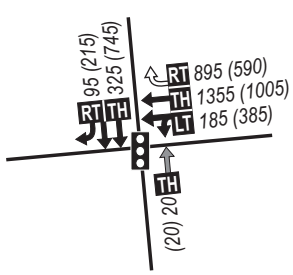
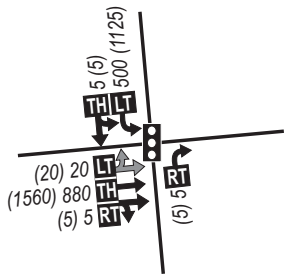


2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



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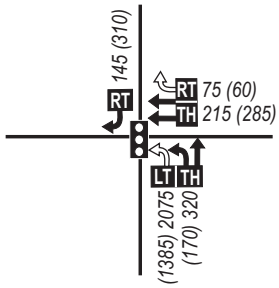
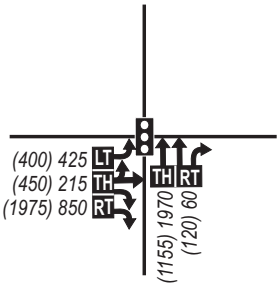
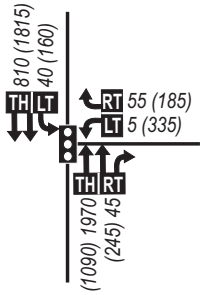


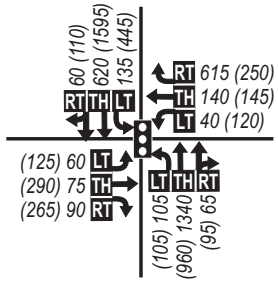
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- ⇐ - Alternative 3
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

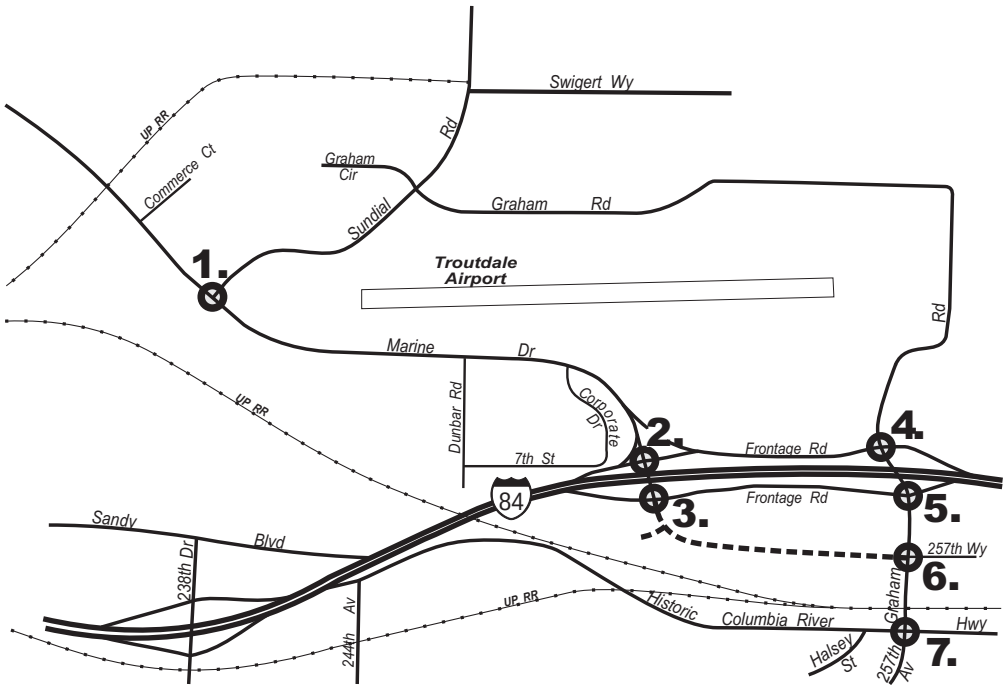
Figure 10

Alternative 3 - 2035 BASE + 2-WAY MARINE DRIVE WITH 238TH EXTENSION

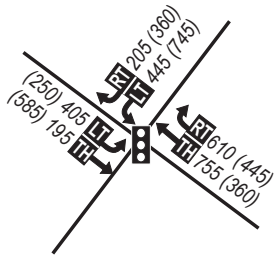
AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

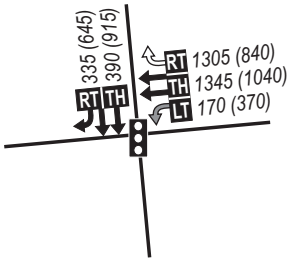
NO SCALE



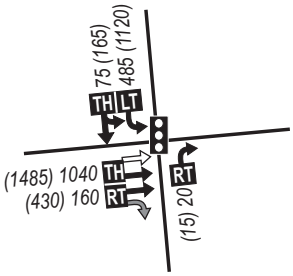
1. Marine Dr. @ Sundial Rd.



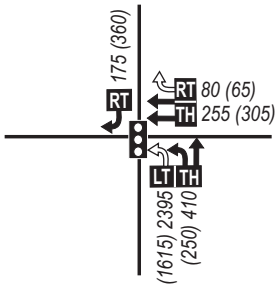
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



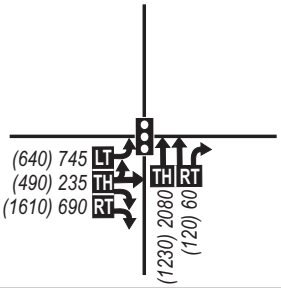
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



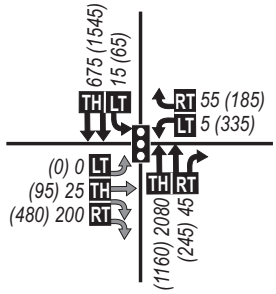
4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



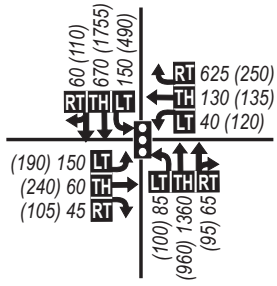
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- ⇐ - Alternative 4
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

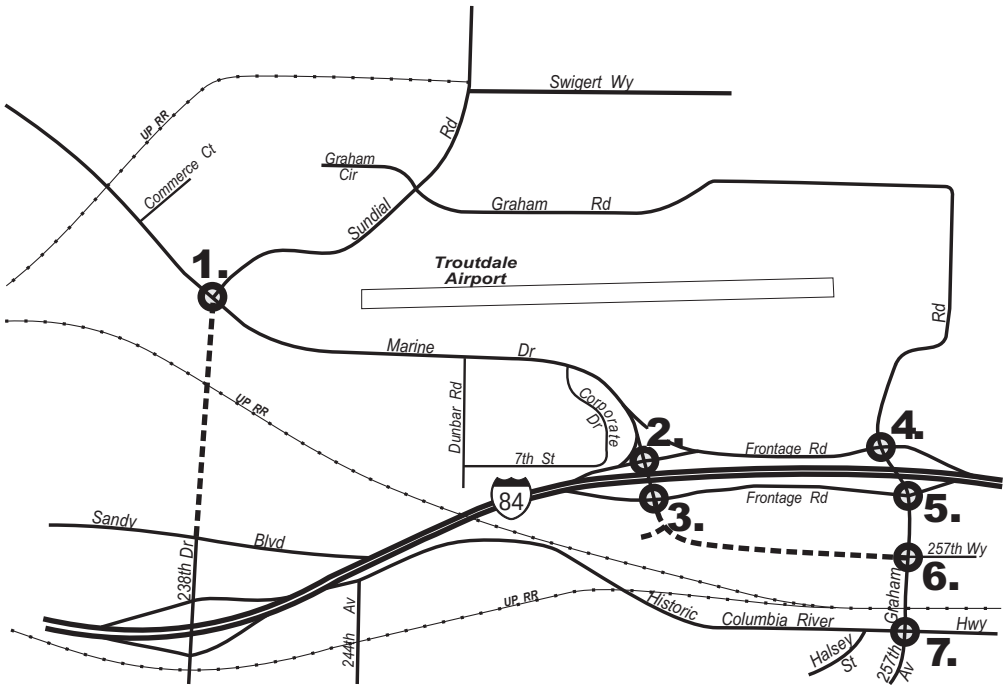
Figure 11

Alternative 4 - 2035 BASE + MARINE DRIVE EXTENTION WITHOUT 238TH EXTENSION

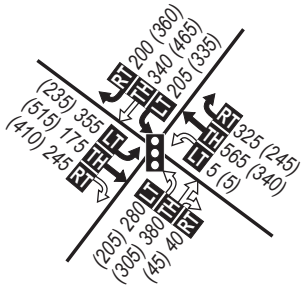
AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

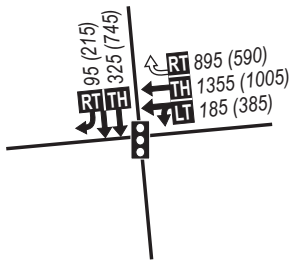
NO SCALE



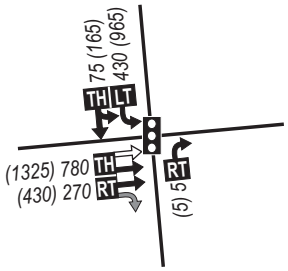
1. Marine Dr. @ Sundial Rd.



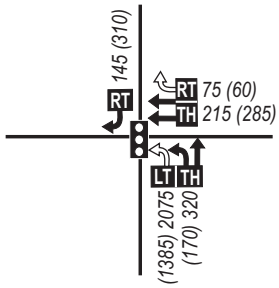
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



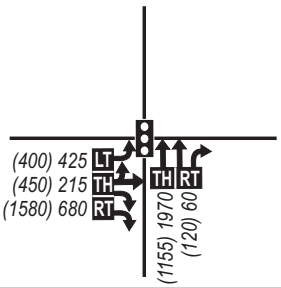
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



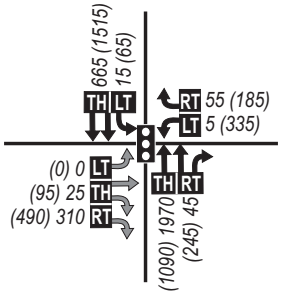
4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



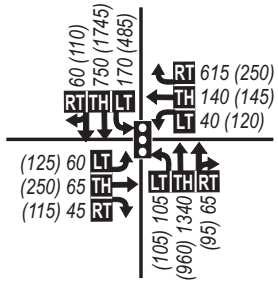
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- ⇐ - Alternative 5
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

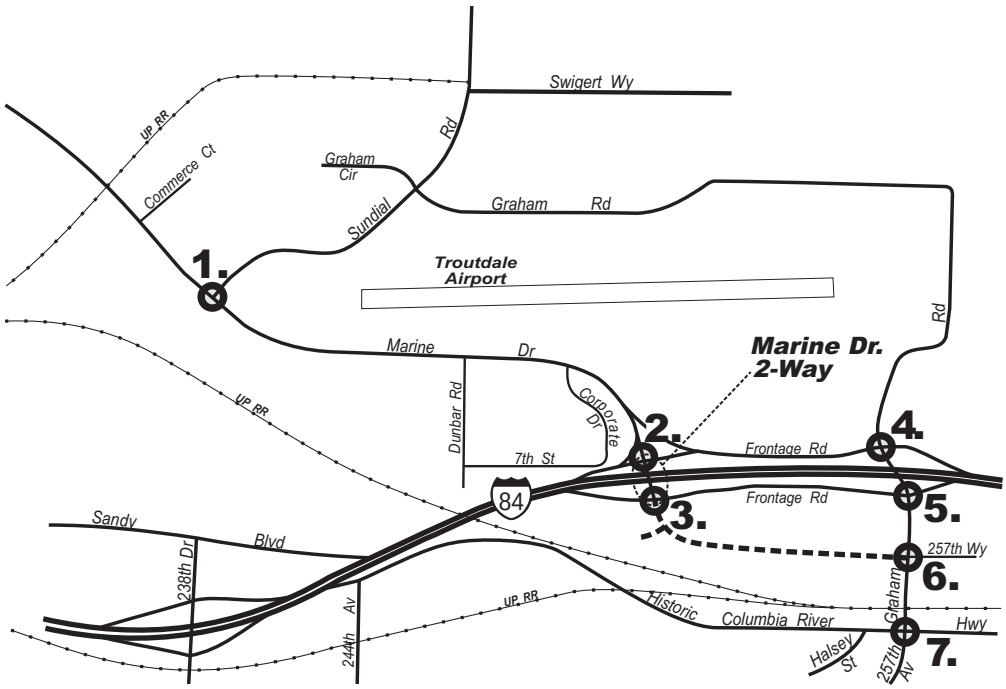
Figure 12

Alternative 5 - 2035 BASE + MARINE DRIVE EXTENSION WITH 238TH EXTENSION

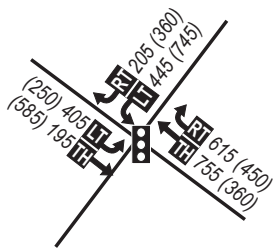
AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

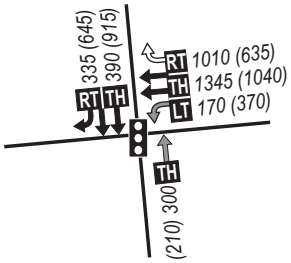
NO SCALE



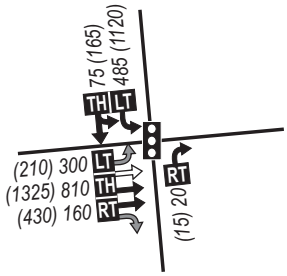
1. Marine Dr. @ Sundial Rd.



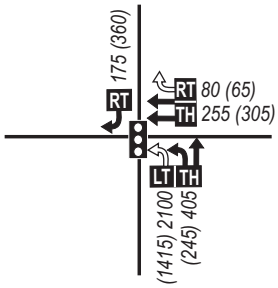
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



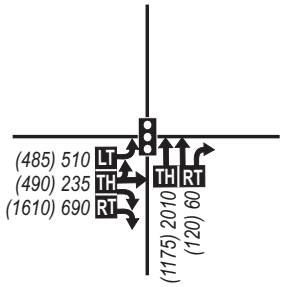
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



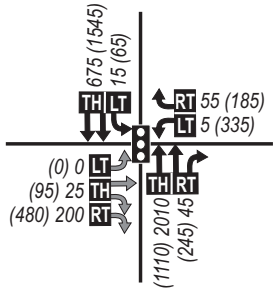
4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



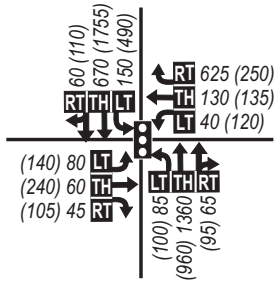
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- ⇐ - Alternative 6
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

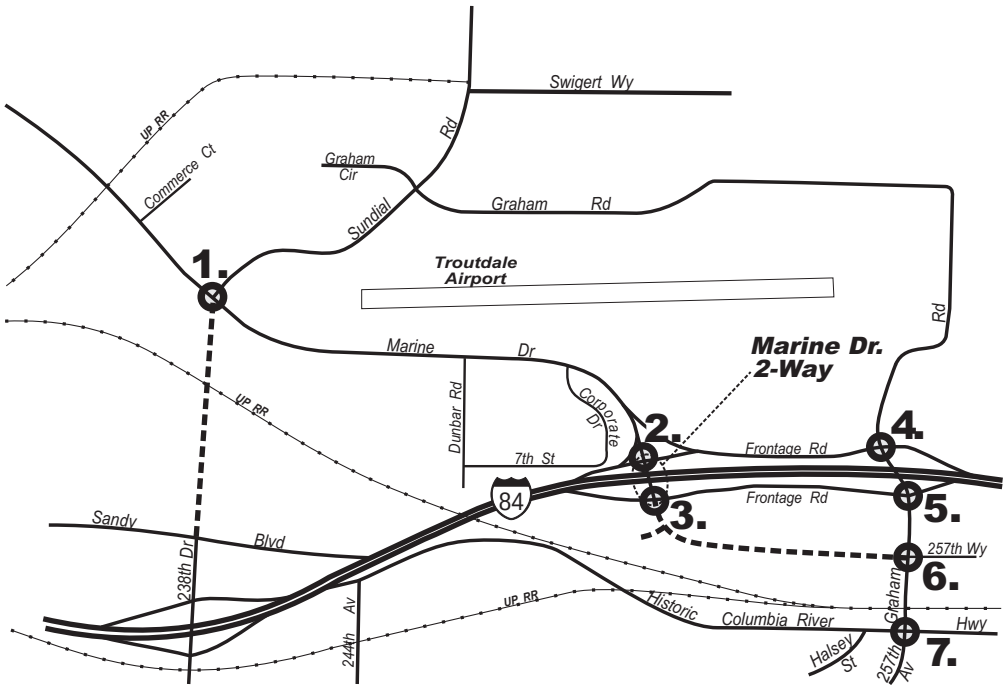
Figure 13

Alternative 6 - 2035 BASE + 2-WAY MARINE DRIVE EXTENSION WITHOUT 238TH EXTENSION

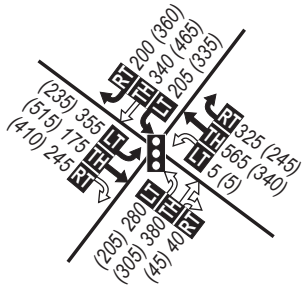
AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

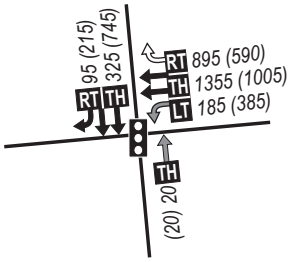
NO SCALE



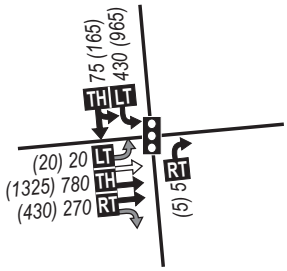
1. Marine Dr. @ Sundial Rd.



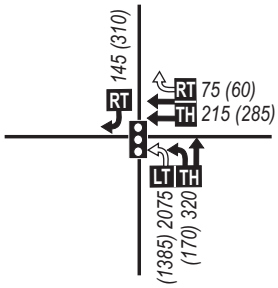
2. Marine Dr. @ Frontage Rd. (I-84 WB Ramps)



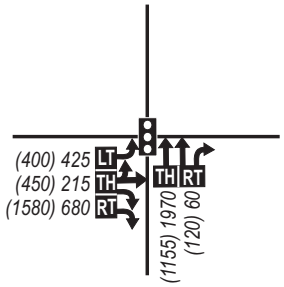
3. Marine Dr. @ Frontage Rd. (I-84 EB Ramps)



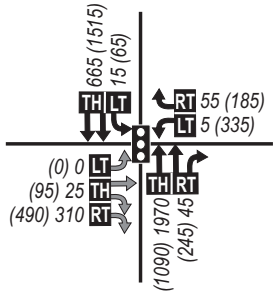
4. Graham Rd. @ Frontage Rd. (I-84 WB Ramps)



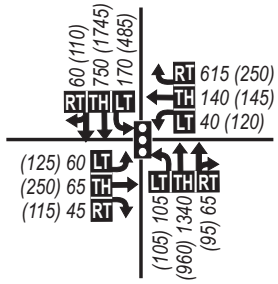
5. Graham Rd. @ Frontage Rd. (I-84 EB Ramps)



6. Graham Rd. @ 257th Wy.



7. Graham Rd./257th Av. @ Historic Columbia River Hwy.



LEGEND

- 1.0 - Study Intersection & Number
- ---- - Planned Roadway
- - Traffic Signal
- STOP - Stop Sign
- ← - Existing Lane Configuration
- ⇦ - Future Lane Configuration
- ⇐ - Alternative 7
- AM (PM) - Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

Figure 14

Alternative 7 - 2035 BASE + 2-WAY MARINE DRIVE EXTENSION WITH 238TH EXTENSION

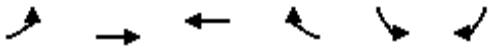
AM/PM Peak Hour Traffic Volumes

DKS Associates
TRANSPORTATION SOLUTIONS

DRAFT

Appendix F

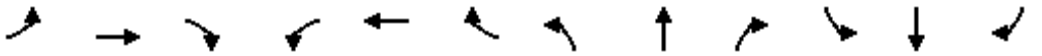
Intersection Analysis



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	195	755	610	445	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1500	1579	1667	1417	1221	1093
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1500	1579	1667	1417	1221	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	450	217	839	678	494	228
RTOR Reduction (vph)	0	0	0	169	0	171
Lane Group Flow (vph)	450	217	839	509	494	57
Heavy Vehicles (%)	14%	14%	8%	8%	40%	40%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	22.0	63.0	37.0	37.0	26.0	25.0
Effective Green, g (s)	22.0	63.0	37.0	37.0	26.0	25.0
Actuated g/C Ratio	0.22	0.63	0.37	0.37	0.26	0.25
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	330	995	617	524	317	273
v/s Ratio Prot	c0.30	0.14	c0.50		c0.40	
v/s Ratio Perm				0.36		0.05
v/c Ratio	1.36	0.22	1.36	0.97	1.56	0.21
Uniform Delay, d1	39.0	7.9	31.5	31.0	37.0	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	182.0	0.3	172.3	32.6	266.2	0.1
Delay (s)	221.0	8.2	203.8	63.5	303.2	29.8
Level of Service	F	A	F	E	F	C
Approach Delay (s)		151.8	141.1		216.9	
Approach LOS		F	F		F	

Intersection Summary			
HCM Average Control Delay	162.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

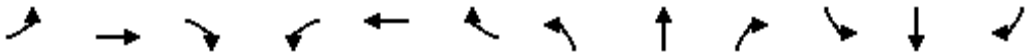
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	170	1345	1305	0	0	0	0	390	335
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5					3.5	3.5
Lane Util. Factor					0.95	1.00					0.95	1.00
Frt					1.00	0.85					1.00	0.85
Flt Protected					0.99	1.00					1.00	1.00
Satd. Flow (prot)					3062	1377					2578	1153
Flt Permitted					0.99	1.00					1.00	1.00
Satd. Flow (perm)					3062	1377					2578	1153
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)	0	0	0	179	1416	1374	0	0	0	0	411	353
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	0	25
Lane Group Flow (vph)	0	0	0	0	1581	1374	0	0	0	0	411	328
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)					37.0	65.0					20.0	20.0
Effective Green, g (s)					37.5	65.0					20.5	20.5
Actuated g/C Ratio					0.58	1.00					0.32	0.32
Clearance Time (s)					4.0						4.0	4.0
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					1767	1377					813	364
v/s Ratio Prot					0.52						0.16	
v/s Ratio Perm						c1.00						0.28
v/c Ratio					0.89	1.00					0.51	0.90
Uniform Delay, d1					12.0	0.0					18.1	21.3
Progression Factor					0.97	1.00					1.00	1.00
Incremental Delay, d2					2.9	14.0					0.5	24.6
Delay (s)					14.6	14.0					18.6	45.9
Level of Service					B	B					B	D
Approach Delay (s)		0.0			14.3			0.0			31.2	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

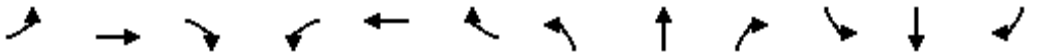
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1140	5	0	0	0	0	0	20	555	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0							3.5	3.5	3.5	
Lane Util. Factor		0.91							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		4152							1484	1244	1253	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		4152							1484	1244	1253	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	1188	5	0	0	0	0	0	22	578	6	0
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	22	0	0	0
Lane Group Flow (vph)	0	1192	0	0	0	0	0	0	0	289	295	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type									custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases												
Actuated Green, G (s)		32.3							0.8	19.9	19.9	
Effective Green, g (s)		32.3							1.3	20.4	20.4	
Actuated g/C Ratio		0.50							0.02	0.31	0.31	
Clearance Time (s)		4.0							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		2063							30	390	393	
v/s Ratio Prot		c0.29							c0.00	0.23	c0.24	
v/s Ratio Perm												
v/c Ratio		0.58							0.01	0.74	0.75	
Uniform Delay, d1		11.5							31.2	19.9	20.0	
Progression Factor		1.00							1.00	0.53	0.54	
Incremental Delay, d2		1.2							0.2	6.0	6.3	
Delay (s)		12.7							31.4	16.5	17.1	
Level of Service		B							C	B	B	
Approach Delay (s)		12.7			0.0			31.4			16.8	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

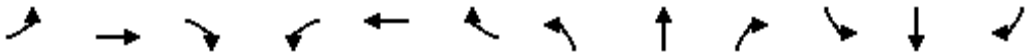
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	255	80	2395	410	0	0	0	175
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	268	84	2521	432	0	0	0	184
RTOR Reduction (vph)	0	0	0	0	0	74	18	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	268	10	2503	432	0	0	0	184
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					15.3	15.3	106.7	106.7				130.0
Effective Green, g (s)					15.8	15.8	106.7	106.7				130.0
Actuated g/C Ratio					0.12	0.12	0.82	0.82				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					345	154	2474	1343				1428
v/s Ratio Prot					c0.09		c0.83	0.26				
v/s Ratio Perm						0.01						0.13
v/c Ratio					0.78	0.07	1.01	0.32				0.13
Uniform Delay, d1					55.4	50.6	11.6	2.8				0.0
Progression Factor					1.00	1.00	0.31	0.54				1.00
Incremental Delay, d2					10.5	0.2	8.8	0.1				0.2
Delay (s)					65.9	50.8	12.4	1.6				0.2
Level of Service					E	D	B	A				A
Approach Delay (s)		0.0			62.3			10.8			0.2	
Approach LOS		A			E			B			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	122.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



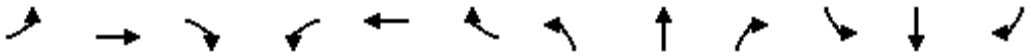
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	745	235	860	0	0	0	0	2080	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.97	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1396	2257					3228	1444			
Flt Permitted	0.95	0.97	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1396	2257					3228	1444			
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)	784	247	905	0	0	0	0	2189	63	0	0	0
RTOR Reduction (vph)	5	5	66	0	0	0	0	0	9	0	0	0
Lane Group Flow (vph)	505	516	839	0	0	0	0	2189	54	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	44.0	44.0	120.0					78.0	78.0			
Effective Green, g (s)	44.5	44.5	120.5					77.0	77.0			
Actuated g/C Ratio	0.34	0.34	0.93					0.59	0.59			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	466	478	2092					1912	855			
v/s Ratio Prot	c0.37	0.37	0.37					c0.68	0.04			
v/s Ratio Perm												
v/c Ratio	1.08	1.08	0.40					1.14	0.06			
Uniform Delay, d1	42.8	42.8	0.6					26.5	11.2			
Progression Factor	0.94	0.94	0.46					0.48	0.56			
Incremental Delay, d2	63.8	61.9	0.1					69.4	0.0			
Delay (s)	104.0	102.1	0.4					82.1	6.4			
Level of Service	F	F	A					F	A			
Approach Delay (s)		55.0			0.0			80.0			0.0	
Approach LOS		E			A			E			A	

Intersection Summary			
HCM Average Control Delay	68.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	5	55	2080	45	40	820
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	58	2189	47	42	863
RTOR Reduction (vph)	0	56	0	3	0	0
Lane Group Flow (vph)	5	2	2189	44	42	863
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	5.6	5.6	103.8	103.8	7.6	114.4
Effective Green, g (s)	5.6	5.6	103.8	103.8	7.6	114.4
Actuated g/C Ratio	0.04	0.04	0.80	0.80	0.06	0.88
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	72	65	2677	1198	98	2951
v/s Ratio Prot	c0.00	0.00	c0.65		c0.03	0.26
v/s Ratio Perm				0.03		
v/c Ratio	0.07	0.04	0.82	0.04	0.43	0.29
Uniform Delay, d1	59.7	59.6	7.6	2.7	59.1	1.3
Progression Factor	1.00	1.00	0.60	0.62	1.03	0.96
Incremental Delay, d2	0.2	0.1	0.3	0.0	2.8	0.2
Delay (s)	59.9	59.8	4.8	1.7	63.6	1.4
Level of Service	E	E	A	A	E	A
Approach Delay (s)	59.8		4.7			4.3
Approach LOS	E		A			A

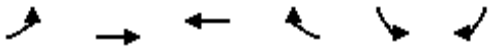
Intersection Summary			
HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	70	90	40	130	625	85	1360	65	140	625	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
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)	158	74	95	42	137	658	89	1432	68	147	658	63
RTOR Reduction (vph)	0	0	63	0	0	130	0	2	0	0	5	0
Lane Group Flow (vph)	158	74	32	42	137	528	89	1498	0	147	716	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	11.0	43.2	43.2	6.4	38.6	38.6	10.6	53.4		11.0	53.8	
Effective Green, g (s)	11.0	43.2	43.2	6.4	38.6	38.6	10.6	53.4		11.0	53.8	
Actuated g/C Ratio	0.08	0.33	0.33	0.05	0.30	0.30	0.08	0.41		0.08	0.41	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	142	587	498	83	524	445	137	1368		139	1369	
v/s Ratio Prot	c0.09	0.04		0.03	0.08		0.05	c0.45		c0.09	0.22	
v/s Ratio Perm			0.02			c0.35						
v/c Ratio	1.11	0.13	0.06	0.51	0.26	1.19	0.65	1.09		1.06	0.52	
Uniform Delay, d1	59.5	30.2	29.6	60.3	34.8	45.7	57.9	38.3		59.5	28.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.06	1.04	
Incremental Delay, d2	109.0	0.1	0.1	1.8	0.3	104.5	7.7	54.5		91.5	1.4	
Delay (s)	168.5	30.3	29.7	62.0	35.1	150.2	65.6	92.8		154.6	31.1	
Level of Service	F	C	C	E	D	F	E	F		F	C	
Approach Delay (s)		96.9			127.0			91.3			52.0	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	90.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	15		

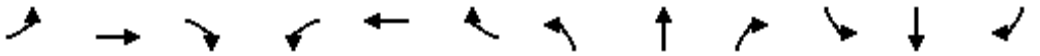
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	250	585	360	445	745	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1569	1651	1488	1264	1449	1297
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1569	1651	1488	1264	1449	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	278	650	400	494	828	400
RTOR Reduction (vph)	0	0	0	258	0	192
Lane Group Flow (vph)	278	650	400	236	828	208
Heavy Vehicles (%)	9%	9%	21%	21%	18%	18%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	15.0	45.0	26.0	26.0	44.0	43.0
Effective Green, g (s)	15.0	45.0	26.0	26.0	44.0	43.0
Actuated g/C Ratio	0.15	0.45	0.26	0.26	0.44	0.43
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	235	743	387	329	638	558
v/s Ratio Prot	c0.18	0.39	c0.27		c0.57	
v/s Ratio Perm				0.19		0.16
v/c Ratio	1.18	0.87	1.03	0.72	1.30	0.37
Uniform Delay, d1	42.5	24.9	37.0	33.7	28.0	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	117.1	12.5	54.7	10.4	145.3	0.2
Delay (s)	159.6	37.5	91.7	44.0	173.3	19.5
Level of Service	F	D	F	D	F	B
Approach Delay (s)		74.1	65.4		123.2	
Approach LOS		E	E		F	

Intersection Summary			
HCM Average Control Delay	91.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

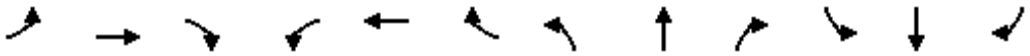
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	370	1040	840	0	0	0	0	915	645
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5					3.5	3.5
Lane Util. Factor					0.95	1.00					0.95	1.00
Frt					1.00	0.85					1.00	0.85
Flt Protected					0.99	1.00					1.00	1.00
Satd. Flow (prot)					2854	1293					3079	1377
Flt Permitted					0.99	1.00					1.00	1.00
Satd. Flow (perm)					2854	1293					3079	1377
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)	0	0	0	389	1095	884	0	0	0	0	963	679
RTOR Reduction (vph)	0	0	0	0	31	0	0	0	0	0	0	28
Lane Group Flow (vph)	0	0	0	0	1453	884	0	0	0	0	963	651
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)					55.0	115.0					52.0	52.0
Effective Green, g (s)					55.5	115.0					52.5	52.5
Actuated g/C Ratio					0.48	1.00					0.46	0.46
Clearance Time (s)					4.0						4.0	4.0
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					1377	1293					1406	629
v/s Ratio Prot					c0.51						0.31	
v/s Ratio Perm						0.68						c0.47
v/c Ratio					1.06	0.68					0.68	1.03
Uniform Delay, d1					29.8	0.0					24.7	31.2
Progression Factor					0.99	1.00					1.00	1.00
Incremental Delay, d2					37.1	2.2					1.4	45.1
Delay (s)					66.6	2.2					26.1	76.3
Level of Service					E	A					C	E
Approach Delay (s)		0.0			42.5			0.0			46.9	
Approach LOS		A			D			A			D	

Intersection Summary			
HCM Average Control Delay	44.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	119.6%	ICU Level of Service	H
Analysis Period (min)	15		

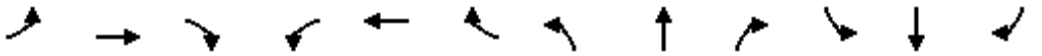
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1725	15	0	0	0	0	0	15	1280	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0							3.5	3.5	3.5	
Lane Util. Factor		0.91							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		4680							1484	2950	1403	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		4680							1484	2950	1403	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	1797	17	0	0	0	0	0	17	1333	6	0
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	14	0	0	0
Lane Group Flow (vph)	0	1813	0	0	0	0	0	0	3	666	673	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type									custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases												
Actuated Green, G (s)		42.1							1.6	58.8	58.8	
Effective Green, g (s)		42.6							2.1	59.3	59.3	
Actuated g/C Ratio		0.37							0.02	0.52	0.52	
Clearance Time (s)		4.5							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1734							27	1521	723	
v/s Ratio Prot		c0.39							c0.00	0.23	c0.48	
v/s Ratio Perm												
v/c Ratio		1.05							0.12	0.44	0.93	
Uniform Delay, d1		36.2							55.5	17.4	25.9	
Progression Factor		1.00							1.00	0.52	0.49	
Incremental Delay, d2		34.7							2.0	0.1	12.4	
Delay (s)		70.9							57.5	9.1	25.2	
Level of Service		E							E	A	C	
Approach Delay (s)		70.9			0.0			57.5			17.2	
Approach LOS		E			A			E			B	

Intersection Summary			
HCM Average Control Delay	48.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	126.1%	ICU Level of Service	H
Analysis Period (min)	15		

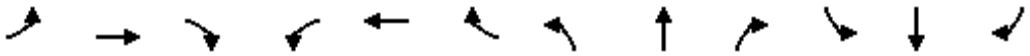
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	305	65	1615	250	0	0	0	360
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	321	68	1700	263	0	0	0	379
RTOR Reduction (vph)	0	0	0	0	0	57	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	321	11	1700	263	0	0	0	379
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					18.3	18.3	88.7	88.7				115.0
Effective Green, g (s)					18.8	18.8	89.2	89.2				115.0
Actuated g/C Ratio					0.16	0.16	0.78	0.78				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					431	193	2254	1223				1294
v/s Ratio Prot					c0.12		c0.59	0.17				
v/s Ratio Perm						0.01						0.29
v/c Ratio					0.74	0.06	0.75	0.22				0.29
Uniform Delay, d1					45.8	40.6	7.0	3.5				0.0
Progression Factor					1.00	1.00	0.48	0.68				1.00
Incremental Delay, d2					6.9	0.1	1.1	0.2				0.6
Delay (s)					52.7	40.7	4.4	2.5				0.6
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			50.6			4.2			0.6	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	141.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



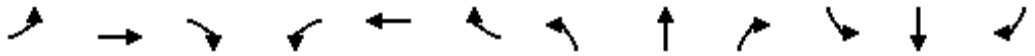
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	640	490	2010	0	0	0	0	1230	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.99	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1500	2380					3197	1430			
Flt Permitted	0.95	0.99	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1500	2380					3197	1430			
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)	674	516	2116	0	0	0	0	1295	126	0	0	0
RTOR Reduction (vph)	9	6	165	0	0	0	0	0	34	0	0	0
Lane Group Flow (vph)	571	604	1951	0	0	0	0	1295	92	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	57.6	57.6	104.6					49.4	49.4			
Effective Green, g (s)	58.1	58.1	105.1					48.4	48.4			
Actuated g/C Ratio	0.51	0.51	0.91					0.42	0.42			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	725	758	2175					1346	602			
v/s Ratio Prot	0.40	0.40	c0.82					c0.41	0.06			
v/s Ratio Perm												
v/c Ratio	0.79	0.80	0.90					0.96	0.15			
Uniform Delay, d1	23.4	23.6	2.4					32.4	20.6			
Progression Factor	0.66	0.66	24.61					0.49	0.55			
Incremental Delay, d2	3.3	3.4	3.2					13.5	0.1			
Delay (s)	18.7	19.0	61.3					29.5	11.4			
Level of Service	B	B	E					C	B			
Approach Delay (s)		46.0			0.0			27.9			0.0	
Approach LOS		D			A			C			A	

Intersection Summary			
HCM Average Control Delay	40.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	119.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	335	185	1160	245	160	1850
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	353	195	1221	258	168	1947
RTOR Reduction (vph)	0	149	0	71	0	0
Lane Group Flow (vph)	353	46	1221	187	168	1947
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	27.2	27.2	60.5	60.5	14.3	77.8
Effective Green, g (s)	27.2	27.2	60.5	60.5	14.3	77.8
Actuated g/C Ratio	0.24	0.24	0.53	0.53	0.12	0.68
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	396	355	1764	789	208	2268
v/s Ratio Prot	c0.21	0.03	0.36		0.10	c0.58
v/s Ratio Perm				0.12		
v/c Ratio	0.89	0.13	0.69	0.24	0.81	0.86
Uniform Delay, d1	42.5	34.6	20.3	14.8	49.0	14.4
Progression Factor	1.00	1.00	0.21	0.02	1.00	0.84
Incremental Delay, d2	21.2	0.1	0.7	0.2	9.1	1.9
Delay (s)	63.7	34.7	5.0	0.4	58.3	14.0
Level of Service	E	C	A	A	E	B
Approach Delay (s)	53.3		4.2			17.5
Approach LOS	D		A			B

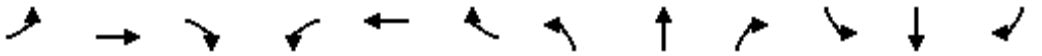
Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	275	245	120	135	250	100	960	95	455	1615	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3321	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3321	
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)	200	289	258	126	142	263	105	1011	100	479	1700	116
RTOR Reduction (vph)	0	0	93	0	0	222	0	6	0	0	4	0
Lane Group Flow (vph)	200	289	165	126	142	41	105	1105	0	479	1812	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	14.0	21.5	21.5	10.5	18.0	18.0	7.0	36.0		31.0	60.0	
Effective Green, g (s)	14.0	21.5	21.5	10.5	18.0	18.0	7.0	36.0		31.0	60.0	
Actuated g/C Ratio	0.12	0.19	0.19	0.09	0.16	0.16	0.06	0.31		0.27	0.52	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	204	330	280	153	276	235	102	1036		443	1733	
v/s Ratio Prot	c0.12	c0.16		0.08	0.08		0.06	0.33		c0.29	c0.55	
v/s Ratio Perm			0.11			0.03						
v/c Ratio	0.98	0.88	0.59	0.82	0.51	0.18	1.03	1.07		1.08	1.05	
Uniform Delay, d1	50.4	45.5	42.7	51.3	44.5	42.1	54.0	39.5		42.0	27.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.09	1.03	
Incremental Delay, d2	57.0	21.9	3.3	27.6	1.6	0.4	97.3	47.5		54.6	28.9	
Delay (s)	107.4	67.3	46.0	78.9	46.1	42.4	151.3	87.0		100.2	57.3	
Level of Service	F	E	D	E	D	D	F	F		F	E	
Approach Delay (s)		70.7			52.1			92.5			66.3	
Approach LOS		E			D			F			E	

Intersection Summary			
HCM Average Control Delay	72.0	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

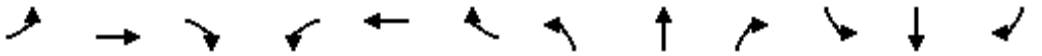
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	355	175	245	5	565	325	280	380	40	205	340	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1500	1579	1342	1676	1765	1500	1513	1570		1221	1286	1093
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1500	1579	1342	1676	1765	1500	1513	1570		1221	1286	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	394	194	272	6	628	361	311	422	44	228	378	222
RTOR Reduction (vph)	0	0	140	0	0	98	0	3	0	0	0	124
Lane Group Flow (vph)	394	194	132	6	628	263	311	463	0	228	378	98
Heavy Vehicles (%)	14%	14%	14%	2%	2%	2%	13%	13%	13%	40%	40%	40%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Effective Green, g (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Actuated g/C Ratio	0.19	0.48	0.48	0.00	0.30	0.30	0.14	0.23		0.12	0.21	0.21
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	280	764	649	8	533	453	209	357		149	271	231
v/s Ratio Prot	c0.26	0.12		0.00	c0.36		c0.21	c0.29		0.19	0.29	
v/s Ratio Perm			0.10			0.18						0.09
v/c Ratio	1.41	0.25	0.20	0.75	1.18	0.58	1.49	1.30		1.53	1.39	0.42
Uniform Delay, d1	50.1	18.7	18.2	61.2	43.0	36.4	53.1	47.6		54.1	48.6	42.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	203.2	0.5	0.4	166.2	98.4	3.6	243.3	152.8		269.5	198.7	0.5
Delay (s)	253.3	19.2	18.6	227.4	141.4	40.0	296.4	200.4		323.6	247.3	42.6
Level of Service	F	B	B	F	F	D	F	F		F	F	D
Approach Delay (s)		126.3			105.1			238.8			213.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	166.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.5%	ICU Level of Service	G
Analysis Period (min)	15		

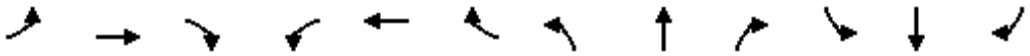
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	185	1355	895	0	0	0	0	325	95
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5					3.5	3.5
Lane Util. Factor					0.95	1.00					0.95	1.00
Frt					1.00	0.85					1.00	0.85
Flt Protected					0.99	1.00					1.00	1.00
Satd. Flow (prot)					3060	1377					2578	1153
Flt Permitted					0.99	1.00					1.00	1.00
Satd. Flow (perm)					3060	1377					2578	1153
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)	0	0	0	195	1426	942	0	0	0	0	342	100
RTOR Reduction (vph)	0	0	0	0	8	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	0	0	1613	942	0	0	0	0	342	38
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)					82.5	110.0					19.5	19.5
Effective Green, g (s)					83.0	110.0					20.0	20.0
Actuated g/C Ratio					0.75	1.00					0.18	0.18
Clearance Time (s)					4.0						4.0	4.0
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2309	1377					469	210
v/s Ratio Prot					0.53						0.13	
v/s Ratio Perm						c0.68						0.03
v/c Ratio					0.70	0.68					0.73	0.18
Uniform Delay, d1					7.0	0.0					42.4	38.1
Progression Factor					0.62	1.00					1.00	1.00
Incremental Delay, d2					1.0	1.6					5.6	0.4
Delay (s)					5.4	1.6					48.1	38.5
Level of Service					A	A					D	D
Approach Delay (s)		0.0			4.0			0.0			45.9	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	10.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

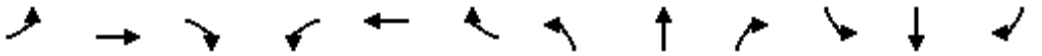
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	880	5	0	0	0	0	0	5	500	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0							3.5	3.5	3.5	
Lane Util. Factor		0.91							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		4152							1484	1244	1254	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		4152							1484	1244	1254	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	917	5	0	0	0	0	0	6	521	6	0
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	0	921	0	0	0	0	0	0	0	266	261	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type									custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases												
Actuated Green, G (s)		26.2							0.8	16.0	16.0	
Effective Green, g (s)		26.2							1.3	16.5	16.5	
Actuated g/C Ratio		0.48							0.02	0.30	0.30	
Clearance Time (s)		4.0							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1978							35	373	376	
v/s Ratio Prot		c0.22							c0.00	c0.21	0.21	
v/s Ratio Perm												
v/c Ratio		0.47							0.00	0.71	0.69	
Uniform Delay, d1		9.7							26.2	17.1	17.0	
Progression Factor		1.00							1.00	0.71	0.69	
Incremental Delay, d2		0.8							0.0	4.9	4.3	
Delay (s)		10.5							26.3	17.1	16.0	
Level of Service		B							C	B	B	
Approach Delay (s)		10.5			0.0			26.3			16.6	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

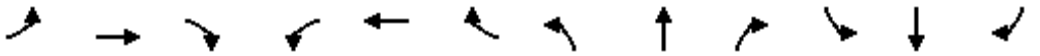
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	215	75	2075	320	0	0	0	145
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	226	79	2184	337	0	0	0	153
RTOR Reduction (vph)	0	0	0	0	0	69	46	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	226	10	2138	337	0	0	0	153
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					13.6	13.6	88.4	88.4				110.0
Effective Green, g (s)					14.1	14.1	88.4	88.4				110.0
Actuated g/C Ratio					0.13	0.13	0.80	0.80				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					364	163	2422	1315				1428
v/s Ratio Prot					c0.08		c0.71	0.21				
v/s Ratio Perm						0.01						0.11
v/c Ratio					0.62	0.06	0.88	0.26				0.11
Uniform Delay, d1					45.4	42.1	7.3	2.7				0.0
Progression Factor					1.00	1.00	0.27	0.49				1.00
Incremental Delay, d2					3.3	0.2	1.9	0.2				0.2
Delay (s)					48.7	42.3	3.9	1.5				0.2
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			47.0			3.5			0.2	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	119.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



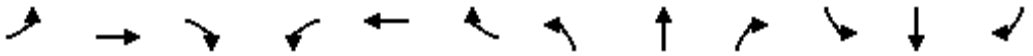
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	215	850	0	0	0	0	1970	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1409	2257					3228	1444			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1409	2257					3228	1444			
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)	447	226	895	0	0	0	0	2074	63	0	0	0
RTOR Reduction (vph)	13	13	81	0	0	0	0	0	11	0	0	0
Lane Group Flow (vph)	318	329	814	0	0	0	0	2074	52	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	27.6	27.6	99.6					74.4	74.4			
Effective Green, g (s)	28.1	28.1	100.1					73.4	73.4			
Actuated g/C Ratio	0.26	0.26	0.91					0.67	0.67			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	348	360	2054					2154	964			
v/s Ratio Prot	0.23	c0.23	0.36					c0.64	0.04			
v/s Ratio Perm												
v/c Ratio	0.91	0.91	0.40					0.96	0.05			
Uniform Delay, d1	39.8	39.8	0.7					17.0	6.3			
Progression Factor	0.84	0.84	5.92					0.22	0.04			
Incremental Delay, d2	25.9	25.3	0.1					8.4	0.0			
Delay (s)	59.4	58.8	4.2					12.2	0.3			
Level of Service	E	E	A					B	A			
Approach Delay (s)		27.8			0.0			11.8			0.0	
Approach LOS		C			A			B			A	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	5	55	1970	45	40	810
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	58	2074	47	42	853
RTOR Reduction (vph)	0	55	0	5	0	0
Lane Group Flow (vph)	5	3	2074	42	42	853
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	5.5	5.5	84.0	84.0	7.5	94.5
Effective Green, g (s)	5.5	5.5	84.0	84.0	7.5	94.5
Actuated g/C Ratio	0.05	0.05	0.76	0.76	0.07	0.86
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	84	75	2560	1145	114	2881
v/s Ratio Prot	c0.00	0.00	c0.62		c0.03	0.25
v/s Ratio Perm				0.03		
v/c Ratio	0.06	0.04	0.81	0.04	0.37	0.30
Uniform Delay, d1	49.8	49.7	8.1	3.2	49.0	1.5
Progression Factor	1.00	1.00	0.51	0.54	1.03	0.55
Incremental Delay, d2	0.2	0.1	0.3	0.0	1.9	0.2
Delay (s)	50.0	49.9	4.4	1.7	52.4	1.1
Level of Service	D	D	A	A	D	A
Approach Delay (s)	49.9		4.3			3.5
Approach LOS	D		A			A

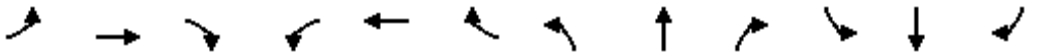
Intersection Summary			
HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	75	90	40	140	615	105	1340	65	135	620	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
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)	63	79	95	42	147	647	111	1411	68	142	653	63
RTOR Reduction (vph)	0	0	66	0	0	129	0	3	0	0	7	0
Lane Group Flow (vph)	63	79	29	42	147	518	111	1476	0	142	709	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	4.0	34.0	34.0	4.2	34.2	34.2	11.1	46.8		9.0	44.7	
Effective Green, g (s)	4.0	34.0	34.0	4.2	34.2	34.2	11.1	46.8		9.0	44.7	
Actuated g/C Ratio	0.04	0.31	0.31	0.04	0.31	0.31	0.10	0.43		0.08	0.41	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	61	546	464	64	549	466	169	1417		135	1345	
v/s Ratio Prot	c0.04	0.04		0.03	0.08		0.07	c0.44		c0.09	0.21	
v/s Ratio Perm			0.02			c0.35						
v/c Ratio	1.03	0.14	0.06	0.66	0.27	1.11	0.66	1.04		1.05	0.53	
Uniform Delay, d1	53.0	27.5	26.8	52.2	28.5	37.9	47.6	31.6		50.5	24.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.19	0.87	
Incremental Delay, d2	124.7	0.1	0.1	16.9	0.3	75.8	6.8	35.4		90.9	1.4	
Delay (s)	177.7	27.6	26.8	69.1	28.8	113.7	54.4	67.0		150.9	22.9	
Level of Service	F	C	C	E	C	F	D	E		F	C	
Approach Delay (s)		67.2			96.6			66.1			44.1	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM Average Control Delay	68.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

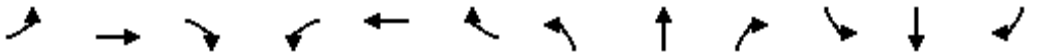
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	515	410	5	340	245	205	305	45	335	465	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1569	1651	1404	1613	1698	1443	1346	1390		1449	1525	1297
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1569	1651	1404	1613	1698	1443	1346	1390		1449	1525	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	261	572	456	6	378	272	228	339	50	372	517	400
RTOR Reduction (vph)	0	0	158	0	0	122	0	5	0	0	0	164
Lane Group Flow (vph)	261	572	298	6	378	150	228	384	0	372	517	236
Heavy Vehicles (%)	9%	9%	9%	6%	6%	6%	27%	27%	27%	18%	18%	18%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Effective Green, g (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Actuated g/C Ratio	0.15	0.38	0.38	0.00	0.23	0.23	0.15	0.23		0.23	0.30	0.30
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	3.0		2.0	2.0	2.0
Lane Grp Cap (vph)	242	624	531	8	389	330	208	316		329	458	390
v/s Ratio Prot	c0.17	c0.35		0.00	0.22		0.17	0.28		c0.26	c0.34	
v/s Ratio Perm			0.21			0.10						0.18
v/c Ratio	1.08	0.92	0.56	0.75	0.97	0.46	1.10	1.22		1.13	1.13	0.60
Uniform Delay, d1	52.1	36.5	30.2	61.2	47.1	40.9	52.1	47.6		47.6	43.1	36.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	80.3	19.7	2.8	166.2	38.7	2.8	90.5	122.8		89.8	82.2	1.8
Delay (s)	132.4	56.1	33.0	227.4	85.8	43.7	142.6	170.4		137.4	125.3	38.7
Level of Service	F	E	C	F	F	D	F	F		F	F	D
Approach Delay (s)		63.4			69.6			160.1			101.9	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	92.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

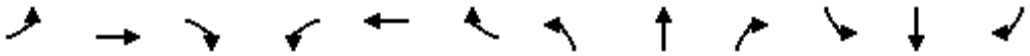
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	385	1005	590	0	0	0	0	745	215
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5					3.5	3.5
Lane Util. Factor					0.95	1.00					0.95	1.00
Frt					1.00	0.85					1.00	0.85
Flt Protected					0.99	1.00					1.00	1.00
Satd. Flow (prot)					2852	1293					3079	1377
Flt Permitted					0.99	1.00					1.00	1.00
Satd. Flow (perm)					2852	1293					3079	1377
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)	0	0	0	405	1058	621	0	0	0	0	784	226
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	0	0	0	78
Lane Group Flow (vph)	0	0	0	0	1447	621	0	0	0	0	784	148
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)					76.5	120.0					35.5	35.5
Effective Green, g (s)					77.0	120.0					36.0	36.0
Actuated g/C Ratio					0.64	1.00					0.30	0.30
Clearance Time (s)					4.0						4.0	4.0
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					1830	1293					924	413
v/s Ratio Prot					c0.51						c0.25	
v/s Ratio Perm						0.48						0.11
v/c Ratio					0.79	0.48					0.85	0.36
Uniform Delay, d1					15.6	0.0					39.4	32.9
Progression Factor					1.08	1.00					1.00	1.00
Incremental Delay, d2					3.0	1.1					7.3	0.5
Delay (s)					19.8	1.1					46.8	33.5
Level of Service					B	A					D	C
Approach Delay (s)		0.0			14.2			0.0			43.8	
Approach LOS		A			B			A			D	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	94.3%	ICU Level of Service	F
Analysis Period (min)	15		

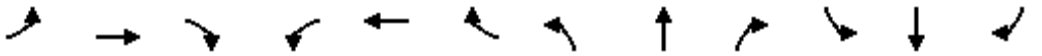
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1560	5	0	0	0	0	0	5	1125	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0							3.5	3.5	3.5	
Lane Util. Factor		0.91							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		4680							1484	2950	1403	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		4680							1484	2950	1403	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	1625	6	0	0	0	0	0	6	1172	6	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	0	1631	0	0	0	0	0	0	0	586	592	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type									custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases												
Actuated Green, G (s)		49.4							0.8	57.3	57.3	
Effective Green, g (s)		49.9							1.3	57.8	57.8	
Actuated g/C Ratio		0.42							0.01	0.48	0.48	
Clearance Time (s)		4.5							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1946							16	1421	676	
v/s Ratio Prot		c0.35							c0.00	0.20	c0.42	
v/s Ratio Perm												
v/c Ratio		0.84							0.00	0.41	0.88	
Uniform Delay, d1		31.4							58.7	20.1	27.9	
Progression Factor		1.00							1.00	0.68	0.62	
Incremental Delay, d2		4.5							0.1	0.1	7.8	
Delay (s)		35.9							58.8	13.8	25.0	
Level of Service		D							E	B	C	
Approach Delay (s)		35.9			0.0			58.8			19.4	
Approach LOS		D			A			E			B	

Intersection Summary			
HCM Average Control Delay	29.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		

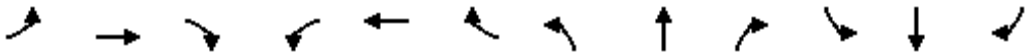
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	285	60	1385	170	0	0	0	310
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	300	63	1458	179	0	0	0	326
RTOR Reduction (vph)	0	0	0	0	0	53	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	300	10	1458	179	0	0	0	326
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					18.8	18.8	93.2	93.2				120.0
Effective Green, g (s)					19.3	19.3	93.7	93.7				120.0
Actuated g/C Ratio					0.16	0.16	0.78	0.78				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					424	190	2269	1231				1294
v/s Ratio Prot					c0.11		c0.50	0.11				
v/s Ratio Perm						0.01						0.25
v/c Ratio					0.71	0.05	0.64	0.15				0.25
Uniform Delay, d1					47.7	42.6	5.8	3.3				0.0
Progression Factor					1.00	1.00	0.52	0.67				1.00
Incremental Delay, d2					5.3	0.1	0.9	0.2				0.5
Delay (s)					53.0	42.7	3.9	2.3				0.5
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			51.2			3.7			0.5	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	137.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



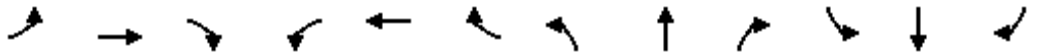
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	400	450	1975	0	0	0	0	1155	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1505	2380					3197	1430			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1505	2380					3197	1430			
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)	421	474	2079	0	0	0	0	1216	126	0	0	0
RTOR Reduction (vph)	10	3	208	0	0	0	0	0	34	0	0	0
Lane Group Flow (vph)	369	513	1871	0	0	0	0	1216	92	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	59.5	59.5	106.5					52.5	52.5			
Effective Green, g (s)	60.0	60.0	107.0					51.5	51.5			
Actuated g/C Ratio	0.50	0.50	0.89					0.43	0.43			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	718	753	2122					1372	614			
v/s Ratio Prot	0.26	0.34	c0.79					c0.38	0.06			
v/s Ratio Perm												
v/c Ratio	0.51	0.68	0.88					0.89	0.15			
Uniform Delay, d1	20.2	22.7	3.3					31.6	20.9			
Progression Factor	0.77	0.81	27.79					0.81	0.64			
Incremental Delay, d2	0.5	1.9	3.5					5.8	0.1			
Delay (s)	16.1	20.3	95.0					31.4	13.4			
Level of Service	B	C	F					C	B			
Approach Delay (s)		72.0			0.0			29.7			0.0	
Approach LOS		E			A			C			A	

Intersection Summary			
HCM Average Control Delay	58.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	116.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	335	185	1090	245	160	1815
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	353	195	1147	258	168	1911
RTOR Reduction (vph)	0	149	0	68	0	0
Lane Group Flow (vph)	353	46	1147	190	168	1911
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	28.4	28.4	61.9	61.9	16.7	81.6
Effective Green, g (s)	28.4	28.4	61.9	61.9	16.7	81.6
Actuated g/C Ratio	0.24	0.24	0.52	0.52	0.14	0.68
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	397	355	1730	774	233	2280
v/s Ratio Prot	c0.21	0.03	0.34		0.10	c0.57
v/s Ratio Perm				0.13		
v/c Ratio	0.89	0.13	0.66	0.25	0.72	0.84
Uniform Delay, d1	44.3	36.1	21.4	16.1	49.4	14.3
Progression Factor	1.00	1.00	1.62	2.60	1.03	0.94
Incremental Delay, d2	20.5	0.1	0.7	0.3	4.8	1.7
Delay (s)	64.8	36.2	35.2	42.1	55.5	15.1
Level of Service	E	D	D	D	E	B
Approach Delay (s)	54.6		36.5			18.4
Approach LOS	D		D			B

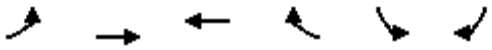
Intersection Summary			
HCM Average Control Delay	29.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	290	265	120	145	250	105	960	95	445	1595	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3320	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3320	
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)	132	305	279	126	153	263	111	1011	100	468	1679	116
RTOR Reduction (vph)	0	0	115	0	0	214	0	6	0	0	4	0
Lane Group Flow (vph)	132	305	164	126	153	49	111	1105	0	468	1791	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	22.4	22.4	10.0	22.4	22.4	8.6	38.0		33.6	63.0	
Effective Green, g (s)	10.0	22.4	22.4	10.0	22.4	22.4	8.6	38.0		33.6	63.0	
Actuated g/C Ratio	0.08	0.19	0.19	0.08	0.19	0.19	0.07	0.32		0.28	0.52	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	140	329	280	140	329	280	120	1048		460	1743	
v/s Ratio Prot	c0.08	c0.17		0.08	0.09		0.07	0.33		c0.28	c0.54	
v/s Ratio Perm			0.11			0.03						
v/c Ratio	0.94	0.93	0.58	0.90	0.47	0.18	0.93	1.05		1.02	1.03	
Uniform Delay, d1	54.7	48.0	44.5	54.5	43.5	41.0	55.4	41.0		43.2	28.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	0.75	
Incremental Delay, d2	58.1	31.1	3.1	46.6	1.0	0.3	58.2	43.3		34.9	23.2	
Delay (s)	112.8	79.1	47.6	101.1	44.5	41.3	113.5	84.3		76.9	44.5	
Level of Service	F	E	D	F	D	D	F	F		E	D	
Approach Delay (s)		73.1			56.1			86.9			51.2	
Approach LOS		E			E			F			D	

Intersection Summary			
HCM Average Control Delay	64.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

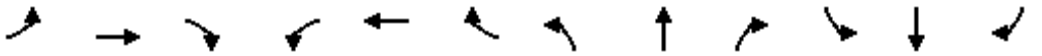
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	195	755	615	445	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1500	1579	1667	1417	1221	1093
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1500	1579	1667	1417	1221	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	450	217	839	683	494	228
RTOR Reduction (vph)	0	0	0	170	0	171
Lane Group Flow (vph)	450	217	839	513	494	57
Heavy Vehicles (%)	14%	14%	8%	8%	40%	40%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	22.0	63.0	37.0	37.0	26.0	25.0
Effective Green, g (s)	22.0	63.0	37.0	37.0	26.0	25.0
Actuated g/C Ratio	0.22	0.63	0.37	0.37	0.26	0.25
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	330	995	617	524	317	273
v/s Ratio Prot	c0.30	0.14	c0.50		c0.40	
v/s Ratio Perm				0.36		0.05
v/c Ratio	1.36	0.22	1.36	0.98	1.56	0.21
Uniform Delay, d1	39.0	7.9	31.5	31.1	37.0	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	182.0	0.3	172.3	34.1	266.2	0.1
Delay (s)	221.0	8.2	203.8	65.2	303.2	29.8
Level of Service	F	A	F	E	F	C
Approach Delay (s)		151.8	141.6		216.9	
Approach LOS		F	F		F	

Intersection Summary			
HCM Average Control Delay	162.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

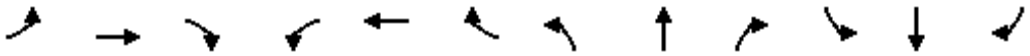
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	170	1345	1010	0	300	0	0	390	335
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)				3.0	3.5	3.5		4.0			3.5	3.5
Lane Util. Factor				1.00	0.95	1.00		1.00			0.95	1.00
Frt				1.00	1.00	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1539	3079	1377		1716			2578	1153
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1539	3079	1377		1716			2578	1153
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)	0	0	0	179	1416	1063	0	316	0	0	411	353
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	24
Lane Group Flow (vph)	0	0	0	179	1416	1063	0	316	0	0	411	329
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4			6			2	
Permitted Phases						Free						2
Actuated Green, G (s)				66.6	66.6	110.0		35.4			35.4	35.4
Effective Green, g (s)				67.6	67.1	110.0		35.4			35.9	35.9
Actuated g/C Ratio				0.61	0.61	1.00		0.32			0.33	0.33
Clearance Time (s)				4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)				946	1878	1377		552			841	376
v/s Ratio Prot				0.12	0.46			0.18			0.16	
v/s Ratio Perm						c0.77						c0.29
v/c Ratio				0.19	0.75	0.77		0.57			0.49	0.87
Uniform Delay, d1				9.2	15.5	0.0		31.0			29.7	34.9
Progression Factor				0.97	0.92	1.00		0.89			1.00	1.00
Incremental Delay, d2				0.2	1.5	2.3		1.4			0.4	19.6
Delay (s)				9.2	15.8	2.3		28.9			30.1	54.5
Level of Service				A	B	A		C			C	D
Approach Delay (s)		0.0			10.0			28.9			41.4	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	3.5
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

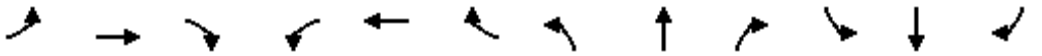
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	910	5	0	0	0	0	0	20	555	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.0							3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91							1.00	0.95	0.95	
Frt	1.00	1.00							0.86	1.00	1.00	
Flt Protected	0.95	1.00							1.00	0.95	0.95	
Satd. Flow (prot)	1446	4152							1484	1244	1253	
Flt Permitted	0.95	1.00							1.00	0.95	0.95	
Satd. Flow (perm)	1446	4152							1484	1244	1253	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	312	948	5	0	0	0	0	0	22	578	6	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	22	0	0	0
Lane Group Flow (vph)	312	953	0	0	0	0	0	0	0	289	295	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type	Split								custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases												
Actuated Green, G (s)	63.5	63.5							1.6	32.9	32.9	
Effective Green, g (s)	63.0	63.5							2.1	33.4	33.4	
Actuated g/C Ratio	0.57	0.58							0.02	0.30	0.30	
Clearance Time (s)	4.0	4.0							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	828	2397							28	378	380	
v/s Ratio Prot	0.22	c0.23							c0.00	0.23	c0.24	
v/s Ratio Perm												
v/c Ratio	0.38	0.40							0.02	0.76	0.78	
Uniform Delay, d1	12.8	12.8							52.9	34.7	34.9	
Progression Factor	1.00	1.00							1.00	0.64	0.64	
Incremental Delay, d2	1.3	0.5							0.2	8.5	9.2	
Delay (s)	14.1	13.2							53.2	30.6	31.4	
Level of Service	B	B							D	C	C	
Approach Delay (s)		13.5			0.0			53.2			31.0	
Approach LOS		B			A			D			C	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

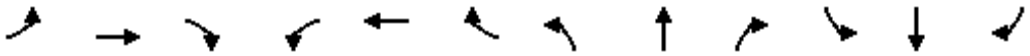
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	255	80	2100	405	0	0	0	175
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	268	84	2211	426	0	0	0	184
RTOR Reduction (vph)	0	0	0	0	0	73	31	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	268	11	2180	426	0	0	0	184
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					14.4	14.4	87.6	87.6				110.0
Effective Green, g (s)					14.9	14.9	87.6	87.6				110.0
Actuated g/C Ratio					0.14	0.14	0.80	0.80				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					385	172	2400	1303				1428
v/s Ratio Prot					c0.09		c0.72	0.26				
v/s Ratio Perm						0.01						0.13
v/c Ratio					0.70	0.07	0.91	0.33				0.13
Uniform Delay, d1					45.4	41.5	8.2	3.1				0.0
Progression Factor					1.00	1.00	0.29	0.49				1.00
Incremental Delay, d2					5.4	0.2	0.7	0.1				0.2
Delay (s)					50.8	41.6	3.1	1.6				0.2
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			48.6			2.8			0.2	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	120.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



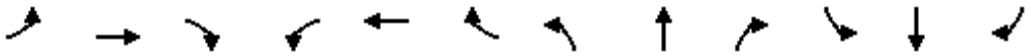
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	510	235	860	0	0	0	0	2010	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1407	2257					3228	1444			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1407	2257					3228	1444			
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)	537	247	905	0	0	0	0	2116	63	0	0	0
RTOR Reduction (vph)	9	9	78	0	0	0	0	0	11	0	0	0
Lane Group Flow (vph)	378	388	827	0	0	0	0	2116	52	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	31.0	31.0	100.0					71.0	71.0			
Effective Green, g (s)	31.5	31.5	100.5					70.0	70.0			
Actuated g/C Ratio	0.29	0.29	0.91					0.64	0.64			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	390	403	2062					2054	919			
v/s Ratio Prot	c0.28	0.28	0.37					c0.66	0.04			
v/s Ratio Perm												
v/c Ratio	0.97	0.96	0.40					1.03	0.06			
Uniform Delay, d1	38.8	38.7	0.6					20.0	7.5			
Progression Factor	0.95	0.95	19.47					0.31	0.17			
Incremental Delay, d2	35.4	33.4	0.1					23.8	0.0			
Delay (s)	72.1	70.0	12.7					30.0	1.3			
Level of Service	E	E	B					C	A			
Approach Delay (s)		39.8			0.0			29.1			0.0	
Approach LOS		D			A			C			A	

Intersection Summary			
HCM Average Control Delay	33.8	HCM Level of Service	C
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	5	55	2010	45	40	820
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	58	2116	47	42	863
RTOR Reduction (vph)	0	55	0	4	0	0
Lane Group Flow (vph)	5	3	2116	43	42	863
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	5.5	5.5	84.0	84.0	7.5	94.5
Effective Green, g (s)	5.5	5.5	84.0	84.0	7.5	94.5
Actuated g/C Ratio	0.05	0.05	0.76	0.76	0.07	0.86
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	84	75	2560	1145	114	2881
v/s Ratio Prot	c0.00	0.00	c0.63		c0.03	0.26
v/s Ratio Perm				0.03		
v/c Ratio	0.06	0.04	0.83	0.04	0.37	0.30
Uniform Delay, d1	49.8	49.7	8.3	3.2	49.0	1.5
Progression Factor	1.00	1.00	0.55	0.53	1.02	1.13
Incremental Delay, d2	0.2	0.1	0.3	0.0	1.9	0.2
Delay (s)	50.0	49.9	4.9	1.7	51.9	1.9
Level of Service	D	D	A	A	D	A
Approach Delay (s)	49.9		4.8			4.2
Approach LOS	D		A			A

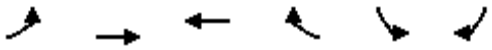
Intersection Summary			
HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	70	90	40	130	625	85	1360	65	140	625	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
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)	84	74	95	42	137	658	89	1432	68	147	658	63
RTOR Reduction (vph)	0	0	65	0	0	142	0	3	0	0	6	0
Lane Group Flow (vph)	84	74	30	42	137	516	89	1497	0	147	715	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	6.0	35.0	35.0	4.2	33.2	33.2	8.5	44.8		10.0	46.3	
Effective Green, g (s)	6.0	35.0	35.0	4.2	33.2	33.2	8.5	44.8		10.0	46.3	
Actuated g/C Ratio	0.05	0.32	0.32	0.04	0.30	0.30	0.08	0.41		0.09	0.42	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	91	562	477	64	533	453	130	1356		149	1393	
v/s Ratio Prot	c0.05	0.04		0.03	0.08		0.05	c0.45		c0.09	0.22	
v/s Ratio Perm			0.02			c0.34						
v/c Ratio	0.92	0.13	0.06	0.66	0.26	1.14	0.68	1.10		0.99	0.51	
Uniform Delay, d1	51.8	26.7	26.1	52.2	29.1	38.4	49.4	32.6		49.9	23.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.27	0.84	
Incremental Delay, d2	68.3	0.1	0.1	16.9	0.3	86.4	11.3	58.1		67.9	1.3	
Delay (s)	120.1	26.8	26.2	69.1	29.3	124.8	60.7	90.7		131.6	21.2	
Level of Service	F	C	C	E	C	F	E	F		F	C	
Approach Delay (s)		57.5			106.4			89.1			39.9	
Approach LOS		E			F			F			D	

Intersection Summary			
HCM Average Control Delay	78.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.1%	ICU Level of Service	F
Analysis Period (min)	15		

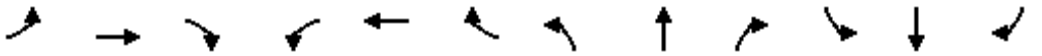
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	250	585	360	450	745	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1569	1651	1488	1264	1449	1297
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1569	1651	1488	1264	1449	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	278	650	400	500	828	400
RTOR Reduction (vph)	0	0	0	261	0	192
Lane Group Flow (vph)	278	650	400	239	828	208
Heavy Vehicles (%)	9%	9%	21%	21%	18%	18%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	15.0	45.0	26.0	26.0	44.0	43.0
Effective Green, g (s)	15.0	45.0	26.0	26.0	44.0	43.0
Actuated g/C Ratio	0.15	0.45	0.26	0.26	0.44	0.43
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	235	743	387	329	638	558
v/s Ratio Prot	c0.18	0.39	c0.27		c0.57	
v/s Ratio Perm				0.19		0.16
v/c Ratio	1.18	0.87	1.03	0.73	1.30	0.37
Uniform Delay, d1	42.5	24.9	37.0	33.7	28.0	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	117.1	12.5	54.7	10.7	145.3	0.2
Delay (s)	159.6	37.5	91.7	44.5	173.3	19.5
Level of Service	F	D	F	D	F	B
Approach Delay (s)		74.1	65.4		123.2	
Approach LOS		E	E		F	

Intersection Summary			
HCM Average Control Delay	91.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

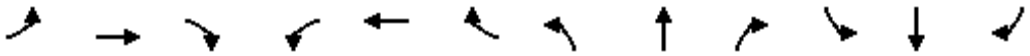
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	370	1040	635	0	210	0	0	915	645
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)				3.0	3.5	3.5		3.0			3.5	3.5
Lane Util. Factor				1.00	0.95	1.00		1.00			0.95	1.00
Frt				1.00	1.00	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1446	2891	1293		1509			3079	1377
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1446	2891	1293		1509			3079	1377
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)	0	0	0	389	1095	668	0	221	0	0	963	679
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	16
Lane Group Flow (vph)	0	0	0	389	1095	668	0	221	0	0	963	663
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4			6			2	
Permitted Phases						Free						2
Actuated Green, G (s)				51.4	51.4	120.0		60.6			60.6	60.6
Effective Green, g (s)				52.4	51.9	120.0		61.6			61.1	61.1
Actuated g/C Ratio				0.44	0.43	1.00		0.51			0.51	0.51
Clearance Time (s)				4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)				631	1250	1293		775			1568	701
v/s Ratio Prot				0.27	c0.38			0.15			0.31	
v/s Ratio Perm						0.52						c0.48
v/c Ratio				0.62	0.88	0.52		0.29			0.61	0.95
Uniform Delay, d1				26.1	31.1	0.0		16.6			21.0	27.9
Progression Factor				0.84	0.85	1.00		3.10			1.00	1.00
Incremental Delay, d2				3.7	7.3	1.2		0.2			0.7	21.6
Delay (s)				25.7	33.8	1.2		51.7			21.8	49.5
Level of Service				C	C	A		D			C	D
Approach Delay (s)		0.0			22.2			51.7			33.2	
Approach LOS		A			C			D			C	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		

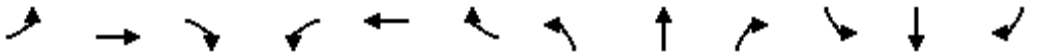
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	210	1565	15	0	0	0	0	0	15	1280	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.0	4.0							3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91							1.00	0.95	0.95	
Frt	1.00	1.00							0.86	1.00	1.00	
Flt Protected	0.95	1.00							1.00	0.95	0.95	
Satd. Flow (prot)	1525	4680							1484	2950	1403	
Flt Permitted	0.95	1.00							1.00	0.95	0.95	
Satd. Flow (perm)	1525	4680							1484	2950	1403	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	219	1630	17	0	0	0	0	0	17	1333	6	0
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	17	0	0	0
Lane Group Flow (vph)	219	1646	0	0	0	0	0	0	0	666	673	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type	Split								custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases												
Actuated Green, G (s)	43.7	43.7							1.6	62.2	62.2	
Effective Green, g (s)	43.2	44.2							2.1	62.7	62.7	
Actuated g/C Ratio	0.36	0.37							0.02	0.52	0.52	
Clearance Time (s)	4.5	4.5							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	549	1724							26	1541	733	
v/s Ratio Prot	0.14	c0.35							c0.00	0.23	c0.48	
v/s Ratio Perm												
v/c Ratio	0.40	0.95							0.01	0.43	0.92	
Uniform Delay, d1	28.7	36.9							57.9	17.7	26.3	
Progression Factor	1.00	1.00							1.00	0.67	0.61	
Incremental Delay, d2	2.2	13.3							0.2	0.2	13.7	
Delay (s)	30.9	50.3							58.1	12.0	29.8	
Level of Service	C	D							E	B	C	
Approach Delay (s)		48.0			0.0			58.1			21.0	
Approach LOS		D			A			E			C	

Intersection Summary			
HCM Average Control Delay	36.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		

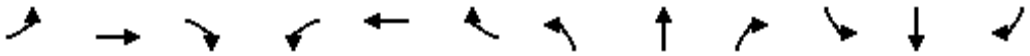
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	305	65	1415	245	0	0	0	360
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	321	68	1489	258	0	0	0	379
RTOR Reduction (vph)	0	0	0	0	0	57	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	321	11	1489	258	0	0	0	379
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					19.7	19.7	92.3	92.3				120.0
Effective Green, g (s)					20.2	20.2	92.8	92.8				120.0
Actuated g/C Ratio					0.17	0.17	0.77	0.77				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					444	199	2247	1220				1294
v/s Ratio Prot					c0.12		c0.51	0.16				
v/s Ratio Perm						0.01						0.29
v/c Ratio					0.72	0.06	0.66	0.21				0.29
Uniform Delay, d1					47.3	41.9	6.3	3.7				0.0
Progression Factor					1.00	1.00	0.31	0.42				1.00
Incremental Delay, d2					5.7	0.1	0.9	0.2				0.6
Delay (s)					53.0	42.0	2.8	1.8				0.6
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			51.1			2.7			0.6	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	139.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



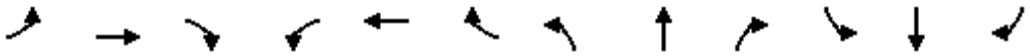
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	485	490	2010	0	0	0	0	1175	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1505	2380					3197	1430			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1505	2380					3197	1430			
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)	511	516	2116	0	0	0	0	1237	126	0	0	0
RTOR Reduction (vph)	9	3	181	0	0	0	0	0	34	0	0	0
Lane Group Flow (vph)	451	564	1935	0	0	0	0	1237	92	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	61.2	61.2	108.2					50.8	50.8			
Effective Green, g (s)	61.7	61.7	108.7					49.8	49.8			
Actuated g/C Ratio	0.51	0.51	0.91					0.41	0.41			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	738	774	2156					1327	593			
v/s Ratio Prot	0.31	0.37	c0.81					c0.39	0.06			
v/s Ratio Perm												
v/c Ratio	0.61	0.73	0.90					0.93	0.16			
Uniform Delay, d1	20.7	22.6	2.8					33.5	21.9			
Progression Factor	0.69	0.69	26.37					0.57	0.79			
Incremental Delay, d2	1.0	2.3	3.6					9.7	0.1			
Delay (s)	15.3	17.8	78.7					28.8	17.4			
Level of Service	B	B	E					C	B			
Approach Delay (s)		58.4			0.0			27.7			0.0	
Approach LOS		E			A			C			A	

Intersection Summary			
HCM Average Control Delay	49.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	118.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	335	185	1110	245	160	1850
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	353	195	1168	258	168	1947
RTOR Reduction (vph)	0	149	0	66	0	0
Lane Group Flow (vph)	353	46	1168	192	168	1947
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	28.4	28.4	61.9	61.9	16.7	81.6
Effective Green, g (s)	28.4	28.4	61.9	61.9	16.7	81.6
Actuated g/C Ratio	0.24	0.24	0.52	0.52	0.14	0.68
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	397	355	1730	774	233	2280
v/s Ratio Prot	c0.21	0.03	0.35		0.10	c0.58
v/s Ratio Perm				0.13		
v/c Ratio	0.89	0.13	0.68	0.25	0.72	0.85
Uniform Delay, d1	44.3	36.1	21.6	16.1	49.4	14.7
Progression Factor	1.00	1.00	0.28	0.03	1.00	0.88
Incremental Delay, d2	20.5	0.1	0.7	0.2	4.5	1.8
Delay (s)	64.8	36.2	6.8	0.7	53.7	14.7
Level of Service	E	D	A	A	D	B
Approach Delay (s)	54.6		5.7			17.8
Approach LOS	D		A			B

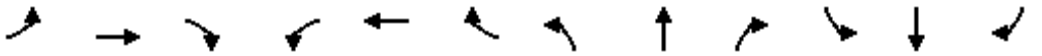
Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	275	245	120	135	250	100	960	95	455	1615	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3321	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3321	
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)	147	289	258	126	142	263	105	1011	100	479	1700	116
RTOR Reduction (vph)	0	0	115	0	0	215	0	6	0	0	4	0
Lane Group Flow (vph)	147	289	143	126	142	48	105	1105	0	479	1812	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	22.1	22.1	10.0	22.1	22.1	8.4	38.0		33.9	63.5	
Effective Green, g (s)	10.0	22.1	22.1	10.0	22.1	22.1	8.4	38.0		33.9	63.5	
Actuated g/C Ratio	0.08	0.18	0.18	0.08	0.18	0.18	0.07	0.32		0.28	0.53	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	140	325	276	140	325	276	117	1048		464	1757	
v/s Ratio Prot	c0.09	c0.16		0.08	0.08		0.06	0.33		c0.29	c0.55	
v/s Ratio Perm			0.10			0.03						
v/c Ratio	1.05	0.89	0.52	0.90	0.44	0.18	0.90	1.05		1.03	1.03	
Uniform Delay, d1	55.0	47.8	44.1	54.5	43.4	41.3	55.4	41.0		43.0	28.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.07	1.03	
Incremental Delay, d2	90.0	24.2	1.6	46.6	0.9	0.3	51.2	43.3		38.3	24.0	
Delay (s)	145.0	71.9	45.8	101.1	44.4	41.6	106.6	84.3		84.5	53.2	
Level of Service	F	E	D	F	D	D	F	F		F	D	
Approach Delay (s)		77.7			56.5			86.2			59.7	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM Average Control Delay	68.8	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

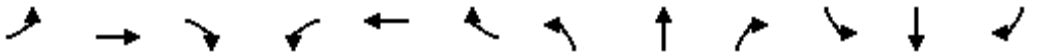
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	355	175	245	5	565	325	280	380	20	205	340	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1500	1579	1342	1676	1765	1500	1513	1581		1221	1286	1093
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1500	1579	1342	1676	1765	1500	1513	1581		1221	1286	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	394	194	272	6	628	361	311	422	22	228	378	222
RTOR Reduction (vph)	0	0	140	0	0	98	0	2	0	0	0	124
Lane Group Flow (vph)	394	194	132	6	628	263	311	442	0	228	378	98
Heavy Vehicles (%)	14%	14%	14%	2%	2%	2%	13%	13%	13%	40%	40%	40%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Effective Green, g (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Actuated g/C Ratio	0.19	0.48	0.48	0.00	0.30	0.30	0.14	0.23		0.12	0.21	0.21
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	280	764	649	8	533	453	209	359		149	271	231
v/s Ratio Prot	c0.26	0.12		0.00	c0.36		c0.21	0.28		0.19	c0.29	
v/s Ratio Perm			0.10			0.18						0.09
v/c Ratio	1.41	0.25	0.20	0.75	1.18	0.58	1.49	1.23		1.53	1.39	0.42
Uniform Delay, d1	50.1	18.7	18.2	61.2	43.0	36.4	53.1	47.6		54.1	48.6	42.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	203.2	0.5	0.4	166.2	98.4	3.6	243.3	126.6		269.5	198.7	0.5
Delay (s)	253.3	19.2	18.6	227.4	141.4	40.0	296.4	174.2		323.6	247.3	42.6
Level of Service	F	B	B	F	F	D	F	F		F	F	D
Approach Delay (s)		126.3			105.1			224.5			213.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	162.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		

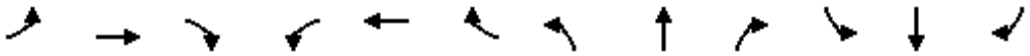
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	185	1355	895	0	20	0	0	325	95
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5		4.0			3.5	3.5
Lane Util. Factor					0.95	1.00		1.00			0.95	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3060	1377		1716			2578	1153
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3060	1377		1716			2578	1153
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)	0	0	0	195	1426	942	0	21	0	0	342	100
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	0	0	1621	942	0	21	0	0	342	38
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4			2			2	
Permitted Phases						Free						2
Actuated Green, G (s)					82.5	110.0		19.5			19.5	19.5
Effective Green, g (s)					83.0	110.0		19.5			20.0	20.0
Actuated g/C Ratio					0.75	1.00		0.18			0.18	0.18
Clearance Time (s)					4.0			4.0			4.0	4.0
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					2309	1377		304			469	210
v/s Ratio Prot					0.53			0.01			0.13	
v/s Ratio Perm						c0.68						0.03
v/c Ratio					0.70	0.68		0.07			0.73	0.18
Uniform Delay, d1					7.0	0.0		37.7			42.4	38.1
Progression Factor					0.63	1.00		0.90			1.00	1.00
Incremental Delay, d2					1.0	1.6		0.1			5.6	0.4
Delay (s)					5.5	1.6		34.0			48.1	38.5
Level of Service					A	A		C			D	D
Approach Delay (s)		0.0			4.0			34.0			45.9	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

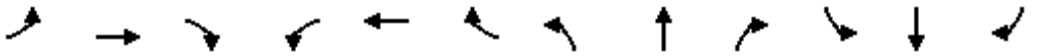
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	880	5	0	0	0	0	0	5	500	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.0							3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91							1.00	0.95	0.95	
Frt	1.00	1.00							0.86	1.00	1.00	
Flt Protected	0.95	1.00							1.00	0.95	0.95	
Satd. Flow (prot)	1446	4152							1484	1244	1254	
Flt Permitted	0.95	1.00							1.00	0.95	0.95	
Satd. Flow (perm)	1446	4152							1484	1244	1254	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	21	917	5	0	0	0	0	0	6	521	6	0
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	21	921	0	0	0	0	0	0	0	266	261	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type	Split								custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases												
Actuated Green, G (s)	26.2	26.2							0.8	16.0	16.0	
Effective Green, g (s)	25.7	26.2							1.3	16.5	16.5	
Actuated g/C Ratio	0.47	0.48							0.02	0.30	0.30	
Clearance Time (s)	4.0	4.0							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	676	1978							35	373	376	
v/s Ratio Prot	0.01	c0.22							c0.00	c0.21	0.21	
v/s Ratio Perm												
v/c Ratio	0.03	0.47							0.00	0.71	0.69	
Uniform Delay, d1	7.9	9.7							26.2	17.1	17.0	
Progression Factor	1.00	1.00							1.00	0.71	0.69	
Incremental Delay, d2	0.1	0.8							0.0	4.9	4.3	
Delay (s)	8.0	10.5							26.3	17.0	16.0	
Level of Service	A	B							C	B	B	
Approach Delay (s)		10.4			0.0			26.3			16.5	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

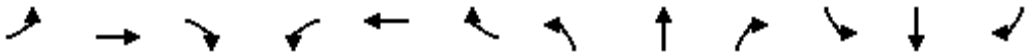
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	215	75	2075	320	0	0	0	145
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	226	79	2184	337	0	0	0	153
RTOR Reduction (vph)	0	0	0	0	0	69	46	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	226	10	2138	337	0	0	0	153
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					13.6	13.6	88.4	88.4				110.0
Effective Green, g (s)					14.1	14.1	88.4	88.4				110.0
Actuated g/C Ratio					0.13	0.13	0.80	0.80				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					364	163	2422	1315				1428
v/s Ratio Prot					c0.08		c0.71	0.21				
v/s Ratio Perm						0.01						0.11
v/c Ratio					0.62	0.06	0.88	0.26				0.11
Uniform Delay, d1					45.4	42.1	7.3	2.7				0.0
Progression Factor					1.00	1.00	0.27	0.49				1.00
Incremental Delay, d2					3.3	0.2	1.9	0.2				0.2
Delay (s)					48.7	42.3	3.9	1.5				0.2
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			47.0			3.5			0.2	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	119.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



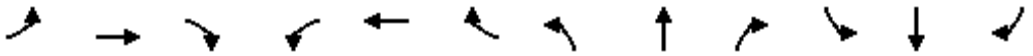
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	215	850	0	0	0	0	1970	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1409	2257					3228	1444			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1409	2257					3228	1444			
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)	447	226	895	0	0	0	0	2074	63	0	0	0
RTOR Reduction (vph)	13	13	81	0	0	0	0	0	11	0	0	0
Lane Group Flow (vph)	318	329	814	0	0	0	0	2074	52	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	27.6	27.6	99.6					74.4	74.4			
Effective Green, g (s)	28.1	28.1	100.1					73.4	73.4			
Actuated g/C Ratio	0.26	0.26	0.91					0.67	0.67			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	348	360	2054					2154	964			
v/s Ratio Prot	0.23	c0.23	0.36					c0.64	0.04			
v/s Ratio Perm												
v/c Ratio	0.91	0.91	0.40					0.96	0.05			
Uniform Delay, d1	39.8	39.8	0.7					17.0	6.3			
Progression Factor	0.84	0.84	5.92					0.22	0.04			
Incremental Delay, d2	25.9	25.3	0.1					8.4	0.0			
Delay (s)	59.3	58.8	4.2					12.2	0.3			
Level of Service	E	E	A					B	A			
Approach Delay (s)		27.8			0.0			11.8			0.0	
Approach LOS		C			A			B			A	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	5	55	1970	45	40	810
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	58	2074	47	42	853
RTOR Reduction (vph)	0	55	0	5	0	0
Lane Group Flow (vph)	5	3	2074	42	42	853
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	5.5	5.5	84.0	84.0	7.5	94.5
Effective Green, g (s)	5.5	5.5	84.0	84.0	7.5	94.5
Actuated g/C Ratio	0.05	0.05	0.76	0.76	0.07	0.86
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	84	75	2560	1145	114	2881
v/s Ratio Prot	c0.00	0.00	c0.62		c0.03	0.25
v/s Ratio Perm				0.03		
v/c Ratio	0.06	0.04	0.81	0.04	0.37	0.30
Uniform Delay, d1	49.8	49.7	8.1	3.2	49.0	1.5
Progression Factor	1.00	1.00	0.51	0.54	1.03	0.55
Incremental Delay, d2	0.2	0.1	0.3	0.0	1.9	0.2
Delay (s)	50.0	49.9	4.4	1.7	52.4	1.0
Level of Service	D	D	A	A	D	A
Approach Delay (s)	49.9		4.3			3.5
Approach LOS	D		A			A

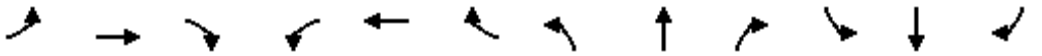
Intersection Summary			
HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	75	90	40	140	615	105	1340	65	135	620	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3309	
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)	63	79	95	42	147	647	111	1411	68	142	653	63
RTOR Reduction (vph)	0	0	66	0	0	129	0	3	0	0	7	0
Lane Group Flow (vph)	63	79	29	42	147	518	111	1476	0	142	709	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	4.0	34.0	34.0	4.2	34.2	34.2	11.1	46.8		9.0	44.7	
Effective Green, g (s)	4.0	34.0	34.0	4.2	34.2	34.2	11.1	46.8		9.0	44.7	
Actuated g/C Ratio	0.04	0.31	0.31	0.04	0.31	0.31	0.10	0.43		0.08	0.41	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	61	546	464	64	549	466	169	1417		135	1345	
v/s Ratio Prot	c0.04	0.04		0.03	0.08		0.07	c0.44		c0.09	0.21	
v/s Ratio Perm			0.02			c0.35						
v/c Ratio	1.03	0.14	0.06	0.66	0.27	1.11	0.66	1.04		1.05	0.53	
Uniform Delay, d1	53.0	27.5	26.8	52.2	28.5	37.9	47.6	31.6		50.5	24.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.19	0.87	
Incremental Delay, d2	124.7	0.1	0.1	16.9	0.3	75.8	6.8	35.4		90.9	1.4	
Delay (s)	177.7	27.6	26.8	69.1	28.8	113.7	54.4	67.0		150.9	22.9	
Level of Service	F	C	C	E	C	F	D	E		F	C	
Approach Delay (s)		67.2			96.6			66.1			44.1	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM Average Control Delay	68.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

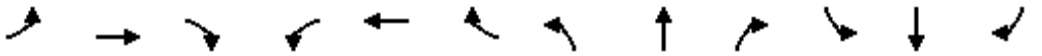
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	515	410	5	340	245	205	305	25	335	465	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1569	1651	1404	1613	1698	1443	1346	1401		1449	1525	1297
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1569	1651	1404	1613	1698	1443	1346	1401		1449	1525	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	261	572	456	6	378	272	228	339	28	372	517	400
RTOR Reduction (vph)	0	0	158	0	0	122	0	2	0	0	0	164
Lane Group Flow (vph)	261	572	298	6	378	150	228	365	0	372	517	236
Heavy Vehicles (%)	9%	9%	9%	6%	6%	6%	27%	27%	27%	18%	18%	18%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Effective Green, g (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Actuated g/C Ratio	0.15	0.38	0.38	0.00	0.23	0.23	0.15	0.23		0.23	0.30	0.30
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	3.0		2.0	2.0	2.0
Lane Grp Cap (vph)	242	624	531	8	389	330	208	318		329	458	390
v/s Ratio Prot	c0.17	c0.35		0.00	0.22		0.17	0.26		c0.26	c0.34	
v/s Ratio Perm			0.21			0.10						0.18
v/c Ratio	1.08	0.92	0.56	0.75	0.97	0.46	1.10	1.15		1.13	1.13	0.60
Uniform Delay, d1	52.1	36.5	30.2	61.2	47.1	40.9	52.1	47.6		47.6	43.1	36.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	80.3	19.7	2.8	166.2	38.7	2.8	90.5	96.4		89.8	82.2	1.8
Delay (s)	132.4	56.1	33.0	227.4	85.8	43.7	142.6	144.0		137.4	125.3	38.7
Level of Service	F	E	C	F	F	D	F	F		F	F	D
Approach Delay (s)		63.4			69.6			143.4			101.9	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	89.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		

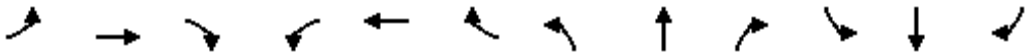
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	385	1005	590	0	20	0	0	745	215
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5		3.0			3.5	3.5
Lane Util. Factor					0.95	1.00		1.00			0.95	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					2852	1293		1509			3079	1377
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					2852	1293		1509			3079	1377
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)	0	0	0	405	1058	621	0	21	0	0	784	226
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	81
Lane Group Flow (vph)	0	0	0	0	1463	621	0	21	0	0	784	145
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4			6			2	
Permitted Phases						Free						2
Actuated Green, G (s)					76.9	120.0		35.1			35.1	35.1
Effective Green, g (s)					77.4	120.0		36.1			35.6	35.6
Actuated g/C Ratio					0.65	1.00		0.30			0.30	0.30
Clearance Time (s)					4.0			4.0			4.0	4.0
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					1840	1293		454			913	409
v/s Ratio Prot					c0.51			0.01			c0.25	
v/s Ratio Perm						0.48						0.11
v/c Ratio					0.80	0.48		0.05			0.86	0.35
Uniform Delay, d1					15.5	0.0		29.7			39.8	33.2
Progression Factor					0.54	1.00		1.30			1.00	1.00
Incremental Delay, d2					3.1	1.1		0.0			8.1	0.5
Delay (s)					11.5	1.1		38.7			47.9	33.7
Level of Service					B	A		D			D	C
Approach Delay (s)		0.0			8.4			38.7			44.7	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		

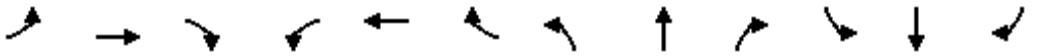
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	1560	5	0	0	0	0	0	5	1125	5	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0							3.5	3.5	3.5	
Lane Util. Factor		0.91							1.00	0.95	0.95	
Frt		1.00							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	0.95	
Satd. Flow (prot)		4680							1484	2950	1403	
Flt Permitted		1.00							1.00	0.95	0.95	
Satd. Flow (perm)		4680							1484	2950	1403	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	21	1625	6	0	0	0	0	0	6	1172	6	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	0	1652	0	0	0	0	0	0	0	586	592	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type	Split								custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases												
Actuated Green, G (s)		49.7							0.8	57.0	57.0	
Effective Green, g (s)		50.2							1.3	57.5	57.5	
Actuated g/C Ratio		0.42							0.01	0.48	0.48	
Clearance Time (s)		4.5							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1958							16	1414	672	
v/s Ratio Prot		c0.35							c0.00	0.20	c0.42	
v/s Ratio Perm												
v/c Ratio		0.84							0.00	0.41	0.88	
Uniform Delay, d1		31.4							58.7	20.3	28.2	
Progression Factor		1.00							1.00	0.55	0.52	
Incremental Delay, d2		4.7							0.1	0.1	8.1	
Delay (s)		36.0							58.8	11.4	22.7	
Level of Service		D							E	B	C	
Approach Delay (s)		36.0			0.0			58.8			17.1	
Approach LOS		D			A			E			B	

Intersection Summary			
HCM Average Control Delay	28.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		

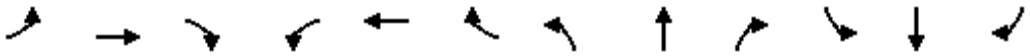
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	285	60	1385	170	0	0	0	310
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	300	63	1458	179	0	0	0	326
RTOR Reduction (vph)	0	0	0	0	0	53	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	300	10	1458	179	0	0	0	326
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					18.8	18.8	93.2	93.2				120.0
Effective Green, g (s)					19.3	19.3	93.7	93.7				120.0
Actuated g/C Ratio					0.16	0.16	0.78	0.78				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					424	190	2269	1231				1294
v/s Ratio Prot					c0.11		c0.50	0.11				
v/s Ratio Perm						0.01						0.25
v/c Ratio					0.71	0.05	0.64	0.15				0.25
Uniform Delay, d1					47.7	42.6	5.8	3.3				0.0
Progression Factor					1.00	1.00	0.26	0.31				1.00
Incremental Delay, d2					5.3	0.1	0.9	0.2				0.5
Delay (s)					53.0	42.7	2.4	1.2				0.5
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			51.2			2.2			0.5	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	137.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



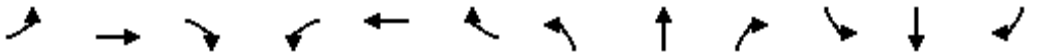
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	400	450	1975	0	0	0	0	1155	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1505	2380					3197	1430			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1505	2380					3197	1430			
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)	421	474	2079	0	0	0	0	1216	126	0	0	0
RTOR Reduction (vph)	10	3	208	0	0	0	0	0	34	0	0	0
Lane Group Flow (vph)	369	513	1871	0	0	0	0	1216	92	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	59.5	59.5	106.5					52.5	52.5			
Effective Green, g (s)	60.0	60.0	107.0					51.5	51.5			
Actuated g/C Ratio	0.50	0.50	0.89					0.43	0.43			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	718	753	2122					1372	614			
v/s Ratio Prot	0.26	0.34	c0.79					c0.38	0.06			
v/s Ratio Perm												
v/c Ratio	0.51	0.68	0.88					0.89	0.15			
Uniform Delay, d1	20.2	22.7	3.3					31.6	20.9			
Progression Factor	0.75	0.74	26.80					0.21	0.06			
Incremental Delay, d2	0.5	1.9	3.5					5.8	0.1			
Delay (s)	15.6	18.6	91.8					12.6	1.3			
Level of Service	B	B	F					B	A			
Approach Delay (s)		69.4			0.0			11.5			0.0	
Approach LOS		E			A			B			A	

Intersection Summary			
HCM Average Control Delay	51.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	116.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	335	185	1090	245	160	1815
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1676	1500	3353	1500	1676	3353
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1676	1500	3353	1500	1676	3353
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	353	195	1147	258	168	1911
RTOR Reduction (vph)	0	149	0	68	0	0
Lane Group Flow (vph)	353	46	1147	190	168	1911
Turn Type		Prot		Perm	Prot	
Protected Phases	4	4	6		5	2
Permitted Phases				6		
Actuated Green, G (s)	28.4	28.4	61.9	61.9	16.7	81.6
Effective Green, g (s)	28.4	28.4	61.9	61.9	16.7	81.6
Actuated g/C Ratio	0.24	0.24	0.52	0.52	0.14	0.68
Clearance Time (s)	5.0	5.0	5.0	5.0	3.0	5.0
Vehicle Extension (s)	2.3	2.3	6.3	6.3	3.0	6.3
Lane Grp Cap (vph)	397	355	1730	774	233	2280
v/s Ratio Prot	c0.21	0.03	0.34		0.10	c0.57
v/s Ratio Perm				0.13		
v/c Ratio	0.89	0.13	0.66	0.25	0.72	0.84
Uniform Delay, d1	44.3	36.1	21.4	16.1	49.4	14.3
Progression Factor	1.00	1.00	0.39	0.23	1.04	0.87
Incremental Delay, d2	20.5	0.1	0.7	0.3	4.8	1.7
Delay (s)	64.8	36.2	8.9	4.0	56.1	14.2
Level of Service	E	D	A	A	E	B
Approach Delay (s)	54.6		8.0			17.6
Approach LOS	D		A			B

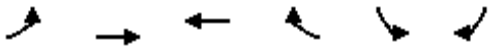
Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	290	265	120	145	250	105	960	95	445	1595	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3320	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3320	
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)	132	305	279	126	153	263	111	1011	100	468	1679	116
RTOR Reduction (vph)	0	0	115	0	0	214	0	6	0	0	4	0
Lane Group Flow (vph)	132	305	164	126	153	49	111	1105	0	468	1791	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	22.4	22.4	10.0	22.4	22.4	8.6	38.0		33.6	63.0	
Effective Green, g (s)	10.0	22.4	22.4	10.0	22.4	22.4	8.6	38.0		33.6	63.0	
Actuated g/C Ratio	0.08	0.19	0.19	0.08	0.19	0.19	0.07	0.32		0.28	0.52	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	140	329	280	140	329	280	120	1048		460	1743	
v/s Ratio Prot	c0.08	c0.17		0.08	0.09		0.07	0.33		c0.28	c0.54	
v/s Ratio Perm			0.11			0.03						
v/c Ratio	0.94	0.93	0.58	0.90	0.47	0.18	0.93	1.05		1.02	1.03	
Uniform Delay, d1	54.7	48.0	44.5	54.5	43.5	41.0	55.4	41.0		43.2	28.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.24	0.80	
Incremental Delay, d2	58.1	31.1	3.1	46.6	1.0	0.3	58.2	43.3		34.9	23.2	
Delay (s)	112.8	79.1	47.6	101.1	44.5	41.3	113.5	84.3		88.4	46.1	
Level of Service	F	E	D	F	D	D	F	F		F	D	
Approach Delay (s)		73.1			56.1			86.9			54.8	
Approach LOS		E			E			F			D	

Intersection Summary			
HCM Average Control Delay	66.0	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

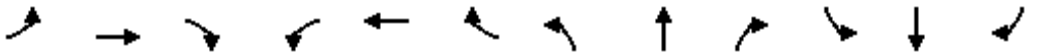
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	195	755	610	445	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1500	1579	1667	1417	1221	1093
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1500	1579	1667	1417	1221	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	450	217	839	678	494	228
RTOR Reduction (vph)	0	0	0	169	0	171
Lane Group Flow (vph)	450	217	839	509	494	57
Heavy Vehicles (%)	14%	14%	8%	8%	40%	40%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	22.0	63.0	37.0	37.0	26.0	25.0
Effective Green, g (s)	22.0	63.0	37.0	37.0	26.0	25.0
Actuated g/C Ratio	0.22	0.63	0.37	0.37	0.26	0.25
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	330	995	617	524	317	273
v/s Ratio Prot	c0.30	0.14	c0.50		c0.40	
v/s Ratio Perm				0.36		0.05
v/c Ratio	1.36	0.22	1.36	0.97	1.56	0.21
Uniform Delay, d1	39.0	7.9	31.5	31.0	37.0	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	182.0	0.3	172.3	32.6	266.2	0.1
Delay (s)	221.0	8.2	203.8	63.5	303.2	29.8
Level of Service	F	A	F	E	F	C
Approach Delay (s)		151.8	141.1		216.9	
Approach LOS		F	F		F	

Intersection Summary			
HCM Average Control Delay	162.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

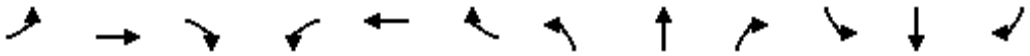
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	170	1345	1305	0	0	0	0	390	335
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)				3.0	3.5	3.5					3.5	3.5
Lane Util. Factor				1.00	0.95	1.00					0.95	1.00
Frt				1.00	1.00	0.85					1.00	0.85
Flt Protected				0.95	1.00	1.00					1.00	1.00
Satd. Flow (prot)				1539	3079	1377					2578	1153
Flt Permitted				0.95	1.00	1.00					1.00	1.00
Satd. Flow (perm)				1539	3079	1377					2578	1153
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)	0	0	0	179	1416	1374	0	0	0	0	411	353
RTOR Reduction (vph)	0	0	0	76	0	0	0	0	0	0	0	22
Lane Group Flow (vph)	0	0	0	103	1416	1374	0	0	0	0	411	331
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)				36.4	36.4	65.0					20.6	20.6
Effective Green, g (s)				37.4	36.9	65.0					21.1	21.1
Actuated g/C Ratio				0.58	0.57	1.00					0.32	0.32
Clearance Time (s)				4.0	4.0						4.0	4.0
Vehicle Extension (s)				3.0	3.0						3.0	3.0
Lane Grp Cap (vph)				886	1748	1377					837	374
v/s Ratio Prot				0.07	0.46						0.16	
v/s Ratio Perm						c1.00						0.29
v/c Ratio				0.12	0.81	1.00					0.49	0.88
Uniform Delay, d1				6.3	11.2	0.0					17.6	20.8
Progression Factor				1.11	0.97	1.00					1.00	1.00
Incremental Delay, d2				0.1	1.5	14.0					0.5	21.1
Delay (s)				7.1	12.5	14.0					18.1	41.9
Level of Service				A	B	B					B	D
Approach Delay (s)		0.0			12.8			0.0			29.1	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

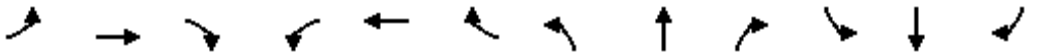
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1040	160	0	0	0	0	0	20	485	75	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor		0.91	1.00						1.00	0.95	0.95	
Frt		1.00	0.85						0.86	1.00	1.00	
Flt Protected		1.00	1.00						1.00	0.95	0.97	
Satd. Flow (prot)		4152	1458						1484	1244	1338	
Flt Permitted		1.00	1.00						1.00	0.95	0.97	
Satd. Flow (perm)		4152	1458						1484	1244	1338	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	1083	168	0	0	0	0	0	22	505	83	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	22	0	0	0
Lane Group Flow (vph)	0	1083	168	0	0	0	0	0	0	293	295	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type			Free						custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)		32.0	65.0						0.8	20.2	20.2	
Effective Green, g (s)		32.0	65.0						1.3	20.7	20.7	
Actuated g/C Ratio		0.49	1.00						0.02	0.32	0.32	
Clearance Time (s)		4.0							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		2044	1458						30	396	426	
v/s Ratio Prot		c0.26							0.00	c0.24	0.22	
v/s Ratio Perm			c0.12									
v/c Ratio		0.53	0.12						0.01	0.74	0.69	
Uniform Delay, d1		11.3	0.0						31.2	19.7	19.4	
Progression Factor		1.00	1.00						1.00	0.46	0.45	
Incremental Delay, d2		1.0	0.2						0.2	6.7	4.6	
Delay (s)		12.3	0.2						31.4	15.7	13.2	
Level of Service		B	A						C	B	B	
Approach Delay (s)		10.7			0.0			31.4			14.5	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

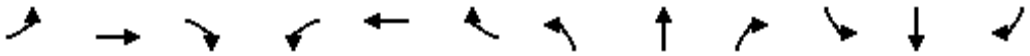
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	255	80	2395	410	0	0	0	175
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	268	84	2521	432	0	0	0	184
RTOR Reduction (vph)	0	0	0	0	0	74	18	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	268	10	2503	432	0	0	0	184
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					15.3	15.3	106.7	106.7				130.0
Effective Green, g (s)					15.8	15.8	106.7	106.7				130.0
Actuated g/C Ratio					0.12	0.12	0.82	0.82				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					345	154	2474	1343				1428
v/s Ratio Prot					c0.09		c0.83	0.26				
v/s Ratio Perm						0.01						0.13
v/c Ratio					0.78	0.07	1.01	0.32				0.13
Uniform Delay, d1					55.4	50.6	11.6	2.8				0.0
Progression Factor					1.00	1.00	0.31	0.53				1.00
Incremental Delay, d2					10.5	0.2	8.8	0.1				0.2
Delay (s)					65.9	50.8	12.4	1.6				0.2
Level of Service					E	D	B	A				A
Approach Delay (s)		0.0			62.3			10.8			0.2	
Approach LOS		A			E			B			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	119.4%	ICU Level of Service	H
Analysis Period (min)	15		

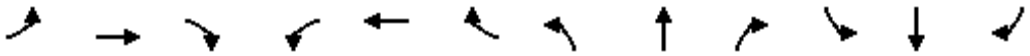
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	745	235	690	0	0	0	0	2080	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.97	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1396	2257					3228	1444			
Flt Permitted	0.95	0.97	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1396	2257					3228	1444			
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)	784	247	726	0	0	0	0	2189	63	0	0	0
RTOR Reduction (vph)	5	5	53	0	0	0	0	0	9	0	0	0
Lane Group Flow (vph)	505	516	673	0	0	0	0	2189	54	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	44.0	44.0	120.0					78.0	78.0			
Effective Green, g (s)	44.5	44.5	120.5					77.0	77.0			
Actuated g/C Ratio	0.34	0.34	0.93					0.59	0.59			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	466	478	2092					1912	855			
v/s Ratio Prot	c0.37	0.37	0.30					c0.68	0.04			
v/s Ratio Perm												
v/c Ratio	1.08	1.08	0.32					1.14	0.06			
Uniform Delay, d1	42.8	42.8	0.5					26.5	11.2			
Progression Factor	0.94	0.94	3.19					0.48	0.51			
Incremental Delay, d2	64.3	62.4	0.1					69.4	0.0			
Delay (s)	104.6	102.7	1.7					82.2	5.8			
Level of Service	F	F	A					F	A			
Approach Delay (s)		61.5			0.0			80.0			0.0	
Approach LOS		E			A			F			A	

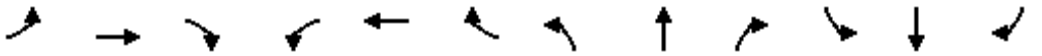
Intersection Summary			
HCM Average Control Delay	71.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	25	200	5	0	55	0	2080	45	15	675	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	28	222	5	0	58	0	2189	47	16	711	0
RTOR Reduction (vph)	0	0	209	0	0	52	0	0	4	0	0	0
Lane Group Flow (vph)	0	28	13	5	0	6	0	2189	43	16	711	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7		4		6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)		7.4	7.4	0.8		13.2		100.6	100.6	3.2	106.8	
Effective Green, g (s)		7.4	7.4	0.8		13.2		100.6	100.6	3.2	106.8	
Actuated g/C Ratio		0.06	0.06	0.01		0.10		0.77	0.77	0.02	0.82	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		98	146	10		152		2595	1161	41	2755	
v/s Ratio Prot		c0.02		c0.00		0.00		c0.65		c0.01	0.21	
v/s Ratio Perm			0.00						0.03			
v/c Ratio		0.29	0.09	0.50		0.04		0.84	0.04	0.39	0.26	
Uniform Delay, d1		58.8	58.1	64.4		52.7		9.6	3.4	62.4	2.6	
Progression Factor		1.03	1.33	1.00		1.00		0.57	0.62	1.09	0.61	
Incremental Delay, d2		0.9	0.1	21.1		0.1		0.3	0.0	5.8	0.2	
Delay (s)		61.3	77.4	85.5		52.7		5.8	2.1	73.6	1.8	
Level of Service		E	E	F		D		A	A	E	A	
Approach Delay (s)		75.6			55.3			5.8			3.4	
Approach LOS		E			E			A			A	

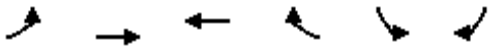
Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	60	45	40	130	625	85	1360	65	150	670	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3312	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3312	
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)	158	63	47	42	137	658	89	1432	68	158	705	63
RTOR Reduction (vph)	0	0	32	0	0	139	0	2	0	0	5	0
Lane Group Flow (vph)	158	63	15	42	137	519	89	1498	0	158	763	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	11.0	42.2	42.2	6.4	37.6	37.6	10.6	53.4		12.0	54.8	
Effective Green, g (s)	11.0	42.2	42.2	6.4	37.6	37.6	10.6	53.4		12.0	54.8	
Actuated g/C Ratio	0.08	0.32	0.32	0.05	0.29	0.29	0.08	0.41		0.09	0.42	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	142	573	487	83	510	434	137	1368		152	1396	
v/s Ratio Prot	c0.09	0.04		0.03	0.08		0.05	c0.45		c0.10	0.23	
v/s Ratio Perm			0.01			c0.35						
v/c Ratio	1.11	0.11	0.03	0.51	0.27	1.20	0.65	1.09		1.04	0.55	
Uniform Delay, d1	59.5	30.7	30.0	60.3	35.6	46.2	57.9	38.3		59.0	28.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.04	1.01	
Incremental Delay, d2	109.0	0.1	0.0	1.8	0.3	109.0	7.7	54.5		83.1	1.5	
Delay (s)	168.5	30.8	30.0	62.0	35.9	155.2	65.6	92.8		144.6	30.1	
Level of Service	F	C	C	E	D	F	E	F		F	C	
Approach Delay (s)		111.8			131.0			91.3			49.6	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	91.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	15		

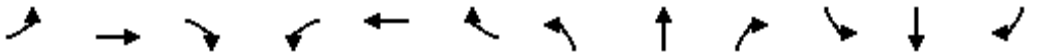
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	250	585	360	445	745	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1569	1651	1488	1264	1449	1297
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1569	1651	1488	1264	1449	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	278	650	400	494	828	400
RTOR Reduction (vph)	0	0	0	258	0	192
Lane Group Flow (vph)	278	650	400	236	828	208
Heavy Vehicles (%)	9%	9%	21%	21%	18%	18%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	15.0	45.0	26.0	26.0	44.0	43.0
Effective Green, g (s)	15.0	45.0	26.0	26.0	44.0	43.0
Actuated g/C Ratio	0.15	0.45	0.26	0.26	0.44	0.43
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	235	743	387	329	638	558
v/s Ratio Prot	c0.18	0.39	c0.27		c0.57	
v/s Ratio Perm				0.19		0.16
v/c Ratio	1.18	0.87	1.03	0.72	1.30	0.37
Uniform Delay, d1	42.5	24.9	37.0	33.7	28.0	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	117.1	12.5	54.7	10.4	145.3	0.2
Delay (s)	159.6	37.5	91.7	44.0	173.3	19.5
Level of Service	F	D	F	D	F	B
Approach Delay (s)		74.1	65.4		123.2	
Approach LOS		E	E		F	

Intersection Summary			
HCM Average Control Delay	91.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

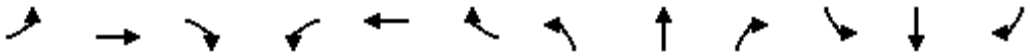
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	370	1040	840	0	0	0	0	915	645
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)				3.0	3.5	3.5					3.5	3.5
Lane Util. Factor				1.00	0.95	1.00					0.95	1.00
Frt				1.00	1.00	0.85					1.00	0.85
Flt Protected				0.95	1.00	1.00					1.00	1.00
Satd. Flow (prot)				1446	2891	1293					3079	1377
Flt Permitted				0.95	1.00	1.00					1.00	1.00
Satd. Flow (perm)				1446	2891	1293					3079	1377
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)	0	0	0	389	1095	884	0	0	0	0	963	679
RTOR Reduction (vph)	0	0	0	53	0	0	0	0	0	0	0	16
Lane Group Flow (vph)	0	0	0	336	1095	884	0	0	0	0	963	663
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)				51.4	51.4	120.0					60.6	60.6
Effective Green, g (s)				52.4	51.9	120.0					61.1	61.1
Actuated g/C Ratio				0.44	0.43	1.00					0.51	0.51
Clearance Time (s)				4.0	4.0						4.0	4.0
Vehicle Extension (s)				3.0	3.0						3.0	3.0
Lane Grp Cap (vph)				631	1250	1293					1568	701
v/s Ratio Prot				0.23	c0.38						0.31	
v/s Ratio Perm						0.68						c0.48
v/c Ratio				0.53	0.88	0.68					0.61	0.95
Uniform Delay, d1				24.8	31.1	0.0					21.0	27.9
Progression Factor				0.72	0.79	1.00					1.00	1.00
Incremental Delay, d2				2.4	6.7	2.2					0.7	21.6
Delay (s)				20.2	31.4	2.2					21.8	49.5
Level of Service				C	C	A					C	D
Approach Delay (s)		0.0			18.7			0.0			33.2	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		

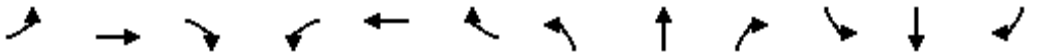
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1485	430	0	0	0	0	0	15	1120	165	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor		0.91	1.00						1.00	0.95	0.95	
Frt		1.00	0.85						0.86	1.00	1.00	
Flt Protected		1.00	1.00						1.00	0.95	0.96	
Satd. Flow (prot)		4680	1458						1484	2950	1457	
Flt Permitted		1.00	1.00						1.00	0.95	0.96	
Satd. Flow (perm)		4680	1458						1484	2950	1457	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	1547	478	0	0	0	0	0	17	1167	183	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	17	0	0	0
Lane Group Flow (vph)	0	1547	478	0	0	0	0	0	0	665	685	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type			Free						custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)		44.4	120.0						1.6	61.5	61.5	
Effective Green, g (s)		44.9	120.0						2.1	62.0	62.0	
Actuated g/C Ratio		0.37	1.00						0.02	0.52	0.52	
Clearance Time (s)		4.5							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1751	1458						26	1524	753	
v/s Ratio Prot		c0.33							0.00	0.23	c0.47	
v/s Ratio Perm			c0.33									
v/c Ratio		0.88	0.33						0.01	0.44	0.91	
Uniform Delay, d1		35.1	0.0						57.9	18.1	26.4	
Progression Factor		1.00	1.00						1.00	0.71	0.62	
Incremental Delay, d2		6.9	0.6						0.2	0.2	12.5	
Delay (s)		42.0	0.6						58.1	13.0	28.9	
Level of Service		D	A						E	B	C	
Approach Delay (s)		32.2			0.0			58.1			21.0	
Approach LOS		C			A			E			C	

Intersection Summary			
HCM Average Control Delay	27.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	109.1%	ICU Level of Service	H
Analysis Period (min)	15		

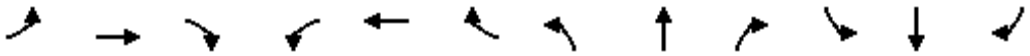
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	305	65	1615	250	0	0	0	360
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	321	68	1700	263	0	0	0	379
RTOR Reduction (vph)	0	0	0	0	0	57	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	321	11	1700	263	0	0	0	379
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					19.0	19.0	93.0	93.0				120.0
Effective Green, g (s)					19.5	19.5	93.5	93.5				120.0
Actuated g/C Ratio					0.16	0.16	0.78	0.78				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					429	192	2264	1229				1294
v/s Ratio Prot					c0.12		c0.59	0.17				
v/s Ratio Perm						0.01						0.29
v/c Ratio					0.75	0.06	0.75	0.21				0.29
Uniform Delay, d1					47.9	42.5	7.1	3.5				0.0
Progression Factor					1.00	1.00	0.55	0.75				1.00
Incremental Delay, d2					7.0	0.1	1.2	0.2				0.6
Delay (s)					54.9	42.6	5.0	2.8				0.6
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			52.8			4.7			0.6	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	125.9%	ICU Level of Service	H
Analysis Period (min)	15		

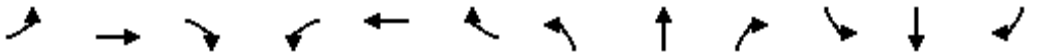
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	640	490	1610	0	0	0	0	1230	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.99	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1500	2380					3197	1430			
Flt Permitted	0.95	0.99	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1500	2380					3197	1430			
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)	674	516	1695	0	0	0	0	1295	126	0	0	0
RTOR Reduction (vph)	13	5	147	0	0	0	0	0	33	0	0	0
Lane Group Flow (vph)	567	605	1548	0	0	0	0	1295	93	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	56.1	56.1	109.1					55.9	55.9			
Effective Green, g (s)	56.6	56.6	109.6					54.9	54.9			
Actuated g/C Ratio	0.47	0.47	0.91					0.46	0.46			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	677	708	2174					1463	654			
v/s Ratio Prot	0.40	c0.40	0.65					c0.41	0.07			
v/s Ratio Perm												
v/c Ratio	0.84	0.85	0.71					0.89	0.14			
Uniform Delay, d1	27.7	28.0	1.3					29.7	18.9			
Progression Factor	0.75	0.76	98.95					0.15	0.01			
Incremental Delay, d2	6.5	7.2	0.8					3.6	0.1			
Delay (s)	27.3	28.4	128.3					7.9	0.2			
Level of Service	C	C	F					A	A			
Approach Delay (s)		86.9			0.0			7.2			0.0	
Approach LOS		F			A			A			A	

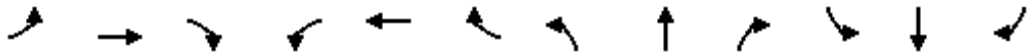
Intersection Summary			
HCM Average Control Delay	60.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	104.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	95	480	335	0	185	0	1160	245	65	1545	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	106	533	353	0	195	0	1221	258	68	1626	0
RTOR Reduction (vph)	0	0	37	0	0	106	0	0	72	0	0	0
Lane Group Flow (vph)	0	106	496	353	0	89	0	1221	186	68	1626	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7				6		5	2	
Permitted Phases			8			4			6			
Actuated Green, G (s)		26.6	26.6	22.0		53.6		46.0	46.0	7.4	56.4	
Effective Green, g (s)		26.6	26.6	22.0		53.6		46.0	46.0	7.4	56.4	
Actuated g/C Ratio		0.22	0.22	0.18		0.45		0.38	0.38	0.06	0.47	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		380	569	307		670		1285	575	103	1576	
v/s Ratio Prot		0.06		c0.21				0.36		0.04	c0.48	
v/s Ratio Perm			c0.19			0.06			0.12			
v/c Ratio		0.28	0.87	1.15		0.13		0.95	0.32	0.66	1.03	
Uniform Delay, d1		38.7	45.0	49.0		19.5		35.9	26.1	55.1	31.8	
Progression Factor		0.86	0.87	1.00		1.00		0.45	0.31	1.01	0.83	
Incremental Delay, d2		0.2	12.2	98.3		0.1		5.7	0.4	10.1	27.3	
Delay (s)		33.3	51.4	147.3		19.6		21.8	8.4	65.9	53.5	
Level of Service		C	D	F		B		C	A	E	D	
Approach Delay (s)		48.4			101.8			19.4			54.0	
Approach LOS		D			F			B			D	

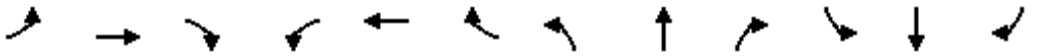
Intersection Summary			
HCM Average Control Delay	47.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	240	105	120	135	250	100	960	95	490	1755	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
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)	200	253	111	126	142	263	105	1011	100	516	1847	116
RTOR Reduction (vph)	0	0	77	0	0	225	0	6	0	0	4	0
Lane Group Flow (vph)	200	253	34	126	142	38	105	1105	0	516	1959	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	14.0	20.3	20.3	11.2	17.5	17.5	7.5	37.0		35.5	65.0	
Effective Green, g (s)	14.0	20.3	20.3	11.2	17.5	17.5	7.5	37.0		35.5	65.0	
Actuated g/C Ratio	0.12	0.17	0.17	0.09	0.15	0.15	0.06	0.31		0.30	0.54	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	196	299	254	156	257	219	105	1020		486	1800	
v/s Ratio Prot	c0.12	c0.14		0.08	0.08		0.06	0.33		c0.31	c0.59	
v/s Ratio Perm			0.02			0.03						
v/c Ratio	1.02	0.85	0.13	0.81	0.55	0.18	1.00	1.08		1.06	1.09	
Uniform Delay, d1	53.0	48.3	42.4	53.3	47.6	44.9	56.2	41.5		42.2	27.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.08	1.04	
Incremental Delay, d2	69.7	19.3	0.2	24.2	2.6	0.4	87.8	53.5		38.5	42.5	
Delay (s)	122.7	67.6	42.6	77.6	50.2	45.3	144.1	95.0		84.3	71.1	
Level of Service	F	E	D	E	D	D	F	F		F	E	
Approach Delay (s)		82.2			54.3			99.2			73.8	
Approach LOS		F			D			F			E	

Intersection Summary			
HCM Average Control Delay	79.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

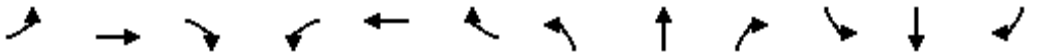
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	355	175	245	5	565	325	280	380	40	205	340	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1500	1579	1342	1676	1765	1500	1513	1570		1221	1286	1093
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1500	1579	1342	1676	1765	1500	1513	1570		1221	1286	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	394	194	272	6	628	361	311	422	44	228	378	222
RTOR Reduction (vph)	0	0	140	0	0	98	0	3	0	0	0	124
Lane Group Flow (vph)	394	194	132	6	628	263	311	463	0	228	378	98
Heavy Vehicles (%)	14%	14%	14%	2%	2%	2%	13%	13%	13%	40%	40%	40%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Effective Green, g (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Actuated g/C Ratio	0.19	0.48	0.48	0.00	0.30	0.30	0.14	0.23		0.12	0.21	0.21
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	280	764	649	8	533	453	209	357		149	271	231
v/s Ratio Prot	c0.26	0.12		0.00	c0.36		c0.21	c0.29		0.19	0.29	
v/s Ratio Perm			0.10			0.18						0.09
v/c Ratio	1.41	0.25	0.20	0.75	1.18	0.58	1.49	1.30		1.53	1.39	0.42
Uniform Delay, d1	50.1	18.7	18.2	61.2	43.0	36.4	53.1	47.6		54.1	48.6	42.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	203.2	0.5	0.4	166.2	98.4	3.6	243.3	152.8		269.5	198.7	0.5
Delay (s)	253.3	19.2	18.6	227.4	141.4	40.0	296.4	200.4		323.6	247.3	42.6
Level of Service	F	B	B	F	F	D	F	F		F	F	D
Approach Delay (s)		126.3			105.1			238.8			213.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	166.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.5%	ICU Level of Service	G
Analysis Period (min)	15		

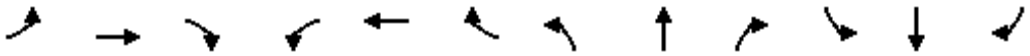
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	185	1355	895	0	0	0	0	325	95
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5					3.5	3.5
Lane Util. Factor					0.95	1.00					0.95	1.00
Frt					1.00	0.85					1.00	0.85
Flt Protected					0.99	1.00					1.00	1.00
Satd. Flow (prot)					3060	1377					2578	1153
Flt Permitted					0.99	1.00					1.00	1.00
Satd. Flow (perm)					3060	1377					2578	1153
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)	0	0	0	195	1426	942	0	0	0	0	342	100
RTOR Reduction (vph)	0	0	0	0	8	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	0	0	1613	942	0	0	0	0	342	38
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)					82.5	110.0					19.5	19.5
Effective Green, g (s)					83.0	110.0					20.0	20.0
Actuated g/C Ratio					0.75	1.00					0.18	0.18
Clearance Time (s)					4.0						4.0	4.0
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					2309	1377					469	210
v/s Ratio Prot					0.53						0.13	
v/s Ratio Perm						c0.68						0.03
v/c Ratio					0.70	0.68					0.73	0.18
Uniform Delay, d1					7.0	0.0					42.4	38.1
Progression Factor					0.72	1.00					1.00	1.00
Incremental Delay, d2					1.0	1.6					5.6	0.4
Delay (s)					6.1	1.6					48.1	38.5
Level of Service					A	A					D	D
Approach Delay (s)		0.0			4.4			0.0			45.9	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

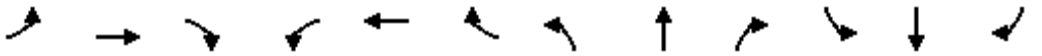
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	780	270	0	0	0	0	0	5	430	75	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor		0.91	1.00						1.00	0.95	0.95	
Frt		1.00	0.85						0.86	1.00	1.00	
Flt Protected		1.00	1.00						1.00	0.95	0.97	
Satd. Flow (prot)		4152	1458						1484	1244	1348	
Flt Permitted		1.00	1.00						1.00	0.95	0.97	
Satd. Flow (perm)		4152	1458						1484	1244	1348	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	812	284	0	0	0	0	0	6	448	83	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	0	812	284	0	0	0	0	0	0	264	267	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type			Free						custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)		26.3	55.0						0.8	15.9	15.9	
Effective Green, g (s)		26.3	55.0						1.3	16.4	16.4	
Actuated g/C Ratio		0.48	1.00						0.02	0.30	0.30	
Clearance Time (s)		4.0							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1985	1458						35	371	402	
v/s Ratio Prot		c0.20							0.00	c0.21	0.20	
v/s Ratio Perm			c0.19									
v/c Ratio		0.41	0.19						0.00	0.71	0.66	
Uniform Delay, d1		9.3	0.0						26.2	17.2	16.9	
Progression Factor		1.00	1.00						1.00	0.71	0.67	
Incremental Delay, d2		0.6	0.3						0.0	4.9	3.2	
Delay (s)		9.9	0.3						26.3	17.1	14.5	
Level of Service		A	A						C	B	B	
Approach Delay (s)		7.4			0.0			26.3			15.8	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

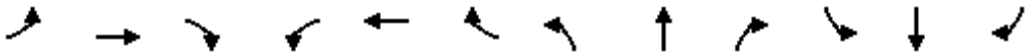
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	215	75	2075	320	0	0	0	145
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	226	79	2184	337	0	0	0	153
RTOR Reduction (vph)	0	0	0	0	0	69	46	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	226	10	2138	337	0	0	0	153
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					13.6	13.6	88.4	88.4				110.0
Effective Green, g (s)					14.1	14.1	88.4	88.4				110.0
Actuated g/C Ratio					0.13	0.13	0.80	0.80				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					364	163	2422	1315				1428
v/s Ratio Prot					c0.08		c0.71	0.21				
v/s Ratio Perm						0.01						0.11
v/c Ratio					0.62	0.06	0.88	0.26				0.11
Uniform Delay, d1					45.4	42.1	7.3	2.7				0.0
Progression Factor					1.00	1.00	0.27	0.50				1.00
Incremental Delay, d2					3.3	0.2	1.9	0.2				0.2
Delay (s)					48.7	42.3	3.9	1.5				0.2
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			47.0			3.6			0.2	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	112.8%	ICU Level of Service	H
Analysis Period (min)	15		

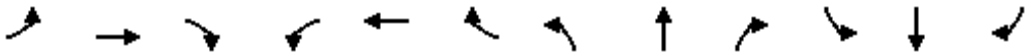
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	215	680	0	0	0	0	1970	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1409	2257					3228	1444			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1409	2257					3228	1444			
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)	447	226	716	0	0	0	0	2074	63	0	0	0
RTOR Reduction (vph)	13	13	66	0	0	0	0	0	11	0	0	0
Lane Group Flow (vph)	318	329	650	0	0	0	0	2074	52	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	27.4	27.4	99.4					74.6	74.6			
Effective Green, g (s)	27.9	27.9	99.9					73.6	73.6			
Actuated g/C Ratio	0.25	0.25	0.91					0.67	0.67			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	345	357	2050					2160	966			
v/s Ratio Prot	0.23	c0.23	0.29					c0.64	0.04			
v/s Ratio Perm												
v/c Ratio	0.92	0.92	0.32					0.96	0.05			
Uniform Delay, d1	40.0	40.0	0.7					16.8	6.2			
Progression Factor	0.83	0.83	0.22					0.32	0.16			
Incremental Delay, d2	28.0	27.3	0.1					8.0	0.0			
Delay (s)	61.2	60.6	0.2					13.4	1.0			
Level of Service	E	E	A					B	A			
Approach Delay (s)		29.6			0.0			13.0			0.0	
Approach LOS		C			A			B			A	

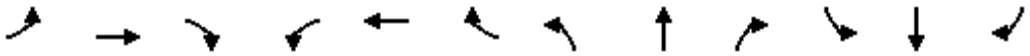
Intersection Summary			
HCM Average Control Delay	19.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	91.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	25	310	5	0	55	0	1970	45	15	665	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	28	344	5	0	58	0	2074	47	16	700	0
RTOR Reduction (vph)	0	0	321	0	0	51	0	0	5	0	0	0
Lane Group Flow (vph)	0	28	23	5	0	7	0	2074	42	16	700	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7		4		6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)		7.5	7.5	0.8		13.3		80.6	80.6	3.1	86.7	
Effective Green, g (s)		7.5	7.5	0.8		13.3		80.6	80.6	3.1	86.7	
Actuated g/C Ratio		0.07	0.07	0.01		0.12		0.73	0.73	0.03	0.79	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		117	175	12		181		2457	1099	47	2643	
v/s Ratio Prot		c0.02		c0.00		0.00		c0.62		c0.01	0.21	
v/s Ratio Perm			0.01						0.03			
v/c Ratio		0.24	0.13	0.42		0.04		0.84	0.04	0.34	0.26	
Uniform Delay, d1		48.5	48.2	54.4		42.7		10.3	4.0	52.4	3.1	
Progression Factor		1.09	1.71	1.00		1.00		0.52	0.58	1.06	0.61	
Incremental Delay, d2		0.6	0.2	13.1		0.1		0.4	0.0	4.1	0.2	
Delay (s)		53.4	82.5	67.4		42.8		5.7	2.3	59.9	2.1	
Level of Service		D	F	E		D		A	A	E	A	
Approach Delay (s)		80.3			44.7			5.7			3.4	
Approach LOS		F			D			A			A	

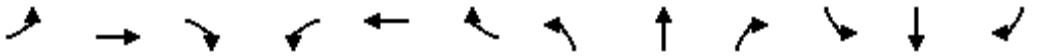
Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	65	45	40	140	615	105	1340	65	170	750	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3316	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3316	
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)	63	68	47	42	147	647	111	1411	68	179	789	63
RTOR Reduction (vph)	0	0	33	0	0	153	0	3	0	0	5	0
Lane Group Flow (vph)	63	68	14	42	147	494	111	1476	0	179	847	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	4.0	32.0	32.0	4.2	32.2	32.2	11.1	46.8		11.0	46.7	
Effective Green, g (s)	4.0	32.0	32.0	4.2	32.2	32.2	11.1	46.8		11.0	46.7	
Actuated g/C Ratio	0.04	0.29	0.29	0.04	0.29	0.29	0.10	0.43		0.10	0.42	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	61	513	436	64	517	439	169	1417		164	1408	
v/s Ratio Prot	c0.04	0.04		0.03	0.08		0.07	c0.44		c0.11	0.26	
v/s Ratio Perm			0.01			c0.33						
v/c Ratio	1.03	0.13	0.03	0.66	0.28	1.12	0.66	1.04		1.09	0.60	
Uniform Delay, d1	53.0	28.8	27.9	52.2	30.0	38.9	47.6	31.6		49.5	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	0.99	
Incremental Delay, d2	124.7	0.1	0.0	16.9	0.3	81.4	6.8	35.4		95.9	1.9	
Delay (s)	177.7	28.9	27.9	69.1	30.3	120.3	54.4	67.0		145.6	26.0	
Level of Service	F	C	C	E	C	F	D	E		F	C	
Approach Delay (s)		81.3			101.9			66.1			46.8	
Approach LOS		F			F			E			D	

Intersection Summary			
HCM Average Control Delay	69.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

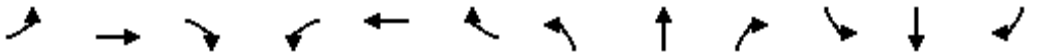
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	515	410	5	340	245	205	305	45	335	465	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1569	1651	1404	1613	1698	1443	1346	1390		1449	1525	1297
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1569	1651	1404	1613	1698	1443	1346	1390		1449	1525	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	261	572	456	6	378	272	228	339	50	372	517	400
RTOR Reduction (vph)	0	0	158	0	0	122	0	5	0	0	0	164
Lane Group Flow (vph)	261	572	298	6	378	150	228	384	0	372	517	236
Heavy Vehicles (%)	9%	9%	9%	6%	6%	6%	27%	27%	27%	18%	18%	18%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Effective Green, g (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Actuated g/C Ratio	0.15	0.38	0.38	0.00	0.23	0.23	0.15	0.23		0.23	0.30	0.30
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	3.0		2.0	2.0	2.0
Lane Grp Cap (vph)	242	624	531	8	389	330	208	316		329	458	390
v/s Ratio Prot	c0.17	c0.35		0.00	0.22		0.17	0.28		c0.26	c0.34	
v/s Ratio Perm			0.21			0.10						0.18
v/c Ratio	1.08	0.92	0.56	0.75	0.97	0.46	1.10	1.22		1.13	1.13	0.60
Uniform Delay, d1	52.1	36.5	30.2	61.2	47.1	40.9	52.1	47.6		47.6	43.1	36.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	80.3	19.7	2.8	166.2	38.7	2.8	90.5	122.8		89.8	82.2	1.8
Delay (s)	132.4	56.1	33.0	227.4	85.8	43.7	142.6	170.4		137.4	125.3	38.7
Level of Service	F	E	C	F	F	D	F	F		F	F	D
Approach Delay (s)		63.4			69.6			160.1			101.9	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	92.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

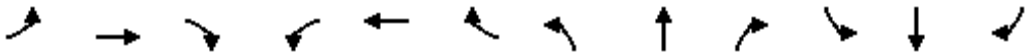
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	385	1005	590	0	0	0	0	745	215
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5					3.5	3.5
Lane Util. Factor					0.95	1.00					0.95	1.00
Frt					1.00	0.85					1.00	0.85
Flt Protected					0.99	1.00					1.00	1.00
Satd. Flow (prot)					2852	1293					3079	1377
Flt Permitted					0.99	1.00					1.00	1.00
Satd. Flow (perm)					2852	1293					3079	1377
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)	0	0	0	405	1058	621	0	0	0	0	784	226
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	0	0	0	78
Lane Group Flow (vph)	0	0	0	0	1447	621	0	0	0	0	784	148
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4						2	
Permitted Phases						Free						2
Actuated Green, G (s)					76.5	120.0					35.5	35.5
Effective Green, g (s)					77.0	120.0					36.0	36.0
Actuated g/C Ratio					0.64	1.00					0.30	0.30
Clearance Time (s)					4.0						4.0	4.0
Vehicle Extension (s)					3.0						3.0	3.0
Lane Grp Cap (vph)					1830	1293					924	413
v/s Ratio Prot					c0.51						c0.25	
v/s Ratio Perm						0.48						0.11
v/c Ratio					0.79	0.48					0.85	0.36
Uniform Delay, d1					15.6	0.0					39.4	32.9
Progression Factor					0.56	1.00					1.00	1.00
Incremental Delay, d2					3.0	1.1					7.3	0.5
Delay (s)					11.7	1.1					46.8	33.5
Level of Service					B	A					D	C
Approach Delay (s)		0.0			8.6			0.0			43.8	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

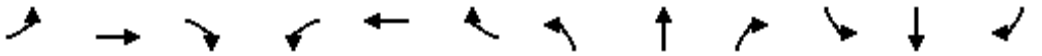
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1325	430	0	0	0	0	0	5	965	165	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor		0.91	1.00						1.00	0.95	0.95	
Frt		1.00	0.85						0.86	1.00	1.00	
Flt Protected		1.00	1.00						1.00	0.95	0.97	
Satd. Flow (prot)		4680	1458						1484	2950	1466	
Flt Permitted		1.00	1.00						1.00	0.95	0.97	
Satd. Flow (perm)		4680	1458						1484	2950	1466	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	0	1380	478	0	0	0	0	0	6	1005	183	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	0	1380	478	0	0	0	0	0	0	593	595	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type			Free						custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)		50.2	120.0						0.8	56.5	56.5	
Effective Green, g (s)		50.7	120.0						1.3	57.0	57.0	
Actuated g/C Ratio		0.42	1.00						0.01	0.48	0.48	
Clearance Time (s)		4.5							4.0	4.0	4.0	
Vehicle Extension (s)		3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)		1977	1458						16	1401	696	
v/s Ratio Prot		c0.29							0.00	0.20	c0.41	
v/s Ratio Perm			c0.33									
v/c Ratio		0.70	0.33						0.00	0.42	0.85	
Uniform Delay, d1		28.4	0.0						58.7	20.7	27.8	
Progression Factor		1.00	1.00						1.00	0.57	0.52	
Incremental Delay, d2		2.1	0.6						0.1	0.1	6.3	
Delay (s)		30.5	0.6						58.8	11.9	20.9	
Level of Service		C	A						E	B	C	
Approach Delay (s)		22.8			0.0			58.8			16.4	
Approach LOS		C			A			E			B	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		

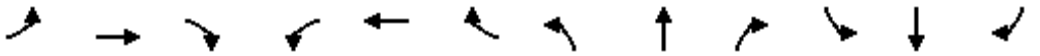
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	285	60	1385	170	0	0	0	310
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	300	63	1458	179	0	0	0	326
RTOR Reduction (vph)	0	0	0	0	0	53	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	300	10	1458	179	0	0	0	326
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					18.8	18.8	93.2	93.2				120.0
Effective Green, g (s)					19.3	19.3	93.7	93.7				120.0
Actuated g/C Ratio					0.16	0.16	0.78	0.78				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					424	190	2269	1231				1294
v/s Ratio Prot					c0.11		c0.50	0.11				
v/s Ratio Perm						0.01						0.25
v/c Ratio					0.71	0.05	0.64	0.15				0.25
Uniform Delay, d1					47.7	42.6	5.8	3.3				0.0
Progression Factor					1.00	1.00	0.26	0.37				1.00
Incremental Delay, d2					5.3	0.1	1.0	0.2				0.5
Delay (s)					53.0	42.7	2.5	1.4				0.5
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			51.2			2.4			0.5	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	122.5%	ICU Level of Service	H
Analysis Period (min)	15		

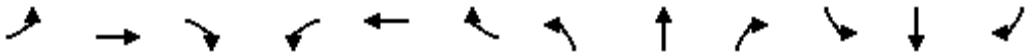
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	400	450	1580	0	0	0	0	1155	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1505	2380					3197	1430			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1505	2380					3197	1430			
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)	421	474	1663	0	0	0	0	1216	126	0	0	0
RTOR Reduction (vph)	18	3	177	0	0	0	0	0	33	0	0	0
Lane Group Flow (vph)	361	513	1486	0	0	0	0	1216	93	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	52.7	52.7	106.7					59.3	59.3			
Effective Green, g (s)	53.2	53.2	107.2					58.3	58.3			
Actuated g/C Ratio	0.44	0.44	0.89					0.49	0.49			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	637	667	2126					1553	695			
v/s Ratio Prot	0.25	c0.34	0.62					c0.38	0.06			
v/s Ratio Perm												
v/c Ratio	0.57	0.77	0.70					0.78	0.13			
Uniform Delay, d1	24.8	28.2	1.8					25.6	17.0			
Progression Factor	0.74	0.74	113.17					0.13	0.00			
Incremental Delay, d2	1.0	4.5	0.8					1.5	0.0			
Delay (s)	19.4	25.3	206.5					4.9	0.1			
Level of Service	B	C	F					A	A			
Approach Delay (s)		142.2			0.0			4.5			0.0	
Approach LOS		F			A			A			A	

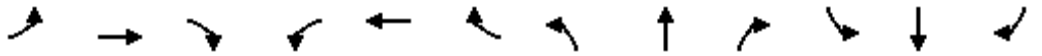
Intersection Summary			
HCM Average Control Delay	94.8	HCM Level of Service	F
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	95	490	335	0	185	0	1090	245	65	1515	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	106	544	353	0	195	0	1147	258	68	1595	0
RTOR Reduction (vph)	0	0	43	0	0	106	0	0	76	0	0	0
Lane Group Flow (vph)	0	106	501	353	0	89	0	1147	182	68	1595	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7				6		5	2	
Permitted Phases			8			4			6			
Actuated Green, G (s)		26.7	26.7	23.0		54.7		45.0	45.0	7.3	55.3	
Effective Green, g (s)		26.7	26.7	23.0		54.7		45.0	45.0	7.3	55.3	
Actuated g/C Ratio		0.22	0.22	0.19		0.46		0.38	0.38	0.06	0.46	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		382	571	321		684		1257	563	102	1545	
v/s Ratio Prot		0.06		c0.21				0.34		0.04	c0.48	
v/s Ratio Perm			c0.20			0.06			0.12			
v/c Ratio		0.28	0.88	1.10		0.13		0.91	0.32	0.67	1.03	
Uniform Delay, d1		38.7	45.1	48.5		18.9		35.6	26.7	55.2	32.4	
Progression Factor		0.82	0.84	1.00		1.00		0.39	0.18	1.01	0.85	
Incremental Delay, d2		0.2	12.9	79.7		0.1		4.7	0.5	10.7	27.8	
Delay (s)		32.1	50.6	128.2		18.9		18.5	5.5	66.1	55.2	
Level of Service		C	D	F		B		B	A	E	E	
Approach Delay (s)		47.6			89.3			16.1			55.7	
Approach LOS		D			F			B			E	

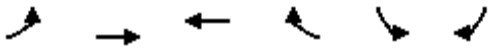
Intersection Summary			
HCM Average Control Delay	45.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	94.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	250	115	120	145	250	105	960	95	485	1745	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
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)	132	263	121	126	153	263	111	1011	100	511	1837	116
RTOR Reduction (vph)	0	0	80	0	0	220	0	6	0	0	4	0
Lane Group Flow (vph)	132	263	41	126	153	43	111	1105	0	511	1949	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	19.5	19.5	10.0	19.5	19.5	8.5	39.0		35.5	66.0	
Effective Green, g (s)	10.0	19.5	19.5	10.0	19.5	19.5	8.5	39.0		35.5	66.0	
Actuated g/C Ratio	0.08	0.16	0.16	0.08	0.16	0.16	0.07	0.32		0.30	0.55	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	140	287	244	140	287	244	119	1075		486	1828	
v/s Ratio Prot	c0.08	c0.15		0.08	0.09		0.07	0.33		c0.31	c0.59	
v/s Ratio Perm			0.03			0.03						
v/c Ratio	0.94	0.92	0.17	0.90	0.53	0.18	0.93	1.03		1.05	1.07	
Uniform Delay, d1	54.7	49.4	43.3	54.5	46.1	43.3	55.5	40.5		42.2	27.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.09	1.05	
Incremental Delay, d2	58.1	31.9	0.3	46.6	1.9	0.3	60.9	34.8		35.2	33.3	
Delay (s)	112.8	81.3	43.6	101.1	48.0	43.7	116.4	75.3		81.3	61.7	
Level of Service	F	F	D	F	D	D	F	E		F	E	
Approach Delay (s)		80.5			58.2			79.0			65.8	
Approach LOS		F			E			E			E	

Intersection Summary			
HCM Average Control Delay	69.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

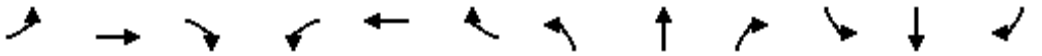
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	195	755	615	445	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1500	1579	1667	1417	1221	1093
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1500	1579	1667	1417	1221	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	450	217	839	683	494	228
RTOR Reduction (vph)	0	0	0	170	0	171
Lane Group Flow (vph)	450	217	839	513	494	57
Heavy Vehicles (%)	14%	14%	8%	8%	40%	40%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	22.0	63.0	37.0	37.0	26.0	25.0
Effective Green, g (s)	22.0	63.0	37.0	37.0	26.0	25.0
Actuated g/C Ratio	0.22	0.63	0.37	0.37	0.26	0.25
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	330	995	617	524	317	273
v/s Ratio Prot	c0.30	0.14	c0.50		c0.40	
v/s Ratio Perm				0.36		0.05
v/c Ratio	1.36	0.22	1.36	0.98	1.56	0.21
Uniform Delay, d1	39.0	7.9	31.5	31.1	37.0	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	182.0	0.3	172.3	34.1	266.2	0.1
Delay (s)	221.0	8.2	203.8	65.2	303.2	29.8
Level of Service	F	A	F	E	F	C
Approach Delay (s)		151.8	141.6		216.9	
Approach LOS		F	F		F	

Intersection Summary			
HCM Average Control Delay	162.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

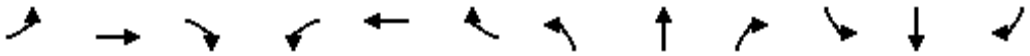
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	170	1345	1010	0	300	0	0	390	335
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)				3.0	3.5	3.5		4.0			3.5	3.5
Lane Util. Factor				1.00	0.95	1.00		1.00			0.95	1.00
Frt				1.00	1.00	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1539	3079	1377		1716			2578	1153
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1539	3079	1377		1716			2578	1153
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)	0	0	0	179	1416	1063	0	316	0	0	411	353
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	19
Lane Group Flow (vph)	0	0	0	179	1416	1063	0	316	0	0	411	334
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4			6			2	
Permitted Phases						Free						2
Actuated Green, G (s)				32.5	32.5	60.0		19.5			19.5	19.5
Effective Green, g (s)				33.5	33.0	60.0		19.5			20.0	20.0
Actuated g/C Ratio				0.56	0.55	1.00		0.32			0.33	0.33
Clearance Time (s)				4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)				859	1693	1377		558			859	384
v/s Ratio Prot				0.12	0.46			0.18			0.16	
v/s Ratio Perm						c0.77						0.29
v/c Ratio				0.21	0.84	0.77		0.57			0.48	0.87
Uniform Delay, d1				6.6	11.3	0.0		16.8			15.9	18.8
Progression Factor				0.88	0.96	1.00		0.38			1.00	1.00
Incremental Delay, d2				0.3	2.8	2.3		1.2			0.4	18.9
Delay (s)				6.1	13.7	2.3		7.7			16.3	37.7
Level of Service				A	B	A		A			B	D
Approach Delay (s)		0.0			8.6			7.7			26.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

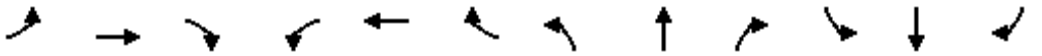
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	810	160	0	0	0	0	0	20	485	75	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91	1.00						1.00	0.95	0.95	
Frt	1.00	1.00	0.85						0.86	1.00	1.00	
Flt Protected	0.95	1.00	1.00						1.00	0.95	0.97	
Satd. Flow (prot)	1446	4152	1458						1484	1244	1338	
Flt Permitted	0.95	1.00	1.00						1.00	0.95	0.97	
Satd. Flow (perm)	1446	4152	1458						1484	1244	1338	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	312	844	168	0	0	0	0	0	22	505	83	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	22	0	0	0
Lane Group Flow (vph)	312	844	168	0	0	0	0	0	0	293	295	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type	Split		Free						custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)	28.4	28.4	60.0						0.8	18.8	18.8	
Effective Green, g (s)	27.9	28.4	60.0						1.3	19.3	19.3	
Actuated g/C Ratio	0.46	0.47	1.00						0.02	0.32	0.32	
Clearance Time (s)	4.0	4.0							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	672	1965	1458						32	400	430	
v/s Ratio Prot	c0.22	0.20							0.00	c0.24	0.22	
v/s Ratio Perm			c0.12									
v/c Ratio	0.46	0.43	0.12						0.01	0.73	0.69	
Uniform Delay, d1	11.0	10.4	0.0						28.7	18.1	17.7	
Progression Factor	1.00	1.00	1.00						1.00	0.69	0.68	
Incremental Delay, d2	2.3	0.7	0.2						0.2	6.4	4.3	
Delay (s)	13.3	11.1	0.2						28.9	18.9	16.4	
Level of Service	B	B	A						C	B	B	
Approach Delay (s)		10.2			0.0			28.9			17.6	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

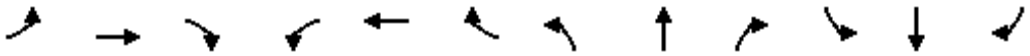
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	255	80	2100	405	0	0	0	175
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	268	84	2211	426	0	0	0	184
RTOR Reduction (vph)	0	0	0	0	0	73	23	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	268	11	2188	426	0	0	0	184
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					14.9	14.9	97.1	97.1				120.0
Effective Green, g (s)					15.4	15.4	97.1	97.1				120.0
Actuated g/C Ratio					0.13	0.13	0.81	0.81				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					365	163	2439	1324				1428
v/s Ratio Prot					c0.09		c0.73	0.26				
v/s Ratio Perm						0.01						0.13
v/c Ratio					0.73	0.07	0.90	0.32				0.13
Uniform Delay, d1					50.3	46.0	8.0	3.0				0.0
Progression Factor					1.00	1.00	0.30	0.51				1.00
Incremental Delay, d2					7.5	0.2	1.5	0.2				0.2
Delay (s)					57.8	46.2	3.9	1.7				0.2
Level of Service					E	D	A	A				A
Approach Delay (s)		0.0			55.0			3.6			0.2	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	114.4%	ICU Level of Service	H
Analysis Period (min)	15		

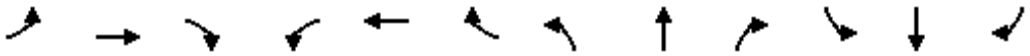
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	510	235	690	0	0	0	0	2010	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1407	2257					3228	1444			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1407	2257					3228	1444			
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)	537	247	726	0	0	0	0	2116	63	0	0	0
RTOR Reduction (vph)	10	10	57	0	0	0	0	0	10	0	0	0
Lane Group Flow (vph)	377	387	669	0	0	0	0	2116	53	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	33.0	33.0	110.0					79.0	79.0			
Effective Green, g (s)	33.5	33.5	110.5					78.0	78.0			
Actuated g/C Ratio	0.28	0.28	0.92					0.65	0.65			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	380	393	2078					2098	939			
v/s Ratio Prot	c0.28	0.28	0.30					c0.66	0.04			
v/s Ratio Perm												
v/c Ratio	0.99	0.98	0.32					1.01	0.06			
Uniform Delay, d1	43.1	43.0	0.5					21.0	7.6			
Progression Factor	0.93	0.92	1.97					0.29	0.20			
Incremental Delay, d2	42.0	39.2	0.1					17.6	0.0			
Delay (s)	81.9	78.9	1.1					23.7	1.6			
Level of Service	F	E	A					C	A			
Approach Delay (s)		42.3			0.0			23.0			0.0	
Approach LOS		D			A			C			A	

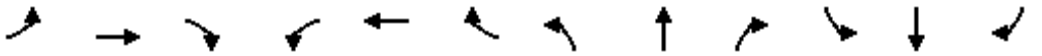
Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	25	200	5	0	55	0	2010	45	15	675	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	28	222	5	0	58	0	2116	47	16	711	0
RTOR Reduction (vph)	0	0	208	0	0	52	0	0	4	0	0	0
Lane Group Flow (vph)	0	28	14	5	0	6	0	2116	43	16	711	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7		4		6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)		7.3	7.3	0.8		13.1		90.7	90.7	3.2	96.9	
Effective Green, g (s)		7.3	7.3	0.8		13.1		90.7	90.7	3.2	96.9	
Actuated g/C Ratio		0.06	0.06	0.01		0.11		0.76	0.76	0.03	0.81	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		104	156	11		164		2534	1134	45	2708	
v/s Ratio Prot		c0.02		c0.00		0.00		c0.63		c0.01	0.21	
v/s Ratio Perm			0.01						0.03			
v/c Ratio		0.27	0.09	0.45		0.04		0.84	0.04	0.36	0.26	
Uniform Delay, d1		53.8	53.2	59.4		47.8		9.7	3.7	57.4	2.8	
Progression Factor		1.11	1.78	1.00		1.00		0.57	0.63	1.02	0.58	
Incremental Delay, d2		0.8	0.1	16.4		0.1		0.3	0.0	4.6	0.2	
Delay (s)		60.4	94.8	75.7		47.9		5.8	2.3	63.1	1.9	
Level of Service		E	F	E		D		A	A	E	A	
Approach Delay (s)		90.9			50.1			5.8			3.2	
Approach LOS		F			D			A			A	

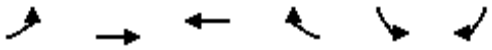
Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	60	45	40	130	625	85	1360	65	150	670	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3312	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3312	
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)	84	63	47	42	137	658	89	1432	68	158	705	63
RTOR Reduction (vph)	0	0	32	0	0	140	0	3	0	0	5	0
Lane Group Flow (vph)	84	63	15	42	137	518	89	1497	0	158	763	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	6.0	37.2	37.2	5.4	36.6	36.6	10.2	50.4		11.0	51.2	
Effective Green, g (s)	6.0	37.2	37.2	5.4	36.6	36.6	10.2	50.4		11.0	51.2	
Actuated g/C Ratio	0.05	0.31	0.31	0.05	0.31	0.31	0.08	0.42		0.09	0.43	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	84	547	465	75	538	458	142	1399		151	1413	
v/s Ratio Prot	c0.05	0.04		0.03	0.08		0.05	c0.45		c0.10	0.23	
v/s Ratio Perm			0.01			c0.35						
v/c Ratio	1.00	0.12	0.03	0.56	0.25	1.13	0.63	1.07		1.05	0.54	
Uniform Delay, d1	57.0	29.6	28.8	56.1	31.4	41.7	53.1	34.8		54.5	25.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.02	0.99	
Incremental Delay, d2	98.2	0.1	0.0	5.6	0.3	83.3	6.1	45.2		85.3	1.5	
Delay (s)	155.2	29.7	28.9	61.7	31.7	125.0	59.1	80.0		141.0	26.7	
Level of Service	F	C	C	E	C	F	E	F		F	C	
Approach Delay (s)		83.8			106.5			78.9			46.2	
Approach LOS		F			F			E			D	

Intersection Summary			
HCM Average Control Delay	77.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.1%	ICU Level of Service	F
Analysis Period (min)	15		

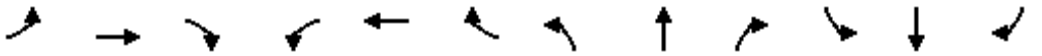
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	250	585	360	450	745	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1569	1651	1488	1264	1449	1297
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1569	1651	1488	1264	1449	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	278	650	400	500	828	400
RTOR Reduction (vph)	0	0	0	261	0	192
Lane Group Flow (vph)	278	650	400	239	828	208
Heavy Vehicles (%)	9%	9%	21%	21%	18%	18%
Turn Type	Prot			Perm		custom
Protected Phases	5	2	6		7	
Permitted Phases				6		4
Actuated Green, G (s)	15.0	45.0	26.0	26.0	44.0	43.0
Effective Green, g (s)	15.0	45.0	26.0	26.0	44.0	43.0
Actuated g/C Ratio	0.15	0.45	0.26	0.26	0.44	0.43
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	235	743	387	329	638	558
v/s Ratio Prot	c0.18	0.39	c0.27		c0.57	
v/s Ratio Perm				0.19		0.16
v/c Ratio	1.18	0.87	1.03	0.73	1.30	0.37
Uniform Delay, d1	42.5	24.9	37.0	33.7	28.0	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	117.1	12.5	54.7	10.7	145.3	0.2
Delay (s)	159.6	37.5	91.7	44.5	173.3	19.5
Level of Service	F	D	F	D	F	B
Approach Delay (s)		74.1	65.4		123.2	
Approach LOS		E	E		F	

Intersection Summary			
HCM Average Control Delay	91.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

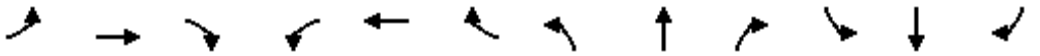
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	370	1040	635	0	210	0	0	915	645
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)				3.0	3.5	3.5		3.0			3.5	3.5
Lane Util. Factor				1.00	0.95	1.00		1.00			0.95	1.00
Frt				1.00	1.00	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1446	2891	1293		1509			3079	1377
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1446	2891	1293		1509			3079	1377
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)	0	0	0	389	1095	668	0	221	0	0	963	679
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	16
Lane Group Flow (vph)	0	0	0	389	1095	668	0	221	0	0	963	663
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4			2			2	
Permitted Phases						Free						2
Actuated Green, G (s)				47.0	47.0	110.0		55.0			55.0	55.0
Effective Green, g (s)				48.0	47.5	110.0		56.0			55.5	55.5
Actuated g/C Ratio				0.44	0.43	1.00		0.51			0.50	0.50
Clearance Time (s)				4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)				631	1248	1293		768			1553	695
v/s Ratio Prot				0.27	c0.38			0.15			0.31	
v/s Ratio Perm						0.52						c0.48
v/c Ratio				0.62	0.88	0.52		0.29			0.62	0.95
Uniform Delay, d1				23.9	28.6	0.0		15.5			19.6	26.0
Progression Factor				0.73	0.75	1.00		2.02			1.00	1.00
Incremental Delay, d2				3.6	7.4	1.2		0.2			0.8	23.2
Delay (s)				21.1	28.7	1.2		31.6			20.4	49.2
Level of Service				C	C	A		C			C	D
Approach Delay (s)		0.0			18.8			31.6			32.3	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM Average Control Delay	25.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		

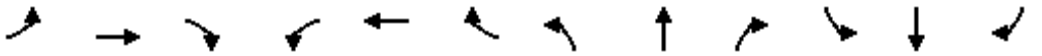
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	210	1325	430	0	0	0	0	0	15	1120	165	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.0	4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91	1.00						1.00	0.95	0.95	
Frt	1.00	1.00	0.85						0.86	1.00	1.00	
Flt Protected	0.95	1.00	1.00						1.00	0.95	0.96	
Satd. Flow (prot)	1525	4680	1458						1484	2950	1457	
Flt Permitted	0.95	1.00	1.00						1.00	0.95	0.96	
Satd. Flow (perm)	1525	4680	1458						1484	2950	1457	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	219	1380	478	0	0	0	0	0	17	1167	183	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	17	0	0	0
Lane Group Flow (vph)	219	1380	478	0	0	0	0	0	0	665	685	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type	Perm		Free						custom	Split		
Protected Phases		8							5	6	6	
Permitted Phases	8		Free									
Actuated Green, G (s)	38.8	38.8	110.0						1.6	57.1	57.1	
Effective Green, g (s)	38.3	39.3	110.0						2.1	57.6	57.6	
Actuated g/C Ratio	0.35	0.36	1.00						0.02	0.52	0.52	
Clearance Time (s)	4.5	4.5							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	531	1672	1458						28	1545	763	
v/s Ratio Prot		c0.29							0.00	0.23	c0.47	
v/s Ratio Perm	0.14		c0.33									
v/c Ratio	0.41	0.83	0.33						0.01	0.43	0.90	
Uniform Delay, d1	27.3	32.2	0.0						52.9	16.1	23.6	
Progression Factor	1.00	1.00	1.00						1.00	0.92	0.87	
Incremental Delay, d2	2.4	4.8	0.6						0.2	0.2	10.9	
Delay (s)	29.6	37.0	0.6						53.1	15.0	31.4	
Level of Service	C	D	A						D	B	C	
Approach Delay (s)		27.9			0.0			53.1			23.3	
Approach LOS		C			A			D			C	

Intersection Summary			
HCM Average Control Delay	26.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	105.7%	ICU Level of Service	G
Analysis Period (min)	15		

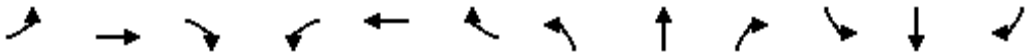
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	305	65	1415	245	0	0	0	360
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	321	68	1489	258	0	0	0	379
RTOR Reduction (vph)	0	0	0	0	0	56	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	321	12	1489	258	0	0	0	379
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					18.4	18.4	83.6	83.6				110.0
Effective Green, g (s)					18.9	18.9	84.1	84.1				110.0
Actuated g/C Ratio					0.17	0.17	0.76	0.76				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					453	203	2222	1206				1294
v/s Ratio Prot					c0.12		c0.51	0.16				
v/s Ratio Perm						0.01						0.29
v/c Ratio					0.71	0.06	0.67	0.21				0.29
Uniform Delay, d1					43.0	38.1	6.3	3.6				0.0
Progression Factor					1.00	1.00	0.39	0.54				1.00
Incremental Delay, d2					5.0	0.1	1.0	0.2				0.6
Delay (s)					48.0	38.2	3.5	2.2				0.6
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			46.3			3.3			0.6	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	124.2%	ICU Level of Service	H
Analysis Period (min)	15		

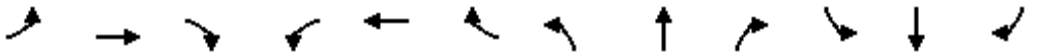
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	485	490	1610	0	0	0	0	1175	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1505	2380					3197	1430			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1505	2380					3197	1430			
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)	511	516	1695	0	0	0	0	1237	126	0	0	0
RTOR Reduction (vph)	17	3	168	0	0	0	0	0	37	0	0	0
Lane Group Flow (vph)	443	564	1527	0	0	0	0	1237	89	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	49.6	49.6	98.6					52.4	52.4			
Effective Green, g (s)	50.1	50.1	99.1					51.4	51.4			
Actuated g/C Ratio	0.46	0.46	0.90					0.47	0.47			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	654	685	2144					1494	668			
v/s Ratio Prot	0.31	c0.37	0.64					c0.39	0.06			
v/s Ratio Perm												
v/c Ratio	0.68	0.82	0.71					0.83	0.13			
Uniform Delay, d1	23.6	26.1	1.5					25.5	16.6			
Progression Factor	0.73	0.74	85.95					0.17	0.00			
Incremental Delay, d2	2.1	6.1	0.9					2.0	0.0			
Delay (s)	19.4	25.3	130.4					6.4	0.1			
Level of Service	B	C	F					A	A			
Approach Delay (s)		89.7			0.0			5.8			0.0	
Approach LOS		F			A			A			A	

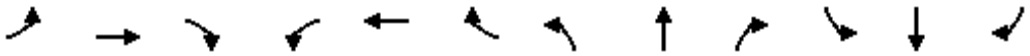
Intersection Summary			
HCM Average Control Delay	61.7	HCM Level of Service	E
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	103.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	95	480	335	0	185	0	1110	245	65	1545	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	106	533	353	0	195	0	1168	258	68	1626	0
RTOR Reduction (vph)	0	0	30	0	0	107	0	0	80	0	0	0
Lane Group Flow (vph)	0	106	503	353	0	88	0	1168	178	68	1626	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7				6		5	2	
Permitted Phases			8			4			6			
Actuated Green, G (s)		25.4	25.4	19.0		49.4		39.9	39.9	7.7	50.6	
Effective Green, g (s)		25.4	25.4	19.0		49.4		39.9	39.9	7.7	50.6	
Actuated g/C Ratio		0.23	0.23	0.17		0.45		0.36	0.36	0.07	0.46	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		396	593	289		674		1216	544	117	1542	
v/s Ratio Prot		0.06		c0.21				0.35		0.04	c0.48	
v/s Ratio Perm			c0.20			0.06			0.12			
v/c Ratio		0.27	0.85	1.22		0.13		0.96	0.33	0.58	1.05	
Uniform Delay, d1		34.7	40.5	45.5		17.7		34.3	25.3	49.6	29.7	
Progression Factor		0.84	0.86	1.00		1.00		0.43	0.21	1.03	0.78	
Incremental Delay, d2		0.2	9.6	126.7		0.1		7.0	0.4	4.8	35.0	
Delay (s)		29.4	44.2	172.2		17.8		21.6	5.8	55.7	58.2	
Level of Service		C	D	F		B		C	A	E	E	
Approach Delay (s)		41.8			117.2			18.8			58.1	
Approach LOS		D			F			B			E	

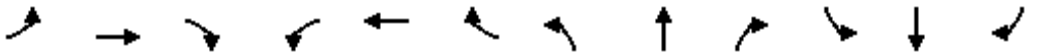
Intersection Summary			
HCM Average Control Delay	50.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	240	105	120	135	250	100	960	95	490	1755	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
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)	147	253	111	126	142	263	105	1011	100	516	1847	116
RTOR Reduction (vph)	0	0	85	0	0	219	0	7	0	0	4	0
Lane Group Flow (vph)	147	253	26	126	142	44	105	1104	0	516	1959	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	9.0	18.6	18.6	9.0	18.6	18.6	6.4	34.0		32.4	60.0	
Effective Green, g (s)	9.0	18.6	18.6	9.0	18.6	18.6	6.4	34.0		32.4	60.0	
Actuated g/C Ratio	0.08	0.17	0.17	0.08	0.17	0.17	0.06	0.31		0.29	0.55	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	137	298	254	137	298	254	98	1022		484	1813	
v/s Ratio Prot	c0.09	c0.14		0.08	0.08		0.06	0.33		c0.31	c0.59	
v/s Ratio Perm			0.02			0.03						
v/c Ratio	1.07	0.85	0.10	0.92	0.48	0.18	1.07	1.08		1.07	1.08	
Uniform Delay, d1	50.5	44.3	38.6	50.1	41.3	39.1	51.8	38.0		38.8	25.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.07	1.10	
Incremental Delay, d2	97.7	19.6	0.2	51.8	1.2	0.3	111.5	52.5		34.4	37.4	
Delay (s)	148.2	63.9	38.8	102.0	42.5	39.5	163.3	90.5		75.8	64.9	
Level of Service	F	E	D	F	D	D	F	F		E	E	
Approach Delay (s)		82.7			55.1			96.8			67.1	
Approach LOS		F			E			F			E	

Intersection Summary			
HCM Average Control Delay	75.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

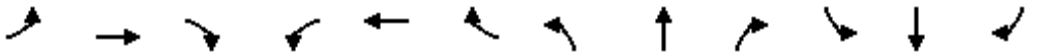
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	355	175	245	5	565	325	280	380	20	205	340	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1500	1579	1342	1676	1765	1500	1513	1581		1221	1286	1093
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1500	1579	1342	1676	1765	1500	1513	1581		1221	1286	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	394	194	272	6	628	361	311	422	22	228	378	222
RTOR Reduction (vph)	0	0	140	0	0	98	0	2	0	0	0	124
Lane Group Flow (vph)	394	194	132	6	628	263	311	442	0	228	378	98
Heavy Vehicles (%)	14%	14%	14%	2%	2%	2%	13%	13%	13%	40%	40%	40%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Effective Green, g (s)	23.0	59.6	59.6	0.6	37.2	37.2	17.0	28.0		15.0	26.0	26.0
Actuated g/C Ratio	0.19	0.48	0.48	0.00	0.30	0.30	0.14	0.23		0.12	0.21	0.21
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	280	764	649	8	533	453	209	359		149	271	231
v/s Ratio Prot	c0.26	0.12		0.00	c0.36		c0.21	0.28		0.19	c0.29	
v/s Ratio Perm			0.10			0.18						0.09
v/c Ratio	1.41	0.25	0.20	0.75	1.18	0.58	1.49	1.23		1.53	1.39	0.42
Uniform Delay, d1	50.1	18.7	18.2	61.2	43.0	36.4	53.1	47.6		54.1	48.6	42.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	203.2	0.5	0.4	166.2	98.4	3.6	243.3	126.6		269.5	198.7	0.5
Delay (s)	253.3	19.2	18.6	227.4	141.4	40.0	296.4	174.2		323.6	247.3	42.6
Level of Service	F	B	B	F	F	D	F	F		F	F	D
Approach Delay (s)		126.3			105.1			224.5			213.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	162.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		

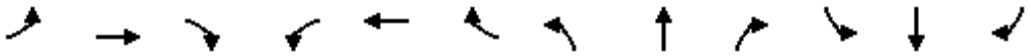
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	185	1355	895	0	20	0	0	325	95
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5		4.0			3.5	3.5
Lane Util. Factor					0.95	1.00		1.00			0.95	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3060	1377		1716			2578	1153
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3060	1377		1716			2578	1153
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)	0	0	0	195	1426	942	0	21	0	0	342	100
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	0	0	1621	942	0	21	0	0	342	38
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	2%	2%	2%	29%	29%	29%
Turn Type				Split		Free						Perm
Protected Phases				4	4			6			2	
Permitted Phases						Free						2
Actuated Green, G (s)					82.5	110.0		19.5			19.5	19.5
Effective Green, g (s)					83.0	110.0		19.5			20.0	20.0
Actuated g/C Ratio					0.75	1.00		0.18			0.18	0.18
Clearance Time (s)					4.0			4.0			4.0	4.0
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					2309	1377		304			469	210
v/s Ratio Prot					0.53			0.01			0.13	
v/s Ratio Perm						c0.68						0.03
v/c Ratio					0.70	0.68		0.07			0.73	0.18
Uniform Delay, d1					7.0	0.0		37.7			42.4	38.1
Progression Factor					0.69	1.00		0.79			1.00	1.00
Incremental Delay, d2					1.0	1.6		0.1			5.6	0.4
Delay (s)					5.9	1.6		30.0			48.1	38.5
Level of Service					A	A		C			D	D
Approach Delay (s)		0.0			4.3			30.0			45.9	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

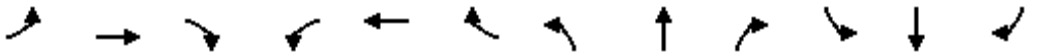
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	780	270	0	0	0	0	0	5	430	75	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91	1.00						1.00	0.95	0.95	
Frt	1.00	1.00	0.85						0.86	1.00	1.00	
Flt Protected	0.95	1.00	1.00						1.00	0.95	0.97	
Satd. Flow (prot)	1446	4152	1458						1484	1244	1348	
Flt Permitted	0.95	1.00	1.00						1.00	0.95	0.97	
Satd. Flow (perm)	1446	4152	1458						1484	1244	1348	
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.96	0.96	0.95	0.95	0.90	0.96	0.90	0.96
Adj. Flow (vph)	21	812	284	0	0	0	0	0	6	448	83	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	21	812	284	0	0	0	0	0	0	264	267	0
Heavy Vehicles (%)	15%	15%	2%	2%	2%	2%	2%	2%	2%	27%	2%	27%
Turn Type	Split		Free						custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)	26.3	26.3	55.0						0.8	15.9	15.9	
Effective Green, g (s)	25.8	26.3	55.0						1.3	16.4	16.4	
Actuated g/C Ratio	0.47	0.48	1.00						0.02	0.30	0.30	
Clearance Time (s)	4.0	4.0							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	678	1985	1458						35	371	402	
v/s Ratio Prot	0.01	c0.20							0.00	c0.21	0.20	
v/s Ratio Perm			c0.19									
v/c Ratio	0.03	0.41	0.19						0.00	0.71	0.66	
Uniform Delay, d1	7.9	9.3	0.0						26.2	17.2	16.9	
Progression Factor	1.00	1.00	1.00						1.00	0.95	0.92	
Incremental Delay, d2	0.1	0.6	0.3						0.0	4.9	3.2	
Delay (s)	8.0	9.9	0.3						26.3	21.3	18.7	
Level of Service	A	A	A						C	C	B	
Approach Delay (s)		7.4			0.0			26.3			20.0	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

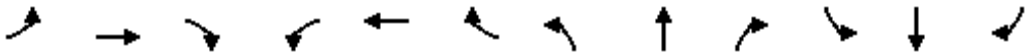
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	215	75	2075	320	0	0	0	145
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	4.0	4.0				3.5
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2842	1271	3014	1636				1428
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2842	1271	3014	1636				1428
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)	0	0	0	0	226	79	2184	337	0	0	0	153
RTOR Reduction (vph)	0	0	0	0	0	69	46	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	226	10	2138	337	0	0	0	153
Heavy Vehicles (%)	2%	2%	2%	17%	17%	17%	7%	7%	7%	6%	6%	6%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					13.6	13.6	88.4	88.4				110.0
Effective Green, g (s)					14.1	14.1	88.4	88.4				110.0
Actuated g/C Ratio					0.13	0.13	0.80	0.80				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					364	163	2422	1315				1428
v/s Ratio Prot					c0.08		c0.71	0.21				
v/s Ratio Perm						0.01						0.11
v/c Ratio					0.62	0.06	0.88	0.26				0.11
Uniform Delay, d1					45.4	42.1	7.3	2.7				0.0
Progression Factor					1.00	1.00	0.33	0.61				1.00
Incremental Delay, d2					3.3	0.2	1.9	0.2				0.2
Delay (s)					48.7	42.3	4.3	1.8				0.2
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			47.0			4.0			0.2	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	112.8%	ICU Level of Service	H
Analysis Period (min)	15		

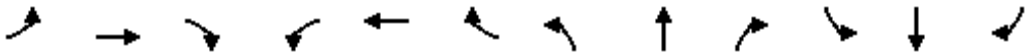
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	215	680	0	0	0	0	1970	60	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (prot)	1362	1409	2257					3228	1444			
Flt Permitted	0.95	0.98	1.00					1.00	1.00			
Satd. Flow (perm)	1362	1409	2257					3228	1444			
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)	447	226	716	0	0	0	0	2074	63	0	0	0
RTOR Reduction (vph)	13	13	66	0	0	0	0	0	11	0	0	0
Lane Group Flow (vph)	318	329	650	0	0	0	0	2074	52	0	0	0
Heavy Vehicles (%)	16%	16%	16%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	27.4	27.4	99.4					74.6	74.6			
Effective Green, g (s)	27.9	27.9	99.9					73.6	73.6			
Actuated g/C Ratio	0.25	0.25	0.91					0.67	0.67			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	345	357	2050					2160	966			
v/s Ratio Prot	0.23	c0.23	0.29					c0.64	0.04			
v/s Ratio Perm												
v/c Ratio	0.92	0.92	0.32					0.96	0.05			
Uniform Delay, d1	40.0	40.0	0.7					16.8	6.2			
Progression Factor	0.93	0.93	9.84					0.32	0.16			
Incremental Delay, d2	28.0	27.3	0.1					8.0	0.0			
Delay (s)	65.3	64.6	6.5					13.4	1.0			
Level of Service	E	E	A					B	A			
Approach Delay (s)		34.8			0.0			13.0			0.0	
Approach LOS		C			A			B			A	

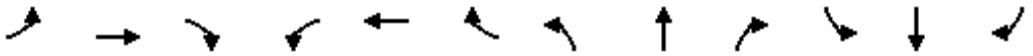
Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	91.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	25	310	5	0	55	0	1970	45	15	665	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	28	344	5	0	58	0	2074	47	16	700	0
RTOR Reduction (vph)	0	0	321	0	0	51	0	0	5	0	0	0
Lane Group Flow (vph)	0	28	23	5	0	7	0	2074	42	16	700	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7		4		6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)		7.5	7.5	0.8		13.3		80.6	80.6	3.1	86.7	
Effective Green, g (s)		7.5	7.5	0.8		13.3		80.6	80.6	3.1	86.7	
Actuated g/C Ratio		0.07	0.07	0.01		0.12		0.73	0.73	0.03	0.79	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		117	175	12		181		2457	1099	47	2643	
v/s Ratio Prot		c0.02		c0.00		0.00		c0.62		c0.01	0.21	
v/s Ratio Perm			0.01						0.03			
v/c Ratio		0.24	0.13	0.42		0.04		0.84	0.04	0.34	0.26	
Uniform Delay, d1		48.5	48.2	54.4		42.7		10.3	4.0	52.4	3.1	
Progression Factor		1.09	1.79	1.00		1.00		0.50	0.55	1.05	0.84	
Incremental Delay, d2		0.6	0.2	13.1		0.1		0.4	0.0	4.1	0.2	
Delay (s)		53.7	86.4	67.4		42.8		5.5	2.2	59.4	2.8	
Level of Service		D	F	E		D		A	A	E	A	
Approach Delay (s)		84.0			44.7			5.4			4.1	
Approach LOS		F			D			A			A	

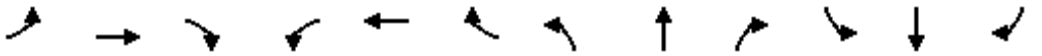
Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	65	45	40	140	615	105	1340	65	170	750	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3316	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3330		1644	3316	
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)	63	68	47	42	147	647	111	1411	68	179	789	63
RTOR Reduction (vph)	0	0	33	0	0	153	0	3	0	0	5	0
Lane Group Flow (vph)	63	68	14	42	147	494	111	1476	0	179	847	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	4.0	32.0	32.0	4.2	32.2	32.2	11.1	46.8		11.0	46.7	
Effective Green, g (s)	4.0	32.0	32.0	4.2	32.2	32.2	11.1	46.8		11.0	46.7	
Actuated g/C Ratio	0.04	0.29	0.29	0.04	0.29	0.29	0.10	0.43		0.10	0.42	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	61	513	436	64	517	439	169	1417		164	1408	
v/s Ratio Prot	c0.04	0.04		0.03	0.08		0.07	c0.44		c0.11	0.26	
v/s Ratio Perm			0.01			c0.33						
v/c Ratio	1.03	0.13	0.03	0.66	0.28	1.12	0.66	1.04		1.09	0.60	
Uniform Delay, d1	53.0	28.8	27.9	52.2	30.0	38.9	47.6	31.6		49.5	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.03	0.90	
Incremental Delay, d2	124.7	0.1	0.0	16.9	0.3	81.4	6.8	35.4		95.9	1.9	
Delay (s)	177.7	28.9	27.9	69.1	30.3	120.3	54.4	67.0		146.7	23.8	
Level of Service	F	C	C	E	C	F	D	E		F	C	
Approach Delay (s)		81.3			101.9			66.1			45.1	
Approach LOS		F			F			E			D	

Intersection Summary			
HCM Average Control Delay	69.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

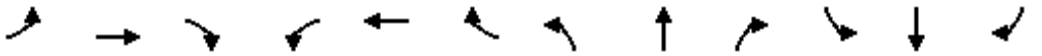
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	515	410	5	340	245	205	305	25	335	465	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	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	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1569	1651	1404	1613	1698	1443	1346	1401		1449	1525	1297
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1569	1651	1404	1613	1698	1443	1346	1401		1449	1525	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	261	572	456	6	378	272	228	339	28	372	517	400
RTOR Reduction (vph)	0	0	158	0	0	122	0	2	0	0	0	164
Lane Group Flow (vph)	261	572	298	6	378	150	228	365	0	372	517	236
Heavy Vehicles (%)	9%	9%	9%	6%	6%	6%	27%	27%	27%	18%	18%	18%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Effective Green, g (s)	19.0	46.6	46.6	0.6	28.2	28.2	19.0	28.0		28.0	37.0	37.0
Actuated g/C Ratio	0.15	0.38	0.38	0.00	0.23	0.23	0.15	0.23		0.23	0.30	0.30
Clearance Time (s)	4.0	7.0	7.0	4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0	6.0	3.0	6.0	6.0	1.0	3.0		2.0	2.0	2.0
Lane Grp Cap (vph)	242	624	531	8	389	330	208	318		329	458	390
v/s Ratio Prot	c0.17	c0.35		0.00	0.22		0.17	0.26		c0.26	c0.34	
v/s Ratio Perm			0.21			0.10						0.18
v/c Ratio	1.08	0.92	0.56	0.75	0.97	0.46	1.10	1.15		1.13	1.13	0.60
Uniform Delay, d1	52.1	36.5	30.2	61.2	47.1	40.9	52.1	47.6		47.6	43.1	36.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	80.3	19.7	2.8	166.2	38.7	2.8	90.5	96.4		89.8	82.2	1.8
Delay (s)	132.4	56.1	33.0	227.4	85.8	43.7	142.6	144.0		137.4	125.3	38.7
Level of Service	F	E	C	F	F	D	F	F		F	F	D
Approach Delay (s)		63.4			69.6			143.4			101.9	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	89.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		

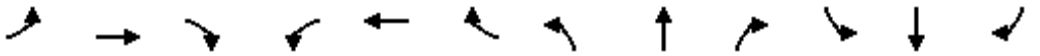
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	385	1005	590	0	20	0	0	745	215
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5		3.0			3.5	3.5
Lane Util. Factor					0.95	1.00		1.00			0.95	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					2852	1293		1509			3079	1377
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					2852	1293		1509			3079	1377
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)	0	0	0	405	1058	621	0	21	0	0	784	226
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	81
Lane Group Flow (vph)	0	0	0	0	1463	621	0	21	0	0	784	145
Heavy Vehicles (%)	2%	2%	2%	15%	15%	15%	16%	16%	16%	8%	8%	8%
Turn Type				Split		Free						Perm
Protected Phases				4	4			2			2	
Permitted Phases						Free						2
Actuated Green, G (s)					76.9	120.0		35.1			35.1	35.1
Effective Green, g (s)					77.4	120.0		36.1			35.6	35.6
Actuated g/C Ratio					0.65	1.00		0.30			0.30	0.30
Clearance Time (s)					4.0			4.0			4.0	4.0
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					1840	1293		454			913	409
v/s Ratio Prot					c0.51			0.01			c0.25	
v/s Ratio Perm						0.48						0.11
v/c Ratio					0.80	0.48		0.05			0.86	0.35
Uniform Delay, d1					15.5	0.0		29.7			39.8	33.2
Progression Factor					0.58	1.00		1.71			1.00	1.00
Incremental Delay, d2					3.1	1.1		0.0			8.1	0.5
Delay (s)					12.0	1.1		51.0			47.9	33.7
Level of Service					B	A		D			D	C
Approach Delay (s)		0.0			8.7			51.0			44.7	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

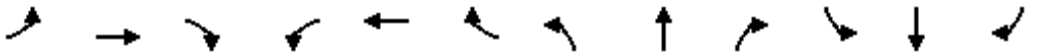
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	1325	430	0	0	0	0	0	5	965	165	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.0	4.0	4.0						3.5	3.5	3.5	
Lane Util. Factor	1.00	0.91	1.00						1.00	0.95	0.95	
Frt	1.00	1.00	0.85						0.86	1.00	1.00	
Flt Protected	0.95	1.00	1.00						1.00	0.95	0.97	
Satd. Flow (prot)	1525	4680	1458						1484	2950	1466	
Flt Permitted	0.95	1.00	1.00						1.00	0.95	0.97	
Satd. Flow (perm)	1525	4680	1458						1484	2950	1466	
Peak-hour factor, PHF	0.96	0.96	0.90	0.90	0.96	0.96	0.90	0.90	0.90	0.96	0.90	0.96
Adj. Flow (vph)	21	1380	478	0	0	0	0	0	6	1005	183	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	6	0	0	0
Lane Group Flow (vph)	21	1380	478	0	0	0	0	0	0	593	595	0
Heavy Vehicles (%)	9%	9%	2%	2%	0%	0%	2%	2%	2%	13%	2%	13%
Turn Type	Split		Free						custom	Split		
Protected Phases	8	8							5	6	6	
Permitted Phases			Free									
Actuated Green, G (s)	50.2	50.2	120.0						0.8	56.5	56.5	
Effective Green, g (s)	49.7	50.7	120.0						1.3	57.0	57.0	
Actuated g/C Ratio	0.41	0.42	1.00						0.01	0.48	0.48	
Clearance Time (s)	4.5	4.5							4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0							3.0	3.0	3.0	
Lane Grp Cap (vph)	632	1977	1458						16	1401	696	
v/s Ratio Prot	0.01	c0.29							0.00	0.20	c0.41	
v/s Ratio Perm			c0.33									
v/c Ratio	0.03	0.70	0.33						0.00	0.42	0.85	
Uniform Delay, d1	20.9	28.4	0.0						58.7	20.7	27.8	
Progression Factor	1.00	1.00	1.00						1.00	0.57	0.52	
Incremental Delay, d2	0.1	2.1	0.6						0.1	0.1	6.1	
Delay (s)	21.0	30.5	0.6						58.8	11.9	20.7	
Level of Service	C	C	A						E	B	C	
Approach Delay (s)		22.8			0.0			58.8			16.3	
Approach LOS		C			A			E			B	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.5
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		

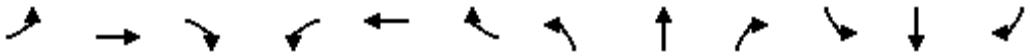
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	285	60	1385	170	0	0	0	310
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)					3.5	3.5	3.5	3.5				4.0
Lane Util. Factor					0.95	1.00	0.97	1.00				1.00
Frt					1.00	0.85	1.00	1.00				0.86
Flt Protected					1.00	1.00	0.95	1.00				1.00
Satd. Flow (prot)					2639	1181	2906	1577				1294
Flt Permitted					1.00	1.00	0.95	1.00				1.00
Satd. Flow (perm)					2639	1181	2906	1577				1294
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)	0	0	0	0	300	63	1458	179	0	0	0	326
RTOR Reduction (vph)	0	0	0	0	0	53	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	300	10	1458	179	0	0	0	326
Heavy Vehicles (%)	2%	2%	2%	26%	26%	26%	11%	11%	11%	17%	17%	17%
Turn Type						Perm	Split					Free
Protected Phases					4		6	6				
Permitted Phases						4						Free
Actuated Green, G (s)					18.8	18.8	93.2	93.2				120.0
Effective Green, g (s)					19.3	19.3	93.7	93.7				120.0
Actuated g/C Ratio					0.16	0.16	0.78	0.78				1.00
Clearance Time (s)					4.0	4.0	4.0	4.0				
Vehicle Extension (s)					3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)					424	190	2269	1231				1294
v/s Ratio Prot					c0.11		c0.50	0.11				
v/s Ratio Perm						0.01						0.25
v/c Ratio					0.71	0.05	0.64	0.15				0.25
Uniform Delay, d1					47.7	42.6	5.8	3.3				0.0
Progression Factor					1.00	1.00	0.26	0.37				1.00
Incremental Delay, d2					5.3	0.1	1.0	0.2				0.5
Delay (s)					53.0	42.7	2.5	1.4				0.5
Level of Service					D	D	A	A				A
Approach Delay (s)		0.0			51.2			2.3			0.5	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	122.5%	ICU Level of Service	H
Analysis Period (min)	15		

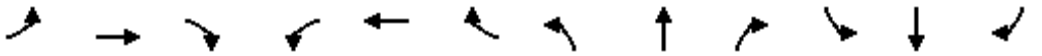
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	400	450	1580	0	0	0	0	1155	120	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.5	3.5	3.5					3.5	3.5			
Lane Util. Factor	0.95	0.95	0.88					0.95	1.00			
Frt	1.00	1.00	0.85					1.00	0.85			
Flt Protected	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (prot)	1436	1505	2380					3197	1430			
Flt Permitted	0.95	1.00	1.00					1.00	1.00			
Satd. Flow (perm)	1436	1505	2380					3197	1430			
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)	421	474	1663	0	0	0	0	1216	126	0	0	0
RTOR Reduction (vph)	18	3	177	0	0	0	0	0	33	0	0	0
Lane Group Flow (vph)	361	513	1486	0	0	0	0	1216	93	0	0	0
Heavy Vehicles (%)	10%	10%	10%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Turn Type	Split		custom						Prot			
Protected Phases	8	8	8 6					6 5	6 5			
Permitted Phases												
Actuated Green, G (s)	52.7	52.7	106.7					59.3	59.3			
Effective Green, g (s)	53.2	53.2	107.2					58.3	58.3			
Actuated g/C Ratio	0.44	0.44	0.89					0.49	0.49			
Clearance Time (s)	4.0	4.0										
Vehicle Extension (s)	3.0	3.0										
Lane Grp Cap (vph)	637	667	2126					1553	695			
v/s Ratio Prot	0.25	c0.34	0.62					c0.38	0.06			
v/s Ratio Perm												
v/c Ratio	0.57	0.77	0.70					0.78	0.13			
Uniform Delay, d1	24.8	28.2	1.8					25.6	17.0			
Progression Factor	0.75	0.75	114.18					0.14	0.01			
Incremental Delay, d2	1.0	4.5	0.8					1.5	0.0			
Delay (s)	19.7	25.5	208.3					5.1	0.2			
Level of Service	B	C	F					A	A			
Approach Delay (s)		143.5			0.0			4.7			0.0	
Approach LOS		F			A			A			A	

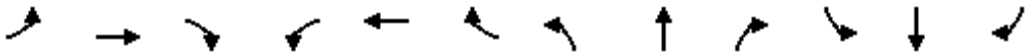
Intersection Summary			
HCM Average Control Delay	95.7	HCM Level of Service	F
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	95	490	335	0	185	0	1090	245	65	1515	0
Ideal Flow (vphpl)	1750	1750	1750	1800	1750	1800	1750	1800	1800	1800	1800	1750
Total Lost time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Lane Util. Factor		1.00	0.88	1.00		1.00		0.95	1.00	1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1716	2567	1676		1500		3353	1500	1676	3353	
Flt Permitted		1.00	1.00	0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1716	2567	1676		1500		3353	1500	1676	3353	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.90	0.95	0.90	0.95	0.95	0.95	0.95	0.90
Adj. Flow (vph)	0	106	544	353	0	195	0	1147	258	68	1595	0
RTOR Reduction (vph)	0	0	43	0	0	106	0	0	76	0	0	0
Lane Group Flow (vph)	0	106	501	353	0	89	0	1147	182	68	1595	0
Turn Type	Prot		Perm	Prot		custom			Perm	Prot		
Protected Phases	3	8		7				6		5	2	
Permitted Phases			8			4			6			
Actuated Green, G (s)		26.7	26.7	23.0		54.7		45.0	45.0	7.3	55.3	
Effective Green, g (s)		26.7	26.7	23.0		54.7		45.0	45.0	7.3	55.3	
Actuated g/C Ratio		0.22	0.22	0.19		0.46		0.38	0.38	0.06	0.46	
Clearance Time (s)		5.0	5.0	5.0		5.0		5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.3	2.3	2.3		2.3		6.3	6.3	3.0	6.3	
Lane Grp Cap (vph)		382	571	321		684		1257	563	102	1545	
v/s Ratio Prot		0.06		c0.21				0.34		0.04	c0.48	
v/s Ratio Perm			c0.20			0.06			0.12			
v/c Ratio		0.28	0.88	1.10		0.13		0.91	0.32	0.67	1.03	
Uniform Delay, d1		38.7	45.1	48.5		18.9		35.6	26.7	55.2	32.4	
Progression Factor		0.82	0.84	1.00		1.00		0.39	0.18	1.01	0.85	
Incremental Delay, d2		0.2	12.9	79.7		0.1		4.7	0.5	10.7	27.8	
Delay (s)		32.0	50.6	128.2		18.9		18.5	5.5	66.2	55.2	
Level of Service		C	D	F		B		B	A	E	E	
Approach Delay (s)		47.5			89.3			16.1			55.7	
Approach LOS		D			F			B			E	

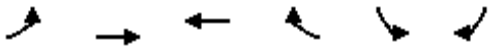
Intersection Summary			
HCM Average Control Delay	45.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	94.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	250	115	120	145	250	105	960	95	485	1745	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1676	1765	1500	1676	1765	1500	1676	3308		1644	3323	
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)	132	263	121	126	153	263	111	1011	100	511	1837	116
RTOR Reduction (vph)	0	0	80	0	0	220	0	6	0	0	4	0
Lane Group Flow (vph)	132	263	41	126	153	43	111	1105	0	511	1949	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	19.5	19.5	10.0	19.5	19.5	9.0	39.0		35.5	65.5	
Effective Green, g (s)	10.0	19.5	19.5	10.0	19.5	19.5	9.0	39.0		35.5	65.5	
Actuated g/C Ratio	0.08	0.16	0.16	0.08	0.16	0.16	0.08	0.32		0.30	0.55	
Clearance Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	140	287	244	140	287	244	126	1075		486	1814	
v/s Ratio Prot	c0.08	c0.15		0.08	0.09		0.07	0.33		c0.31	c0.59	
v/s Ratio Perm			0.03			0.03						
v/c Ratio	0.94	0.92	0.17	0.90	0.53	0.18	0.88	1.03		1.05	1.07	
Uniform Delay, d1	54.7	49.4	43.3	54.5	46.1	43.3	55.0	40.5		42.2	27.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.09	1.05	
Incremental Delay, d2	58.1	31.9	0.3	46.6	1.9	0.3	45.0	34.8		35.2	36.8	
Delay (s)	112.8	81.3	43.6	101.1	48.0	43.7	100.0	75.3		81.3	65.4	
Level of Service	F	F	D	F	D	D	F	E		F	E	
Approach Delay (s)		80.5			58.2			77.5			68.7	
Approach LOS		F			E			E			E	

Intersection Summary			
HCM Average Control Delay	71.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

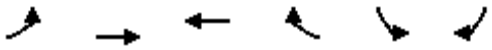
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	195	755	610	445	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1500	3000	3167	1417	1221	1093
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1500	3000	3167	1417	1221	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	450	217	839	678	494	228
RTOR Reduction (vph)	0	0	0	320	0	150
Lane Group Flow (vph)	450	217	839	358	494	78
Heavy Vehicles (%)	14%	14%	8%	8%	40%	40%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		7	
Permitted Phases				6		7
Actuated Green, G (s)	26.0	55.0	25.0	25.0	34.0	34.0
Effective Green, g (s)	26.0	55.0	25.0	25.0	34.0	34.0
Actuated g/C Ratio	0.26	0.55	0.25	0.25	0.34	0.34
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	390	1650	792	354	415	372
v/s Ratio Prot	c0.30	0.07	c0.26		c0.40	
v/s Ratio Perm				0.25		0.07
v/c Ratio	1.15	0.13	1.06	1.01	1.19	0.21
Uniform Delay, d1	37.0	10.9	37.5	37.5	33.0	23.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	94.6	0.1	48.9	50.5	107.3	0.1
Delay (s)	131.6	11.0	86.4	88.0	140.3	23.5
Level of Service	F	B	F	F	F	C
Approach Delay (s)		92.4	87.1		103.4	
Approach LOS		F	F		F	

Intersection Summary			
HCM Average Control Delay	92.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

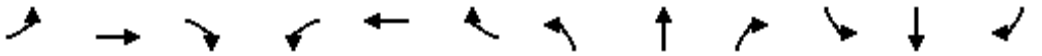
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	250	585	360	445	745	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1569	3138	2826	1264	1449	1297
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1569	3138	2826	1264	1449	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	278	650	400	494	828	400
RTOR Reduction (vph)	0	0	0	405	0	191
Lane Group Flow (vph)	278	650	400	89	828	209
Heavy Vehicles (%)	9%	9%	21%	21%	18%	18%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		7	
Permitted Phases				6		7
Actuated Green, G (s)	16.0	38.0	18.0	18.0	51.0	51.0
Effective Green, g (s)	16.0	38.0	18.0	18.0	51.0	51.0
Actuated g/C Ratio	0.16	0.38	0.18	0.18	0.51	0.51
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	251	1192	509	228	739	661
v/s Ratio Prot	c0.18	0.21	c0.14		c0.57	
v/s Ratio Perm				0.07		0.16
v/c Ratio	1.11	0.55	0.79	0.39	1.12	0.32
Uniform Delay, d1	42.0	24.2	39.2	36.2	24.5	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	88.7	1.2	9.6	3.1	71.4	0.1
Delay (s)	130.7	25.4	48.8	39.3	95.9	14.4
Level of Service	F	C	D	D	F	B
Approach Delay (s)		56.9	43.5		69.4	
Approach LOS		E	D		E	

Intersection Summary			
HCM Average Control Delay	58.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.2%	ICU Level of Service	E
Analysis Period (min)	15		

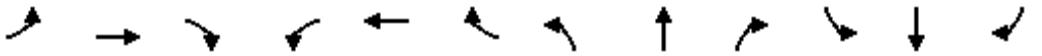
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	355	175	245	5	565	325	280	380	40	205	340	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.91		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1500	2737		1676	3353	1500	1513	1570		1221	1286	1093
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1500	2737		1676	3353	1500	1513	1570		1221	1286	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	394	194	272	6	628	361	311	422	44	228	378	222
RTOR Reduction (vph)	0	158	0	0	0	185	0	3	0	0	0	124
Lane Group Flow (vph)	394	308	0	6	628	176	311	463	0	228	378	98
Heavy Vehicles (%)	14%	14%	14%	2%	2%	2%	13%	13%	13%	40%	40%	40%
Turn Type	Prot			Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						4
Actuated Green, G (s)	27.0	51.6		0.6	25.2	25.2	21.0	30.0		21.0	30.0	30.0
Effective Green, g (s)	27.0	51.6		0.6	25.2	25.2	21.0	30.0		21.0	30.0	30.0
Actuated g/C Ratio	0.22	0.42		0.00	0.20	0.20	0.17	0.24		0.17	0.24	0.24
Clearance Time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0		3.0	6.0	6.0	1.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	329	1146		8	686	307	258	382		208	313	266
v/s Ratio Prot	c0.26	0.11		0.00	c0.19		c0.21	c0.29		0.19	0.29	
v/s Ratio Perm						0.12						0.09
v/c Ratio	1.20	0.27		0.75	0.92	0.57	1.21	1.21		1.10	1.21	0.37
Uniform Delay, d1	48.1	23.4		61.2	48.0	44.2	51.1	46.6		51.1	46.6	38.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	114.6	0.4		166.2	18.2	5.1	123.2	117.3		90.5	119.6	0.3
Delay (s)	162.7	23.8		227.4	66.1	49.3	174.3	163.9		141.6	166.2	39.0
Level of Service	F	C		F	E	D	F	F		F	F	D
Approach Delay (s)		87.4			61.0			168.0			125.3	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	107.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

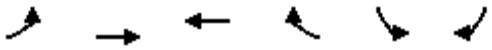
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	515	410	5	340	245	205	305	45	335	465	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1569	2929		1613	3226	1443	1346	1390		1449	1525	1297
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1569	2929		1613	3226	1443	1346	1390		1449	1525	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	261	572	456	6	378	272	228	339	50	372	517	400
RTOR Reduction (vph)	0	115	0	0	0	221	0	5	0	0	0	164
Lane Group Flow (vph)	261	913	0	6	378	51	228	384	0	372	517	236
Heavy Vehicles (%)	9%	9%	9%	6%	6%	6%	27%	27%	27%	18%	18%	18%
Turn Type	Prot			Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						4
Actuated Green, G (s)	20.5	42.7		0.6	22.8	22.8	20.0	29.0		30.0	39.0	39.0
Effective Green, g (s)	20.5	42.7		0.6	22.8	22.8	20.0	29.0		30.0	39.0	39.0
Actuated g/C Ratio	0.17	0.35		0.00	0.19	0.19	0.16	0.24		0.25	0.32	0.32
Clearance Time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0		3.0	6.0	6.0	1.0	3.0		2.0	2.0	2.0
Lane Grp Cap (vph)	263	1023		8	601	269	220	330		355	486	414
v/s Ratio Prot	c0.17	c0.31		0.00	0.12		0.17	c0.28		c0.26	0.34	
v/s Ratio Perm						0.04						0.18
v/c Ratio	0.99	0.89		0.75	0.63	0.19	1.04	1.16		1.05	1.06	0.57
Uniform Delay, d1	50.8	37.6		60.8	45.9	41.9	51.1	46.6		46.1	41.6	34.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	53.1	11.1		166.2	3.5	1.0	70.5	102.2		60.8	58.8	1.1
Delay (s)	103.9	48.7		227.0	49.4	42.9	121.6	148.8		107.0	100.5	35.7
Level of Service	F	D		F	D	D	F	F		F	F	D
Approach Delay (s)		59.9			48.3			138.8			82.3	
Approach LOS		E			D			F			F	

Intersection Summary			
HCM Average Control Delay	78.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	122.3	Sum of lost time (s)	13.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

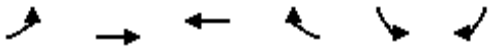
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	195	755	615	445	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1500	3000	3167	1417	1221	1093
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1500	3000	3167	1417	1221	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	450	217	839	683	494	228
RTOR Reduction (vph)	0	0	0	323	0	150
Lane Group Flow (vph)	450	217	839	361	494	78
Heavy Vehicles (%)	14%	14%	8%	8%	40%	40%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		7	
Permitted Phases				6		7
Actuated Green, G (s)	26.0	55.0	25.0	25.0	34.0	34.0
Effective Green, g (s)	26.0	55.0	25.0	25.0	34.0	34.0
Actuated g/C Ratio	0.26	0.55	0.25	0.25	0.34	0.34
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	390	1650	792	354	415	372
v/s Ratio Prot	c0.30	0.07	c0.26		c0.40	
v/s Ratio Perm				0.25		0.07
v/c Ratio	1.15	0.13	1.06	1.02	1.19	0.21
Uniform Delay, d1	37.0	10.9	37.5	37.5	33.0	23.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	94.6	0.1	48.9	52.6	107.3	0.1
Delay (s)	131.6	11.0	86.4	90.1	140.3	23.5
Level of Service	F	B	F	F	F	C
Approach Delay (s)		92.4	88.0		103.4	
Approach LOS		F	F		F	

Intersection Summary			
HCM Average Control Delay	92.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

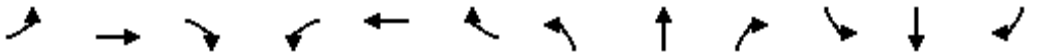
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	250	585	360	450	745	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1569	3138	2826	1264	1449	1297
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1569	3138	2826	1264	1449	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	278	650	400	500	828	400
RTOR Reduction (vph)	0	0	0	410	0	191
Lane Group Flow (vph)	278	650	400	90	828	209
Heavy Vehicles (%)	9%	9%	21%	21%	18%	18%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		7	
Permitted Phases				6		7
Actuated Green, G (s)	16.0	38.0	18.0	18.0	51.0	51.0
Effective Green, g (s)	16.0	38.0	18.0	18.0	51.0	51.0
Actuated g/C Ratio	0.16	0.38	0.18	0.18	0.51	0.51
Clearance Time (s)	4.0	7.0	7.0	7.0	4.0	4.0
Vehicle Extension (s)	1.0	6.0	6.0	6.0	2.0	2.0
Lane Grp Cap (vph)	251	1192	509	228	739	661
v/s Ratio Prot	c0.18	0.21	c0.14		c0.57	
v/s Ratio Perm				0.07		0.16
v/c Ratio	1.11	0.55	0.79	0.39	1.12	0.32
Uniform Delay, d1	42.0	24.2	39.2	36.2	24.5	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	88.7	1.2	9.6	3.2	71.4	0.1
Delay (s)	130.7	25.4	48.8	39.3	95.9	14.4
Level of Service	F	C	D	D	F	B
Approach Delay (s)		56.9	43.5		69.4	
Approach LOS		E	D		E	

Intersection Summary			
HCM Average Control Delay	58.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.2%	ICU Level of Service	E
Analysis Period (min)	15		

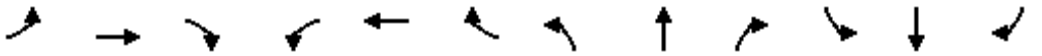
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	515	410	5	340	245	205	305	25	335	465	360
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1569	2929		1613	3226	1443	1346	1401		1449	1525	1297
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1569	2929		1613	3226	1443	1346	1401		1449	1525	1297
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	261	572	456	6	378	272	228	339	28	372	517	400
RTOR Reduction (vph)	0	115	0	0	0	221	0	2	0	0	0	164
Lane Group Flow (vph)	261	913	0	6	378	51	228	365	0	372	517	236
Heavy Vehicles (%)	9%	9%	9%	6%	6%	6%	27%	27%	27%	18%	18%	18%
Turn Type	Prot			Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						4
Actuated Green, G (s)	20.5	42.7		0.6	22.8	22.8	20.0	29.0		30.0	39.0	39.0
Effective Green, g (s)	20.5	42.7		0.6	22.8	22.8	20.0	29.0		30.0	39.0	39.0
Actuated g/C Ratio	0.17	0.35		0.00	0.19	0.19	0.16	0.24		0.25	0.32	0.32
Clearance Time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0		3.0	6.0	6.0	1.0	3.0		2.0	2.0	2.0
Lane Grp Cap (vph)	263	1023		8	601	269	220	332		355	486	414
v/s Ratio Prot	c0.17	c0.31		0.00	0.12		0.17	0.26		c0.26	c0.34	
v/s Ratio Perm						0.04						0.18
v/c Ratio	0.99	0.89		0.75	0.63	0.19	1.04	1.10		1.05	1.06	0.57
Uniform Delay, d1	50.8	37.6		60.8	45.9	41.9	51.1	46.6		46.1	41.6	34.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	53.1	11.1		166.2	3.5	1.0	70.5	78.5		60.8	58.8	1.1
Delay (s)	103.9	48.7		227.0	49.4	42.9	121.6	125.1		107.0	100.5	35.7
Level of Service	F	D		F	D	D	F	F		F	F	D
Approach Delay (s)		59.9			48.3			123.8			82.3	
Approach LOS		E			D			F			F	

Intersection Summary			
HCM Average Control Delay	75.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	122.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	355	175	245	5	565	325	280	380	20	205	340	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.91		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1500	2737		1676	3353	1500	1513	1581		1221	1286	1093
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1500	2737		1676	3353	1500	1513	1581		1221	1286	1093
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	394	194	272	6	628	361	311	422	22	228	378	222
RTOR Reduction (vph)	0	158	0	0	0	185	0	2	0	0	0	124
Lane Group Flow (vph)	394	308	0	6	628	176	311	442	0	228	378	98
Heavy Vehicles (%)	14%	14%	14%	2%	2%	2%	13%	13%	13%	40%	40%	40%
Turn Type	Prot			Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						4
Actuated Green, G (s)	27.0	51.6		0.6	25.2	25.2	21.0	30.0		21.0	30.0	30.0
Effective Green, g (s)	27.0	51.6		0.6	25.2	25.2	21.0	30.0		21.0	30.0	30.0
Actuated g/C Ratio	0.22	0.42		0.00	0.20	0.20	0.17	0.24		0.17	0.24	0.24
Clearance Time (s)	4.0	7.0		4.0	7.0	7.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	1.0	6.0		3.0	6.0	6.0	1.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	329	1146		8	686	307	258	385		208	313	266
v/s Ratio Prot	c0.26	0.11		0.00	c0.19		c0.21	0.28		0.19	c0.29	
v/s Ratio Perm						0.12						0.09
v/c Ratio	1.20	0.27		0.75	0.92	0.57	1.21	1.15		1.10	1.21	0.37
Uniform Delay, d1	48.1	23.4		61.2	48.0	44.2	51.1	46.6		51.1	46.6	38.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	114.6	0.4		166.2	18.2	5.1	123.2	93.2		90.5	119.6	0.3
Delay (s)	162.7	23.8		227.4	66.1	49.3	174.3	139.8		141.6	166.2	39.0
Level of Service	F	C		F	E	D	F	F		F	F	D
Approach Delay (s)		87.4			61.0			154.0			125.3	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	103.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	123.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

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TRANSPORTATION SOLUTIONS

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Appendix G

Alternative Evaluation Scoring

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Table 5: I-84/257th IAMP Alternative Technical Evaluation Scoring

Measure of Effectiveness	Evaluation Score	238th Avenue Extension	Marine Drive Extension	Two-Way Marine Drive Under I-84
Safety	***-1 to +1***			
Reduce Vehicular Conflict Points Reductions in conflicts through better access management, roadway design, or other means are essential for enhanced safety.	+1 Reduction in conflict points 0 Same number of vehicular conflict points -1 Increase in vehicular conflict points	+1	+1	+1
Geometric Design/Driver Expectations Predictable routing and roadway designs contribute to driver safety.	+1 No geometric design or routing problems 0 Same geometric design or routing problems -1 Increase in quantity of geometric design or routing problems.	+1	+1	+1
Livability	***-1 to +1***			
Quality of Life While quality of life can be difficult to quantify, Troutdale's quality of life is dependent on sustaining and preserving the qualities that make it a cohesive community and a desirable place to live. Alternatives should support Troutdale's small town character and lifestyle with access to larger urban areas and amenities, attractive	+1 Positive impact on current quality of life 0 Neutral impact on current quality of life -1 Negative impact on current quality of life	+1	+1	+1

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Measure of Effectiveness	Evaluation Score	238th Avenue Extension	Marine Drive Extension	Two-Way Marine Drive Under I-84
downtown, and community pride.				
<u>Increase Economic Vitality of City of Troutdale</u> The wellbeing of a city is dependent upon its ability to meet the economic needs of its citizens. These needs primarily include employment opportunities and commercial services/products. Alternatives should provide good access to and mobility between the I-84 freight corridor and industrial/commercial areas	+1 Good access and mobility to and from I-84 0 Marginal access and mobility to and from I-84 -1 Poor access and mobility to and from I-84	+1	0	+1
Balance Service to All Users The ability of the transportation system to serve the needs of the users of all transportation modes is an important element for the wellbeing of the community. Alternatives should incorporate basic serviceability elements (e.g. a sufficient number of traffic lanes, pedestrian crossings and sidewalks, transit stops, bike lanes and paths, etc.) for all transportation modes.	+1 Pedestrians, cyclists, transit users, and vehicles all accommodated 0 At a minimum, pedestrians and vehicles accommodated -1 Only vehicles accommodated	+1	+1	+1
<u>Low Environmental Impact</u> A healthy and well-cared for	+1 Reduced environmental impact compared to current	-1	-1	0

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Measure of Effectiveness	Evaluation Score	238th Avenue Extension	Marine Drive Extension	Two-Way Marine Drive Under I-84
environment, including natural resources, contributes to a community's wellbeing. Those alternatives that have a lower impact on the environment and associated natural resources should be given preference.	conditions 0 Insignificant environmental impact compared to current conditions -1 Increased environmental impact compared to current conditions			
Mobility	***-1 to +1***			
Meet V/C Mobility Standards All study intersections are required to meet the following ODOT V/C standard: **0.85**	+1 Intersections well within standards 0 Intersections meet standards -1 Intersections do not meet standards	+1	0	+1
Facilitate Pedestrian and Bicycle Movements Proposed alternatives should accommodate pedestrian and bicycle needs.	+1 Significant increase in pedestrian and/or bicycle facilities 0 Minor increase in pedestrian and/or bicycle facilities -1 No increase in pedestrian and/or bicycle facilities	0	0	0
Facilitate Truck Movements Trucks are a principal method for transporting freight to and from the City of Troutdale. Where applicable (e.g. at interchange ramp terminals and	+1 Truck movements accommodated at all intersections 0 Truck movements accommodated at only major intersections	+1	0	+1

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Measure of Effectiveness	Evaluation Score	238th Avenue Extension	Marine Drive Extension	Two-Way Marine Drive Under I-84
major intersections) facilities should accommodate truck movements through adequate turning radii and turn lane storage capacity.	-1 Not all truck movements at major intersections are accommodated			
Feasibility	***-1 to +1***			
<u>Meet Adopted Policies or Plans</u> Alternatives considered should not conflict with adopted policies or planned improvements in the City of Troutdale TSP unless it is reasonable to assume that adopted plans would be amended by the City to remove such conflicts.	+1 Meets adopted policies and plans 0 Would require deviation or probable amendment -1 Does not meet adopted policies and plans	+1	+1	+1
<u>Minimize Costs</u> To accommodate budget and spending priorities, low cost solutions should be given preference	+1 Low cost 0 Moderate cost -1 High cost	-1	-1	0
<u>Minimize Private Property Impacts</u> Alternatives with no private property impacts would be the most desirable. While private property impacts should be minimized where feasible, impacts that would not require purchasing the entire property and would allow current development to continue operating are preferable.	+1 No private property impact 0 Minor private property impact -1 Significant private property impact	-1	-1	+1

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Measure of Effectiveness	Evaluation Score	238th Avenue Extension	Marine Drive Extension	Two-Way Marine Drive Under I-84
<u>Minimize Impact During Construction Stage</u> Alternatives that can be constructed or implemented with little impact to traffic flow should be rated higher than those that would require the elimination of travel lanes during construction.	+1 No construction impact 0 Minor construction impact -1 Significant construction impact	0	0	-1
Total for Each Alternative		**+5**	**+2**	**+8**

APPENDIX F – FINDINGS

I-84-TROUTDALE INTERCHANGE MANAGEMENT AREAS

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Findings

Statewide Planning Goals

Oregon law created a hierarchy of consistency between local, regional and state plans. The foundation of Oregon's land use planning program is a set of 19 Statewide Planning Goals (http://www.lcd.state.or.us/LCD/goals.shtml#Statewide_Planning_Goals) OAR 660-15-0000 (1-15). The goals express the state's policies on land use and related topics, such as citizen involvement, housing, and natural resources.

Oregon's statewide goals are achieved through local comprehensive plans. State law requires each city and county to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. Troutdale's Comprehensive Land Use Plan was adopted in 1990 and acknowledged by the state's Land Conservation and Development Commission (LCDC).and has become the controlling document for land use in the area covered by that plan.

State law requires local governments to periodically review their comprehensive land use plans and development regulations (zoning, subdivision, environmental) to ensure compliance with statewide planning goals and various rules and statutes that govern how Oregon communities must plan for growth. The City of Troutdale's latest comprehensive plan review, relating to economic development was completed then changes were adopted on February 23rd, 2011. The last amendment relating to Transportation was adopted in December of 2009.

The City of Troutdale's Comprehensive Plan which includes transportation policies as pertains to service interchange connections and local street improvements will require consistency with the Troutdale Interchange Area Management Plan (IAMP).

This appendix will list and describe the statewide goals reviewed during amendment of Comprehensive Plans in order to insure that local government comprehensive plans maintain its consistency with state planning goals while being updated through the IAMP process. These goals include: Goal 1 (Citizen Involvement), Goal 2 (Land Use Planning), Goal 7 (Areas Subject to Natural Hazards), (Goal 9 (Economic Development), Goal 11 (Public Facilities and Service), Goal 12 (Transportation), and Goal 14 (Urbanization).

Goal 1 (Citizen Involvement)

Goal 1, Citizen Involvement, requires development of a citizen involvement program that is widespread, understandable, responsive, funded, and that allows for two-way communications throughout all planning phases.

> ***Finding:*** *Appendix A of the Troutdale Interchange Area Management Plans (IAMPs) contains a summary of the public involvement efforts that were undertaken as part of the IAMPs project. These efforts included the following:*

- *Three rounds of open houses/public meetings covering the following topics:*
    - *October 2008 Open House for the I-84 Troutdale right turn lane project*

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- *December 2010 Open House: Regarding proposed concepts for interchange improvements*
- *July 2010 Open Houses: Proposed construction improvements (included mailed project information and materials distributed to the public)*

- *Project Advisory Committee (PAC) Meeting held on Oct 11, 2010*
- *PAC Meeting number two held on December 2, 2010*
- *PAC Meeting number three held on March 15, 2011*
- *PAC Meeting number four held on April 14th, 2011*

The draft IAMP was made available for public review and comment for a 30-day period in June, 2011. Notice of the public review draft was sent to individuals near the proposed interchange and those who had expressed interest at previous public events. Public comment was accepted via email, mail and telephone.

This information demonstrates consistency with Goal 1.

Goal 2 (Land Use Planning) and OAR 660, Division 4

Goal 2, Land Use Planning, and OAR 660, Division 4, require that a land use planning process and policy framework be established as a basis for all decisions and actions relating to the use of land. Goal 2 includes several requirements:

It requires planning coordination between those local governments and state agencies, "which have programs, land ownerships, or responsibilities within the area included in the plan." With regard to the Troutdale Interchange IAMPs, Goal 2 requires that ODOT coordinate with Multnomah County, the Port of Portland and the City of Troutdale, each of which has planning authority over some of the area impacted by the proposed interchange improvements. Coordination is particularly important because development within the County and the City will impact use of the interchange, and land use decisions could affect future use and operation of the interchange.

Finding: *Preliminary tasks for the Troutdale Interchange IAMPs included a thorough review and analysis of all relevant state, regional and local planning documents in order to establish a planning process and policy framework. The following documents were reviewed:*

- *Applicable Oregon Statewide Planning Goals;*
- *Oregon Administrative Rule 731, Division 15, Department of Transportation Coordination Rules;*
- *Oregon Transportation Plan (2006);*
- *Oregon Highway Plan (1999);*
- *Oregon Administrative Rule 734-051, Highway Approaches, Access Control, Spacing Standards and Medians;*
- *Metro Regional Urban Growth Goals and Objectives (RUGGOs) (1991);*
- *Metro 2040 Growth Concept (1995);*

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- *Metro Regional Transportation Plan (2007);*
- *Multnomah County Comprehensive Plan (2008);*
- *Multnomah County Zoning Ordinance (2010);*
- *Troutdale County Transportation System Plan (1987, last amended December 09);*
- *Troutdale Comprehensive Plan (1990, last amended December 2009);*
- *Troutdale Zoning Ordinance (1987;last amended December 2009)*

This review identified how the documents influence planning for the proposed Troutdale Interchange Area Management Plan (IAMP).

The Troutdale IAMP will be prepared jointly by Multnomah County, the City of Troutdale and ODOT. Coordination between these agencies routinely takes place throughout the process. A Project Advisory Committee (PAC)) was established to guide the IAMP process. The PAC consisted of representatives from Multnomah County, the City of Troutdale, local stakeholders and ODOT. The PAC met to make decisions regarding design and access improvements. Meetings of these groups will be documented in the Access Management Plan section of the IAMP. ODOT staff facilitated and will support the adoption of the IAMPs both by Multnomah County, the City of Troutdale, and by the Oregon Transportation Commission (OTC). ODOT, Multnomah County and the city of Troutdale will continue to coordinate on development activity and land use actions within the interchange areas.

Goal 2 has a provision that land use decisions and actions be supported by an "adequate factual base." This requirement applies to both legislative and quasi-judicial land use actions and requires that such actions be supported by "substantial evidence." In essence, it requires that there be evidence that a reasonable person would find to be adequate to support findings of fact that a land use action complies with the applicable review standards.

Finding: *This requirement is met through the technical analysis associated with the IAMP. Appendices C and D of the IAMPs contain an analysis of the existing and future conditions within the IAMP study areas. These appendices describes the land use and zoning conditions and historic growth patterns in the vicinity of the proposed interchanges, and provide an inventory of existing transportation facilities and their relative functionality. Appendix C also provides a detailed description of the land use scenario that was used, including future household and employment growth and development patterns. The scenario was used for modeling the transportation network and determining where deficiencies may occur over time. A summary of deficiencies and issues is provided based on analysis of current conditions.*

Appendix D provides information and analysis concerning the alternatives considered for the Troutdale interchanges and refinements to the preferred alternative.

The analysis determined that improvements to the Troutdale Interchange areas were necessary in order to accommodate existing and future traffic.

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Appendices B through C offer a factual base to support the Troutdale Interchange Area Management Plans and provide evidence to demonstrate compliance with the applicable Troutdale review standards.

Goal 7: (Areas Subject to Natural Hazards)

The purpose of this goal is to protect people and property from natural hazards.

Finding: *While the areas are subject to certain natural hazards, such as landslides and earthquakes, design of the facilities will minimize structural damage from earth movements.*

The interchanges are not in a designated 100-year floodplain.

The design of these structures is part of the design and engineering of the interchange facilities and not applicable to this IAMP.

In addition, the IAMP will be prepared in conjunction with the Troutdale Interchange JTA Project

Goal 9: (Economic Development)

This goal requires that local comprehensive plans and policies contribute to a stable, healthy economy in all regions of the state.

Finding: *The Troutdale Interchanges provide a vital function in supporting local and regional economic development goals and plans. Local and regional traffic, including a large volume of freight vehicles, must have safe and efficient access to and from I-84 as well as efficient access to local businesses. A vital goal of the Troutdale Interchange Improvements is to support freight movements, including safe, reliable and efficient movement to and from the Troutdale Reynolds Industrial Park (TRIP) as well as provide safe and efficient movement of passenger vehicles to local businesses including the Columbia Gorge Premium Outlet Mall . The intent of the IAMP is to improve the operations and safety of the interchanges and local access roads. Proposed IAMP policy language illustrates the County's and the Cities' role in preserving capacity and improving operations at the interchanges. Adopting the IAMP will ensure that transportation improvements will be available to support the planned employment uses in Multnomah County and the City of Troutdale, consistent with this economic development goal.*

Goal 11 (Public Facilities Planning) and OAR 660, Division 11

Goal 11, Public Facilities Planning and OAR 660, Division 11, require cities and counties to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development. The goal requires that urban and rural development be "guided and supported by types and levels of urban and rural public facilities and services appropriate for, but limited to, the needs and requirements of the urban, urbanizable and rural areas to be served."

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Finding: *Transportation facilities are considered a primary type of public facility. The Troutdale IAMP documents the current and future transportation needs of the urban and urbanizable, areas in the vicinity of the I-84 on and off ramps as well as the City of Troutdale. The analysis of possible alternatives concluded that the construction of a two way Marine Drive as well as turning and signalization improvements to the interchange areas is the appropriate facilities to serve planned growth within the urban growth boundary as well as through-transportation needs to other parts of the state and are consistent with Troutdale's TSP.*

The IAMPs do not affect other public facilities.

Goal 12 (Transportation) and OAR 660, Division 12

Goal 12, Transportation, requires cities, counties, metropolitan planning organizations, and ODOT to provide and encourage a "safe, convenient and economic transportation system." This is accomplished through development of Transportation System Plans based on inventories of local, regional and state transportation needs. Goal 12 is implemented through OAR 660, Division 12, also known as the Transportation Planning Rule (TPR). The TPR contains numerous requirements governing transportation planning and project development. (See the "OAR 660, Division 12" section of this document for findings of compliance with the TPR.)

Finding: *The intent of the Troutdale Interchange Project is to improve the safety and efficiency of traffic through the area. The objectives of the Troutdale IAMP are to protect the functionality of the interchange and its ability to serve future transportation demands, especially movements to and from the Troutdale Reynolds Industrial Park (TRIP).*

The IAMP contains a discussion of the transportation analysis that was conducted in order to determine future demand, available capacity, deficiencies and necessary improvements for these interchange areas.

None of the proposed changes will require changes to Troutdale's Transportation System Plan or zoning code for the City of Troutdale

The Troutdale IAMP was jointly developed by ODOT, Port of Portland, and Troutdale. Policy language contained in the IAMP describes continued coordination between these agencies for management of the interchange areas. Current and future planned land uses were considered in the design of the interchanges in order to ensure their ability to support future traffic demands.

The IAMP calls for the improvement of this interchange. The IAMP documents the various design alternatives that were considered, the criteria that were used to evaluate the alternatives, and the rationale for selecting the preferred alternatives in Appendix D.

The TPR requires local governments to adopt land use regulations consistent with state and federal requirements "to protect transportation facilities, corridors and

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sites for their identified functions." OAR 660-012. This policy is achieved through a variety of measures, including:

- *Access control measures which are consistent with the functional classification of roads and consistent with limiting development on rural lands to rural uses and densities;*
- *Standards to protect future operations of roads;*
- *A process for coordinated review of future land use decisions affecting transportation facilities, corridors or sites;*
- *A process to apply conditions to development proposals in order to minimize impacts and protect transportation facilities, corridors or sites;*
- *Regulations to provide notice to ODOT of land use applications that require public hearings, involve land divisions, or affect private access to roads; and*
- *Regulations assuring that amendments to land use designations, densities and design standards are consistent with the functions, capacities and performance standards of facilities identified in the TSP. See also OAR 660-012.*

In addition to the measures noted above, the TPR (660-012-0060 Plan and Land Use Regulation Amendments) requires:

(1) Where an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation would significantly affect an existing or planned transportation facility, the local government shall put in place measures as provided in section (2) of this rule to assure that allowed land uses are consistent with the identified function, capacity and performance standards (e.g. level of service, volume to capacity ratio, etc.) of the facility.

(4) (A) Planned interchange means new interchanges and relocation of existing interchanges that are authorized in adopted transportation system plan or comprehensive plan;

The interchange areas as defined in the Interchange Area Management Plans adopted as an amendment to the Oregon Highway Plan

This is the area in which planning and analysis for the IAMP takes place locally and is the area in which local governments must comply with interchange-related state access management rules.

The Oregon Land Conservation and Development Commission's (LCDC's) rules implementing Goal 12 do not regulate access management. That is regulated by OAR 734, Division 51.

Goal 14 (Urbanization) and OAR 660, Divisions 14 and 22

Goal 14, Urbanization, requires an orderly and efficient transition from rural to urban land use. This is accomplished through the establishment of Urban Growth Boundaries (UGBs). UGBs and unincorporated community boundaries separate urbanizable land from rural land. Land uses

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permitted within the urban areas are more urban in nature and higher intensity than in rural areas, which primarily include farm and forest uses. Goal 14 is important because it focuses development within relatively compact boundaries of the UGB and, to a lesser degree, in unincorporated communities. This compact development helps contain the costs of public facilities by reducing the need to expand facilities further out from existing services and population centers. The location, type, and intensity of future development within the management area will impact the function and operational life of the interchange.

Additionally, **ORS 197.298** establishes priorities for including land inside urban growth boundaries. The first (highest) priority for inclusion is land that is designated "urban reserve" land. The second priority is land adjacent to a UGB that is identified as "an exception area or non-resource land." The third priority is land that is designated as "marginal land" pursuant to ORS 197.247. The final (lowest) priority is land that is designated for agriculture, forestry, or both.

> ***Finding:*** *The Troutdale interchange planning areas are located entirely within Portland metropolitan area UGB. The interchanges are needed to serve urban land uses, including residential and industrial in their vicinity.*

Goal 3 Agricultural Lands
Goal 4 Forest Lands
Goal 6 Air, Water and Land Resources Quality
Goal 13 Energy Conservation
Goal 15 Willamette River Greenway
Goal 16 Estuarine Resources
Goal 17 Coastal Shorelands
Goal 18 Beaches and Dunes
Goal 19 Ocean Resources

These goals were determined to not be applicable to the development of the IAMP. Goals 3 and 4 are not applicable because the area within the IAMP is within the Metro urban growth boundary. Goal 6 is not applicable because no changes to waste and discharge will occur from these plans, and environmental quality will not fall below accepted state or federal standards as a result of the plans. Goal 13 is not applicable as no changes will occur to density of land use nor will it encumber energy conservation efforts in the area of the plans. Goal 15 is not applicable because the Willamette River Greenway is not in or near the interchange area. Goals 16, 17, 18, 19 are not applicable because no estuarine resources, coastal shore lands, beaches, dunes or ocean resources existing in or near the interchange areas.

Oregon Transportation Plan (2006)

The Oregon Transportation Plan (OTP) is the state's long-range multimodal transportation plan. The OTP is the overarching policy document among a series of plans that together form the state transportation system plan (TSP). An IAMP must be consistent with applicable OTP goals and policies. Findings of compatibility will be part of the basis for IAMP approval. The most pertinent OTP goals and policies for interchange planning are as follows:

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Goal 1 – Mobility and Accessibility

POLICY 1.1 - Development of an Integrated Multimodal System

It is the policy of the State of Oregon to plan and develop a balanced, integrated transportation system with modal choices for the movement of people and goods.

> ***Finding:*** *The Troutdale Interchange will facilitate an integrated multimodal system by efficiently separating types of travel, namely separating the freight movements to the North from the commute and regional travel to the South of the interchange. The interchange will also facilitate the efficient movement of bicycle and pedestrian traffic by separating them from more high-speed through movements and freight traffic on the Marine Drive and the north and south Frontage Roads.*

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POLICY 1.2 – Equity, Efficiency and Travel Choices

It is the policy of the State of Oregon to promote a transportation system with multiple travel choices that are easy to use, reliable, cost-effective and accessible to all potential users, including the transportation disadvantaged.

Finding: *Improved bicycle and pedestrian facilities are incorporated into the designs for the interchanges. Any new roadway projects (including local streets) will meet current applicable standards. Pursuant to existing local requirements, minimum of 5-foot wide sidewalks will be constructed as part of all collector or local streets planned within the interchange areas, with bike lanes required for roadways classified as collectors or above.*

POLICY 1.3 – Relationship of Interurban and Urban Mobility

It is the policy of the State of Oregon to provide intercity mobility through and near urban areas in a manner which minimizes adverse effects on urban land use and travel patterns and provides for efficient long distance travel.

- **STRATEGY 1.3.2** – Develop and manage the transportation network so that local trips can be conducted primarily on the local system, and the statewide facilities can primarily serve intercity movement and interconnect the systems.

  Finding: *The Troutdale IAMP provides for improved safety and intercity mobility along the North and South Frontage Road as well as along a reconstructed two-way Marine Drive. The IAMP regulates access and land uses in the vicinity of the interchanges to ensure the facilities will operate at levels consistent with established state/regional mobility standards through the 2035 design year.*

  The Troutdale Interchange Project has coordinated with local partners in the vicinity of the Troutdale Interchanges, through their TSP, to develop/enhance the local street network, to accommodate local access and connectivity. Proposed improvements to Marine Drive and North and South Frontage will provide better access to East and Westbound I-84, will improve local circulation and will accommodate additional freight capacity expected with the completion of the TRIP.

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Goal 2 – Management of the System

POLICY 2.1 - Capacity and Operational Efficiency

It is the policy of the State of Oregon to manage the transportation system to improve its capacity and operational efficiency for the long term benefit of people and goods movement.

Finding: *The Troutdale Interchange Project will better facilitate the capacity and operational efficiency of connecting roadways by adding a third lane on the North and South Frontage Roads, Two-way Marine Drive to accommodate increased truck traffic to and from the TRIP and improved vehicle circulation patterns and signage.*

POLICY 2.2 – Management of Assets

It is the policy of the State of Oregon to manage transportation assets to extend their life and reduce maintenance costs.

- **STRATEGY 2.12** – Protect the integrity of transportation corridors and facilities from encroachment by such means as managing access to state highways and limiting incompatible land uses around facilities.
- **STRATEGY 2.1.6** – Support incentives and regulations for locating high traffic generators such as hospitals and mixed use development near fixed route, high frequency pubic transportation.

Finding: *The Troutdale Interchange Project was developed in response to safety, capacity and operational efficiency issues affecting the Troutdale Interchanges connections with I-84. Short term actions in the IAMP accomplish these management objectives by adding a third through lane along the South and North Frontage Roads, the reconfiguration of turning movements at the Graham Road intersections with Graham Road and the North and South Frontage roads as well as the construction of a two way Marine Drive. The improvements protect the long-term system capacity by ensuring that the interchanges continue to function at a level that meets the mobility expectations of the state. The IAMP contains policies that regulate land use in the vicinity of the interchanges by requiring that proposed land use actions must include a review of potential impacts to interchange operations.*

The stated purpose of the IAMP is to maximize the operational life of the Troutdale Interchanges and adjacent roads and consequently, protect the State's investment in the facilities. Specifically, the goal of the IAMP is to protect the function and operation of the interchanges within the IAMP area. This includes providing safe and efficient connections between local streets and state highways and minimizing local traffic traveling through the interchanges. The IAMP require proposed changes to the planned land use system to demonstrate consistency with IAMP policies protecting the long-term function of the interchange facilities.

Goal 3 – Economic Vitality

POLICY 3.1 – An Integrated and Efficient Freight System

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It is the policy of the State of Oregon to promote an integrated, efficient and reliable freight system involving air, barges, pipelines, rail, ships and trucks to provide Oregon a competitive advantage by moving goods faster and more reliably to regional, national and international markets.

- **STRATEGY 3.1.1** - Develop coordinated state, regional and local transportation plans and master plans that address current and future freight needs, issues, and economic strategies.

  Finding**:** *The Troutdale Interchange and related collector distributor roadways serves a high level of east and westbound traffic travelling east and westbound along I-84 seeking food, fuel and lodging as well as truck traffic generated by local businesses and especially trips originating at the Fed-Ex Facility located within the TRIP. The TRIP is a multi-modal facility that allows for the transfer of goods from air to surface transportation. The Troutdale Interchanges also serve local residents and is the main access to the Columbia Gorge Premium Outlet Mall.*

  The improvements to the North and South Frontage Roads, Two-Way Marine Drive and Graham Road will alleviate congestion and conflicts between automobiles and freight movements. The Troutdale IAMPs provide extra capacity along the North South Frontage Roads, strategies to separate freight and auto movements, tools to ensure the continued safety and efficiency of travel along the North and South Frontage Roads and their intersections with Marine Drive and Graham Roads.

POLICY 3.2 – Moving People to Support Economic Vitality

It is the policy of the State of Oregon to develop an integrated system of transportation facilities, services and information so that intrastate, interstate and international travelers can travel easily for business and recreation.

Finding: *The Troutdale Interchange improvements will serve to provide safer and more convenient truck access to the businesses along the South Frontage Road and will improve freight movement to and from the TRIP to the north of the interchange. The improvements will also create more efficient vehicular patterns for automobile trips to local shops and residences, will separate auto and freight traffic and will improve projected levels of service at the North and South Frontage Road intersections with Graham Road and Marine Drive. The project will also clarify vehicular patterns, separate truck and personally owned vehicles to avoid conflicts and ease movement towards individual destinations.*

POLICY 3.4 – Downtowns and Economic Development

The Troutdale Interchange improvements will serve to provide safer and more convenient access to the businesses along the South Frontage Road, will create clarified vehicular patterns for automobile trips to local shops and residences, will separate auto and freight traffic, will provide improved access to the local outlet mall and will improve projected levels of service at the North and South Frontage Road intersections with Graham Road and Marine Drive.

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Goal 4 – Sustainability

POLICY 4.1 - Environmentally Responsible Transportation System

It is the policy of the State of Oregon to provide a transportation system that is environmentally responsible and encourages conservation and protection of natural resources.

> ***Finding:*** *IAMP policy language protects resource land within the IAMP study area by restricting the location and operation of approach roads in the vicinity of the interchanges consistent with the existing designations in the comprehensive plan. The Troutdale Interchange Project will expand the North and South Frontage Roads and two-way Marine Drive. As mentioned, the footprint of the proposed system will be widened by a lane, though the basic layout of the existing system will not be altered. Run-off related to the additional impervious surfaces will be managed with rebuilt swales adjacent to all reconstructed roadways will be compliant with current design standards.*

POLICY 4.2 – Energy Supply

This policy is not applicable.

POLICY 4.3 – Creating Communities

This policy is not applicable.

Goal 5 – Safety and Security

POLICY 5.1 – Safety

It is the policy of the State of Oregon to continually improve the safety and security of all modes and transportation facilities for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.

> ***Finding:*** *The Troutdale IAMP addresses high crash rates along the South and North Frontage roads. The highway improvements minimize access to the highway and the grade-separated interchanges limits conflicts between local and regional trips - a contributing cause for vehicle crashes in the area. The interchange designs, and the specified locations and authorized use of approach roads provide for long-term highway safety.*
>
> *The interchanges will also provide for separation of high-speed expressway traffic and slower speed arterial traffic including bicycles and pedestrians.*

POLICY 5.2 – Security

This policy is not applicable.

Goal 6 – Funding the Transportation System

POLICY 6.1 – Funding Structure

It is the policy of the State of Oregon to develop a transportation finance structure that addresses the public funding aspects of all modes and reinforces plan strategies. This

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structure should include provisions for flexibility in the use of new funding sources and new partnerships to achieve system integration while also protecting transportation funds for transportation purposes.

Finding: *ODOT has worked and will continue to work in partnership with Multnomah County, the Port of Portland and the City of Troutdale to develop acceptable funding packages to implement the Troutdale Interchange Area Management Plans.*

POLICY 6.2 – Achievement of State and Local Goals

It is the policy of the State of Oregon to plan and manage the transportation finance structure to contribute to the accomplishment of state and local environmental, land use and economic goals and objectives.

Finding: *Through the environmental process and continuing through final design and construction of the Troutdale interchanges, ODOT and its partner agencies have and will continue to incorporate state and local environmental, land use and economic goals and objectives.*

POLICY 6.3 – Public Acceptability and Understanding

It is the policy of the State of Oregon to use finance mechanisms that have broad public acceptance and are understandable to transportation system users.

Finding: *In developing financing plans and programs for the development and construction of the Troutdale Interchange Project, ODOT and its partners have used widely accepted and understood financing mechanisms.*

POLICY 6.4 – Beneficiary Responsibility

It is the policy of the State of Oregon to examine mechanisms to expand the beneficiary pay concept to reflect the costs and benefits of uses of the transportation system and reinforce the relationship between benefiting from transportation facilities and paying for their benefit, but to retain essential fairness including cost responsibility. This policy recognizes some modes will continue to need subsidies to achieve overall transportation system goals and provide essential services.

Finding: The Fed Ex facility at the TRIP has paid $1,344,723 in SDC fees for the first phase of facility construction and will pay approximately $273,400 for the Phase 2 expansion. In addition the Port of Portland will be funding a large portion of the Graham Road reconstruction leading to the TRIP Facility.

POLICY 6.5 – Triage in the Event of Insufficient Revenue

It is the policy of the State of Oregon to resolve revenue shortfalls by means that maximize public acceptance and that minimize undesirable long-term consequences to the overall transportation system in urban and rural areas.

Finding: *Funding is in place for all the proposed improvements. $24 million dollars has been allocated to this project, while the estimated cost for completion is*

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expected to cost slightly less.Original Cost estimates were higher, but by implementing practical design, scope was cut back to match current funding.

Goal 7 – Coordination, Communication and Cooperation

POLICY 7.1 – A Coordinated Transportation System

It is the policy of the State of Oregon to work collaboratively with other jurisdictions and agencies with the objective of removing barriers so the transportation system can function as one system.

Finding: *Through the process there has been close coordination with local jurisdictions with interests in the Troutdale Interchange area to include: Multnomah County, the Port of Portland, and the City of Troutdale. The plan provides better linkages among the North and South Frontage Roads and the TRIP Facility.*

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Strategy 7.1.5
Coordinate federal, state, regional and local planning to protect transportation facilities, corridors and sites for their identified functions and to facilitate community development. This includes adopting appropriate regulations.

> ***Finding:*** *ODOT worked in collaboration with Multnomah County, the City of Troutdale and the Port of Portland to develop and adopt the IAMP. Improvements to local street connectivity and access to state facilities within the IAMP area will be further coordinated in the development and updating of local jurisdiction's TSP. The IAMP policy language adopted by these local jurisdictions requires continued coordination between themselves and ODOT to protect the long-term function of the interchange.*

POLICY 7.2 – Public/Private Partnerships

The Fed Ex processing center at the trip has paid System Development Charges (SDCs) as part of the first phase of the development and will pay additional fees with the next phase of construction. SDC's paid to date have amounted to

POLICY 7.3 – Public Involvement and Consultation

It is the policy of the State of Oregon to involve Oregonians to the fullest practical extent in transportation planning and implementation in order to deliver a transportation system that meets the diverse needs of the state.

Strategy 7.3.1
In all phases of decision-making, provide affected Oregonians early, open, continuous, and meaningful opportunity to influence decisions about proposed transportation activities. When preparing and adopting a multimodal transportation plan, modal/topic plan, facility plan or transportation improvement program, conduct and publicize a program for citizen, business, and tribal, local, state and federal government involvement. Clearly define the procedures by which these groups will be involved.

> ***Finding:*** *Appendix A provides a summary of the public involvement efforts that took place during development of the IAMP. Various methods were used to gather public input about the interchange area management plans, including open houses, a series of Public Advisory Committee meetings (PAC), and a public review and comment period for the draft IAMP. Press releases to announce the open were sent to all local newspapers, as well as local radio and television stations. Input from citizens was used to evaluate alternatives. These opportunities were provided equally to all, regardless of race, culture or income.*

POLICY 7.4 - Environmental Justice

It is the policy of the State of Oregon to provide all Oregonians, regardless of race, culture or income, equal access to transportation decision-making so all Oregonians may fairly share in benefits and burdens and enjoy the same degree of protection from disproportionate adverse impacts.

Strategy 7.4.1

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Provide equal access to public information and decision-making about transportation planning, financing, construction, operations and maintenance activities.

Finding: *There are no impacts to environmental justice populations that are disproportionately greater than the population of the area as a whole.*

Oregon Highway Plan

The 1999 Oregon Highway Plan (OHP) establishes policies and investment strategies for Oregon's state highway system over a 20-year period and refines the goals and policies found in the OTP. Policies in the OHP emphasize the efficient management of the highway system to increase safety and to extend highway capacity, partnerships with other agencies and local governments, and the use of new techniques to improve road safety and capacity. These policies also link land use and transportation, set standards for highway performance and access management, and emphasize the relationship between state highways and local road, bicycle, pedestrian, transit, rail and air systems.

Under Goal 1: System Definition, the following policies are applicable:

Policy 1A (Highway Classification) defines the function of state highways to serve different types of traffic that should be incorporated into and specified through IAMPs.

Finding: *According to the City of Troutdale's TSP, the North and South Frontage roads as well as 258th are classified as collectors. Marine Drive is classified as a collector and Graham Road is classified as a local street. According to the TSP, I-84 is classified as an arterial. These roadways currently serve their functional classification.*

Policy 1B (Land Use and Transportation) establishes a requirement for the state to coordinate land use and transportation decisions with local jurisdictions to efficiently use transportation investments.

Finding: *Coordination between state and local jurisdictions occurred throughout the preparation of the IAMP. A Policy Advisory Committee (PAC) was convened to inform the IAMP process and included members representing ODOT, Troutdale, and the Port of Portland. The PAC met four times to determine the most viable improvements to serve businesses along the South Frontage Road and to the TRIP located north of I-84. Policy Actions in the IAMP speak to ongoing coordination between the state and local jurisdictions concerning the efficient use of transportation investments.*

Policy 1C (State Highway Freight System) states the need to balance the movement of goods and services with other uses and to recognize the importance of maintaining efficient through movement on major truck freight routes.

Finding: *The Existing Local Circulation and Private Property Approaches section of the Troutdale IAMP summarizes the functional classification of roadways within the IAMP study areas. The North and South Frontage Roads, Halsey 238th Street and I-84 are classified as freight roads in the Troutdale TSP. In addition Graham Road and*

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Marine Drive between the North and South Frontage roads are classified as freight routes according to the TSP.

The Troutdale Interchange Project improve freight mobility through the area by addressing safety and efficiency issues that have been identified at current intersections and throughout the corridor due to the conflict of combined regional freight movements and local trips. Existing freight distribution centers to the North (TRIP), and lands to the South of I-84 zoned as General Commercial which includes the Wood Village Outlet Mall, will benefit from the construction of an additional lane on both the North and South Frontage Road, a two-way Marine Drive and the separation of freight and local traffic will improve safety, operations and LOS within the study area boundaries.

Policy 1D (Scenic Byways)

This policy is not applicable.

Policy 1E (Lifeline Routes) provides a secure lifeline network of streets, highways, and bridges to facilitate emergency services response and to support rapid economic recovery after a disaster.

Finding: *There are no major medical facilities in the City of Troutdale. The closest major medical institutions are located in Portland. The affected roadways have not been designated Lifeline Routes by the Oregon Transportation Commission.*

Policy 1F (Highway Mobility Standards) sets mobility standards for ensuring a reliable and acceptable level of mobility on the highway system by identifying necessary improvements that would allow the interchange to function in a manner consistent with OHP mobility standards.

Finding: *The analysis of existing and future traffic conditions in the vicinity of the Troutdale Interchange Project shows that North and South Frontage Roads and their intersections with Graham Road, Marine Drive and 257th Street cannot perform at the level expected in the OHP without modernization. The traffic analysis done for the Troutdale Interchange Project demonstrates that the facilities will accommodate the mobility standards of the OHP throughout the 20-year planning horizon.*

Policy 1G (Major Improvements) requires maintaining performance and improving safety by improving efficiency and management before adding capacity. ODOT works with regional and local governments to address highway performance and safety.

Finding: *Appendix D summarizes the alternatives that were evaluated for their potential to accommodate existing and future traffic demand at the Troutdale interchanges. Those alternatives included an evaluation of a 2035 No-Build scenario with the retention of current circulation patterns, as well as different Build Alternative roadway alignments operational fixes. The 2035 No-Build alternative, does not provide a solution to the highway capacity and highway safety needs. Therefore, adding capacity is the necessary means for improving safety and efficiency in this highway section.*

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Policy 1H (Bypasses) Generally bypasses relocate a highway alignment around a downtown, an urban or metropolitan area or an existing highway. The goal of bypass facilities is to effectively serve state and regional traffic trips. It is the policy of the State of Oregon to build bypasses to provide safe, efficient passage for through travelers and commerce**.**

Finding: This policy is not applicable

Under Goal 2: System Management, the following policies are applicable:

Policy 2A (Partnerships) It is the policy of the State of Oregon to establish cooperative partnerships to make more efficient and effective use of limited resources to develop, operate, and maintain the highway and road system. These partnerships are relationships among ODOT and state and federal agencies, regional governments, cities, counties, tribal governments, and the private sector.

Finding: *ODOT has worked with the Federal Highway Administration, Multnomah County, the Port of Portland and the City of Troutdale in the development of the Troutdale IAMP. Other state agencies involved with the development of the IAMP include the Department of Justice and the Department of Land Conservation and Development.*

Policy 2B (Off-System Improvements) helps local jurisdictions adopt land use and access management policies. Supports state financial assistance to local jurisdictions to develop, enhance, and maintain improvements on local transportation systems when they are a cost-effective way to improve the operation of the state highway system.

Finding: *Both Multnomah County and the City of Troutdale have access management policies and actions. For the proposed North and South Frontage roads as well as Graham Road and Marine Drive, ODOT and the City of Troutdale jointly developed approaches to separate local traffic from freight traffic and ways to clarify vehicular patterns for all users and have designed improvements to facilitate improved access to land uses north of the interchange, including a regional Fed-Ex Facility located at the TRIP.*

Policy 2C (Interjurisdictional Transfers) It is the policy of the State of Oregon to consider, in cooperation with local jurisdictions, interjurisdictional transfers that:

- Rationalize and simplify the management responsibilities along a particular roadway segment or corridor;
- Reflect the appropriate functional classification of a particular roadway segment or corridor; and/or
- Lead to increased efficiencies in the operation and maintenance of a particular roadway segment or corridor.

Finding: *Not Applicable*

Policy 2D: (Public Involvement**).** This policy ensures that there are sufficient opportunities for citizens, businesses, and local governments to provide input into improvement projects that affect the state highway system.

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Finding: *A Project Advisory Committee (PAC) consisting of local citizens and business representatives were convened as a part of the Troutdale Interchange outreach process, and met regularly with the project team on the development of the Troutdale IAMPs. Summaries of the public meetings are provided in Appendix A of the Troutdale IAMPs. This effort included the following:*

- *A series or public open houses were held in 2008 and 2010 to discuss the new Troutdale interchanges and local roadways as well as the IAMPs;*
- *Project Advisory Committee meetings held to obtain feedback on a variety of project deliverables, including the purpose and need, evaluation criteria, interchange design concepts and draft IAMPs.;*
- *A newsletter sent out to individuals near the proposed interchange to provide information and notification of the public open house*

Appendix A contains the information for the public involvement of the Troutdale IAMPs. The IAMPs were jointly developed by Multnomah County, the City of Troutdale and ODOT.

The Troutdale IAMPs have adequately addressed Policy 2D.

Policy 2E (Intelligent Transportation Systems) It is the policy of the State of Oregon to consider a broad range of Intelligent Transportation Systems services to improve system efficiency and safety in a cost-effective manner. Deployment of ITS shall reflect the user service priorities established in the Oregon Intelligent Transportation Systems Strategic Plan. Specifically:

- Incident Management
- En-route Driver Information
- Traffic Control (Arterials and Freeways)
- Route Guidance
- Commercial Vehicle Electronic Clearance
- Pre-trip Travel Information
- Public Transportation Management
- Emergency Notification and Personal Security
- Emergency Vehicle Management
- Commercial Fleet Management

Finding: *Applicable aspects of intelligent transportation systems will be incorporated into the Troutdale interchange designs. Such aspects could include (but are not limited to) ramp metering, breakdown lanes, signage and emergency vehicle management.*

Policy 2F (Traffic Safety) It is the policy of the State of Oregon to continually improve safety for all users of the highway system using solutions involving engineering, education, enforcement, and emergency medical services.

Finding: *An important reason for planning for the interchanges is to address safety issues at the Troutdale Interchange and at the North and South Frontage Roads. The*

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IAMPs protect the safe and efficient operation of these roadways by regulating access and land use in the vicinity, and through separation of local, regional, and freight movements.

Policy 2G (Rail and Highway Compatibility)

This policy is not applicable to the Troutdale IAMP, as no rail facilities are impacted by the project.

Under Goal 3: Access Management, the following policies are applicable:

Policy 3A: (Classification and Spacing Standards) sets access spacing standards for driveways and approaches to the state highway system.

Finding: *The IAMP largely adheres to the approach road spacing standards along the North Frontage Road outlined in the OHP. Along the South Frontage Road, there are numerous non compliant curb-cuts built to support access to a large number of local businesses.*

The IAMP contains short, medium, and long-term access strategies that will be applied within the IAMP planning areas in order to regulate existing and future driveways and other approaches in the vicinity of the interchanges.

Policy 3B (Medians) It is the policy of the State of Oregon to plan for and manage the placement of medians and the location of median openings on state highways to enhance the efficiency and safety of the highways, and influence and support land use development patterns that are consistent with approved transportation system plans.

Finding: This policy is not applicable to the Troutdale IAMP as no medians are planned within the project area.

Policy 3C (Interchange Access Management Areas) sets policy for managing interchange areas by developing an IAMP that identifies and addresses current interchange deficiencies and establishes short, medium and long term solutions.

Finding: *The purpose of the Troutdale IAMP is to effectively manage the traffic generated by the TRIP and to manage inbound and outbound freight traffic as well as local traffic within the frontage road areas. The IAMP provide recommendations for short term implementation and access management actions, as well as land use policies that are intended to protect the interchange through 2035.*

Policy 3D (Deviations) establishes general policies and procedures for deviations from adopted access management standards and policies.

Findings: *Not applicable*

Policy 3E (Appeals) It is the policy of the State of Oregon to manage appeals of both denied requests for approach roads and denied requests for deviations from adopted access management standards and policies through an appeals process to ensure statewide consistency**.**

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Finding: *As of this writing, there have not been any appeals to denied requests for deviations or approach roads. Should such actions occur in the future they will be managed in a consistent manner.*

Under Goal 4: Travel Alternatives, the following policies are applicable:

Policy 4A: (Efficiency of Freight Movement). This policy emphasizes the need to maintain and improve the efficiency of freight movement on the state highway system. The Troutdale Interchange Project is designed to improve freight ingress and egress to the study area. The frontage are designated freight routes as are Marine Drive and Graham Road between the North and South Frontage roads.

Finding: *Refer to Policy 1C above.*

Policy 4B (Alternative Passenger Modes) It is the policy of the State of Oregon to advance and support alternative passenger transportation systems where travel demand, land use, and other factors indicate the potential for successful and effective development of alternative passenger modes.

Finding: *With the construction of improvements to the Troutdale interchanges and adjacent collector roads, alternative modes of transportation will be better supported, especially bicycle and pedestrian travel. Bicycle and pedestrians will be provided additional bike lanes within the project area.*

Policy 4C (High-Occupancy Vehicle (HOV) Facilities) It is the policy of the State of Oregon to utilize HOV facilities to improve the efficiency of the highway system in locations where travel demand, land use, transit, and other factors are favorable to their effectiveness. A systems planning approach shall be taken in which individual HOV facilities complement one another and the other elements of the multimodal transportation system.

Finding: *The Troutdale Interchange Project does not propose the introduction of HOV lanes as the focus is on the interchanges to I-84 in Troutdale and the improvement of local access along the Troutdale frontage roads.*

Policy 4D (Transportation Demand Management) It is the policy of the State of Oregon to support the efficient use of the state transportation system through investment in transportation demand management strategies.

Finding: *ODOT in cooperation with the City of Troutdale, Port of Portland and local employers located in the Troutdale Interchange Management Areas will actively pursue TDM strategies designed to alleviate traffic demand on the interchange and supporting road network. The OTC recently approved a TDM that helps reduce peak hour traffic from the TRIP facility.*

Policy 4E (Park-and-Ride Facilities) It is the policy of the State of Oregon to encourage the efficient use of the existing transportation system and to seek cost-effective expansion of the highway system's passenger capacity through development and use of park-and-ride facilities.

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Finding: *Not applicable as there are no applicable facilities within the Troutdale IAMP management area.*

Under Goal 5: Environmental and Scenic Resources, the following policies are applicable:

Policy 5A (Environmental Resources) This policy states that the design, construction, operation and maintenance of the state highway system should maintain or improve the natural and built environment where affected by ODOT facilities.

Finding: *The Troutdale IAMP was done in conjunction with the Troutdale Project and the Troutdale project and addresses environmental resources and what actions are to be taken to avoid or mitigate any impacts to both the natural and built environment.*

Wetlands were identified adjacent to the Sandy River and a small strip adjacent to properties located near the South Frontage Road in low lying areas along an unnamed tributary of the Sandy River. No impacts to these resources are anticipated. There are no potential fishery resources located within the study area. No impacts are anticipated.

Policy 5B (Scenic Resources) This policy applies to all state highways and commits the State to using best management practices to protect and enhance scenic resources in all phases of highway project planning, development, construction and maintenance.

Finding: *Although the Troutdale Interchange Project area largely traverses a Commercial and Industrial corridor with limited scenic resources, this policy was considered as part of the IAMP project, and will be implemented largely by complying with other state and local policies and regulations.* ***The Columbia River Gorge National Scenic Areais located to the East of the project, and no impacts will occur as a result of the project or IAMP.***

OAR 660 Division 12 Transportation Planning Rule (TPR)

The purpose of the TPR is "to implement Statewide Planning Goal 12 (Transportation) and promote the development of safe, convenient and economic transportation systems that are designed to reduce reliance on the automobile so that the air pollution, traffic and other livability problems faced by urban areas in other parts of the country might be avoided." A major purpose of the Transportation Planning Rule (TPR) is to promote more careful coordination of land use and transportation planning, to ensure that planned land uses are supported by and consistent with planned transportation facilities and improvements. The TPR references OAR 731, Division 15 for ODOT coordination procedures for adopting facility plans and plans for Class 1 and 3 projects.

Section 660-012-0005 through 660-012-0050

Finding: *These sections of the TPR contain policies for preparing and implementing a transportation system plan. The Troutdale IAMP is consistent with the City's existing transportation system plan and most of these sections are not applicable. The TPR*

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requires that local governments adopt land use regulations consistent with state and federal requirements "to protect transportation facilities, corridors, and sites for their identified functions" (OAR 660-012-0045(2)). The City of Troutdale

Section 660-012-0055 – Timing of Adoption and Update of Transportation System Plans

Finding: *Part 5 of this section requires cities and counties to update their TSPs and implementing measures when a refinement plan has been completed. The IAMP is consistent with Troutdale's Transportation System Plan.*

Section 660-012-0060 – Plan and Land Use Regulation Amendments

Finding: *Part 1 of this section requires that where an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation would significantly affect an existing or planned transportation facility, the local government shall put in place measures to assure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility. Current and future planned land uses were considered in development of the Troutdale Interchange Projects preferred interchange alternative (as described in the Troutdale IAMP) in order to ensure the interchanges' ability to support future traffic demands. The Troutdale Interchange Plan also demonstrated that the interchange design can accommodate future planned land uses.*

OAR 731-015-0065 Coordination Procedures for Adopting Final Facility Plans

OAR 731-015-0065(1) requires ODOT to involve DLCD and affected metropolitan planning organizations, cities, counties, state and federal agencies, special districts and other interested parties in the development or amendment of a facility plan. This involvement may take the form of mailings, meetings or other means that the Department determines are appropriate for the circumstances. The Department shall hold at least one public meeting on the plan prior to adoption.

Finding: *731-015-0065 (1) The Troutdale IAMP was developed jointly by ODOT and the City of Troutdale, Port of Portland and included coordination with DLCD primarily through requests for review of DRAFT materials. The final public meeting for the Troutdale IAMP was held on April 14th, 2011. In addition, a series of seven public meetings were held from October of 2008 to Spring 2011 to discuss the Troutdale Interchange Project. A summary of the public involvement process is included in Appendix A.*

(2) The Department shall provide a draft of the proposed facility plan to planning representatives of all affected cities, counties and metropolitan planning organization and shall request that they identify any specific plan requirements which apply, any general plan requirements which apply and whether the draft

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facility plan is compatible with the acknowledged comprehensive plan. If no reply is received from an affected city, county or metropolitan planning organization within 30 days of the Department's request for a compatibility determination, the Department shall deem that the draft plan is compatible with that jurisdiction's acknowledged comprehensive plan. The Department may extend the reply time if requested to do so by an affected city, county or metropolitan planning organization.

731-015-0065 (2) A draft of the IAMP will be provided to Multnomah County the City of Troutdale and, the Department of Justice and the Department of Land Conservation and Development, as well as applicable resources within ODOT, so that any potential conflicts with state or local plans will be jointly resolved before adoption by the OTC.

(3) If any statewide goal or comprehensive plan conflicts are identified, the Department shall meet with the local government planning representatives to discuss ways to resolve the conflicts.

731-015-0065 (3) The Troutdale IAMP were developed jointly by ODOT, Multnomah County and the City of Troutdale, and included coordination with DLCD. No conflicts were found.

(4) The Department shall evaluate and write draft findings of compatibility with acknowledged comprehensive plans of affected cities and counties, findings of compliance with any statewide planning goals which specifically apply as determined by OAR 660-030-0065(3)(d), and findings of compliance with all provisions of other statewide planning goals that can be clearly defined if the comprehensive plan of an affected city or county contains no conditions specifically applicable or any general provisions, purposes or objectives that would be substantially affected by the facility plan.

731-015-0065 (4) Findings of compliance with statewide planning goals and compatibility with local comprehensive plans have been completed and are included here.

(5) The Department shall present to the Transportation Commission the draft plan, findings of compatibility with the acknowledged comprehensive plans of affecting cities and counties and findings of compliance with applicable statewide planning goals.

731-015-0065 (5) Findings of compliance with statewide planning goals and compatibility with local comprehensive plans will be included in materials for presentation to the Oregon Transportation Commission. Adoption of the IAMPs and findings will take place in conformance with this provision.

(6) The Transportation Commission shall adopt findings of compatibility with the acknowledged comprehensive plans of affected cities and counties and findings of

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compliance with applicable statewide planning goals when it adopts the final facility plan.

731-015-0065 (6) The Oregon Transportation Commission will adopt these findings concurrent with adoption of the IAMP.

(7) The Department shall provide copies of the adopted final facility plan and findings to DLCD, to affected metropolitan planning organizations, cities, counties, state and federal agencies, special districts and to others who request to receive a copy.

731-015-0065 (7) Subsequent to OTC adoption of the IAMP ODOT will provide copies of the IAMP and facility plans and findings to DLCD, the City of Troutdale, Multnomah County, Metro, Department of Justice, Department of Land Conservation and Development, ODOT and Federal Highways and others who request copies.

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OAR 734, Division 51: Highway Approaches, Access Control, Spacing Standards and Medians

OAR 734-051 governs the permitting, management, and standards of approaches to state highways to ensure safe and efficient operation of the state highways. OAR 734-051 policies address the following:

- How to bring existing and future approaches into compliance with access spacing standards, and ensure the safe and efficient operation of the highway;
- The purpose and components of an access management plan; and
- Requirements regarding mitigation, modification and closure of existing approaches as part of project development.

Section 734-051-0125, Access Management Spacing Standards for Approaches in an Interchange Area, establishes interchange management area access spacing standards. It also specifies elements that are to be included in IAMPs, such as short-, medium-, and long-range actions to improve and maintain safe and efficient roadway operations within the interchange area.

Specifically, 734-051-0125 states that access management spacing standards for approaches:

1. Be developed no later than the time the interchange is being developed or redeveloped-0155(7)(a.)
2. Identify opportunities to improve operations and safety in conjunction with roadway projects and property development or redevelopment and adopt strategies and development standards to capture those opportunities-0155(7)(b).
3. Include short and long-term actions to improve operations and safety in the interchange area -0155(7)(c).
4. Consider current and future traffic volumes and flows, roadway geometry, traffic control devices, current and planned land uses and zoning, and the location of all current and planned approaches -0155(7)(d).
5. Provide adequate assurance of the safe operation of the facility through the design traffic forecast period, typically 20 years-0155(7)(e).
6. Consider existing and proposed uses of all property in the interchange area consistent with its comprehensive plan designations and zoning -155(7)(f).
7. Be consistent with any applicable access management plan, corridor plan, or facility plan adopted by the OTC. -155(7)(g).
8. Include polices, provisions and standards from local comprehensive plans, transportation system plans, and land use and subdivision codes that are relied upon for consistency and that are relied upon to implement the Interchange Area Management Plan. -155(7)(h).

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Finding:

1. *These plans were produced during the planning and design process for the Troutdale Interchange area. They are also being adopted in advance of final plans and construction.*
2. *The land use controls and access management elements identified in these plans and incorporated into the project design or identified for implementation with future property redevelopment or project development activities, such as the completion of annex B and C at the new Troutdale Fed-Ex facility at the TRIP. The design changes will constitute significant operational and safety improvements.*
3. *Short and long-term actions to improve operations and safety in the interchange areas have been identified. Short -term actions include widening the eastbound off-ramp at the interchange to accommodate additional turn lanes and additional storage, and adding a third through lane to South Frontage Road. Adding intersection improvements at the northeast quadrant of the interchange to improve operations at the ramp terminal and provide storage.*

   Long-term actions are described in the IAMP as Project B. The long term actions include widening the Marine Drive undercrossing to five lanes for two-way traffic and to improve vertical clearance, as well as improving the intersection in the NW quadrant of the interchange to improve operations and add storage.
4. *A full analysis of existing and forecast (2035) operational, geometric, and safety conditions was conducted. Future land use development within the Troutdale city limits influence areas was identified, as were all affected accesses. These elements led to the plan's transportation improvement project recommendations and detailed access management plans for the interchange study areas.*
5. *The transportation recommendations were developed based on a long-term (2035) forecast traffic operations analysis. The improvement projects described in the IAMPs will ensure the safe and efficient operation of the interchanges through the planning horizon year.*
6. *An analysis of the interchange influence areas and their long-term development potential was included in the planning effort. This analysis resulted in recommendations for the interchange improvements to ensure the long-term function of the interchange areas.*
7. *The Troutdale Interchange Area Management Plans are consistent with the 1999 OHP and consistent with the applicable access management polices, principles, and standards.*

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8. *The Troutdale Interchange Area Management Plans contain references to, and are consistent with the polices, operational standards, and access management standards of Multnomah County and the City of Troutdale and ODOT.*

The Troutdale IAMPs have adequately addressed OAR 734, Division 51. Highway Approaches, Access Control, Spacing Standards and Medians.

Metro's Role in Land Use Planning

Metro is responsible for a number of regional land use planning functions, including all adjustments to the UGB and related activities. Metro's land use planning functions support the assumptions behind the UGB and RTP.

Metro's Role in Transportation Planning

Metro is the regional government responsible for regional transportation planning under state law and is the federally-designated metropolitan planning organization (MPO) for the Portland metropolitan area. As the federally designated MPO, Metro guides regional transportation system planning and development in the Portland metropolitan area. Metro is also responsible for developing a regional transportation system plan (TSP), consistent with Oregon Transportation Planning Rule (TPR) requirements and Federal planning rules.

Metro's Regional Framework Plan

The Regional Framework Plan unites all of Metro's adopted land use planning policies and requirements. The Metro Charter directs the agency to address the following subjects in the Plan:

- Management and amendment of the Urban Growth Boundary
- Protection of lands outside the Urban Growth Boundary for natural resource use and conservation, future urban expansion or other uses
- Urban design and settlement patterns
- Housing densities
- Transportation and mass transit systems
- Parks, open spaces and recreational facilities
- Water sources and storage
- Coordination with Multnomah County
- Planning responsibilities mandated by state law
- Other issues of metropolitan concern

Metro's Regional Framework Plan can be accessed in its entirety through this link:

(http://www.oregonmetro.gov/index.cfm/go/by.web/id=432).

Regional Framework Plan Structure

Each chapter of this Plan contains an introduction followed by a list of relevant Fundamentals. Fundamentals are eight value statements adopted by the Metro Council

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that synthesize the 2040 Growth Concept and regional policies and are listed below:

Fundamental 1: Encourage a strong local economy by providing an orderly and efficient use of land, balancing economic growth around the region and supporting high quality education.

Fundamental 2: Encourage the efficient use of land within the UGB including buildable industrial and commercial land and focus development in 2040 mixed use centers and corridors.

Fundamental 3: Protect and restore the natural environment including fish and wildlife habitat, streams and wetlands, surface and ground water quality and quantity, and air quality.

Fundamental 4: Provide a balanced transportation system including safe, attractive facilities for bicycling, walking and transit as well as for motor vehicles and freight.

Fundamental 5: Maintain separation between the Metro UGB and neighboring cities by working actively with these cities and their respective counties.

Fundamental 6: Enable communities inside the Metro UGB to enhance their physical sense of place by using among other tools, greenways, natural areas, and built environment elements.

Fundamental 7: Enable communities to provide diverse housing options for all residents by providing a mix of housing types as well as affordable homes in every jurisdiction.

Fundamental 8: Create a vibrant place to live and work by providing sufficient and accessible parks and natural areas, improving access to community resources such as schools, community centers and libraries as well as by balancing the distribution of high quality jobs throughout the region, and providing attractive facilities for cultural and artistic performances and supporting arts and cultural organizations.

These Fundamentals are followed by policies of the Metro Council. Chapters 1 through 6 address substantive planning policies. Chapter 7 addresses how Metro will manage the plan and amendments to the plan. Chapter 8 addresses how the plan policies are to be implemented. Related documents and background information are contained in the Appendices.

Policies – Chapter 1, Land Use

1.1 Urban Form
1.2 Built Environment
1.3 Housing Choice
1.4 Economic Opportunity
1.5 Economic Vitality
1.6 Growth Management
1.7 Urban/Rural Transition

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1.8 Developed Urban Land
1.9 Urban Growth Boundary
1.10 Urban Design
1.11 Neighbor Cities
1.12 Protection of Agriculture and Forest Resource Lands
1.13 Participation of Citizens
1.14 School and Local Government Plan and Policy Coordination
1.15 Centers
1.16 Residential Neighborhoods

Finding: *The Troutdale IAMP contain no policies or actions that would limit Metro from carrying out policies identified in Chapter 1 of the Regional Framework Plan. In fact, the IAMP contributes positively to many of the land use policies identified in the Regional Framework Plan.*

Policies – Chapter 2, Transportation

2.1 Public Involvement
2.2 Intergovernmental Coordination
2.3 Urban Form
2.4 Consistency Between Land Use and Transportation Planning
2.5 Barrier-Free Transportation
2.6 Interim Job Access and Reverse Commute Policy
2.7 Transportation Safety and Education
2.8 The Natural Environment
2.9 Water Quality
2.10 Clean Air
2.11 Energy Efficiency
2.12 Regional Street Design
2.13 Local Street Design
2.14 Regional Motor Vehicle System
2.15 Regional Public Transportation System
2.16 Public Transportation Awareness and Education
2.17 Public Transportation Safety and Environmental Impacts
2.18 Regional Public Transportation Performance
2.19 Special Needs Public Transportation
2.20 Regional Freight System
2.21 Regional Freight System Investments
2.22 Regional Bicycle System Connectivity
2.23 Regional Bicycle System Mode Share and Accessibility
2.24 Regional Pedestrian System
2.25 Regional Pedestrian Mode Share
2.26 Regional Pedestrian Access and Connectivity
2.27 Transportation System Management
2.28 Regional Transportation Demand Management
2.29 Regional Parking Management

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2.30 Peak Period Pricing
2.31 Transportation Funding
2.32 2040 Growth Concept Implementation
2.33 Transportation System Maintenance and Preservation
2.34 Transportation Safety

Finding: *The Troutdale IAMP contains no policies or actions that would limit Metro from carrying out policies identified in Chapter 2 of the Regional Framework Plan. In fact, the IAMP contributes positively to many of the transportation policies identified in the Regional Framework Plan.*

Policies – Chapter 3, Nature in Neighborhoods

3.1 Inventory of Park Facilities and Identification and Inventory of Regionally Significant Parks, Natural Areas, Open Spaces, Fish and Wildlife Habitat, Trails and Greenways
3.2 Protection of Regionally Significant Parks, Natural Areas, Open Spaces, Fish and Wildlife Habitat, Trails and Greenways
3.3 Management of the Publicly-Owned Portion of the Regional System of Parks, Natural Areas, Open Spaces, Fish and Wildlife Habitat, Trails and Greenways
3.4 Protection, Establishment and Management of a Regional Trails System
3.5 Provision of Community and Neighborhood Parks, Open Spaces, Fish and Wildlife Habitat, Natural Areas, Trails and Recreation Programs
3.6 Participation of Citizens in Environmental Education, Planning, Stewardship Activities, and Recreational Services

Finding: *Chapter 3 of the Regional Framework Plan is not applicable to the Troutdale IAMP. The IAMP contain no policies that would preclude Metro from carrying out policies in this chapter for the acquisition of parks and open spaces.*

Policies – Chapter 4, Watershed Health and Water Quality

4.1 Water Supply
4.2 Overall Watershed Management
4.3 Water Quality
4.4 Stormwater Management
4.5 Urban Planning and Natural Systems

Finding: *Chapter 4 of the Regional Framework Plan is not directly applicable to the Troutdale IAMP because the chapter addresses how Metro is to plan for watershed health and water quality. The Troutdale interchanges will need to address water quality and stormwater runoff during the design of the interchanges, but the Troutdale IAMP will not themselves prohibit Metro from implementing Policies in Chapter 4 of the Regional Framework Plan.*

Policies – Chapter 5, Regional Natural Hazards

5.1 Earthquake Hazard Mitigation Measures
5.2 Flood Hazard Mitigation Measures

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5.3 Landslide Hazard Mitigation Measures
5.4 Volcanic Hazard Mitigation Measures
5.5 Wildland-Urban Interface Fire Mitigation Measures
5.6 Severe Weather Hazard Mitigation Measures
5.7 Biological Hazard Mitigation Measures
5.8 Other Hazard Mitigation Measures
5.9 Natural Disaster Response Coordination

> ***Finding:*** *Chapter 5 of the Regional Framework Plan is not directly applicable to the Troutdale IAMP because the chapter addresses how Metro is to plan for the future with consideration given to natural hazards. Chapter 5 is not applicable in that the design of the Troutdale interchanges does not impact any natural hazard areas.*

Metro Urban Growth Management Functional Plan

The regional policies which are adopted by this Urban Growth Management Functional Plan recommend and require changes to city and county comprehensive plans and implementing ordinances. The purpose of this functional plan is to implement regional goals and objectives adopted by the Metro Council as the Regional Urban Growth Goals and Objectives (RUGGO), including the Metro 2040 Growth Concept and the Regional Framework Plan. The comprehensive plan changes and related actions, including implementing regulations, required by this functional plan as a component of the Regional Framework Plan, shall be complied with by the city and county as required by Section 5(e)(2) of the Metro Charter. Any city or county determination not to incorporate all required functional plan policies into comprehensive plans shall be subject to the conflict resolution and mediation processes included within the RUGGO, Goal I provisions, prior to the final adoption of inconsistent policies or actions.

The regional policies adopted in this Urban Growth Management Functional Plan are formulated from, and are consistent with, the RUGGOs, including the Metro 2040 Growth Concept. The overall principles of the Greenspaces Master Plan are also incorporated within this functional plan. In addition, the updated Regional Transportation Plan (RTP), when adopted, will serve as the primary transportation policy implementation of the 2040 Growth Concept. However, early implementation land use policies in this functional plan are integrated with early implementation transportation policies derived from preparation of the 1996 Regional Transportation Plan, and consistent with the Metro 2040 Growth Concept.

The Urban Growth Management Functional Plan is a regional functional plan which contains "requirements" that are binding on cities and counties of the region as well as recommendations that are not binding. Shall" or other directive words are used with requirements. The words "should" or "may" are used with recommendations. In general, the plan is structured so that local jurisdictions may choose either performance standard requirements or prescriptive requirements. The intent of the requirements is to assure that cities and counties have a significant amount of flexibility as to how they meet requirements. Performance standards are included in most titles. If local jurisdictions demonstrate to Metro that they meet the performance standard, they have

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met that requirement of the title. Standard methods of compliance are also included in the plan to establish one very specific way that jurisdictions may meet a title requirement, but these standard methods are not the only way a city or county may show compliance. In addition, certain mandatory requirements that apply to all cities and counties are established by this functional plan.

There are 13 titles (Chapters) to the Urban Growth Management Functional Plan. They are as follows:

TITLE 1: REQUIREMENTS FOR HOUSING AND EMPLOYMENT ACCOMMODATION

Title 1 directs each city and county in the region to consider actions to increase its capacity and to take action if necessary to accommodate its share of regional growth as specified in this title.

Finding: *The Troutdale IAMP does not remove land from the inventory that could be used for additional housing and employment. The current roadways and proposed improvements where never in Troutdale's land inventory designated for the provision of increased housing and employment.*

TITLE 2: REGIONAL PARKING POLICY (Repealed Ord. 10-1241B, § 6)

Finding: *This section is not applicable to the Troutdale IAMP*

TITLE 3: WATER QUALITY and FLOOD MANAGEMENT

To protect the beneficial water uses and functions and values of resources within the Water Quality and Flood Management Areas by limiting or mitigating the impact on these areas from development activities and protecting life and property from dangers associated with flooding.

Finding: *Water resources in the corridor were evaluated in the Troutdale Project SDEIS. The IAMPs for the Troutdale Interchange project do not conflict with the protection of water resources.*

TITLE 4: INDUSTRIAL AND OTHER EMPLOYMENT AREAS

Title 4 seeks to provide and protect a supply of sites for employment by limiting the types and scale of non-industrial uses in Regionally Significant Industrial Areas (RSIAs), Industrial and Employment Areas. Title 4 also seeks to provide the benefits of "clustering" to those industries that operate more productively and efficiently in proximity to one another than in dispersed locations. Title 4 further seeks to protect the capacity and efficiency of the region's transportation system for the movement of goods and services and to encourage the location of other types of employment in Centers, Employment Areas, Corridors, Main Streets and Station Communities.

Finding: *This section is not applicable as the land used for the proposed improvements serve to improve circulation and access to Regionally Significant Industrial Areas as well as local employment areas. In addition the improvements do not remove land that would other wise be used for the new development.*

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TITLE 5: NEIGHBOR CITIES AND RURAL RESERVES (Repealed, Ord. 10-1238A, § 4)

TITLE 6: CENTRAL CITY, REGIONAL CENTERS, TOWN CENTERS AND STATION COMMUNITIES

Title 6 intends to enhance Centers by encouraging development in these Centers that will improve the critical roles they play in the region and by discouraging development outside Centers that will detract from those roles.

Finding: *The Troutdale IAMP improves circulation and levels of service adjacent to businesses along the South Frontage Road and improves capacity and traffic flow to and from the TRIP.*

TITLE 7: HOUSING CHOICE

The intent of Title 7 is to establish and promote voluntary affordable housing production goals.

Finding: *The Troutdale IAMP does not directly inhibit the City of Troutdale and Multnomah County from providing affordable housing. The interchanges do not remove viable land from the inventory that could otherwise be used to provide for housing.*

TITLE 8: COMPLIANCE PROCEDURES

The purpose of this section is to establish a process for determining whether city or county comprehensive plans and land use regulations comply with requirements of the Urban Growth Management Functional Plan.

Finding: *This Title is not applicable.*

TITLE 9: PERFORMANCE MEASURES

In order to monitor progress in implementation of the Urban Growth Management Functional Plan and to evaluate and improve the plan over time, Metro shall measure and report on progress toward achievement and expected outcomes resulting from the implementation of the functional plan.

Finding: *This Title is not applicable.*

TITLE 10: FUNCTIONAL PLAN DEFINITIONS

Finding: *This Title is not applicable.*

TITLE 11: PLANNING FOR NEW URBAN AREAS

The purpose of Title 11 to guide such long-range planning for urban reserves and areas added to the UGB. It is also the purpose of Title 11 to provide interim protection for areas added to the UGB until city or county amendments to land use regulations to allow urbanization become applicable to the areas.

Finding: *This Title is not applicable.*

TITLE 12: PROTECTION OF RESIDENTIAL NEIGHBORHOODS

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The purpose of Title 12 is to help implement the policy of the Regional Framework Plan to protect existing residential neighborhoods from air and water pollution, noise and crime and to provide adequate levels of public services.

Finding: *There are residential neighborhoods to the south of the Troutdale interchanges, however, the interchanges do not impact these residential areas to any extent greater than any other land use.*

No residential neighborhoods are bisected by the Troutdale Interchange improvements alignment, or the associated interchanges.

TITLE 13: NATURE IN NEIGHBORHOODS

The purposes of this program are to (1) conserve, protect, and restore a continuous ecologically viable streamside corridor system, from the streams' headwaters to their confluence with other streams and rivers, and with their floodplains in a manner that is integrated with upland wildlife habitat and with the surrounding urban landscape; and (2) to control and prevent water pollution for the protection of the public health and safety, and to maintain and improve water quality throughout the region.

Finding: *This Title is not applicable*.

Metro's Urban Growth Management Functional Plan can be accessed in its entirety through the following link:

(http://library.oregonmetro.gov/files//chap307.reserves.rtfp_clean_eff._090810.02.pdf)

Regional Transportation Plan (2007)

According to state law, the Regional Transportation Plan (RTP) serves as the region's TSP. The RTP is the 20-year blueprint that guides investment in the region's transportation system. It must meet federal requirements specific to the metropolitan transportation planning process and also be consistent with state plans and the statewide planning goals. For transportation projects and programs to receive federal – and some state – funding, they must be in the RTP, and local plans must be consistent with the RTP. Multnomah County and the city of Troutdale coordinate with Metro's other cities, counties and transit providers in regional transportation planning related to the RTP.

The RTP establishes policies and strategies for all modes of travel – motor vehicles, transit, walking and bicycling – as well as the movement of freight and goods. The RTP also addresses street design and the efficient management of the transportation system.

The 2030 RTP update is being conducted as part of the New Look at regional choices to support the land use, economic, environmental and transportation goals of the Region 2040 Growth Concept (see below). The plan identifies goals, objectives, transportation investments and actions needed throughout the region to implement the 2040 Growth Concept and address the impacts of future growth on our transportation system

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through the year 2030. The update prioritizes transportation investments that best help us reach our 2040 vision for growth, yet remain within expected funding constraints.

Elements of the RTP: Regional Transportation System

Regional multi-modal transportation facilities and services include eight components: Regional Street and Throughway System; Regional Transit System; Regional Bicycle System; Regional Pedestrian System; Regional Freight System; Regional Design System; System Management Strategies and Demand Management Strategies.

Elements of the RTP: Regional Street and Throughway System

The **Regional Street and Throughway System** seeks to apply a regularly spaced street network design to accommodate travel demands of the region. **Throughways** connect major activity centers within the region, including the central city, regional centers, industrial areas and intermodal facilities. They generally *span several jurisdictions and often are of statewide importance linking the Metro area with neighboring cities, other parts of the state, and beyond.* Throughway interchanges are spaced no less than two miles apart.

> ***Finding:*** *No Regional Street or Throughway System are included for improvement within the Troutdale Interchange study areas to include the North and South Frontage Roads and Marine Drive.*

Elements of the RTP: Local Streets Network Concept

Collector and local streets are general access facilities that provide for community and neighborhood circulation. Although they are not part of the regional transportation system, they play an important supporting role to the design and optimization of the regional transportation system.

Local jurisdictions are responsible for defining the network of local streets within a mile-spacing grid of arterial streets. Since the late 1990s, the region has required a maximum spacing of 1/10 mile for local streets, with the goal of encouraging local traffic to use local streets to minimize local traffic on regional arterial streets. Local street connectivity also benefits emergency response.

The local street network concept provides for bicycle and pedestrian travel and provides for direct access from local street systems to community destinations and transit on regional arterial streets. More frequent bike and pedestrian connections are recommended where collector and local streets cannot be constructed due to existing development or topographic or environmental constraints.

The IAMP analyzed the local street network, and modifications to the system were proposed.

> ***Finding:*** *The Troutdale Project, which includes the Troutdale IAMP, is identified in thefiscally constrained RTP. The affected roads are designated as Collectors. The South Frontage Road provides more capacity and improved circulation, ingress and egress to businesses south of the frontage Road. The North Frontage Road and a*

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reconfigured two-way Marine Drive improves circulation and anticipates future freight volumes generated by the TRIP.

Elements of the RTP: Regional Freight System

The Regional Freight System identifies the transportation networks and facilities that serve our region and state's freight mobility needs, based on the regional freight concept.

Since the Troutdale Interchange project provides enhanced access to a major freight distribution center (TRIP), the Regional Freight System standards must be addressed in the IAMP.

Finding: *The Troutdale Interchange project is identified in the RTP, and designated as a Collector on the Regional Freight System.*

Elements of the RTP: 2030 RTP Investment Pool

The 2030 RTP Investment Pool describes the projects and programs identified by local agencies, ODOT, TriMet and Metro to address the impacts of future growth on our regional transportation system.

State and Regional Mobility Corridor Investment Strategy focuses on regional mobility corridor investments that leverage the 2040 Growth Concept and improve interstate, intrastate and cross-regional people and goods movement. These corridors are the backbone of the regional transportation system because of their statewide significance and the magnitude of costs associated with providing for people and goods movement in these corridors.

Examples of the types of projects include:

- *Freight access and connections*. Rail and street expansions to maintain access and connections for national and international rail, air and marine freight to reach its destination with limited delay.
- *Throughway expansion.* Major throughway expansions to maintain regional mobility and enhance access to intermodal industrial areas and facilities where goods move from one transportation mode to another.

Finding: *The Troutdale Project is identified in the fiscally constrained RTP analysis for phased construction along the North and South Frontage Roads as well as the construction of a two-way Marine Drive and the construction truck circulation route adjacent to businesses located along the South Frontage Road.*

A mid term project will include the reconstruction of Graham Road to improve geometry and improve the load rating of the roadway to accommodate an increase in freight trips from the new Fed-Ex facility.

Elements of the RTP: Financially Constrained RTP Project List

The **financially constrained system** is the system of investments that responds to federal planning requirements, and is based on the financial forecast. The Troutdale Interchange project is on Financially Constrained RTP Project List.

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Finding: *Components of the Troutdale Project, including interchanges, and associated collector and local street improvements designed to complement the Troutdale Project, and enhance local access and connectivity have been identified in the RTP financially-constrained project list.*

Troutdale Comprehensive Land Use Plan

The City of Troutdale Land Use Plan contains broad comprehensive plan designations such as Residential, Commercial, Institutional, Parks and Open Space, etc. are included within the City's Development Plan.

Goal 1 of the Troutdale Comprehensive Plan (TCP) requires citizen involvement. Within the document it is stated that; "A major component of the City's Citizen Involvement Program is its Citizen Advisory Committee (CAC). The CAC is comprised of Troutdale resident from throughout the City. CAC members not only represent the interests of their particular neighborhood, some members are selected on the basis of their ties to business, environmental resource organizations, or other community service interests. The CAC members monitor plan content and implementation measures and participates in the periodic review process."

Finding: *Four CAC meetings where a determination as to which combination of proposed improvements would provide the most benefit to residents, local businesses as well as access to the TRIP.*

Goal 6 : Air Water and Land Resource and Land Use Quality: The first paragraph related to this goal states that "the quality of life in Troutdale is directly related to the air, water and land quality in the community."

Air Quality: There are existing air quality issues within the Troutdale area and measurements of particulates are generally higher than in many parts of Portland. Ambient air quality is 30 micrograms per cubic meter. Both the federal and state standards for suspended particulates is 60 micrograms per meter per cubic meter maximum, suggesting that Troutdale has a saturation level of only 50% of the maximum allowable level.

Further, "the only source of suspended particulates in the Troutdale area are the Reynolds Aluminum Plant and the Crown Zellerbach paper mill campus."

Finding: *Minor roadway improvements within the Troutdale are expected to minimally impact air quality through the year 2035.*

Noise: As stated in the TCP, the major sources of noise in Troutdale include motor vehicle, rail and air traffic from both the Portland-Troutdale Airport (PTA) and Portland International Airport (PDX). Noise levels at the PTA are below the level requiring a noise abatement program; PDX has developed a noise abatement program.

Finding: *Proposed roadway improvements within the study area are not expected to significantly increase the levels of ambient noise. The one exception is a significant increase in traffic as generated by the Fed-Ex facility at the TRIP.*

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Water Quality: "The City's goal is to reduce erosion and turbidity by providing stable conditions in areas of steep slopes where there is high erosion potential"

> ***Finding:*** *Increase in storm water run-off resulting from an increase in impervious surfaces will be treated in a manner consistent with current ODOT and City standards.*

Goal 9: Economy

Employment Generating Land Uses: "Convenience oriented retail is located at the intersection of the major arterials and is expanding along the south side of I-84. As the population of Troutdale and East Multnomah County grows, additional retail growth will be necessary to accommodate demand. Areas designated for further commercial development include a corridor along Stark Street between 257th Avenue just north of Cherry Park , and the area between I-84 and the Union Pacific Railroad west of 257th.

> ***Finding:*** *The proposed improvements are consistent with the desire to accommodate future commercial development, especially in the area between I-84 and the Union Pacific Railroad west of 257th.*

Troutdale Transportation System Plan (TSP), Adopted February 21, 2006

Troutdale's Transportation System Plan (TSP) addresses existing and future facility needs for Pedestrian, Bicycle, Transit, Motor Vehicles and Other Modes of travel. The TSP also contains a list of proposed transportation improvements.. The following elements from Troutdale's TSP apply to the Troutdale IAMP Management Areas.

Page 4-9: Pedestrian Plan

Current connectivity issues that need to be addressed include:

- The southern I-84 frontage road has recurring issues with queing and heavy traffic congestion. A parallel route for local commercial traffic should be considered to relieve the congestion and excessive queues along this route.
- A lack of adequate east/west connectivity . Particularly, connections between Sturges Lane / Sturges Drive and Hensley Road/ 21st Street and the extension of Marine Drive across I-84 to the Historic Columbia River Highway should be considered.
- Additional multi-use paths connecting parks, retail centers and other trip generators with residential areas, increasing the opportunities for non-motorized trips and reducing single occupied vehicle trips.

> ***Finding:*** *There are a series of bike and pedestrian improvements planned in the Troutdale TSP to be developed and built by the City. As part of the Troutdale IAMP, bicycle and pedestrian facilities will be added to Graham Road from the TRIP towards the North and South Frontage Roads. Sidewalks and bike paths currently exist along the North and South Frontage Roads.*

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Bicycle Action Plan Projects

There are no projects in the Bicycle Action Plan that is located in the vicinity of the Troutdale IAMP, though enhanced bicycle and pedestrian improvements will be included in the rebuild of Graham Road from the TRIP to the North and South Frontage Roads.

Transit: Pages 4-22

Tri-Met is the regional transit provider for the Portland metropolitan area and operates fixed route transit service in Troutdale. Due to it's location, Troutdale is an end point for the regional service system. Tri-Met's Transit Investment Plan (TIP) identifies strategies for meeting regional public transportation needs, focusing on investments and improvements to the total transit system, such as improvements on existing lines. Therefore the TIP focuses on targeted, strategic improvements to the system, with priorities in the following order:

- Maintain the quality of the existing system
- Expand the high capacity Transit System (MAX light rail or bus rapid transit).
- Expand the Frequent Service system
- Improve local service

Transit Master Plan Projects

There is one project listed in the Transit Master Plan that is located in the vicinity of the Interchange Management Area: Coordinate with Tri-Met to provide a new route connecting the outlet mall to Rockwood MAX Station.

Transit Strategies

The 2995 TSP identified strategies to meet transit needs in Troutdale. These strategies have not changed, but were re-ranked as part of this TSP. The strategies, which rely on coordination with Tri-Met, include (listed in order of importance):

- Provide direct/express access to the MAX
- Provide access to employment areas
- Provide park and ride lots
- Provide express routes to regional employment centers
- Provide frequent service in peak commute periods
- Provide access to commercial areas
- Provide access to activity and service centers
- Provide bus shelters

Transit Corridors - direct growth to increase the density of development along transit

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routes in the Management Area in an effort to support regional transit service goals.

Finding: *Four new bus stops and future transit routes are planned for the North and South Frontage Roads.*

Motor Vehicle Plan: Page 4-31

The City's Comprehensive Plan lays out a general policy framework regarding transportation service. These include:

- Goal 1: Transportation facilities should be designed and constructed in a manner which enhances the livability of Troutdale
- Goal 2: Provide a transportation system in Troutdale which is safe, reduces length of travel and limits congestion
- Goal 3: Provide a balanced transportation system and reduce the number of trips by single occupant vehicles
- Goal 4: Provide for efficient movement of goods
- Goal 5: Develop transportation facilities which are accessible to all members of the community
- Goal 6: Develop a transportation system that is consistent with the City's adopted comprehensive land use plan, and with the adopted plans of state, local and regional jurisdictions.
- Goal 7: Establish a clear and objective set of transportation design and development regulations that addresses all elements of the city transportation system and that promote access to and utilization of a multi-modal transportation system.

Findings: Proposed improvement creating a two way, widened Marine Drive and improvements to the north and south frontage roads are consistent with Goals 1, 2, 4, 5, 6.

Local Street Connectivity

Figure 4-9 of the TSP shows the proposed Street Connectivity Plan for Troutdale. The arrows shown on Figure 4-9 indicates priorities for local and neighborhood connections only. Additionally, new development that constructs new streets, or street extensions, must provide a proposed street map that:

- Provides full street connections with spacing of no more than 530 feet between connections except where prevented by barriers.
- Provides bike and pedestrian access ways in lieu of streets with spacing of no more than 330 feet except where prevented by barriers.
- Limits use of cul-de-sacs and other closed-end street systems to situations where barriers prevent full street connections.

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- Includes no close-end street longer than 200 feet or having no more than 10 dwelling units.
- Includes street cross-sections demonstrating dimensions of ROW improvements, with streets designed for posted or expected speed limits.

Finding: *The proposed Troutdale Motor Vehicle plan strategies relating to the provision for a local street network is not applicable as proposed improvements do not come in contact within any residential areas. Many of the curb cuts adjacent to local businesses currently don't meet spacing standards. Spacing standards for new streets, traffic signals, and access management will comply with local street connectivity and other applicable standards.*

Intersection Performance Standards

Page 3-23 of the TSP establishes minimum intersection operating standards to be maintained for the City of Troutdale. The City shall utilize these standards to evaluate land use actions and proposed mitigations. All public facilities shall be designed to meet these standards.

All signalized intersections shall operate at level of service D and V/C ratio of 0.90 or better during the peak hours of analysis. Individual movements must meet level of service E and a V/C ratio of 1.0.

Finding: *TSP identifies acceptable operating standards of LOS "D" and "E" for City arterials and collectors. Restrictions on zone change approvals to those that will not reduce the LOS below acceptable performance evaluation LOS standards provide further protection to long-term operation of the Troutdale Interchange.*

2025 Priority

The 2025 Priority scenario includes additional transportation improvement projects that do not have an identified funding source and may not be constructed by the year 2025. Table 8-9 identifies the additional capacity improvements that are included in the priority scenario.

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